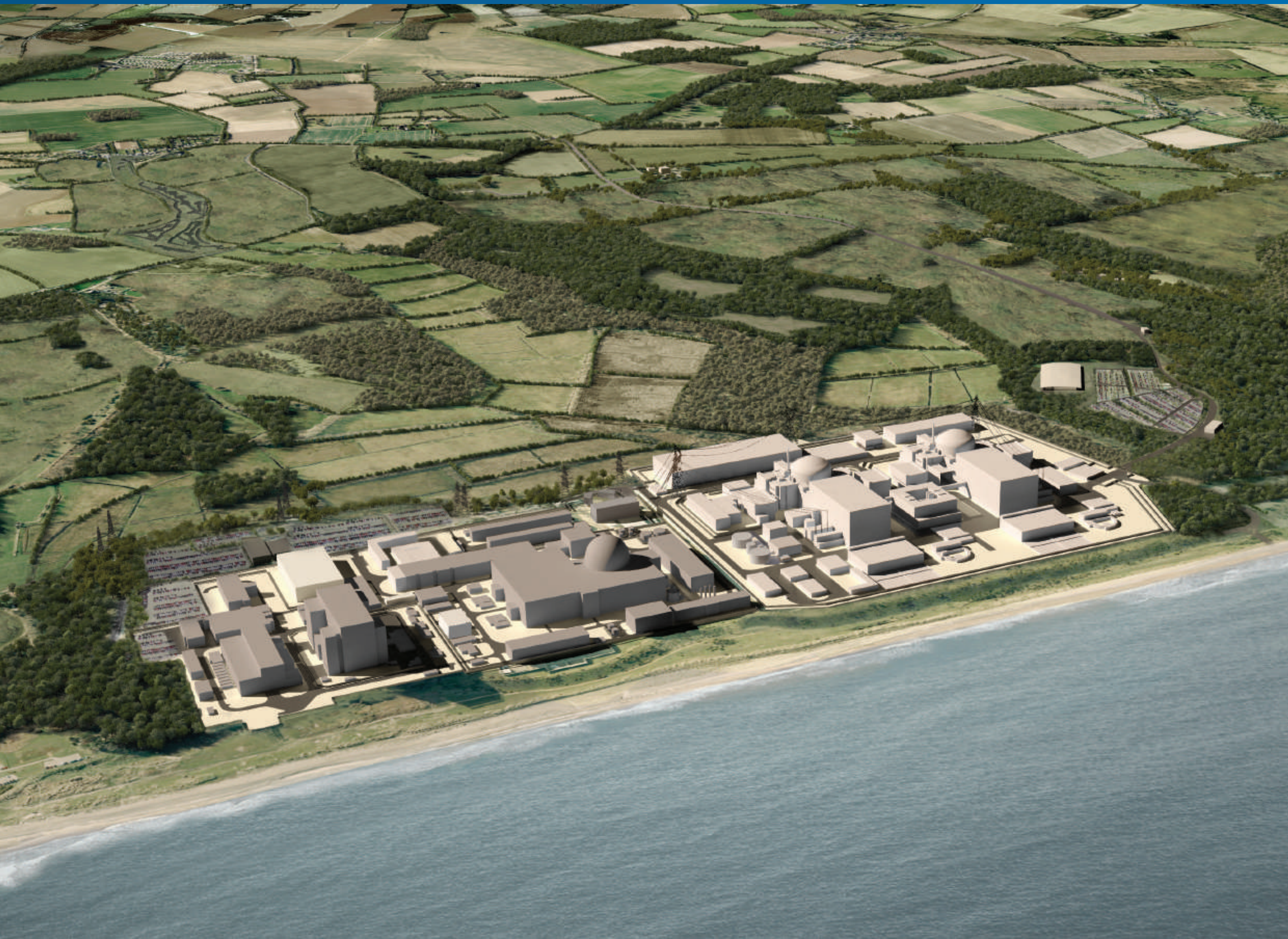
Sizewell C | Proposed Nuclear Development

Stage 3 Pre-Application Consultation

January 2019

2A

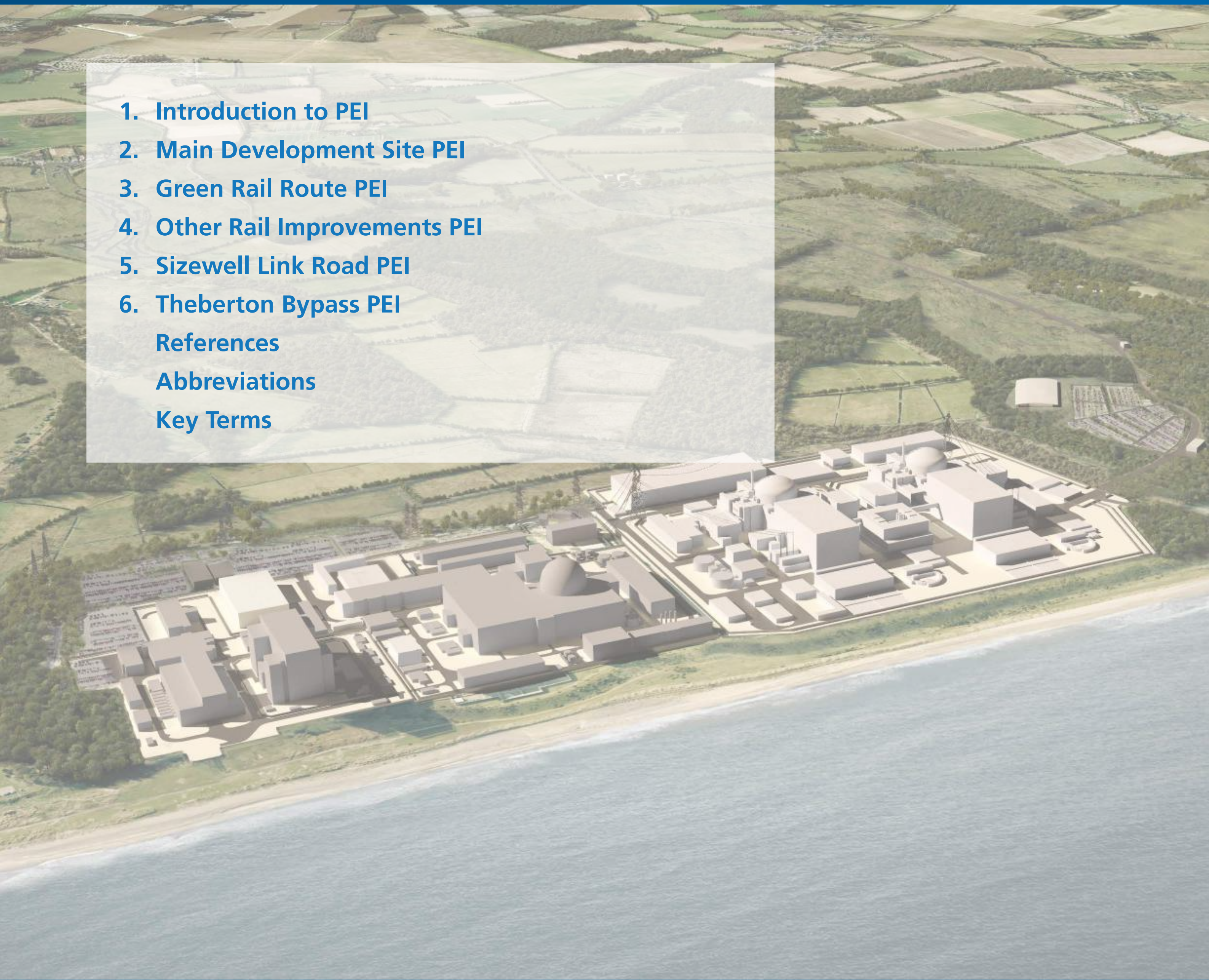


Volume 2A

Preliminary Environmental Information

EDF ENERGY SZC CGN

Contents



Sizewell C | Proposed Nuclear Development

Volume 2A Preliminary Environmental Information

1. Introduction to PEI

1.1. Introduction to PEI

a) What is Preliminary Environmental Information?

1.1.1. Preliminary Environmental Information (PEI) is defined in The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the EIA Regulations 2009) (Ref. 1.1, Regulation 2.1) as:

"information referred to in Part 1 of Schedule 4 which –
(a) has been compiled by the applicant; and
(b) is reasonably required to assess the environmental effects of the development (and of any associated development)."

1.1.2. The Ministry for Housing, Communities and Local Government's (MHCLG) (formerly the Department for Communities and Local Government) guidance note Planning Act 2008: Guidance on the pre-application process (Ref. 1.2) dated March 2015 states:

"For the pre-application consultation process, applicants are advised to include sufficient preliminary environmental information to enable consultees to develop an informed view of the project" (para 93).

1.1.3. The Planning Inspectorate's (PINS) Advice Note Seven: Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements dated December 2017 (Version 6) (Ref. 1.3) states:

"A good PEI document is one that enables consultees (both specialist and non-specialist) to understand the likely environmental effects of the Proposed Development and helps to inform their consultation responses on the Proposed Development during the pre-application stage" (para 7.4).

1.1.4. The PEI within **Volumes 2A** and **2B** has been prepared in accordance with the EIA Regulations 2009, MHCLG's pre-application guidance and Advice Note Seven. The focus of the PEI presented is on providing sufficient information on the likely significant effects of the proposals, so as to facilitate and inform the consultation process. Whilst the focus is on the more important significant effects, in identifying these, the preliminary assessments review a much wider range of impacts and potential effects.

b) Our approach to Preliminary Environmental Information at Stage 3

1.1.5. The PEI presented here is based upon the ongoing studies which form the Environmental Impact Assessment (EIA) for the Sizewell C proposals and which will ultimately be brought together to form an Environmental Statement (ES) which will accompany the application for development consent.

1.1.6. Each element of PEI within this **Volume 2A** and **Volume 2B** has been drafted by the technical specialists undertaking the individual EIA workstreams, working to a model structure, described below. The level of detail available for each element of the scheme varies somewhat, for example, the PEI for some of the roads proposals has been informed to date by desk studies but this approach still allows a clear indication of the likely significant effects to inform the Stage 3 consultation. Additional surveys are being undertaken as part of the ongoing EIA and these will help inform the technical assessments presented in the ES in due course.

1.1.7. The significant effects identified within the PEI are identified on a preliminary basis and are subject to change as the individual assessments progress. However, in broad terms, the majority of the significant adverse effects identified here are either likely to remain significant at the ES stage or will be addressed by further mitigation measures to reduce the likely significance of effects. Similarly, significant beneficial effects are identified where they are likely to arise, given their importance in establishing the full pattern of significant effects associated with the options presented and the proposals as a whole.

c) The need for Environmental Impact Assessments

1.1.8. The first step in determining the need for EIA for a proposed development is known as EIA screening. This step was undertaken by EDF Energy in accordance with the EIA Regulations 2009.

1.1.9. The Sizewell C proposals fulfil one of the 'descriptions of development and criteria for the purposes of the definition of "Schedule 1 development," as follows:

"2(b) Nuclear power stations and other nuclear reactors (except research installations for the production and conversion of fissionable and fertile materials, whose maximum power does not exceed 1 kilowatt continuous thermal load)".

1.1.10. Schedule 1 development is defined as EIA Development under the EIA Regulations 2009, meaning that EIA is always required for development of this type.

d) Environmental Impact Assessment scoping

1.1.11. EDF Energy undertook a scoping process in order to identify the environmental topics and issues that require assessment and the proposed scope and methodology of those assessments. The matters that are scoped into the EIA are those that are considered likely, without effective mitigation, to have the potential to cause a significant effect. The matters that are scoped out of the EIA are those that are considered not likely to lead to a significant effect, regardless of the need for mitigation.

The proposed scope of the EIA was set out by EDF Energy in an EIA Scoping Report submitted to the Secretary of State in 2014 and available at:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010012/EN010012-000103-Sizewell%20C%20EIA%20Scoping%20Report_Main%20text.pdf

1.1.12. The Secretary of State considered the EIA Scoping Report and, after consulting various bodies, set out in a Scoping Opinion what information should be included in the ES to be submitted in support of an application for development consent for the project. The Scoping Opinion identified that the consultation bodies consulted were generally satisfied with the proposed approach, stating that it reflected the ongoing discussions between the parties. The Scoping Opinion is available at:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010012/EN010012-000093-Sizewell%20C%20Proposed%20Nuclear%20Development%20Scoping%20Opinion.pdf

1.1.13. EDF Energy is currently addressing those specific issues identified in the Scoping Opinion as part of the EIA process, liaising with stakeholders as appropriate. The ES will detail how regard has been given to the Scoping Opinion, as well as including all of the information required to comply with the EIA Regulations 2009. As explained above, the PEI presented here is a preliminary assessment of the studies undertaken to date, guided by the EIA Scoping Report and the Scoping Opinion to help inform the Stage 3 consultation.

1.1.14. The EIA Scoping Report and Scoping Opinion identified above were based on the understanding of the Sizewell C proposals at that point in time. With greater certainty of the proposals and more importantly the nature of the additional road infrastructure that would be required, particularly under a road-led strategy, EDF Energy believes that it is appropriate to re-scope the EIA. EDF Energy is likely to do this in 2019 under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations 2017), once the Stage 3 consultation is complete and once we have taken the opportunity to consider the consultation responses, so far as they might affect consideration of the EIA scope.

1.1.15. As part of the EIA re-scoping exercise, the Secretary of State will provide the statutory consultation bodies the opportunity to comment further on the EIA scope.

e) The National Policy Statements (Overarching National Policy Statement for Energy (EN-1) and National Policy Statement for Nuclear Power Generation (EN-6)) and Environmental Impact Assessment

1.1.16. **Volume 1, Chapter 3** explains the planning policy context against which the application for development consent for the Sizewell C proposals will be determined.

1.1.17. The National Policy Statements (NPSs) and in particular Part 5 of the Overarching National Policy Statement for Energy (NPS EN-1) (Ref. 1.4) set out detailed technical requirements for the scope of EIA technical assessments. NPS EN-1 is available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

1.1.18. Both the ongoing EIA and the PEI presented in this **Volume 2A** and **Volume 2B** have been informed by these detailed technical requirements and where necessary further work is being undertaken in order to produce an ES which fully meets the requirements of the two relevant NPSs.

1.1.19. It should be noted that the Government is currently working towards the preparation of a new NPS for nuclear power generation for deployment after 2025. As a first step towards this new NPS, between 7 December 2017 and 15 March 2018 the Government consulted on the process and criteria for designating potentially suitable sites for the deployment of new nuclear power stations between 2026 to 2035 with over 1 gigawatt (GW) of single reactor electricity generating capacity. The Government has announced that there will be a further consultation on the draft NPS in due course. EDF Energy's approach to the ongoing EIA will be adjusted to address any revised or additional assessment requirements defined therein provided that it is reasonable to do so within the programme and governance for the project. Any changes in environmental legislation, such as the technical requirements under the EIA Regulations 2017, will be accommodated within the ES as relevant.

1.2. The structure of Volumes 2A and 2B

1.2.1. **Volumes 2A** and **2B** present the PEI for each of the scheme components in turn, within its own chapter, as follows:

- **Chapter 2**: Main Development Site PEI – including but not limited to the offshore works and the beach landing facility (BLF), the main construction area around the main platform, the temporary construction area west to the boundary of the green rail route, the accommodation campus, the land to the east of Eastland Industrial Estate (LEEIE), works at Sizewell Halt and the Sizewell B relocated facilities;
- **Chapter 3**: Green Rail Route PEI – from the boundary of the temporary construction area to the existing Saxmundham to Leiston branch line, west of Leiston, built under the rail-led strategy;
- **Chapter 4**: Other Rail Improvements PEI – including upgrades to the East Suffolk line (currently expected to be required for the rail-led strategy only) and the Saxmundham to Leiston branch upgrades;
- **Chapter 5**: Sizewell Link Road PEI – (including a bypass around Theberton), built only under the road-led strategy;
- **Chapter 6**: Theberton Bypass PEI – when built on its own only under a rail-led strategy;
- **Chapter 7**: Two Village Bypass PEI – built under both road- and rail-led strategies;
- **Chapter 8**: Northern Park and Ride PEI – built under both road- and rail-led strategies;
- **Chapter 9**: Southern Park and Ride PEI – built under both road- and rail-led strategies;
- **Chapter 10**: Freight Management Facility PEI – two possible locations east of Ipswich close to the A14, built only under the road-led strategy;
- **Chapter 11**: Yoxford Roundabout PEI – built under both road-led and rail-led strategies; and
- **Chapter 12**: Highway Improvements PEI – built under both road-led and rail-led strategies, as follows:
  - Wickham Market road diversion via Valley Road & Easton Road;
  - Mill Street improvements on the B1122;
  - A1094/B1069 junction improvements, South of Knodishall; and
  - A12/A144 junction improvements, South of Bramfield.

1.2.2. A summary of those elements of the proposals which are built under the road-led and rail-led strategies is provided in **Figure 1.1** below. Both park and ride facilities would be included in both strategies.

Figure 1.1 Stage 3 freight management strategy options

RAIL - LED

- A12 - Two village bypass
- A12 / B1122 - Yoxford roundabout
- B1122 - Theberton bypass
- Other minor road improvements
- Rail - Green rail route to the temporary construction area
- Rail - East Suffolk Line and branch line upgrades and level crossings works
- Rail - Sizewell Halt or rail siding at LEEIE for early years
- Beach landing facility

HGV operation 07:00 – 23:00
HGVs 225 average at peak / 450 busiest day
Up to 5 trains a day

ROAD - LED

- A12 - Two village bypass
- A12 / B1122 - Yoxford roundabout
- B1122 - Sizewell link road
- Other minor road improvements
- Freight management facility
- Rail - East Suffolk Line and branch line upgrades and level crossings works
- Rail - Sizewell Halt or rail siding at LEEIE for construction period
- Beach landing facility

HGV operation potential for extended hours
HGVs 375 average at peak / 750 busiest day
Up to 2 trains a day

1.2.3. Further details of all of these proposals are provided in the relevant sections of **Volume 1** which explain the rationale for the proposals, the design changes which have occurred between Stage 2 and Stage 3 and why they are relevant under the road-led and/or rail-led strategies.

1.2.4. **Volume 2B** concludes with two further chapters as follows:

- **Chapter 13**, which provides an update on the assessment of in combination, cumulative effect and project-wide effects; and
- **Chapter 14**, which provides a summary of the other assessments which are being progressed as part of or in parallel with the ongoing EIA, including a waste assessment, the Water Framework Directive Assessment and the Habitat Regulation Assessment.

1.2.5. Within each of the main PEI chapters of this **Volume 2A** and **Volume 2B**, a short introduction explains the scope of the topics covered for that scheme component. The scope of topics for most scheme components, is as follows:

- landscape and visual;
- terrestrial ecology and ornithology;
- amenity and recreation;
- geology and land quality;
- soils and agriculture;
- historic environment;
- noise and vibration;
- air quality;
- groundwater;
- surface water;
- flood risk; and
- traffic and transport.

1.2.6. The scope of topics is reduced in **Volume 2A, Chapter 4** and **Volume 2B, Chapter 12** for the reasons explained within those chapters. In summary, the relatively small scale of the proposed works and the localised extent of any impact means that the potential for significant effects is greatly reduced compared to the main elements of the project.

1.2.7. There is no separate PEI for socio-economics for individual sites as effects are overarching for the project as a whole. **Volume 1, Chapter 4** sets out the socio-economic baseline, predicted likely significant effects and strategies proposed both to address these and optimise the economic benefits.

1.2.8. **Volume 1, Chapter 7** which presents the PEI for the main development site, includes an additional five topics which are only relevant in the marine context at the main development site, these being:

- marine historic environment;
- marine ecology;
- marine water quality;
- coastal geomorphology; and
- navigation.

1.3. The Preliminary Environmental Information assessments

1.3.1. In general, each topic uses the following six-part structure:

(a) Baseline environment - which describes the current site conditions or 'baseline' state and where particularly important for a topic, summarises a 'future baseline', which predicts how the baseline is likely to change in the absence of the proposed development (e.g. baseline trends in air quality).

(b) Environmental design and embedded mitigation – which describes measures which have been included within the proposals to avoid, limit or mitigate for potential impacts of the development (e.g. habitat mitigation proposals to mitigate habitat loss within the proposed development area).

(c) Preliminary assessment of effects – which provides a preliminary review of the impacts of the proposals which have the potential to lead to significant effects, taking into account the measures defined as environmental design and embedded mitigation. In undertaking this assessment, there is typically a discussion of a wider range of potential impacts and effects and an explanation of why certain significant effects are likely.

(d) Additional mitigation and monitoring – which identifies the measures that might be required to address any significant adverse effects identified in the previous section. In general, additional mitigation measures tend to be rather limited, since it is preferable to 'embed' measures within the proposals. The ongoing EIA will determine whether the 'additional mitigation measures' become 'embedded' in the final proposals.

(e) Preliminary assessment of residual effects – which provides a 're-assessment' of any significant effects presented in (c) but taking into account any additional mitigation defined in (d). Where no additional mitigation is required or stated, the residual effects remain the same as those defined in (c).

(f) Completing the assessment - which explains briefly the main elements of the ongoing EIA for that topic which need to be completed before the ES is completed.

1.3.2. Each topic, other than traffic and transport, includes summary tables enabling the reader to see at a glance whether significant effects are likely.

1.3.3. The PEI does not include EIA technical methodologies for individual topics since these are provided in the EIA Scoping Report (see reference provided above). A short summary of how the EIA methodology is applied in this PEI is provided below.

1.3.4. At the end of each chapter, a summary is presented which presents a comparison of the road-led and rail-led strategies for the relevant element of the proposals, using the main conclusions of each topic area.

1.4. Environmental Impact Assessment and Preliminary Environmental Information methodologies

a) General approach

1.4.1. The ongoing EIA adheres to the guidance relevant in each technical area and any required assessments defined in NPS EN-1 and NPS EN-6 (Ref. 1.5) (see description of NPS EN-1 and NPS EN-6 and EIA Scoping Report above). The methodologies used for the preliminary assessments for individual topics in this PEI are based on those provided in the EIA Scoping Report (see reference above), having regard to the current stage of the assessment. Any changes to the assessment approaches which are used in the ongoing EIA will be presented within the new EIA Scoping Report, allowing statutory consultees to comment on any amended approaches (see EIA Scoping Report above).

1.4.2. Should the new NPS for nuclear power generation for deployment after 2025 be published prior to the submission of the application for development consent, any amendments to the requirements of technical assessments will be adopted where appropriate, provided that it is reasonable to do so within the programme and governance for the project. Any changes in environmental legislation, such as the technical requirements under the EIA Regulations 2017, will be accommodated within the ES as relevant.

1.4.3. The methodology followed by most environmental topics in EIA and defined within the Scoping Report 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.

1.4.4. It should be noted that in the context of the ongoing EIA and the PEI presented here, the terms ‘impact’ and ‘effect’ are distinctly different. The EIA Regulations 2017 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 Regulations 2017.

1.4.5. Within the PEI, in order to determine whether significant effects on the environment are likely, technical specialists have given consideration to the importance (value) and sensitivity of receptors and the changes that are likely to arise as a result of the activities associated with building and operating Sizewell C and the associated developments. Within this PEI, the potential effects which have been identified are classified simply as likely to be significant or not significant.

1.4.6. The terms “significant” and “not significant” used in the PEI are aligned with the EIA Scoping Report and defined in **Table 1.1** Generic effect definitions. As a general rule within EIA, major and moderate effects are considered to be significant, whilst minor and negligible effects are considered to be not significant. However, professional judgement has been applied where necessary, including taking account of whether the effect is permanent or temporary.

Table 1.1: Generic effect definitions

Significance of Effect	Description
Significant	**Major effect:** 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.
Not significant.	**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.

b) Phases of development

1.4.7. For most topics, the PEI considers two main phases of development, i.e. construction and operation for each of the scheme components. These are defined as follows:

- **construction** – the phase during which that scheme element (e.g. park and ride site or main development site) is under construction; and
- **operation** – the operational phase is that in which the scheme element is in use for its intended purpose. For example, for the park and ride sites, this would be when the sites are used for car parking and transferring workers to site. For the main development site, this phase commences when the Sizewell C power station becomes operational.

1.4.8. The construction phase for the main development site includes all of the relevant phases of construction as well as removal of the temporary facilities, such as the accommodation campus and the temporary construction area. As the main construction phases conclude, temporary facilities would be removed and the temporary construction site areas restored in accordance with a landscape and ecology masterplan. Facilities such as concrete batching plants and prefabrication facilities would be dismantled and removed and contractors' compounds and the accommodation campus would also be cleared along with any hardstanding materials stockpiled for reuse or disposal.

1.4.9. For some scheme components, a third phase is also considered – this is the 'removal and reinstatement' phase. This is a phase in which the temporary facility is removed and the land reinstated to its former use. For example, the green rail route and both of the park and ride sites would be restored to their existing arable use in a removal and restoration phase. It is anticipated that the effects of removal and restoration are likely to be broadly similar to the effects arising during the construction phase and the environmental control measures would be similar.

1.4.10. As the new power station would remain into the long-term, there is no removal and restoration element for the main development site. Any decommissioning process for the new nuclear power station would be subject to the appropriate consenting regime at that time and towards the end of its design life. The relevant EIA legislation is the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (as amended in 2006 and 2018) (Ref. 1.6).

c) Variations of approach

1.4.11. Within each site-specific PEI chapter, the significance of effects reported is based on the effects only from that particular development arising at, or near, the location. However, the traffic and transport PEI is different; the traffic predictions at each location are based on the construction traffic arising from the Sizewell C project as a whole. In order to form a view of the proposals, the PEI gives stakeholders all the traffic and transport impacts at that location, rather than just those arising from the individual development in isolation.

1.5. The approach to limiting environmental effects

1.5.1. EDF Energy's vision for the project includes a commitment to limit and anticipate environmental effects where practical, as follows:

"…In recognition of the environmental sensitivity of the location, EDF Energy will ensure that the power station is designed in such a way as to limit any adverse effects on the environment and on local communities as far as is reasonably practical. Any significant adverse effects of the construction, operation or decommissioning of the power station shall be mitigated where practical and appropriate in a way which is environmentally responsible and sensitive both to the needs of the community and to the strategies of the relevant authorities."

1.5.2. The proposals presented in the consultation document as a whole have been developed with the aim of avoiding significant adverse effects wherever possible. In some cases, significant adverse effects have been avoided by substantially changing the design approach. For example, the use of a marine offloading facility has been excluded as the extensive piling required could potentially have caused significant adverse effects on marine mammals, as well as causing significant changes to local marine sediment movements.

1.5.3. In other cases, measures have been 'embedded' within the design to mitigate the impacts that arise. For example, at Aldhurst Farm a habitat creation scheme has been developed to ensure that habitats are created and have time to become established before any land take from the Site of Special Scientific Interest (SSSI) associated with the construction of Sizewell C occurs. **Figure 17.17** in **Volume 1** shows the location of Aldhurst Farm.

1.5.4. At Aldhurst Farm, the habitat creation scheme has created approximately 6 hectares (ha) of wetland habitat, integrated into a mosaic of neutral and acidic grassland, heathland, scrub and scattered trees is being established across a 67ha site and the wetland areas have been specifically designed to compensate for the potential loss of reed bed and lowland ditch habitat from the SSSI, and their associated invertebrate and rare vascular plant assemblages. As well as providing high quality habitat for a diversity of wildlife, the new habitats will also strengthen the link between Leiston, the Suffolk Coast and Heaths Area of Outstanding Natural Beauty and the Heritage Coast.

1.5.5. Since Stage 2 the designs of the operational buildings on the main development site have been developed further and respond to their prominent location on this part of the coastline. The proposals for the main development site also include the implementation of an integrated ecology and landscape strategy which will ensure that the most effective mitigation measures are delivered for the local area.

1.5.6. Many of the associated developments are mitigation measures in themselves, designed to minimise or mitigate impacts that would arise from the construction of Sizewell C. For example, the on-site accommodation campus and the two park and ride facilities would greatly reduce the number of Sizewell C vehicle movements, thereby further reducing the impact of the project on the local road network. Similarly, the proposed two village bypass around Farnham and Stratford St Andrew and the proposed Theberton bypass / Sizewell link road and related options are designed to further reduce the impacts on the local road network. However, the proposed infrastructure would itself give rise to some environmental impacts. Those potential impacts and related mitigation measures are described in the relevant PEI site specific chapters in **Volume 2A** and **2B**.

1.5.7. Prior to commencement of the construction phase, the contractor would prepare a Construction Environmental Management Plan (CEMP) relevant to the scope of their works and in accordance with an Outline Environmental Management Plan or Code of Construction Practice which would be submitted alongside the application for development consent. The measures within the CEMP, secured against the development consent order, would be the measures used to limit the construction impacts of the scheme in order to minimise the potential for significant adverse effects.

1.5.8. The preliminary assessments within the PEI and the ongoing EIA process take account of these measures and are being used to identify any significant adverse effects that could arise as a result of the Sizewell C proposals and where necessary, the design is being refined or further mitigation measures developed, in consultation with stakeholders, to minimise the significance of these effects.

1.5.9. Stakeholders are invited to comment on the PEI presented within these consultation documents and in particular those effects which are identified as 'significant adverse' and the measures proposed to mitigate these.

1.5.10. EDF Energy will have regard to the feedback from the Stage 3 consultation as well as emerging results from the EIA in finalising the proposals and application documents in order to minimise the adverse effects of the proposals so far as is practicable.

2. Main Development Site PEI

2.1. Introduction to Preliminary Environmental Information (PEI) for the main development site

2.1.1. The proposals on the main development site are described in **Volume 1, Chapter 7** and illustrated in **Volume 1, Figure 7.27**. The development at the main development site would comprise the following building, engineering or other operations:

- nuclear power station (Sizewell C), including two United Kingdom European Pressurised Reactor (UK EPR™) units capable of exporting a total of approximately 3,340 megawatts (MW) to the National Grid;
- associated buildings, plant and infrastructure within the power station perimeter, including overhead power lines and pylons;
- associated buildings, plant and infrastructure outside of the power station perimeter, including a training building, beach landing facility (BLF) and flood defences;
- marine works and associated infrastructure, including a cooling water system and combined drainage outfall in the North Sea;
- a temporary accommodation campus for up to 2,400 construction workers and associated facilities, buildings and infrastructure, located east of Eastbridge Road;
- National Grid 400 kilovolts (kV) substation and associated relocation of an existing pylon and power line south of Sizewell C;
- relocation of certain Sizewell B supporting buildings, plant and infrastructure south of Sizewell C;
- vehicular and pedestrian crossing over the Sizewell Marshes Site of Special Scientific Interest (SSSI) south of Goose Hill;
- power station access road, linking the SSSI crossing with a new roundabout onto Abbey Road (B1122);
- public access works including permanent and temporary closures and diversions of Public Rights of Way (PRoWs);
- diversion and installation of utilities and services;
- temporary construction compounds, parking, laydown areas and working areas, plus related works and structures;
- temporary excavated material management areas, including borrow pits and stockpiles;
- temporary rail infrastructure associated with the green rail route (rail-led strategy only); and
- landscape restoration works and planting.

2.1.2. Development at land to the east of the Eastlands Industrial Estate (LEEIE) would comprise the following building, engineering or other operations. All development in this location is temporary unless otherwise stated:

- construction compounds, laydown areas and working areas, plus related works and structures;
- spoil management areas, including borrow pits and stockpiles;
- accommodation for approximately 400 caravans and associated welfare and parking;
- heavy goods vehicle (HGV) and bus management area;
- park and ride facility;
- reconfiguration of the existing railhead at Sizewell Halt to accommodate longer trains (Option 1 – permanent);
- overhead conveyor system to transfer freight material into LEEIE over King George's Avenue (Option 1);
- a new rail siding adjacent to the existing railway track (Option 2); and
- landscape restoration works and planting (permanent).

2.1.3. The construction process for the main development site includes all of the relevant phases of construction as well as removal of the temporary facilities, such as the accommodation campus and the temporary construction area. As the main construction phases conclude the majority of development within the temporary construction area and LEEIE would be removed and the land restored in accordance with an integrated landscape and ecology masterplan. Further details are set out in **Volume 1, Chapter 7**.

2.1.4. As the new power station will remain, there is no removal and restoration element within this Preliminary Environmental Information (PEI) section. Any decommissioning process for the new nuclear power station would be subject to the appropriate consenting regime at that time and towards the end of its design life.

2.1.5. The scope of the preliminary assessment includes landscape and visual, terrestrial ecology and ornithology, amenity and recreation, geology and soils, land quality and agriculture, terrestrial historic environment, noise and vibration, air quality, groundwater, surface water, flood risk, traffic and transport and five marine topics. No topics have been 'scoped out' of the assessment. Updates on the conventional waste strategy and the radiological impact assessment are provided in **Volume 2B, Chapter 14**. The chapter concludes with a short comparison between the road-led and rail-led strategies as relevant to the main development site.

2.1.6. The proposals for the main development site are likely to have some significant effects on the environment during both construction and operation. The PEI presented in the following sections for these two phases present each of the topics in turn. Each topic uses the following structure: (a) Baseline environment, (b) Environmental design and embedded mitigation, (c) Preliminary assessment of effects, (d) Additional mitigation and monitoring, (e) Preliminary assessment of residual effects and (f) Completing the assessment.

2.2. Landscape and visual

2.2.1. The figures for landscape and visual are presented in **Volume 3** as **Figures 2.2.1** to **2.2.11**.

a) Baseline environment

i) Study area

2.2.2. The extent of the study area for the development proposal is broadly defined by the visual envelope of the proposed development site and the anticipated Zone of Theoretical Visibility (ZTV) arising from the development itself. A study area of 15km (measured from the boundary of the onshore part of the main development site) has been judged to be appropriate to cover all potentially material impacts during construction and operation. The study area which includes terrestrial, coastal and offshore areas is illustrated in **Figure 2.2.1**. The main development site and its surrounding context are illustrated in **Figure 2.2.2**.

ii) Landscape character

2.2.3. The full extent of the onshore part of the main development site and majority of the study area is located within the Suffolk Coast and Heaths National Character Area (NCA). Further inland, approximately 1.5km west of the boundary of the main development site, the western portion of the study area lies within the South Norfolk and High Suffolk Claylands NCA.

2.2.4. The Suffolk Coast and Heaths NCA is described (Ref. 2.2.1) as a predominantly low-lying landscape characterised by productive agricultural areas on sandy free draining soils. Cereal crops are widespread but large-scale vegetable production is a distinctive feature along with free range pig units. Coastal level grazing marshes are notable habitats, as are fragments of lowland heathland. Farm woodlands, plantations and field boundary trees along with some substantial coniferous forests provide a well-wooded character. Views are described as expansive except where enclosed by woodland and there are few commanding viewpoints in the mainly flat or gently rolling landscape. The coastline is formed by long, sweeping bays and more sheltered estuaries and the shoreline is characterised by shingle beaches and low, soft crumbling cliffs in places. Large commercial ports, Sizewell power station, Cobra Mist transmitting station and Orwell Bridge are cited as landmarks contributing to the diversity of the landscape. Settlement patterns are sparse, consisting mainly of small villages and coastal market towns. The area is described as having inspired many artists, writers and naturalists and is recorded as being a recreation and tourist destination with extensive public access.

2.2.5. The NCA's landscape character is described in several published assessments from regional to local scale. The key reference is the Suffolk County Landscape Character Assessment (Ref. 2.2.2) which identifies 30 landscape types (excluding urban). The distribution of landscape types is illustrated in **Figure 2.2.3**.

2.2.6. The majority of the main development site falls within the estate sandlands Landscape Type (LT) which extends along the coast in areas known as the Sandlings. The flat or very gently rolling plateaux is characterised by free-draining sandy soils that prior to widespread enclosure were characterised by extensive areas of heathland or acid grassland, remnants of which survive. Plantations and tree belts are common and large coniferous forests are a feature. The westernmost portion of the main development site, in the vicinity of Upper Abbey Farm and Old Abbey, lies within the ancient estate claylands LT. This forms part of an extensive dissected boulder clay plateau extending westwards towards and beyond the study area boundary. A small area of the main development site, within the Minsmere Level, to the north of Goose Hill, and the Sizewell Belts, to the west of the existing Sizewell power station complex, falls within the coastal levels LT. This is a relatively unsettled landscape that occurs in several locations along the coast. The main development site also includes a narrow stretch of the coastal dunes and shingle ridges LT. Here, beaches are often characterised by a long high ridge, backed by soft cliffs or saltmarsh.

2.2.7. Other landscape types in close proximity to the main development site are the rolling estate claylands LT and valley meadows and fens LT. These follow the valley of the Minsmere River, north-west of Eastbridge.

iii) Seascape character

2.2.8. At the regional scale of assessment, the offshore part of the main development site and majority of the study area lies within the Suffolk Coastal Waters Seascape Character Area (SCA) (Ref. 2.2.3). The characteristics of this SCA are similar to the coastal elements described for the Suffolk Coast and Heaths NCA, with additional references to colourful seafront towns and large-scale panoramic views of the seascape dominated by busy offshore shipping waters.

2.2.9. Within the framework of the regional SCAs, seascape character is described in more detail in the Sizewell C Seascape Character Assessment (Ref. 2.2.4). The offshore portion of the main development site is located within the nearshore waters Seascape Character Type (SCT) which extends along the full length of the coastline in the study area. The seascape is characterised by relatively shallow sheltered or moderately sheltered waters adjacent to long curving coastal bays, backed by shingle beaches, low vegetated dunes, low crumbling cliffs and coastal settlements. The distribution of SCTs is illustrated in **Figure 2.2.3.**

iv) Main development site

2.2.10. Land use and land cover within and adjacent to the main development site displays several of the characteristics recorded in the published landscape and seascape character assessments for the wider study area.

2.2.11. Arable farmland is the predominant land use with relatively large geometric fields defined by hedges and tree belts. Also present are areas of pasture, for example in the vicinity of Upper Abbey Farm; pockets of acid grassland and heathland; wet woodland, freshwater grazing marsh and reedbeds; and areas of conifer plantation, notably at Goose Hill. The coastal strip within the main development site is characterised by a vegetated engineered embankment, known as Bent Hills and a lower vegetated bund which together form the sea defences to the existing Sizewell power stations. East of the lower bund is a shingle beach which shelves into the offshore portion of the main development site which includes the Sizewell A intake and outfall headworks structures.

2.2.12. The main development site includes land within and adjacent to the Sizewell B secure perimeter which is characterised by structures associated with the existing operational Sizewell B power station, parking areas, access infrastructure, ancillary structures and overhead power lines and pylons. Buildings are arranged on an axial alignment and the area has a planned and industrial character. North of Sizewell B, and in the location of the proposed Sizewell C power station, is an area of made ground associated with the construction of the Sizewell B power station. This area is characterised by grassland, regenerating scrub and planted tree belts.

v) Views and visual amenity

2.2.13. A variety of visual receptors are located in the study area that have the potential to experience views of the proposed development. Visual receptors include residents within settlements and isolated properties; those visiting the area for recreational and amenity purposes including visitors to towns and villages, areas inland, the coast and offshore; those travelling through the area; and those engaged in work.

2.2.14. The majority of visual receptors will be located onshore but there is potential for visual receptors in locations offshore, such as those engaged in recreational sailing along the coast.

2.2.15. There are significant variations in the visual character of the study area due to the nature of topography, built form, vegetation and land use patterns. For example, views along the coast and offshore from the coastline, and from areas of elevated open landscape can be extensive, whereas views from lower lying areas, within settlements and areas that are particularly well-wooded are relatively constrained. These variations in visual character influence the nature and extent of views to the existing Sizewell power stations, and by extension to the Sizewell C proposals of similar type and scale.

vi) Designated and defined landscape/seascape/ townscape

2.2.16. The majority of the onshore portion of the main development site is located within the Suffolk Coast and Heaths Area of Outstanding Natural Beauty (AONB). The remainder of the onshore portion of the main development site is considered as being located within the setting of the AONB, which is defined as:

"…the area within which development and land management proposals, by virtue of their nature; size; scale; siting, materials or design can be considered to have an impact, positive or negative, on the natural beauty and special qualities of the nationally designated landscape." (Ref. 2.2.5)

2.2.17. The natural beauty and special qualities of the Suffolk Coast and Heaths AONB are described in a document prepared by EDF Energy in consultation with the AONB Partnership, Suffolk Coastal District Council (SCDC) and Suffolk County Council (SCC).

2.2.18. The central portion of the main development site (both on and offshore) also falls within the Suffolk Heritage Coast which is an area of undeveloped coastline managed to conserve natural beauty and, where appropriate, improve accessibility for visitors.

2.2.19. A small area of the main development site, north of Upper Abbey Farm, is located within an area designated locally as a Special Landscape Area (SLA), which extends along the valley of the Minsmere River and is noted for its traditionally grazed river valley meadows and marshes with intact hedgerows and dykes and associated flora and fauna.

2.2.20. The extent of the Suffolk Coast and Heaths AONB, Suffolk Heritage Coast and areas designated locally as a SLA are illustrated in **Figure 2.2.4**.

2.2.21. There are no ancient woodlands, Tree Preservation Order trees, tree groups, areas or woodlands within the main development site.

b) Environmental design and embedded mitigation

i) Construction

2.2.22. Mitigation measures aim to minimise as much as practicable the extent of physical disturbance to the landscape and the visual prominence of activity and temporary buildings, structures, compounds and storage areas during the construction phase. A summary of the key measures that have been incorporated into the design of the proposed development is set out below:

- Configuring the physical extents of the main development site boundary to exclude and protect woodland and forested areas on rising landform that provides screening, such as Ash Wood, Dunwich Forest, Kenton Hills and along the northern perimeter of Goose Hill.
- Optimising the land required for construction and avoiding or minimising activity and use of land in visually sensitive locations where possible, such as north of the Sizewell Gap and land west of Eastbridge Road (to the east of Theberton House).
- Retaining, where possible, established vegetation within the main development site, including along the bridleway east of Upper Abbey Farm and hedgerows and tree belts at the perimeter of the main development site.
- Landscaping early in the construction phase to provide localised screening of the construction works and to allow areas of new planting associated with the operational phase landscape masterplan to become established. Early planting would include reinforcing existing vegetation around the perimeter of the main development site. Some early planting (Winter 2014/2015) has been completed around the periphery of the main development site, including tree/shrub planting at Red Rails and White Gates Fields and along the northern edge of Goose Hill. Supplementary planting to reinforce existing hedgerows has been completed south of Lower Abbey Farm (outside the main development site) and at the northern boundary of the main development site at Black Walks.
- Creating earth bunds and installing acoustic and temporary fencing to provide visual containment of construction areas including along the northern haul road; along the northern edge of Kenton Hills; and along the eastern edge of the sea defences, adjacent to Sizewell Beach to reduce effects on users of recreational resources including PRoWs and permissive footpaths.
- Selecting the causeway option for the SSSI crossing allows for the establishment of vegetation along its eastern edge that would be retained into the operational phase.
- Selecting option 2(ii) for the accommodation campus development in the area east of Eastbridge Road and configuring its layout to reduce the visual prominence of new buildings and structures from locations to the west, including in the vicinity of Leiston Abbey and from elevated locations to the north.
- Limiting the maximum height parameters of material storage and borrow pit areas to the north and east of the accommodation campus to reduce their visual prominence.
- The construction lighting strategy includes objectives to target lighting where it is required, avoid unnecessary illumination and minimise upward lighting and light spill to neighbouring areas. Where possible, fixed lighting has been minimised within areas of the main development site where ecological buffers are retained (see also section 2.3), several of which are also adjacent to sensitive visual receptors, including Leiston Old Abbey care home, residential properties along Lover's Lane, Sandy Lane and Abbey Road and east of Leiston Abbey. Similarly, fixed lighting has been minimised along the coastal frontage in the area of the sea defences and beach (excluding a small area providing access to the beach landing facility (BLF) and operations building).

ii) Operation

2.2.23. Mitigation measures aim to minimise the visual prominence of the permanent elements of the operational power station, including buildings, structures, infrastructure and vehicles (both moving and parked); restore areas of landscape used during the construction phase to enhance biodiversity interest, landscape character and opportunities for access and recreation; and to integrate the area affected during construction into the remainder of the EDF Energy Estate and wider landscape.

2.2.24. A summary of the key measures that have been incorporated into the design of the proposed development is set out below:

- Any excess excavated material arising from the construction phase would be accommodated though localised ground raising in areas used during construction, primarily within the temporary construction area, to form naturalistic landforms and contribute to screening of the access road and training centre.
- New planting and landscaping will be designed to integrate with existing vegetation and early planting established in the construction phase, and to contribute to visual screening, enhance landscape character and improve biodiversity interest.

- Vegetation within the EDF Energy Estate would be managed to enhance landscape character and maintain the long-term screening function of vegetation in views towards existing and new power station structures and ancillary features, structures and infrastructure.
- The sea defences would screen views to activity and lower lying buildings and structures adjacent to the main power station structures from locations along Sizewell Beach and offshore. Planting on the sea defences and northern mound will comprise species that integrate these features into the Bent Hills and wider coastal landscape and enhance visual screening.
- The width of the main access road would be reduced during the operational phase from its maximum width during construction and the margins landscaped in accordance with the landscape and ecology masterplan.
- The temporary road on the eastern side of the proposed SSSI crossing would be removed and additional native tree and shrub planting will be introduced to screen vehicle movements in views from the coast.
- Prominent structures, notably the Turbine Halls and Operational Services Centre, located along the coast will be designed to respond to their sensitive landscape and visual context within the Suffolk Coast and Heaths AONB and Suffolk Heritage Coast. Measures will include careful consideration of design detailing, materials, finishes and colours.
- Permanent structures inland from the coast, such as the training centre and emergency equipment store will be designed to respond to their sensitive landscape context within or adjacent to the Suffolk Coast and Heaths AONB.
- The Sizewell B Relocated Facilities, located adjacent to the existing Sizewell A and Sizewell B power stations, will be designed to be consistent with the adjacent nuclear structures/buildings and to reduce as far as practicable their visibility from locations to the west and south.
- The outage car park in Pill Box Field will be located to the north of rising land to reduce its visibility. Ground modelling and new planting would enhance screening of vehicles and lighting.
- The lighting strategy includes measures to target lighting where it is required and avoid unnecessary illumination and light spill.

c) Preliminary assessment of effects

i) Construction

Effects on-site fabric

2.2.25. Preparation of the main development site for construction will require clearance of the main power station platform area, contractors compound areas, spoil management zones, site entrance hub, accommodation campus area, the LEEIE and beach/foreshore area. These works would result in the removal of features comprising the physical fabric of the landscape including some areas of agricultural land/grassland, hedgerows, trees, tree belts, shrubs, plantation woodlands (including parts of Coronation Wood and at Goose Hill) and the sea defences and northern mound. There would also be localised changes to landform due to excavation, groundworks to create level working platforms and stockpiling and storage of excavated materials. The removal of existing fencing, buildings and other structures may also be required.

Effects on landscape/seascape character

2.2.26. The nature and extent of changes to landscape/seascape character will vary over the construction period, with different activities happening in different parts of the main development site at different times and for different durations.

2.2.27. There is potential for significant adverse effects on landscape/seascape character throughout the duration of the construction phase resulting from the initial phase of site clearance and preparation; the continued modification of the landscape/seascape through the introduction of new temporary and permanent buildings, structures and infrastructure; the removal of temporary buildings, structures and infrastructure and landscaping to restore the main development site towards the end of the construction phase.

2.2.28. Potential for significant adverse effects would be limited to the estate sandlands LT, ancient estate claylands LT, coastal levels LT, coastal dunes and shingle ridges LT and nearshore waters SCT within the main development site as a result of changes to the fabric of the landscape/seascape, construction activity and the erection of temporary and permanent buildings, structures and infrastructure.

2.2.29. Significant adverse effects on landscape/seascape character may also arise at distances up to approximately 2.5 kilometres (km) from the main development site, where construction activity would be a prominent feature in elevated and expansive views that contribute to landscape/seascape character, for example from locations within the estate sandlands LT, coastal levels LT, coastal dunes and shingle ridges LT and within the nearshore waters SCT.

2.2.30. Whilst significant adverse landscape effects may arise during construction as described above, the effects would be temporary, albeit in some cases for up to ten years.

Visual effects

2.2.31. There is potential for significant adverse visual effects throughout the period of construction. The scale and extent of visual change will vary dependent on the type of activity being undertaken, its location, duration and the potential interaction with other construction activity undertaken previously or being undertaken at the same time (for example material stockpiles may screen views to some construction activity).

2.2.32. The extent of views to some construction activity may be relatively restricted and limited to locations in close proximity to the works being undertaken, such as views to Pill Box Field and LEEIE. However, other activity may be visible from locations at greater distances from the main development site, such as views to construction activity when tall cranes are in use; to materials storage areas, particularly when these are at the maximum height parameters proposed; and to works located on the coast and offshore which are relatively exposed.

2.2.33. The following visual receptors at locations within the main development site that remain open to the public during the construction phase (including Sizewell Beach and offshore areas) and up to approximately 1km from the main development site boundary, may experience significant adverse visual effects:

- Recreational users of the Suffolk Coast Path and Sandlings Walk and PRoWs (E-363/021/0), Sizewell Beach and immediate offshore waters approximately between Sizewell Village and Minsmere Sluice.
- Recreational users of the bridleway (E-363/019/0, referred to as bridleway 19) on Sandy Lane and north of Sandy Lane to Eastbridge Road (which is part of the diverted route of the Suffolk Coast Path and Sandlings Walk during construction), permissive paths at Kenton Hills, Goose Hill and Sizewell Belts and visitors to Leiston Common, including users of the footpath crossing the Common (E-363/030/0).
- Residents at the eastern edge of Leiston, including along Valley Road, and King George's Avenue and at the junction of Lover's Lane and Sandy Lane and motorists on Lover's Lane, King George's Avenue and Valley Road.
- Residents at the northern edge of Leiston on Abbey Road and in properties immediately adjacent to the boundary of the main development site, such as at the junction of the B1122 Abbey Road and Eastbridge Road and at Potter's Farm; visitors to Leiston Abbey and Pro Corda; users of PRoWs (E-363/010/0, E-515/011/0, E-515/009/0, E-515/010/0, E-515/015/0) and re-routed Suffolk Coast Path and Sandlings Walk between Sizewell and Eastbridge and PRoW E-363/013/0; users of the Suffolk Coastal Cycle Route; cyclists on Abbey Road and (diverted) Eastbridge Road; and motorists on local roads (Lover's Lane, Abbey Road, and Eastbridge Road).
- Recreational users of the re-routed section of the Suffolk Coast Path and Sandlings Walk between Eastbridge and Minsmere Sluice and PRoW (E-363/020/0).

2.2.34. Significant adverse effects may also be experienced by visual receptors at prominent locations in the wider landscape and with direct views to construction works between 1 and 2.5km from the main development site, including visitors to the Royal Society for the Protection of Birds (RSPB) Minsmere reserve (see also section 2.4) and National Trust Dunwich Coast Guard Cottages and from locations along the coast and offshore.

2.2.35. As for landscape effects, whilst significant visual effects may arise during construction as described above, the effects would be temporary, albeit in some cases for up to ten years.

Effects on designated and defined landscape/seascape

2.2.36. Construction activity has the potential to have a direct effect on several of the Natural Beauty Indicators for the Suffolk Coast and Heaths AONB as follows:

- Characteristic semi-natural and cultural landscapes, notably areas of shingle beach, Sandlings heath, forest and farmland would be removed and replaced by construction activity, plant and materials storage areas.
- The uncluttered, simple appearance and outline of the existing power stations and lack of visible human activity would change to a complex and dynamic construction site with views of moving plant and vehicles and general construction activity.
- Aesthetic, spatial and emotional experiences along the open and exposed coast would be affected by the proximity to construction activity.
- Sensory stimuli, notably dark skies, natural sounds and a sense of relative tranquillity would be periodically affected by noise, activity and light spill/glow.

- The relatively undeveloped stretch of coastline, accessed by often lightly trafficked access routes, would become busier due to increased traffic on local roads and new road and rail routes crossing the width of the AONB.
- An area of accessible plantation woodland, providing a sense of enclosure and isolation, would be felled and access removed.
- Field patterns, defined by hedgerows reflecting the process of land management and enclosure, would be removed as part of site clearance.

2.2.37. Potential for significant adverse effects would be limited to the area of the Suffolk Coast and Heaths AONB and Suffolk Heritage Coast within and immediately adjacent to the main development site, extending to approximately 1km from the main development site boundary.

2.2.38. Significant adverse effects may also arise due to changes to important or characteristic views that contribute to the AONBs Natural Beauty Indicators including panoramic views from the coastline along the coast and out to sea and from elevated vantage points over low lying coastal marshes and estuaries up to approximately 2.5km from the main development site boundary.

2.2.39. A very small area of the SLA designation extends into the westernmost portion of the main development site, broadly coincident with the accommodation campus and site access and entrance hub. This area is judged to make a limited contribution to the special landscape qualities of the SLA and the remainder of the SLA will be unaffected. Significant effects are judged as unlikely to occur on the SLA designation.

2.2.40. Whilst significant adverse effects may arise on designated and defined landscapes and seascapes during construction as described above, the effects would be temporary, albeit in some cases for up to ten years.

ii) Operation

Effects on landscape/seascape character

2.2.41. During operation, there would be a localised significant adverse effect on the character of the landscape/seascape within and immediately adjacent to the main development site. These effects would be limited to the estate sandlands LT, coastal levels LT and coastal dunes and shingle ridges LT within which the main power station structures, training centre, access road, SSSI crossing and sea defences and northern mound are located.

2.2.42. Implementation of the operational phase landscape masterplan across the EDF Energy Estate would result in the gradual establishment of new areas of woodland, tree belts, grassland and coastal habitat that would enhance landscape character in areas of the estate sandlands LT, ancient estate claylands LT, coastal levels LT, and coastal dunes and shingle ridges LT. The area of the LEEIE would be returned to its existing agricultural use.

Visual effects

2.2.43. The ZTV[1] presented in **Figure 2.2.5** indicates areas of potential visibility of the principal permanent structures associated with proposed development. It shows that the principal structures would be potentially visible across wide areas of the offshore component of the study area. Onshore, the ZTV illustrates that the principal structures would be potentially visible extensively within an area extending to approximately 5km from the main development site boundary and along the coast to Southwold in the north and Orfordness in the south. Beyond this area the ZTV indicates that potential visibility is more fragmented.

2.2.44. The ZTV study was used to aid the identification of those receptors that are likely to be most affected by the proposed development and to select representative viewpoints for use in the assessment of effects. Twenty-eight representative viewpoints have been identified for the assessment. The representative viewpoint locations are presented in **Figure 2.2.6**. Photowires have been prepared to illustrate the nature of visual effects of the operational development from five of the representative viewpoints. These are presented in **Figures 2.2.7** to **2.2.11**.

2.2.45. Given their proximity to permanent elements of the proposed development, notably the access road, training centre, car parking areas, main power station structures and sea defences and northern mound, the following groups are likely to experience significant adverse effects:

- Recreational users of the Suffolk Coast Path and Sandlings Walk and PRoW (E-363/021/0), Sizewell Beach and immediate offshore waters approximately between Sizewell Village and Minsmere Sluice (refer to Figure 2.2.8: Representative viewpoint 10: Suffolk Coast Path and Sandlings Walk east of Hill Wood; **Figure 2.2.9**: Representative viewpoint 6: Suffolk Coast Path east of Goose Hill and **Figure 2.2.10** Representative viewpoint 14: Suffolk Coast Path at Minsmere Sluice).
- Recreational users of the bridleway (E-363/019/0) between Sizewell Gap and Sandy Lane; permissive paths at Kenton Hills, Goose Hill and Sizewell Belts; and Sandlings Walk and bridleway (E-363/019/0) in the vicinity of Upper Abbey Farm.

[1] The ZTV was carried out using Environment Agency 2m resolution LiDAR data (Digital Surface Model) resampled to 5m which includes built form and woodlands as visual barriers in order to provide a more realistic indication of potential visibility. The proposed sea defence structures are modelled into the ZTV as they form part of the proposed development and will contribute to the screening of new and existing power station structures.

2.2.46. Significant visual effects may also be experienced by visual receptors at prominent locations in the wider landscape and with direct views of the existing Sizewell A and Sizewell B and main power station structures, up to approximately 2.5km from the main development site, including visitors to the RSPB Minsmere Reserve and National Trust Dunwich Coast Guard Cottages (refer to **Figure 2.2.11**) Representative viewpoint 17: National Trust Dunwich Coastguard Cottages car park).

2.2.47. Effects would be greatest at the commencement of the operational phase as new planting implemented in the construction phase becomes established. As areas of new planting mature, effects would reduce, but it is judged that the effects would remain significant and adverse from these locations.

2.2.48. There would be views to the main power station structures from less prominent locations in the wider landscape including from within settlements, such as Leiston, local destinations such as Leiston Abbey and from roads, footpaths and accessible landscapes, such as The Walks, Leiston Common and Dunwich Heath. Views would typically be of the upper portions of the main power station structures and pylons, with lower elevations screened by woodland and trees. In views from the north, for example from locations along the coast and within Southwold, the main structures will be seen in front of Sizewell A and B. In views from locations to the south, Sizewell A and B will partially screen views to Sizewell C, further reducing the effects of the proposed development on views (refer to **Figure 2.2.7** Representative viewpoint 9: Sizewell Gap south of Greater Gabbard Sub-Station. It is judged that effects would not be significant.

Effects on designated and defined landscape/seascape

2.2.49. Permanent elements of the proposed development, comprising the access road, car parking areas, training centre, SSSI crossing, power station buildings and associated infrastructure including pylons and the BLF are located within and immediately adjacent to the Suffolk Coast and Heaths AONB and Suffolk Heritage Coast.

2.2.50. The permanent development has the potential to have a direct effect on several of the Natural Beauty Indicators for the Suffolk Coast and Heaths AONB as follows:

- New power station structures, ancillary buildings and infrastructure including access road, parking areas and pylons would be introduced to the designated area affecting the aesthetic, spatial and emotional experiences along the open and exposed coast;
- A new permanent access road crossing the width of the AONB would be introduced to the relatively undeveloped stretch of coastline, accessed by often lightly trafficked access routes; and
- Access to a small area of formerly accessible plantation woodland at Goose Hill, providing a sense of enclosure and isolation, would be permanently removed.

2.2.51. Potential for significant adverse effects would be limited to the area of the Suffolk Coast and Heaths AONB and Suffolk Heritage Coast within and immediately adjacent to the permanent elements of the proposed development.

2.2.52. Significant adverse effects may also arise due to changes to important or characteristic views that contribute to the AONBs Natural Beauty Indicators including panoramic views from the coastline along the coast and out to sea and from elevated vantage points over low lying coastal marshes and estuaries up approximately 2.5km from the main development site boundary.

2.2.53. There would be limited or no effects on the remainder of the Suffolk Coast and Heaths AONB and Heritage Coast.

2.2.54. No significant adverse effects are anticipated on the SLA designation arising from the operational development.

d) Additional mitigation and monitoring

i) Construction

2.2.55. The mitigation measures required to reduce the effects of the proposed development during construction have been incorporated into the design of the project and the preliminary assessment of effects assumes that this mitigation forms part of the proposed development. No additional mitigation is proposed.

ii) Operation

2.2.56. The mitigation measures required to reduce the effect of the proposed development has been incorporated into the design of the project and the preliminary assessment of permanent effects assumes that this mitigation forms part of the proposed development. No additional mitigation is proposed.

e) Preliminary assessment of residual effects

i) Construction

2.2.57. No further mitigation measures are proposed, and as such, the residual effects will be the same as those described for effects of the proposed development during construction.

ii) Operation

2.2.58. No further mitigation measures are proposed, and as such, the residual effects will be the same as those described for effects of the proposed development during operation.

f) Completing the assessment

2.2.59. The Environmental Statement (ES) will present a full Landscape and Visual Impact Assessment (LVIA) underpinning the conclusions drawn above in relation to significant effects, updated where relevant to account for design changes. Effects of lesser significance will also be assessed and described. To complete the LVIA the following actions are required:

- finalise the draft Sizewell C Seascape Character Assessment in consultation with the LVIA consultees;
- re-run ZTV based on final fixed design and parameters for main structures/zones;
- agree the final list of representative viewpoints with the LVIA consultees and locations of viewpoints to generate photowires and photomontages;
- undertake professional photography for agreed representative viewpoints during winter 2018/2019; and
- produce photowires and photomontages for agreed representative viewpoints.

Table 2.2.1 Summary of effects for the construction phase

Landscape and visual

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Landscape / seascape character within the site.	Site clearance and preparation; modification of the landscape/seascape arising from construction activity and landscaping towards the end of the construction phase.	Retention of established vegetation. Landscaping early in the construction phase.	Significant	None	Significant
Landscape / seascape character up to approximately 2.5km from the site.	Views to construction activity from locations where elevated and expansive views are characteristic.	Retention and protection of wooded and forested areas on rising landform that provides screening. Limiting the maximum height parameters of material storage and borrow pit areas.	Significant	None	Significant
Visual receptors within the main development site and up to approximately 1km from the site.	Views to construction activity.	Retention of established vegetation, Landscaping early in the construction phase to provide localised screening, Creating earth bunds and fencing to provide visual containment, Selecting the causeway option for the SSSI crossing, reducing the visual prominence of the accommodation campus, Limiting the maximum height parameters of material storage and borrow pit areas.	Significant	None	Significant
Visual receptors at prominent locations between approximately 1km and 2.5km from the site.	Views to construction activity from locations where elevated and expansive views are possible.	Retention and protection of wooded and forested areas on rising landform that provides screening. Reducing the visual prominence of the accommodation campus. Limiting the maximum height parameters of material storage and borrow pit areas.	Significant	None	Significant
Suffolk Coast and Heaths AONB and Suffolk Heritage Coast within and immediately adjacent to the site, extending to approximately 1km from the site boundary.	Direct effects on Natural Beauty Indicators, including removal of characteristic semi-natural and cultural landscapes/ landscape features; views to construction activity and plant; increased traffic and new access provision crossing the width of the AONB; and removal of access to an area of plantation woodland.	Retention of established vegetation. Landscaping early in the construction phase.	Significant	None	Significant
Suffolk Coast and Heaths AONB and Suffolk Heritage Coast up to approximately 2.5km from the site.	Views to construction activity from locations along the coastline and out to sea and from elevated vantage points.	Retention and protection of wooded and forested areas on rising landform that provides screening	Significant	None	Significant
Special Landscape Area north of Upper Abbey Farm.	Construction and operation of site access, entrance hub and accommodation campus .	Retention of established vegetation. Landscaping early in the construction phase. Limiting the accommodation campus development to the area east of Eastbridge Road.	Not Significant	None	Significant

Table 2.2.2 Summary of effects for the operational phase

Landscape and visual

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Landscape / seascape character within and immediately adjacent to the site.	Introduction of new permanent buildings/ structures and infrastructure and implementation of operational phase landscape masterplan.	Implementation of the operational phase landscape masterplan and management plan. Designing the main access road to reflect rural roads in local landscape. Designing prominent structures on the coast, and structures inland from the coastline within or adjacent to the Suffolk Coast and Heaths AONB.	Significant	None	Significant
Visual receptors within and adjacent to the main development site.	Views to permanent elements of the proposed development.	Implementation of the operational phase landscape masterplan and management plan. Localised ground raising and creation of naturalistic landforms. Fixing the maximum height of smaller buildings and structures. Planting of the sea defences and northern mound to enhance screening of lower lying buildings. Designing prominent structures on the coast, and structures inland from the coastline within or adjacent to the Suffolk Coast and Heaths AONB.	Significant	None	Significant
Visual receptors in prominent locations and with direct views up to approximately 2.5km from the site.	Views to permanent elements of the proposed development, seen in the context of the existing Sizewell A and Sizewell B.	Retention and protection of wooded and forested areas on rising landform that provides screening.	Significant	None	Significant
Visual receptors in the wider landscape in less prominent locations.	Views to the upper portions of permanent elements of the proposed development, and seen in the context of the existing Sizewell A and Sizewell B.	Retention and protection of wooded and forested areas on rising landform that provides screening.	Not Significant	None	Not Significant
Suffolk Coast and Heaths AONB and Suffolk Heritage Coast within and immediately adjacent to the site.	Direct effects on Natural Beauty Indicators, including introduction of new power station structures, ancillary buildings and infrastructure; new access provision crossing the width of the AONB; and removal of access to an area of plantation woodland.	Designing prominent structures on the coast, and structures inland from the coastline within or adjacent to the Suffolk Coast and Heaths AONB. Designing the main access road to reflect rural roads in local landscape. Implementation of the operational phase landscape masterplan and management plan.	Significant	None	Significant
Suffolk Coast and Heaths AONB and Suffolk Heritage Coast up to approximately 2.5km from the site.	Views to permanent elements of the proposed development, and seen in the context of the existing Sizewell A and Sizewell B.	Retention and protection of wooded and forested areas on rising landform that provides screening.	Significant	None	Significant

2.3. Terrestrial ecology and ornithology

2.3.1. The figures for terrestrial and ornithology are presented in **Volume 3** as **Figures 2.3.1** to **2.3.4**.

a) Baseline environment

2.3.2. The baseline environment for terrestrial ecology[2] and ornithology (including freshwater habitats and related species) has been prepared following an extensive suite of ecological surveys and desk studies. A summary of the baseline is given, focusing on the elements that may experience significant effects. The full ecological baseline will be presented in the ES that will accompany the application for development consent.

2.3.3. There are 12 European designations comprising Special Protection Areas (SPAs), Special Areas for Conservation (SACs) and Ramsar Sites within a 20km radius of the main development site for which the Habitats Regulations Assessment (HRA) cannot, at this stage, exclude the potential for a likely significant effect to occur. The HRA is being undertaken to consider in detail the potential for impacts on the important species within these European sites. The 12 designations are:

- Alde – Ore Estuary SPA, SAC and Ramsar Site;
- Benacre to Easton Bavents Lagoons SAC, SPA and Ramsar Site;
- Minsmere to Walberswick Heaths and Marshes SPA, SAC and Ramsar Site;
- Orfordness to Shingle Street SAC;
- Sandlings SPA; and
- Outer Thames Estuary SPA.

2.3.4. There are 18 nationally designated sites within a 20km radius of the main development site, all of which are SSSIs. Further assessment work is required to fully assess the potential for significant effects on these sites. The following are considered the most likely to be significantly affected:

- Minsmere to Walberswick Heaths and Marshes SSSI; and
- Sizewell Marshes SSSI.

2.3.5. There are seven non-statutory local designated sites (Country Wildlife Sites (CWS)) within a 2km radius of the main development site. The Sizewell Levels and associated areas CWS, and the Suffolk Shingle Beaches CWS, are the two sites most likely to be significantly affected.

2.3.6. The main habitats within the main development site are agricultural farmland with large areas of conifer plantation and smaller areas of deciduous woodland, acid grassland and heathland, with newly created acid grassland and reedbed at Aldhurst Farm. The deciduous woodlands, in particular Ash Wood and Fiscal Policy, contain mature and semi-mature trees suitable for roosting bats and nesting birds. The conifer plantations of Goose Hill and Kenton Hills are of more limited ecological value, but the rides and glades support reptile populations and habitat for invertebrate species, as well as providing foraging habitat for bats. The coastal beach vegetation supports nationally scarce plant species such as sea pea (*Lathyrus japonicus*) and sea-kale (*Crambe maritima*) and, at Sizewell Marshes SSSI, wetland plant communities of national importance, including fen meadow dominated by blunt-flowered Rush (*Juncus subnodulosus*), ditches with diverse aquatic plant assemblages (including frogbit (*Hydrocharis morsus-ranae*) and soft hornwort (*Ceratophyllum submersum*), and reedbed. The acid grassland, heathland, broadleaved woodland coastal vegetation and wetland vegetation within Sizewell Marshes SSSI are all habitats of Principal Importance under the Natural Environment and Rural Communities Act 2006 (NERC Act) (Ref. 2.3.1, Section 41).

2.3.7. Invertebrate surveys of Sizewell Marshes SSSI and adjacent coastal vegetation have confirmed that both support nationally important invertebrate assemblages including the Norfolk hawker dragonfly (*Aeshna isoceles*); small heath (*Coenonympha pamphilus*); white admiral (*Limenitis camilla*) and grayling (*Hipparchia semele*) butterflies; white-mantled wainscot moth (*Archanara neurica*); greater silver water beetle (*Hydrophilus piceus*); and the rare antlion species *Euroleon nostras*. Survey work has also confirmed that the sandy track edges within Goosehill plantation and some of the arable field margins also support an invertebrate assemblage of importance, similar to that present within the coastal habitats.

2.3.8. The main development site supports an important reptile[3] assemblage, in particular, populations of adder (*Vipera berus*) and slow worm (*Anguis fragilis*). An introduced population of natterjack toads[4] (*Epidalea calamita*) is present within Retsom's Field on the northern edge of the main development site.

[2] A separate section on Marine Ecology is presented in section 2.16.

[3] All UK species of reptiles are protected under the Wildlife and Countryside Act 1981 (Ref. 2.3.2), making it an offence to kill or injure these species. They are also species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

[4] Natterjack toads are a European Protected Species (EPS) and also receive full protection under the Wildlife and Countryside Act 1981.

2.3.9. Studies conducted over four breeding seasons have identified that the mosaic of habitats across the main development site supports a diverse assemblage of breeding and wintering birds[5], including specially protected species such as Cetti's warbler (*Cettia cetti)*, hobby (*Falco subbuteo*), black redstart (*Phoenicurus ochruros*), barn owl (*Tyto alba*), and crossbill (*Loxia curvirostra*). Marsh harriers[6] (*Circus aeruginosus*) nesting at Minsmere hunt over Sizewell Marshes SSSI and adjacent arable farmland, and detailed survey work has established the extent of this foraging behaviour. Survey work has, in addition, established the distribution and abundance of wintering wildfowl species, with both Sizewell Marshes SSSI and the Minsmere South Levels supporting wintering populations.

2.3.10. The wintering bird surveys confirmed that the main development site supports a diverse wintering bird population. A total of 63 bird species were recorded including the following species of principal importance under the NERC Act including: marsh tit (*Parus palustris*); skylark (*Alauda arvensis*); starling (*Sturnus vulgaris*); song thrush (*Turdus philomelos*); house sparrow (*Passer domesticus*); tree sparrow (*Passer montanus*); linnet (*Carduelis cannabina*); lesser redpoll (*Carduelis cabaret*); and yellowhammer (*Emberiza citronella*).

2.3.11. Recent studies also indicate that the inshore waters adjacent to Sizewell are an important foraging habitat for a range of seabird species. Surveys for red-throated diver (*Gavia stellata*) indicate that, whilst this qualifying feature of the Outer Thames Estuary SPA is present in significant numbers along the Suffolk coast, the inshore waters close to Sizewell have been found to support fewer individuals than adjacent stretches further north and south. Similarly, studies of breeding little tern (*Sternula albifrons*)[6], which is also a qualifying feature of the SPA, have shown that this species does not forage extensively along the coast immediately adjacent to Sizewell.

2.3.12. Sizewell Marshes SSSI supports a nationally important population of water voles[7] (*Arvicola amphibious*) and a locally important population of otters[8] (*Lutra lutra)* is also present. Several badger[9] (*Meles meles*) setts have been identified and detailed bait-marking studies have confirmed the territory size and interrelationships between the two social groups present.

2.3.13. Extensive surveys since 2007, including trapping and radio tracking, have confirmed that the main development site supports an important assemblage of bats[10] comprising ten species. This assemblage includes a breeding colony of the rare barbastelle (*Barbastella barbastellus*), assessed as being of national[11] importance, and Natterer's bat (*Myotis nattereri*), assessed as being of county importance.

2.3.14. The remaining eight bat species that use the EDF Energy Estate are considered to be of local importance. These are: Daubenton's bat (*Myotis daubentonii*); noctule (*Nyctalus noctula*); Leisler's bat *(Nyctalus leisleri*); common pipistrelle (*Pipistrellus pipistrellus)*; soprano pipistrelle (*Pipistrellus pygmaeus*); Nathusius' pipistrelle *(Pipistrellus nathusii*); serotine (*Eptesicus serotinus*); and brown long-eared bat (*Plecotus auritus*).

2.3.15. The EDF Energy Estate supports a significant bat roost resource, with over 500 trees identified as having medium or higher potential for roosting bats. Roosts have been identified in trees, buildings and bat boxes, with the highest numbers of confirmed roosts identified in Ash Woods, Kenton Hills and The Grove, in areas outside of the proposed construction footprint. Barbastelle roosts, the majority of them tree-roosts, were distributed within and beyond the EDF Energy Estate, as far west as Saxmundham, almost as far east as the coast, as far north as Scottshall Covert, Minsmere, and as far south as the edge of Leiston. Natterer's bats were recorded roosting in buildings, bat boxes and trees, within the EDF Energy Estate but outside of the proposed construction footprint. Other maternity roosts included brown long-eared bat (Ash Wood cottages and Upper Abbey Farm) and soprano pipistrelle (bat boxes in Kenton Hills). Upper Abbey Farm has been used by other species in small numbers as an occasional, mating or hibernating roost site.

2.3.16. The most well-used commuting routes/flight-paths for bats identified during surveys were bridleway E-363/019/0; north from Ash Wood and The Grove; and east-west along the northern edge of Kenton Hills. The junction of the Upper

[5] All wild birds, their eggs and nests are protected under Section 1 of the Wildlife and Countryside Act 1981. Species such as Cetti's warbler, black redstart, crossbills, hobby and barn owl are listed on Schedule 1 of the Wildlife and Countryside Act 1981 and are afforded extra protection against disturbance whilst nesting.

[6] Schedule 1 species of the Wildlife and Countryside Act 1981.

[7] The water vole is protected under Schedule 5 of the Wildlife and Countryside Act 1981 and is included within Section 41 of the NERC Act (2006).

[8] The otter is an EPS (Ref. 2.3.3, Schedule 2) and protected under Schedule 5 and 6 of the Wildlife and Countryside Act 1981 and is included within Section 41 of the NERC Act (2006).

[9] Badgers are protected from disturbance under the Badger Act (1992) (Ref. 2.3.4).

[10] All species of bat in the UK are EPSs, receiving protection under the Conservation of Habitats and Species Regulations (2017). They are also protected under the Wildlife and Countryside Act 1981. Several bat species, including soprano pipistrelle, brown long-eared bat, noctule and barbastelle are species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

[11] The conservation value assigned to each bat species has considered their conservation status, distribution and abundance in the UK, within Suffolk, and locally; the presence of maternity and/or hibernation roots; and their use of different habitats for foraging and commuting.

Abbey bridleway and Leiston Old Abbey/Fiscal Policy was also well-used. Areas of greatest value to foraging bats varied between seasons and years, but included Ash Wood and areas to the north, part of the Upper Abbey bridleway, Leiston Old Abbey, Kenton Hills/Nursery Covert, rides within Goose Hill, and Sizewell Marshes SSSI.

2.3.17. The ten bat species present use the habitats within the EDF Energy Estate to differing extents. Barbastelle, the rarest species, use a wide range of habitats of varying quality situated in close proximity to each other and areas of open arable land do not appear to restrict their movement. There is higher relative activity and a greater reliance on habitats within the EDF Energy Estate earlier in the bats' active season. It is possible that the colonies within Sizewell and Minsmere behave as separate sub-populations earlier in the year, but there is a noticeable interchange between these sub-populations in the later Summer/Autumn, perhaps suggesting that both sub-populations are using a foraging resource beyond the boundaries of the EDF Energy Estate at this time of year. Of the other bat species, Natterer's bats also have a high reliance on the EDF Energy Estate.

b) Environmental design and embedded mitigation

2.3.18. A summary of the measures that have been incorporated into the design of the main development site that would protect existing features of ecological interest, are set out below.

i) Construction

- The rights of way and access strategy for the EDF Energy Estate (see **Volume 1, Chapter 17**) will be further developed in consultation with reserve and habitat managers to reduce the extent to which people access habitat within European sites for recreational purposes, minimising disturbance to ground-nesting bird species and trampling of vegetation. The strategy would outline local mitigation measures, aimed at reducing the potential for recreational disturbance.
- Foraging habitat for marsh harrier would be established and enhanced across the northern part of the EDF Energy Estate, in advance of construction, to mitigate any potential disturbance effects which might discourage marsh harriers from foraging over parts of the Minsmere South Levels and Sizewell Marshes SSSI during construction. This habitat creation would also likely provide additional habitat for nesting bird species and potential foraging for bat species.
- Boundary treatments are included within the construction masterplan to minimise noise and visual disturbance to adjacent designated sites or valuable habitats.
- A mitigating solution (e.g. sheet piling) would be installed to provide separation from the main development site platform and Sizewell Marshes SSSI to limit the disturbance to the hydrology and geology of Sizewell Marshes SSSI.
- The realignment of the Sizewell Drain and the construction of associated water control features would enable manipulation of the water levels within Sizewell Marshes SSSI, and would help to ensure that any alterations to the hydrological regime caused by construction activities can be brought back to the correct parameters needed to safeguard retained areas of fen meadow and reedbed habitats. Control structures would include passage for eels and other fish.
- The Sizewell Marshes SSSI crossing has been designed to be a culvert of sufficient dimensions to leave the bank and channel of the Leiston Drain intact. The culvert would be of sufficient size to facilitate the passage of bats and water voles through the structure, and a ledge would be installed to enable passage by otters.
- The establishment of new reedbed and ditches at Aldhurst Farm (completed in 2016) has provided replacement for the predicted loss of these habitats within Sizewell Marshes SSSI. The replacement habitats have been established successfully, and mobile aquatic plant and invertebrate species will colonise over time from the adjacent areas of the Sizewell Marshes SSSI. These new habitats also provide nesting and foraging habitat for bird and bat species.
- Reedbed habitat at Aldhurst Farm also provides suitable habitat to enable the translocation of water voles from within the main development site. The habitat at Aldhurst Farm has been fenced to minimise the risk of water voles colonising naturally ahead of translocation.
- A fen meadow strategy is being developed to identify a derelict area of fen meadow in Suffolk which could be restored to compensate for the permanent loss of about 0.5ha of fen meadow habitat from within Sizewell Marshes SSSI, associated with the construction of the platform and the diversion of the Sizewell Drain.
- Sand and shingle substrate would be stockpiled to preserve the seedbank of the coastal vegetation and would be incorporated into the final landscaping of the new sea defence to reinstate the coastal vegetation.
- The majority of the woodland resource within the EDF Energy Estate would be retained and the line of broadleaved trees on the northern edge of Kenton Hills, known to support features of importance for roosting bat species, would be retained.

- Large areas of habitats for reptiles have been established, in advance of construction, to enable the translocation of reptiles from the main development site. This has also created areas of sand-dominated habitat likely to be beneficial to invertebrate species such as those identified in the coastal and woodland ride habitats.
- Mitigation strategies would be implemented for legally protected species including bats, natterjack toads, water voles and reptiles. These would include monitoring protocols to ensure any receptor sites are in the correct condition to receive translocations.
- Alternate roost sites (bat boxes) have been erected in advance of construction within woodland least likely to be directly affected by noise and lighting disturbance, should the main development site displace roosting bats from woodland more directly exposed to disturbance.
- The measures within the construction lighting strategy would minimise light spill onto surrounding habitats. The strategy will define measures to minimise impacts on nocturnal species such as bats that may use nearby habitats for roosts or foraging.
- The Construction Environmental Management Plan (CEMP) would define any ecological constraints and specify any measures required during enabling works and construction in relation to the presence of protected species and any required vegetation clearance works. The CEMP would also outline suitable biosecurity controls for the management of invasive non-native species.
- Measures within the CEMP would be overseen by an Environmental Clerk of Works (ECoW), who would brief contractors on the ecological sensitivities of the main development site and surroundings.

ii) Operation

- The measures within the operational lighting strategy would minimise light spill onto surrounding habitats to minimise impacts on nocturnal species such as bats that may use nearby habitats for roosts or foraging.
- Infrastructure would be in place to ensure all surface run-off and foul water is captured and treated and does not enter adjacent designated sites.
- A Landscape and Ecology Management Plan (LEMP) has been drafted which would return arable land on the EDF Energy Estate post-construction to Suffolk Sandlings habitat comprising acid grassland and heathland. This landscape-scale habitat creation would replace existing intensively managed arable farmland with vhabitat of greater biodiversity value and would reduce habitat fragmentation.
- The LEMP includes long-term management prescriptions and a monitoring programme for habitats created ensuring that these areas deliver the environmental enhancements required.

c) Preliminary assessment of effects

2.3.19. Given the embedded mitigation measures proposed, this preliminary assessment focuses on the habitats and species for which potentially significant effects could occur. It also discusses effects on specific key ecological features associated with European and nationally designated sites where it is envisaged a significant effect is unlikely to occur. The ES and HRA will examine in detail the potential for significant effects to occur. The section below focusses on the likely significant effects.

2.3.20. There would be adverse effects on some ecological features (for example, legally protected species such as badgers) but these are unlikely to be significant, and they are not discussed further. A detailed impact assessment will be presented for these habitats and species within the ES.

i) Construction

2.3.21. Construction noise has the potential to disturb both breeding and wintering bird species. A noise level threshold of 70 decibels (dB) LAmax has been identified as the point beyond which potentially adverse disturbance effects to waterbirds could arise. Modelling of potential construction noise levels (see **section 2.7**) indicates that levels above this threshold could occur in some areas adjacent to the main development site. Modelling has shown that the areas used by breeding populations of gadwall (*Anas strepera*), teal (*Anas crecca*), shoveler (*Anas clypeata*) and avocet (*Recurvirostra avosetta*) would not be affected by noise levels above the 70dB LAmax threshold or use areas at which they would be sensitive to visual disturbance as they are located over 1km from the closest part of the main development site boundary. No significant effect from noise is therefore envisaged on breeding waterbirds within the Minsmere to Walberswick SPA boundary.

2.3.22. The southern-most part of Minsmere South Levels[12] could be subject to noise levels above the 70dB LAmax threshold. This area supports less than 1% of the SPA wintering populations of gadwall, shoveler and teal. Initial noise modelling has indicated that there will be some intrusion of noise levels above the 70dB LAmax threshold for short periods during the initial phases of the construction programme and

[12] This is located to the north of the main development site and part of the Minsmere to Walberswick Heaths and Marshes SSSI, but is not part of the SPA/Ramsar Site and so considered separately here.

that noise disturbance could potentially lead to a short-term significant adverse effect on bird species using the Minsmere South Levels. Further noise modelling and assessment is required before the likely significance of the effect is confirmed.

2.3.23. Sizewell Marshes SSSI, located to the south and west of the main development site, also supports wintering gadwall, shoveler and teal, some of which are likely to be associated with the designated populations within the Minsmere to Walberswick SPA. Initial noise modelling indicates that the majority of Sizewell Marshes SSSI would not be subject to potentially adverse noise disturbance and would still be available for foraging and roosting waterbirds. No long-term significant adverse effect on the wintering waterbird assemblage within Sizewell Marshes SSSI is predicted.

2.3.24. Construction activities can lead to visual disturbance to birds. For waterbirds, a distance of 300m is used within which visual disturbance is assumed to occur whilst at distances greater than 300m no noticeable disturbance effects are expected. Throughout the construction phase, activity on the main development site would constitute a potential source of visual disturbance to wintering birds at the southern end of Minsmere South Levels; however, the habitat used by most wintering waterbirds in this area is located approximately 400m from the main development site and no significant effects from visual disturbance are expected.

2.3.25. Potential adverse effects on the breeding population of marsh harriers within the Minsmere to Walberswick SPA and Ramsar Site could be experienced. This is due to a potential barrier effect arising from construction noise and visual disturbance which may discourage marsh harriers from foraging over parts of the Minsmere South Levels and Sizewell Marshes SSSI.

2.3.26. Where screening around the main development site is not present, it is possible that visual disturbance to marsh harriers in adjacent areas could arise. Around 150m is considered to be a realistic precautionary distance beyond which the foraging activity of breeding marsh harrier is unlikely to be disturbed. The retained woodland around the main development site perimeter provides some screening to foraging birds. Only a relatively small area of Minsmere South Levels would fall within 150m of the site boundary and would not be screened by woodland or retained planting and the effect of visual disturbance on marsh harriers is unlikely to be significant.

2.3.27. A noise threshold of 70dB LAmax is considered to be the level at which foraging marsh harriers and other bird species might avoid affected habitats. The majority of Sizewell Marshes SSSI would not be subject to noise levels greater than 70dB LAmax for extended periods during construction and no negative effect on foraging marsh harriers in this area is predicted. However, noise levels across the main development site would be greater than 80dB LAmax and this could potentially act as a barrier to the movement of marsh harriers south into Sizewell Marshes SSSI (along with visual disturbance from construction infrastructure) from breeding sites within the Minsmere to Walberswick SPA and Ramsar Site to the north. Suitable foraging habitat within Sizewell Marshes SSSI could therefore be effectively lost as a foraging resource to marsh harriers. In addition, arable land on the western side of the main development site lies within the >70dB LAmax footprint and could also be lost to foraging marsh harriers. This loss of foraging habitat could potentially reduce the breeding success of marsh harriers within the Minsmere to Walberswick SPA and Ramsar Site.

2.3.28. Given the duration of the construction programme, the potential loss of Sizewell Marshes SSSI as a foraging resource could have a longer-term effect on the breeding success of marsh harriers. As part of the embedded mitigation, alternative foraging habitat, designed to support large populations of prey species, would be established across the northern part of the EDF Energy Estate in advance of construction. If the alternative foraging areas are used by marsh harriers as an alternative, or in addition to, Sizewell Marshes SSSI, a significant effect on the marsh harrier population of the Minsmere to Walberswick SPA and Ramsar Site is unlikely to arise[13].

2.3.29. The fen meadow within Sizewell Marshes SSSI is dependent on a combination of water levels and an existing grazing regime to maintain species richness. Approximately 0.5 hectares (ha) of fen meadow from the eastern edge of Sizewell Marshes SSSI, would be lost due to the construction of the platform for the proposed power station. As part of the embedded mitigation, EDF Energy would restore an area of derelict fen meadow, at an offsite location within Suffolk, to species-rich fen meadow habitat. There would still be a localised residual effect due to the loss of fen meadow within Sizewell Marshes SSSI and the time taken for a derelict site to be restored. Assuming the successful offsite restoration of an area of derelict fen meadow, this would be sufficient to compensate for the loss of this habitat within Sizewell Marshes SSSI and there is unlikely to be a significant adverse effect on the extent of fen meadow habitat within Suffolk.

2.3.30. Wet woodland is not a feature for which Sizewell Marshes SSSI is designated although it is a Suffolk

[13] To assess the likely success of this additional foraging (and support the selected threshold of 70dB LAmax), a study was undertaken at Trimley Marshes, next to the docks at Felixstowe. This indicated that, over time marsh harriers, can become accustomed (habituated) to noisy environments. Noise from the docks at times exceeded 50dB LAmax and marsh harriers bred successfully in 2016.

Biodiversity Partnership priority habitat and supports part of the designated invertebrate assemblage. The majority of wet woodland within Sizewell Marshes SSSI would be retained, but there would be a small loss of wet woodland and this is considered potentially significant.

2.3.31. Ecological survey work and hydrological modelling have provided a detailed understanding of the optimal environmental parameters required to maintain habitats within Sizewell Marshes SSSI. Construction of Sizewell C has the potential to alter the underlying hydrological regime (see **section 2.10**), principally by increasing water levels slightly on the upstream side of the sheet pilling and cut-off wall. Initial hydrological modelling suggests that the changes in levels would be minor and that a control structure such as a sluice on the Sizewell Drain would enable control of water levels to optimise conditions within Sizewell Marshes SSSI. Further detailed hydrological modelling and assessment will be undertaken. If a control structure is successfully deployed, then there is unlikely to be a significant adverse effect on the hydrology of Sizewell Marshes SSSI.

2.3.32. The sand and shingle substrate of the coastline fronting Sizewell supports vegetation communities and associated invertebrate assemblages considered to be nationally important although these habitats are not covered by an SSSI designation. Over time, sea level rise is likely to erode the substrates as the existing sea defences would prevent the sand and shingle from migrating inland. The new sea defence structures which would be built to defend Sizewell C would be closer to the sea, occupying the area currently supporting the vegetation. As part of the flood defence design, substrates supporting coastal vegetation would be reinstated and vegetation allowed to re-establish on the new defences but given sea level rise predictions, there is the potential for this coastal vegetation to be lost to natural processes at some point in the future. This long-term net loss of coastal vegetation would be significant.

2.3.33. During construction, bats are likely to be displaced from foraging within the main development site and an ongoing assessment is investigating the extent to which construction noise might dissuade bats from foraging or roosting close to (or within) the main development site. It is thought likely that displacement of foraging and roosting bats species would constitute a significant adverse effect, at least in the short to medium term but that some habituation to noise and lighting disturbance may occur over the construction phase, reducing the potential for significant adverse effects in the longer term.

2.3.34. The majority of habitat loss relevant to bats comprises intensively managed arable areas, with the majority of tree loss occurring within the less-valuable plantation within Goose Hill. The construction layout would maintain a predominantly open landscape with small woodland blocks. The existing broadleaved woodland and associated foraging and roosting resource would be retained. The ongoing conversion of open intensive arable fields across the southern part the EDF Energy Estate to a Suffolk Sandlings habitats of open acid grassland/heath associated with the creation of reptile receptor sites is likely to be of benefit to bats by providing habitats supporting greater invertebrate prey, as would the established reedbed and grassland at Aldhurst Farm. Any requirements for additional connectivity or roost provision for bats would be determined by the ongoing impact assessment.

2.3.35. The construction impacts associated with the removal of the temporary construction area and the accommodation campus would be similar to those described for construction although the construction activities would be different.

ii) Operation

2.3.36. During the operational phase, noise disturbance is not likely to exceed the 70dB LAmax threshold (see **section 2.7**) and no significant noise disturbance effects on bird species are envisaged. Similarly, visual and lighting disturbance would be restricted to the operational infrastructure and disturbance to adjacent habitats would be minimal. No significant effects on bird species arising from lighting or visual disturbance are expected. Disturbance of bat species from operational noise and lighting is also unlikely to be significant.

2.3.37. The control structure on the Sizewell Drain along with appropriate monitoring and interventions would be expected to maintain the hydrological regime of Sizewell Marshes SSSI during the operational phase and no significant effects on Sizewell Marshes SSSI are envisaged.

2.3.38. Nitrogen deposition from backup diesel generator emissions may occur and under certain circumstances there is the potential that there may be some significant effects related to the daily ecological critical level nitrogen deposition on sensitive habitats (see **section 2.8**). This could to lead to a change in vegetation composition and structure promoting the growth of vigorous grasses and ruderal weed species at the expense of less vigorous plant species. The average background deposition rates are in excess of the lower and higher critical load range. Considering this and that increases in nitrogen deposition of sensitive habitats will be short-term and temporary, a significant effect on ecological receptors is unlikely. This will be the subject of detailed air quality assessment to determine if the effect is likely to be significant and suitable mitigation measures would be developed if required.

2.3.39. The measures within the LEMP would convert existing intensively farmed arable habitat within the EDF Energy Estate to acid grassland and heath characteristic of the Suffolk Sandlings. This landscape-scale approach would reduce existing fragmentation effects whilst providing additional habitats that would further enhance the populations of protected species present within the EDF Energy Estate. Overall net gains in biodiversity are anticipated as a result of this approach with an overall significant beneficial effect.

d) Additional mitigation and monitoring

2.3.40. The assessment has identified the potential for a number of significant effects to occur despite the embedded mitigation measures. Additional mitigation measures may therefore be required to minimise impacts so that significant effects are avoided. Furthermore, additional mitigation measures may also be required in relation to habitats and species for which a significant effect is not anticipated, but which are nonetheless legally protected, to ensure compliance with the legislation. Under the CEMP, pre-construction surveys will be required and may result in mitigation measures such as micro-siting of specific elements of the project and/or licences for protected species. Monitoring of mitigation measures may also be required to ensure their effectiveness. These measures will be presented in the ES, if relevant.

i) Construction

- Provision of additional bat roosting features if ongoing assessments indicate that these are required.
- Protection and demarcation of retained habitat such as woodland and hedgerows with fencing and briefing of contractors on ecological sensitivities of retained habitats and the main development site.
- Undertaking a rescue of fish and notable invertebrate species remaining when the Sizewell Drain is diverted and translocating these to the realigned ditch.
- Ensuring the CEMP and ECoW take account of any legally protected species or other environmental constraints that require consideration when the campus and other construction infrastructure are removed.
- Local mitigation measures on a site-by-site basis that may be required to mitigate recreational disturbance effects that would be outlined in the recreation and amenity strategy.
- Monitoring the behaviour of recreational users to ensure that mitigation measures outlined in the recreation and amenity strategy have been implemented successfully and allow for remedial action if required.
- Monitoring of habitats created to ensure these areas are established and deliver the enhancements required with a clear strategy for remedial action if habitats are not delivering the required enhancements.
- Monitoring of hydrological parameters within Sizewell Marshes SSSI to allow for remedial action if required, such as modifications to the operation of the water control structure or manipulation of the grazing regime.

ii) Operation

- Monitoring of Sizewell Marshes SSSI crossing to ascertain that it is not presenting a barrier to the movement of water voles and otters and to determine if remedial action required.
- Monitoring of the Sizewell Drain water control structure would be required to ensure the water control mechanism is working effectively.

e) Preliminary assessment of residual effects

i) Construction

2.3.41. This section identifies any residual effects taking account of embedded mitigation and the additional mitigation measures described above.

- There is likely to be a short-term displacement of waterbird species from the southern portion of the Minsmere South Levels (part of the Minsmere to Walberswick SSSI) due to intrusion of construction noise above the 70dB LAmax threshold. Some habituation may occur, and construction noise levels would only exceed the 70dB LAmax threshold for short periods, reducing the potential for residual effects over time.
- There is likely to be a medium-term displacement of bat species away from the immediate environs of the main construction site into the wider landscape due to noise and lighting disturbance arising from the construction phase. Some habituation may occur, reducing the potential for residual effects over time but the residual effect may still be significant.
- There will be land take within Sizewell Marshes SSSI, although this would be compensated by the ditch and

reedbed creation at Aldhurst Farm and the restoration of fen meadow habitat off-site.

- There will be a small residual loss of wet woodland and associated species from Sizewell Marshes SSSI. This residual impact would be potentially significant at local level but compensated through the overall net gain in biodiversity from the long-term proposals to restore the arable land within the EDF Energy Estate to Sandlings heath and acid grassland.
- There would be a potential accelerated erosion of the coastal vegetation due to the forward projection of the new sea defence. This residual impact would be offset through the overall net gain in biodiversity from the long-term proposals to restore the arable land within the EDF Energy Estate.

ii) Operation

2.3.42. The operational masterplan would restore the arable land within the EDF Energy Estate to Sandlings heath and acid grassland. Overall net gains in biodiversity are anticipated as a result of this approach and the gains would be expected to result in a significant beneficial effect.

f) Completing the assessment

2.3.43. Although survey and assessment of the ecological impacts on the main development site are largely complete, there will be a need to undertake a number of surveys in 2019, in order to confirm the existing baseline and complete some assessments. The surveys will include bat surveys of Upper and Lower Abbey Farm and of trees suitable for bat roosts across the main development site. The assessment of the effects of construction noise on bats will also be completed. These surveys and assessments will be reported in the ES.

2.3.44. Ongoing assessment of the impacts of construction noise on bats will help determine the need for any further mitigation measures. The assessment and any additional mitigation that is required will be reported in the ES.

Table 2.3.1 Summary of effects for the construction phase

Terrestrial ecology and ornithology

Topic / Receptor	Potential Impact	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Minsmere to Walberswick Heaths and Marshes SAC, SPA, Ramsar and SSSI – Habitat interest features.	Loss of habitat.	No loss of habitat within the designated site.	Not significant	None required	Not significant
	Alteration of groundwater or surface water hydrological regime. Potential pollution from surface water run-off and spillages.	Hydrological investigation has shown no potential for alteration of hydrological regime. Appropriate air and surface water control and chemical management outlined in the CEMP. Construction surface water management plan.	Not significant	None required	Not significant
	Displacement of recreational activity from Sizewell to nearby European sites. Trampling of sensitive vegetation.	Rights of way and access strategy: creation of alternate green space on Aldhurst Farm; improving access links between Leiston and the coast.	Initial assessment suggests a non-significant diffuse increase in visitor pressure.	Strategy would outline measures which would be developed with site managers. Monitoring to ensure efficacy of mitigation.	Not significant
	Alteration in vegetation structure and composition due to changes in air quality from vehicles and diesel generator emissions.	Dust management plan and dust suppression measures, as outlined in the CEMP.	Initial assessment suggests impacts highly localised and unlikely to be significant.	None required	Not significant
Minsmere to Walberswick Heaths and Marshes SPA, SAC, Ramsar and SSSI – Bird Interest features.	Disturbance due to recreational displacement from Sizewell.	Recreation and amenity strategy. Construction workers not permitted to have pet dogs. Provision of recreation facilities for construction workers.	Initial assessment suggests non-significant diffuse increase in visitor pressure.	Strategy would outline local measures developed with site managers. Behaviour of people (dog walkers) would be monitored.	Not significant

Table 2.3.1 Summary of effects for the construction phase

Terrestrial ecology and ornithology

Topic / Receptor	Potential Impact	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Minsmere to Walberswick Heaths and Marshes SPA, SAC, Ramsar and SSSI – Bird Interest features.	Noise, lighting and visual disturbance from construction activities.	Noise, lighting and visual disturbance control measures set out in CEMP as well as noise bunds and screens along site boundaries. Retention and reinforcement of woodland fringe along north-east boundary of main development site. Provision of alternate foraging habitat for marsh harrier.	Noise levels within almost all of the SPA would be below 70dB LA_{max} so not significant. Noise levels within a small area of the SSSI (Minsmere South Levels) would be greater than 70dB LA_{max} but only a small proportion of SPA bird species are present. Short-term significant effect. SPA boundary more than 300m from development so not significant. Displacement of foraging marsh harrier potentially a significant effect.	Monitoring of marsh harrier mitigation to ensure effective.	Initial assessment suggests no significant residual effects but detailed assessment to be carried out at ES stage.
	Disturbance to marine bird species due to shipping traffic associated with the BLF.	Minimal number of ship movements.	Due to the small number of predicted ship movements, impacts considered to be not significant.	None required	Not significant
Outer Thames Estuary SPA.	Disturbance to red-throated diver and other bird species from shipping traffic associated with the BLF.	See above under Minsmere to Walberswick SPA.	See above under Minsmere to Walberswick SPA.	None required	Not significant
Sandlings SPA and component SSSIs: birds.	Disturbance due to recreational displacement from Sizewell.	See above under Minsmere to Walberswick SPA.	Initial assessment not significant.	See above under Minsmere to Walberswick SPA.	Not significant

Table 2.3.1 Summary of effects for the construction phase

Terrestrial ecology and ornithology

Topic / Receptor	Potential Impact	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Sizewell Marshes SSSI.	Loss of wet woodland habitat.	Design to minimise land take within SSSI. Majority of wet woodland retained. Creation of Suffolk Sandlings Habitat.	Significant adverse	None required	Significant at the local level.
	Loss of reedbed and ditch habitat.	Design to minimise land take within the SSSI. Creation of replacement reedbed and ditch habitats at Aldhurst Farm. Realignment of Sizewell Drain so no net loss of ditch habitat.	Not significant	None required	Not significant
	Loss of fen meadow habitat.	Off-site compensation for loss of fen meadow habitat.	Not significant	None required	Not significant
	Loss of habitat supporting invertebrate assemblage.	Retention of majority of habitat within SSSI. Creation of like-for-like replacement of reedbed and ditch habitat and fen meadow compensation.	Not significant	Relocation of invertebrates and fish (if any) from current course of Sizewell Drain following realignment.	Not significant New habitat would gradually develop invertebrate interest but adjacent to SSSI so colonisation by invertebrates can occur.
	Alteration of hydrological regime. Potential pollution from surface water run-off and spillages.	Use of sheet piling to separate SSSI from the construction area. Provision of water control structure on Sizewell Drain to allow manipulation of levels. Construction surface water management plan.	Initial modelling indicates that a control structure would maintain correct hydrological regime - not significant.	None required	Not significant
	Noise, lighting and visual disturbance to wetland bird assemblage.	Retention of Kenton Hills woodland in entirety and some of Goose Hill to act as a buffer. Noise, lighting and visual disturbance control measures set out in CEMP.	Initial assessment suggests unlikely to be significant.	None required	Not significant

Table 2.3.1 Summary of effects for the construction phase

Terrestrial ecology and ornithology

Topic / Receptor	Potential Impact	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Sizewell Marshes SSSI.	Incidental mortality to water voles and loss of habitat.	Receptor habitat for water voles already created in advance. Detailed water vole mitigation strategy.	Not significant	Potential mitigation measures under Natural England licence. Habitat management of receptor site.	Not significant
	Fragmentation of water vole populations due to SSSI crossing.	Culvert design would leave channel and bank of Leiston Drain intact and facilitate passage for water voles. Improved culvert underneath Lover's Lane crossing of the Leiston Drain to improve connectivity for water voles.	Not significant	None required	Not significant
Sizewell Levels and Associated Areas CWS.	Loss of conifer woodland habitat.	Construction laydown area minimised. Retention of Kenton Hills conifer woodland in its entirety. Creation of Suffolk Sandlings habitat.	Not significant	None required	Not significant
	Loss of sandy rides and arable margins supporting invertebrate assemblage.	Retention of Kenton Hills conifer woodland in its entirety. New acid grassland creation within reptile mitigation areas and Aldhurst farm. Creation of Suffolk Sandlings habitat.	Not significant	None required	Not significant
Suffolk Shingle Beaches CWS.	Loss of shingle and sand dune habitat to accommodate new sea defence.	Stockpile sand and shingle to preserve seed bank and reuse stockpiled material to landscape new sea defence. Creation of Suffolk Sandlings habitat.	Significant adverse	If required, collection and storage of seed from existing vegetation.	Significant adverse at local level.
Reptile assemblage.	Habitat loss and incidental mortality.	Reptile receptor habitat created in advance. Reptile translocation.	Not significant	None required	Significant beneficial effect.

Table 2.3.1 Summary of effects for the construction phase

Terrestrial ecology and ornithology

Topic / Receptor	Potential Impact	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Natterjack toads.	Loss of foraging habitat to accommodate water balancing facility.	Natterjack mitigation strategy – creation of suitable alternative habitat prior to construction, if required.	Not significant	None required	Not significant
Nesting bird assemblage.	Loss of habitat for nesting and foraging.	Measures for nesting birds and vegetation clearance outlined in the CEMP. Provision of new habitat for nesting and foraging birds and provision of alternate nesting boxes for barn owls.	Not significant	None required	Not significant
Bat assemblage including barbastelle.	Loss of foraging habitat.	Retention of majority of tree resource. New reedbed and acid grassland at Aldhurst Farm together with reptile receptor areas provides additional invertebrate-rich habitat likely to benefit foraging bat species.	Not significant	None required	Not significant
	Loss of roosting resource (trees, buildings and other structures).	Retention of majority of tree resource. Early provision of new roost resource (e.g. bat boxes). Bat mitigation strategy.	Significant adverse	Potential mitigation measures under Natural England licence.	Not significant (dependent on additional mitigation).
	Noise and lighting disturbance causing fragmentation and displacement of resident bat populations.	Noise and lighting control measures set out in CEMP. Design of SSSI crossing to be of sufficient size to facilitate passage by bat species to give a north-to-south foraging/commuting linkage.	Significant adverse	Potential mitigation measures under Natural England licence. Monitoring of bat distribution and abundance during construction would inform additional mitigation measures if required.	Significant adverse (medium term).

Table 2.3.2 Summary of effects for operational phase

Terrestrial ecology and ornithology

Topic / Receptor	Potential Impact	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Minsmere to Walberswick Heaths and Marshes SAC, SPA, Ramsar and SSSI – Habitat interest features.	Potential pollution from surface water run-off and spillages.	Instructure in place for capture and treatment of surface and foul water.	Not significant	None required	Not significant
	Nitrogen deposition from back-up diesel generators.	Design of stack height to minimise deposition of nitrogen on adjacent vegetation.	Likely not significant	Mitigation would be developed if necessary.	Likely not significant
Minsmere to Walberswick Heaths and Marshes SPA, SAC, Ramsar and SSSI – Bird Interest features.	Noise, lighting and visual disturbance.	Operational lighting strategy.	Noise levels would be below 70dB and therefore not significant.	None required	Not significant
	Disturbance to marine bird species due to shipping traffic associated with the BLF.	Minimal number of infrequent ship movements.	Due to the small number of predicted ship movement, impacts considered to be not significant.	None required	Not significant
	Disturbance or displacement of fish and other prey species due to cooling water outflow.	Cooling and intake structures to be fitted with a fish return and recovery system. Outfall head placed in deep water to generate a thermally buoyant discharge plume.	Initial assessment considers that cooling waters would be buoyant, but any effects would be localised to the top 2-3m of the surface.	None required	Not significant
Outer Thames Estuary SPA.	Disturbance to red-throated diver and other associated bird species from shipping traffic associated with the BLF.	See above under Minsmere to Walberswick SPA.	See above under Minsmere to Walberswick SPA.	None required	Not significant
	Disturbance or displacement of fish and other prey species due to cooling water outflow.	See above under Minsmere to Walberswick SPA.	Not significant	None required	Not significant
Sizewell Marshes SSSI.	Establishment of replacement habitat.	LEMP would outline ongoing monitoring and management requirement to ensure success of replacement habitat.	Neutral	None required	Neutral
	Alteration of hydrological regime.	Provision of water control structure on Sizewell Drain to allow manipulation of levels.	Not significant	Ongoing monitoring would be required to ensure water control mechanism is effective.	Not significant

Table 2.3.2 Summary of effects for operational phase

Terrestrial ecology and ornithology

Topic / Receptor	Potential Impact	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Sizewell Marshes SSSI.	Fragmentation of water vole populations due to SSSI crossing.	See same impact under construction.	Not significant	None required	Not significant
	Nitrogen deposition from back-up diesel generators.	Design of stack height to minimise deposition of nitrogen on adjacent vegetation.	Likely not significant	Mitigation would be developed if necessary.	Likely not significant
	Potential pollution from surface water run-off and spillages.	Instructure in place for capture and treatment of surface and foul water.	Not significant	None required	Not significant
Sizewell Levels and Associated Areas CWS.	Creation of Suffolk Sandlings Habitat.	LEMP and creation of Suffolk Sandlings Habitat.	Significant beneficial – created habitat would establish over time.	None required	Significant beneficial
Suffolk Shingle Beaches CWS.	Loss of shingle and sand dune habitat when the BLF needs to be used.	Stockpile sand and shingle to preserve seed bank and reuse stockpiled material to landscape the BLF when use is finished.	Not significant as BLF comprises a small area.	None required	Not significant
	Increased erosion rate of shoreline habitat.	None proposed	Potentially significant.	Mitigation would be developed if necessary.	Potentially significant
Reptile assemblage.	Increase in reptile population due to reptile mitigation areas and established habitats.	LEMP and maintenance of reptile mitigation areas and reinstated habitats.	Significant beneficial – created habitat would establish over time and would reduce fragmentation in the wider landscape.	None required; however, monitoring as part of the LEMP would determine long-term management requirements.	Significant beneficial
Natterjack toads.	Potential increase in Natterjack toad populations due to habitat creation and enhancement.	LEMP and maintenance of Natterjack mitigation areas and reinstated habitats.	Significant beneficial – created habitat would establish over time and would reduce fragmentation in the wider landscape.	None required; however, monitoring as part of the LEMP would determine long-term management requirements.	Significant beneficial
Nesting bird assemblage.	Improved nesting and foraging opportunities for birds due to the creation and establishment of semi-natural habitat across the Sizewell estate.	LEMP	Significant beneficial – created habitat would establish over time and would reduce fragmentation in the wider landscape.	None required; however, monitoring as part of the LEMP would determine long-term management requirements.	Significant beneficial
Bat assemblage including barbastelle.	Improved foraging opportunities for bats.	LEMP	Significant beneficial – created habitat would establish over time and would reduce fragmentation in the wider landscape.	None required; however, monitoring as part of the LEMP would determine long-term management requirements.	Significant beneficial

2.4. Amenity and recreation

2.4.1. The figures for amenity and recreation are presented in **Volume 3** as **Figures 2.4.1** and **2.4.2**.

a) Baseline environment

2.4.2. Amenity and recreation resources include PRoWs (comprising footpaths, bridleways, restricted byways and byways open to all traffic), outside recreational facilities, open access land, public open space and visitor attractions such as RSPB Minsmere (i.e. recreational resources) within the rural and coastal landscape, and within settlements surrounding the Sizewell C main development site.

2.4.3. For the purposes of this assessment, recreational resources within the main development site and the surrounding area have been divided into four recreational routes (Suffolk Coast Path, Sandlings Walk, bridleway E-363/019/0 and Sustrans Regional Cycle Route 42/ Suffolk Coastal Cycle Route) and seven receptor areas each comprising a number of recreational resources, which are shown on **Figure 4.1** and **Figure 4.2**. Users of these recreational routes and areas are likely to be affected to a greater degree and potential impacts are provided in section (c) below. The recreational routes and areas are described below. There are other recreational resources within the wider surrounding area but users of these are unlikely to experience significant effects.

2.4.4. Questionnaire and observation surveys of users of existing recreational resources within the landscape, both inside and outside the main development site, have been carried out on behalf of EDF Energy, and the information gained has informed this assessment.

i) Suffolk Coast Path

2.4.5. This 50-mile route runs from north to south between Lowestoft and Felixstowe, following PRoW, local roads and the coastline.

2.4.6. The Suffolk Coast Path (the Path) extends along the coastline to the east of the existing Sizewell Power Station within the eastern part of the main development site, on a grassed area which is slightly raised from the beach as a sea defence. The Path has an open setting to the east, and is relatively flat, providing access to the grass and low heathland landscape of the sea defence, and the shingle beach to the east.

2.4.7. North of the existing power station the Path extends along the coastline before turning inland at the National Trust Coastguard Cottages. From here it runs northwards along PRoW. South of the existing power station the Path passes through the village of Sizewell and runs southwards along the coast across grass and heath, and along a cliff top path before turning inland along a track.

2.4.8. The Path lies within the Suffolk Coast and Heaths AONB and is likely to be the route of the future England Coast Path and would then be of greater importance in that context.

ii) Sandlings walk

2.4.9. This 60-mile route runs between Southwold and Ipswich. The Sandlings Walk (the Walk) follows PRoW, local roads and the coastline, passing through predominantly woodland, heathland, arable and coastal landscapes. It extends through the main development site along definitive and permissive footpaths, following the route of the Suffolk Coast Path along the coastline east of the power station.

2.4.10. At the north-eastern corner of the main development site, the Walk turns inland and follows permissive footpaths through and along the edge of the main development site at Goose Hill and Kenton Hills. It then turns north through the main development site along bridleway E-363/019/0, continuing beyond the main development site on local roads and PRoW, through Eastbridge until it re-joins the Suffolk Coast Path north of National Trust Coastguard Cottages. South of the main development site boundary, the Walk passes through the village of Sizewell and turns west (diverging from the Suffolk Coast Path) and then south on local roads, before re-joining the Suffolk Coast Path where it runs inland.

2.4.11. The Walk lies within the Suffolk Coast and Heaths AONB.

iii) Bridleway E-363/019/0

2.4.12. Bridleway E-363/019/0 passes through the main development site. It runs in a north-west direction from Sizewell Gap, along Sandy Lane following the site boundary of the main development site west of Pillbox Field. It extends along Lover's Lane where it joins a track running northwards. It passes The Round House before terminating at Eastbridge Road at the boundary of the main development site.

2.4.13. Bridleway E-363/019/0 lies within the Suffolk Coast and Heaths AONB.

iv) Sustrans Regional Cycle Route 42/Suffolk Coastal Cycle Route

2.4.14. These cycle routes follow the same alignment within the vicinity of the main development site. They run from south-west to north along local roads and tracks, passing Leiston Abbey, through the western edge of the main development site along Eastbridge Road, and continuing northwards through Eastbridge and beyond.

2.4.15. To the north of the main development site, these cycle routes lie within the Suffolk Coast and Heaths AONB.

v) Area 1 – Leiston Common and Kenton Hills

2.4.16. This area encompasses a number of permissive footpaths which extend through and around the woodland at Kenton Hills, Goose Hill and Sizewell Belts. It also includes Leiston Common (open access land) and footpath E-363/030/0. These recreational resources lie within or close to the main development site and within the Suffolk Coast and Heaths AONB.

vi) Area 2 – south

2.4.17. This area lies to the south of the main development site and includes open access and common land and a dense network of footpaths and bridleways in the vicinity of The Walks and Aldringham Common, east and south-east of Leiston.

2.4.18. None of the recreational resources within this area are located within the main development site. The majority lie within the Suffolk Coast and Heaths AONB.

vii) Area 3 – west

2.4.19. This area lies to the west of the main development site and mainly comprises footpaths and bridleways within an arable landscape, and the English Heritage visitor attraction at Leiston Abbey. Bridleway E-363/013/0 runs along Lover's Lane and is within the main development site. All other recreational resources lie outside the main development site.

2.4.20. These recreational resources lie outside the Suffolk Coast and Heaths AONB.

viii) Area 4 – north

2.4.21. This area lies to the north of the main development site and includes footpath E-363/020/0 running east-west between Eastbridge and the coast, RSPB Minsmere Nature Reserve (with its network of walking trails, bird hides, car park and visitor centre/shop/café), open access land at Dunwich Heath (including a National Trust car park and visitor centre at Coastguard Cottages) north of RSPB Minsmere, and other rights of way and land with public access rights.

2.4.22. None of the recreational resources within this area are located within the main development site. The large majority lie within the Suffolk Coast and Heaths AONB.

ix) Area 5 – beach

2.4.23. This area comprises the coastal strip, including the sea defences and foreshore to the east of the existing Sizewell Power Station and within the eastern part of the onshore area of the main development site. It forms part of beaches of varying widths and character (sand, shingle, cliff edge or gently inclined with nearby settlement or remote) extending in an unbroken stretch between Orford in the north and Lowestoft in the south.

2.4.24. The beach within the main development site is accessible from a number of locations, the closest being at Sizewell (south), permissive footpaths and Sandlings Walk through the main development site, and from PRoW E-363/020/0 from Eastbridge and from RSPB Minsmere, Dunwich Heath and other routes and accessible land to the north. Walkers and dog walkers frequently use the public car park at Sizewell and walk northwards along the beach including a number of inland circular walks. Both the Suffolk Coast Path and Sandlings Walk run in a north to south direction through this area.

2.4.25. The coastal strip within the main development site is characterised by a vegetated engineered embankment, known as Bent Hills and a lower vegetated bund which together form the sea defences to the existing Sizewell power stations. The Suffolk Coast Path, Sandlings Walk and PRoW E-363/021/0 extend along the same route between the two sea defence bunds within a relatively flat and wide area with access to the grass and low heathland landscape of the sea defence. East of the lower bund is a shingle beach which shelves into the offshore portion of the main development site. The shingle beach is accessed from the coast path by numerous desire lines across the grass and heath.

2.4.26. The beach lies within the Suffolk Coast and Heaths AONB.

x) Area 6 – Leiston

2.4.27. This area comprises PRoWs, outdoor sports clubs and recreational facilities within Leiston including Leiston Town Athletic Association/Leiston Football Club and an outdoor recreation space and park alongside the B1069 and Victory Road.

2.4.28. These recreational resources lie outside the Suffolk Coast and Heaths AONB.

xi) Area 7 – offshore

2.4.29. Offshore water based recreation in the vicinity of the main development site includes various activities involving different forms of watercraft, most of which originate from coastal locations (e.g. marinas and sailing clubs) to the north and south of the main development site, including sailing, racing and cruising. It also includes other activities such as sea kayaking, canoeing, sailboarding and fishing. Most activity occurs within approximately 1km and 6km of the coastline opposite the main development site, with lower levels of activity within 0.5km of the coast.

2.4.30. Recreational receptors within 1.5km of the coast lie within the Heritage Coast.

b) Environmental design and embedded mitigation

2.4.31. The measures below form part of both the construction and operational approaches unless otherwise stated.

i) Rights of Way and Open Access Strategy

2.4.32. During the construction and operational phases mitigation measures would aim to minimise physical disturbance to users of recreational resources. Appropriate diversion routes would be provided during construction where temporary closure cannot be avoided. The rights of way and access strategy provided in **Volume 1, Chapter 17** includes the strategy for the main development site and the green rail route. The preliminary environmental impacts and rights of way diversion strategy for the green rail route are addressed separately in **Chapter 3** of this volume; the rights of way diversions associated with the green rail route are not discussed below.

Sustrans Regional Cycle Route 42/Suffolk Coastal Cycle Route

2.4.33. A section of the Sustrans Regional Cycle Route 42/Suffolk Coastal Cycle Route on Eastbridge Road would be permanently diverted a short distance during the construction and operation of Sizewell C to accommodate the construction of the roundabout on the B1122, and permanent off-road routes would be provided parallel to the B1122 and Eastbridge Road.

Suffolk Coast path and beach

2.4.34. The long distance walking routes along the coast, east of the power station (the Suffolk Coast Path and Sandlings Walk, and the likely route of the England Coast Path) and footpath E-363/021/0 would remain open during construction and operation of Sizewell C, but may need to be closed for periods to ensure public safety during the construction of the coastal defences and the operation of the BLF and associated track. The phasing of this work would be planned to minimise physical disturbance and diversions. The existing route within the main development site would be re-aligned east or west parallel to the existing route, but along the coast, as sea defence construction progresses.

2.4.35. An inland diversion would be provided for the Suffolk Coast Path, Sandlings Walk and England Coast Path to allow for their temporary closure during essential construction works and for the delivery of Abnormal Indivisible Loads (AILs) at the BLF. The period of these closures would be minimised as far as possible. The proposed diversion route would extend inland from Sizewell village to the south to reconnect with the coast at the Minsmere Sluice to the north, following existing PRoW and proposed new routes (see **Volume 1, Chapter 17, Figure 17.17**).

2.4.36. Open access to the coastline more generally would be retained as much as possible during the construction phase, however, in line with the approach described above for the formal rights of way, some areas would need to be closed for parts or all of this phase.

2.4.37. Once Sizewell C is operational, the coast path would be permanently reinstated on a slightly realigned route fronting the new power station and to the east of the new sea defences. The new route would pass through a newly formed coastal grassland area and within the publicly accessible 'coastal margin' extending down to the low tide level.

Sandlings Walk north of the existing power stations

2.4.38. North of the existing power stations, Sandlings Walk would be closed for the construction phase where it turns west inland from the coast and then north, through the main development site. It would be diverted along existing footpath E-363/020/0 north of the main development site during the construction phase, following the inland diversion route of the Suffolk Coast Path.

2.4.39. Sandlings Walk would be reinstated on the majority of its original alignment during operation. A portion of Sandlings Walk on a permissive footpath through Goose Hill would be realigned, to provide connectivity to the coast.

Permissive footpaths at Goose Hill

2.4.40. Some permissive footpaths at Goose Hill extending to the coast would be closed during construction. Kenton Hills car park and the permissive footpaths within Kenton Hills would remain open, although there would be no access along permissive footpaths from Kenton Hills to the coast during construction.

2.4.41. During the operational phase one section of the permissive footpaths at Goose Hill would remain closed, with the link to the coast provided on an existing and re-aligned permissive footpath along the north and east edges of Goose Hill.

Bridleway E-363/019/0

2.4.42. Bridleway E-363/019/0 would be closed throughout the construction phase between Kenton Hills car park and where it joins Eastbridge Road, and a re-aligned route provided as part of the new off-road combined bridleway, cycleway and footpath described below. The southern end would remain open, enabling access to the existing Kenton Hills car park and the permissive footpaths within Kenton Hills.

A new off-road combined bridleway, cycleway and footpath

2.4.43. A new off-road combined bridleway, cycleway and footpath would be created from Sizewell Gap and King George's Avenue in the south to the construction phase accommodation campus in the north. Parts of this would be entirely new routes (from Sizewell Gap to Sandy Lane east of Lover's Lane), and parts would take sections of existing bridleways which currently run along roads. It would incorporate the diversions of the Suffolk Coast Path and Sandlings Walk described above, and include diversion of bridleways E-363/019/0 and E-363/013/0 and the Sustrans Regional Cycle Route.

ii) Operational phase

2.4.44. The operational phase would allow all existing permissive footpaths and definitive rights of way to substantially revert to their original alignment and condition. Improvements to rights of way and permissive footpaths, such as signage and surface improvements, would be provided within the EDF Energy Estate in accordance with an improvement strategy agreed with the relevant authorities.

2.4.45. The coast path comprising the Suffolk Coast Path, Sandlings Walk, England Coast Path and footpath E-363/021/0, would be reinstated on a slightly realigned route fronting the Sizewell C power station and to the east of the new sea defences once constructed as described above.

2.4.46. The north – south, combined bridleway, cycleway and footpath from Sizewell Gap and King George's Avenue to the northern edge of the former accommodation campus site on Eastbridge Road, created during the construction phase, would be retained for the operational phase; this would be off-road with road crossings, and would be extended to the junction with the northern end of bridleway E-363/019/0. This route would provide an improvement to the right of way network and would extend south from Sandy Lane, to run parallel with the eastern side of Lover's Lane through the EDF Energy Estate.

iii) Landscape mitigation and design

2.4.47. **Section 2.2** above describes the approach to environmental design and mitigation during the construction and operational phases which would help to mitigate for adverse visual effects on the amenity of recreational receptors.

Construction

2.4.48. Mitigation measures aim to minimise as much as practicable the extent of physical disturbance to the landscape and the visual prominence of activity and temporary buildings, structures, compounds and storage areas during the construction phase. Measures include retaining, where possible, established vegetation, creating earth bunds to provide visual as well as acoustic screening, planting to screen and integrate the development into the landscape (including early in the construction phase to allow areas of new planting associated with the operational phase landscape masterplan to become established), limiting maximum height parameters for buildings and structures, and implementation of a lighting strategy to minimise light pollution.

Operation

2.4.49. The operational masterplan proposals for the main development site are described in **Volume 1, Chapter 7.**

2.4.50. Mitigation measures include planting to screen and integrate the development into the landscape, design of buildings and structures to respond to their sensitive context within the Suffolk Coast and Heaths AONB and Suffolk Heritage Coast, design of the sea defences to provide screening of lower level activity and structures from the beach and coast path, and implementation of a lighting strategy to minimise light pollution.

iv) Noise mitigation

2.4.51. During construction, noise mitigation measures would be implemented to help minimise adverse effects. These measures include noise screening that would benefit the users of recreational resources and are defined in **section 2.7**.

v) Air quality mitigation

2.4.52. The control of construction dust would be achieved with the adoption of good working practices. Measures to minimise traffic during construction and operation would be employed as described in **section 2.8** thereby minimising associated fumes.

c) Preliminary assessment of effects

2.4.53. Impacts may occur due to physical changes to recreational resources such as PRoW diversions, or changes to views, noise or air quality experienced on the PRoW alignments. Impacts may also occur due to increased traffic; increased use of recreational resources by construction workers who come to the area for the construction phase and by displacement of existing users from areas disturbed by construction close to the main development site to other resources.

2.4.54. It is not anticipated that increases in numbers of visitors to the displacement locations, and to recreational resources by construction workers, would contribute to significant effects on the amenity of existing recreational users at existing resources, except where noted below.

i) Construction

Suffolk Coast Path

2.4.55. Users of the Suffolk Coast Path (including PRoW E-363/021/0) would be subject to disturbance due to the construction of new sea defences and cross-shore infrastructure, including temporary diversions along the coast parallel to the existing route, or inland, as described earlier in this section. The inland diversion would result in longer journeys and extend through areas of differing landscape character, along existing rights of way and new routes including sections extending parallel to highways. Receptors would in places have close views of the construction works from sections of the Path. Noise generated during the construction works would be significant for temporary periods on sections of the Path within or close to the main development site, including within areas with existing quiet character and where existing natural sounds are predominant. Users of the Path may also be affected by short-term and intermittent exposure to dust in locations within 500m of the main development site.

2.4.56. These changes to the environment of people using the Path and PRoW E-363/021/0 would affect their recreational amenity including their perception of relative tranquillity. Effects are likely to be significant and temporary.

Sandlings Walk

2.4.57. Users of Sandlings Walk would be subject to disturbance due to the construction of new sea defences and cross-shore infrastructure, including temporary diversions along the coast parallel to the existing route, or inland, as described earlier in this section. They would have a variety of views of the construction works from sections of the Walk from close to distant. Noise generated during the construction works would be significant for temporary periods on sections of the Walk within or close to the main development site, including within areas with existing quiet character and where existing natural sounds are predominant. Users of the Walk may also be affected by short-term and intermittent exposure to dust in locations within 500m of the main development site.

2.4.58. These changes to the environment of people using Sandlings Walk would affect their recreational amenity including their perception of relative tranquillity. Effects are likely to be significant and temporary.

Bridleway E-363/019/0

2.4.59. Users of bridleway E-363/019/0 would be subject to disturbance due to temporary diversions as described earlier in this section. There would be close views of the construction works from sections of the bridleway. Noise generated during the construction works would be significant for temporary periods on sections of the bridleway within or close to the main development site, including within areas with existing quiet character and where existing natural sounds are predominant. Users of the bridleway may also be affected by short-term and intermittent exposure to dust in locations within 500m of the main development site. The southern part of the retained bridleway would experience greater use due to diversion of Sandlings Walk and the Suffolk Coast Path along it for temporary periods during construction.

2.4.60. These changes to the environment of people using bridleway E-363/019/0 would affect their recreational amenity including their perception of relative tranquillity. Effects are likely to be significant and temporary.

Area 1 – Leiston Common and Kenton Hills

2.4.61. The permissive footpath which extends across Goose Hill to the coast would be closed during construction. Users of some of the retained permissive footpaths, Leiston Common and PRoW E-363/030/0 within this area would have views of the construction works, although many of the permissive footpaths in close proximity to the construction area extend within woodland or trees where the construction works would be substantially screened. Noise generated during the construction works would be significant for temporary periods, including within areas with existing quiet character and where existing natural sounds are predominant. Users of the recreational resources may also be affected by short-term and intermittent exposure to dust in locations within 500m of the main development site.

2.4.62. These changes to the environment of people using the recreational resources would affect their recreational amenity including their perception of relative tranquillity. Effects on users of the permissive footpaths, Leiston Common and PRoW E-363/030/0 are likely to be significant but temporary.

Area 2 – south

2.4.63. The construction works are unlikely to be visible from many of the recreational resources within this area due to intervening vegetation including woodland at Kenton Hills. However, taller elements such as cranes, and construction of buildings and pylons are likely to be visible from some PRoW within the northern part of this area. Noise generated during the construction works would be audible for temporary periods from some recreational resources closer to the main development site. Users of the recreational resources are unlikely to be affected by changes to air quality.

2.4.64. The following receptors closer to the main development site may experience significant effects for temporary periods, principally due to changes in noise: E-363/022/0, E-363/024/0, E-363/026/0 and E-363/028/0. These changes to the environment of people using the recreational resources would affect their recreational amenity including their perception of relative tranquillity. Effects on other receptors in the area are unlikely to be significant.

Area 3 – west

2.4.65. The construction works are unlikely to be visible from many of the recreational resources within this area due to intervening vegetation. However, receptors closer to the main development site are likely to have views of construction works. Noise generated during the construction works would be audible for temporary periods from some recreational resources closer to the main development site, including within areas with existing quiet character and where existing natural sounds are predominant. Users of the recreational resources are unlikely to be affected by changes to air quality.

2.4.66. The following receptors closer to or within the main development site may experience significant effects due to changes in views and noise: visitors to Leiston Abbey; users of PRoW (E-363/010/0, E-363/013/0, E-363/018/0, E-515/010/0, E-515/011/0, E-515/015/0) and users of the Sustrans Regional Cycle Route. These changes to the environment of people using the recreational resources would affect their recreational amenity including their perception of relative tranquillity. Effects on other receptors in the area are unlikely to be significant.

Area 4 – north

2.4.67. Users of footpath E-363/020/0 which runs west-east from Eastbridge to the coast would be the most affected receptors within this area. They would have views of the construction works from sections of the footpath. Noise generated during the construction works would be audible for temporary periods within areas with existing quiet character and where existing natural sounds are predominant. Whilst users of the footpath may come within 500m of the main development site, there are unlikely to be significant works in this area and users are therefore unlikely to be affected by changes to air quality. The footpath would experience greater use due to diversion of Sandlings Walk along it during construction, and the Suffolk Coast Path for shorter periods.

2.4.68. The construction works are also likely to be visible from parts of RSPB Minsmere Nature Reserve, open access land and facilities at and near National Trust Coastguard Cottages, and from some sections of other PRoWs where taller elements such as cranes, spoil mounds and other works are likely to be visible from distant and in places elevated locations. Noise generated during the construction works would be audible for temporary periods from some recreational resources, including within areas with existing quiet character and where existing natural sounds are predominant. Users of the recreational resources are unlikely to be affected by changes to air quality given their distance from the main development site.

2.4.69. These changes to the environment of people using the recreational resources would affect their recreational amenity including their perception of relative tranquillity. Effects on users of footpath E-363/020/0 are likely to be significant. Significant effects may also be experienced by recreational receptors at locations in the wider landscape, including visitors to the RSPB Minsmere Reserve. Effects on users of other recreational resources are unlikely to be significant.

Area 5 – beach

2.4.70. Users of the beach would be subject to disturbance due to the construction of new sea defences and cross-shore infrastructure and the BLF, including temporary closure of areas within the main development site. Measures including screen mounds and retaining access along the coast as far as reasonably practicable would help to mitigate effects. However, receptors would have close views of the construction works from areas of the beach, particularly within and immediately north and south of the main development site. Noise generated during the construction works would be significant for temporary periods on areas of the beach within or close to the main development site, including within areas with existing quiet character and where existing natural sounds are predominant. Users of the beach may also be affected by changes to air quality due to, for example, dust from construction activities for a limited duration.

2.4.71. These changes to the environment of people using the beach would affect their recreational amenity including their perception of relative tranquillity. Effects on users within or close to the main development site are likely to be significant and temporary.

Area 6 – Leiston

2.4.72. Views of the construction works from recreational resources within Leiston would be limited due to intervening development and vegetation. Noise generated during the construction works would be audible for temporary periods from some recreational resources within urban areas closer to the main development site including within areas where existing man-made sounds are often heard. Users of the recreational resources are unlikely to be affected by changes to air quality.

2.4.73. Receptors using outside recreational facilities close to the main development site, such as outside space at Sizewell Sports & Social Club on King George's Avenue, may experience significant effects for temporary periods, principally due to changes in noise. Effects on the majority of recreational receptors within Leiston are unlikely to be significant.

Other areas

2.4.74. No significant effects are predicted on recreational resources in Area 7 (offshore).

2.4.75. During removal of the accommodation campus and the temporary construction area, the effects experienced might be similar to those of the main construction phase, although effects on the Suffolk Coast Path are unlikely to be significant.

ii) Operation

2.4.76. During operation receptors would be able to undertake their recreational activities in a similar manner as at present. The restored landscape and rights of way network would, in some instances, provide enhancements to recreational amenity by measures including:

- landscape and habitat improvements described earlier in the section;
- the enhanced north-south recreational connection through the creation of an off-road combined bridleway, cycleway and footpath including off road routes where existing rights of way currently run along roads, and the creation of new routes where none exist at present; and
- improvements to rights of way and permissive footpaths, such as signage and surface improvements, would be provided within the EDF Energy Estate in accordance with an improvement strategy agreed with the relevant authorities.

2.4.77. Adverse effects would be greatest at the commencement of the operational phase before new planting implemented in the construction phase becomes fully established. As areas of new planting mature, effects on visual amenity would reduce.

2.4.78. Effects on all receptors are unlikely to be significant and in some cases may be beneficial where new routes are in place and where landscape planting has become established.

d) Additional mitigation and monitoring

2.4.79. The need for any addition mitigation will be discussed and agreed with the appropriate bodies.

e) Preliminary assessment of residual effects

i) Construction

2.4.80. During the construction stage of the proposed development there are likely to be significant residual effects on users of the Suffolk Coast Path, Sandlings Walk, bridleway E-363/019/0, permissive footpaths at Kenton Hills and Goose Hill, visitors to Leiston Abbey, visitors to Leiston Common, users of PRoW E-363/010/0, E-363/013/0, E-363/018/0, E-363/020/0, E-363/021/0, E-363/022/0, E-363/024/0, E-363/026/0, E-363/028/0, E-363/030/0, E-515/010/0, E-515/011/0 and E-515/015/0, users of the Sustrans Regional Cycle Route, and visitors to the beach. There may also be significant residual effects on recreational receptors at prominent locations in the wider landscape and with direct views to construction works, including visitors to the RSPB Minsmere reserve. There are unlikely to be significant residual effects on users of other recreational resources.

ii) Operation

2.4.81. The operation of the Sizewell C power station is unlikely to result in significant residual amenity and recreation effects.

f) Completing the assessment

2.4.82. An amenity and recreational Impact Assessment will be undertaken as a part of the Environmental Impact Assessment (EIA) and the results would be presented in the ES. The ES would present the full assessment checking and updating the preliminary conclusions drawn above in relation to significant effects.

Table 2.4.1 Summary of effects for the construction phase

Amenity and recreation

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Suffolk Coast Path	Physical changes to route including temporary closure and diversion. Changes to views and noise. Potential changes to air quality.	Temporary diversions providing alternative routes. Planned design and construction of the sea defences and coastal works to minimise disturbance. The boundaries of the construction site would be screened with landscaped bunds and/ or acoustic fencing, where necessary.	Significant	None	Significant
Sandlings Walk	Physical changes to route including temporary closure and diversion. Changes to views and noise. Potential changes to air quality.	Temporary diversions providing alternative routes. Planned design and construction of the sea defences and coastal works to minimise disturbance. The boundaries of the construction site would be screened with landscaped bunds and/ or acoustic fencing, where necessary.	Significant	None	Significant
Bridleway E-363/019/0	Physical changes to route including temporary closure and diversion. Changes to views and noise. Potential changes to air quality.	Temporary diversion providing alternative route. Boundaries of the construction site to be screened with landscaped bunds and/ or acoustic fencing, where necessary.	Significant	None	Significant
Area 1 – Leiston Common and Kenton Hills.	Closure of permissive footpaths connecting to coast at Goose Hill. Changes to views and noise.	Boundaries of the construction site to be screened with landscaped bunds and/ or acoustic fencing, where necessary.	Significant	None	Significant
Area 2 – south	Changes to views and noise.	Boundaries of the construction site to be screened with l landscaped bunds and/ or acoustic fencing, where necessary.	Effects will vary from significant to potentially insignificant subject to location within the area.	None	Effects will vary from significant to potentially insignificant subject to location within the area.

Table 2.4.1 Summary of effects for the construction phase

Amenity and recreation

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Visitors to Leiston Abbey, users of PRoWs and Sustrans Route.	Noise and visual disturbance from construction phase activities.	Retention of significant established vegetation to provide screening and containment. Early planting in the construction phase to provide localised screening and softening. Creating earth bunds and installing acoustic fencing to provide visual and noise containment in key areas. Design of worker campus, site access and construction hub to limit visual intrusion.	Effects will vary from significant to potentially insignificant subject to location within the area.	None	Effects will vary from significant to potentially insignificant subject to location within the area.
Visitors to RSPB Minsmere, user of PRoWs, Dunwich Heath.	Noise and visual disturbance from construction phase activities.	Retention of significant established vegetation to provide screening and containment, especially on rising landforms to provide screening. Early planting in the construction phase to provide localised screening and softening. Creating earth bunds and installing acoustic fencing to provide visual and noise containment in key areas.	Effects will vary from significant to potentially insignificant subject to location within the area.	None	Effects will vary from significant to potentially insignificant subject to location within the area.
Area 5 – beach	Physical changes to beach including temporary closure of areas. Changes to views and noise. Potential changes to air quality.	Planned design and construction of the sea defences and coastal works to minimise disturbance. The boundaries of the construction site would be screened with landscaped bunds and/or acoustic fencing, where necessary.	Significant	None	Significant

Table 2.4.1 Summary of effects for the construction phase

Amenity and recreation

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Area 6 – Leiston	Noise disturbance from construction phase activities.	The boundaries of the construction site would be screened with landscaped bunds and/or acoustic fencing, where necessary.	Effects will vary from potentially significant to insignificant subject to location within Leiston.	None	Effects will vary from potentially significant to insignificant subject to location within Leiston.
Area 7 – offshore	Changes to views and noise.	Planned design and construction of the sea defences and coastal works to minimise disturbance. Boundaries of the construction site to be screened with landscaped bunds and/or acoustic fencing, where necessary.	Not significant	None	Not significant

Table 2.4.2 Summary of effects for the operational phase

Amenity and recreation

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Suffolk Coast Path	Changes to views and noise.	Permanent route provided along the coastline in accordance with the rights of way and access strategy. Landscape proposals implemented including on the new sea defences.	Not significant	None	Not significant
Sandlings Walk	Changes to views and noise.	Permanent route provided in accordance with the rights of way and access strategy. Landscape proposals implemented including on the new sea defences.	Not significant	None	Not significant
Bridleway E-363/019/0	Changes to views and noise.	Permanent route provided in accordance with the rights of way and access strategy. Landscape proposals implemented.	Not significant	None	Not significant
Area 1, Leiston Common and Kenton Hills.	Changes to views and noise.	Permanent permissive footpath connection to the coast provided in accordance with the rights of way and access strategy. Landscape proposals implemented.	Not significant	None	Not significant
Area 2, south	Changes to views and noise.	Landscape proposals implemented.	Not significant	None	Not significant
Area 3, west	Changes to views and noise.	Landscape proposals implemented.	Not significant	None	Not significant
Area 4, north	Changes to views and noise.	Landscape proposals implemented.	Not significant	None	Not significant
Area 5, beach	Changes to views and noise.	Landscape proposals implemented.	Not significant	None	Not significant
Area 6, Leiston	Impacts unlikely		Not significant	None	Not significant
Area 7, offshore	Changes to views and noise.	Landscape proposals implemented.	Not significant	None	Not significant

2.5. Terrestrial historic environment

2.5.1. The figure for terrestrial historic environment is presented in **Volume 3** as **Figure 2.5.1.**

a) Historic environment

i) Baseline environment

2.5.2. An archaeological Desk Based Assessment (DBA) was undertaken for the main development site, most recently updated in 2015. This DBA considered existing records of archaeological features and investigations as well as historic mapping, aerial photography and documentary sources. Updated searches of the Historic England Archive (HEA) and Suffolk Historic Environment Record (HER), and the National Heritage List for England (NHLE) were undertaken in April 2018 to ensure that the current assessment included the most up to date information.

2.5.3. The study area was agreed with Suffolk County Council Archaeological Services (SCCAS) to encompass an area of at least 250m from the site boundary, as defined at the time that the DBA was produced, for undesignated heritage assets. A study area of up to 10km was agreed with SCCAS and Historic England for designated heritage assets (5km for Grade II and 10km for Grade I, Grade II, Scheduled Monuments and Conservation Areas). Following site visits, this area was extended as far as Covehithe to the north and Orford to the south along the coast and reduced inland.

2.5.4. Two designated heritage assets lie within the main development site, both of which are Grade II listed buildings – Upper Abbey Farmhouse (LB 1216394), and the Barn, 400m north of Upper Abbey Farmhouse (LB 1216655).

2.5.5. There are a further 12 listed buildings within the study area. One of these is listed at Grade I (St Mary's Abbey; LB 1215753), with the remainder being listed at Grade II and comprising farmhouses and associated buildings, cottages, and a coastal watch house (LB1391360). There are two scheduled monuments within the study area – Leiston Abbey (second site) and moated site (SM 1014520), and Leiston Abbey (first site) with later chapel and pillbox (SM 1015687).

2.5.6. There are 86 HERs within the main development site and a further 159 HERs are located within the study area (including 42 records added since the 2015 DBA). The HEA includes one record within the main development site, and a further 21 records within the study area (including three records added since the 2015 DBA). The HER and HEA records comprise a variety of heritage features ranging from prehistoric flint artefact scatters to Second World War (WWII) defences, which are discussed more fully later in the chapter.

2.5.7. A number of potentially important hedgerows are located within the main development site, many of which lie within the north-western part of the site in and around Upper Abbey Farm.

2.5.8. The HER includes 52 records of archaeological investigations undertaken across parts of the main development site and study area including geophysical survey, trial trench evaluation and the archaeological monitoring of boreholes. These records include archaeological investigations undertaken in relation to schemes such as the Greater Gabbard and Galloper offshore wind farms, as well as previous phases of work directly related to the Sizewell C proposals.

2.5.9. There are no designated historic landscapes within the site or study area, which comprise a range of historic landscape character types typical of the region. The study area contains only a few areas of the most highly valued historic landscape types, with relatively small areas of grazing marsh, heathland grazing and early agricultural enclosure.

2.5.10. A programme of archaeological evaluation across the main development site is currently underway in relation to the proposed development of Sizewell C. Geophysical survey has been undertaken across much of the main development site, and this is being followed by a programme of archaeological trial trenching. To date, archaeological trial trenching has been undertaken across approximately 50% of the main development site, at Pillbox Field, and at LEEIE. This section draws upon key findings and conclusions from interim reports from these evaluations, or final reports where complete.

2.5.11. Designated heritage assets within the main development site study area are listed in **Table 2.5.3** and are shown on **Figure 2.5.1**.

Prehistoric

2.5.12. To date, there are no records of archaeological material dating from the Palaeolithic period within the study area.

2.5.13. Flint scatters dating from the Mesolithic have been found within the study area, as well as two Mesolithic maceheads (MSF806). It is likely that the coastal margins would have offered favourable conditions for human occupation during this period. Peat deposits, which accumulated in the Mesolithic period, have been identified in an infilled former river channel which runs to the west and north of the existing Sizewell A and B sites. These deposits have been found to extend below the high water mark and are also considered within the marine historic environment section.

2.5.14. Neolithic activity is also represented by lithic objects, and the well-drained Sandlings soils and wetland-edge environments would have offered favourable conditions for settlement, although no settlement remains have been observed. Neolithic peats have been identified in the infilled former river channel which runs to the west and north of the existing Sizewell A and B sites.

2.5.15. Previously recorded Bronze Age activity within the study area includes findings of two cinerary urns from Leiston (MSF2343), and a possible round barrow (MSF 33445) recorded at the southern end of the parkland around Theberton House. Trial trenching at LEEIE uncovered probable Bronze Age pottery stratified in pits and postholes within several trenches, as well as an arrowhead dating to the late Neolithic/Early Bronze Age. Portable Antiquities Scheme data records one find, a Neolithic axehead, within the study area. Ditches of possible Iron Age date were also observed in the excavations and evaluation for the Greater Gabbard substation, located at the southern edge of the main development site (Ref. 2.5.1).

2.5.16. A number of cropmarks within the study area are recorded in the HER as possible ring ditches (e.g. MSF21602; MSF21604). Several of these cropmarks were targeted during the recent archaeological trial trenching at the main development site. No features supporting the interpretation as ring ditches were identified. Prehistoric ditches and pits were, however, identified in four of the evaluated fields, largely focused within the west of the main development site. These represented a low density spread of enclosures and settlement across the landscape.

2.5.17. The site of a possible Iron Age or Roman saltern mound or 'Red Hill' (MSF31919) was identified from aerial photographs during the National Mapping Project for the Suffolk Coast within the main development site. The site was investigated by trial trenching, but no evidence of the feature was uncovered. Other possible saltern mounds are recorded in the HER within the study area (e.g. MSF26879). These features are tentatively dated from the Early Iron Age to the Roman period, although the absence of evidence from the site in 10 Acres field suggests that these interpretations may be erroneous.

2.5.18. Prehistoric remains dating from the Bronze Age through to the Iron Age, were observed during the evaluation at LEEIE (including a trackway defined by parallel flanking ditches, a series of ditches setting out parcels of land, and small pits and worked flint suggesting nearby settlement).

2.5.19. Prehistoric remains observed to date in the main development site and LEEIE evaluations comprise scattered elements of field systems and possible elements of settlement, which add to our general understanding of the extent and nature of prehistoric activity in this area, but are of limited significance. Where the presence of prehistoric features suggested by aerial photography has been tested through field evaluation, it has been identified that these interpretations are erroneous. Study of aerial photography and geophysical survey does not provide any clear evidence for more extensive or significant remains to be present, and it is likely that further prehistoric remains would be of similar character and significance to those observed in trial trenching.

2.5.20. During evaluation trial trenching at the main development site, several prehistoric features were uncovered which were not visible on the geophysical survey particularly in areas where the substrate was sandier, or where they were masked by later archaeological features with strong responses. More precise characterisation of the extent and distribution of prehistoric remains will come from future planned trial trenching investigation across the remaining parts of the site.

2.5.21. Prehistoric remains observed within the main development site are of archaeological interest, providing new information to understand the prehistoric occupation of this part of the Suffolk Coast, and would fit into a clearly defined regional context. Where these features have been observed within the main development site, they are of low to medium significance and it is likely that other remains of this date observed elsewhere on the site would be of equivalent significance.

Romano-British

2.5.22. There is limited evidence for Romano-British activity within the study area. Artefact scatters and chance finds are recorded around Leiston. Trial trenching in 2017 identified a single Roman ditch, which corresponds to geophysical anomalies depicting a rectilinear enclosure, in Barn Piece, to the north of the main development site. The HERs potential Roman field systems and stock enclosures, visible as cropmarks within the study area.

2.5.23. Settlements dating to the Romano-British period are usually readily apparent on geophysical survey and aerial photography, and are frequently evidenced by discernible surface scatters of artefactual material in arable land. Consequently, the apparent absence of evidence for such features from the main development site is likely to reflect a genuine absence and there is a low potential for the presence of features of this date within the main development site. Additional trial trenching should establish the presence, distribution nature and extent of any remains dating to the Roman period.

Early-medieval and medieval

2.5.24. The DBA revealed no specific evidence for activity dating from the early-medieval period within the main development site or study area. Trial trenching within LEEIE found the remains of two sunken featured buildings dating to the early-medieval period along with a large number of postholes, which may represent post-built structures, within the northern part of the area.

2.5.25. There is significant archaeological evidence for the use of the area within the medieval period. This activity was principally focused around five locations – the two sites of Leiston Abbey and the villages of Sizewell, Leiston and Theberton.

2.5.26. Leiston Abbey was originally founded as a Premonstratensian house in 1182, on a site approximately 1km north of the main development site. As a result of coastal erosion, and following unsuccessful attempts at land reclamation, the Canons were granted a papal licence in 1363 to relocate the Abbey from its original site on the shore of the estuary to a more favourable location inland, approximately 200m west of the main development site. The original building was retained as a monastic cell.

2.5.27. The monastic sites would have comprised relatively small and tightly grouped building complexes, neither of which would have extended onto the main development site. However, the main development site is likely to include elements of the wider monastic landholdings, primarily comprising land which would have been in agricultural use at that time. Similarly, the villages of Leiston and Theberton would not have extended onto the main development site, although elements of their associated agricultural landscapes are potentially present, principally in the form of grazing land within the Sandlings heath and the seasonal grazing marshes, but also potentially including activities such as peat cutting or outlying farmsteads.

2.5.28. The village of Sizewell was substantially larger in this period than at present, extending further to the east into land which has been lost through coastal retreat. The full extent of the village and its associated agricultural landscape has been reconstructed through detailed documentary survey (AMEC 2011) (Ref. 2.5.2) and archaeological evaluation has been carried out at Pillbox Field. These demonstrate that the extreme southern part of the main development site occupies fields immediately outside the former village.

2.5.29. Archaeological evaluation in advance of residential development at Abbey View Lodges, Leiston, identified medieval ditches (ESF25501). Evaluation (ESF26157) and excavation (ESF26159) in advance of the Greater Gabbard onshore works, to the south and west of Pillbox Field, recorded a medieval site including ovens and associated structures (granaries) and possible fishing equipment, representing the periphery either of an 'industrial suburb' or the medieval centre of Sizewell.

2.5.30. Trial trenching at LEEIE in 2017 observed a series of rectilinear enclosures at the northern and eastern parts of the site dating to the medieval period, including possible domestic plots, although no structures were evident. Evaluation at the main development site in 2017 found further medieval remains comprising sub-rectangular enclosures in discrete areas including Badgers Burrow, Broom Walk and Stone Walk North. A large pit containing possible industrial material was also found within one of the enclosures. Near the enclosures in Broom Walk and Stone Walk North were further large pits, possibly clay-built ovens/kilns, adding to the evidence for medieval agricultural activity within the area. These provide further evidence that remains dating to the medieval period are present within the main development site, although at this stage the observed remains largely represent dispersed agricultural and industrial activity rather than discrete settlements.

2.5.31. There is moderate potential for further remains dating to the early-medieval and medieval period within the site boundary. Areas of higher potential have been identified during the geophysical survey and trial trenching, and further trial trenching is planned to investigate the remaining parts of the site over the coming months.

2.5.32. Remains dating to early-medieval and medieval periods would be of archaeological interest for informing the study of early-medieval agricultural settlement and activity, as well as understanding later medieval exploitation of the coastal marshes and Sandlings, particularly where they could be associated with monastic activity. Depending on the nature, preservation and extent of features, they would be of low to medium significance. Remains dating to the early-medieval period, as well as more substantial evidence of settlement and dwellings such as those found recently at LEEIE, are likely to be of medium significance.

Post-Medieval

2.5.33. The basic settlement geography established in the medieval period remained through the post-medieval period, with the former monastic site at Leiston becoming a secular manorial centre. The principal change in this period was in terms of the use and division of land, with the steady enclosure and 'improvement' of lands within the Sandlings and marshland to provide more productive land.

2.5.34. Heritage assets within the main development site dating from the post-medieval period include farmsteads which are still extant (including the listed buildings) as well as evidence of quarrying (MSF24565). The former Aldeburgh branch line (MSF35003), which still survives to service Sizewell Halt, runs along the south-west boundary of LEEIE, and was built as far as Leiston in 1850, carrying passengers until 1966.

2.5.35. Within the study area, the heritage assets dating from this period largely comprise agricultural features and buildings including those associated with the drainage and improvement of the marshes.

2.5.36. The potential for further as yet unknown heritage assets dating to this period is considered low. The existing pattern of farmsteads and settlements appears to have been established by the late 18th century, and mapping evidence does not suggest the presence of any significant sites other than these still extant farmsteads. The presence of features such as an outlying field barn, shown on historic mapping, suggests that some associated structures were present and may survive as archaeological features.

2.5.37. Designated heritage assets dating to this period are of high significance. The majority of non-designated remains dating to this period would be of archaeological interest primarily for their contribution to historic landscape character and development rather than as individual assets, and are likely to be of low significance.

Modern

2.5.38. The modern period experienced a general continuity of settlement and agricultural land use from the post-medieval period.

2.5.39. There are extensive records of the defensive works and activities undertaken within the site and study area as part of the defence of the East Coast of England during WWII. In particular, a complex of WWII emplacements are known to the north of Sizewell B, comprising a variety of earthworks and structures (MXS19687), which formed part of the wider coastal anti-invasion defences. Also to the north-west of Sizewell B, on Goose Hill and in Dunwich Forest, was an extensive WWII site, comprising two anti-aircraft batteries, associated buildings and numerous practice trenches (MXS19502). Other remains across the site and study area include pillboxes, the site of a probable WWII 'SOS' Field Artillery position, and slit trenches. Anti-invasion obstacles made of scaffolding were constructed on Sizewell beach and appear to have been partially dismantled at the end of WWII.

2.5.40. Key sites of this type and period can be confidently located as they either survive as visible features, or are recorded on aerial photographs or in documentary records. Many of these sites have been demolished, leaving fragmentary sub-surface remains, while others (particularly entrenchments), may have more extensive below ground remains surviving. The construction of the Sizewell A and B power stations has also removed a substantial section of the defences. Further remains are occasionally uncovered, as is the case with beach scaffolding and 'pikes teeth' in front of Sizewell B uncovered during storms in early 2018. There is a small potential for areas of as yet unknown modern military remains.

2.5.41. Remains dating to this period have a degree of archaeological and historic interest, but are likely to be of low significance as a result of poor preservation.

Deposits of geoarchaeological and palaeoenvironmental interest

2.5.42. Sizewell B was constructed on an island of gravel which was formerly adjacent to a river valley or channel. This valley has become infilled over millennia, resulting in the accumulation of significant deposits of soils and peats.

2.5.43. Geoarchaeological survey comprising geophysical and intrusive survey work has determined that these deposits are of high archaeological interest as they contain material which provides information on the past environment that may provide an important context for understanding how the formation processes of this mobile landscape have influenced the past environment and human activity. These deposits extend below the mean high water mark and into the area considered in the marine historic environment assessment.

Modern disturbance

2.5.44. The construction of the existing Sizewell power station complex will have given rise to a limited degree of disturbance across the proposed permanent development site, through ground reduction or build-up of construction-related material at the site, although this is likely to be localised and to have had a minimal effect on the survival in other areas.

2.5.45. As was found during the excavations for Greater Gabbard, intensive cultivation during the 20th century has disturbed the upper layers of any buried archaeology. Repeated ploughing, particularly subsoil ploughing, can be expected to have disturbed near surface features, although more substantial negative features such as ditches and pits have been shown to be relatively well-preserved.

2.5.46. It can also be demonstrated that many of the former field boundaries within the site have been removed and infilled, although some are visible either as soilmarks on aerial photographs or as magnetic anomalies within the geophysical surveys.

b) Environmental design and embedded mitigation

2.5.47. Disturbance or removal of archaeological heritage assets as a result of the proposed development could give rise to loss of archaeological interest. A programme of trial trenching is currently underway to determine the presence or absence of archaeology and to characterise any remains found.

2.5.48. Hedgerows to the site boundary will be retained and strengthened where possible and where appropriate planting, bunding and acoustic fencing will be installed to screen views of the proposed development and minimise visibility of, and noise from, the proposed construction works and development.

2.5.49. Change to setting arising from visibility of the proposed development, and construction noise or changes to air quality, can give rise to loss of or harm to heritage significance. Detailed design and landscaping will seek to minimise perceptual change to setting, wherever practicable, for example, site lighting will be designed to minimise light spill.

2.5.50. A number of design changes have been made to reduce the impact on Leiston Abbey (second site). Between Stage 1 and Stage 2, the proposed T-junction was replaced with a roundabout, offset from the B1122, with associated landscape screening in order to reduce visual impacts on the Abbey.

2.5.51. Between Stage 2 and Stage 3, borrow pit field 1 has been discounted and campus Option 2(ii) chosen, both of which decrease development west of Eastbridge Road thereby increasing the distance between Leiston Abbey and the development site and reducing potential noise and visual impacts. Removal of the sports pitches off-site should also reduce noise and lighting impacts on the Abbey complex.

2.5.52. The campus buildings would be orientated west-east to minimise the extent of the elevations/built mass along the western edge of the site closest to Leiston Abbey. Re-masterplanning of Option 2(ii) between Stage 2 and Stage 3 has also reduced the height of the buildings so accommodation blocks are now three or four storey only, further decreasing visual impacts from the Abbey complex and addressing concerns raised on five storey buildings at Stage 2. The campus design incorporates a series of landscape buffers in order to enhance screening to the west of the site.

2.5.53. Mitigation of adverse change within the setting of Upper Abbey Farm would be provided by the retention, as far as possible, of existing mature tree and hedgerow planting to provide visual screening and retain the perceptual integrity of the farmyard and house as a discrete unit and by the sensitive restoration of the structure of the listed barn.

2.5.54. Re-masterplanning of Option 2(ii) between Stage 2 and 3 has enabled the access road to Upper Abbey Farm and adjacent hedgerows to be retained (these were truncated in the Stage 2 Option 2(ii) layout). The emergency store and Combined Heat and Power (CHP) have been located as far as possible to screen views from the Grade II listed farmhouse and barn through use of adjacent buildings and existing vegetation. Post Stage 3, further work will be undertaken on design and cladding materials with the aim to fit these as far as possible with the architectural language of the existing vernacular.

2.5.55. The proposed Water Management Zone (WMZ) to the north of Goose Hill would be screened through landscape bunds and tree planting to minimise any visual intrusion of the development on the setting of the Leiston Abbey (first site).

2.5.56. Construction period impacts to settings would largely be reversed on the completion of construction activities in the immediate vicinity of these structures and the subsequent removal of temporary structures and surfaces in their immediate vicinity.

2.5.57. Design iterations resulting in the adoption of road or rail-led transport strategies have resulted in the removal of the proposals for a jetty at Sizewell C. This would reduce any visual change in the settings of heritage assets which draw significance from views along the coast, particularly the Aldeburgh and Southwold conservation areas.

c) Preliminary assessment of effects

i) Construction

2.5.58. Works including topsoil stripping, site levelling, excavations, sub-soil disturbance for road access, installation of fencing and vegetation clearance would take place across the main development site during the early phases of construction. These works would adversely affect any surviving sub-surface archaeological remains, reducing or removing their ability to be further interpreted, resulting in the loss of archaeological interest.

2.5.59. DBA, geophysical survey and ongoing trial trenching have suggested the presence of previously unrecorded archaeological remains on the main development site that are likely to be of low to moderate importance. Any archaeological remains within the main development site would be substantially disturbed, if not removed entirely, by the proposed development. This would give rise to a large magnitude of change which would, in the absence of further mitigation, be significant.

2.5.60. It is possible that elements of the BLF would disturb archaeological features within the beach; these would be restricted to disturbance of partly dismantled WWII anti-invasion obstacles which would not give rise to a significant adverse effect. Effects on potential remains of marine origin have been considered within **section 2.17**.

2.5.61. Deposits of geoarchaeological and palaeoenvironmental significance would be subject to localised disturbance to the main site platform area, leaving extensive deposits beyond the main site platform area undisturbed in situ, but potentially also causing localised dewatering and consequent degradation of peats. This would give rise to a medium magnitude of adverse change which would, in the absence of further mitigation, be significant.

2.5.62. There are a number of hedgerows, which could be considered important under the Hedgerow Regulations 1997 (Ref. 2.5.3), across the main development site, particularly within the northern part of the site. These are best considered as heritage assets of low significance for historic and aesthetic interest resulting from their contribution to historic landscape character. As a result, the change to the important hedgerows is considered to be medium, with a resulting minor effect, which would be not significant. The value of hedgerows across the site is considered further as relevant within the terrestrial ecology and landscape and visual PEI sections.

2.5.63. Construction activities could potentially affect the settings of designated heritage assets within and beyond the main development site. In particular, the scheduled monument of Leiston Abbey (second site) and moated site (SM 1014520), which contains four listed buildings (St Mary's Abbey – LB 1215753, Retreat House – LB 1215754; Guesten Hall – LB 1268290 and Barn at Abbey Farm – LB 1216380), would potentially be affected during construction by visibility of the proposed construction campus, particularly at night, and visibility of at-height construction activity. Noise, arising from construction activity and increased traffic movements around the site entrance, may also result in perceptual change to the setting of these assets.

2.5.64. The scheduled monument of Leiston Abbey (second site) and associated listed buildings are presently located in a relatively quiet rural location, with the low levels of background noise contributing to appreciation of the site as a former place of prayer and contemplation. Individual buildings within the scheduled area may be subject to differing magnitudes of change, and further assessment will be undertaken to understand effects on individual structures. These changes could give rise to a loss of historic interest, and it is possible that a significant adverse effect would arise.

2.5.65. The adverse effects are likely to be exacerbated by the effects arising from the construction and operation of the proposed rail route to the south of Leiston Abbey and the ES will consider these effects at the project-wide level.

2.5.66. The scheduled monument of Leiston Abbey (first site) with later chapel and pillbox (SM 1015687), comprises the below-ground remains of the demolished abbey buildings and the ruins of the later building (the Chapel of St Mary) with the WWII pill box constructed within it. This asset would potentially be affected by visible change due to the increased proximity, scale and height of Sizewell C construction activity when compared to the existing Sizewell B complex, particularly with the introduction of low level developments and construction activities into views from the asset and in views from Minsmere, in which the asset is clearly visible. Construction noise may also give rise to perceptual change in the setting of the asset. The changes could give rise to a significant adverse effect.

2.5.67. Upper Abbey Farm and Barn (LB 1216655, LB 1216394) are located within the accommodation campus area of the main development site and in close proximity to the construction activities. These structures would be retained for use during the construction period. Existing planting would be strengthened by screening planting proposed as part of the mitigation measures, thereby limiting visibility of construction activities. There would, however, be a change to the historic character of the landscape around the farmyard, and an increase in noise and dust and a sense of enclosure as a result of the proposed development. The changes could give rise to a significant adverse effect.

2.5.68. There are a number of listed buildings in close proximity to the site. These include Theberton House (LB 1228378), Cottage 450m south-west of Upper Abbey Farmhouse (LB 1216395), Potter's Farmhouse (LB 1228267), Bob's Cottage (LB 1228266), Flash Cottages (LB 1228263), and Potter's Farmhouse (LB 228267) and the Watch-House (LB 1391360). These structures are generally well screened from the proposed development and from any increased traffic along the B1120 and it is not anticipated that significant effects would arise.

2.5.69. It is possible that more distant heritage assets could be adversely affected by change to setting caused during construction and operation of the proposed development. Effects are likely to arise primarily as a result of the visibility of the proposed construction works in views along the coast from heritage assets including the Aldeburgh and Southwold Conservation Areas, the non-designated Coastguard Cottages at Dunwich Heath and Orford Castle (LB 1030873, SM 1014860). However, it is not anticipated that significant effects would arise.

2.5.70. Change to historic seascape character has been considered. The Southwold to Clacton Historic Seascape Characterisation (HSC) identifies the main development site as within the Sizewell power stations HSC sub-area of the Southwold HSC area. In that the character of the Sizewell power stations HSC sub-area is defined by the presence of the existing power stations, which provide dominant and clearly visible elements of the existing historic seascape, construction activities would be perceived as elements of the existing industrial use of the character area and would not give rise to a significant adverse effect.

2.5.71. No adverse direct effects are anticipated during the removal of the campus, temporary construction areas and infrastructure on the LEEIE as any disturbance of archaeological heritage assets within the site would have occurred and been effectively mitigated during the construction of the proposed development described above.

ii) Operation

2.5.72. If it is assumed that any disturbance of archaeological heritage assets within the site would have occurred and been effectively mitigated, during the construction of the proposed development, no direct effects on heritage assets within the main development site are anticipated during the operation of the proposed development. Upper Abbey Farm and barn would be returned to a sustainable use.

2.5.73. Change to setting of heritage assets can be expected to reduce markedly on completion of construction activities, with reductions in traffic movements, the removal of the construction campus and associated lighting and restoration of the agricultural landscape. Some effects will persist, but it is not anticipated that lasting effects during operation would be of sufficient magnitude to give rise to significant adverse effects.

2.5.74. The creation of Suffolk Sandlings habitats including heathland and acid grassland as well as the sensitive restoration of hedgerows at the end of the construction period would mitigate most of the adverse change resulting from loss of historic hedgerows. Any such restoration would, however, take several years to mature sufficiently for adverse change to be fully reversed. The restoration, where possible, of hedgerows which have been removed in or close to their original locations would result in the partial reversal loss of aesthetic interest, although the historic interest of restored hedgerows would remain limited. The effect caused by the removal of hedgerows during construction would therefore be reduced on their restoration and would not be significant.

2.5.75. The removal of the proposed construction campus, laydown areas and other construction activity, followed by the creation of Suffolk Sandlings heathland and acid grassland habitats as well as replanting of hedgerows which were removed at construction would help mitigate the majority of the perceptual change in the historic landscape and effects are not likely to be significant.

2.5.76. During operation, the presence of the operational Sizewell C power station in the Sizewell power stations HSC sub-area would represent a continuation or an extension of the existing use and therefore no significant effects on the historic settings are anticipated.

d) Additional mitigation and monitoring

2.5.77. Additional mitigation of direct effects on buried archaeology in the main construction area and LEEIE would comprise the adoption of an agreed written scheme of archaeological investigation to ensure that the archaeological interest of any significant deposits and features within the main development site could be appropriately investigated, recorded and disseminated. This would ensure that the effect on buried archaeological remains from the proposed development could be adequately mitigated.

2.5.78. A suitable mitigation strategy will be agreed with SCCAS once all trial trenching has been completed and the results are known. An approach to investigation of wooded areas, which will not be cleared, until the construction phase will be agreed with SCCAS. Monitoring of the agreed programme of archaeological investigation would be carried out by SCCAS during the implementation of the scheme. Publication and popular dissemination of the results of mitigation works would allow any informative and historic value to be fully realised.

2.5.79. A peat strategy is under development in consultation with SCCAS and Historic England, targeted on areas of geoarchaeological interest and where there is higher potential for buried archaeology, and this to allow the informative potential of disturbed material to be realised.

2.5.80. Where possible, additional mitigation measures would be implemented for the designated heritage assets at Leiston Abbey (second site), Upper Abbey Farm and Leiston Abbey (first site) following agreement of the measures and/or offsetting proposals with Suffolk Coastal Conservation Officer and Historic England. These measures could include provision of visual and acoustic screening to the fringes of the construction campus, enhanced interpretation materials at Leiston Abbey (first site) and repair of the Grade II listed Barn at Upper Abbey Farm.

2.5.81. Mitigation of change to setting of more distant heritage assets and those which are less sensitive to change would be achieved through landscaping and screening to be proposed and agreed in consultation. It is likely that change to setting would generally be limited, but significant effects may still arise where particularly sensitive heritage assets are affected.

e) Preliminary assessment of residual effects

i) Construction

2.5.82. Following the implementation of an agreed scheme of archaeological investigation the loss of archaeological interest through disturbance is not expected to be significant.

2.5.83. Effects to the setting of Leiston Abbey (second site) and associated listed buildings, Leiston Abbey (first site) and listed buildings at Upper Abbey Farm would be carefully considered during the final design and mitigation process and any agreed additional measures would be applied. The magnitude of any adverse effect could be reduced by such measures.

2.5.84. The implementation of appropriate landscape mitigation in relation to settings effects on other designated assets could reduce the magnitude of any adverse effect, and it is not anticipated that any significant adverse effects would remain.

ii) Operation

2.5.85. There would be no additional operational phase effects on terrestrial historic environment.

f) Completing the assessment

2.5.86. A full archaeological assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant direct effects, and would draw upon LVIA, noise, air quality and other assessments where appropriate.

2.5.87. Those assets identified as being subject to potentially significant effects arising from change to setting will undergo more detailed assessment. This assessment will draw on existing studies, including the Settings Baseline Report and Settings Scoping Report as well as the LVIA and noise chapters as appropriate to inform the understanding of adverse effects.

2.5.88. Further consultation on detailed mitigation proposals for the setting of Leiston Abbey will be undertaken with relevant stakeholders, primarily Historic England and Pro Corda, to identify proposals to minimise any adverse change.

2.5.89. Details of all mitigation proposals will be consulted upon with relevant consultees comprising SCCAS, Historic England, and the SCDC and Waveney District Council (WDC) Conservation Officers in order that these proposals provide effective responses to predicted change caused by the construction and operation of the proposed development.

Table 2.5.1 Summary of effects for the construction phase

Terrestrial historic environment

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Archaeological remains within the proposed site boundary.	Disturbance or removal as a result of topsoil stripping and subsoil disturbance.	None	Significant	Agreed written scheme of archaeological investigation to ensure that the archaeological interest of any significant deposits and features could be appropriately investigated, recorded and disseminated.	Not significant
Historic Hedgerows	Loss due to construction activities/location of site.	Retain where possible and restore where possible following end of construction phase.	Not significant	None	Not significant
Change to setting of Upper Abbey Farmhouse and barn.	Change to setting resulting from change of use of agricultural land outside the farmyard, visibility of and noise from construction activities, accommodation campus and ancillary structures.	Removal of accommodation campus on completion of construction phase. Retention of curtilage structures and surrounding planting to ensure that asset remains within a coherent farmstead and screen construction activities where possible. Structural repair and enhancement of structures where necessary.	Potentially significant	Additional mitigation and/or offsetting measures to be confirmed with relevant consultees.	Potentially significant
Change to setting of heritage assets at Leiston Abbey (second site).	Change in setting resulting from visibility of and noise from construction activity and campus development, increased traffic movements on the B1122 and potential in-combination effects with the green rail route.	Removal of accommodation campus on completion of construction phase. Amended design of campus to minimise light spill and visibility from Leiston Abbey and to increase separation from the assets. Amendment to highways design to screen main site entrance and reduce light spill, provision of acoustic and visual screening to fringes of campus and rail route.	Potentially significant	Additional mitigation and/or offsetting measures to be confirmed with relevant consultees.	Potentially significant

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Change to setting of Leiston Abbey (first site).	Visibility of construction works in views of and from the asset.	Retention of screening planting at Sizewell Belts/screening of water management zone 1.	Potentially significant	Additional mitigation and/or offsetting measures to be confirmed with relevant consultees.	Potentially significant
Change to setting of other off-site heritage assets.	Visibility of construction works in views of and from the asset.	Design changes to campus to increase separation from heritage assets at Eastbridge and Theberton House.	Potentially significant	None	Potentially significant
Change to historic seascape character.	Visibility of construction activities in views of and from the coast.	None	Not significant	None	Not significant

Table 2.5.2 Summary of effects for operational phase

Terrestrial historic environment

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Change to setting of Upper Abbey Farmhouse and Barn.	Visibility of the proposed development and ancillary structures in views of and from the assets.	Removal of construction campus and return of farmhouse, barn and curtilage structures to sustainable reuse.	Not significant	None	Not significant
Change to setting of heritage assets at Leiston Abbey (second site).	Visibility of the proposed development and ancillary structures in views of and from the assets.	Removal of construction campus and green rail route.	Not significant	None	Not significant
Change to setting of Leiston Abbey (first site).	Visibility of the proposed development and ancillary structures in views of and from the assets.	Restoration of screening planting at Sizewell Belts.	Not significant	None	Not significant
Change to setting of other off-site heritage assets.	Visibility of the proposed development and ancillary structures in views of and from the assets.	Retention of existing screening.	Not significant	None	Not significant
Change to historic seascape character.	Visibility of proposed development in views of and from the coast.	None	Not significant	None	Not significant

Table 2.5.3 Designated Heritage Assets within main development site study area

Historic England List Entry	Name	Grade	Easting	Northing
1215753	St Mary's Abbey	I	644521	264174
1215754	Retreat House	II	644468	264172
1216380	Barn at Abbey Farm	II	644442	264252
1216394	Upper Abbey Farmhouse	II	645327	264545
1216395	Cottage 450 metres (m) south-west of Upper Abbey Farmhouse	II	644902	264420
1216655	Barn 40m north of Upper Abbey Farmhouse	II	645312	264606
1227936	The Old Thatched Cottage	II	645225	266170
1228266	Bob's Cottage	II	644601	265220
1228267	Potter's Farmhouse	II	644981	265185
1268290	The Guesten Hall at Abbey Farm	II	644412	264266
1287237	Gate and Gate Piers 105msouth-east of main entrance to Theberton House	II	644567	265011
1287530	Sweet Briar Cottage	II	644928	266192
1391360	The Watch-House	II	647542	262749

2.6. Soils and agriculture

2.6.1. The figures for soils and agriculture are presented in **Volume 3** as **Figures 2.6.1** to **2.6.5.**

a) Baseline environment

2.6.2. The site is underlain by an area within the Crag Group (quaternary sand), which in places is overlain with drift deposit of Lowestoft Formation comprising sand and gravel.

2.6.3. The distribution of soil types is shown in **Figure 2.6.1**. The majority of the site comprises deep well drained sandy soils belonging to the Newport Soil Association (representing a group of soil types which are typically found occurring together in a landscape). The main land use on these soils is defined as being cereals and sugar beet, some carrots and potatoes with some coniferous woodland and lowland heath habitats.

2.6.4. Along the coastal strip the soils comprise deep well drained calcareous and non-calcareous sandy soils belonging to the Sandwich Soil Association. The main land use on these soils where they occur is described as being sand dune and wetland habitats; recreation; coniferous woodland; some gravel extraction, with limited potential for agriculture.

2.6.5. Along the western and southern extent of the site the soils comprise deep well drained fine loamy over clayey soils belonging to the Melford Soil Association. The main land use on these soils is described as being cereals, sugar beet and other arable crops.

2.6.6. In the low-lying land associated with Sizewell Belts the soils comprise either deep stoneless non-calcareous and calcareous clayey soils (belonging to the Wallasea Soil Association) or deep peat soils associated with clayey over sandy soils, in part very acid (belonging to the Mendham Soil Association).

2.6.7. The main land use on these soils where they occur is described as being winter cereals, sugar beet, potatoes and permanent grassland.

2.6.8. Published Agricultural Land Classification (ALC) maps (Ref. 2.6.1; See **Figures 2.6.2** and **2.6.3**) show the land within the site boundary to comprise a mix of Grades 3 and 4, as well as non-agricultural land. Under the ALC system land is graded between Grade 1 and 5, with Grade 3 subdivided into 3a and 3b. Land in grades 1, 2 and 3a is considered to be 'best and most versatile' land.

2.6.9. Based on the provisional mapping the proportions of land of each grade would be as follows.

Table 2.6.1 Agricultural Land Classification grade distribution

Agricultural Land Classification Grade	Area (ha)
Grade 3 (undifferentiated)*	165.08
Grade 4	83.45
Non-agricultural	104.17
Urban	9.38
Total	**362.08**

*Based on available provisional ALC maps

2.6.10. Published semi-detailed ALC mapping is available for some of the land within the main development site boundary (**Figure 2.6.3**). Further detailed ALC surveys have been undertaken, in consultation with Natural England, in those parts of the site where detailed mapping was not available and also to support the currently available mapping.

2.6.11. These surveys have confirmed the presence of land comprising Grades 3a, 3b and 4, although the largest proportion of land falls into Grades 3b and 4 (i.e. limited proportion of best and most versatile land).

2.6.12. Agricultural land within the scheme boundary is predominantly under arable production. Non-agricultural uses include plantations, woodland blocks and parts of the existing power station sites. Some of the land is under Entry Level plus Higher Level Stewardship agreements (**Figure 2.6.4**). Areas of woodland within the site boundary are also under English Woodland Grant Schemes (**Figure 2.6.5**).

b) Environmental design and embedded mitigation

2.6.13. A summary of the measures that have been incorporated into the design of the proposed development and that would protect the existing features of soil and agricultural interest is set out below.

i) Construction

2.6.14. The sustainable re-use of the soil resource would be undertaken in line with the Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (Ref. 2.6.2). This would be achieved by the development of a Soil Management Plan identifying the soils present, proposed storage locations and handling methods and how the resource will be re-used. The Soil Management Plan would form part of the CEMP. Measures which would be implemented include (but are not limited to):

- completion of a Soil Resources Survey and incorporate results into a Soil Management Plan;
- linking the Soil Management Plan to the Site Waste Management Plan (SWMP);

- ensuring soils are stripped and handled in the driest condition possible;
- confining vehicle movements to defined haul routes until all the soil resource has been stripped;
- protecting stockpiles from erosion; and
- ensuring physical condition of the entire replaced soil profile is sufficient for the post-construction use.

2.6.15. All soils would be stored away from watercourses (or potential pathways to watercourses) and any potentially contaminated soil would be stored on an impermeable surface and covered to reduce leachate generation and potential migration to surface waters.

2.6.16. Industry standard measures would be put in place to control pollution, including from fuel or chemical stores, silt-laden run-off or dust.

2.6.17. A considerate construction approach would be used to minimise potential impacts on the remainder of the landholding and on neighbouring landholdings during the construction phase. Toolbox talks would be used to inform all those working on the site of the requirements for soil handling and minimisation of disturbance to agricultural activities.

2.6.18. All fencing around the proposed development would be sufficient to resist damage by livestock and will be regularly checked and maintained in a suitable condition. Any damage to boundary fencing would be repaired immediately.

2.6.19. Measures contained in relevant Department for Environment, Food and Rural Affairs (Defra) and Environment Agency best practice guidance on the control and removal of invasive weed species (Ref. 2.6.3) would be implemented where appropriate.

2.6.20. Works would cease, and the Animal Health Regional Office would be advised, should animal bones be discovered which indicate a potential burial site.

2.6.21. All movement of plant and vehicles between fields would cease in the event of a disease outbreak and official Defra advice would be followed to minimise the biosecurity risk associated with the continuation of works.

2.6.22. In relation to temporary and permanent land take requirements EDF Energy would liaise with landowners to understand and where possible address their concerns.

ii) Operation

2.6.23. The measures described for the construction phase would be maintained throughout the operational phase.

c) Preliminary assessment of effects

i) Construction

2.6.24. The proposals for the main development site would result in impacts on 248.53ha of land from primary agricultural productivity. Some of this land comprises best and most versatile agricultural land (Grade 3a) but given that the potential extent of best and most versatile land to be lost permanently is limited, there is unlikely to be a significant effect.

2.6.25. There would also be an impact on the agricultural enterprise because of the loss of a proportion of the productive land. This would be assessed on a case by case basis as required, including permanent land take, temporary land take with a return to the previous agricultural use and where the land is to be returned to a different land use (for example the Sandlings habitat creation area).

2.6.26. On the assumption that landowners' concerns are addressed, through appropriate mitigation, this preliminary environmental assessment considers that significant effects on the agricultural enterprise are unlikely to occur and so are not considered further.

ii) Operation

2.6.27. There would be no additional operational phase effects on the soil resource or agricultural enterprise.

d) Additional mitigation and monitoring

2.6.28. There are no mitigation measures available for the loss of best and most versatile land.

e) Preliminary assessment of residual effects

2.6.29. The embedded mitigation measures would ensure that the potential for significant effects is removed, with the exception of the permanent loss of agricultural land which results in a significant effect for both construction and operational phases.

f) Completing the assessment

2.6.30. Once the proposals for the development as a whole are finalised, a full assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant effects. An ALC survey would be undertaken across the site to fully inform the assessment impacts. In addition, landowner interviews would be undertaken.

Table 2.6.2 Summary of effects for the construction phase
Soils and agriculture

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Agricultural land	Loss of approximately 248ha of which at least a proportion will be best and most versatile land.	There are no mitigation measures available for the loss of agricultural land.	Significant	There are no additional mitigation measures available.	Significant
Agricultural businesses	Temporary impact due to the loss of a proportion of the productive land.	EDF Energy engage with all affected landowners.	Not significant	No adverse significant effects identified additional mitigation measures are therefore not required.	Not significant

Table 2.6.3 Summary of effects for the operational phase
Soils and agriculture

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Agricultural land	There are no impacts identified during the operational phase.				
Agricultural businesses	There are no impacts identified during the operational phase.				

2.7. Noise and vibration

2.7.1. The figures for noise and vibration are presented in **Volume 3** as **Figures 2.7.1** to **2.7.4**.

a) Baseline environment

2.7.2. Baseline survey work was undertaken in 2015 and 2016 for the area around the main development site. A plan showing the locations of all noise monitoring locations in the vicinity is shown as **Figure 2.7.1**.

2.7.3. Noise and vibration sensitive receptors around the main development site have been identified and are shown in **Figure 2.7.2**. In some cases, a single receptor is identified to represent a number of nearby receptors. A list of receptors is shown in **Table 2.7.1** below, along with the monitoring location closest to each and details of daytime ambient levels based on survey results.

a) Environmental design and embedded mitigation

i) Construction

2.7.4. The standard of good practice outlined in 'British Standard BS5228-1 Noise: 2009 + A1 2014 – Code of Practice for noise and vibration control at open construction sites' (Ref. 2.7.1), would be followed. Embedded mitigation for the control of noise and vibration could include, but not be restricted to the following measures:

- landscaping (as this would provide an effective noise screen);
- selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earth moving activities;
- selection of mechanical services (such as air conditioning condenser units and air handling units) which would ensure that limit values would be met;
- avoiding unnecessary revving of engines and switching off equipment when not required;
- use of reversing alarms that ensure proper warning whilst minimising noise impacts off-site; and
- provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts.

2.7.5. BS 5228-2 gives detailed advice on standard good practice for minimising impacts from construction vibration. Reference to BS 5228-2 would be set out in the Code of Construction Practice and that it would be a requirement of the contractors to adhere to this where significant vibration effects would otherwise occur.

2.7.6. There would be a 5m high screen or bund to the north of the temporary construction area and around the eastern edge of the borrow pit area, and a 5m high earth bund to the south of the temporary construction area. Within this assessment it has been assumed that the 5m screen or bund to the north would be constructed early in Phase 1, whilst the 5m earth bund would be completed later in Phase 1 (with the benefit from this not realised until Phase 2).

2.7.7. EDF Energy would have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.

ii) Operation

2.7.8. There is no embedded noise and vibration mitigation for the operational phase of the development.

b) Preliminary assessment of effects

2.7.9. Noise and vibration levels have been predicted by calculation and modelling. A "significant" effect has been identified where levels are predicted to exceed a specified threshold value. Appropriate threshold levels are based on various standards and a relevant guidance and depend on the type of source; the sensitivity of the receptors; the time of day when it might occur; and, in some situations, on the existing noise levels in the area.

i) Construction

2.7.10. A noise propagation model has been created to predict noise levels around the construction site. Off-site noise levels would be greatest during the first two phases of construction, when site clearance and earth movement is undertaken and the infrastructure for the temporary construction area is constructed. Phases 3 and 4 are those phases of construction during which works on the main platform will occur and initial modelling indicates offsite noise levels would be lower, since the main noise sources would be considerably further from the majority of noise sensitive receptors.

2.7.11. The average noise level per phase has been calculated. This provides an indication of the noise levels which will typically be experienced at each receptor during the phase. However, since many of the noisy activities would move across the site within each phase (particularly during Phase 1) it is also helpful to provide information about noise exposure over shorter term periods, when noise levels will be higher.

2.7.12. Two shorter term periods were chosen to represent a typical day during the worst case month and a typical day during the worst case week. A worst case month would occur when activity such as stripping and levelling takes place in an area close to the boundary with a receptor. A worst case week would occur when activity occurs at the closest point to that receptor, immediately adjacent to the boundary.

2.7.13. Noise levels are therefore reported as:

- phase average – typical overall level during the phase;
- medium term – typical day during the worst case month; and
- short-term – typical day during the worst case week.

2.7.14. Predicted levels for these periods during Phases 1 and 2 are as shown in **Tables 2.7.2** and **2.7.3** and show the phase average noise contours for Phases 1 and 2 respectively.

2.7.15. It is assumed that construction work with the potential to generate noise would take place between 07:00 and 23:00 hours on any day and thus a significant level would occur when the level at any receptor exceeds 60 dB, LAeq, T. On this basis, a significant noise impact would occur at the locations shown in **Table 2.7.2** below during Phase 1 and at the locations shown in **Table 2.7.3** in Phase 2.

2.7.16. Further analysis will be undertaken as part of the ongoing EIA using any updated phasing or construction details that become available. For some receptors it is anticipated that predicted levels would be lower than shown as fewer 'worst case assumptions' would need to be made.

2.7.17. Piling, which is a primary source of high levels of vibration, would occur on the main development site but at distances sufficiently far from sensitive receptors that it is unlikely to have a significant effect. For other significant sources of vibration, such as compactors, it is possible that a significant effect might occur where these activities take place within 30m of vibration sensitive premises. Such effects would be short-term only.

ii) Operation

2.7.18. The operation of the Sizewell C power station will not result in significant noise or vibration effects offsite.

d) Additional mitigation and monitoring

i) Construction

2.7.19. Mitigation should be possible in the form of further screening around construction areas where significant effects are considered likely. Further modelling will be undertaken to determine the linear extent and height of any required screening.

ii) Operation

2.7.20. No additional mitigation is necessary.

iii) Monitoring

2.7.21. Routine monitoring would be carried out to a scheme to be agreed with local authorities. Provision would be made as necessary for monitoring of noise and vibration levels in the event of complaints being received from occupiers of noise sensitive receptors, or on request of the local authorities.

e) Preliminary assessment of residual effects

i) Construction

2.7.22. With the additional screening in place, significant effects are still likely to occur at the following locations and for the durations as shown in **Tables 2.7.4** and **2.7.5** for Phases 1 and 2 respectively.

ii) Operation

2.7.23. Noise and vibration impacts during the operation of the main development site would not be significant.

f) Completing the assessment

2.7.24. Detailed assessment of impacts will be undertaken and will include consideration of any further detailed construction methodologies and phasing, local topographical features and layouts and in particular the ability of screening and other measures to help limit the likelihood of significant adverse effects. The final noise and vibration assessment will be presented in the ES.

Table 2.7.1 Noise and vibration receptors in the vicinity of the main development site

Receptor/receptor group name	Monitoring location	Typical Daytime $L_{Aeq,16hour}$, dB
Abbey Cottages	MS14	56
Abbey Farm	MS5	36
Abbey Road Leiston	MS19	60
Ash Wood Cottages	MS7	40
Common Cottages	MS26	44
Eastbridge	MS1	52
Halfway Cottage	MS5	36
Keepers Cottage	MS26	44
Leiston Abbey residential accommodation	MS39	48
Leiston Abbey music school courtyard and rear garden	MS12/MS38	42
Lover's Lane/Sandy Lane	MS25	55
Old Abbey Farm/Care Home	MS15	47
Potters Farm	MS4	43
Potters Street	None yet	46*
Round House	MS6	41
Sizewell Village	MS28	48
The Studio	MS26	44
Valley Road	MS24	45
Rosery Cottage	MS27	44
Barley Rise	MS41	50
Crown Lodge	MS30	60
Grimseys Lane	MS43	44*
King George's Ave	MS29	62
Heath View	MS45	45
Sizewell Sports and Social Club	MS29	45

* Full monitoring data is not yet available for these sites, so levels have been estimated based on interpolation from other nearby locations.

Table 2.7.2 Locations where a significant noise impact is predicted during Phase 1

Receptor/receptor group name	Impact		
	Phase*	Mid-term	Short-term
Abbey Cottages	Significant	Significant	Significant
Abbey Road Leiston		Significant	Significant
Ash Wood Cottages		Significant	Significant
Halfway Cottage		Significant	Significant
Leiston Abbey		Significant	Significant
Lover's Lane/Sandy Lane		Significant	Significant
Old Abbey Farm/Care Home	Significant	Significant	Significant
Potters Farm			Significant
Round House		Significant	Significant
The Studio			Significant
Valley Road North		Significant	Significant
Valley Road South		Significant	Significant
Barley Rise	Significant	Significant	Significant
Crown Lodge	Significant	Significant	Significant
Grimseys Lane	Significant	Significant	Significant
Heath View		Significant	Significant
King George's Ave (Leiston)	Significant	Significant	Significant
Sizewell S&SC	Significant	Significant	Significant

* 'average day' over the whole of the phase
Blank spaces indicate "No significant effect"

Table 2.7.3 Locations where a significant noise impact is predicted during Phase 2

Receptor/receptor group name	Impact		
	Phase*	Mid-term	Short-term
Abbey Cottages		Significant	Significant
Old Abbey Farm/Care Home		Significant	Significant
Potters Farm			Significant
Round House		Significant	Significant
Crown Lodge	Significant	Significant	Significant
King George's Ave	Significant	Significant	Significant
Sizewell S&SC	Significant	Significant	Significant

* 'average day' over the whole of the phase
Blank spaces indicate "No significant effect"

Table 2.7.4 Significant noise impacts after mitigation during Phase 1

Receptor/receptor group name	Impact		
	Phase*	Mid-term	Short-term
Abbey Cottages		Significant	Significant
Lover's Lane/Sandy Lane		Significant	Significant
Old Abbey Farm/Care Home		Significant	Significant
Round House		Significant	Significant
Valley Road North		Significant	Significant
Valley Road South		Significant	Significant
Barley Rise		Significant	Significant
Crown Lodge		Significant	Significant
Grimseys Lane		Significant	Significant
Heath View		Significant	Significant
King Georges Ave	Significant	Significant	Significant
Sizewell S&SC	Significant	Significant	Significant

* 'average day' over the whole of the phase
Blank spaces indicate "No significant effect"

Table 2.7.5 Significant noise impacts after mitigation during Phase 2

Receptor/receptor group name	Impact		
	Phase*	Mid-term	Short-term
Old Abbey Farm/Care Home		Significant	Significant
Potters Farm			Significant
Round House			Significant

* 'average day' over the whole of the phase
Blank spaces indicate "No significant effect"

Table 2.7.6 Summary of effects for the construction phase

Noise and vibration

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Seven named receptors (see main text).	Phase 1 – noise impact over the phase.	Selection of plant and methodology in accordance with good practice. Bunding and screening around the temporary construction area.	Significant	Local screening	Significant effects at: King George's Ave Sizewell S&SC Other receptors: Not significant
16 named receptors (see main text).	Phase 1 – impact during the busiest month.		Significant	Local screening	Significant effects at 12 named receptors (see main text) Other receptors: Not significant
18 named receptors (see main text).	Phase 1 – impact during the busiest week.		Significant	Local screening	Significant effects at 12 named receptors (see main text) Other receptors: Not significant
All other receptors.	Phase 1 noise impact.		Not significant	None needed	Not significant
Crown Lodge King George's Ave Sizewell S&SC	Phase 2 – noise impact over the phase.		Significant	Local screening	Not significant
Six named receptors (see main text).	Phase 2 – impact during the busiest month.		Significant	Local screening	Significant effects at: Old Abbey Farm/Care Home Other receptors: not significant
Seven named receptors (see main text).	Phase 2 – impact during the busiest week.		Significant	Local screening	Significant effects at: Old Abbey Farm/Care Home Potters Farm Round House Other receptors: not significant
All other receptors.	Phase 2 noise impact.		Not significant	None needed	Not significant
Vibration sensitive receptors within 30m from the site boundary.	Short-term vibration impact during Phases 1 and 2.	None	Potentially significant	Not yet known	Not yet known
Vibration sensitive receptors more than 30m from the site boundary.	Short-term vibration impact during Phases 1 and 2.	None	Not significant	None needed	Not significant

Table 2.7.7 Summary of effects for the operational phase

Noise and vibration

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
All receptors	Operation of main development site	None	No significant effects	None needed	No significant effects

2.8. Air quality

2.8.1. The figure for air quality is presented in **Volume 3** as **Figure 2.8.1**.

a) Baseline environment

i) Site zones

2.8.2. The following zones have been defined for the assessment of the construction phase at the main development site, based on the likely nature and duration of activities that would be undertaken:

- the main construction area and operational power station;
- the temporary construction area, including:
  - construction contractor area (CCA);
  - spoil/stockpile storage areas and borrow pits; and
  - site access hub and accommodation campus;
- LEEIE and Sizewell Halt, including the Helipad access track off Sizewell Gap; and
- Sandy Lane area defined for underground cable installation and Pillbox field.

ii) Receptors

2.8.3. The proposed development is located close to a number of residential receptors and adjacent to potentially sensitive nationally and locally designated ecological receptors. Receptors have been identified through desk study and are identified in **Table 2.8.1** below, and shown in **Figure 2.8.1**. A screening distance of up to 500m from the closest site boundary has been applied in identification of receptors for construction impacts, in accordance with Institute of Air Quality Management (IAQM) guidance (Ref. 2.8.1). Screening distances have been applied for identification of receptors of operational point source impacts, up to 2km for human health receptors and up to 10km for ecological receptors, in accordance with Environment Agency guidance (Ref. 2.8.2).

2.8.4. Receptor types are identified as residential receptors, transient receptors (for example recreational areas and PRoWs) and commercial premises that could experience impacts from dust soiling or health impacts, and ecological receptors.

2.8.5. No significant odour sources are anticipated for the main development site therefore odour effects would be negligible and are not considered further in the preliminary assessment.

iii) Atmospheric Pollutants

2.8.6. The baseline air quality in the immediate site vicinity is good. SCDC has declared three Air Quality Management Areas (AQMAs) within its boundary due to elevated monitored concentrations of ambient Nitrogen Dioxide (NO2), the nearest of which is approximately 12km from the site, along the A12 at Stratford St. Andrew, and is considered very unlikely to be impacted by emissions within the main development site. The AQMA is considered further in relation to the two village bypass at **Volume 2B, Chapter 7**.

2.8.7. Current air quality pollutant concentrations in the vicinity of the main development site are well below the relevant national air quality objectives (Ref. 2.8.3). The annual mean ambient pollutant concentrations are provided in **Table 2.8.2.**

Table 2.8.1 Potential air quality receptors

ID	Receptor Name	Receptor Type	Grid Reference (Ordnance Survey)	Closest Site Zone Boundary
AQ1	Sizewell village	Residential	647480 262850	main construction area (>350m)
AQ2	Home Farm, Sizewell	Residential	647155, 262420	main construction area (>350m)
AQ3	Accommodation Campus	Residential	645300, 265000	BP (<100m)
AQ4	Suffolk Coastal Path / Suffolk beaches	Transient recreational	647600, 264000	main construction area (<50m)
AQ5	The Round House	Residential	645420, 265240	Spoil/stockpile storage areas/BP (<20m)
AQ6	Potters Farm	Residential	644965, 265210	Spoil/stockpile storage areas/BP (<350m)
AQ7	Eastbridge village (nearest)	Residential	645225, 265945	Spoil/stockpile storage areas/BP (>350m)
AQ8	Old Abbey Farm	Residential	645065, 264190	Campus (<50m)
AQ9	Old Abbey Farm care home	Residential	645030, 264080	Campus (<50m)
AQ10	Leiston Abbey / Lady Chapel	Transient recreational/ Residential	644445, 264215	Campus (<250m)
AQ11	Abbey Cottage	Residential	644900, 264415	Campus (<50m)
AQ12	Abbey farm lodge	Residential	644820, 264305	Campus (<200m)
AQ13	Diverted bridleway 19 and Sustrans Regional Cycle Route 42	Transient recreational	645340, 265350	Spoil/stockpile storage areas/BP (<50m)
AQ14	Kenton Hills Path	Transient recreational	645500, 264050	CCA (<100m)
AQ15	Sandlings Walk Path	Transient recreational	646400, 264550	CCA (<100m)
AQ16	Abbey Road properties	Residential	644450, 263670	Train holding area (<50m)
AQ17	Keeper's Cottage	Residential	646290, 263450	Cable installation (<200m)
AQ18	Common Cottages	Residential	645650, 263490	LEEIE (<350m)
AQ19	Common Farm, Lover's Lane	Residential	645645, 263185	LEEIE (<50m)
AQ20	Sandy Lane properties (west)	Residential	645685, 263245	Cable installation (<50m)
AQ21	Caravan Park, Leiston	Residential	645020, 262805	LEEIE (<100m)
AQ22	Valley Road properties, Leiston	Residential	644945, 262905	LEEIE (<20m)
AQ23	King George's Ave properties, Leiston	Residential	645510, 262495	LEEIE / Sizewell Halt (<50m)
AQ24	Crown Farm properties	Residential	645930, 262455	Sizewell Halt (<200m)
AQ25	Crown Lodge, Lover's Lane	Residential	645815, 262550	LEEIE / Sizewell Halt (<50m)
AQ26	Halfway Cottages, Sizewell Gap	Residential	646290, 262350	LEEIE (<350m) Helipad access track (<200m)
AQ27	Eastlands Industrial Estate	Commercial	645300, 262750	LEEIE (<50m)
AQ28	Sizewell Sports and Social Club	Transient recreational	645610, 262420	Sizewell Halt (<20m)
AQ29	Leiston Primary School	School	645070, 262450	LEEIE (>350m)
EAQ1	Minsmere - Walberswick Heaths and Marshes	SAC, SPA, Ramsar, SSSI	647500, 264500	Main construction area (<20m)
EAQ2	Sizewell Marshes	SSSI	Within main construction area/temporary construction area.	Main construction area/temporary construction area (<20m).

ID	Receptor Name	Receptor Type	Grid Reference (Ordnance Survey)	Closest Site Zone Boundary
EAQ3	Suffolk Shingle Beaches	CWS	647600, 264000	Main construction area (<20m).
EAQ4	Southern Minsmere Levels	CWS	Within main construction area/temporary construction area.	Main construction area/temporary construction area (<20m).
EAQ5	Sizewell Rigs	CWS	647800, 263000	Main construction area (>50m).
EAQ6	Suffolk Wildlife Trust Reserve	Wildlife Trust Reserve	Within main construction area/temporary construction area.	Main construction area/temporary construction area (<20m).
EAQ7	Marsh Harrier/reptile habitat creation	Habitat creation	646100, 265250	BP (<50m).
EAQ8	Ash Wood	Priority habitat	645700, 265250	BP (<20m).
EAQ9	Minsmere - Walberswick Heaths and Marshes	SSSI	645400, 266000	Spoil/stockpile storage areas/BP (>50m).
EAQ10	Leiston Common/Reckham Pits Wood	CWS	646000, 263700	Temporary construction area (>50m).
EAQ11	Aldhurst farm habitat creation	Habitat creation	645000, 263700	LEEIE (<20m).
EAQ12	Sandlings	SPA	646240, 262250	Sizewell Halt (>50m); Helipad access track (>50m).
EAQ13	Leiston Aldeburgh	SSSI	646240, 262250	Sizewell Halt >50m).
EAQ14	Aldringham to Aldeburgh Disused Railway	CWS	646050, 261920	LEEIE (>50m).
EAQ15	Alde-Ore and Butley Estuaries	SAC, SPA and Ramsar	643321, 258097	Main construction area (5km).
EAQ16	Orfordness to Shingle Street	SAC	646214, 254433	Main construction area (8km).
EAQ17	Dower House	CWS	647613, 262001	Main construction area (1.7km).

Table 2.8.2 Defra background mapping – annual mean (2018)

Location	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	NO_2 (µg/m³)	CO (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
646500, 263500 (main construction area, temporary construction area).	12.8	8.5	6.8	89	8.8	3.0
644500, 263500 (Campus, temporary construction area).	13.5	8.9	6.9	91	9.0	2.6
644500, 262500 (LEEIE, Sandy Lane).	14.0	10.0	7.9	91	10.4	3.2
National Air Quality Objective.	***40***	***20***	***40***	***10,000***	***30***	***20***

iv) Deposited dust

2.8.8. The baseline dust deposition rate in the site vicinity was monitored over a period of 12 months during 2016-17, using passive deposition gauges to determine the existing dust environment at eight sites representing proposed boundary and specific receptor locations.

2.8.9. The rate of dust deposition is affected by meteorological conditions, industrial and agricultural activities and road traffic. As the site is coastal, the sea also contributes to current dust deposition rates in form of salt spray and sand. The predominant land use around the site is open arable farmland, and farming activities are expected to contribute to a baseline rate of dust deposition. Agricultural activities are seasonal, and some, such as ploughing and harvesting, are likely to periodically generate larger amounts of fugitive dust due to disturbance of the soil or organic matter. Trackout of mud and soil onto the road network leads to vehicles spreading dust beyond the field boundaries.

2.8.10. The summary dust deposition rates from monitoring are detailed in **Table 2.8.3**. The table also shows the IAQM guidance (Ref. 2.8.4) recommended site action level (4-week average) for construction dust deposition. The site action level is used as a level above which additional mitigation or control measures may need to be applied to avoid potential nuisance impacts on sensitive receptors.

2.8.11. The results indicate some variation, with several higher deposition rates recorded during the monitoring period, likely to be the result of localised sources or activities close to the monitor, such as vehicle movement. Of particular note is the peak baseline deposition rate at Location 4 that was higher than the recommended site action level. The monitoring indicates a general trend for lower dust deposition rates during the wetter, winter months and an increase in the summer months, with winter and summer seasonal averages of 24mg/m^2/day and 40mg/m^2/day respectively (over the eight sites).

v) Nutrient nitrogen and acid deposition

2.8.12. The baseline nutrient nitrogen and acid deposition rates at the identified ecological receptors have been obtained from the UK Air Pollution Information System (APIS) website (Ref. 2.8.5) for the period 2014-2016. The majority of habitat types within the ecological sites have background deposition rates that are already exceeding the lower critical load range for the habitat types present, as summarised in **Table 2.8.4**, and therefore may be sensitive to changes in nutrient status or soil chemistry.

b) Environmental design and embedded mitigation

2.8.13. The following mitigation measures have been embedded into the construction of the proposed development:

- use of two off-site park and ride facilities to reduce construction worker traffic to site, as well as the use of an accommodation campus to further reduce travel to site, which would help reduce transport related emissions;
- use of an offsite freight management facility (under a road-led strategy), which would help manage freight arrivals and reduce on-site queuing and engine idling;
- an accommodation campus energy centre designed, maintained and operated in accordance with Medium Combustion Plant Directive requirements and the combustion plant emission stack height optimised to minimise ground-level air quality impacts balanced against the visual impacts of taller stacks;
- site access located as far as practicable from sensitive receptors;
- hard-surfaced roadways used as far as practicable, to minimise trackout and dust raising from vehicle movements;
- use of earth bunds with grassing/seeding, and early planting to screen sensitive boundaries, including a bund along the length of the southern temporary construction area boundary (5m height);
- deposited dust and materials would be monitored and controlled through additional mitigation as necessary to avoid trackout of material into adjacent construction zones;
- concrete batching plant located as far as practicable, from sensitive receptors; and
- mobile crushing and screening plant located as far as practicable from sensitive receptors.

2.8.14. Air quality impacts arising from the construction phase would be monitored and managed through a Dust Management Plan, as part of the CEMP.

2.8.15. The following mitigation measure is embedded in the operation of the proposed development:

- emergency diesel generators designed, maintained and operated in accordance with all relevant requirements.

Table 2.8.3 Baseline dust deposition monitoring (2016-17)

Location	Deposited dust (mg/m²/day)		
	Max 4-week average	Min 4-week average	Mean
1 – West of site access	137	13	53
2 – North-west of campus	66	6	25
3 – North of borrow pit	46	10	27
4 – Campus/site access hub	327	11	53
5 – North-western edge of Minsmere SSSI	42	3	19
6 – Southern temporary construction area	93	5	39
7 – Temporary construction area/Sizewell Marshes SSSI	55	5	23
8 – Lover's Lane/Sizewell Marshes SSSI	57	9	26
Recommended Site Action Level	***200 (4-week average)***		

Table 2.8.4 Baseline nutrient nitrogen deposition, ecological receptors

Receptor ID	Critical Load Class	Critical Load Range (kg N/ha/yr)	Background N-Deposition (kg N/ha/yr)	Background Deposition / Lower Critical Load
EAQ15	Pioneer, low-mid, mid upper saltmarshes	20 – 30	13.31	66%
EAQ1 and EAQ9	Coastal stable dunes	8 – 15	12.75	159%
	Dry heath	10 – 20	12.75	128%
	Fen, marsh and swamp (Rush pasture)	15 – 25	13.25	88%
EAQ16	Coastal stable dunes	8 – 15	11.23	140%
EAQ12	Dry heath	10 – 20	14.51	145%
EAQ2	Fen, marsh and swamp (Fen meadow)	15 – 30	11.90	79%
	Fen, marsh and swamp (Rush pasture)	15 – 25	11.90	79%
EAQ13	Dry heath	10 – 20	11.39	114%
EAQ10	Dwarf Shrub Heath	10 – 20	11.90	119%
EAQ14	Dwarf Shrub Heath	10 – 20	11.90	119%
EAQ3	Coastal stable dunes – acid type	8 – 10	11.90	149%
EAQ10	Broadleaved, mixed and yew woodland	10 – 20	20.3	203%
	Coniferous woodland	5 – 15	20.3	406%
	Broadleaved, mixed and yew woodland	10 – 20	20.3	203%
EAQ4	Dwarf Shrub Heath	10 – 20	11.90	119%

c) Preliminary assessment of effects

i) Construction

2.8.16. The main construction area would be in close proximity to the statutory designated sites (Minsmere-Walberswick Heaths and Marshes SAC/SPA/Ramsar/SSSI; Sizewell Marshes SSSI). Works to be undertaken in this area include the principal construction works for the Sizewell C power station platform in addition to long-term earthworks and movement of materials, with potential for dust raising and vehicle exhaust emissions.

2.8.17. Potentially significant effects are predicted from dust deposition (physical and/or chemical effects) resulting from the construction activities on the designated sites and similarly potentially significant effects are also predicted from Nitrogen Oxide (NO_x) emissions, from HGVs on the haul road, on the closest ecological receptors. Further assessment is required (see below).

2.8.18. The construction activities within the main construction area are considered to be sufficient distant from residential and transient human health receptors that dust soiling effects and PM10[14] health effects would not be expected to be significant. Likewise, NOx effects on human health are not predicted to be significant due to the distance to residential receptors.

2.8.19. The HGV movements within the main construction area would be sufficiently remote from residential receptors that HGV emission effects are not expected to be significant.

2.8.20. Emissions of carbon monoxide from HGV and non-road mobile machinery (NRMM) movements are not likely to result in significant effects.

2.8.21. The embedded design mitigation within the temporary construction area, including surfaced roads, sensitive siting of potentially dusty activities (such as the concrete batching plant), retention and/or augmentation of screening vegetation, and the distance from sensitive receptors, would limit the potential for impacts from dust raising and vehicle emissions, and therefore these would not be expected to be significant.

2.8.22. The spoil storage area and borrow pits would be located in close proximity (<20m) to the Round House, and would involve earth-moving and material storage and reclamation activities over a period of years. Given this proximity, the Round House is predicted to experience potentially significant effects from dust soiling, airborne particulates and NRMM NOx emissions, even though the baseline pollutant concentrations in the area are well below the air quality standards.

2.8.23. The other identified residential receptors within the screening distance could also be impacted by dust from the activities in the spoil storage areas and borrow pit areas, although the effects would be less significant given the distance from the activities, and would be controlled through additional mitigation as necessary.

2.8.24. The ecological receptors identified within the screening distance of the spoil storage areas and borrow pit areas are not expected to be sensitive to dust deposition and effects on these receptors are not likely to be significant.

2.8.25. Emissions of carbon monoxide from HGV and NRMM movements are not likely to result in significant effects.

2.8.26. The campus energy centre would not result in significant effect on local air quality receptors, given the existing low background concentrations of pollutants and embedded mitigation. The impacts from traffic emissions within the site access hub are anticipated to be negligible and therefore there is not anticipated to be an effect from these sources. There is potential for a combined impact from both the campus energy centre emissions and emissions from the commissioning/testing of emergency diesel generators during the construction phase, on ecological receptors. Further assessment of this will be undertaken and is expected to demonstrate that such in-combination effects are not significant.

2.8.27. The potential impacts associated with the construction of the proposed development include fugitive emissions of dust, emissions from NRMM, emissions from HGVs accessing the site and emissions from vehicles carrying workers to and from the site.

2.8.28. The embedded design mitigation within the campus and site access hub areas, including surfaced roads, retention and/or augmentation of screening vegetation, would limit the potential for dust impacts. Possible dust sources could include material dispersed from HGVs transferring to and from the borrow pits, or dust blown from the spoil storage areas that could become re-mobilised with vehicle movements in this area and impact on nearby receptors.

2.8.29. Given that the location is relatively remote from most receptors and the embedded mitigation measures described above, the effects on receptors are not likely to be significant.

2.8.30. The activities within the LEEIE would be located in close proximity (<20m) to the residential properties on Valley Road, in particular the Archway Cottages to the west of the LEEIE, and residential properties on King George's Avenue that are close to proposed material storage areas. However, the effects from dust and NRMM emissions within the LEEIE on local receptors are not likely to be significant, given the embedded mitigation.

[14] Particulate matter 10 micrometres or less in diameter

2.8.31. The ecological receptors identified within the screening distance of these areas are not expected to be sensitive to dust deposition and effects on these receptors are not likely to be significant.

2.8.32. The activities that would be undertaken within the areas to the south of Sandy Lane (underground cable installation) and Pillbox field (vehicle parking) would be short-term earthmoving operations, and the effects on receptors are not likely to be significant.

ii) Operation

2.8.33. Combustion emissions to air from the Sizewell C operational plant, such as the diesel generators, would be regulated by the Environment Agency under the Environmental Permitting Regulations and controlled in accordance with an Environmental Permit to be issued for their operation. The permit would specify emission limit values for pollutant releases to air, as well as ongoing monitoring requirements.

2.8.34. The impacts from the commissioning and routine testing operation of the emergency diesel generators are not likely to lead to significant effects for human health receptors for any of the pollutants assessed.

2.8.35. There may be some potentially significant effects associated with short-term NO2 emissions during the emergency Loss of On-site Power (LOOP) scenario, however as this is considered an emergency event, any such effects would be infrequent and short in duration.

2.8.36. The annual average impacts from the commissioning and routine testing operation of the emergency diesel generators are not likely to be significant but there is potential that there may be some significant effects related to the daily ecological critical level for NOx, given the proximity of a number of the habitats and designated sites to the main development site. The short-term (24 hour) mean for NOx is of less importance than the annual mean, as vegetation exposed to levels of NOx above the critical level will be more likely to recover from that exposure if the exceedance is for a short duration.

2.8.37. The impacts of nutrient nitrogen and acid deposition from the emissions of the emergency diesel generators are not likely to be significant at the majority of the ecological receptors although a number of sites could experience effects that could be considered significant. It should be noted that the average background deposition rates at all of these sites are in excess of the lower end of the critical load range, and in some cases exceed the higher end of the critical load range. Whilst an increase in the levels of deposition is predicted for a number of the habitats within the vicinity of the main development site, it is important to note that the process contributions discussed would be relatively short-term and temporary (especially during commissioning operations), and are also set against a background of high chronic nitrogen deposition in the wider area. The impacts are therefore considered unlikely to result in a significant effect for species composition or habitat condition at any ecological receptor.

2.8.38. Emissions of carbon monoxide and formaldehyde from the nuclear island stacks (70m high), released during commissioning (approximately 62 hours' duration) and when the plant re-enters operation following a shutdown (assumed this would occur twice per year and take 84 hours per event) are not likely to result in significant effects at human health receptors. This is because of the high stacks (60m) and the distance to receptors (approx. 1km) and the limited duration of such emissions.

2.8.39. Emissions of ammonia from the four steam generators associated with the main steam relief train will occur when the plant re-enters operation following a shutdown (anticipated to occur twice per year, for limited hours). Given the limited duration of the release, and the distance to the human health receptors, significant effects are unlikely to arise. The depositional effects at ecological receptors are also not likely to be significant, given the small quantities involved and the limited duration of the release.

2.8.40. Traffic-related emissions within site would be much lower than those for the construction phase and the effects on receptors are not likely to be significant.

d) Additional mitigation and monitoring

i) Construction

2.8.41. The main potential risks from uncontrolled sources relate to dust soiling of properties and ecological dust deposition. A dust management plan would be implemented for the works, including details of dust monitoring, meteorological observations and appropriate mitigation measures.

2.8.42. Additional mitigation measures that could be used to minimise effects include:

- use of fewer, larger HGVs on temporary construction area haul road with lower average emission rates; and/or use of NRMM with EURO Stage IV/V emission limits;
- use of water-suppression sprays and/or screens or barriers at sensitive boundaries and around plant with significant dust raising potential;

- surface stripping would be planned accordingly to minimise the potential for dust generation upwind of sensitive receptors;
- damping down would be used prior to commencement of extraction works, with surface binding agents as required, to suppress and minimise dust generation;
- stockpiles would be seeded or fenced to minimise wind-blown dust;
- drop heights would be restricted from loaders, hoppers and other handling equipment to the minimum required for safe and efficient operations, to minimise dust emissions;
- stockpile worked areas would be minimised to avoid unnecessary disturbance;
- use of hard standing areas to reduce vehicle movements on unmade ground and minimise the trackout of mud;
- use of water spraying of vehicles at site access and sheeting to avoid material loss from vehicles;
- use of wheel washes for vehicles accessing the site;
- regular road sweeping of the site access roads and local roads as necessary to remove residual tracked out materials, and minimise re-mobilisation of dust; and
- regular inspection of haul routes would be made, with repairs as required, to ensure surfaces are maintained.

2.8.43. Additional monitoring and management of protected ecological sites may be required to mitigate short-term increased nutrient nitrogen deposition during commissioning of the diesel generators.

ii) Operation

2.8.44. Effects from the operational combustion sources would be minimised and controlled in accordance with Best Available Techniques (BAT) as determined through the Environmental Permit determination process, and through use of low sulphur fuels. Additional control options, such as burner configuration to minimise NOx formation will be further considered as part of the application for the combustion activity permit, provided that the reliability of the generators is not compromised, during the procurement and maintenance of equipment.

e) Preliminary assessment of residual effects

2.8.45. The embedded mitigation within the design and the use of addition appropriate mitigation measures to control NRMM and dust in areas of high risk is likely to result in residual construction effects that are not significant at most receptors.

2.8.46. Similarly, the embedded mitigation within the design of the operational development is likely to result in residual effects that are not significant at identified receptors.

2.8.47. Even with additional mitigation measures in place, there remains a likely residual effects on several receptors including:

- ecological dust deposition impacts on Minsmere – Walberswick Heaths and Marshes SAC, and Sizewell Marshes SSSI, in the form of low-level deposition to vegetation over several growing seasons that could impact growth; however the impact area is expected to be small (the area within 50m of the activity or main construction area/temporary construction area site boundary) and significant effects on the overall quality of the SAC and SSSI are not likely; dust soiling and PM10 health effects at the Round House within the spoil storage and borrow pit areas, as a result of the duration and proximity of activities; and
- effects of NOx emissions on statutory ecological receptors adjacent to the main development site and on air quality at the Round House.

f) Completing the assessment

2.8.48. The dust screening assessment will be further developed to include an assessment of the scale and nature of activities within each defined zone, the phases of construction activities within each zone, and the sensitivity of receptors, to determine whether the uncontrolled dust emission is of high, medium or low risk potential.

2.8.49. Further assessment of HGV NOx emissions on the main construction area haul road will also be undertaken to determine the potential for impacts on air quality at the identified receptors.

2.8.50. Further assessment of impacts acting on the designated ecological sites during the construction and commissioning phases will be undertaken, including the combined impacts of the campus energy centre emissions, emissions from the commissioning/ testing of emergency diesel generators and HGV emissions.

2.8.51. The need for, and level of, activity-specific mitigation will then be further defined and the residual effects on receptors determined and reported in the ES.

Table 2.8.5 Summary of effects for the construction phase

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Transient human health receptors and ecological receptors, NRMM and on-site HGV emissions.	Atmospheric NOx concentration; deposited nitrogen.	Selection of plant and vehicles fitted with best practice controls for minimising NO_x generation.	Potential for significant effect from volume and duration of activity.	To be confirmed following further assessment.	Potential for significant effect on Minsmere-Walberswick Heaths and Marshes SAC and Sizewell Marshes SSSI. No significant effect for human health receptors.
Residential receptors, NRMM and on-site HGV emissions.	Atmospheric NO_x concentration.	Selection of plant and vehicles fitted with best practice controls for minimising NO_x generation.	Not significant, with exception of Round House.	None	Not significant, with exception of Round House.
Ecological receptors and residential receptors construction dust emissions.	Dust deposition, dust soiling and atmospheric particulate concentrations.	Siting higher dust generating activities as far as practicable from receptors and sensitive boundaries; use of hard surfacing, bunds and screening to minimise dust raising.	Potential for significant effect from scale and duration of activity.	Dust Management Plan. Water suppression sprays, road-sweeping and damping down; seeding of stockpiles; planning works with consideration for weather where practicable; minimisation of worked stockpile areas and drop heights; regular monitoring.	Potential for significant effect at Round House. Effects on designated ecological receptors not significant.
Residential receptors and ecological receptors. Campus energy centre emissions.	Atmospheric NO_x, deposited nitrogen.	Selection of technology and operation of plant in accordance with regulatory requirements and best practice stack height.	Not significant in isolation, potential for cumulative effects with Emergency Diesel Generator (EDG) plant commissioning emissions (operational phase).	To be confirmed following further assessment.	Not significant

Table 2.8.6 Summary of effects for the operational phase

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Ecological receptors, EDG plant commissioning emissions.	Atmospheric NO_x; deposited nitrogen.	Selection of technology and operation of plant in accordance with regulatory requirements.	Potential for significant effects at some receptors.	Additional monitoring and management to be determined.	Not significant
Ecological receptors, EDG plant routine testing and LOOP emissions.	Atmospheric NO_x; deposited nitrogen.	Selection of technology and operation of plant in accordance with regulatory requirements.	Not significant	None	Not significant

2.9. Geology and land quality

a) Baseline environment

2.9.1. The following sections provide a summary of baseline conditions within the site and the site vicinity.

i) Geology

2.9.2. The following provides a summary of the geology and geological characteristics within the site and the site vicinity:

- made ground: present within the main construction area associated with the construction of the adjacent Sizewell B power station, within the LEEIE associated with the railway line and within the temporary construction area associated with former pits located in this area;
- superficial deposits: marine deposits (tidal flat deposits and sand and gravel) within the main construction area and temporary construction area in the eastern area of the site. Alluvium, peat and head deposits are present within the southern part of the main construction area and eastern part of the temporary construction area. Lowestoft Formation (till and sand and gravel) is present within the LEEIE and eastern part of the temporary construction area;
- bedrock: Crag Group is present underlying the entire site;
- important geological sites: none present;
- identified geological hazards: none present;
- mining, quarrying and natural cavities: the site is not located in an area that is likely to be affected by coal mining, other mining activities or natural cavities. However, several sand and clay pits were located across the site and in the local area which are now marked as disused;
- ground stability hazards: moderate to high risk of compressible ground associated with peat in the eastern part of the temporary construction area and southern section of the main construction area. Moderate risk of running sands in areas of the site adjacent to the coast; and
- unexploded ordnance (UXO) risks: 'Moderate Bomb Risk' identified for the site.

ii) Hydrology and hydrogeology

2.9.3. The following provides a summary of the hydrological and hydrogeological characteristics within the site and site vicinity:

- surface water features: North Sea located adjacent to the eastern boundary of the site, ponds and drainage ditches (Sizewell Belts) located adjacent to the west and south of the site, Leiston Beck and Minsmere New Cut located west of the main construction area;
- superficial aquifer: the alluvium, tidal flat deposits, marine sand and gravel and Lowestoft sand and gravel are classified as a Secondary A Aquifer. The peat, head deposits and Lowestoft till are classified as unproductive strata;
- bedrock aquifer: the Crag Group is classified as a Principal Aquifer;
- groundwater vulnerability: a Source Protection Zone (SPZ) III (Total Catchment) and a Source Protect Zone II (Outer Zone) are located 500m and 750m to the west of the LEEIE around Leiston. The soils underlying the majority of the site are identified as having high permeability, with the exception of the peat deposits and Lowestoft Formation, which are identified as having intermediate leaching potential;
- groundwater/surface water abstractions: two permits for groundwater abstractions are located on the site at Upper Abbey Farm for general farming and domestic purposes from the Crag Group and at Sizewell B power station for make-up/top-up water from the marine deposits. An additional 20 groundwater abstractions are listed within 1km of the site. The closest abstraction to the site is a SPZ borehole located adjacent to the south-west of the temporary construction area associated with the SPZ;
- groundwater discharge consents: two consents for discharges onto land and into groundwater are present within 500m of the site for the disposal of sewage to land from a domestic property located adjacent to the west of the temporary construction area and the disposal of trade discharge into groundwater at an agricultural property located adjacent to the south-west of the temporary construction area;
- surface water discharge consents: one discharge consent located on-site within the main construction area for sewage discharges into Leiston Beck associated with the existing power station activities. Several additional discharge consents within 500m of the site to the North Sea and Leiston Beck relating to the existing power station, Leiston Sewage Works and Suffolk Water Company;
- pollution incidents: several pollution incidents have been recorded within 500m of the site including incidents relating to oils, chemicals, organic wastes, crude and storm sewage and naturally occurring pollutants to the North Sea and Leiston Beck. One incident recorded on-

site within the main construction area in 1993 relating to an unknown pollutant in Leiston Beck, listed as a Category 3 (minor) inciden; and

- flood risk: several areas of the site are at risk of flooding (Flood Risk 3) as a result of rivers or seas without defences, including the central and northern sections of the main construction area and the eastern and southern sections of the temporary construction area.

iii) Site history

2.9.4. The historical use of the site is summarised in the following sections. The site history details are divided into three zones including the main construction area, temporary construction area and LEEIE.

2.9.5. The main construction area has historically comprised open fields with drains, an old drainage pump and two sand pits present in the north and centre of the zone in 1883. Sandy Lane was also present in the south of the zone from 1883 in its current layout. On the 1905 map, a wind pump and additional sand pits were present in the centre of the zone. By 1958, additional sand pits and a rifle range were shown present within the south-west and centre of the zone. Foundations relating to the Sizewell B Power Station were shown present within the zone by publication of the 1976 map, and Sizewell B was fully operational by 1995 in the southern half of the zone.

2.9.6. The temporary construction area has historically comprised open fields, farmland, marshland and woodland from publication of the 1883 map including Goose Hill in the east and Greenhouse Plantation in the west. Isolated residential properties, farms, roads and tracks were also shown present across the zone from 1883. Drains and sand pits were mapped in the east of the zone from 1883. From the 1928-1951 map, a wind pump was present in the west of the zone. The pits previously identified were labelled as disused by 1976. Grass covered mounds (suspected made ground) were noted to be present in the north-east of the temporary construction area in 2015.

2.9.7. The LEEIE has historically comprised open fields with the Great Eastern Railway Line running through the south-west of the zone from publication of the 1883 map. Buildings/hardstanding associated with the railway were shown present in the southern part of the zone and around Sizewell Crossing. On the 1971 map, the railway line was dismantled halfway along the southern section of the zone. A small reservoir was shown in the north-west of the zone from the 1989 to 2012 maps. By publication of the 2012 map, a pond was present in the centre of the zone and additional roads/hardstanding in the south of the zone. An electricity substation was also present within the eastern extent of the proposed access road in the east of the zone from the 2012 map.

2.9.8. Potentially contaminating historical activities within 500m of the site include various sand and clay pits located between 60m and 500m of the site (1883 – 1976); a wind/drainage pump adjacent to the east of the temporary construction area (1957); Sizewell B Power Station adjacent to the main construction area (1976 – present); a brick works, works farm and associated clay pit 300m to the north-west of the LEEIE (1883 – 1977); a brick field and kilns 300m west of the LEEIE (1883 – 1905); a smithy 450m south-east of the LEEIE (1883 – 1905); windmills 220m and 460m west of the LEEIE (1883 – 1905); tank and sewage outfall (later Sewage Disposal Works) 100m to the north-west of the LEEIE (1905 – present); allotment gardens adjacent to the south of the LEEIE (1905 – 2012); gasworks 40m west of the LEEIE (1928 – 2012); a factory adjacent to the south of the LEEIE (1971 – present); an electricity substation 100m south-west of the LEEIE (1971 – present); a coal yard 55m west of the LEEIE (1971 – 2012) and a refuse tip 130m north of the LEEIE (1976 – 2012).

iv) Landfills and waste management sites

2.9.9. There are several landfills located within 500m of the site, including two registered landfills located 200m south of the main construction area (Ogilvie at Home Farm) and 500m to the west of the LEEIE (Leiston Landfill) and three historical landfill sites located 500m to the west of the LEEIE (Carrs Pit), adjacent to the south-west of the temporary construction area (Abbey Pit) and 300m to the north-west of the LEEIE (Aldhurst Farm).

2.9.10. There are two waste management sites listed within 500m of the site including a household waste amenity site located on Lovers Lane 350m to the north of the LEEIE and a registered waste transfer site is located on Lover's Lane 355m to the north of the LEEIE.

v) Sensitive land uses

2.9.11. The site is located within 500m of several sensitive land uses as follows:

- nitrate vulnerable zone – the entire site is located within a nitrate vulnerable zone;
- Suffolk Coast and Heaths AONB – the AONB (see also section 2.2) is present within the main construction area and eastern edge of the temporary construction area;

- Sizewell Marshes SSSI – the SSSI (see also section 2.3) is present within the western edge of the main construction area and adjacent to the south and north of the temporary construction area; and
- Minsmere-Walberswick Heaths and Marshes SSSI, SAC, Ramsar and SPA (see also section 2.3) is located adjacent to the north-east of the temporary construction area.

vi) Previous investigations

2.9.12. A series of ground investigations have been undertaken at the site between 2009 and 2015. The investigations comprised the drilling and excavation of 373 cable percussion boreholes, rotary core holes and trial pits to a maximum depth of 125.8m below ground level (bgl). Soil, leachate, groundwater and surface water samples were collected and tested and groundwater level and gas monitoring was also undertaken.

2.9.13. Made ground up to 10.8m bgl was encountered within the main construction area overlying marine deposits, alluvium and peat, and the Crag sand formation. Ground conditions within the temporary construction area comprised made ground up to 3.2m bgl overlying alluvium, the Lowestoft till formation and the Crag sand formation. Topsoil overlying the Lowestoft till formation and Crag formation was encountered within the LEEIE. Groundwater was recorded within the Crag sand formation, sometimes at shallow depths of 0.9m bgl (see **section 2.10**).

2.9.14. There were no exceedances against the human health generic assessment criteria for either a commercial or public open space (parks) end use for the contaminants in the soil samples analysed. No asbestos was identified within the soil samples which were visually screened.

2.9.15. Leachate testing of soils identified limited exceedances in the natural material from the Crag sand formation at three locations within the temporary construction area with no evidence of contamination within the overlying made ground. Due to the baseline water quality, the depth of groundwater and distance to surface water courses, it is considered unlikely that the exceedances identified in soil leachate would represent an unacceptable risk to identified controlled water receptors.

2.9.16. Elevated concentrations of contaminants of concern were recorded in the groundwater and surface water samples tested. The groundwater underlying the majority of the main construction area and parts of the temporary construction area is subject to significant saline intrusion and may also be affected by the underlying geology, adjacent marshes and farming activities. Water quality within the surface watercourses is also noted to be Moderate to Poor which is attributed to marine influences, discharges from the Leiston sewage treatment works and farming activities in the surrounding areas.

2.9.17. The ground gas regime at the site has been initially classified based on a limited dataset in accordance with BS8485:2015 as Characteristic Situation CS2, which implies a low risk but requiring gas protection measures. This means that ground gas protection measures may need to be incorporated within the proposed development depending on the proposed earthworks and construction works.

2.9.18. A radiochemical data assessment undertaken in 2014 and concluded that radiation levels within the soil, groundwater and surface water at the main construction area were unlikely to pose a significant risk to human health.

2.9.19. The results suggest that site won materials are suitable for re-use. However, in areas of proposed landscaping a suitable growing medium may be required. A preliminary waste assessment indicated that the majority of samples would be classified as non-hazardous waste with one sample classed as hazardous waste due to elevated lead and zinc concentrations.

2.9.20. Geotechnical constraints include the made ground and peat which are considered unsuitable founding strata, the potential presence of historical buried foundations and structures, the presence of existing services, and UXO risks.

vii) Key hazards

2.9.21. Key hazards present within the site vicinity include the following:

- Made ground on-site associated with former infilled pits, grass covered mounds, the construction of Sizewell B Power Station, fly tipping, the construction of the railway line, infilled reservoir and the construction of roads and buildings across the site.
- Various historical and current activities undertaken on-site including the former rifle range, farming activities, former drainage and wind pumps, former contractor’s compound, activities associated with the construction and operation of Sizewell B, current car park, operation of the railway line and operation of the electricity substation.
- Made ground and contaminative activities associated with various historical and current land uses undertaken within the surrounding area including the construction and operation of roads, sewage treatment works, farming

activities, operation of Sizewell A and B power stations, former sand and clay pits, former coal yard and refuse tip, former brick works, former brick field, former sewage works, former smithy, former gasworks, former coal yard, historical landfills, electricity substation, former allotments and works and factories.

- The presence of unsuitable founding strata underlying the site including made ground and peat.
- The potential presence of buried foundations and existing services within the site.
- Changes in soil compaction and soil erosion.
- Moderate UXO risks across the site.

viii) Summary of preliminary conceptual site model

2.9.22. A summary of potential contamination sources, pathways and receptors identified within the Preliminary Conceptual Site Model is provided in **Table 2.9.1**.

2.9.23. Potential receptors and pathways as summarised in **Table 2.9.2**.

Table 2.9.1 Potential sources of contamination

Potential source of contamination	Potential contamination	Approximate location
Former rifle range located in the centre of the main construction area.	Inorganic and organic contamination including metals and hydrocarbons.	On-site
Made ground within the north-east of the main construction area.	Inorganic and organic contamination including metals and hydrocarbons, polychlorinated biphenyls (PCB) asbestos. Ground gas generation including carbon dioxide and methane.	
Drainage and wind pumps in the north and centre of the main construction area.	Inorganic and organic contamination including metals and hydrocarbons.	
Sewage treatment works located on the western boundary of the main construction area.	Metals and organic contaminants including biological contaminants.	
Made ground, spoil disposal and construction waste on the main construction area associated with the construction of Sizewell B and former contractors' compound.	Inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos. Ground gas generation including carbon dioxide and methane.	
Activities relating to the former contractors' compound on the main construction area for Sizewell B including possible storage areas, fabrication areas, lagoons, stone washing/concrete batching area.	Inorganic and organic contamination including metals and hydrocarbons, PCBs, solvents, paints, oils, asbestos.	
Car park located on western edge of the main construction area.	Fuels and oils attributed to spills from vehicles, plus exhaust particulates. A range of inorganic and organic contaminants.	
Activities within the main construction area associated with the operation of Sizewell B power station including radioactive materials.	Risk of contamination from radioactive materials, fuel oil contamination, asbestos and PCBs.	
Former infilled sand pits located across the main construction area and temporary construction area.	Risk of inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos. Ground gas generation including carbon dioxide and methane.	

Potential source of contamination	Potential contamination	Approximate location
Peat and alluvial deposits within the eastern edge of the temporary construction area and in the main construction area.	Ground gas generation including carbon dioxide and methane.	On-site
Grass covered mounds (suspected made ground) located in the north-east of the temporary construction area.	Inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos. Ground gas generation including carbon dioxide and methane.	
Fly tipping in the north-west of the LEEIE.	Inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos.	
Railway line running through the southern extent of the LEEIE and associated buildings.	Possible inorganic and organic contaminants including hydrocarbons, diesel, lubricating oils, PCBs, PAHs, solvents, herbicides, metals, asbestos and ash used as fill material.	
Made ground present within the southern section of the LEEIE associated with the railway line and in the northern section associated with an infilled reservoir.	Risk of inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos. Ground gas generation including carbon dioxide and methane.	
Electricity substation at the eastern extent of the proposed access road in the east of the LEEIE.	Risk of contamination from metals, asbestos, hydrocarbons and PCBs.	
Farming activities across the entire site area including potential for unmarked farmers' tips.	Contamination risk from herbicides, pesticides, silage, effluent, and fuel oils. Risk of inorganic and organic contamination including metals and hydrocarbons, asbestos. and biological pathogens.	
Made ground associated with the construction of roads crossing the various areas of the site as well as activities associated with their operation.	Fuels and oils attributed to spills from vehicles on the roads, plus exhaust particulates. A range of inorganic and organic contaminants including the potential for asbestos.	
Activities associated with the operation of Sizewell A and B power stations including asbestos lined tanks and their infill, the deposition of radioactive materials on the main construction area and migration of contaminated groundwater onto the main construction area.	Risk of contamination from radioactive materials, fuel oil contamination, asbestos and PCBs.	
Former sand pits located 250m north-west and south-east of the main construction area and 250m to the south of the temporary construction area which have been infilled.	Risk of inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos. Ground gas generation including carbon dioxide and methane.	
Former brick works, brick field and clay pit located 300m to the west of the LEEIE which have been infilled.	Risk of inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos. Ground gas generation including carbon dioxide and methane.	
Smithy located approximately 450m south-east of the LEEIE.	Risk of inorganic and organic contamination including metals and hydrocarbons.	
Tank and sewage works located 500m to the south-west of the LEEIE.	Metals, hydrocarbons, organic contaminants including biological contaminants.	
Gasworks, coal yard and tanks/gas holders located 40m to the west of the LEEIE.	Coal tar, natural gas processing, fuels. Inorganic chemicals acids and alkalis, other inorganic compounds, metals and metal compounds and asbestos.	
Historical landfills within 500m of the site including unnamed refuse tip, Ogilvie at Home Farm, Leiston Landfill, Carrs Pit, Abbey Pit and Aldhurst Farm.	A range of inorganic and recalcitrant organic contaminants including metals, leachate, nitrates, and the potential for ground gas generation.	
Electrical substation located 100m south-west of the LEEIE.	Risk of inorganic and organic contamination including metals and hydrocarbons and PCBs.	

Potential source of contamination	Potential contamination	Approximate location
Farming activities in surrounding areas including potential for unmarked farmer's tips.	Contamination risk from herbicides, pesticides, silage, effluent, and fuel oils. Risk of inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos.	On-site
Allotments adjacent to the south of the LEEIE.	Contamination risk from herbicides, pesticides and fuel oils.	
Works and factories within Eastlands Industrial Estate.	Risk of inorganic and organic contamination including metals and hydrocarbons, asbestos.	
Made ground associated with the construction of roads surrounding the site as well as activities associated with their operation.	Fuels and oils attributed to spills from vehicles on the roads, plus exhaust particulates. A range of inorganic and organic contaminants including the potential for asbestos.	

Table 2.9.2 Potential receptors and pathways

Receptor Group	Receptor	Principal Contaminant Migration pathways
Human health (on-site).	Pedestrians and road users using existing and future roads, roundabout, footpaths and fields within the site (noted that power station site would be secure).	Dermal contact with and/or ingestion of contaminants in soils, soil-derived dusts and water. Inhalation of soil derived dust, fibres and gas/vapours.
	Recreational site users of the SSSI, marshes and beach along the foreshore .	
	Current Sizewell B site workers using the main construction area.	
	Future site workers.	
	Occupants of nearby residential and commercial properties.	
Human health (off-site).	Pedestrians accessing surrounding roads and footpaths.	Dermal contact with and/or ingestion of contaminants in windblown soil-derived dusts and water that may have migrated off-site. Inhalation of windblown soil derived dust, fibres and gas/vapours which may have migrated off-site.
	Recreational site users of the surrounding SSSI and marshes.	
	Agricultural workers.	
	Workers in adjacent Sizewell B power station.	
	Groundwater in Principal Bedrock Aquifer; and Secondary A Superficial Aquifer.	
Controlled waters: groundwater (on-site and off-site).	Ponds and drains on-site.	Leaching of contaminants in soil to groundwater in underlying aquifers. Migration of contaminated water through preferential pathways such as underground services, pipes and granular material to groundwater in underlying aquifers.
Controlled waters: surface waters (on-site and off-site).	Ponds and drains off-site within 500m of the site.	Lateral migration of contaminated groundwater with discharge to surface watercourses as base flow. Discharge of contaminants entrained in groundwater and/or surface water run-off followed by overland flow and discharge.
	North Sea (off-site).	
	Existing on-site services and structures on and off-site.	
	Proposed on-site services and structures.	

Receptor Group	Receptor	Principal Contaminant Migration pathways
Property (on-site and off-site).	Crops and livestock (on-site and off-site).	Direct contact of contaminants in soil and/or groundwater with existing and proposed structures and buried services. Migration of contaminated groundwater, ground gas and/or vapours along strata and preferential pathways such as service routes or differentially permeable strata.
	Sizewell Marshes SSSI.	Direct contact, ingestion, inhalation and uptake of soil and water contamination by crops and/or livestock. Migration of contaminated waters/dust/fibres and subsequent uptake by crops or ingestion/inhalation/dermal contact by livestock.
Ecological receptors (on-site and off-site).	Minsmere-Walberswick Heaths and Marshes SSSI, RAMSAR, SAC and SPA.	Direct contact, ingestion, inhalation and uptake of soil and water contamination by flora and/or fauna. Migration of contaminated waters/dust/fibres and subsequent uptake by flora or ingestion/inhalation/dermal contact by fauna.
	Suffolk Coast and Heaths AONB.	

b) Environmental design and embedded mitigation

i) Construction

2.9.24. A summary of the measures that have been incorporated into the design of the proposed development during construction, including the removal and restoration phase for the temporary facilities, and that would protect land quality during construction is set out below:

- A piling risk assessment in accordance with Environment Agency guidance would be undertaken, if required, to ensure that piling techniques are identified which are appropriate and manage the potential risks to the aquifer.
- The CEMP would specify measures required during enabling works and construction and could include:
  - minimising the area and duration of soil exposure and timely reinstatement of vegetation or hardstanding to prevent soil erosion and reduce temporary effects on soil compaction;
  - stockpile management (such as water spraying and avoiding over stockpiling to reduce compaction of soil and loss of integrity) to prevent windblown dust and surface water run-off;
  - implementation of appropriate dust suppression measures to prevent migration of contaminated dust;
  - implementation of working methods during construction to ensure that there is no surface water run-off from the works or any stockpiles into the proposed drainage system, adjacent surface watercourses/leaching into underlying groundwater in accordance with good practice;
  - implementation of appropriate pollution incident control e.g. plant drip trays and spill kits;
  - implementation of appropriate and safe storage of fuel, oils and equipment during construction;
  - implementation of an appropriate Materials Management Plan (MMP) to document how the excavated materials would be dealt with and a verification plan to record the placement of materials at the site; and
  - implementation of a SWMP.
- Remediation of soil/groundwater contamination (e.g. source removal, treatment or capping) would be undertaken if deemed necessary.
- Gas protection measures would be incorporated within proposed structures, if monitoring and risk assessments deem them to be necessary.
- Hydroseeding of the earth bunds and long-term stockpiles would be used to reduce soil erosion and dust.

- Design of the road and car parking areas and the selection of construction materials would take into account the ground conditions including the potential for ground movement, compaction, ground gas and ground aggressivity.
- Concrete would be designed in accordance with good practice and in relation to ground conditions and the nature and location of the site.
- Design of the drainage/flood prevention strategies would consider the ground conditions including the permeability of the strata and the level of contamination present on-site and be compliant with relevant permits.
- Additional assessment of the potential risks posed by UXO across the site and implementation of mitigation measures would be implemented as appropriate.

ii) Operation

2.9.25. In order to protect land quality, Sizewell C would be operated in accordance with good practice including the following measures:

- the use of hardstanding to avoid spills and leaks;
- the incorporation of petrol/oil interceptors within the drainage design where considered necessary;
- the use of appropriate drainage systems compliant with relevant permits (refer **section 2.11**);
- connection into the local foul water system for foul water; and
- implementation of UXO mitigation measures as appropriate.

c) Preliminary assessment of effects

i) Construction

Ground contamination

2.9.26. The construction works would potentially introduce new sources of contamination and disturb and mobilise existing sources of contamination through excavation and exposure of contaminated soil, remobilisation of contaminants through soil disturbance and the creation of preferential pathways for surface water run-off and ground gas migration pathways. However, with the embedded mitigation measures implemented, construction activities should not increase the contamination risks presented at the site and an overall neutral to minor beneficial effect is predicted. These effects would not be significant.

2.9.27. A preliminary assessment of the effects during the construction phase is summarised in **Table 2.9.3**.

Table 2.9.3 Construction phase effects for the proposed development

Receptor	Value/Sensitivity	Baseline risk	Construction risk	Effect
Human health	High	Very low	Very low	Not significant
Controlled waters (groundwater)	Medium	Low	Very low	Not significant
Controlled waters (surface water)	Medium	Low	Very low	Not significant
Property (existing and future structures and services)	Medium	Very low	Very low	Not significant
Property (crops and livestock)	Medium	Very low	Very low	Not significant
Ecological	High	Very low	Very low	Not significant

Physical effects

2.9.28. The development may also cause physical effects including soil erosion, soil compaction and ground instability issues associated with stripping of topsoil, vegetation clearance, earthworks, stockpiling, movement of heavy plant, piling, temporary works and construction of the new infrastructure.

2.9.29. Construction would require deep excavations within the main construction area for the main platform as well as the raising of land levels to achieve the permanent platform height. This would both require significant quantities of material for use as backfill. An area of borrow pits within the temporary construction area of up to 17ha would be used to generate material for use as backfill and would be reinstated with materials determined to be geotechnically 'unsuitable' for re-use.

2.9.30. Material would be stored in temporary stockpiles in bunds around the site at various periods over the construction phase. There is the potential for increased soil erosion and run-off with a high sediment load likely to impact local surface waters. Earthworks would be planned to minimise soil exposure as far as practicable and areas required for temporary works would be reinstated as soon as possible after they are no longer required. The stockpiles would be managed to prevent soil erosion and dust including spraying with water and hydroseeding. With embedded mitigation, the effects on soil erosion would not be significant.

2.9.31. There are no known ground stability hazards (landslides, historical earthquakes, modern instrument recorded earthquakes) and the site is not in an area affected by coal mining. However, historical extraction of sand and clay has been undertaken on-site and in the areas surrounding the site. The site is also identified as having a moderate UXO risk. The presence of unsuitable founding strata has been identified underlying the site including made ground and peat and there is also the potential to encounter buried foundations and existing services within the site. Several of the proposed works may affect the stability of the ground at the site including the construction of the concrete cut-off wall between the site and SSSI and the installation of cooling tunnels (to a depth of 20-30m bgl).

2.9.32. The main platform area would be dewatered following the installation of the cut-off wall and unsuitable founding material would be removed and the ground would be stabilised to provide a suitable founding platform. Additional assessment of the potential risks posed by UXO across the site would be undertaken and mitigation measures implemented as appropriate. Effects on soil compaction and ground stability are therefore considered to be beneficial as embedded mitigation would improve the ground conditions at the site.

2.9.33. With the embedded mitigation measures in place, physical effects in relation to changes in soil erosion are assessed to be not significant and physical effects in relation to soil compaction and soil stability are assessed to be significant beneficial.

2.9.34. Towards the end of the construction phase, the temporary construction area would be re-instated to a similar condition as currently exists at baseline stage although where habitat creation or landscape re-profiling is proposed, existing field drainage is unlikely to be restored. With embedded mitigation incorporated into the design and effectively implemented during the construction phase, there would be a minor beneficial effect although the effect would not be significant.

ii) Operation

Ground contamination

2.9.35. The operation would potentially introduce new sources of contamination. Spillages and leaks may occur and below ground services could create additional potential pathways for the migration of potential contamination that were not present at baseline. With embedded mitigation a neutral effect is anticipated and would therefore not be significant.

2.9.36. Effects during the operational phase are summarised in **Table 2.9.4**.

Physical effects

2.9.37. Impacts in relation to physical effects including soil erosion, compaction and changes in soil stability would be mainly related to the construction phase of the development and there are unlikely to be any significant effects during the operational phase.

d) Additional mitigation and monitoring

2.9.38. The preliminary assessment of effects presented above identifies no adverse significant effects during construction or operation in relation to land quality. Additional measures to mitigate significant adverse effects are not therefore required.

e) Preliminary assessment of residual effects

2.9.39. No additional mitigation is proposed beyond the embedded measures described above and the residual effects for all phases of development would remain the same as those described above in the preliminary assessment of effects. The effects would be neutral or minor beneficial and would not be significant.

f) Completing the assessment

2.9.40. An assessment has been undertaken of the effects of the proposed development on land quality. With the proposed embedded mitigation, neutral to moderate beneficial effects are generally predicted during the construction and operational phases.

2.9.41. Once the proposals for the Sizewell C Project development as a whole are finalised, a full land quality assessment of the proposals would be undertaken as part of the EIA and the results would be presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant effects.

2.9.42. A summary of the significance of overall effects is provided in **Table 2.9.5** and **Table 2.9.6**.

Table 2.9.4 Operational phase effects for the proposed development

Receptor	Value/Sensitivity	Baseline risk	Construction risk	Effect
Human health	High	Very low	Very low	Not significant
Controlled waters (groundwater)	Medium	Low	Very low	Not significant
Controlled waters (surface water)	Medium	Low	Very low	Not significant
Property (existing and future structures and services)	Medium	Very low	Very low	Not significant
Property (crops and livestock)	Medium	Very low	Very low	Not significant
Ecological	High	Very low	Very low	Not significant

Table 2.9.5 Summary of effects for the construction phase

Geology and land quality

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Ground contamination: current and future on-site and off-site human health receptors.	Contamination from on-site sources.	Incorporate mitigation measures into the construction process, as set out in the CEMP.	Not significant	Not required	Not significant
Ground contamination: controlled waters receptors (groundwater and surface water).	Contamination from on-site sources.		Not significant		Not significant
Ground contamination: property receptors (services/structures).	Contamination from on-site sources.		Not significant		Not significant
Ground contamination: property receptors (crops and livestock).	Contamination from on-site sources.		Not significant		Not significant
Ecological receptors.	Contamination from on-site sources.		Not significant		Not significant
Physical effects: ground conditions.	Soil erosion.		Not significant		Not significant
Physical effects: ground conditions	Soil compaction and ground stability.		Significant (beneficial)		Significant (beneficial)

Table 2.9.6 Summary of effects for the operational phase

Geology and land quality

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Ground contamination: current and future on-site and off-site human health receptors.	Contamination from on-site sources	The Project would be operated in accordance with the relevant regulations and good practice	Not significant	Not required	Not significant
Ground contamination: controlled waters receptors (groundwater and surface water).	Contamination from on-site sources		Not significant		Not significant
Ground contamination: property receptors (services/structures).	Contamination from on-site sources		Not significant		Not significant
Ground contamination: property receptors (crops and livestock).	Contamination from on-site sources		Not significant		Not significant
Ground contamination: ecological receptors	Contamination from on-site sources		Not significant		Not significant
Physical effects: ground conditions.	Soil erosion, soil compaction and ground stability		Not significant		Not significant

2.10. Groundwater

2.10.1. The figures for groundwater are presented in **Volume 3** as **Figures 2.10.1** and **2.10.2**.

a) Baseline environment

2.10.2. Details on the geology of the main development site are provided in section 2.9.

2.10.3. Superficial deposits, comprising marine beach deposits to the east of the site and the Lowestoft sands and gravels located in higher ground to the west of the site, are classified as Secondary A Superficial Aquifers[15]. The peat deposits located adjacent to the west of the site are classified as unproductive strata[16]. The superficial deposits are thought to be in partial hydraulic continuity with the underlying Crag aquifer; however, due to local variability in lithological composition, inconsistent areas of cohesive material may act to delay recharge to the Crag.

2.10.4. The Crag and the Chalk aquifers are classified as Principal Bedrock Aquifers and are hydraulically separated by the presence of the paleogene deposits. Due to the thickness of the low permeability paleogene deposits present, there is not considered to be the potential for significant environmental effects on the Chalk aquifer and is therefore not considered further.

2.10.5. Available groundwater monitoring data in the vicinity of the proposed development record a maximum groundwater level in the area of 2.28m above Ordnance Datum (AOD) which occurred during a storm surge event in December 2013 (**Figure 2.10.1**). Under standard winter conditions, maximum groundwater levels typically reach 1.4m AOD.

2.10.6. Groundwater in the made ground, where present, is considered to be in partial hydraulic continuity with the underlying strata. The laterally inconsistent areas of cohesive material will act to delay recharge to the underlying aquifers, potentially resulting in locally perched water tables.

2.10.7. An SPZ III[17] (total catchment) and a Source Protect Zone II[18] (outer zone) are located 500m and 750m to the west of the LEEIE, around Leiston. The soils underlying the majority of the site are identified as having high permeability, with the exception of the peat deposits and Lowestoft Formation, which are identified as having intermediate leaching potential.

2.10.8. The proposed development is located on the Waveney and East Suffolk Chalk and Crag groundwater body (Water Framework Directive (WFD) reference GB40501G400600). This groundwater body has been classified by the Environment Agency as being of Poor Quantitative and Poor Chemical status, with an objective to being of Good Quantitative and Good Chemical status by 2027. The Poor Chemical status is attributed to impacts from agriculture as evidenced by elevated nitrate concentrations in groundwater. The proposed development falls within a groundwater nitrate vulnerable zone.

2.10.9. Two permits for groundwater abstraction are located on the site at Upper Abbey Farm for general farming and domestic purposes from the Crag Group and at Sizewell B power station for make-up/top-up water from the marine deposits. An additional 20 groundwater abstractions have been identified within 1km of the site. The closest abstraction to the site is a borehole located adjacent to the south-west of the temporary construction area, associated with the SPZ.

2.10.10. Two consents for discharges onto land and into groundwater are present within 500m of the site, for the disposal of sewage to land from a domestic property located adjacent to the west of the temporary construction area and the disposal of trade discharge into groundwater at an agricultural property, located to the south-west.

2.10.11. A number of surface water features are present within the development area, with some degree of connection with groundwater. Of particular importance is the area which falls within the Sizewell Marshes SSSI (see **section 2.5**). Surface water is discussed in further detail in **section 2.11**.

2.10.12. The Suffolk Coastal and Waveney District Strategic Flood Risk Assessment (SFRA) makes no reference to groundwater flooding across the Suffolk Coastal and Waveney District (Ref. 2.10.1). Flood risk is discussed further in **section 2.12**.

2.10.13. The potential for existing contaminative sources are discussed in detail in Ground contamination in **section 2.9**. The following are potential sources that may be contaminative to the groundwater regime;

[15] Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

[16] These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

[17] Total catchment (Zone 3) – defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source.

[18] Outer zone (Zone 2) – defined by a 400day travel time from a point below the water table. The previous methodology gave an option to define SPZ2 as the minimum recharge area required to support 25 per cent of the protected yield. This option is no longer available in defining new SPZs and instead this zone has a minimum radius of 250 or 500m around the source, depending on the size of the abstraction.

- historical site usage;
- waste management sites;
- fuel stations; and
- industrial and other potentially contaminative land uses.

2.10.14. The Sizewell Marshes SSSI is located within the western boundary of the main construction area and adjacent to the south and north of the temporary construction area. Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar Site is north-east adjacent to the development site (see **Terrestrial ecology and ornithology section 2.3**).

2.10.15. The distribution of sensitive invertebrate and plant species within these designated sites is closely connected to shading and is also likely to be influenced by water quality and quantity, with ecological receptors influenced by changes in both groundwater and surface water. There is likely to be a strong interaction with surface water features, with some groundwater discharge to, and recharge from, surface waters.

b) Environmental design and embedded mitigation

i) Construction

2.10.16. Where necessary, perimeter ditches and bund would be constructed at an early stage of construction to prevent untreated surface water run-off from leaving the site, after which a drainage system would be put into place for the temporary construction area that would include drainage to ground, and pollution prevention measures. Construction phase drainage is discussed further in **section 2.11 Surface Water**.

2.10.17. A piling risk assessment in accordance with Environment Agency guidance may be required to ensure that appropriate piling techniques are implemented at the site (by identifying and managing potential risks as a result of creating pathways to groundwater).

2.10.18. The CEMP would specify measures required during enabling works and construction, which could include, but not be limited to:

- implementation of working methods during construction to ensure there would be no surface water run-off from the works, or any stockpiles, into adjacent surface watercourses/leaching into underlying groundwater, in accordance with best practice;
- minimising the area and duration of soil exposure and timely reinstatement of vegetation or hardstanding to prevent soil erosion and reduce risk of contaminated surface run-off entering groundwater receptors;
- stockpile management (such as water spraying and avoiding over stockpiling to reduce compaction of soil and loss of integrity) to prevent windblown dust and surface water run-off;
- implementation of appropriate dust suppression measures to prevent migration of contaminated dust;
- implementation of appropriate pollution incident control e.g. plant drip trays and spill kits;
- implementation of appropriate and safe storage of fuel, oils and equipment during construction;
- implementation of an appropriate Materials Management Plan (MMP) to document how the excavated materials will be dealt with; and
- implementation of a Site Waste Management Plan (SWMP).

2.10.19. Construction activities are anticipated to increase surface run-off of potentially contaminated water, which would be managed under the drainage strategy for the site to prevent migration of contaminated surface run-off to groundwater.

2.10.20. Remediation of soil/groundwater contamination (e.g. source removal, treatment or capping) would be undertaken if further investigation and risk assessments deem this to be necessary.

2.10.21. The excavation of borrow pits would likely increase the potential for surface run-off to groundwater. Engineered drainage would be designed to protect groundwater in this area.

2.10.22. Sizewell Drain would be diverted north, parallel to the base of the platform slope. At its northern extent, it would discharge to the Leiston Drain. This realignment would act to mitigate groundwater impacts through the inclusion of an additional water level control structure.

2.10.23. Sheet piling or an equivalent solution along the eastern boundary of the Sizewell Marshes SSSI would enable the diversion of the Sizewell Drain and to enable the construction of the main platform to the east. This has the potential to introduce preferential pathways for potentially contaminative surface water to enter the underlying groundwater aquifer, which may cause pollution. Drainage would be designed to protect groundwater in this area.

2.10.24. To the east of the realigned Sizewell Drain, a cut-off wall would be anchored into the London Clay Formation, to limit the extent of drawdown associated with dewatering during construction works in the main platform area. The cut-off wall may be breached towards the end of the construction period to enable groundwater levels and flow regime across the area to recover as close as possible to original conditions. Should a breach be performed, the location, depth and timing would be designed to consider potential changes in the wider environment and additional mitigation identified if required.

2.10.25. Appropriate drainage will be used across the temporary construction area, including the incorporation of Sustainable Urban Drainage Systems (SuDS) measures where appropriate.

ii) Operation

2.10.26. The cut-off wall would isolate the newly constructed power station from the external groundwater system, and there would be minimal encroachment into designated areas. Should the cut-off wall be breached, the location and depth would be designed taking into account the long-term connection with the wider environment and additional mitigation identified if required.

2.10.27. An operational drainage system would be built and where possible would include SuDS measures to intercept water, sediment and contaminants. Drainage infrastructure within storage areas for oils or hydrocarbon fuels would be segregated from other drainage, preventing the contamination of other effluents and clean surface water run-off. The approach to drainage is discussed further in **section 2.11 Surface Water**.

c) Preliminary assessment of effects

i) Construction

2.10.28. The construction works would potentially introduce new sources of contamination and disturb, or mobilise, existing sources of contamination through excavation and exposure of contaminated soil, remobilisation of contaminants through soil disturbance and the creation of preferential pathways for surface water run-off to receiving groundwater bodies. However, with the embedded mitigation measures implemented as described, construction activities should not increase the contamination risks present at the site and an overall neutral effect on groundwaters is predicted. These effects would not be significant.

2.10.29. Earthworks for platform development would involve the excavation of a large amount of spoil comprising soil, made ground, peat, alluvium and Crag sand to reach the foundation depths required. Effects would arise from the pumping and discharge of groundwater during construction of the plant within the cut-off wall. These effects will be assessed in detail using numerical groundwater and surface water modelling and there is the potential for a significant adverse effect.

2.10.30. Preliminary modelling indicates that winter groundwater levels within the fen meadow close to the cut-off wall would decrease relative to baseline conditions. The actual extent of the change will be fully assessed using numerical groundwater and surface water modelling.

2.10.31. There is a significant risk presented by a potential engineering requirement to breach the cut-off wall on the border of the main construction area and the Sizewell Marshes SSSI. If it is required, a breach of the cut-off wall could lead to rapid lowering of water levels in the peat and other shallow groundwater, which could then lead to a significant adverse ecological effect. The timing of any breach and its design would be assessed and optimised to minimise potential impacts. Modelling will be undertaken to assess the impact and determine the methodology for any breach.

ii) Operation

2.10.32. The operation of the site would potentially introduce new sources of contamination to groundwater receptors. Spillages and leaks may occur and below ground services could create additional potential pathways for the migration of potential contamination that were not present at baseline. With embedded mitigation a neutral effect is anticipated and the effect is not likely to be significant.

2.10.33. Direct changes to groundwater flow patterns and volumes are anticipated due to the presence of new infrastructure including the cut-off wall for main power station platform. The level changes would be dependent on whether or not the cut-off wall is breached and the groundwater response to this. The potential impact of these effects will be assessed using numerical groundwater and surface water modelling and the potential for a significant adverse effect cannot be ruled out.

d) Additional mitigation and monitoring

2.10.34. No additional mitigation is identified in this assessment, although further measures are likely to be identified in response to ongoing modelling and may become embedded within the design in future. Groundwater monitoring is on-going and would continue through the construction and operational phase.

e) Preliminary assessment of residual effects

2.10.35. The preliminary assessment of effects presented above identifies some potential adverse significant effects during construction and operation in relation to groundwater. The groundwater assessment presented in the ES will consider additional mitigation measures informed by future modelling and assessment.

f) Completing the assessment

2.10.36. Preliminary assessment has been undertaken of the effects of the proposed development on groundwater. Embedded mitigation measures are proposed; however, potentially significant effects cannot be ruled out until both the surface water and groundwater modelling has been completed. Information from on-going monitoring, modelling and further assessment will be used to assist the ongoing engineering design process and minimise the likelihood of significant effects to sensitive receptors.

2.10.37. A full groundwater assessment of the proposals will be undertaken as part of the EIA and the results presented in the ES. The ES will present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 2.10.1 Summary of effects for construction phase

Groundwater

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Crag groundwater (Principal Aquifer); Secondary A Aquifers (alluvium, tidal flat deposits, marine sand & gravel, and the Lowestoft till);	Leaching and migration of existing contaminants (free and dissolved phase) from soils in the unsaturated zone into groundwater in underlying aquifers.	Piling risk assessment to be undertaken where appropriate (to avoid creating of preferential pathways). Health and safety risk assessments and method statements. Implementation of good practice to avoid spillages, e.g. oils or chemicals used on-site stored in suitable bunded area, use of drip trays under mobile plant. Implementation of appropriate pollution incident control e.g. use of spill kits. Implementation of appropriate MMP.	Not significant	No adverse significant effects identified during construction works. Additional mitigation measures are not therefore required.	Not significant
	Migration of contaminants via preferential pathways to deeper groundwater.		Not significant		Not significant
	Construction materials and the use of construction vehicles have the potential to introduce contamination to groundwater via drips and spillages and infiltration of run-off from the construction site.		Not significant		Not significant
Bedrock and Superficial Aquifers, peat deposits; Groundwater Dependent Terrestrial Ecosystems (GWDTE). Abstractions within 1km bedrock and superficial aquifers, peat deposits. GWDTE. Abstractions within 1km.	Dewatering for the construction of the plant.	Realignment of Sizewell Drain and presence of control structures. Cut-off wall. Detailed mitigation measures are not finalised at the time of writing.	Potentially significant	Groundwater modelling results would provide guidance for finalising mitigation design	Potentially significant
Bedrock and superficial aquifers, peat deposits. GWDTE. Abstractions within 1km.	Breach of the cut-off wall (if required).	Mitigation measures to be defined.	Potentially significant	Groundwater modelling results would provide guidance for finalising mitigation design.	Potentially significant

Table 2.10.2 Summary of effects for the operational phase

Groundwater

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Principal Aquifer. (Crag groundwater). Secondary A Aquifers (alluvium, tidal flat deposits, marine sand & gravel, and the Lowestoft till).	Increase in the impermeable area of ground cover at the development site.	Construction methodology and associated mitigation measures will prevent impacts during operation. The Project will be operated in accordance with the relevant regulations and best practice guidance to prevent contamination to groundwater.	Not significant	Additional mitigation measures are not required.	Not significant
	Fuel spills or leaks infiltrating to groundwater.		Not significant		Not significant
Bedrock and superficial aquifers, peat deposits. GWDTE. Abstractions within 1km.	Presence of platform infrastructure and cut-off wall.	Realignment of Sizewell Drain and presence of control structures. Mitigation measures to be defined.	Potentially significant adverse effect.	Groundwater modelling results would provide guidance for finalising mitigation design.	Potentially significant adverse effect.

2.11. Surface water

2.11.1. The figure for surface water is presented in **Volume 3** as **Figure 2.11.1**.

a) Baseline environment

i) Hydrology

Overview of the surface water drainage network

2.11.2. Surface water drainage in the Sizewell C study area comprises two, low energy, lowland river systems. The Leiston Drain and Minsmere River discharge to the sea at the Minsmere Sluice. The Minsmere Sluice is located at the downstream end of the Minsmere New Cut. Flows in Leiston Drain are influenced by the consented discharge of treated effluent from Leiston Water Recycling Centre (WRC).

2.11.3. The river systems have been extensively modified by human activities, including the enlargement and diversion of the main river channels and the construction of a complex network of interconnecting drains throughout the floodplain. As a result of these modifications, the watercourses have uniform, trapezoidal channels with steep banks and very little geomorphological diversity.

2.11.4. Minsmere Sluice is the most important structure governing the surface water drainage system. The Sluice is divided into two chambers, each with its own gravity-outlet culvert. The northern chamber receives flows from the Minsmere New Cut, while the southern chamber receives flows from Leiston Drain and Scott's Hall Drain. When river levels exceed sea levels, water flows from river to sea. When sea levels exceed river levels, flow ceases and water is stored upstream of the Sluice. Some ingress of seawater into the freshwater system has been factored into the design of the Sluice.

Hydrology

2.11.5. The hydrology of the study area is governed by distinct differences between lowland and upland areas. The lowland areas of the catchment, such as the Sizewell Belts and Minsmere Levels, are drained by a network of drains. These drains are manually controlled and regulated by the operation of over 100 control structures such as sluiced pipes, siphons and stop boards. In upland areas of the catchment, rainfall drains to streams and channels under the influence of gravity before discharging to larger watercourses.

2.11.6. Surface water is strongly influenced by the water levels and flows within the groundwater system. Surface water contributes to groundwater in the upper areas of the Sizewell Marshes and groundwater contributes to surface waters in the lower lying (eastern) areas of the marshes. The connectivity between surface waters and groundwater means that the entire hydrological system must be considered as a whole.

Surface water features

2.11.7. There are a series of surface water channels and drainage units within the study area shown in **Figure 2.11.1** and discussed in the following paragraphs.

2.11.8. Minsmere River is the largest hydrological input to the study area (79% by area). The Minsmere River rises to the north-west of Saxmundham (upstream of the study area). It includes the Minsmere New Cut and Minsmere Old River, a remnant watercourse of the original Minsmere River, prior to the construction of the Minsmere New Cut. IDB Drain No. 7 (IDB Drain DRN163G0101) drains the Minsmere South Levels Drainage Unit to the south of Minsmere New Cut.

2.11.9. The Leiston Drain provides a relatively small hydrological input to the study area. It rises at Aldhurst Farm and drains the rural catchment to the north of Leiston. Sizewell Drain (IDB Drain DRN163G0202) is the primary watercourse draining the Sizewell Marshes Drainage Unit. The drain originates at Sizewell village, immediately south of the Sizewell A power station. The drain flows in a northerly direction along the landward toe of the existing power station complex, before joining the Leiston Drain to the north of the proposed Sizewell C power station. IDB Drain DRN163G0201 bisects the area between Leiston Drain and Sizewell Drain. It is an artificial land drain that has a significant influence on water levels in the adjacent land parcels.

2.11.10. Scott's Hall Drain drains into Minsmere Sluice from the north, running parallel to the coast and draining The Scrape.

2.11.11. In addition to the surface water channels, there are a series of adjacent drainage areas within the study area.

2.11.12. The Sizewell Marshes Drainage Unit covers the network of drains (including Sizewell Drain) to the west of the Sizewell power station platform. The drainage unit receives water from the catchment draining the higher ground to the south and south-west, to the east of Leiston. Groundwater from the underlying aquifer contributes to the water balance of the Marshes. Sizewell Marshes drains under gravity to the Leiston Drain and is therefore controlled by in-channel water levels.

2.11.13. The Sizewell Belts Drainage Unit receives water from run-off from the catchment draining to the Leiston Beck and higher ground to the west of Kenton Hills and Leiston Common. Groundwater-surface water interactions are important within this drainage unit. Water levels in the Sizewell Belts are controlled by a series of interconnecting drains, which ultimately discharge to Leiston Drain.

2.11.14. The Minsmere South Levels Drainage Unit represents the large area to the south of the Minsmere New Cut. Water flows into the drainage unit either via direct rainfall or baseflow from high groundwater levels. Run-off from higher ground to the west and south-west is intercepted by a toe drain on the western fringe of the drainage unit, from where it is discharged to the IDB Drain No. 7. Water is drained from the Minsmere South Levels via a network of drains, which also lead to IBD Drain No. 7. The western side drains to IDB Drain No. 7 via Tank Drain, while the eastern side drains to IDB Drain No. 7 via a RSPB boundary ditch. IDB Drain No. 7 ultimately discharges under gravity into Leiston Drain.

Surface water abstractions

2.11.15. There are four licenced surface water abstractions within the Leiston Drain and lower Minsmere River systems.

ii) Geomorphology

2.11.16. The watercourses typically have artificial, uniform, trapezoidal channels with steep to near-vertical banks and very low energy flows. The banks and riparian zone are generally heavily vegetated, with extensive emergent vegetation communities and floating vegetation found in large parts of the drainage network. The substrate is largely obscured, but typically consists of fine sediments (predominantly silts) when it flows over the peat, and fine sediments over a coarser matrix (gravels) when the watercourses flow over the Crag.

2.11.17. Sediment deposition and sediment transport, when flows have sufficient energy, are likely to be the dominant fluvial processes which operate in the main rivers.

iii) Water quality

2.11.18. Although water quality in the drainage catchments generally meets WFD Good status, there are failures. Parts of Leiston Beck/Drain are affected by consented discharges from the Leiston WRC and display elevated concentrations of ammonia, nitrate, nitrite and phosphate. In addition, the upstream end of Sizewell Drain is affected by road run-off, displaying elevated concentrations of total petroleum hydrocarbons and several specific pollutants or WFD priority substances.

2.11.19. Water quality in the surface watercourses is also influenced by the input of saline water from Minsmere Sluice, which results in elevated salinity and sulphate levels in the surface waters.

2.11.20. Water quality sampling continues to be undertaken across the study area.

iv) Ecology

2.11.21. The southern parts of the surface drainage network (including the Leiston Drain and surrounding drainage units) comprise the nationally designated Sizewell Marshes SSSI, and the northern parts (including the drainage units that connect to the Minsmere New Cut) form part of the nationally and internationally designated Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar Site. The ecological interest of these sites is covered more fully within **section 2.3**.

b) Environmental design and embedded mitigation

i) Construction

2.11.22. Ditches and buds would be constructed early in the construction phase as required to prevent untreated surface water run-off from leaving the site. A construction phase drainage system would then be implemented, incorporating SuDS measures such as open ditches and swales to promote infiltration to ground. Oil/petrol interceptors would be incorporated into the design as required.

2.11.23. Where complete infiltration to ground is not feasible, water would be channelled through an underground piped network to WMZs. These WMZs would attenuate and treat surface water run-off, before either infiltrating to ground, discharging to the surface water drainage network (at greenfield run-off rates) or a combination of both.

2.11.24. The excavation of borrow pits would likely increase the potential for surface run-off to groundwater. Engineered drainage would be designed to protect groundwater in this area.

2.11.25. The construction phase temporary drainage would need to remain operational until the land is restored to its proposed end use, or until permanent site drainage and associated outfalls are commissioned. Where possible, temporary drainage would be incorporated into the permanent drainage.

2.11.26. Foul water would be pumped to a central sewage treatment plant, prior to discharge to sea. This would prevent the contamination of surface waters with sewage effluent during construction.

2.11.27. The Sizewell Drain would be realigned north, parallel to the base of the platform slope. At its northern extent, it would discharge to the Leiston Drain upstream of the proposed SSSI crossing. In addition, revised water level management may be required for the realigned drain, drainage units and watercourses adjacent to the construction site. This would require the inclusion of additional water level control structures and the revised operation of other existing structures. Enhanced water level control would allow for fine tuning of the management regime over time.

2.11.28. The design of the SSSI crossing accounts for the existing hydrological conditions within the Leiston Drain and localised effect that the diverted Sizewell Drain will have on these conditions. The potential geomorphological implications of its construction and operation have informed its design.

2.11.29. A cut-off wall would be anchored into the London Clay Formation, to limit the extent of drawdown associated with dewatering during construction works in the main platform area. This is further considered within **section 2.10**.

2.11.30. The CEMP would specify measures required during enabling works and construction. These would include the measures listed in **section 2.9** and **section 2.10**, but are also likely to include the following measures of direct relevance to surface waters:

- Concrete and cement mixing and washing areas would be situated at least 10m away from surface water receptors. These would incorporate settlement and recirculation systems to allow water to be re-used. The washing of equipment would be undertaken in a contained area, and all water would be collected for off-site disposal.
- Implementation of working methods during construction to ensure that there is no surface water run-off from the works or any stockpiles into the proposed drainage system, adjacent surface watercourses/leaching into underlying groundwater in accordance with best practice.
- All fuels, oils, lubricants and other chemicals would be stored in an impermeable bund with at least 110% of the stored capacity. Spill kits would be available at all times and damaged containers would be removed from site. All refuelling would take place in a dedicated impermeable area, using a bunded bowser. Biodegradable oils would be used where possible.
- Sand bags or stop logs would also be available for deployment on the outlets from the site drainage system in case of emergency spillages.

ii) Operation

2.11.31. The temporary construction area would be restored in accordance with the Landscape and Ecology Masterplan. For the operational power station site as well as the car park and simulator building area on Goose Hill, an operational phase drainage system would be implemented, including SuDS measures to intercept water, sediment and contaminants.

2.11.32. Rainfall falling onto the power station site would be managed through an engineered drainage system and would ultimately be discharged to sea via the cooling water outfall. Forecourt separators would be provided at all locations where fuel handling takes place. Bypass separators would be provided for car parks of a size greater than 800m^2 or with more than 50 spaces if the car park discharges via drains to a water body. Bypass separators are also required for other areas where there is a risk of oil/hydrocarbon contamination in surface water run-off.

2.11.33. At the western perimeter of the site, a filter drain would be installed to capture surface water run-off and prevent direct discharge to Sizewell Drain. The realigned Sizewell Drain will remain during the operational phase.

2.11.34. The SSSI crossing infrastructure would divert run-off away from the SSSI. Its design would be compliant with the Drainage Manual for Roads and Bridges. Drainage would collect surface water run-off from the road where it will outfall into a swale and infiltrate to ground.

2.11.35. Foul water would be pumped to a new sewage treatment plant with the effluent transferred to the Sizewell B effluent network and being discharged to sea.

c) Preliminary assessment of effects

i) Construction

2.11.36. During the initial site preparation, large-scale earthworks would be required, including the realignment of Sizewell Drain, the establishment of site infrastructure (e.g. drainage, roads, rail, SSSI crossing, borrow areas and stockpiles), site facilities (e.g. campus, construction compounds, batching plant).

2.11.37. The construction of the platform and cut-off wall would disrupt patterns of groundwater flow and this could in turn alter surface water levels. Once established, the cut-off wall would reduce, but not totally eliminate, drawdown arising from dewatering. Should the cut-off wall be breached later for engineering purposes, the proposed method for breaching and the recovery of water levels would require careful management. This is considered further in **section 2.10**.

2.11.38. The establishment of perimeter drainage and implementation of the construction phase drainage system would minimise off-site effects. These systems would account for potential hydrological and water quality risks through a combination of SuDS features and engineered structures.

2.11.39. The drainage system is being designed to avoid an increase in discharge and flow through the Leiston Drain and therefore it is unlikely there would be an impact on the Minsmere Sluice and its capacity to drain the Scott's Hall Drain.

2.11.40. The preliminary design and construction methods for the realigned Sizewell Drain have taken account of the sensitivity of Sizewell Marshes SSSI. The realigned channel would be located as close to the cut-off wall as possible and would incorporate one or more water level control structures. This system would allow the control and adjustment of water levels to minimise effects on the SSSI and the wider surface water network.

2.11.41. Based upon currently available information, it is concluded that the main site construction could potentially lead to significant adverse effects on Sizewell Drain, Leiston Drain and IDB Drain DRN163G0201 through a variety of mechanisms. The adjacent drainage units, namely Sizewell Marshes and Sizewell Belts, could also be affected. Significant effects for other watercourses and drainage units are not predicted.

2.11.42. It is however thought likely that with ongoing design of embedded mitigation, it will be possible to avoid significant effects on surface water features. However, until further modelling and assessment work has been completed, there remains the potential for significant adverse effects on the SSSI.

ii) Operation

2.11.43. Direct changes to groundwater flow patterns and volumes have the potential to affect surface water flows. The degree of change would depend upon whether the cut-off wall is breached. The presence of a control structure on the realigned Sizewell Drain would allow any groundwater-surface water change to be managed. This is considered further in the **section 2.10**.

2.11.44. Changes in the proportion of water received from surface and groundwater sources have the potential to change surface water chemistry. The surface drainage network would be designed to manage potential effects arising from road run-off and leakage or accidental spills of fuels, oils, lubricants and other potential contaminants.

2.11.45. There is the potential for significant adverse effects on surface waters including the Sizewell Drain, the Leiston Drain, the IDB Drain DRN163G0201 and the adjacent drainage units, namely Sizewell Marshes and Sizewell Belts (and the SSSI as whole). This would be similar in nature to the effect which would arise during construction and it is thought likely that with ongoing design of embedded mitigation, it will be possible to avoid significant effects.

d) Additional mitigation and monitoring

i) Construction

2.11.46. Monitoring will continue throughout the construction phase, informing the adaptive management of the site. In addition, once the construction phase drainage systems are operational, they will be subject to periodic inspection and maintenance to ensure their continued efficacy.

2.11.47. Adjustment of the control structures on the realigned Sizewell Drain is anticipated, both to ensure that the regime is appropriate for the adjacent drainage units, and, to allow for effective mitigation of potential construction effects.

ii) Operation

2.11.48. An adaptive management regime would, if required, allow for fine-tuning of the revised surface water drainage system. This would ensure that effects are minimised and acknowledges that there could be residual uncertainty in the hydrological response and potential long-term ecological consequences of the proposed development.

2.11.49. Drainage infrastructure and any control structures would be inspected and subject to routine maintenance to ensure its continued efficacy.

e) Preliminary assessment of residual effects

2.11.50. The preliminary assessment of residual significant effects is summarised in **Table 2.11.1** and **Table 2.11.2**. The preliminary conclusion, which is precautionary, indicates that significant adverse effects could potentially arise for a number of surface water features if no appropriate mechanism is defined for maintaining water levels.

f) Completing the assessment

2.11.51. Further surface water and groundwater numerical modelling and assessment will be undertaken to help inform the design of appropriate mitigation measures, including control structures, to maintain the SSSI water levels. Information from the modelling and further assessment will be used to inform the decision making process on mitigation and should reduce the likelihood that there would be significant effects to surface waters.

2.11.52. A full surface water assessment of the proposals will be undertaken and presented in the ES, which will present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 2.11.1 Summary of effects for the construction phase

Surface water

<table>
<thead>
<tr><th>Topic / Receptor</th><th>Impacts</th><th>Environmental Design and Embedded Mitigation</th><th>Assessment of Effects</th><th>Additional Mitigation</th><th>Residual Effects</th></tr>
</thead>
<tbody>
<tr><td>Leiston Drain</td><td rowspan="3">Potential changes in:
Water quality and the sediment regime.
Flow and the hydrological regime.
Physical change and alteration of morphological processes.
These possible effects are associated with the following activities;
The initial site preparation;
Earthworks for platform development;
Winning and placement of materials for platform height; and
Potential breach of the cut-off and the recovery of water levels.</td><td rowspan="9">Construction phase drainage system incorporating SuDS and WMZs.
CEMP would specify measures required during enabling works and construction.
Design of modified watercourses and water features, including new and revised structures.
SSSI crossing accounting for hydrological conditions.
Cut-off wall anchored into impermeable strata to limit drawdown.
Foul water strategy.</td><td>Potentially significant</td><td rowspan="9">Monitoring enabling adaptive site management.
Inspection and maintenance.</td><td>Potentially significant</td></tr>
<tr><td>Sizewell Drain</td><td>Potentially significant</td><td>Potentially significant</td></tr>
<tr><td>IDB Drain DRN163G0201</td><td>Potentially significant</td><td>Potentially significant</td></tr>
<tr><td>Minsmere River, Minsmere New Cut and Minsmere Old River.</td><td rowspan="2">Potential changes in:
Water quality and the sediment regime.
Flow and the hydrological regime.</td><td>Not significant</td><td>Not significant</td></tr>
<tr><td>IDB Drain No. 7</td><td>Not significant</td><td>Not significant</td></tr>
<tr><td>Sizewell Marshes</td><td rowspan="2">Effects could occur through the following activities:
Initial site preparation.
Earthworks for platform development.
Potential breach of the cut-off and the recovery of water levels.</td><td>Potentially significant</td><td>Potentially significant</td></tr>
<tr><td>Sizewell Belts</td><td>Potentially significant</td><td>Potentially significant</td></tr>
<tr><td rowspan="2">Minsmere South Levels</td><td>Effects could occur through the following activities:
Initial site preparation.
Earthworks for platform development.
Winning and placement of materials for platform height.
Potential breach of the cut-off and the recovery of water levels.</td><td>Not significant</td><td>Not significant</td></tr>
<tr><td>Effects could occur through the following activities:
Winning and placement of materials for platform height.</td><td>Potentially significant</td><td>Potentially significant</td></tr>
</tbody>
</table>

Table 2.11.2 Summary of effects for the operational phase

Surface water

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Leiston Drain	Potential changes in: Water quality and the sediment regime. Flow and the hydrological regime. Physical change and alteration of morphological processes. These possible effects are associated with the following activities: Presence of power station platform and cut-off wall. Surface water drainage from the power station and road infrastructure, together with topographical changes. Presence of the permanent 'SSSI crossing'.	Operational phase drainage system, incorporating SuDS. Design of modified water features would account for potential mechanisms of effect (e.g. minimising hydrological and morphological change). Foul water strategy.	Potentially significant	An adaptive management regime would be required to fine-tune the surface water drainage system. Drainage infrastructure will be regularly inspected and subject to routine maintenance.	Potentially significant
IDB Drain DRN163G0201			Potentially significant		Potentially significant
Sizewell Drain			Potentially significant		Potentially significant
Minsmere River, Minsmere New Cut, Minsmere Old River.	Potential indirect changes in flow and the hydrological regime.		Not significant		Not significant
IDB Drain No. 7			Not significant		Not significant
Sizewell Marshes	Potential changes in: Water quality and the sediment regime. Flow and the hydrological regime. Physical change and alteration of morphological processes. These possible effects are associated with the following activities: Presence of power station platform and cut-off wall. Surface water drainage from the power station and road infrastructure, together with topographical changes. Presence of the permanent 'SSSI crossing'.		Potentially significant		Potentially significant
Sizewell Belts			Potentially significant		Potentially significant

2.12. Flood risk

2.12.1. The figures for flood risk are presented in **Volume 3** as **Figures 2.12.1** to **2.12.5**.

a) Baseline environment

i) Environment context and key features

2.12.2. The proposed Sizewell C main platform area is sited immediately behind existing sea defences with a secondary sacrificial bund on the seaward side. The Suffolk Shoreline Management Plan (SMP) developed by the Suffolk Coastal and Waveney Councils states that the long-term intent is to maintain a natural development of the coast allowing overtopping and flooding of the Minsmere valley, whilst sustaining defence to the (existing) Power Station and Sizewell village.

2.12.3. In front of the existing power station complex, the natural topography and sediment composition of the foreshore areas were substantially modified during the construction of both existing power stations and subsequently re-profiled as part of the coastal defences.

2.12.4. The site is in the hydrological catchment of the Leiston Drain, which is classified as a 'main river' by the Environment Agency. The Leiston Drain and Minsmere River to the north comprise low energy systems with extensive marshlands, which drain into the North Sea through the Minsmere Sluice. The Sizewell Drain, classified as an 'ordinary watercourse', flows northwards past the western side of the existing Sizewell power station complex before joining Leiston Drain to the north. Further details of these water courses are provided in **section 2.11**.

2.12.5. The Aldhurst Farm habitat creation scheme has recently been implemented adjacent to Leiston Beck, between Abbey Road and Lover's Lane.

2.12.6. The main development site topography generally slopes from west to the east. The highest areas are located on the western side of the site, adjacent to Abbey Road. The lowest areas are located on the eastern side of the site, within the Sizewell Belts.

2.12.7. At the proposed Sizewell C main platform area, the existing topography generally slopes from south to north. The exception to this is along the existing sea defences and the northern mound, which form a high feature between the beach and inland. This topography suggests that overland flow, if not infiltrated into the ground, would generally flow northwards into the Sizewell Belts.

2.12.8. The temporary construction area has higher topography to the west of the site, with a general slope to the east and south. General topography slopes towards watercourses and marshland. At the southern boundary of the temporary construction area, the slope is generally towards the Leiston Drain and Sizewell Belts. At the northern boundary of the temporary construction area, the ground slopes generally towards the River Minsmere and Minsmere Nature Reserve.

2.12.9. The topography of the LEEIE shows a generally level centre sloping down towards the boundaries of the site. Topographically lower levels are located in the north-west corner, north-east corner and the south-east edge of the site. The railway embankment forms a topographically high feature along the south-western boundary of this part of the site.

2.12.10. The proposed development site as a whole is predominantly undeveloped land, except for the existing Sizewell power station complex and the existing road network.

2.12.11. The soils across the site are generally deep, well drained sandy and coarse loamy soil. However, in some areas the soils are coarse and fine loamy soils with slowly permeable sub-soils and slight seasonal waterlogging. A total of five soil types are identified by the Soilscape Map (see **Figure 2.6.1**) across the site (**Table 2.12.1**).

ii) Baseline flood risk

Coastal flood risk

2.12.12. Coastal flood risk depends on a variety of environmental conditions, notably the combined probability of extreme water levels (astronomical tides, surge, and sea level rise), and wave climate (off-shore to near-shore). In addition, flood and erosion risk will often depend on the position and form of the coast and seabed.

2.12.13. The sub-tidal part of the beach along the power stations frontage is sand-dominated with inner and outer longshore bars that run parallel to the shore (see also **section 2.14** and **Figure 2.14.1**). The longshore bars are a conduit for longshore sand transport and act to dissipate wave energy by causing breaking during storms which reduces the wave energy at the shoreline.

2.12.14. The existing sea defence along the frontage of the proposed main platform is currently approximately 10m AOD at its highest point. A sacrificial bund at approximately 5m AOD is located on the seaward side. This bund helps dissipate wave energy before reaching the existing sea defence. **Table 2.12.2** shows the extreme still water level and nearshore wave conditions for the 2008 baseline and three climate change scenarios. Based on existing defence height of 10m AOD and width of the existing beach profile, the current risk of overtopping is very low although the risk is expected to increase with climate change and associated sea level rise.

Table 2.12.1 Soilscape soils type and drainage potential summary for the main development site

Soilscape Soil Type	Natural Drainage Type	Approximate location(s) within main development site
Sand dune soils.	Freely draining	Coastal extent.
Loamy and clayey soils of coastal flats with naturally high groundwater.	Naturally wet	Existing land to the north of Sizewell B.
Fen peat soils.	Naturally wet	Associated with Sizewell Belts marshland and existing sewage treatment works area.
Freely draining slightly acid sandy soils.	Freely draining	Majority of main development site.
Freely draining slightly acid but base-rich soils.	Freely draining	North of Leiston Old Abbey on western edge of temporary construction area.

Table 2.12.2 Baseline and future extreme still water level and nearshore wave conditions

Cefas Climate Change Scenario*	Annual Probability / Cefas JP combination code	Extreme Still Water Level (m AOD)	Nearshore Wave Height (Hs, m)**
2008 baseline.	1:200 / C 3	3.66	2.39
	1:1,000 / F 2	4.02	3.20
	1:10,000 / F 1	4.93	3.61
High emissions 95% (0.11m SLR at 2025 relative to 2008 baseline.	1:1:200 / C 3	3.77	2.62
	1:1,000 / F 2	4.13	3.25
	1:10,000 / F 1	5.04	-
Medium emissions 95% (1.01m SLR at 2140 relative to 2008 baseline).	1:200 / C 3	4.67	2.63
	1:1,000 / F 2	5.03	3.68
	1:10,000 / F 1	5.94	4.1
H++ with land motion + surge (3.21m SLR at 2100 relative to 2008 baseline).	1:200 / C 3	6.86	-
	1:1,000 / F 2	7.22	4.13
	1:10,000 / F 1	8.13	4.83

* Climate change allowances based on UKCP09 and will be updated following publication of UKCP18.

**Note – nearshore wave conditions taken for Profile 3 (middle of the main sea defence) approximately 200m offshore

2.12.15. The Climate Projections for the United Kingdom (UK) (UKCP18) (Ref. 2.12.1) to be updated in late 2018 will supersede the UKCP09 (Ref. 2.12.2) allowances for sea level rise and extreme surge and some of the assessments may need to be updated based on the new projections.

2.12.16. Off-site, coastal flooding into the lower reaches of the Leiston Drain and Minsmere River catchments could occur if the existing sea defences are overtopped or breached. Historic flood mapping indicates that flooding reached Reckford Bridge (approximately 400m downstream of the Middleton village) in 1968 and 1993 during extreme storm surge events. The probability of overtopping or breach of existing defences is expected to increase with climate change.

Fluvial flood risk

2.12.17. Fluvial flood risk is dependent on several factors, including interaction with the tide, predicted climate change, the sea level rise and the presence, position, alignment and operation of coastal and river defence structures.

2.12.18. The main development site is predominately located in Flood Zone 1, with minor areas in Flood Zone 2 and 3. The main platform, the SSSI crossing and a small area in the east of the temporary construction area are in Flood Zone 2 and Flood Zone 3. To the west of the main development site, a short section of Lover's Lane in the vicinity of the Leiston Drain crossing is in Flood Zones 2 and 3 (**Figure 2.12.2**).

2.12.19. The lower part of the Leiston Drain catchment is affected by fluvial flooding due to tide locking at Minsmere Sluice and overtopping of the Minsmere New Cut embankments. During large fluvial events, excess water from the Minsmere River causes backflow in Leiston Drain, such that flood levels in the Sizewell Belts are similar to those in Minsmere levels.

2.12.20. Low-lying marshlands within the floodplains of the Leiston Drain and Minsmere River provide considerable flood storage. However, there are raised embankments along the Minsmere New Cut that extend from Dam Bridge to the Minsmere Tidal Sluice, which prevent the floodplains from filling in smaller events.

2.12.21. The Sizewell Belts and Minsmere Levels areas are drained by a network of interconnecting drains, manually controlled and regulated by the operation of control structures, such as sluiced pipes, siphons and stop boards. The Minsmere Tidal Sluice is the primary outfall into the sea for the Minsmere River, Leiston Drain and the Minsmere Bird Reserve (Scott's Hall Drain). The flow is controlled by tidal flaps and penstocks that limit discharge from the watercourses during high tide. The structures are operated and maintained by the Environment Agency, with exception of the Scott's Hall Drain tidal flaps that are operated by the RSPB.

2.12.22. Preliminary fluvial modelling indicates the defended 1 in 100 annual probability baseline flood extents are likely to be less than the existing Environment Agency's Flood Zone 3. This is because Flood Zone 3 includes coastal flood risk, and ignores the presence of defences. However, the EDF Energy modelled fluvial extent maintains a broadly similar shape to the Environment Agency's Flood Zone 3 (**Figure 2.12.2**). The baseline EDF Energy fluvial model now includes the wetland scheme at Aldhurst Farm. The preliminary fluvial modelling indicates that the newly created Aldhurst Farm Habitat Creation Area wetlands provides a minor flood risk benefit to Sizewell Belts and Minsmere Marshes.

2.12.23. Current climate change allowances for extreme fluvial flows and rainfall events are based on the Environment Agency's guidance published in 2016, which are based largely on UKCP09. With the climate projections for the UK updated in late 2018, the allowances used for assessment of fluvial risk will be revised during the final Flood Risk Assessment (FRA) development.

Surface water flood risk

2.12.24. The Suffolk and Waveney Strategic Flood Risk Assessment (SFRA) (Ref. 2.12.3) indicates flash flooding caused by surface water run-off from saturated catchments has been a source of historical flooding in the district. Records of surface water flooding incidents within the vicinity of the site are limited to the Leiston urban area. One surface water flooding event is recorded on Valley Road which forms the northern boundary of the LEEIE.

2.12.25. The main development site is predominantly an undeveloped greenfield permeable site with the exception of existing roads and impermeable areas within the existing Sizewell power station complex.

2.12.26. The Environment Agency 'flood risk from surface water' identifies the majority of the main development site to be at 'very low' risk (less than 1 in 1,000 annual probability of surface water flooding in any year) of surface water flooding. However, there are very small localised areas of low (between 1 in 1,000 and 1 in 100 annual probability of surface water flooding in any year) to high risk (greater than 1 in 30 annual probability of surface water flooding in any year) of surface water flooding across the site (**Figure 2.12.3**).

2.12.27. The small localised areas of low to high surface water flooding are associated with topographical low points, ordinary watercourses and drainage ditches. A small surface water flow path that runs from the north-west to the south-east is identified in the central area of the temporary construction area. These minor areas of increased risk, as identified from national scale modelling, do not coincide with existing property or infrastructure receptors within the main development site.

Groundwater flood risk

2.12.28. The majority of the site is classified by the East Suffolk Councils Level 1 SFRA as having either 'no' or 'limited' potential for groundwater flooding. At present, there is no evidence of significant groundwater appearing on the surface suggesting there is low risk of flooding from groundwater.

Sewer flood risk

2.12.29. Records of sewer flooding incidents within the vicinity of the site within the Suffolk and Waveney SFRA are limited to the Leiston urban area. One foul or surface water sewer flood event and one highway drainage flood event are recorded on Valley Road which forms the northern boundary of the LEEIE.

Reservoir flood risk

2.12.30. The Environment Agency Risk of 'flood risk from reservoirs' map shows the maximum extent of flooding in the event of reservoir failure. Flooding from Sizewell Walks reservoir is shown to potentially affect the existing access road to the existing Sizewell power station complex and the field east of Sandy Lane. The reservoir is sited at a topographical high point and has a maximum flood extent to both the north-east and south-west of the reservoir (**Figure 2.12.4**).

2.12.31. Given safety regulations under the Reservoirs Act, the likelihood of reservoir failure is considered to be low.

Summary of flood risk

2.12.32. Table 2.12.3 summarises the baseline flood risk to the site from all sources.

b) Environmental design and embedded mitigation

2.12.33. A substantial proportion of the site is located in Flood Zone 1 with a small area of the main platform, the SSSI crossing and the temporary construction area currently within Flood Zones 2 and 3. A FRA will be submitted with the application for development consent, demonstrating that the project will be safe for its lifetime without increasing flood risk elsewhere.

Table 2.12.3 Summary of flood risk at the main development site

Source of flooding	Flood risk
Tidal/coastal	Predominantly low, as most of the site is in Flood Zone 1.
	Areas of exception in Flood Zone 2 (medium risk) and 3 (high risk) include: the SSSI crossing, part of the main development platform and an attenuation pond.
Fluvial	Predominantly low, as most of the site is in Flood Zone 1.
	Areas of exception in Flood Zone 2 (medium risk) and 3 (high risk) include: the SSSI crossing, part of the main development platform, an attenuation pond and a small area west of the main platform on Lover's Lane.
Surface water (pluvial).	Predominantly Very Low as defined by the Environment Agency Surface Water Flood Map.
	Isolated areas with low to high risk associated with topographical low points, ordinary watercourses and drainage ditches. One historic surface water flooding event is recorded on Valley Road, the northern boundary of the LEEIE.
Groundwater	Low: no evidence of significant groundwater emergence at surface.
Sewers	Low: existing sewer system privately managed with a maintenance and management plan. One recorded sewer flooding event and one highway drainage flood event recorded on Valley Road, the northern boundary of the LEEIE.
Reservoirs and other artificial sources.	Predominantly not at risk of flooding from reservoirs or other artificial sources.
	Areas within the maximum reservoir flood extent include: existing access road to existing Sizewell power station complex and small undeveloped field east of the Sandy Lane.

2.12.34. Further details on the design measures which are included within each phase of the development and serve to reduce flood risk are provided below:

i) Construction

2.12.35. The site would be accessed by existing infrastructure and proposed access roads located in Flood Zone 1 and/or above predicted flood levels to ensure safe access and egress to the site. The sequence of construction will ensure that flooding risks on-site are managed, without increasing flood risk to off-site receptors.

2.12.36. During construction, the proposed development would increase impermeable areas and associated surface water run-off. A surface water drainage system would be built as part of the enabling works to manage the increase surface water run-off. Further information for each of the site elements is provided in the following sections.

Main platform

Coastal

2.12.37. The construction phase sea defences would be installed at the same time as the piling platform cut off wall works. The construction of the sea defences would commence at the southern end with the 7.0m AOD bund tying into the existing Sizewell B sea defence bund. The existing sea defences would be excavated to facilitate ground works to secure the stability of the finished coastal embankment. The temporary lowering of the embankments would increase the risk of wave overtopping and temporary bunding may therefore be required to prevent flooding of the land behind the defences. Any minor risk from overtopping in extreme events during this construction period would be managed in conjunction with a weather warning system and flood action plan.

Fluvial

2.12.38. The construction of the main platform requires the diversion of the Sizewell Drain and other minor ordinary watercourses within the SSSI area to maintain a connected hydraulic network. New channel capacity would be created before closing any existing channels, to ensure no loss of conveyance capacity. The raising of the ground level for the main platform would create a very small loss of flood storage.

2.12.39. The piling platform would be constructed at 3.0m AOD, which is above existing ground levels and well above the modelled fluvial flood levels (which are less than 1.6m AOD for the 1 in 100 annual probability event). This means that the construction of the platform would be at negligible fluvial flood risk.

Surface water

2.12.40. Overall there would be an increase in the impermeable area on the main platform that would require surface water to be managed for the safety of staff and visitors on-site and without increasing flood risk elsewhere.

2.12.41. The proposed main platform area is currently predominantly undeveloped greenfield land. Currently surface water either infiltrates into the ground or flows overland and into the nearby Sizewell Drain. At present some Sizewell B facilities and buildings occupy part of the proposed Sizewell C main platform area but these would be relocated as a preliminary phase of the Sizewell C works and any existing surface drainage removed as appropriate.

2.12.42. The construction phase surface water drainage design would have a design capacity to manage rainfall from a 1 in 30 annual probability storm event without surface water flooding occurring. In a 1 in 100 annual probability return period rainfall event the drainage design would ensure that no buildings would be flooded and no untreated surface water would flow beyond the site boundary. A 10% allowance for climate change would be incorporated within the construction drainage system.

2.12.43. At present, some of the surface water run-off from Sizewell B flows overland into the Sizewell C main platform area. The existing Sizewell B platform level is 6.4m AOD, while for Sizewell C the proposed main platform level is 7.3m AOD. The difference in the topographic levels would prevent a limited amount of existing surface water run-off from Sizewell B discharging towards Sizewell C. Further assessment will be undertaken to determine the extent of the impact and finalise design of alternative flow paths. Alternative flow paths would be established prior to raising the main platform for Sizewell C above the level of the existing Sizewell B platform level of 6.4m AOD. This approach does not apply to the sea defences.

2.12.44. Where practical, some of the construction phase surface water drainage network would be designed to later become part of the permanent surface water drainage network. On completion and commissioning of Sizewell C the permanent site would be drained solely by the permanent network and the unnecessary temporary network decommissioned.

Sewers

2.12.45. Sizewell B and Sizewell A currently share a private sewage treatment works that serves the existing power station complex. To prevent any increase in foul water flooding on these sites, a new sewage treatment works serving only Sizewell C would be constructed.

SSSI crossing

Coastal

2.12.46. Construction of the SSSI crossing to an elevation of 7.3m AOD would provide safe access and egress from the temporary construction area to the main platform without any significant wave overtopping during the construction phase. The road would also be safe in the unlikely event of a breach of the coastal defences north of the main platform.

Fluvial

2.12.47. The structural form proposed for the SSSI crossing is an embankment over a culvert. The culvert size requirements are based on width of current watercourse, flood levels, ecological connectivity, plus safe access for inspection and maintenance. The combination of these factors results in a culvert that is much larger than just dictated by flood flow capacity. The culvert would accommodate more than the fluvial 1 in 100 annual probability plus climate change flows without a significant throttling effect. It is anticipated that modelling for the final FRA will confirm this.

2.12.48. During the early stages of the construction phase, a temporary haul road using short span panel bridges to the site at low level would be built on the western side of the SSSI crossing. This installation would be timed with drier months to reduce risk of working on waterlogged floodplain. The short span panel bridge would remain in place until the eastern embankment is brought to full height of 7.3m AOD with the interim haul road on it.

2.12.49. The SSSI crossing would be formed of an embankment over a culvert. The road level of the SSSI crossing is designed at 7.3m AOD, the same height as the main platform, to ensure resilience to the worst credible climate change scenarios for the crossing in the operational phase of the development.

Surface water

2.12.50. The surface water from both sides of the crossing would be drained to the north into a swale in the temporary construction area before infiltrating to the ground. The drainage system on the permanent crossing would remain in place after the construction phase.

Temporary construction area

Surface water

2.12.51. As the ground conditions are generally permeable, the temporary construction area would make use of surface water infiltration in areas where the run-off water quality does not pose a significant risk of pollution. It is considered possible to discharge perimeter ditches and roads to local swales. For compounds with hard standing and roofs of most buildings, the surface water would continue to be drained via a piped drainage network to SuDS attenuation ponds, referred to as WMZs.

2.12.52. The temporary construction area is divided into six discreet drainage catchments that would drain to the associated individual WMZs. The WMZs are designed to operate either to:

- treat water to a standard compliant with the environmental permit prior to it discharging to watercourse;
- attenuate surface water run-off and control the discharge to the watercourse at the greenfield run-off rate for up to the 1 in 30 annual probability storm event. These would be lined attenuation ponds that would retain some water for alternative uses such dust suppression; or
- attenuate surface water run-off and infiltrate it into the ground. The infiltration WMZs would comprise an infiltration pond with bunded boundaries and a separate treatment facility.

2.12.53. Two of the catchments would discharge solely through infiltration to ground. The remaining four catchments would discharge to both ground and a watercourse.

2.12.54. Where treatment of the surface water run-off is required, treatment would be provided as set out in the construction phase drainage strategy, which may include the use of treatment lagoons, if required.

2.12.55. The surface water drainage design would also consider exceedance flow routes to limit excessive depths and maintain safe site operation during major rainfall events.

Sewers

2.12.56. The temporary foul water drainage design for the temporary construction area would comprise private foul water drainage network and treatment works. The campus site would drain to a pumping station that would discharge the foul water to the private site wide sewage treatment works.

2.12.57. The temporary construction area gravity network would be designed with capacity and self-cleansing velocities for the normal occupancy. In design of the network to provide self-cleansing velocities, allowance would be made for variation in flow rate in the network.

Initially there would be a small population but the total number would increase as construction ramps up. This would be followed by a relatively consistent population before reducing towards the end of construction as decommissioning takes place.

Land to the East of Eastlands Industrial Estate

Surface water

2.12.58. The construction phase surface water drainage design for the LEEIE is yet to be fully developed. However, the lack of capacity in the local surface water sewer network would prevent the site from being connected. The surface water run-off would be contained on-site during construction, though the use of perimeter swales, and discharged to the ground. Any storage tanks or ponds would be sized to manage the 1 in 30 annual probability storm event.

2.12.59. A local construction phase foul water drainage network would be built to transport foul water flows for the site to a package sewage treatment plant on the eastern site boundary. The treated effluent from the package sewage plant would be discharged to an infiltration field drainage network.

2.12.60. At the end of the construction phase, the site would be returned to the pre-development greenfield state. This would involve the removal of impermeable surfaces and drainage infrastructure.

2.12.61. Some surface water drainage infrastructure may remain in place to limit surface water run-off from the restored greenfield site to the adjacent roads.

ii) Operational phase

2.12.62. The potential impact of the main development on flood risk is being analysed through extensive coastal and fluvial modelling, including assessing risks from breach or overtopping of defences. The Environment Agency has been consulted on modelling methods, and some preliminary modelling has been carried out. The hydraulic modelling will be further refined after the Stage 3 consultation. Further information for each of the site elements is provided in the following sections.

Main platform

Coastal

2.12.63. The main platform would be at a level of 7.3m AOD, which is similar to the 1 in 1000 annual probability extreme still water levels in the year 2110 for the worst credible H++ climate change scenario (3.2m SLR, including land motion). The H++ scenario identified in UKCP09 is beyond the likely range, but within physical plausibility. The main platform would therefore be safe and resilient for its whole operational life against the worst credible climate change predictions.

2.12.64. The sea defences would initially be constructed to 10m AOD in the construction phase. This would provide additional protection against combinations of high water levels and wave action. Preliminary overtopping modelling results for the 1 in 1,000 annual probability storm event, which includes reasonably foreseeable 1.01m SLR for 2140, for the 10m AOD main sea defence and northern mound, indicate negligible risk of overtopping. If required later in the operational phase, to adapt to worst credible climate change, the sea defences could be raised up to 14m AOD. Climate change predictions and sea level rise would be monitored on an ongoing basis to ensure raising of defences is made at the appropriate time to manage any increasing risk.

2.12.65. The operational defences would comply with the joint Environment Agency and Office for Nuclear Regulation Principles for Flood and Coastal Erosion Risk Management. Testing of high end scenarios up to 1 in 10,000 annual probability, including H++ climate change, confirms that the proposed development would be resilient and safe to operate during these extreme scenarios. Further updating of the assessments will be undertaken, where appropriate, to incorporate any changes in defence design and updated climate change scenarios from UKCP18.

2.12.66. Coastal flood risk is highly dependent on climate change allowances used for the assessment. The updated UKCP18 will be considered in relation to further assessments.

2.12.67. A weather warning system would be in place to avoid or mitigate risks to visitors and staff.

Fluvial

2.12.68. The main platform would be raised above the existing ground level to 7.3m AOD, to ensure resilience to high coastal climate change scenarios. This is substantially above modelled levels of fluvial flood risk and so fluvial events are not expected to pose a flood risk to the main platform.

2.12.69. Climate change is anticipated to cause a gradual increase in fluvial flow along with increases in extreme rainfall intensity and duration.

2.12.70. The preliminary fluvial modelling representing the main platform for a 1 in 100 annual probability event (prior to the impacts of climate change) suggests any increase in water levels as a result of the platform are likely to be less than 10mm. Further analysis of the operational phase will be undertaken to assess impacts over a range of return periods and climate change scenarios.

Surface water

2.12.71. Once constructed, the main platform area would comprise predominantly impermeable surfaces. As Sizewell C has a boundary with Sizewell B to the south and both platforms are at differing ground levels, a retaining wall would be constructed to prevent surface water discharging from Sizewell C (the higher platform level) to Sizewell B (the lower platform level). There is the requirement for vehicular access to be possible between Sizewell B and Sizewell C, via construction of a ramp between the two sites. The ramp would be fitted with a flood gate barrier at the access point on Sizewell C.

2.12.72. The surface water drainage design would have sufficient capacity that surface water could be discharged from the site to the sea while ensuring:

- in a 1 in 200 annual probability rainfall event, critical site access and transport links to Sizewell C would be capable of operating safely and that staff operating the power station could do so without surface water flood risk. For events up to this magnitude, the platform would drain to the sea through the main cooling water infrastructure;
- in a 1 in 1,000 annual probability rainfall event, staff and visitors to Sizewell C site would remain safe from the effects of surface water flooding, though design of surface water exceedance flow paths; and
- in a 1 in 10,000 annual probability rainfall event, no flood water that builds up within the site would reach a level where it could flow into safety classified buildings. Any surface water drainage network relied upon to achieve this would be safety classified.

2.12.73. Buildings on the main platform would be built with a flood resistant design to prevent water ingress during extreme rainfall events or minor wave overtopping during extreme coastal events.

2.12.74. Sizewell C would have a separate surface water drainage network. There would be no direct linkages between the surface water drainage networks of Sizewell B and Sizewell C.

Sewers

2.12.75. The foul water drainage network would be designed with capacity and self-cleansing velocities for the normal daytime occupancy. temporary reduction in flow at night and weekends would not have significant adverse hydraulic impact. During production outages, when planned maintenance activities take place during a short fixed period of time, there would be a temporary significant increase of approximately 1,000 persons on-site. The design of pipe capacity would take account of the additional flow rate expected during these periods.

Site of Special Scientific Interest crossing

Coastal

2.12.76. On completion of the construction phase, the temporary haul road surface would be removed, however the embankment would remain. The embankment would be landscaped as part of the site restoration. Depending on the design, there is the potential for the SSSI crossing height to be increased in future for retaining safe access and egress to Sizewell C for high climate change adaptation scenarios.

2.12.77. EDF Energy has considered a range of possible coastal erosion scenarios. These suggest that the main platform is likely to reduce the rate of coastline retreat north of the main platform. This is covered further in **section 2.14**. Modelling with moderate coastal retreat will be undertaken to inform final design of wave protection for the eastern face of the new embankment.

Fluvial

2.12.78. The SSSI crossing would provide access to Sizewell C throughout the lifetime of Sizewell C. The permanent access road from the Abbey Road junction to the SSSI crossing would provide a safe northern access route to the platform and prevent reliance on the existing access route to the south of the existing Sizewell power station complex.

Goose Hill – car park and simulator building

Surface water

2.12.79. The road on the SSSI crossing and the permanent access road would be drained to a suitably sized swale or swales beside the road. No water from the private access road would flow on to the public highway at Abbey Road.

2.12.80. The proposed buildings would discharge roof water run-off via downpipes to individual underground soakaways. The 1,200 space car park would be drained using SuDS infiltration techniques, through a combination of permeable paving direct to ground and channel drains, underground land drainage perforated pipe system and an infiltration pond clear of the car park. The combination of infiltration drainage facilities will be developed further in the detailed drainage design.

Sewers

2.12.81. The permanent foul water drainage design for the buildings would be connected to either:

- a small package sewage treatment plant located on the former temporary construction area with the treated effluent being discharged either into the ground or to a field drain network; or
- a pumping station that would pump up to and discharge into the Sizewell C private sewage treatment works.

2.12.82. The foul water drainage network and treatment facilities would be designed with capacity and self-cleansing velocities for the normal daytime occupancy of these buildings. Temporary reduction in flow at night and weekends would not have significant adverse hydraulic impact.

c) Preliminary assessment of impacts/residual effects

2.12.83. The predominantly low flood risk of most of the site, combined with embedded mitigation measures for those areas potentially at risk, means there would be no significant change in flood risk to existing receptors and the flood risk effect would not therefore be significant.

2.12.84. The flood risk to the proposed development is considered in the following sections.

i) Construction

Main platform

Coastal

2.12.85. Initial overtopping modelling for the completed construction phase sea defence with 10m AOD crest level indicates there is a negligible risk of overtopping up to a 1 in 1,000 annual probability storm event. This modelling takes account of climate change SLR of 0.113m for 2025. Lowest common observed beach profiles in front of the main platform and the Northern Mound (northern end of the main platform) were used for this assessment. These were derived from surveys collected in 2018 and 2014, plus supplementary offshore bathymetry data. The bund on the seaward side of the defences could erode during an extreme storm event and so was removed from the model for the purpose of the preliminary assessment, in order to provide the most conservative results.

2.12.86. The earlier construction phase defence at 7m AOD would require updated modelling for the full FRA, but is expected to provide low overtopping rates that can be safely managed in conjunction with the weather forecasting and a construction phase flood action plan.

2.12.87. **Table 2.12.4** and **Table 2.12.5** show modelled overtopping rates for different climate change scenarios for the main sea defence and the Northern Mound respectively.

2.12.88. Preliminary breach modelling has been conducted to assess possible impacts from the development using a modelled breach just north of the main platform, in front of Goose Hill. Preliminary results (**Figure 2.12.5**) indicate the SSSI crossing and the main platform combined would contribute to slightly higher water levels in the Minsmere Levels and slightly reduced water levels in the Sizewell Belts. The predicted water level increases in the vicinity of the nearest property receptors in Eastbridge are less than 10mm. Based on these preliminary results, this is considered likely to be a negligible impact and would not be significant. Further breach assessments will be conducted where appropriate for the final FRA.

2.12.89. Coastal flood risk will be further assessed where appropriate using updated climate change allowances for sea level rise and storm surge, in line with UKCP18. Assessments will be updated to the new allowances where appropriate for the final FRA.

Fluvial

2.12.90. Early construction activities such as creating the new alignment of Sizewell Drain will be timed to coincide with typically dry periods to reduce risk of waterlogging. Fluvial flood risk to the site is then considered low.

2.12.91. Preliminary fluvial modelling results indicate that any increases in flood depth due to the main platform are likely to be less than 10 millimetres (mm) during the 1 in 100 annual probability event. Further detailed assessment considering a full range of return periods and climate change scenarios on both fluvial flows and rainfall intensity will be carried out for the final FRA. Based on preliminary results this is considered likely to be a negligible impact and would not be significant.

Table 2.12.4 Predicted mean overtopping rates for main sea defence – Profile 3

Cefas Climate Change Scenario/ Defence Crest Level	Cefas Climate Change Case Number	Cefas JP combination code	Annual probability	Mean Overtopping Rates (l/s/m)
High emissions 95% (0.11m at 2025 relative to 2008 baseline)/defence crest level at 10m AOD.	Case D	C 3	1:200	0.00
High emissions 95% (0.11m at 2025 relative to 2008 baseline)/defence crest level at 10m AOD.	Case D	F 2	1:1,000	0.00
Medium emissions 95% (0.74m at 2110 relative to 2008 baseline)/defence crest level at 7.3m AOD.	Case 2	C 3	1:10,000	2.29
Medium emissions 95% (1.01m at 2140 relative to 2008 baseline)/defence crest level at 7.3m AOD.	Case 3	F 2	1:10,000	4.94
H++ with land motion + surge (3.21m at 2100 relative to 2008 baseline)/defence crest level at 10.5m AOD.	Case 10	F 1	1:10,000	9.95

Table 2.12.5 Predicted mean overtopping rates for the Northern Mound + Profile 1

Cefas Climate Change Scenario/ Defence Crest Level	Cefas Climate Change Case Number	Cefas JP combination code	Annual probability	Mean Overtopping Rates (l/s/m)
Medium emissions 95% (0.74m at 2110 relative to 2008 baseline)/defence crest level at 7.3m AOD.	Case 2	C 3	1:200	0.00
Medium emissions 95% (1.01m at 2140 relative to 2008 baseline)/defence crest level at 7.3m AOD.	Case 3	F 2	1:1,000	0.00
H++ with land motion + surge (3.21m at 2100 relative to 2008 baseline)/defence crest level at 10.5m AOD.	Case 10	F 1	1:10,000	0.64

Surface water

2.12.92. Part way through the construction phase, the completion of main platform hardstanding area would increase in its impermeable surface. The construction of the temporary surface water drainage system would be undertaken before this, and some parts are likely to form components of the permanent drainage system. Further assessment of surface water management and detailed drainage design will be undertaken.

SSSI crossing

Coastal

2.12.93. Preliminary breach modelling has been conducted to assess possible impacts. A breach just north of the main platform, in front of Goose Hill, is likely to show the most conservative impacts of the development. Preliminary results indicate the SSSI crossing and the main platform combined would contribute to slightly higher water levels in the Minsmere Levels and slightly reduced water levels in the Sizewell Belts. The impacts in the vicinity of the nearest property receptors in Eastbridge are less than 10mm. Based on these preliminary results, this is considered likely to be a negligible impact and would not be significant. Further breach assessment will be conducted where appropriate for the final FRA.

2.12.94. Climate change allowances used in assessments will be reviewed against UKCP18. Assessments will be updated to the new allowances where appropriate for the final FRA.

Fluvial

2.12.95. Preliminary fluvial modelling results indicate that any increases in flood depth due to the main platform and SSSI crossing are likely to be less than 10mm during the 1 in 100 annual probability event. Further detailed assessment considering a full range of return periods and climate change scenarios on both fluvial flows and rainfall intensity will be carried out for the final FRA. Based on preliminary results this is considered likely to be a negligible impact and would not be significant.

Temporary construction area

2.12.96. The temporary construction area is currently predominantly undeveloped greenfield land and during construction there would be an increase in impermeable area.

ii) Operation

Main platform

Coastal

2.12.97. Main sea defences would be initially constructed up to 10m AOD and ensure safe overtopping rates for the construction phase and the operational phase subject to moderate climate change. The impact of climate change and associated sea level rise would be monitored throughout all phases. The foundations have been designed so that the sea defences can be raised to 14m AOD part way through the operational phase if required to adapt to higher rates of sea level rise than currently anticipated.

2.12.98. Preliminary overtopping modelling results for the 1 in 1,000 annual probability storm event, which includes 1.01m SLR for 2140, for the 10m AOD main platform sea defence and northern mound, indicate negligible risk of overtopping.

2.12.99. Preliminary overtopping modelling results for the 1 in 10,000 annual probability storm event for the 14m AOD defences, which includes 3.2m SLR for 2110 (credible maximum case) indicated an overtopping rate at the main platform defence of 9.95l/s/m and an overtopping rate of 0.64l/s/m at the Northern Mound, as presented in **Table 2.11.1** and **Table 2.11.2** in the previous section. It is considered that trained staff could safely operate at these overtopping rates should the need arise, because the surface water drainage system will ensure that water splashing over the defences does not accumulate to significant depths.

2.12.100. An overtopping rate of 0.1l/s/m is a generally acceptable criterion for pedestrians, although for trained personnel a rate of 10l/s/m would be acceptable.

2.12.101. The probability of a breach occurring during the operational phase is greater than during the construction phase, due to the anticipated increase in sea level and the potential for storm surge due to climate change. In addition, stability of existing coastal defences north of Sizewell C could be influenced by changes to the offshore topography, shoreline and beach profiles. The Sizewell C main platform and SSSI crossing would be designed to safely withstand a breach into the Minsmere levels. The changes to risks associated with breach are considered likely to be minor, but will be further analysed for the final FRA.

2.12.102. Assessment of coastal flood risk during the operational phase is highly dependent on the climate change projections. The UKCP18 will update allowances for sea level rise and storm surge, which may necessitate updating of the modelling assessments for the final FRA.

Fluvial

2.12.103. The height of the main platform would not change between the end of construction phase and operational phase and changes in fluvial flood risk between the two phases would only be those associated with climate change. The results for the early stage of the operational results are therefore likely to be similar to construction phase, namely impacts of less than 10mm for the 1 in 100 annual probability event (prior to climate change). Further assessment will be undertaken for the operational phase, including a full range of return periods and future climate change scenarios. Impacts are considered likely to be minor and so the effect is not likely to be significant.

2.12.104. Any requirement for floodplain compensation will be determined once the fluvial impacts of the main development have been quantified for a range of return periods and climate change scenarios. This will be evaluated in the context of policy and the possible environmental impacts of creating additional compensatory storage.

Surface water

2.12.105. Surface water will be effectively managed on-site and will not pose a risk to staff or visitors. Further work is required on detailed design of the surface water management features and systems, including validating performance during extreme rainfall events.

2.12.106. There is negligible impact or change to surface water flood risk off-site.

Table 2.12.6 Predicted mean overtopping rates for the SSSI crossing + Profile 1

Cefas Climate Change Scenario/ Defence Crest Level	Cefas Climate Change Case Number	Cefas JP combination code	Annual probability	Mean Overtopping Rates (l/s/m)
Medium emissions 95% (0.74m at 2110 relative to 2008 baseline)/defence crest level at 7.3m AOD.	Case 2	C 3	1:200	0.04
Medium emissions 95% (1.01m at 2140 relative to 2008 baseline)/defence crest level at 7.3m AOD.	Case 3	F 2	1:1,000	4.33
H++ with land motion + surge (3.21m at 2100 relative to 2008 baseline)/defence crest level at 10.5m AOD.	Case 10	F 1	1:10,000	67.63

Site of Special Scientific Interest crossing

Coastal

2.12.107. Preliminary overtopping modelling results for the 1 in 1,000 annual probability storm event, which includes 1.01m SLR for 2140, for the 7.3m AOD SSSI Crossing, indicated an overtopping rate of 4.33 l/s/m. It is considered that trained staff could safely operate at these overtopping rates, for example being able to drive on the road during such a storm, should the need arise. **Table 2.12.6** shows modelled overtopping rates for different climate change scenarios.

2.12.108. Preliminary overtopping modelling results for the 1 in 10,000 annual probability storm event for the 10.5m AOD defences, which includes 3.2m SLR for 2110 (credible maximum case) indicated an overtopping rate at the SSSI Crossing defence of 67.6 l/s/m. It is considered that the access road might be temporarily closed at these overtopping rates should the need arise. Weather warning system and appropriate site management in place will ensure safe operation of the nuclear power station.

2.12.109. The impacts of the SSSI crossing on flood risk during a breach scenario were assessed together with the impacts of the main platform. Preliminary results indicate slightly higher water levels in the Minsmere Levels and slightly reduced water levels in the Sizewell Belts. Further breach assessment will be conducted where required for the final FRA.

2.12.110. In addition, a culvert size sensitivity check was carried out with smaller cross-sectional area to assess impact of potential blockage. The preliminary results indicate that a smaller culvert would restrict flood flows entering the Sizewell Belts and cause additional flood flow to be diverted to the north. Across the site, additional flood depths associated with the smaller culvert are less than 10mm, with the majority being less than 5 mm.

2.12.111. The probability of a breach occurring during the operational phase is greater than during the construction phase, due to the anticipated increase in sea level and storm surge due to climate change. The UKCP18 will update allowances for sea level rise and storm surge, which may necessitate updating of the modelling assessments for the final FRA.

Fluvial

2.12.112. The height and width of the SSSI crossing embankment is unlikely to change between the end of construction phase and operational phase, therefore changes in fluvial flood risk would only be those associated with climate change. The modelled results for the early stage of the operational results are likely to be similar to the construction phase, namely impacts of less than 10mm for the 1 in 100 annual probability event (prior to climate change). Further assessment will be undertaken for the operational phase in the FRA, including a full range of return periods and future climate change scenarios.

d) Additional mitigation and monitoring

i) Construction

2.12.113. Any requirement for fluvial floodplain compensation will be determined once the fluvial impacts of the main development have been quantified for the full range of return periods and climate change scenarios. This will be evaluated in the context of policy and the possible environmental impacts of creating additional compensatory storage.

2.12.114. Regular monitoring and maintenance of the temporary surface water drainage and foul water systems for all components of the main development site would be carried out by EDF Energy to maintain an appropriate design capacity and avoid blockages that could potentially increase the risk of flooding. Maintenance work would include the cleaning/desilting and structural maintenance and repair of roads, culverts and other drainage structures.

2.12.115. A flood plan would be prepared and maintained for the construction phase of the main development site. This plan would contain the procedures and incident management arrangements to ensure the safe use and operation of both the temporary developments and the main construction areas during various weather based event scenarios for different sources of flooding, including access and egress.

ii) Operational phase

2.12.116. Monitoring and maintenance of the surface water drainage systems for the main platform and the SSSI crossing, along with the SSSI crossing culvert and the sea defences would be carried out by EDF Energy to preserve its integrity and maintain an appropriate design capacity. Maintenance work would include the cleaning/desilting and structural maintenance of roads and other impermeable surfaces, gullies, pipes and swales.

2.12.117. A flood plan would be prepared and maintained for the lifetime of the permanent development. The flood plan would use weather forecasting and warning systems to identify different types of weather events that could result in any significant flood risk and contain appropriate mitigating action, including safe access and egress.

e) Preliminary assessment of residual effects

2.12.118. Residual effects are likely to be negligible in all cases but further assessment is required, particularly for the fluvial situation as explained below.

f) Completing the assessment

2.12.119. UKCP18 will be reviewed, to inform which assessments need to be revisited using updated boundary conditions and scenarios.

2.12.120. The fluvial modelling of the site will be further refined, where applicable, using the finalised designs to test the construction phase, operational phase and decommissioning phase, each with respective climate change allowances in line with UKCP18. A full range of return periods will be assessed for the critical storm duration.

2.12.121. Coastal modelling of the site will be further refined, where applicable, using the finalised designs and climate change scenarios from UKCP18. This is likely to cover offshore conditions, wave overtopping and breach modelling. The construction phase, operational phase and decommissioning phase will be tested with a variety of climate change scenarios and return periods. The tests will also be extended to cover conservative coastal erosion scenarios and possible wave action on the SSSI crossing. The criteria for raising the sea defences, if required in high climate change scenarios, will be established and documented prior to the application for development consent. This will ensure that the site is safe during extreme conditions from all foreseeable sources of flooding.

2.12.122. Further surface water modelling will be undertaken to assess potential risks on the main platform and ensure no impacts on the existing drainage of Sizewell B, for extreme rainfall events up to 1 in 10,000 annual probability.

2.12.123. A full FRA will be submitted as part of the application for development consent.

Table 2.12.7 Summary of effects for the construction phase

Flood risk

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Coastal	Slightly increased risk of wave overtopping during storm events due to temporary lowering of existing sand dunes could increase the risk of flooding during construction to the main platform excavation and the SSSI crossing.	Construction flood plan would be prepared. A temporary sea defence may be required until the construction sea defence is completed to a sufficient height to protect the workforce within the main construction area.	Minor	Monitoring and maintenance to preserve design capacity during the construction of the main sea defence.	Negligible
	Risk of overtopping of the sea defences during extreme surge and storm events.	The construction of the sea defences to a height of 10m AOD to provide protection up to the 1 in 1,000 annual probability.	Minor	Monitoring and maintenance to preserve design capacity. Weather forecasting and monitoring to warn of storm events.	Negligible
Fluvial	Realignment of the Sizewell Drain in the Sizewell Marshes SSSI could impact conveyance of flow into the Leiston Drain.	Realigned channel designed to have the same (or higher) capacity as the current drain to ensure conveyance of flow is preserved.	Minor, although further assessment required.	Monitoring and maintenance, including channel vegetation clearance to prevent blockage and preserve design capacity.	Negligible
	Construction of the main platform and SSSI crossing would result in loss of flood storage area and volume.	Further assessment of the loss of flood storage for full range of return periods and climate change is yet to be undertaken, and results will be discussed with Environment Agency.	Minor, although further assessment required.	Yet to be confirmed.	Likely to be negligible, further assessment required.
	SSSI Crossing would constrict the flow under the embankment potentially increasing flood risk in the Sizewell Belts and Minsmere Levels.	Cross-sectional area of the SSSI crossing culvert designed to convey flows considerably higher than the 1 in 100 annual probability storm event.	Minor	Monitoring and maintenance of the culvert to maintain design standard to ensure no blockage.	Negligible
Surface Water	Increase in impermeable area and associated surface water run-off during construction of the temporary construction area, SSSI crossing and LEEIE areas.	Shallow perimeter bunds constructed to contain surface water run-off on-site.	Minor	Monitoring and maintenance of bund to preserve integrity and maintain design standard.	Negligible
	Off-site surface water flow crossing the temporary construction area and LEEIE areas.	Bunds and ditches constructed as required to intercept off-site surface water flows to infiltrate to ground or watercourse depending on WMZ arrangement.	Minor	Monitoring and maintenance of ditch and bunds to preserve integrity and maintain design standard.	Negligible

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Surface Water	Construction of the cut-off wall associated with the deep excavation for the main platform would contain on-site surface water within the construction area and increase local surface water flood risk.	A temporary surface water drainage system to collect and discharge surface water flows in to the North Sea via combined drainage outfall (CDO).	Minor	Monitoring and maintenance of surface water drainage system and the outfall to preserve integrity and maintain design standard.	Negligible
	Contamination of the on-site main platform surface water run-off due to construction activities.	Treatment of the surface run-off as described in drainage strategy.	Minor	Monitoring and maintenance of surface water treatment system to preserve integrity and maintain design standard.	Negligible
	An increase in the impermeable surface due to construction of the main platform.	The temporary surface water drainage system would be constructed.	Minor	Monitoring and maintenance of surface water drainage system and the outfall to preserve integrity and maintain design standard.	Negligible
	Surface water run-off from Sizewell B to Sizewell C would be prevented once the main platform is raised which could increase the surface water flood risk for Sizewell B.	Further assessment required to determine the extent of the impact and finalise design of alternative flow paths.	Minor	Installation of alternative flow path on Sizewell B prior to completion of Sizewell C platform.	Negligible
Groundwater	Increased risk of groundwater seepage due to -18m AOD excavations at main platform during construction of site.	Cut-off wall around the perimeter of main platform to fully penetrate the impermeable strata below to disconnect the main platform foundations from the wider groundwater system and dewatering system install to remove any remaining groundwater.	Minor	Monitoring and maintenance of groundwater removal system to preserve integrity and maintain design standard.	Negligible
	Increase in impermeable areas with the potential to increase groundwater levels through increased groundwater recharge.	Some surface water run-off discharged to sea via CDO, and infiltration structures appropriately sited, would prevent net increases in groundwater levels at the site boundary. Further assessment and detailed design yet to be completed.	Likely to be negligible, although further assessment required.	N/A	N/A
Sewer	Increase in foul sewer discharge from the LEEIE and temporary construction area that could lead to local sewer flooding for the public sewer network.	The LEEIE and the temporary construction area would have separate private foul water network and package treatment plants/works that would avoid the need to connect to the public sewer network.	Minor	Monitoring and maintenance of separate private foul water network and package treatment plants/works to preserve integrity and maintain design standard.	Negligible

Table 2.12.8 Summary of effects for the operational phase

Flood risk

Topic / Receptor	Impacts (potential for flood risk to change)	Environmental Design and Embedded Mitigation	Assessment of Effects (resulting flood risk)	Additional Mitigation	Residual Effects
Coastal	Risk of extreme surge and wave overtopping of the sea defences along the main platform due to sea level rise, change in wave climate and shoreline changes.	Sea defences would be designed to 10m AOD with potential raising to 14m AOD. Structural design of the defences in accordance with guidance on nuclear safety.	Minor	Weather forecasting and monitoring and warning system in place.	Negligible
	During a coastal breach north of the main platform, the SSSI culvert may increase risk in Minsmere levels and reduce risk in Sizewell Belts.	Cross-sectional area of the culvert generously designed. Further assessment required with final design.	Minor, although further assessment required.	Weather forecasting along with monitoring and maintenance of coastal defences to reduce the potential of a breach.	Negligible
	Risk of wave action and overtopping of the SSSI crossing during extreme events with high climate change.	Wave protection on eastern face, and potential for future raising depending on design.	Minor, although further assessment required.	Flood plan accompanied by weather forecasting.	Negligible
Fluvial	Realigned Sizewell Drain could impact conveyance of flow into the Leiston Drain.	Realigned channel designed to have the same (or higher) capacity as the current drain to ensure conveyance of flow is preserved.	Minor, although further assessment required.	Monitoring and maintenance, including channel vegetation clearance to prevent blockage and preserve design capacity.	Negligible
	Construction of the main platform and SSSI crossing would result in loss of flood storage area and volume.	Further assessment of the loss of flood storage for full range of return periods and climate change is yet to be undertaken.	Minor, although further assessment required.	Yet to be confirmed.	Yet to be confirmed
	SSSI Crossing would constrict the flow under the embankment potentially increasing flood risk in the Sizewell Belts and Minsmere Levels.	Cross-sectional area of the SSSI crossing culvert designed to convey flows higher than the 1 in 100 annual probability storm event including climate change.	Minor	Monitoring and maintenance of the culvert to maintain design standard to ensure no blockage.	Negligible

Topic / Receptor	Impacts (potential for flood risk to change)	Environmental Design and Embedded Mitigation	Assessment of Effects (resulting flood risk)	Additional Mitigation	Residual Effects
Surface Water	Increase in impermeable area and associated surface water run-off from the northern access road and SSSI crossing.	Surface water from impermeable areas discharged to infiltration SuDS including an allowance for climate change and incorporate the management of existing areas flood risk.	Minor benefit	Monitoring and maintenance of SuDS to preserve integrity and maintain design standard.	Negligible
	Surface water flood risk to safety classified buildings on the main platform during extreme events.	A surface water drainage system capable of managing design flow capacity requirements and facilitating the safe operation of all safety classified buildings on the main platform.	Minor, although further assessment required.	Monitoring and maintenance of the surface water drainage. Surface water drainage system defined as a safety classified system.	Negligible
	Restoration of the LEEIE after the construction phase could influence the existing surface water flooding issues on the local roads.	Restoration of the LEEIE would involve retaining some surface water drainage features that would facilitate the surface water management of the local roads.	Minor benefit	N/A	N/A
	Increase the impermeable area on the former temporary construction area through formation of a car park and buildings.	Any permanent buildings would discharge roof water run-off via downpipes to individual underground soakaways. The car park would be drained using SuDS infiltration techniques in a combination to discharge to ground.	Minor	Monitoring and maintenance of the surface water drainage system.	Negligible
Groundwater	Potential rise in groundwater levels that could cause floatation issue for below ground structures in the main platform foundation.	Groundwater drainage designed for the main platform to prevent groundwater raising to an undesirable level.	Minor	Monitoring and maintenance of groundwater levels to preserve integrity and maintain design standards and below ground structures.	Negligible
Sewer	Increase in foul sewer discharge from Sizewell C could increase loads and local sewer flooding for the existing power station complex.	Separate private foul water treatment works and network to avoid the any foul sewer flood risk to the existing complex.	Minor	Monitoring and maintenance of the private foul water treatment works and network to preserve integrity and maintain design standard.	Negligible

2.13. Traffic and transport

2.13.1. **Volume 1, Chapter 5** presents the transport strategy for the project including both the rail-led strategy and the road-led strategy. The assessment below explains the local baseline context and how the measures incorporated within the main development site proposals help mitigate the effects on the local road network and then describes the effects on these roads with these measures in place.

a) Baseline environment

2.13.2. The main highway access to the Sizewell C main development site is proposed to be located along the B1122 between Theberton and Lover's Lane.

2.13.3. The B1122 is a single carriageway with an existing speed limit of 60 miles per hour (mph) along this section of road. The B1122 currently carries approximately 5,200 vehicles per day along the section where the site access roundabout is proposed to be located. This figure is expected to rise to 6,800 by 2027 without the addition of Sizewell C construction traffic.

2.13.4. The secondary highway access to the main development site is proposed to be located along Lover's Lane east of the B1122 Abbey Road. This section of single carriageway road also has an existing speed limit of 60mph. Lover's Lane currently carries approximately 2,500 vehicles per day. This figure is expected to rise to 3,850 by 2027 without the addition of Sizewell C construction traffic.

2.13.5. A review of accident data for the period 2013-2017 inclusive (the most recent five-year period for which data is available) shows no recorded accidents along the B1122 or Lover's Lane in the vicinity of the proposed site accesses. Two accidents occurred on the B1122 close to the junction with Onner's Lane, and one accident further south along Lover's Lane; all three were slight in severity.

2.13.6. Sizewell Halt is the terminus of the Saxmundham-Leiston railway branch line. It is located to the south of King George's Avenue in Leiston. The railway previously ran as far as Aldeburgh but the track now terminates at Sizewell Halt. Network Rail owns and manages the Saxmundham to Leiston railway line as far as Sizewell Halt.

2.13.7. Following the termination of passenger services along the branch line, nuclear flask trains carrying waste associated with the decommissioning of Sizewell A operated approximately once per month; material was transferred by road from Sizewell A to Sizewell Halt, and from there proceeded by rail.

2.13.8. Nuclear flask trains have not operated for approximately three years, and the Saxmundham-Leiston branch line is now only used by occasional Network Rail maintenance trains as well as occasional rail tours.

2.13.9. A level crossing is located on King George's Avenue immediately north of Sizewell Halt. The gates are left open to road traffic and are manually closed by railway staff in the event of a train passing. Approximately 4,250 vehicles per day travel across the level crossing on King George's Avenue.

2.13.10. There have been two personal injury accidents in the area during the period 2013-17, the last five years for which data is available. One was in July 2015, a slight accident between two vehicles about 120m west of the level crossing. There was a serious accident between two vehicles near the level crossing in April 2016.

b) Environmental design and embedded mitigation

i) Construction

2.13.11. A range of new infrastructure is proposed to mitigate the traffic impacts of the construction of Sizewell C and the infrastructure built would vary depending on whether a road-led or a rail-led strategy is taken forward. Details of this infrastructure are contained in **Volume 1** and the PEI presented within the relevant sections of **Volume 2**.

2.13.12. The main development site access would be a roundabout constructed along the B1122. The roundabout would be constructed off-line immediately to the east of the existing carriageway, thereby allowing traffic to use the B1122 for most of the duration of the roundabout's construction.

2.13.13. During the main construction phase of Sizewell C, the majority of construction vehicles would enter and exit the site via the roundabout on the B1122. By siting this access to the north of Leiston, the amount of construction traffic passing through the town could be minimised.

2.13.14. In the event of the rail-led strategy being progressed, realignment of the western part of Lover's Lane would provide the opportunity for improved pedestrian and cyclist facilities in the form of a footpath and cycle track following the original road alignment. An informal crossing point would also be located close to the secondary entrance to the main development site on Lover's Lane in order to facilitate safe crossing of the road by pedestrians and cyclists.

2.13.15. Some construction materials would be transported by rail during the early years of construction and, under a road-led strategy, throughout the remainder of the construction programme as well.

2.13.16. EDF Energy is proposing to use the LEEIE for the laydown of construction materials from trains. Two options are proposed for the use of this facility:

- trains travelling to Sizewell Halt, which would be modified to allow trains to be unloaded with material transported by a conveyor passing over King George's Avenue; or
- trains stopping on the curve between Valley Road and King George's Avenue and being unloaded directly into the adjacent LEEIE using a shorter conveyor.

2.13.17. In both options HGVs carrying materials between the LEEIE and the main development site would use the proposed access on Lover's Lane. HGVs transferring construction materials between the LEEIE and the main development site would travel via Lover's Lane and the B1122, thereby avoiding the centre of Leiston.

2.13.18. The traffic impacts of construction of the facilities in the LEEIE could be minimised by constructing all other facilities, such as the proposed caravan park, at the same time as the freight laydown facility as far as practicable.

2.13.19. Both options for use of rail freight deliveries to the LEEIE offer the opportunity for consolidation of freight within the laydown area. Different types of freight can be transported by rail over a period of time and then transferred to the main development site as efficiently as possible by HGV. This would mitigate traffic impacts by optimising the number of HGVs required to transfer materials carried to the LEEIE by rail.

2.13.20. In the event of the option of trains terminating at Sizewell Halt being progressed, the upgrades required to the existing Sizewell Halt for the purposes of supporting Sizewell C construction would be minor in scale.

2.13.21. A second set of tracks would be installed parallel to the existing siding, to allow a locomotive to run around and haul the train in the opposite direction. Provision of this loop means that trains could be operated with a single locomotive, thereby reducing the additional negative environmental effects arising from the operation of two locomotives.

2.13.22. The old railway trackbed beyond Sizewell Halt remains in situ, meaning that extending the existing tracks by a short distance (to accommodate full-length freight trains) would not require land take beyond the existing boundary of Sizewell Halt.

2.13.23. The environmental effects of upgrading Sizewell Halt would be minimised by the use of an existing site as opposed to construction of a new facility, thereby minimising the construction traffic required to undertake the modifications. In this option, a conveyor would be built to carry materials unloaded from trains, across King George's Avenue to the laydown area in the LEEIE. Highway access to Sizewell Halt would be via the existing site entrance, but only a small number of vehicles are anticipated to use this access.

2.13.24. In the event of the option of trains stopping on the curve between Valley Road and King George's Avenue and unloading materials directly into the LEEIE, it is not envisaged that any upgrades to Sizewell Halt would take place. The traffic impacts would be mitigated by not requiring closures of King George's Avenue to allow trains to cross. King George's Avenue would also not need to be closed while the overhead conveyor linking Sizewell Halt to the LEEIE is installed.

ii) Operation

2.13.25. The retention of the site access roundabout on the B1122 following the completion of Sizewell C construction works would represent a permanent legacy benefit for traffic travelling to and from Eastbridge. The roundabout would make it easier for vehicles to turn safely in and out of Eastbridge Road.

2.13.26. The site access would also be used during Sizewell C outage periods when traffic levels would be higher than during the main period of operation (though much lower than during the Sizewell C construction period). This piece of legacy infrastructure would therefore retain the additional junction capacity required during outage periods.

2.13.27. Retention of the Lover's Lane realignment following the completion of Sizewell C construction would provide a legacy benefit to pedestrians and cyclists using Lover's Lane.

c) Preliminary assessment of effects

i) Construction

2.13.28. The main traffic and transport effects during the construction activity at the main development site are expected to be an increase in traffic volumes. The traffic impacts of the overall Sizewell C construction programme are set out in **Volume 1, Chapter 6**.

2.13.29. On a typical day under the road-led strategy, daily traffic volumes on the B1122 are projected to increase by 2,850 vehicles north of the main development site entrance, and by 3,500 vehicles to the south. An additional 600 vehicles per day would travel along Lover's Lane.

2.13.30. On a typical day under the rail-led strategy, daily traffic volumes on the B1122 are projected to increase by 2,300 vehicles north of the main development site entrance, and by 3,700 vehicles to the south. An additional 450 vehicles per day would travel along Lover's Lane.

2.13.31. The impacts of these additional vehicles on the local traffic network would be significant, with traffic volumes increasing by over 50% on the B1122 south of the site access on a typical day during the Sizewell C construction programme.

2.13.32. Increased traffic volumes are expected to increase waiting times for traffic waiting to exit the minor arm, or to turn right, at junctions on routes used by Sizewell C construction traffic. An example would be at the access to Leiston Abbey, where traffic on the B1122 would increase by over half during Sizewell C construction. Delay impacts on affected traffic would be moderate but not significant.

2.13.33. Pedestrians, cyclists and equestrians would also be impacted by these increases in traffic. The amount of time between successive vehicles passing would reduce, thereby increasing the waiting time to cross the road and leading to enhanced severance.

2.13.34. Journey times for all vehicles travelling along routes used by Sizewell C traffic would increase during construction. This would be due to several reasons including:

- increased number of slow-moving HGVs on local roads;
- a proposed reduction in speed limits from 60mph to 40mph along certain sections of road, which would reduce the speed of all traffic even at times when no Sizewell C construction activity is taking place; and
- instances of right-turning traffic waiting longer for a gap in oncoming traffic, as a result of which queuing vehicles must wait for longer before proceeding.

2.13.35. Given the low numbers of vehicles using these minor roads, the overall impact on journey times would be low and the effects would not be significant.

2.13.36. Construction work for upgraded rail terminal at Sizewell Halt or the new facility at the LEEIE would last no longer than 12 months.

2.13.37. Construction work at Sizewell Halt would be likely to take longer than the alternative option of constructing a new rail terminal at the LEEIE, given that a longer section of track would need upgrading to reach Sizewell Halt, and there would be construction work within the Sizewell Halt site itself. Some short-term traffic management would be needed on King George's Avenue during the installation of the elevated conveyor connecting Sizewell Halt to the laydown area at the LEEIE.

2.13.38. The traffic impacts of the construction work at the LEEIE would be moderate but not significant, in view of the temporary nature of the traffic generation. In addition to this, the upgrade work at Sizewell Halt would have minor impacts on traffic if this option for the rail terminal is progressed.

2.13.39. The rail facility in either option would be used by up to two trains per day in each direction in the early years in the rail-led strategy, as well as throughout the main development site construction period in the road-led strategy. In the rail-led strategy, the rail terminal would only be used during the early years until the green rail route is operational.

2.13.40. The HGV route from the LEEIE to the main development site would be via Lover's Lane and HGVs transferring material between the laydown area and the main development site would not travel through Leiston town centre. Traffic impacts arising from the HGV transfer of materials would be minor and the effects would not be significant.

2.13.41. In the event of the Sizewell Halt option being selected, the level crossing on King George's Avenue would be closed for up to four times per day (two trains per day in each direction). Each closure would last for a few minutes. The resulting queue, even for a three-minute closure, would not extend back to the Lover's Lane junction, some 300m to the east, nor to the access to Leiston Primary School which is 500m to the west and the effects are not considered significant.

2.13.42. Proposals are being considered to upgrade the level crossing's method of closure: at present the barriers are manually operated by the train crew which extends the closure time, therefore an upgrade would reduce the duration of closure by allowing barriers to close later and open sooner.

2.13.43. The traffic impacts of freight trains using the green rail route and the existing Saxmundham-Leiston branch line are described in **Chapter 4** of this Volume.

2.13.44. Following the completion of the construction of Sizewell C, the associated development infrastructure on-site including the LEEIE would largely be removed. The traffic and transport impacts of this phase would be expected to be less severe than those during construction.

2.13.45. In the event of the Sizewell Halt rail freight laydown option being pursued, it is likely that the facility would be retained given that its upgrades during construction would also have been minor. The overhead conveyor, however, would be removed; this operation would have minor impacts on traffic flow along King George's Avenue and the effects would not be significant.

ii) Operation

2.13.46. In the event of the proposed reduction in speed limits on certain sections of the B1122 being maintained following the completion of Sizewell C construction, traffic would experience a minor increase in journey times. This effect would not be significant.

2.13.47. Traffic turning in and out of Eastbridge Road would benefit from reduced waiting times at the junction with the B1122 as a result of the Sizewell C site access roundabout being permanently retained.

2.13.48. During outage periods during the operational lifespan of Sizewell C, the increased traffic volumes would have a minor negative impact on journey times. This effect would not be significant.

2.13.49. Pedestrians and cyclists using Lover's Lane would benefit from improved amenity by being able to use the segregated pedestrian and cycle route along the old alignment of Lover's Lane, whose new alignment for vehicles would be permanently retained.

d) Additional mitigation and monitoring

i) Construction

2.13.50. No additional highway mitigation measures are proposed during construction.

ii) Operation

2.13.51. No additional highway mitigation measures are proposed during operation.

e) Preliminary assessment of residual effects

i) Construction

2.13.52. The residual effects during construction are anticipated to be the same as those set out under preliminary effects described above.

ii) Operation

2.13.53. The residual effects during operation are anticipated to be the same as those set out under preliminary effects described above.

f) Completing the assessment

2.13.54. Once EDF Energy has decided which option to pursue for the rail terminal at either Sizewell Halt or the LEEIE, more detailed assessment of traffic impacts can be undertaken using the latest estimates of freight volumes and the anticipated timings of trains and construction vehicles.

2.14. Coastal geomorphology and hydrodynamics

2.14.1. The figure for coastal geomorphology and hydrodynamics is presented in **Volume 3** as **Figure 2.14.1**.

a) Baseline environment

2.14.2. The Greater Sizewell Bay (GSB) is considered as the initial reference area for marine assessments. For the purposes of the EIA, the GSB extends from Walberswick in the north to the Coralline Crag outcrops near Thorpeness in the south. The seaward boundary extends to the eastern flank of the Sizewell-Dunwich Bank, which includes the proposed cooling water infrastructure. The landward limit is delineated by Mean High Water Springs (MHWS). However, in some cases attention is paid to designated features above MHWS potentially affected by marine processes or development impacts.

2.14.3. The GSB is not a closed system and water exchanges with the rest of the southern North Sea. The tidal regime is semi-diurnal with a micro-tidal elevation range (< 2m). Water movement is dominated by tidal currents that flow south for most of the rising (flood) tide (1.7m/s (peak) seaward of Sizewell Bank) and flow north for most of the falling (ebb) tide (1.4m/s). The Zone of Influence (ZoI) for developmental impacts is constrained to the GSB because no significant effects on coastal geomorphology are foreseen beyond that coastal sediment cell.

2.14.4. The statutory designated sites with marine components in proximity to the proposed development, which are relevant to coastal geomorphology and could potentially be significantly affected, include:

- the Minsmere to Walberswick SPA and Ramsar Site, and the Minsmere to Walberswick Heaths and Marshes SAC and SSSI, located to the north-east boundary of the main development site (see **section 2.3**); and
- the Suffolk Coast and Heaths AONB (see **section 2.2**).

2.14.5. The coastal geomorphology receptor of the Greater Sizewell Bay comprises several morphologic elements that may interact directly or indirectly with one another. These are:

- the shingle beach and its shoreline position;
- two sandy, shore-parallel longshore bars;
- the Sizewell – Dunwich Bank; and
- the erosion-resistant Coralline Crag ridges that extends to the north-east from Thorpeness.

2.14.6. The seaward limit of the shingle beach is an abrupt beach-step that meets a sub-tidal, low sloping, sandy bed. This boundary demarcates the seaward limit of the shingle beach and indicates there is little cross-shore exchange of shingle. Net longshore shingle transport is low, especially adjacent to the Sizewell power stations, including the proposed Sizewell C development.

2.14.7. The slow longshore shingle transport results in a stable shoreline position adjacent to the Sizewell A, B and C sites. However, an 850m-long zone of erosion has persisted for one to two decades at and to the north of the proposed BLF location (0.5 – 1.2m/yr). The highest erosion rates are 350m north of Sizewell C.

2.14.8. Although the Sizewell frontage has been relatively stable for some decades, slow shoreline retreat is inevitable over the operational life of the Sizewell C power station due to local sea level rise. Only a change in one or more of the following would see a shift away from the low-transport low-change that typifies this coastal section:

- the elevation and extent of the Sizewell – Dunwich bank and/or longshore bars, which dissipate wave energy;
- longshore sediment supply – either an increase (e.g., due to cliff erosion of the Dunwich – Minsmere, Easton, Covehithe or Benacre cliffs, and/or the loss of the Minsmere Sluice outfall) or a decrease (e.g., through the development of an embayment; and/or
- wave climate (which is not predicted in UKCP09 climate change projections).

2.14.9. The sandy inner and outer longshore bars that run parallel to the shore are a conduit for longshore sand transport. They also act to dissipate wave energy by causing breaking during storms and thereby reducing the wave energy incident at the shoreline.

2.14.10. The inner bar is immediately adjacent to the beach and has a low crest 75 to 150m seaward of the 3m (ODN) beach contour, which occasionally emerges on very low tides. Its shallow depth means it is typically mobile during stormy winter seas, and closer to shore with less mobility during calmer summer conditions.

2.14.11. The outer longshore bar is in deeper water, has a crest elevation of -2.5 to -4.5m (ODN) and is located 150 to 400m seaward of the 3.0m (ODN) beach contour. The position of the outer bar varies less than the inner bar, and is roughly shore-parallel except where it curves seaward around the Sizewell B outfall. Since 2005, the beach adjacent to the curved bar has accreted, forming a subtle salient or bulge in the shoreline. The salient may be caused by breaking patterns and wave refraction over the curved bar.

b) Environmental design and embedded mitigation

2.14.12. The development components that would potentially have significant effects on the coastal geomorphology receptor elements are the:

- BLF construction and operation, including plough or scraper dredging for a navigational channel;
- CDO and the fish recovery and return (FRR) outfalls, which are located on the seaward flank of the outer longshore bar;
- soft coastal defence feature (SCDF); and
- hard coastal defence feature (HCDF), toward the later phases of station operation (see **Figure 2.14.1**).

2.14.13. The design details of these features are provided in **Volume 1**, **Chapter 2**. Carefully considered environmental design and embedded mitigation helps minimise the impact of development components. Embedded mitigation for each development component is considered below.

i) Beach landing facility

2.14.14. The primary embedded mitigation in the BLF design would be its transmissive nature, with a small number of marine and terrestrial (i.e. above MHWS) piles (see **Figure 2.14.1**) that would have no significant effect on waves, sediment transport or the adjacent beach.

2.14.15. The construction method for subtidal piling would involve the use of either a jack-up barge or a temporary rock platform. The jack-up barge would introduce limited scour around its temporarily placed legs, but would have no significant effect on the coastal geomorphology receptors.

2.14.16. The dredging depth and volumes would be minimised through the selection of shallow draught (2.5m) North Sea Barges and their high-tide (± two hours) transits to and from the BLF jetty.

2.14.17. Dredged sands would remain close to the bed during the plough or scraper operation and there would be no net loss of sand from the longshore bars.

ii) CDO and FRR outfalls

2.14.18. The CDO and FRR tunnels will be built using either directional drill or tunnel boring machines, which would have no effect on coastal geomorphology. The effect of the presence of their outfall heads on the seaward flank of the outer longshore bar would be minimised by their small (a few square metres) head size.

iii) Coastal defence features

2.14.19. The coastal defence features (CDFs) would be built on land above MHWS. The SCDF would supply sediment to the foreshore when eroded during storms. The HCDF is unlikely to affect coastal processes until the middle or late phases of station operation, when shoreline retreat coastal erosion could expose it. The CDFs have several embedded mitigations features:

- the sacrificial sediments of the SCDF would be of a substantially greater volume than the present beach/dune volumes. These beach grade sediments would be used in landscaping, be vegetated and as they erode under natural storm events they would locally slow the rate of shoreline retreat. Its location, behind the active beach, would result in the gradual release of sediment when storms erode its seaward face;
- the HCDF would be located landward of the SCDF and have a rock armour core dressed in a shingle/sand/soil matrix to facilitate vegetation colonisation which, like the SCDF, would stabilise the sediment;
- the HCDF positioning is as far as practical away from the shore (eastern flank) and the erosion hotspot to the north of Sizewell C (northern flank) to increase its duration as a terrestrial feature that would have no influence on coastal geomorphology and hydrodynamics; and
- the north-eastern corner of the HCDF would be curved to minimise potential disruption to sediment transport if exposed.

c) Preliminary assessment of effects

2.14.20. Given the embedded mitigation, this preliminary assessment of effects only considers the coastal geomorphology receptors to which significant effects would be likely to occur. Non-significant effects have not been considered further in this assessment. Specifically, no significant effects are predicted on the Sizewell – Dunwich Bank or the Coralline Crag ridges.

i) Construction

Temporary rock platform for beach landing facility construction

2.14.21. If used for construction, a temporary rock platform would extend seaward by approximately 37m from the

MHWS mark. It would be present for three to four months and would be impermeable, blocking the movement of water and mobile sediments (shingle on the beach face and sand on the longshore bars) and affect downdrift supply[19] whilst in place.

2.14.22. The degree of impact would be greatest during winter when both gross and net longshore transport are at their highest. This could lead to localised shoreline erosion.

2.14.23. The effect of the temporary rock platform on the beach and inner longshore bar receptors could be significant depending on duration of the works and sea conditions at the time (e.g. likely to be stormier during winter). This will be clarified in further assessment.

Navigation channel and grounding area for beach landing facility usage

2.14.24. The dredged navigation channel and grounding area needed to support the transit and docking of barges would alter the seabed elevation and give rise to localised changes in bed shear stress.

2.14.25. These changes have been assessed by determining the area of seabed where bed shear stress would change by more than five percent. The bed shear stress changes were estimated using a 'worst case', which was determined from the wave height associated with a five times per year return interval and the peak ebb tidal current and its associated water level.

2.14.26. The area of seabed that would experience a bed shear stress change of +/- five percent under these conditions would be 2ha over a 350m frontage.

2.14.27. BLF usage would be highest during the low-wave season only, when the effect on sediment transport would be least. During storms the changes in bed shear stress would typically only persist for a matter of hours and the impacted areas would be small.

2.14.28. Furthermore, as no sediment is extracted/lost from the system and the volumes moved are relatively small (minimised through docking procedures), the morphology and sediment transport regime would be maintained. The dredged area would naturally infill and there would be no significant effect.

CDO and FRR outfalls – presence

2.14.29. The CDO and the two FRR outfalls would be located on the seaward flank of the outer longshore bar (see **Figure 2.14.1)**.

2.14.30. Although the CDO and FRR outfalls would have a substantially smaller size (3m x 3m) than the existing Sizewell B outfall, the longshore bar could still potentially deviate around the new structures, especially where the northern FRR and CDO outfalls would be close together (minimum separation of approximately 40m). If the outer longshore bar deviated around the outfalls, it could cause shingle to accumulate over a short-period, leading to a wider beach, and resulting in a corresponding reduction in longshore shingle supply (equivalent to the volume trapped) to the existing power station frontages to the south. The magnitude of the disruption could potentially be significant, but would only affect shingle transport during the trapping phase.

2.14.31. Following this initial impact and temporary in which shingle would be trapped, the CDO and FRR are not expected to have impacts thereafter into the operational phase. Similarly, the potential for the CDO discharge and the FRR (in the operational phase) to impact sediment transport would be temporary if it arises.

ii) Operation

Navigation channel and grounding area for beach landing facility usage

2.14.32. During the life of the Sizewell C operational power station it would occasionally be necessary to bring in AILs for maintenance purposes. A dredged navigation channel and grounding area would be needed to support the transit and docking of barges for approximately two weeks every five to ten years. BLF usage would be most likely during the low wave energy season (31 March to 31 October).

2.14.33. Although this activity could cause changes in bed shear stress, it would be undertaken infrequently and, in the unlikely event of a storm during the two-week operational period, the area affected would be small and rapidly infilled. Consequently, the creation of a navigation channel and grounding area for BLF use during the operational phase would have no significant effect.

Progressive erosion of the SCDF

2.14.34. The SCDF would slowly supply sediment to the active beach face during storms. Effectively this equates to a natural release of artificially supplied sediments similar to, though slower than, a beach renourishment. This would lead to an increase in sediment volumes above that which would have been naturally available. The sediment would enter the longshore transport system and travel south (in net terms).

2.14.35. The release of material would typically be in small quantities associated with water levels (during storms and

[19] Sediment transport at the coast is determined by wave energy and the wave angle (relative to the shore), which vary from one storm to another. As storms from the north-east are slightly more prevalent than the south-east, there is a weak net sediment transport to south.

surges) of sufficient height to reach the SCDF sediments. As a result, the sediment releases would be individually small and progressive, and have no significant effect on the beach or sediment transport.

Exposure of the HCDF

2.14.36. The HCDF could become exposed towards the middle or end of station operation. Should this occur, the continuous shingle beach of the GSB could be split into two by the emergent north-eastern corner of the HCDF (i.e. it would be occasionally or permanently in the sea). The partial or total blockage caused by the emergent HCDF would affect gross shingle transport during individual storms – significantly affecting local shorelines – and net transport, which would affect downdrift shorelines (to the south).

2.14.37. Furthermore, if the shoreline immediately north of Sizewell C also outflanked the north-eastern corner of the HCDF, it could affect the inner longshore bar and reduce net southerly sand transport along that receptor.

2.14.38. In these circumstances, the presence of Sizewell C would cause more beach shingle to accumulate to the north, acting to slow the erosion rates in the southern 300m of the Minsmere-Walberswick SPA. The net volume of accumulated sediment would result in a reduction, or total loss, in supply south of Sizewell C and, consequently, a potentially significant effect on downdrift beaches.

2.14.39. The degree of reduction in downdrift shingle supply would depend on the net rate of southerly transport and whether the HCDF protrudes into the sea. Modelling to date indicates very low rates of net shingle transport along the Sizewell – Thorpeness frontage, meaning that any effect on shoreline recession would propagate slowly toward the south. An assessment of shingle transport is ongoing to understand the likely net downdrift transport rates towards Thorpeness and potential for losses from the GSB.

2.14.40. The significance of any downdrift erosion caused by an emergent HCDF would also depend on the supply of shingle from updrift sources. Currently there are no known sources of shingle entering the GSB, except for small volumes supplied by erosion of the shingle barrier north of Sizewell C. However, future sea level rise would likely cause erosion of the Dunwich – Minsmere Cliffs and the release of new sand and shingle into the GSB longshore transport system. If the Minsmere Sluice outfall disintegrated or was removed, it could also lead to the release of beach shingle presently trapped there. New shingle from either of these sources could reduce or negate the influence of the HCDF on shoreline position and shingle transport, depending on the relative timings of HCDF exposure and influx of updrift supplied shingle.

2.14.41. Furthermore, if the shoreline north of Sizewell C outflanked the north-eastern corner of the HCDF by more than 10 – 20m, it could also significantly affect sand transport along the inner longshore bar.

2.14.42. If a beach were naturally or artificially maintained in front of the HCDF, the loss of shingle to the southern beaches would be substantially less than for an emergent HCDF, however they could still be potentially significant.

d) Additional mitigation and monitoring

i) Construction

Temporary rock platform for beach landing facility construction

2.14.43. The localised beach erosion and accretion patterns that would develop around the temporary rock platform (if it is used) would be detected using a range of remote (radar, fixed cameras, drones, Light Dection and Ranging (LiDAR)) or traditional ground-survey techniques. Changes in the inner bar would also occur, but could be detected and quantified using remote or traditional (echo-sounder) surveys.

2.14.44. A significant disruption threshold could be set, above which the accumulated volume could be bypassed. Bypassing of sand and/or shingle would maintain longshore transport and result in no significant downdrift effects to the beach or longshore bars. The monitoring and potential bypassing would be conducted for the duration of the rock platforms presence and be continued until the beach and inner bar returned to their natural pre-platform form.

CDO and FRR outfalls – presence

2.14.45. The potential localised accretion on the beach adjacent to the CDO and FRR outfalls, and any associated short-term disruptions to shingle transport, would be detected and quantified using remote (radar, fixed cameras, drones, LiDAR) or traditional ground survey techniques. The volume of material that could accumulate is essentially a short-term loss to longshore shingle transport, which could be periodically bypassed or replaced by a small one-off beach re-nourishment in the downdrift direction.

2.14.46. Undertaking either of these activities would mean that any potential CDO and FRR induced short-term disruption to shingle transport would have no significant effect on the beach.

ii) Operation

Exposure of the HCDF

2.14.47. In several decades, as a result of sea level rise and wave action, the HCDF could become exposed and disrupt longshore sediment transport. Continued persistent erosion to the north of Sizewell C would lead to a shallow embayment in this area. However, the embayment would form slowly because the presence of the HCDF would trap some of the shingle material moving south, thereby reducing supply to the beaches between Sizewell C and Thorpeness.

2.14.48. The potential effects of an emergent HCDF would be mitigated by either natural or artificial maintenance of the SCDF before its depletion leads to exposure of the HCDF.

2.14.49. Maintaining the SCDF through beach recycling or renourishment in front of the HCDF allow sand and shingle to bypass the HCDF naturally.

2.14.50. The condition of the depleted sCDF, and any potential effects to shingle and sand transport that could result in erosion of the southern beaches, would be monitored using remote (radar, fixed cameras, drones, LiDAR) or traditional survey (terrestrial and bathymetric) techniques. These methods would be used to quantify beach nearshore topography and volume.

2.14.51. The same coastal monitoring would be used to detect any effects that could arise from outflanking north of the HCDF. If significant, manual bypassing or renourishment would be undertaken, resulting in no significant effects to net sediment transport, or the beach and inner bar receptors.

e) Completing the assessment

2.14.52. Modelling will be undertaken to assess the impact of a temporary rock platform on sediment transport (via changes to tidal currents and waves) and the extent of any expected changes in shoreline position (erosion or accretion).

2.14.53. Predictions of the infilling rates for the BLF navigation channel and grounding area will be undertaken to improve estimates for the dredging frequency.

2.14.54. Measurements of shingle transport on the Sizewell frontage are currently being undertaken to confirm the rates of shingle transport (currently determined to be low). The measurements will be used alongside an analysis of waves (which drive shingle transport) to assess the likely net downdrift transport rates towards Thorpeness and the potential for losses from the GSB near the Thorpeness headland.

2.14.55. Assessment of shoreline recession leading to exposure of the HCDF, and the likely impacts, is ongoing and will be used to refine the coastal geomorphology assessment in the ES.

Table 2.14.1 Summary of effects for the construction phase

Coastal geomorphology and hydrodynamics

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Temporary rock jetty (beach landing facility) if used					
Beach	Blockage to longshore shingle transport.	None	Significant if present during storms.	Beach monitoring and manual bypassing (if required).	Not significant
Inner longshore bar	Blockage to longshore sand transport.	None	Significant if present during storms.	Longshore bar monitoring and manual bypassing (if required).	Not significant
Dredge channel (beach landing facility)					
Longshore bars	2ha of seabed could experience bed shear stress changes > ±5% during storms.	Sediment is not extracted, only pushed or scraped to the side.	Not significant. Impacted areas would be small and naturally infill, thereby maintaining morphology and sand transport. No net loss of sediment.		
FRRs and CDO outfalls					
Beach	Potential for the outfalls to alter the position and shape of the outer longshore bar (as per Sizewell B) causing localised beach accretion (via wave refraction).	None – optimal position for functionality (ecology and water quality).	Potentially significant – could lead to a short-term reduction in downdrift sediment supply.	Beach monitoring and manual bypassing (if required).	Not significant

Table 2.14.2 Summary of effects for the operational phase

Coastal geomorphology and hydrodynamics

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
BLF dredging					
Longshore bars	2ha of seabed could experience bed shear stress changes > ±5% during storms.	Sediment is not extracted, only pushed or scraped to the side.	Not significant		
Soft Coastal Defence Feature					
Beach	Small-volume episodic inputs of sediment as the SCDF naturally erodes.	Material would be released during storms and so would be slow episodic release.	Not significant		
Hard Coastal Defence Feature					
Beach	Potential interruption to longshore shingle transport if the HCDF were exposed due to natural shoreline recession (not expected for several decades).	HCDF is positioned inland, increasing the time-period before its potential exposure under shoreline retreat. North-eastern corner of the HCDF is curved to minimise potential disruption to shingle transport if exposed.	Significant in several decades time if the SCDF was stripped away, leading to: a) a reduction in shoreline retreat rate north of Sizewell C and b) a reduction in supply to the south as the HCDF would act as a barrier to shingle transport, having split the beach into two parts.	Maintain the SCDF to avoid the HCDF splitting the shingle beach into northern and southern halves, which would progressively block the transmission of shingle – this would minimise any effects on longshore transport. Monitor for volumetric reductions caused by the HCDF and manually bypass to maintain supply.	Not significant

2.15. Marine water and sediment quality

a) Baseline environment

2.15.1. The GSB is considered as the initial reference area for the study site. For the purposes of the EIA, the GSB extends to Walberswick in the north with the southerly extent bound by the Coralline Crag formation at the apex of the Thorpeness headland in the south. The seaward boundary extends to the eastern flank of the Sizewell-Dunwich Bank and includes the proposed cooling water infrastructure on the east side on the bank. The landward limit of the marine study area is delineated by MHWS.

2.15.2. The GSB is not a closed system and water exchanges with the rest of the southern-North Sea. The ZoI for developmental impacts is therefore dependent on the receptor. For the EIA, the ZoI for marine water and sediment quality is considered to be the GSB area plus the tidal excursion. Water movement is dominated by tidal currents that flow south for most of the rising (flood) tide and north for most of the falling (ebb) tide.

2.15.3. The baseline marine water quality environment in the ZoI is characterised as follows; waters are well mixed with regards to salinity; temperature profiles indicate warmer water at the sea surface; concentrations of many elements and compounds are relatively uniform in the area; EQSs[20] (Environmental Quality Standards) may occasionally be exceeded. Upper water temperatures reach around 19.4°C[21]. Total residual oxidant (TRO; associated with Sizewell B biofouling control) concentrations vary between 0.01 and 0.16mg/l (2010 – 2011). The 99 percentile winter dissolved inorganic nitrogen (DIN) is 0.425mg/l (2014 – 2016), which is within an acceptable range for intermediate turbidity waterbodies (annual average SPM 10 to >100mg/l). The phosphate concentration is relatively high (average 0.033mg/l) and ammonia concentrations relatively low (average 0.01mg/l) (2014 – 2016). Except for zinc and chromium, the mean measured concentrations of all the priority metals in the water samples are below their respective environmental quality standards (2014 – 2016). The average maximum suspended particulate matter (SPM) value during April to August is 80mg/l and 180mg/l during September to March.

2.15.4. The baseline marine sediment quality environment in the ZoI is characterised as follows; sediments are comprised mainly of sand, contain low levels of contamination and radionuclide concentrations are low.

2.15.5. The sea adjacent to the main development site is part of the Outer Thames Estuary SPA and the Southern North Sea candidate SAC for harbour porpoises and the Suffolk Coastal waterbody. The impacts of the development on these areas will be assessed separately against WFD and Habitats Directive standards.

2.15.6. A number of other statutory and non-statutory designated sites with marine components are also located close to the proposed development.

ii) The Zone of Influence – marine water and sediment quality baseline

2.15.7. The ZoI area is in relatively shallow water (average 8-12m), with fast currents and mobile sandy sediments. The marine water and sediment quality within this area has moderate ecological functional value as biological ecosystem features are partially dependent on the water and sediment quality of this area. Marine water and sediment quality have no direct conservation value as they are not a designated feature within this area. The ZoI has some socioeconomic value as it contains recreational beaches and bathing waters (below MHWS).

b) Environmental design and embedded mitigation

2.15.8. Development components connected with the main development site include the construction and operation of:

- a BLF;
- cooling water infrastructure (intakes, outfalls and FRR system); and
- a CDO.

2.15.9. The details of these features are outlined in **Volume 1, Chapter 2** and a figure showing locations of these components is at **Figure 2.14.1**. Carefully considered environmental design and embedded mitigation help minimise the impact of development components. Embedded mitigation for each development component is considered below.

i) Beach landing facility and vessel traffic

2.15.10. The BLF will be used for delivery of AILs and rock armour. These deliveries would be made by North Sea barges mooring to the BLF.

[20] Environmental Quality Standards (EQSs) are tools used for assessing the chemical status of waterbodies and for managing compliance of discharges. Where feasible embedded mitigation will be implemented to minimise chemical and thermal discharges, where EQS thresholds are exceeded, further ecological investigation is required.

[21] The seawater temperature 98 percentile is 19.4°C (from temperature data between 2009 -2013).

Navigational dredging

2.15.11. To accommodate the safe passage of barges and accompanying tugs to the BLF a navigational channel and grounding area would be required in the nearshore zone occupied by two longshore bars. Plough dredging is the preferred option to create a planar surface for the barges as the use of a plough dredge minimises sediment extraction from the site.

Pilling

2.15.12. Construction chemicals used in piling (and drilling activities) would be selected from the list of notified chemicals, assessed for use by the offshore oil and gas industry, under the Offshore Chemicals Regulations 2002 (Ref. 2.15.1) or have undergone a similar level of assessment. Similarly, any coatings or treatments applied to offshore infrastructure would be suitable for use in the marine environment in accordance with best environmental practice (or as approved by the Guidance for Pollution Prevention).

Vessel traffic

2.15.13. The potential for chemical and oil spills whilst recognised will be mitigated by compliance with International Maritime Organization (IMO) regulations and the Guidance for Pollution Prevention. Vessel waste management procedures outlined in the Vessel Management Plan (VMP) and Site Waste Management Protocols would be in place to mitigate impacts of marine litter.

ii) Cooling water infrastructure and fish recovery and return

2.15.14. The optimal location of the outfall heads was investigated using hydrodynamic modelling (in compliance with Environment Agency guidelines) to reduce environmental impacts of the thermal plume and minimise recirculation of heated water at the Sizewell B intakes. The intakes and outfalls of the cooling water infrastructure would be located east of the Sizewell-Dunwich Bank approximately 3km offshore. The water depth at the outfalls would mean that the thermal plume would have a minor impact at the seabed. The selection of an offshore location reduces the area of thermal impact exceedance inshore of the Sizewell-Dunwich Bank.

2.15.15. Two cooling water intake tunnels, and one outfall tunnel would be excavated by tunnel boring machines (TBM) from landward. Waste water arising during the tunnelling process would be treated by a silt-buster, or similar technology, to reduce suspended sediments prior to being discharged at sea via the CDO. Discharges will contain bentonite and may contain TBM chemicals and would be assessed accordingly.

2.15.16. A chlorination strategy would be optimised to reduce discharges while still protecting the plant from biological fouling. Chlorination to protect the condensers would be applied after the drum screen filters and applied continuously only during the growing season when seawater temperatures exceed 10°C. At temperatures below 10°C spot chlorine dosing of individual systems would occur when condition monitoring dictates. Depending on hydraulic assessments, the FRR system may need additional flush water to be drawn from the chlorinated system so a seasonally chlorinated FRR discharge has been considered as precautionary measure. The chlorination strategy for Sizewell C will be agreed with the Environment Agency for the Operational Water Discharge Activity (WDA) environmental permit.

2.15.17. Hydrazine is used as a corrosion inhibitor for circuit conditioning. To mitigate the environmental impacts, effluents with residual levels of hydrazine will be treated if required to reduce the concentration until it is environmentally acceptable to discharge.

iii) Construction site combined drainage outfall

2.15.18. During the construction phase, discharges would be made via the CDO. The CDO outfall has also been positioned to allow mixing and avoid effluent contact with the shore. The outfall position is located on the seaward flank of the outer longshore bar.

2.15.19. A CWDA environmental permit assessment will be required prior to any discharges to determine compliance with EQS. Where EQS are not achieved full assessments on the effects for exposed receptors will be completed.

2.15.20. Discharges of foul water, surface run-off water, water arisings during the tunnelling process, and groundwater would be treated, as required, prior to entering the marine environment.

c) Preliminary assessment of effects

2.15.21. The EIA will consider the full range of activity-pressure pathways during the construction and operation of the proposed development. The PEI presented here considers, or a preliminary basis, the activities and associated impacts with the potential to cause significant effects to the marine water and sediment quality receptor (ZoI).

i) Construction

2.15.22. Primary construction activities, with the potential for significant effects on marine water and sediment quality, (ZoI) are dredging and spoil disposal, drilling and construction discharges. Embedded mitigation is aimed at minimising environmental impacts. However, some impacts are inevitable.

Dredging

2.15.23. Installation of cooling water infrastructure, the FRR system, and the CDO would require capital dredging. The most likely dredge method is via a cutter suction dredger with spoil disposed on-site. Impacts from dredging may arise through changes in suspended sediment concentrations and subsequent siltation when dredge spoil settles on the seabed.

2.15.24. Dredging for the cooling water infrastructure results in the largest dredge volume, and associated increases in suspended sediment concentration (SSC) and siltation rates. The modelled plume predicts sediment would be transported up to 13km north and 25km south by the tide, with limited transport and no discernible contact with the coastline. During dredging for a single structure maximum[22] increases in SSC of 1g/l above ambient may occur over a restricted area at the point of discharge. Maximum instantaneous SSC of 300mg/l above background may occur over an area up to 527ha depending on the state of the tide. However, the SSC plume rapidly dissipates, and a discrete mobile patch is transported with the tide meaning that the areas subjected to continuously elevated SSC are limited. For example, an area of just 17ha is exposed to continuous maximum instantaneous concentrations of 100mg/l lasting for three hours. SSC is predicted to return to baseline conditions eight days after the dredge event.

2.15.25. Siltation at the immediate vicinity of the dredge disposal is likely to cause burial of the seabed under a thick deposit. This would be localised and sedimentation would reduce rapidly with distance from the disposal site. On neap tides an area of 3ha may be subject to instantaneous sediment deposition of 300mm, whilst 137ha will be exposed to sedimentation rates of 20mm. Sedimentation is brief and due to resuspension, deposition thicknesses of 10mm were predicted at the end a spring-neap cycle (model duration) over a maximum area of 13ha.

2.15.26. The BLF is close inshore where tidal flows are weaker, and the north-south extent of the dredge plume would be reduced. The lower flows result in more localised SSC plumes and sedimentation rates. SSC of 300mg/l above background may occur over an area up to 141ha depending on the state of the tide. Concentrations drop to 20mg/l just three days after dredging. Instantaneous deposition of 300mm occurs over an area of 1ha. However, due to the proximity to the shore, deposition may interact with beach sediments.

2.15.27. Dredging can sometimes be associated with increases in nutrient and contaminant concentrations due to the resuspension of sediments. Nutrient loads in the GSB marine sediments are sufficiently low that sediment resuspension during dredging activities is predicted to have negligible effect. Sediment-bound organo-metal and polyaromatic hydrocarbons concentrations within the GSB are below Cefas Action Level 2 and the material is coarse in nature, therefore the sediment material is acceptable for disposal at sea. Radionuclide concentrations in marine sediments at the existing Sizewell power station complex are low and consistent with routine local radionuclide monitoring. No significant effects of radionuclide contamination are predicted from the construction phase sediment resuspension.

Drilling

2.15.28. Drilling would occur to connect the cooling water intake and outfall headworks with the subterranean horizontal tunnels. Drilling for each shaft may take several weeks and arisings would be disposed of locally. Temporary increases in suspended sediment concentrations are predicted to be indiscernible from background concentrations. A spoil heap with a depth of centimetres (cm) to tens of cm is anticipated in proximity to the drilling site, extending up to 200m. Beyond the extent of the spoil heap, sedimentation is predicted to be negligible.

Construction discharges

2.15.29. A WDA permit from the Environment Agency will be required for construction discharges.

2.15.30. At the main construction site, large volumes of water would need to be removed to lower the groundwater level within the main development site and discharged via the CDO. Due to high baseline levels therein, discharge of the groundwater from the main development site is predicted to cause localised exceedance of EQS concentrations for the heavy-metals zinc and chromium. A small area of the GSB is predicted to be exposed to zinc and chromium concentrations above the EQS for a short period during the initial dewatering phase. Following the initial dewatering phase, low level discharges would continue to be made to remove groundwater seepage and rainwater during which time concentrations are within EQS criteria. Heavy-metals toxicity is not predicted to have significant effects on the marine water and sediment quality receptor (ZoI).

[22] instantaneous (1 hour).

2.15.31. Ground conditioning chemicals are used to optimise TBM efficiency. A bentonite slurry tunnelling method is likely to be used at the TBM cutter head, a bentonite recovery system will be employed, and negligible losses are to be expected. Bentonite and some polymers used in offshore drilling operations are included on the OSPAR (Convention for the Protection of the Marine Environment of the North-East Atlantic) list of PLONOR substances (Pose Little or No Risk to the Environment) substances. Therefore, the potential for contamination from drilling and tunnelling activities is predicted to have no significant effects on the marine water and sediment quality receptor (ZoI). Should additional substances, such as TBM surfactants, be applied these will be assessed accordingly and subject to an Environment Agency permit.

2.15.32. The commissioning phase requires tests and conditioning of the entire plant. Testing will be undertaken over a two-year period (for each of the two European Pressurised Reactor (EPR) units) and consist of a two-stage process with cold flush testing and hot flush testing. Effluents from the cold flush testing will be discharged through the CDO. Demineralised water and a number of chemical additives including hydrazine (used as a corrosion inhibitor) may be discharged during commissioning. Evaluation of minimum practical discharges is currently being modelled and ecological assessments will be applied to commissioning discharge conditions of hydrazine. Hot flush testing discharges are made via the main cooling water discharge.

2.15.33. To prevent biofouling of critical plant, chlorination would be required. An assessment relating to chlorination has been completed for the operational phase. Chlorination may be required during the commissioning phase and an assessment will be made when there is sufficient detail.

2.15.34. Sewage will undergo tertiary treatment before being discharged via the CDO, therefore the levels of faecal coliforms will be low. Water quality assessments indicate that levels of unionised ammonia, DIN and phosphorus pass relevant standards. Sewage inputs of nutrients, unionised ammonia and faecal coliforms are not expected to have significant effects on the marine water and sediment quality receptor (ZoI) including bathing waters (below MHWS).

ii) Operation

2.15.35. The primary operational impacts are associated with cooling water abstraction and discharges into the receiving waters. Occasional deliveries to the BLF will necessitate navigational dredging where impacts will be similar to those in the construction phase.

Operational discharges

2.15.36. A WDA permit from the Environment Agency will be required for operational discharges.

2.15.37. At the point of discharge, heated cooling water forms a layer of warmer water at the surface. Heat is lost from the plume directly as radiation, both to the air and water. As the plume cools, its buoyancy decreases and mixing occurs causing a general warming effect on the receiving waters. The rate of mixing is determined by the tidal flow and the level of turbulence within the system. Strong tides at the existing Sizewell power station complex (>1m/s) and the interaction with the bathymetry shapes the plume profile.

2.15.38. The behaviour of the thermal plume can be characterised in three zones:

- near-field, occurs at the point of discharge where the plume has restricted horizontal movement and mixes vertically;
- mid-field, vertical momentum decreases and the plume begins to travel slowly with the ambient tidal flow. Shear with the seabed causes the ambient flow to be more turbulent and interact with the edge of the thermal plume causing heat losses; and
- far-field, the plume is integrated in the tidal flow and mixing is subject to differences in density, wave energy and bathymetry, which can cause the plume to decrease in thickness and break into filaments and eddies.

2.15.39. The marine water and sediment quality receptor (ZoI) can be affected by thermal discharges in the following ways:

- absolute temperature increases; and
- relative changes in temperature, whereby the mean temperature increases above ambient conditions.

2.15.40. To control biofouling of critical sections of the station during operation, intake water will be chlorinated. The primary biocidal effects of chlorination result from oxidants associated with bromine chemistry. These oxidants are measured and expressed as the total residual oxidant (TRO) concentration. The Sizewell C TRO plume forms a long narrow feature parallel to the coast and does not mix with Sizewell B plume. Based on current estimates, the TRO plumes from Sizewell B and the proposed development would be above EQS levels over an area of approximately 374ha at the sea surface and 2ha at the seabed.

2.15.41. Daily hydrazine additions of up to 0.00007mg/l will be released into the cooling water system for two hours a day. During wet lay-up[23] of steam generators, approximately every 15 years, larger hydrazine discharges would occur. The hydrazine plume follows a narrow trajectory parallel to the shore. At the seabed, less than 1ha exceeds the chronic predicted no effect concentration (PNEC[24]) whilst the worst-case scenario results in a sea surface area of 161ha above the chronic PNEC.

2.15.42. Treated sewage inputs during the operational phase are predicted to reach a maximum during refuelling outages[25] due to an increased number of staff temporarily on-site. Sewage will undergo tertiary treatment before being discharged, therefore the levels of faecal coliforms will be low. Phosphate inputs are predicted to increase background levels near the outfall by more than DIN additions; ammoniacal nitrogen levels will also be increased. All cases assessed (including worst cases) show that after initial mixing and dilution no areas exceed relevant standard values.

2.15.43. Oxygen is less soluble in water as the temperature increases. Sampling at the Sizewell B outfalls and modelling of dissolved oxygen (DO) concentrations showed that DO was consistently above the threshold for WFD 'High' status and negative effects on marine ecology receptors are not predicted.

d) Additional mitigation and monitoring

i) Construction

2.15.44. No additional mitigation and monitoring measures, best available techniques and relevant embedded monitoring are included in the embedded mitigation (see **section b**).

ii) Operation

2.15.45. No additional mitigation and monitoring measures, best available techniques and relevant embedded monitoring are included in the embedded mitigation (see **section b**).

e) Preliminary assessment of residual effects

i) Construction

2.15.46. As there are no additional mitigation and monitoring measures the conclusions presented in **section c** are unchanged.

ii) Operation

2.15.47. As there are no additional mitigation and monitoring measures the conclusions presented earlier in this section are unchanged.

f) Completing the assessment

2.15.48. To refine the water quality assessment additional information is being sought on background water quality parameters used in support of the most recent assessment of the Suffolk Coastal Waterbody.

2.15.49. The proposed development would be operational by 2030, and remain in operation for 60-years. The 60-year life-cycle of the development suggests that the contemporary baselines described in **section a** are not necessarily appropriate for assessments for the entire operational period. The future baseline is a theoretical situation that would exist in the absence of the development. Extrapolation of current baselines to predict future water quality scenarios is challenging and prone to a large degree of uncertainty. Where reasonable evidence permits, the ES will consider impacts in relation to future baselines.

[23] During those maintenance operations when steam generators are not in use they must be protected from corrosion. During wet lay-up water in idle steam generators is treated with hydrazine to reduce the dissolved oxygen concentration to a level that would not cause system corrosion. The required hydrazine levels are higher than in normal plant operation.

[24] Where there is no existing EQS, toxicological data with relevant safety factors applied may be used to derive the PNEC or Predicted No Effect Concentration below which no harmful effects would be expected. The PNEC typically has two thresholds based on the concentration that may elicit toxicological effects following short-term (acute) or more prolonged exposures (chronic).

[25] A refuelling outage is a routine planned maintenance event when a reactor is shut down for a few weeks to enable fuel rods to be replaced and other planned maintenance activities to take place.

Table 2.15.1 Summary of effects for the construction phase

Marine water and sediment quality

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Dewatering					
ZoI	Increase in turbidity	Waste water would be treated by silt-buster, or similar technology, to reduce suspended sediments. CWDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Not significant	None	Not significant
ZoI	Organometal contamination	CWDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Not significant	None	Not significant
Tunnelling					
ZoI	Bentonite contamination	Construction chemicals would be selected from the list of notified chemicals. CWDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Not significant	None	Not significant
Commissioning					
ZoI	Hydrazine contamination	Discharge treatment. CWDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Potentially significant, may require further investigation of potential ecological effects.	None	Potentially significant, may require further investigation of potential ecological effects.
Sewage					
ZoI	Increase in nutrients	Tertiary treatment. CWDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Not significant	None	Not significant

Table 2.15.2 Summary of effects for the operational phase

Marine water and sediment quality

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Cooling Water Discharge					
ZoI	Increase in temperature	Configuration of well-designed outfalls allows effective heat losses to reduce impacts from thermal discharges. WDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Potentially significant, may require further investigation of potential ecological effects.	None	Not significant
ZoI	TRO contamination	Chlorination strategy to dose only during the growing season when seawater temperatures exceed 10°C. WDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Potentially significant, may require further investigation of potential ecological effects.	None	Not significant
ZoI	Bromoform contamination	The FRR will only be chlorinated during the growing season when seawater temperatures exceed 10°C. WDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Not significant	None	Not significant
ZoI	Hydrazine contamination (during normal operating procedures).	WDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Not significant	None	Not significant
ZoI	Increase in nutrients	WDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Not significant	None	Not significant
FRR discharge					
ZoI	TRO contamination	Chlorination strategy to dose only during the growing season when seawater temperatures exceed 10°C. WDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS.	Potentially significant, may require further investigation of potential ecological effects.	None	Not significant

2.16. Marine ecology and fisheries

2.16.1. The figure for marine ecology and fisheries is presented in **Volume 3** as **Figure 2.16.1**.

a) Baseline environment

2.16.2. A number of statutory and non-statutory designated sites with marine components are located in proximity to the proposed development which have the potential to be significantly affected. These are defined earlier in the chapter but include the Outer Thames Estuary SPA and the Southern North Sea candidate SAC for harbour porpoises, both of which are immediately adjacent to the main development site.

2.16.3. The GSB is the defined reference area for the assessments summarised here and extends from Walberswick in the north to the Coralline Crag outcrops near Thorpeness in the south. The seaward boundary extends to the eastern flank of the Sizewell-Dunwich Bank, so it includes the spatial extent of the proposed cooling water infrastructure. The landward limit is delineated by the MHWS tidal mark.

2.16.4. The GSB is not a closed system and water exchanges with the rest of the southern North Sea. The tidal regime is semi-diurnal with a micro-tidal elevation range (< 2m). Water movement is dominated by tidal currents that flow south for most of the rising (flood) tide (1.7m/s; seaward of Sizewell Bank) and reverse for most of the falling (ebb) tide (1.4m/s). The spatial extent of potential impacts is therefore dependent on the distribution, mobility and ecology of the species being considered.

2.16.5. A series of key taxa has been identified for assessment purposes during the EIA. Selection of key taxa is based on their ecological, conservation and/or socio-economic importance from the plankton, benthic, fish and marine mammal receptor groups. A summary of the key taxa is given below and details of their selection criteria will be provided at the ES stage.

i) Plankton baseline

Phytoplankton

2.16.6. In turbid coastal waters benthic primary productivity is limited and carbon acquired by free-floating single celled algae (phytoplankton) support food-webs. This instability is reflected in more irregular patterns in phytoplankton population sizes, which vary greatly over space and time. The phytoplankton 'spring bloom' occurs in May when light availability increases and available nutrients allow biomass (chlorophyll a) to peak. The phytoplankton community is dominated by diatoms (2-500μm) throughout the year, with microflagellates (2-20μm) becoming more abundant from mid-Summer to Autumn. Phytoplankton are ecologically important to coastal food-webs, but no phytoplankton species present in the GSB have conservation designations.

Zooplankton

2.16.7. The abundance of zooplankton[26] in the GSB follows a seasonal cycle with lower abundances observed in the winter and peak abundance occurring in May. The species present are those expected for the southern North Sea. Zooplankton play an important ecological role in marine food-webs providing a flow of energy from phytoplankton and other small zooplankton to higher trophic levels. No zooplankton[27] species present in the GSB have direct conservation importance.

2.16.8. Approximately 30 taxonomic groups of zooplankton have been identified as characteristic of the GSB based on their abundance and commonality in samples. Four key taxonomic groups have been selected for consideration in the assessment of potential effects of the proposed development. These include mysids, copepods, amphipod shrimps[28], and gelatinous zooplankton. These taxonomic groups are distributed widely across the survey area and have variable, seasonally high abundance. The key zooplankton groups are consistent with the primary zooplankton groups entrained at Sizewell B.

ii) Benthic communities baseline

2.16.9. The benthic fauna of the GSB area has been characterised based on data collected from a series of onshore and offshore surveys implemented between 2008 and 2017.

Intertidal communities

2.16.10. The intertidal beaches within the GSB are predominantly coarse sediment with ephemeral sand veneers harbouring a reasonably broad range of sediment-dwelling organisms. However, the beaches of the area cannot be considered particularly diverse compared with

[26] Zooplankton are a diverse range of animals that spend all or part of their life suspended or weakly swimming in the water column. Zooplankton include invertebrates that spend their whole life-cycle in the plankton, the early life stages (eggs and larvae) of benthic invertebrates and fish (ichthyoplankton).

[27] Ichthyoplankton and benthic invertebrates are considered as potentially vulnerable life-history stages in the fish and benthic community assessments and are not considered as part of the key zooplankton tax assessments.

[28] Amphipods are primarily composed of benthic gammarids, suspended in the shallow tidal system.

other intertidal beaches in Europe[29]. Intertidal surveys of the area show little evidence of spatially distinct assemblages and no benthic species present in the intertidal communities of the GSB are known to have a related conservation importance. Designated coastal vegetated shingle habitats are considered in **section 2.3**.

Subtidal communities and habitats

2.16.11. One overall benthic community (infauna and epifauna[30]) spans most of the GSB. Both the infauna and epifauna communities are common in a regional context as they are part of a larger community distributed across the south of the North Sea 'infralittoral region', corresponding to the subtidal areas within 50m depth. Twenty-one key taxa belonging to the taxonomic groupings (molluscs, crabs and lobsters, shrimps and prawns, polychaetes and echinoderms) have been identified during subtidal surveys as potentially important in terms of their ecological, conservation, and socio-economic significance. One species of conservation importance[31] was observed in benthic surveys. The lagoon sand shrimp, (*Gammarus insensibilis*), typically associated with fine sediments of saline lagoons, was observed in the subtidal in low abundance in June 2010.

2.16.12. Two habitats have been identified for their potential conservation and ecological importance in the GSB. The Coralline Crag hard substrate habitat is locally unusual amongst the sands and gravels of the GSB. Surveys on the Coralline Crag suggest the presence of *Sabellaria spinulosa*. Further surveys are planned to assess if reefs of *S. spinulosa* are present (**Figure 2.16.1**). When in reef aggregations, *S. spinulosa* is an Annex I habitat under the EU Habitats Directive. Seasonally high abundance of benthic taxa following recruitment events on the Sizewell-Dunwich Bank (**Figure 2.16.1**) suggests the sandbank may provide feeding grounds for higher trophic levels (fish, seals, seabirds). The Sizewell-Dunwich Bank is not an Annex I designated sandbank habitat; however, the feature appears to have an important ecological role influencing benthic community composition of the GSB. Except for the occurrence of *G. insensibilis* in low densities in June 2010, no species of conservation importance are known to occur on the sandbank.

iii) Fish baseline

2.16.13. The fish of the GSB area have been characterised based on data collected from impingement sampling at Sizewell B (2009-2013), demersal fishing surveys (2008-2012), a pelagic fish survey in 2015, and stock assessments.

2.16.14. A total of 88 fish taxa were identified during these surveys in the GSB area. Many of the species recorded in the GSB area form part of a larger population or stock that may encompass an ICES (The International Council for the Exploration of the Seas) region, the southern North Sea, or the whole of the North Sea. Therefore, assessment of effects from developmental impacts must consider the appropriate population scale.

2.16.15. Sizewell B impingement data indicates that the five most abundant inshore fish species, accounting for 90% of individuals impinged, were European sprat, Atlantic herring, whiting, European seabass, and sand goby.

2.16.16. The most commonly occurring demersal species in offshore surveys were; Dover sole, whiting, gobies, dab, flounder, and thornback ray. Six pelagic species were recorded including; herring, sprat, anchovy, mackerel, horse mackerel (scad) and pilchard, with sprat being the most abundant.

2.16.17. Table 2.16.1 identifies the 24 taxa considered to be key members of the community.

2.16.18. Spawning grounds for Dover sole and plaice intersect the GSB. Nursery grounds of Dover sole, plaice, whiting, cod, seabass, thornback ray, herring, sprat and mackerel also occur within the GSB. Charts displaying spawning and nursery grounds in relation to the proposed development will be included in the ES.

iv) Fisheries baseline

Commercial fisheries

2.16.19. The baseline for potential effects of the proposed development on commercial fishing activity is informed by landings data submitted to the UK Marine Management Organisation (MMO) by commercial fishing vessels. Commercial landings are partitioned into ICES statistical rectangles. ICES rectangle 33F1 is located off the Suffolk coast and covers an area from Lowestoft in the north to Orford in the south, thereby encompassing the GSB. Landings figures described here are based on data obtained from the MMO for ICES rectangle 33F1 for the year 2013. Landings data, up to 2017, is currently being analysed for 33F1 and the five ICES rectangles adjacent to 33F1. This data will be used to inform the ES assessments.

[29] Over 90% of the macrobenthic faunal abundance on intertidal beaches is comprised of flatworms (Turbellaria), juvenile amphipod shrimps, ribbon worms (nemerteans), and juvenile mussels (*Mytilus edulis*).

[30] Infauna are benthic taxa that live within seabed sediments whilst epifauna live on the surface of the seabed.

[31] *Gammarus insensibilis* is designated under the Wildlife and Countryside Act 1981 (Ref, 2.16.1), The UK List of Priority Habitats and Species (Ref. 2.16.2), the Red Data Book of Invertebrates (Ref. 2.16.3), and the Natural Environment and Rural Communities Act 2006 (Ref. 2.16.4) – Species of Principal Importance in England.

Table 2.16.1 Key fishes of Greater Sizewell Bay based on socio-economic, ecological and conservation importance

(species in grey were not observed during any of the surveys)

Common name	Scientific name	Socio-economic	Ecological	Conservation
European sprat	*Sprattus*			
Atlantic herring	*Clupea harengus*			
Whiting	*Merlangius merlangus*			
European seabass	*Dicentrarchus labrax*			
Sand gobies	*Pomatoschistus spp.*			
Dover sole	*Solea*			
Dab	*Limanda*			
Anchovy	*Engraulis encrasicolus*			
Thin-lipped grey mullet	*Liza ramada*			
European flounder	*Platichthys flesus*			
Atlantic cod	*Gadus morhua*			
European plaice	*Pleuronectes platessa*			
Smelt	*Osmerus eperlanus*			
Thornback ray	*Raja clavata*			
European eel	*Anguilla*			
Horse mackerel	*Trachurus*			
Twaite shad	*Alosa fallax*			
River lamprey	*Lampetra fluviatilis*			
Mackerel	*Scomber scombrus*			
Sea trout	*Salmo trutta*			
Allis shad	*Alosa*			
Tope	*Galeorhinus galeus*			
Atlantic salmon	*Salmo salar*			
Sea lamprey	*Petromyzon marinus*			

2.16.20. During 2013, 66 vessels operated near the GSB area, most of these were less than 10m in length. Most of the catches were landed into Lowestoft, Aldeburgh, Orford, and Southwold, along with minor landings to Sizewell beach and Great Yarmouth. The larger vessels predominantly landed into Lowestoft, with minor landings to West Mersea, Wells-next-the-Sea and Ipswich.

2.16.21. Commercial landings from 33F1 in 2013 were 332t, with a first sale value of £634,000. Seven species contributed over 90% of the total commercial landings by weight[32]. These included: whelk, thornback ray, sole, cod, brown shrimp (*Crangon crangon*), lesser spotted dogfish (*Scyliorhinus canicula*), and seabass. Due to market value, the species that contribute over 90% to landings by value[33] differ slightly and included sole, whelk (*Buccinum undatum*), seabass, thornback ray, cod, lobster, and brown shrimp.

2.16.22. Impingement sampling at Sizewell B between 2009-2012 provides a means to predict the commercially important species that may be impinged by Sizewell C. Impingement surveys identified 24 key finfish taxa that are predicted to be impinged at discernible numbers at Sizewell C. Seven of those key finfish species are landed by commercial fishing vessels operating in ICES rectangle 33F1. **Table 2.16.2** summarises the primary fishing gear and seasons for the primary commercial species.

Table 2.16.2 Primary fishing gears and fishing seasons of Sizewell surveys

Commercial Species	Primary fishing gear(s) used (% of total landings in rectangle 33F1)	Fishing season
Thornback ray	Longline (78%); Gill net (10%); Otter trawl (7%); Trammel net (3%)	April – November, peak in June/July
Sole	Gill net (53%); Otter trawl (28%); Beam trawl (10%); Trammel net (5%)	May – October/November
Cod	Longline (90%); Gill net (4%); Beam trawl (3%); Otter trawl (3%)	March – May, January
Seabass	Longline (54%); Gill net (34%); Trammel net (7%); Drift net (3%)	January, May – June, October
Herring	Drift net (67%); Gill net (30%)	October – November
Flounder	Gill net (53%); Otter trawl (38%); Longline (5%)	June – September
Dab	Gill net (42%); Otter trawl (30%); Drift net (24%); Longline (6%)	June – November, peak in June and July
Whelk	Pots (99%)	July – November
Lobster	Pots (95%); Gill nets (3%)	July – November, peak in August
Brown crab	Pots (100%)	June – November, peak July/August
Brown shrimp	Beam trawl (100%)	August – October, peak in September

[32] 90% of commercial landings by weight: whelks (51.8%), thornback rays (11.7%), sole (11.6%), cod (6.4%), brown shrimp (3.9%), lesser spotted dogfish (3.7%), and seabass (2.3%).

[33] 90% of commercial landings by value: sole (33.8%), whelk (20.2%), seabass (11.5%), thornback ray (10.3%), cod (8.1%), lobster (6.0%), and brown shrimp (4.8%).

Recreational fisheries

2.16.23. Information on recreational angling is available from the Angling 2013 survey and radiological habits surveys of people living in the Sizewell area. These reports show that recreational angling from the shore or from boats is popular throughout the survey area.

2.16.24. Seabass is the main target for most shore anglers fishing in East Anglia, whilst cod, mackerel and smooth-hound are also important target species. Off the Suffolk coast, shore angling targets cod, whiting, seabass, dab, and sole, whilst boat anglers catch the same species as well as mackerel and thornback ray. At Sizewell and Dunwich beaches angling is quiet from December to March, with dab, flounder, whiting and rockling being caught in deeper waters. However, by May, anglers take good catches of cod and sole. Seabass, smooth-hound and dab are taken in June. The best beach fishing is from July to November, when seabass, whiting, dab, flounder and rockling are caught by day and large sole and seabass are also taken at night. Cod are taken at night from October onwards.

2.16.25. Estimates of the number of beach and boat angler visits to the Sizewell area in 2009/10 are available from the Eastern Inshore Fisheries and Conservation Authority (IFCA), based on the experience of the local fishery officer and discussions with local angling clubs. An estimated 23,500 shore-based visits were made to the beaches of the Eastern IFCA area; almost half (10,900) were in the area of Dunwich – Orford Island (which encompasses Sizewell). However, none of the 18,000 boat-based visits to the Eastern IFCA area were known to occur in the Dunwich – Orford Island area.

2.16.26. An estimated 20 charter vessels operated from the various ports in the study area in 2014. Between November and April, the locations fished tended to be within five nautical miles (nm) of the coast, whereas from May onwards, the charter boats venture farther offshore on sandbanks and wrecks, sometimes up to 30nm from the coast.

2.16.27. Valuing the recreational fishery is extremely difficult due to the paucity of data. However, an indication of the economic value of recreational angling in the Sizewell study area (defined by the population of the Suffolk coastal ward including Southwold) was obtained by comparison with published information for Hastings, a seaside resort on the south-east coast of England (that does not have a port and where there are no charter boats). Estimates of the total annual spend by sea anglers in 2013 in the Sizewell Primary area were £2.83 million. Indirectly, sea angling is estimated to contribute £4.85 million of total spending and supports over 50 local jobs. These estimates will be revisited for the ES.

v) Marine mammal baseline

2.16.28. Three species of marine mammal are known to frequent or move past the Sizewell area. They are harbour porpoise (*Phocoena phocoena*), common seal (*Phoca vitulina* – also known as harbour seal), and grey seal (*Halichoerus grypus*). Other species of marine mammal are present in the southern North Sea, although, these species are infrequently observed within the Sizewell area.

2.16.29. Acoustic surveys have recorded harbour porpoise in the GSB throughout the year. Evidence suggests some preference for offshore waters, beyond the Sizewell-Dunwich Bank, over the winter period. The annual occurrence of harbour porpoise indicates they may be ecologically important to the GSB as apex predators.

2.16.30. Aggregations of common seals occur to the north of Sizewell, in The Wash and less so at Blakeney Point (north Norfolk) and to the south in the Thames Estuary. Common seals do not heavily utilise the coast around Sizewell but are known to move through the area.

2.16.31. There are grey seal populations in Lincolnshire (Donna Nook), East Anglia (Blakeney Point) and the Thames Estuary. Grey seals are more wide-ranging than common seals, with movements for food and hauling out reaching up to 300km. Movements between the northerly and southerly sites would include passage along the stretch of coast adjacent to the proposed development although evidence suggests that usage of the waters surrounding Sizewell is low.

2.16.32. Harbour porpoise and the two species of seal are of conservation importance (protected under the Habitats Directive (Ref. 2.16.5, Annex II)). The Southern North Sea SAC (adjacent to the main development site) was designated in 2017 as it has been recognised as an area of importance for harbour porpoise. Common seals are a qualifying feature of The Wash and North Norfolk Coast SAC (approximately 120km from the main development site). Grey seals are a qualifying feature of The Humber Estuary SAC (approximately 220km from the main development site).

b) Environmental design and embedded mitigation

2.16.33. Development components connected with the main development site include the construction and operation of:

- a CDF;
- a BLF;
- cooling water infrastructure (intakes, outfalls and FRR system); and
- a CDO.

2.16.34. Carefully considered environmental design and embedded mitigation help minimise the impact of development components. Embedded mitigation for each development component is considered below.

i) Coastal defence feature

2.16.35. Erosion and longshore sediment transport has the potential to cause coastal squeeze and change sediment dynamics with consequences for intertidal communities and designated coastal vegetated shingle habitats. The CDF has embedded mitigation components to minimise such impacts, which are detailed in **section 2.14**.

ii) Beach landing facility and vessel traffic

2.16.36. The BLF jetty would be a transmissive structure with few slender piles and a negligible effect on waves, sediment transport and the adjacent beach. The primary embedded mitigation is the small number of piles compared with alternative jetty options; deliveries would be made by North Sea barges grounding at the BLF.

Construction and piling

2.16.37. To minimise the effects of noise on the marine environment, piling activities will conform to best environmental practice in accordance with Joint Nature Conservation Committee (JNCC) guidelines.

2.16.38. Construction chemicals, used in piling and any treatment of installed piles would undergo appropriate assessments to ensure suitability for use in the marine environment (**section 2.15**).

Navigational dredging

2.16.39. To accommodate the safe passage of barges and accompanying tugs to the BLF a navigational channel and grounding area would be required in the nearshore zone occupied by two longshore bars. Plough dredging is the preferred option to create a planar surface for the barges as the use of a plough dredge minimises sediment extraction from the site.

Vessel traffic and pollution

2.16.40. Transit speed for North Sea barges is approximately 6 knots. The potential for marine mammal collision with barges is low and compliance with a site-wide speed restriction for all working vessels below 10 knots is recommended for the VMP. The potential for chemical and oil spills whilst recognised will be mitigated by compliance with IMO regulations. The potential for non-native species to be introduced during ballast water activities will be managed by compliance with the IMO Ballast Water Management Convention (adopted in 2004). Vessel waste management procedures outlined in the VMP and Site Waste Management Protocols would be in place to mitigate impacts of marine litter.

iii) Cooling water infrastructure and fish recovery and return

2.16.41. The optimal location of the outfall heads was investigated using hydrodynamic modelling in compliance with Environment Agency guidelines to reduce environmental impacts of the thermal plume, and minimise recirculation of heated water at the Sizewell B intakes. The intakes and outfalls of the cooling water infrastructure would be located east of the Sizewell-Dunwich Bank approximately 3km offshore. The water depth at the outfalls would mean that the thermal plume would have minimal impact at the seabed thereby minimising effects on benthic habitats. The selection of an offshore location reduces the area of thermal impact exceedance inshore of the Sizewell-Dunwich Bank.

2.16.42. Coarse bar screens at the intakes would prevent seals and marine debris from entering the cooling water system. Following passage through the intake tunnels, cooling water would be screened by rotating drum and band screens to remove fish and crustaceans before they are returned via the FRR system. The current design is for two FRR outfalls to be installed, one per EPR. This would avoid the need for a complex junction system and may prevent the requirement for an Archimedes screw (pending hydraulic assessment), thereby reducing the 'handling' and residence time of impinged fish and crustaceans. To reduce the effects on abstracted fish and crustacea the Sizewell C intake heads, tunnels and forebays would not be chlorinated. The seasonal chlorination strategy will reduce the exposure of abstracted biota during the winter months. Chlorination of the FRR wash water will be dependent on hydraulic assessments and assessments of impingement will consider a seasonally chlorinated FRR as a precautionary measure. The FRR outfalls have been optimally located to return fish to the sea as rapidly as possible whilst reducing the risk of predation by seabirds, re-impingement into Sizewell B or return of fish into the Sizewell B discharge plume.

2.16.43. To ensure seismic qualification, cooling water intakes and outfalls will be secured to the bedrock by piles. Piles would be installed by drilling, rather than percussive methods, thereby reducing the impacts of underwater noise.

iv) Combined drainage outfall

2.16.44. During the construction phase, discharges would be made via the CDO. A WDA Environmental Permit assessment will be required prior to any discharges to determine compliance with EQS[34].

2.16.45. Discharges of tertiary treated sewage, surface run-off water, water arising from the tunnelling process, groundwater and surface water would be treated as required prior to discharge. The CDO outfall has been positioned on the seaward flank of the outer longshore bar to allow mixing and avoid effluent contact with the shore.

c) Preliminary assessment of effects

2.16.46. The preliminary assessment of effects considers the species and habitats (receptors) for which the potential for significant effects occurs despite embedded mitigation measures. Selected primary construction and operational activities with non-significant effects are also briefly considered. Marine species would have varying degrees of exposure and/or sensitivity to development activities and are assessed separately.

i) Construction

2.16.47. The primary construction activities with the potential to significantly affect receptors are dredging, pilling, drilling and the installation of infrastructure in the marine environment.

Dredging

2.16.48. Installation of cooling water infrastructure, the FRR system, and the CDO require capital dredging. The most likely dredge method is via a cutter suction dredger with spoil disposed locally. Impacts from dredging may arise through loss or change of habitat due to sediment extraction, changes in suspended sediment concentrations, siltation rate changes when dredge spoil settles on the seabed, and noise during dredge activities. Dredging for the cooling water infrastructure results in the largest dredge volume and increases in suspended sediment and siltation rates. The results of modelling the sediment plume and deposition rates is provided in **section 2.15**. The effects of underwater noise are highly receptor specific due to hearing capabilities and auditory thresholds. Noise effects are described in the relevant receptor sections below.

Drilling

2.16.49. Drilling will occur to connect the cooling water intake and outfall headworks with the subterranean horizontal tunnels. Temporary increases in suspended sediment are predicted to be indiscernible from background concentrations. A spoil heap with a depth of one cm to tens of cm is anticipated in proximity to the drilling site, extending up to 200m. Beyond the extent of the spoil heap, sedimentation is predicted to be negligible. No significant effects on receptors arising from increases in suspended sediment and sedimentation are predicted from drilling activities. Potential effects of underwater noise on marine mammals and fish are assessed below.

Pilling

2.16.50. The primary impact associated with the installation of piles for the BLF by percussive pilling is underwater noise. The effects of underwater noise are considered in the fish and marine mammal sections below. Increases in suspended sediments and siltation rate changes following the insertion of 1m diameter piles and 1.5m diameter mooring dolphins is predicted to have no significant effects on marine ecology receptors.

Construction discharges

2.16.51. Construction discharges include treated sewage, surface run-off water, water arisings during the tunnelling process, and groundwater with associated heavy metals. Details are provided in **section 2.15**.

2.16.52. For a short period of time, dewatering of the main site may lead to concentrations of zinc and chromium exceeding the EQS. No significant effects of heavy-metal toxicity are predicted on marine ecology receptors due to the restricted extent of the potential EQS exceedance and the short duration of discharges. The bioaccumulation potential of zinc and chromium is low and subsequent biomagnification up the food web is minimal. Accordingly, no indirect effects of heavy-metal discharges are predicted.

2.16.53. Sewage from the temporary construction area and accommodation campus would undergo tertiary treatment before discharge to sea. Water quality assessments indicate that levels of unionised ammonia, DIN and phosphorus pass relevant standards. No significant effects of nutrient inputs are predicted for marine ecology receptors.

[34] EQSs are tools used for assessing the chemical status of waterbodies and for managing compliance of discharges. Where feasible embedded mitigation will be implemented to minimise chemical and thermal discharges, where EQS thresholds are exceeded, further ecological investigation is required.

2.16.54. The commissioning phase of the power station requires tests and conditioning of the entire plant and consists of two-stages: cold flush testing followed by hot flush testing. Effluents from the cold flush testing will be discharged through the CDO. Demineralised water and a number of chemical additives including hydrazine (used as a corrosion inhibitor) may be discharged during commissioning. Evaluation of minimum practical discharges is currently being modelled and ecological assessments will be applied to commissioning discharge conditions of hydrazine.

2.16.55. To prevent biofouling of critical plant, chlorination is required. The commissioning phase chlorination strategy is undergoing evaluation and assessments will be reported in the ES.

ii) Operation

2.16.56. The primary operational impacts are associated with cooling water abstraction and discharges into the receiving waters. Occasional deliveries to the BLF will necessitate navigational dredging where impacts will be comparable to those in the construction phase.

Physical presence of infrastructure

2.16.57. The physical presence of infrastructure on the seabed provides a small area of hard substrate in a predominantly sedimentary environment. The magnitude of habitat change is very minor and no ecologically significant effects are predicted due to habitat loss/change.

Cooling water abstraction

2.16.58. Cooling water would be abstracted from seabed intakes located approximately 3km offshore. Fish and larger invertebrates would be impinged by mesh on the drum and band screens and returned to the sea via the FRR system. Smaller organisms including larval fish, ichthyoplankton, benthic invertebrate eggs and larvae, and plankton would be entrained in the cooling water flow. Cooling water would be heated to approximately 11.6°C above ambient and chlorinated. The effects of entrainment are subject to ongoing study but preliminary assessments indicate no significant effects of entrainment.

Operational discharges

2.16.59. Heated cooling water will be discharged into the marine environment. Thermal discharges have the potential to significantly affect marine receptors in the following ways:

- absolute temperature increases can reach the upper thermal tolerance of sensitive species;
- changes in temperature, whereby the mean temperature increases above ambient conditions can lead to distribution changes of sensitive species and changes in behaviour and physiological processes (such effects will be considered during the ES assessments);
- fluctuating temperature interfaces, whereby the tidal flow can cause variations in the temperature front which is particularly important at the seabed; and
- thermal barriers; some evidence suggests that the interface between thermal discharge plumes and cooler receiving waters can present a barrier to migratory fish species.

2.16.60. Receptor specific effects are considered in relation to thermal discharges in the relevant receptor sections below.

2.16.61. Oxygen is less soluble in water as the temperature increases. Sampling at the existing Sizewell B outfalls demonstrated that dissolved oxygen concentrations are consistently above the threshold for WFD 'High' status. This is also the conclusion of modelling of DO concentrations for the proposed Sizewell C outfalls. Therefore, no significant effects arising from changes to DO levels are predicted.

2.16.62. To control biofouling of critical sections of the plant, cooling water will be chlorinated. The primary biocidal effects of seawater chlorination results from oxidants associated with bromine chemistry: measured and expressed as the concentration of TRO. The TRO and bromoform plumes are predicted to exceed EQS thresholds and follow a long narrow trajectory running parallel to the shoreline, 3km offshore. The area of the TRO plume from the proposed Sizewell C discharges that exceed the 0.01mg/l EQS threshold are 374ha at the sea surface and 2ha at the seabed[35]. The potential for significant effects on marine ecology receptors is considered below. The bromoform plume exceeds the 0.005mg/l applied EQS threshold over a sea surface area of 66ha and an area of 0ha at the seabed. No significant effects of bromoform on marine ecology receptors is predicted.

2.16.63. During standard operating procedures, hydrazine discharges would occur for approximately 2 hours each day. The maximum area exceeding the concentrations capable of causing long-term effects (chronic PNEC[36]) is predicted to be 161ha at the surface and less than 1ha at the seabed. Within this area, the concentration threshold above which the most sensitive species may be susceptible to acute

[35] The area of EQS exceedance is reported as the 95th percentile over a month-long model simulation. Therefore, in a tidally dominated environment whereby the plume is transported either in a north or south direction from the point of discharge, the 95th percentile area represents a considerably larger spatial extent than the instantaneous area of the plume above EQS thresholds.

[36] Where there is no existing EQS, toxicological data with relevant safety factors applied may be used to derive the PNEC or Predicted No Effect Concentration below which no harmful effects would be expected. The PNEC typically has two thresholds based on the concentration that may elicit toxicological effects following short-term (acute) or more prolonged exposures (chronic).

toxicological effects (acute PNEC) is exceeded over 18ha at the surface and less than 1ha at the seabed. An assessment of non-standard operating procedures (refuelling outages[37]) will be conducted when sufficient information is available. The potential for significant effects of hydrazine discharges is considered below.

2.16.64. Nutrient inputs during the Sizewell C operational phase are predicted to reach a maximum during the planned 6-week refuelling outages every 12-18 months. Phosphate inputs are predicted to increase background levels near the outfall by more than DIN additions however, DIN additions are relatively small in relation to nutrient and water exchange with the wider area. All cases tested (including worst cases) for unionised ammonia show that no areas exceed the EQS of 0.021mg/l as an annual mean. No significant effects of nutrient inputs on marine ecology receptors are predicted.

iii) Preliminary assessment of construction effects: plankton

Dredging activities

2.16.65. The primary impact of dredging activities would be the increase in suspended sediment in the water column, which would reduce light availability to photosynthetic phytoplankton. Dredging activities would be short duration events and sediment plumes would rapidly decrease to background levels following cessation. No significant effects are predicted on phytoplankton populations. Zooplankton are generally less impacted than phytoplankton by elevated suspended sediments. Effects would be species-specific but no significantly effects on zooplankton populations are predicted.

Construction discharges

2.16.66. Discharges of treated sewage and conditioning chemicals, with elevated nutrient concentrations have the potential to enhance phytoplankton growth and biomass during periods of nutrient limitation. Nutrient enhancements would be rapidly diluted and are minimal in the context of the overall exchange of water and nutrients within the tidal system of the GSB. Construction phase nutrient inputs are therefore predicted to have negligible effects on phytoplankton growth.

iv) Preliminary assessment of operational effects: plankton

Cooling water abstraction

2.16.67. Entrainment effects at the population level have been assessed through modelling approaches. Phytoplankton mortality from Sizewell C acting cumulatively with Sizewell B is estimated to result in losses of approximately 5% of gross annual productivity across the GSB and tidal excursion. Losses at this scale are within the bounds of natural variability and the population level effect of entrainment on the phytoplankton community would not be significant.

2.16.68. Zooplankton species-specific mortality due to entrainment varies between 20-100%. At the population level losses within the tidal excursion due to entrainment at Sizewell C are predicted to be minor[38]. Reductions in zooplankton population abundance are not predicted to be discernible above natural variation and the population level effect of entrainment on the zooplankton community would not be significant.

Operational discharges

2.16.69. Plankton in the receiving waters may be exposed to secondary entrainment[39] in the thermo-chemical discharge plume. Thermal discharges have been shown to result in localised changes in species composition and biomass, bring forward the onset of the spring bloom, enhance productivity during colder months, and potentially reduce growth rates in warmer periods. However, temperature, effects in the far-field of the plume will be dependent on the interplay with limiting factors of light and nutrient availability. Zooplankton exposed to modest temperature uplifts (2-3°C) in the far-field of the plume may experience minor increases in feeding, growth and reproductive rates. Such effects will be limited to a small proportion of the population and will be dependent on food availability. Hydrodynamic processes at the site and exchange of water with the wider southern North Sea indicate no significant effects will occur at the population level.

[37] A refuelling outage is a routine planned maintenance event when a reactor is shut down for a few weeks to enable fuel rods to be replaced and other planned maintenance activities to take place

[38] Copepods are a dominant pelagic zooplankton group, entrainment effects of Sizewell C on the population of the copepod *Acartia tonsa* estimate a 0.4% reduction in abundance within the tidal excursion. Similar estimates with bentho-pelagic mysids and gammarid (amphipods), accounting for behaviour traits, estimate reductions in population size of approximately 0.3% and 1.4%, respectively.

[39] Secondary entrainment occurs when organisms in the receiving water encounter the thermal/chemical discharge plume. This differs from primary entrainment, whereby organisms are abstracted and passage through the cooling water system.

2.16.70. Chlorinated discharges have been shown to cause reductions in primary productivity, changes in species composition and size distribution of phytoplankton at a restricted spatial scale, however, no significant effects on the wider phytoplankton populations within the GSB and tidal excursion are predicted. Zooplankton entrained in the chlorinated chemical plume may experience chronic effects including reductions in feeding rate. However, the transient nature of the tidal plume and the small proportion of the population effected means no significant effects are predicted at the population level[40].

2.16.71. Laboratory toxicity studies indicate that phytoplankton and zooplankton would have limited sensitivity to hydrazine discharges at concentrations experienced during secondary entrainment. Effects at the population level are not predicted to be significant during standard operational running of Sizewell C. Furthermore, the rapid degradation rates of hydrazine indicate that it has very low potential for bioaccumulation, therefore indirect food-web effects are unlikely.

v) Preliminary assessment of construction effects: benthic communities

Dredging and drilling activities

2.16.72. Dredging and drilling result in the permanent loss of suitable habitat following direct removal of substrate, which is subsequently replaced by concrete cooling water infrastructure. The total area of habitat loss/change represents a small spatial extent of approximately 3.16ha. The impact predominantly occurs in fine sand and muddy sand habitats, which extend over most of the GSB, therefore no significant effects on benthic receptors are predicted.

2.16.73. Dredging for the BLF access channel will modify the seabed benthic habitat. The top layer of sediment (up to 2m) will be regularly removed by a plough dredge over an area of <1ha. The seabed disturbance will remove benthic organism, which typically live in the top 10cm of the sediment. The limited spatial extent of the impact indicates benthic receptors will not be significantly affected.

2.16.74. Increase in suspended sediments in the water column associated with dredging, drilling and pilling activities is not predicted to have significant effects on benthic communities as most of the subtidal benthic organisms present in the GSB are deposit feeders or predators.

2.16.75. Sediment deposition has the potential to effect benthic communities depending on the depth, properties, and duration of deposition. Infauna species present in GSB soft sediment are mostly sessile, and they have low resistance to heavy deposition. However, effects of sediment deposition are likely to be limited in duration and heavy siltation is restricted to the vicinity of the dredging disposal location and drilling site (see **section 2.15**). Sediment deposition arising from dredging or drilling is not predicted to have significant effects on benthic receptors.

vi) Preliminary assessment of operational effects: benthic communities

Cooling water abstraction

2.16.76. Large, mobile benthic species such as brown crab and hyper-benthic species (those living above the seabed) such as brown shrimp may become impinged. In addition, benthic species with planktonic larvae are susceptible to entrainment within the cooling water systems. Benthic organisms are highly fecund and predicted to have high resilience to mortality of planktonic larval stages. Resistance to entrainment and impingement of benthic organisms is expected to be species-specific, however, experimental data suggests relatively high resistance[41]. Accordingly, entrainment and impingement is not predicted to have significant effects on benthic receptors.

Operational discharges

2.16.77. The potential effects of thermal discharges are predominantly on sessile benthic organisms that cannot avoid the plume[42]. The thermally buoyant nature of the plume means that benthic invertebrates are unlikely to be exposed to temperatures capable of causing lethal effects. Downward mixing of the thermal plume would result in temperature uplifts at the seabed in the far-field of the plume and the tidal system means benthic fauna would be subject to thermal fronts. Such temperature changes have the potential to cause chronic, sublethal effects influencing physiological processes and may result in changes in distribution of the most sensitive species. Receptor-specific assessments for the key taxa in the GSB will be completed as part of the ES process to identify the potential for effects.

[40] *Schistomysis spiritus* is the dominant mysid species at Sizewell, 48-hour exposure to TRO concentrations likely to be experienced during secondary entrainment did not cause increased mortality but did result in reductions in feeding rates. However, very low numbers of bentho-pelagic mysids are likely to be exposed to sufficient concentrations required to inhibit feeding rates and population level effects are predicted to be negligible. Pelagic copepods would have greater exposure to the buoyant TRO plume but entrainment studies have shown copepods are less sensitive than mysids and population level effects are predicted to be minor.

[41] Studies of impinged brown shrimp have shown 94% survival rates and the effects of impingement on brown crab is predicted to be negligible. Entrainment predictions apply a precautionary 30% mortality of brown shrimp.

[42] Model simulations of the thermal plumes from Sizewell B and Sizewell C indicate that approximately 309ha would be impacted by mean excess temperatures >2°C; 78ha would be impacted by mean excess temperatures of >3°C.

2.16.78. Exposure to chlorinated water can result in a range of lethal and sub-lethal effects. Gammarids have been shown to incur reduced survival rates, abnormal larval development has been observed in bivalves, and reduced growth rates have been documented for brown shrimps. However, a relatively limited area of seabed is likely to be exposed to concentrations that would result in toxicological effects to benthic receptors. Furthermore, the transitory nature of the tidally dominated plume results in reduced periods of exposure. Prolonged exposure is only expected to occur for benthic receptors living in close proximity to the point of discharge (up to 100m). Therefore, there is a low likelihood of significant effects from chlorination upon benthic communities.

2.16.79. Hydrazine discharges during standard operations are transported within the thermally buoyant plume and have negligible intersection with the seabed. Hydrazine discharges are therefore likely to have negligible effects on the infaunal invertebrate community. Hyperbenthic invertebrates have the potential to be affected; however, the small magnitude of the impact at the scale of the population is not expected to result in significant effects.

vii) Preliminary assessment of construction effects: fish

Piling, dredging, drilling and vessel movements

2.16.80. Increases in suspended sediments have the potential to cause behavioural, physical and physiological effects to different life history stages of fish. The duration and magnitude of changes in suspended sediment loads relative to the ambient level of turbidity within the GSB indicates that no significant effects are predicted for fish receptors. Furthermore, whilst temporary increases in suspended sediments would occur, habitat remains available for foraging and spawning/nursery functions within and outside the GSB.

2.16.81. Deposition of suspended sediments has the potential to smother eggs, egg cases, larvae, juveniles and adults leading to mortality or mortal injury. Localised impacts are likely to occur particularly for species that lay demersal eggs and juvenile or adult life history stages with limited mobility. However, effects are predicted to occur over a small spatial area and are unlikely to be significant at the population level, as foraging and spawning/nursery habitat remains available within and outside the GSB. Effects of increases in suspended sediments and sediment deposition will be considered in more detail in the ES.

2.16.82. Noise generated by vessel movements and dredging activities is only capable of causing injury in close proximity to the source, however, behavioural responses may cause localised temporary displacement of acoustically sensitive fish species[43]. No significant long-term effects are predicted.

2.16.83. Piling and drilling activities generate underwater noise at levels which can cause mortality or injury[44], as well as behavioural effects on fish. Noise exposure thresholds were used to model potential effect ranges on fish receptors from construction activities. Drilling activities are predicted to result in very small effect zones for injury and mortality and behavioural response zones were also restricted. Therefore, no significant effects are predicted due to noise impacts from drilling activities.

2.16.84. Based on the new design option for the BLF, noise modelling will be updated for the ES. Soft-start procedures during piling (embedded mitigation) would minimise the exposure of acoustically sensitive fish to mortality or injury; therefore, no significant long-term effects are expected from piling activities. No significant effects on eggs and larvae are predicted and the effect zones modelled to date indicate mortality and injury zones for adult fish are likely to be localised.

Indirect food-web effects

2.16.85. Fish avoidance due to increases in suspended sediment or noise generating activities has the potential to cause food-web effects. Furthermore, increases in suspended sediments may temporarily reduce the foraging efficiency of fish-eating seabirds. SPA designated species with a marine prey component to their diet at Sizewell include the little tern (*Sternula albifrons*), sandwich tern (*Thalasseus sandvicensis*), common tern (*Sterna hirundo*), lesser black-backed gull (*Larus fuscus*), red-throated diver (*Gavia stellata*), and the 'seabird assemblage' is also designated in the Alde Ore SPA. The marine prey of these birds includes (dependent upon species) sprat, herring, anchovy, whiting, seabass, eels, swimming crabs, bivalves, crustacea, and fishing vessel waste. Potential food-web effects will be assessed as part of the ES. Effects on designated birds will be assessed as part of the HRA.

[43] Acoustically sensitive species are those that have a swim bladder or other air cavities which aid hearing. Acoustically sensitive species present in GSB include; herring, sprat, anchovy, and twaite shad and to a lesser extent certain demersal species

[44] Noise exposure assessments consider specific thresholds for mortality and injury in the form of permanent threshold shift, or recoverable temporary threshold shift to determine the effects of noise.

viii) Preliminary assessment of operational effects: fish

Water abstraction and impingement

2.16.86. Pelagic species such as sprat, herring and anchovy are most likely to be impinged whilst other species such as seabass, cod, and whiting would also be impinged. Initial predictions of impingement losses, made from estimates of impingement sampling conducted between 2009 and 2012 at Sizewell B indicated that total losses would be minor when compared with population sizes and with the natural population variability. Impingement predictions will be updated to include sampling data for 2014 to 2017, to allow reassessment of these initial predictions and ascertain the potential for significant effects. The updated impingement predictions will account for the incorporation of the FRR within the design.

Operational Discharges

2.16.87. Heated cooling water discharged from the outfalls is predicted to result in variable areas at the seabed and the sea surface where water temperature exceeds ambient. The potential for thermal uplifts to affect fish species will depend on the species-specific thermal niche.

2.16.88. For colder water species, such as cod and herring, juvenile and adult fish may actively avoid warmed waters. Ichthyoplankton, exposed to elevated temperatures, may incur effects to growth and survival, however, effects are predicted to be negligible in relation to larval availability due to the restricted spatial area. Small, localised changes in species and potentially community composition due to the displacement of juvenile/adult fish is possible. However, no significant effects are predicted at the population level for cold-water species.

2.16.89. For cold-water, migratory species (river lamprey, smelt and salmonids), the elevated temperatures in the thermal plumes are not expected to form a barrier to migration. Therefore, no significant effects to migratory behaviour are predicted.

2.16.90. Warm-water species such as seabass, Dover sole and twaite shad, are predicted to tolerate the elevated temperatures and some species may even exploit the warmer waters. Therefore, no significant negative effects are predicted at population level for warm-water species.

2.16.91. Chlorination of cooling water discharges during the growing season has the potential to affect ichthyoplankton, juvenile and adult life history stages of fish through avoidance behaviour, sub-lethal or lethal effects. The generally high fecundity rates of adult fish indicate that potential mortality of eggs and larvae would be negligible at population level.

2.16.92. The buoyant nature of the TRO plume from Sizewell C means EQS thresholds are exceeded over a seabed area of just 2ha. The limited extent of the plume means potential foraging and spawning/nursery habitat, for demersal species such as plaice, sand goby and thornback rays is unlikely to be affected. The surface plume extents to an area of 374ha. Juvenile and adult fish may avoid the plume by moving to unaffected areas within or outside the GSB, where there is access to habitat to support foraging and/or reproductive requirements. Experiments on a range of fish species found at Sizewell to entrainment concentrations of TROs has shown different mortality rates from 0-60%[45]. Given that dilution rapidly decreases the concentration of TROs from the point of discharge, limited mortality is predicted for fish exposed to the discharge plume (secondary entrainment). Furthermore, species with diurnal or seasonal utilisation of the GSB may incur reduced exposure, particularly if they are abundant in the GSB during the winter months when cooling water is not chlorinated. No significant effects of chlorination are predicted at the population level for fish receptors.

2.16.93. There is limited evidence regarding the toxicity of hydrazine to marine fish. However, toxicology studies with marine invertebrates, algae, and freshwater fish indicate that the concentration of hydrazine in the discharge plume is unlikely to cause significant effects to fish receptors during standard operating procedures.

2.16.94. Avoidance of thermal and/or chemical plumes by some fish species has the potential to cause food-web effects. Food-web effects from potential avoidance behaviour of operational discharges will be assessed as part of the ES and the in-direct effects on designated bird features will be assessed as part of the HRA.

ix) Preliminary assessment of construction effects: fisheries

2.16.95. Installation of offshore infrastructure, such as the cooling water headworks, FRRs and CDO (Figure 2.16.1) would require temporary safety zones to be implemented surrounding working construction vessels. Safety zones would be implemented through Notice to Mariners (NtM). Tiered safety zones of 250m and 500m would typically be applied and the extent of the safety zones and the nature of any required demarcation would be subject to the navigational hazard assessment. However, infrastructure will be installed in predominantly sedimentary areas and safety zones are not expected to impact on fishing operations at the Coralline Crag. Fishing effort in the local area will be investigated further as part of stakeholder consultation.

[45] Entrainment Mimic Unit experiments exposed seabass, plaice, turbot and eel to a concentration of 0.2mg/l TRO. Eel, plaice, sole and turbot suffered no mortality, whereas the survival rates for seabass were between 10% and 60% depending on life stage. TRO concentrations at the discharge point would be approximately 0.2mg/l, whereas the EQS is 20-fold lower at 10µg/l.

2.16.96. The construction of the BLF is predicted to take three to four months, during which time safety zones surrounding construction activities would aim to restrict access to shore-based recreational anglers for a small section of the foreshore.

2.16.97. Vessel traffic associated with deliveries to the BLF would increase the collision risk for both commercial and recreational vessels. Safe movement of vessels will be managed under the VMP, including site speed restrictions for working vessels.

2.16.98. Piling for the BLF and dredging activities may lead to a temporary increase in the local levels of underwater noise and suspended sediments, which may result in avoidance by mobile commercial species. A shift in the distribution of the exploitable part of the fish population may displace fishing activities to alternative areas. Dredging activities are relatively brief, and in the case of highly mobile fish species, displacement is likely to be temporary. The timing of construction activities will have a bearing on the commercial species affected, and this will be further explored in the ES.

x) Preliminary assessment of operational effects: fisheries

2.16.99. Abstraction of cooling water will result in the impingement of species of commercial or recreational angling importance (**Figure 2.16.1**). Impingement predictions are being updated to determine the potential for significant effects on commercial fisheries.

2.16.100. Underwater infrastructure, such as the cooling water headworks, FRRs and CDO may present an entanglement hazard to fishing gear, e.g. gill nets or drift nets (**Table 2.16.2**) or reduce fishing access to a small area to avoid entanglement risks. The spatial extent of the underwater infrastructures is, however, extremely limited[46]. Additional information on the distribution of fishing effort and gear types used in the GSB will be obtained through stakeholder consultation.

xi) Preliminary assessment of construction effects: marine mammals

Visual disturbance and underwater noise impacts

2.16.101. Dredging and drilling produces underwater noise at levels that are capable of causing injury to harbour porpoises and seals. However, these noise levels are only sufficient to cause injury at relatively close distances to the activity. It is expected that any marine mammals in the area would retreat to a safe distance before injury could occur. No significant effects on marine mammals caused by underwater dredging and drilling is expected.

2.16.102. The potential effects of underwater noise from piling range from injury to behavioural avoidance. There is no evidence of injury or mortality in harbour porpoises or seals because of pile driving noise and embedded mitigation should be sufficient to prevent the occurrence of injury. Negative short-term effects on harbour porpoise densities have been reported at offshore windfarm sites, however, porpoises returned to the area after piling was complete and no negative effects have been observed at the population level. Behavioural avoidance has also been observed in seals in response to pile driving, however, seals returned to the area and their haul-out sites shortly after piling ceased. Therefore, avoidance by marine mammals in response to underwater piling noise is expected to be temporary and the effect would not be significant.

2.16.103. The CDF is expected to limit light spill from the main development site on the foreshore and the adjacent marine environment. The BLF will be in use throughout the campaign period to receive deliveries from North Sea barges. Artificial lighting and vessel activity may cause visual and noise disturbance to harbour porpoise and seals resulting in temporary displacement. Effects are not, however, predicted to be significant.

xii) Preliminary assessment of operational effects: marine mammals

Operational discharges

2.16.104. Operational discharges result in thermal uplifts in the receiving waters. Marine mammals are not considered to be sensitive to small uplifts in temperature and therefore no related significant effects are predicted.

2.16.105. Contamination from chlorine has the potential to affect marine mammals due to eye/skin/respiratory irritation or through potential avoidance. Harbour porpoises are the most abundant marine mammal within the GSB. The area of the TRO plume that exceeds EQS concentrations is small relative to their foraging area. Therefore, the exposure time to the TRO plume is likely to be short lived and the effects of chlorination on marine mammals is not likely to be significant.

Noise generating activities and visual disturbance

2.16.106. During the operational phase the BLF will be required for infrequent deliveries of AILs. During periods of BLF activity visual and noise disturbance from artificial lighting and vessel traffic may occur resulting in temporary displacement of any marine mammals present in the vicinity. Such effects are not predicted to be significant.

[46] Six outfall and intake heads would be installed on the eastern flank of the Sizewell-Dunwich Bank in water depths between 11.7m and 16.8m (Figure 3.16.1). The headwork dimensions would be approximately 16x16m length and width, and protrude 4m above the seabed. The FRRs and CDO, located on the seaward flank of the outer longshore bar (see Figure 3.14.1 in Coastal Geomorphology and Hydrography), represent much smaller headworks.

d) Additional mitigation and monitoring

2.16.107. The preliminary assessment of effects presented above does not indicate that additional measures are likely to be required.

e) Preliminary assessment of residual effects

2.16.108. The residual effects would be the same as those presented within the preliminary assessment of effects.

f) Completing the assessment

2.16.109. Initial predictions of impingement for Sizewell C are based on data collected between 2009 and 2012 at Sizewell B. Data is now available until 2017 and revised predictions will be produced to provide predictions incorporating natural seasonal and annual changes in fish populations. The new data will also be analysed using updated methods to provide site and species-specific estimates of Equivalent Adult Value[47] in the context of the most relevant and up to date estimates of stock size. The updated impingement predictions will contain estimates of unmitigated and mitigated effects.

2.16.110. The most recent report on the commercial and recreational fisheries utilised data up to and including 2013. To ensure that any changes to seasonal or annual fish landings and catching methods are reflected in the assessments, the commercial and recreational fisheries report will be updated to the end of 2017[48].

2.16.111. The preliminary assessment of effects summarised in this report are for individual activities and the resulting impacts. In the ES in-combination and indirect, food-web effects will be further considered.

2.16.112. The future baseline for marine ecology will be considered in the ES although extrapolation of current baselines to predict future ecological scenarios is challenging and prone to a large degree of uncertainty, particularly across the range of receptor groups in the assessment, and in relation to natural variability, changes in anthropogenic pressures and climate change. Where reasonable evidence permits, the ES will consider impacts in relation to future baselines particularly in relation to predicted species distribution shifts arising from climate change, and potential future changes in coastal geomorphology.

[47] Equivalent Adult Values are used to convert the numbers of juveniles lost through the impingement process to the representative number of spawning adults that equate to if they had continued to grow and be subject to natural mortality.

[48] Revised assessments will account for recent changes in legislation and how they may have influenced fishing patterns in the area independently of the proposed development. For example, protective measures for seabass and zero total allowable catch on spurdog leading to increases in smooth-hound catches.

Table 2.16.3 Summary of effects for the construction phase

Marine ecology and fisheries

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
All marine ecology receptors.	Hydrazine contamination from commissioning discharges.	Hydrazine will be discharged from the CDO on the seaward flank of the outer longshore bar to minimise contact with the shoreline. Hydrazine will be treated as required in holding tanks prior to being discharged.	Potential for significant effects.	Engineering and treatment options are being investigated to reduce discharges supported by modelling of discharge plumes. Ecological assessments will be undertaken to ensure final discharges are acceptable.	No significant effects predicted.
Fish (noise sensitive species).	Increase in underwater noise from impact piling of the BLF.	Embedded mitigation will include following JNCC guidelines for piling operations including implementing a pre-piling searches and soft-start procedures (where technically feasible).	Significant effects are considered unlikely – noise assessments using the new (reduced) BLF design are currently being undertaken.	None anticipated.	No significant effects predicted.
Marine Mammals.				Additional, site-specific mitigation measures will be considered during the ES e.g. the use of acoustic deterrent devices	No significant effects predicted.

Table 2.16.4 Summary of effects for the operational phase

Marine ecology and fisheries

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Fish	Impingement losses.	Embedded mitigation includes optimally positions intakes to reduce the number of fish impinged, a seasonal chlorination strategy to limit exposure during winter months, an FRR systems with optimally positioned outfalls to maximise survival of impinged fish.	Current (unmitigated) predictions indicate the potential for effects at the local level. Revised predictions, utilising longer term data series and incorporating the latest population statistics are being completed.		Non predicted at this stage, assessments ongoing.
Fish	Increase in temperature.	Outfall position, head design.	No significant effects predicted further assessments underway on potential behavioural changes of specific fish which form the prey of designated marine bird species.		
Fish	TRO contamination.	Outfall position, head design, growing season.	No significant effects predicted further assessments underway on potential behavioural changes of specific fish which form the prey of designated marine bird species.		

2.17. Marine historic environment

2.17.1. The figure for marine historic environment is presented in **Volume 3** as **Figure 2.17.1**.

a) Baseline environment

2.17.2. The marine historic environment study area considers all known heritage assets below the MHWM (hereafter referred to as the main development site offshore zone). An archaeological DBA, most recently updated in 2014, was undertaken to consider an extended area up to 10km from the main development site. This DBA considered existing records of archaeological features and investigations as well as environmental assessments commissioned by EDF Energy, regional syntheses, published and unpublished academic material. These secondary sources were supplemented by archaeological assessment of available, and recently acquired, geophysical (swath bathymetry, sub-bottom, side-scan sonar, magnetometer and backscatter data) and geomorphological (LiDAR, georectified historic maps) data of the offshore region.

2.17.3. The main development site boundary has subsequently been refined, and plans for the necessary marine infrastructure have been developed, resulting in a smaller footprint than originally considered in the DBA. Updated searches of the Historic England National Record of the Historic Environment, Suffolk HER, UK Hydrographic Office (UKHO) Wreck List and the NHLE were undertaken in July 2018. Up to date information, including new heritage assets identified during offshore geophysical surveys commissioned by EDF Energy since 2014, has been considered in the current assessment.

2.17.4. There are no sites designated under the Protection of Wrecks Act 1973 (Ref. 2.17.1) within the main development site offshore zone. The closest designated site, the Dunwich Bank wreck (List entry 1000073), is located 3.2km north of the main development site. There are no sites protected under the Protection of Military Remains Act 1986 (Ref. 2.17.2), or Scheduled Monuments designated under the Ancient Monuments and Archaeological Areas Act 1979 (Ref. 2.17.3), below the MHWM within 5km of the main development site.

2.17.5. There are three HERs within the main development site, with 20 marine losses associated with the Sizewell area. These records date from the post-medieval and modern periods.

2.17.6. A programme of marine archaeological evaluation has been undertaken in relation to the proposed development of Sizewell C. Multiple marine geophysical surveys have been undertaken across the main development site offshore zone, and these have been followed up by a programme of geotechnical sampling using boreholes and vibrocores. This chapter draws upon key findings and conclusions from final reports of these investigations.

i) Prehistoric

2.17.7. To date, there are no records of archaeological material dating from the Palaeolithic period within the study area. Deposits of Palaeolithic Age are not recorded within the main development site offshore zone, and exposures of Coralline and Norwich Crag which pre-date the earliest known hominid occupation of the British Isles suggest that any Palaeolithic deposits which may have been present have been eroded.

2.17.8. The Mesolithic was characterised by rapid changes in sea-level and dramatically shifting coastlines. Evidence of submerged palaeolandscapes is present within the main development site offshore zone as infilled submerged river channel areas containing organic, freshwater and estuarine deposits. A main channel can be laterally traced westwards onshore to the north and west of Sizewell B. The deposits within this channel have the potential to yield palaeoenvironmental information from the Mesolithic Period.

2.17.9. The submergence of much of the offshore area occurred during Mesolithic period, though some early Neolithic peats are located close to the shore.

ii) Romano-British and early-medieval

2.17.10. There are no Romano-British or early-medieval finds recorded within the main development site offshore zone.

iii) Medieval

2.17.11. The village of Sizewell was substantially larger in this period than at present, extending further to the east into land which has been lost through coastal retreat. The Chapel of St Nicholas (now lost to the sea) was dedicated to the patron saint of seafarers and crusaders in 1243 and appears to have been used for burials, baptisms and marriages until the latter part of the 16th century. No reports of further losses to the sea are listed in the manorial records after 1620 and by the latter part of the 17th century a process of accretion appears to have begun at Sizewell.

2.17.12. The importance of fishing to the medieval inhabitants of Sizewell is suggested by the presence of a 'Fishwaye' in the manorial records from 1483, a road linking the parishes of Sizewell and Aldringham. Twenty-three boat masters are recorded at Sizewell in court rolls dating to 1505, though this was reduced to 16 by 1515. The majority of boats would have been used for herring fishing in coastal waters.

2.17.13. Between 1450 and 1520 Sizewell was commonly referred to as 'Sizewell Hythe', a name that has its roots in the Saxon for 'landing place'. It is likely that vessels would have been dragged onto the foreshore or anchored away from the coast. The continual processes of erosion and accretion evident in the area since the medieval period would make the survival of any ephemeral hard landing place or dock structures improbable. Marine geophysical surveys of this stretch of the coastline have not identified any sunken offshore structure associated with the lost settlements at Sizewell.

iv) Post-medieval

2.17.14. Coastal trading was at its height in the 18th and 19th centuries, and hundreds of vessels would have passed through the waters of the study area every year. The shifting Sizewell and Dunwich Banks, combined with their high crests, made navigation of these waters hazardous and large numbers of vessels would likely have been lost to the banks. In 1632, two lighthouses were built at Orford Ness, designed to indicate safe passage between Sizewell and Aldeburgh to reduce the number of losses in the area.

2.17.15. Twenty post-medieval losses are associated with the named location of Sizewell, though the exact positon of these losses is uncertain. No evidence for these losses has been identified by geophysical survey, though some of these wrecks, or fragments of them, could have been incorporated into and dispersed by the Sizewell Bank that has changed morphologically since the date of the wrecks. Descriptions of eight of the recorded losses suggest they were beached, either on the shoreline or sand banks, and were subsequently broken up for salvage, or are recorded as having become broken during the storm with which their loss is associated. A further two losses, the Vine (1243043) and Flora (913991), are given described positions further offshore. Consequently, although many losses are recorded for this area, it is unlikely that many of these would have been preserved within this dynamic environment with those grounding nearshore likely to have been subject to salvage by local communities.

2.17.16. Three wrecks were uncovered during the development of Sizewell B. These consisted of an unnamed 18th century vessel (MSF 20289) located c.120m north-east of the Sizewell B intake structure, remains of a barge discovered in 1982 whilst dredging for the inlet pipe for Sizewell B (MSF 11344), and a 20m long wooden wreck, lying on its port side, discovered in May 1990 (MSF 20288).

2.17.17. A new wreck was identified 80m north of the main development site offshore zone, during geophysical survey for Sizewell C in 2016, and subsequently investigated by Historic England (1956479). The vessel was identified as a 19th or early 20th century wooden merchant sailing ship of at least 300 tonnes. The wreck was deemed to be in poor condition and did not meet the criteria for designation under the Protection of Wrecks Act 1973.

v) Modern

2.17.18. There is one modern wreck positioned 380m south of the main development site offshore zone; the Ocean Pride (UKHO 10324), a British fishing boat lost in April 1972. Its location is recorded as unreliable and the wreck is classified by the UKHO as 'dead', with no trace of a wreck at this location in any of the recent geophysical surveys. There are no reported air crashes within the main development site, with the closest verified crash site, the remains of a Voodoo Jet Aircraft lost on the 30th August 1961 (879929), located 1.6km to the north.

2.17.19. Extensive WWII beach scaffolding (MXS 19837) is located along the beach at Sizewell, remains of which were most recently observed in Spring 2018.

vi) Deposits of geoarchaeological and palaeoenvironmental interest

2.17.20. Geoarchaeological survey, comprising marine geophysical techniques and geotechnical sampling, has determined that the submerged deposits are of high archaeological interest. These deposits contain material which provides information on the past environment, including changes in sea level, which may provide an important context for understanding how the formation processes of this mobile landscape have influenced past human activity. These deposits extend onshore and have been tracked below the beach and onshore as a series of buried channels beneath the main development site main platform site.

b) Environmental design and embedded mitigation

2.17.21. The BLF will consist of a piled structure with the deck located above the seabed. Some localised dredging may also occur to facilitate access to the BLF. The piled foundation design will limit any disturbance of archaeologically significant deposits.

2.17.22. The water cooling intakes/outlets, combined drainage outfall and FRR will consist of tunnels bored through the solid geology under the seabed, with vertical shafts at the seaward end extending up to the intake/outfall headwork mounted on the seabed; the adoption of tunnelling means that effects would be restricted to limited areas of mobile sediments of relatively limited archaeological potential.

2.17.23. The adoption of road-led or rail-led transport strategies have resulted in the removal of the proposals for a jetty at Sizewell C. This would reduce any visual change in the settings of heritage assets which draw significance from views along the coast, particularly the Aldeburgh and Southwold conservation areas and would result in a discernible reduction in the extent of disturbance of potentially archaeologically significant sediments and remains.

2.17.24. A protocol for reporting of any finds during dredging or construction activity in the offshore zone will be put in place, in accordance with Historic England guidance.

c) Preliminary assessment of effects

i) Construction

2.17.25. It is possible that elements of the BLF in the intertidal zone would disturb archaeological features within the beach; these would be restricted to disturbance of partly dismantled WWII anti-invasion obstacles which would not give rise to a significant adverse effect.

2.17.26. The pile structure of the BLF would impact upon the organic freshwater and marine deposits beneath the beach and seabed in this area that have palaeoenvironmental potential. Similar organic deposits have also been identified around some of the proposed intake headworks. Any disturbance would be of limited magnitude and would not give rise to a significant adverse effect.

2.17.27. Localised dredging associated with the cooling water, CDO and FRR headworks, and the BLF approach could lead to the disturbance of material within the relatively recent and mobile marine sediments. While the potential for archaeological remains to be present cannot be excluded, there are no known wrecks located within these areas, and it is likely that any remains would represent fragments of wrecks which have broken up or been partially recovered. Any such remains could be archaeologically recorded through the adoption of a finds reporting protocol and this effect would not be significant.

2.17.28. Change to historic seascape character has been considered. The Southwold to Clacton HSC identifies the main development site as within the Sizewell power stations HSC sub-area of the Southwold HSC area. The character of the Sizewell power stations HSC sub-area is defined by the presence of the existing power stations, which provide dominant and clearly visible elements of the existing historic seascape. Construction activities would therefore be perceived as elements of the existing industrial use of the character area and would not give rise to a significant adverse effect.

ii) Operation

2.17.29. In that any disturbance of archaeological heritage assets within the site would have occurred, and been effectively mitigated, during the construction of the proposed development, no direct effects on heritage assets within the main development site offshore zone are anticipated during the operation of the proposed development.

2.17.30. Localised scour associated with the cooling water headworks and BLF could lead to some seabed erosion, but it is not anticipated that this will impact upon any archaeological sites within the area, with the known wreck sites north of the BLF positioned upstream of the current flow direction.

d) Additional mitigation and monitoring

2.17.31. Further geoarchaeological investigations of the deposits impacted by the BLF and cooling water headwork installations would be undertaken through the analysis of core material from these locations. Academic publication and popular dissemination of the results would allow any informative and historic value to be fully realised.

e) Preliminary assessment of residual effects

2.17.32. The loss of archaeological interest through material disturbance would be minimal and not significant. The BLF and northernmost headworks for the cooling water intake and outfall tunnels will have a small footprint impacting upon the underlying deposits of palaeoenvironmental interest, with the majority of the deposits remaining in situ. The headworks for the CDO, FRR and southernmost cooling water tunnel would affect sediments which are of limited archaeological potential.

f) Completing the assessment

2.17.33. Once the proposals for the proposed development as a whole are finalised, a full archaeological assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant direct effects.

Table 2.17.1 Summary of effects for the construction phase

Marine historic environment

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Disturbance of remains of WWII anti-invasion defences.	Disturbance or removal of elements of beach scaffolding during the construction of the BLF.	None	Not significant	Agreed written scheme of archaeological investigation to ensure that the archaeological interest of any significant deposits and features could be appropriately investigated, recorded and disseminated.	Not significant
Disturbance of deposits of palaeoenvironmental and geoarchaeological interest.	Disturbance by construction of the BLF.	Piling represents a foundation design that causes minimal disturbance of extensive deposits.	Not significant	These deposits represent an extension of the deposits that will be intensively investigated within the terrestrial main development site.	Not significant
Disturbance of previously unrecorded archaeological material on the sea bed.	Disturbance by localised dredging for the BLF, cooling water intakes/ outlets.	A protocol for reporting finds during dredging will be put in place.	Not significant	None	Not significant
Change to historic seascape character.	Visibility of construction activities in views of and from the coast.	None	Not significant	None	Not significant

Table 2.17.2 Summary of effects for the operational phase

Marine historic environment

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Change to historic seascape character.	Visibility of proposed development in views of and from the coast.	None	Not significant	None	Not significant

2.18. Marine navigation

2.18.1. The figures for marine navigation are presented in **Volume 3** as **Figures 2.18.1** to **2.18.4**.

a) Baseline environment

i) Navigational features

2.18.2. The closest major port to the proposed development is the Port of Lowestoft, located 16nm to the north (Ref. 2.18.1). This is a commercial and fishing port which also acts as a base for offshore supply vessels. It is home to the operations and maintenance base for Greater Gabbard offshore wind farm. Other major ports including Great Yarmouth, Felixstowe and Ipswich, all lie in excess of 20nm from the proposed development (Ref. 2.18.2). A general overview of navigation features is presented in **Figure 2.18.1**.

2.18.3. Southwold anchorage is the closest anchorage area to the proposed development (6nm north). Hallesley Bay (12nm from proposed development) and Sledway (14nm from proposed development) also offer anchorage to vessels further south.

2.18.4. There are no marine aggregate dredging areas within proximity of the proposed development. The closest aggregate dredging areas are production areas located approximately 12-13nm south and 14nm east of the proposed development.

2.18.5. The Sunk traffic separation scheme is located approximately 20nm south of the Sizewell C development. This is established to separate traffic travelling in opposite directions in this busy area of shipping.

2.18.6. Export cables associated with Galloper and Greater Gabbard Offshore Wind Farms (OWF), in addition to the Concerto 1 North telecommunication cable, all lie within 1nm south of the proposed outfall/intake positions.

2.18.7. There are no Ministry of Defence practice or exercise areas within proximity of the proposed development. The closest area lies 18nm south-east of Sizewell C.

2.18.8. The closest operational wind farm relative to the proposed development is the Greater Gabbard OWF, located approximately 18.5nm to the south-east.

ii) Incident data

2.18.9. Incident data recorded by the Marine Accident Investigation Branch (MAIB) and the Royal National Lifeboat Institution (RNLI) between 2005 and 2014 (Ref. 2.18.3, Ref. 2.18.4) was reviewed. A total of 28 incidents were recorded by the MAIB and 263 incidents were recorded by the RNLI within 12nm of the proposed Sizewell C location.

2.18.10. Machinery failure was the most frequently recorded incident type within the data sets. Fishing vessels and other commercial vessels were the most frequently involved in the MAIB data set whilst recreational vessels were the most frequently involved in the RNLI data set.

2.18.11. The two closest incidents to the proposed development recorded in the MAIB data were machinery failures both of which both occurred within 2.5nm. In the RNLI data set, two persons in danger were recorded within 0.4nm of the proposed development. The closest machinery failure incident was recorded approximately 0.6nm east of the Sizewell C location and involved a fishing vessel.

iii) Marine traffic

2.18.12. A total of 28 days of Automatic Identification System (AIS) data was used to inform the baseline shipping analysis. These were taken from shore-based surveys undertaken in August 2016 (14 days summer) and between November/December 2015 (14 days winter). A study area was defined as a 12nm buffer around the proposed development.

2.18.13. Throughout the summer survey period (see **Figure 2.18.2**), there was an average of 61 unique vessels recorded per day within the 12nm study area. Throughout the winter survey period (see **Figure 2.18.3**), there was an average of 28 unique vessels recorded per day within the study area.

2.18.14. The most frequently recorded vessel types in the study area in summer were recreational craft (comprising 34% of all traffic) and in winter cargo vessels (51%). Cargo vessels contributed 25% of summer traffic. Other frequently recorded types include wind farm support vessels, fishing vessels and tankers. Recreational activity was significantly lower in the winter survey period than in summer (approximately 1% of all traffic).

2.18.15. The average vessel lengths recorded in the summer and winter survey periods were 77m and 108m, respectively. The average vessel draughts were 4m and 5m in the summer and winter studies, respectively. These are consistent with the reduction in small craft activity (e.g. recreational) recorded in the area during the winter months.

2.18.16. During the summer months, the cooling water outfall/intake positions are located within an area of higher vessel density due to the abundance of small craft activity close to shore. In contrast, lower density is recorded in the same location during the winter months due to the significantly reduced level of small craft activity. Other high density areas can be attributed to the north/south route, approximately 6nm east of the proposed development, for transient traffic identified in the study area. This main route is utilised by commercial vessels transiting to various ports within the Humber Estuary and Thames Estuary for example. The high traffic levels (commercial ferries and cargo in particular) associated with the Sunk traffic separation scheme located south of the study area is also a highly trafficked area.

Anchoring activity

2.18.17. Anchoring activity was limited within the 12nm study area with only four unique vessels recorded on five separate occasions within the combined survey periods (28 days). The largest vessel was the oil tanker *Levana* with a DWT of 14,999 recorded in November 2015, approximately 6nm north of the cooling water outfall/intake head positions. All anchoring activity was recorded in the winter period. It is noted anchoring activity from smaller vessels such as recreational craft is likely under-represented particularly in the summer period. It is also noted that anchoring will also likely vary based on trade as well as weather and is not likely to be fully represented by 28 days of survey data.

Recreational activity

2.18.18. The majority of recreational vessels (98%) were recorded in the summer survey period. An average of 19 unique vessels was recorded per day within the study area in summer, in comparison to an average of one unique vessel every three days in winter. It is noted that there will be an under-representation of recreational craft in the AIS data set as they are not obligated to carry AIS.

Fishing vessel activity

2.18.19. Throughout the summer survey period, there was an average of six unique fishing vessels per day recorded in the study area. Throughout the winter survey period, there was an average of three unique fishing vessels recorded per day in the study area.

2.18.20. Four unique vessels were recorded operating regularly within 12nm of the proposed development (see **Figure 2.18.4**). One gillnetter was recorded regularly operating inshore of the Sizewell Bank, thus within very close proximity to the proposed development. The other gear types recorded included potters and demersal trawlers.

2.18.21. As noted above, small fishing vessels (less than 15m in length) are likely to be under-represented in the data set as there is no requirement to carry AIS.

b) Environmental design and embedded mitigation

i) Construction

2.18.22. A summary of the mitigation measures that are assumed to be in place prior to the construction phase of the proposed development is provided below:

- Circulation of information via NtMs, Radio Navigational Warnings, NAVTEX, and/or broadcast warnings in advance of and during the offshore works. The notices will include a description of the work being carried out.
- Vessels requirement to comply with International Regulations for the Prevention of Collision at Sea (Ref. 2.18.5) and the International Convention for the Safety of Life at Sea (Ref. 2.18.6).
- A safety zone will be created around the construction activity (i.e. cooling water intake and outfall head structures, BLF), and within the vicinity of the BLF to allow preparation and/or maintenance of the navigational channel for AIL deliveries, and monitored by a guard vessel(s).
- A Fisheries Liaison Officer (FLO) will be in place.

ii) Operation

2.18.23. Mitigation measures assumed to be in place during the operational phase of the proposed development include:

- During AIL deliveries, a temporary safety zone will apply, thereby restricting access to beachfront recreational and fishing activities in immediate area.
- Details of the cooling water outfall/intake headwork positions will be included in fishermen's awareness charts issued by Kingfisher.
- Notice to mariners to identify presence of infrastructure.

c) Preliminary assessment of effects

2.18.24. This section describes the impacts that have been considered during the construction and operational phases, as part of the Formal Safety Assessment process. Navigation impact assessments necessarily use different terminology than EIAs and the terminology is described briefly below.

2.18.25. The impact assessment process has been evaluated using the IMO Formal Safety Assessment Methodology (IMO, 2002). The FSA assigns each impact a 'severity of consequence' and a 'frequency of occurrence' to evaluate the significance of each impact. The frequency of occurrence is assessed on a 5-point scale from negligible to frequent as presented in **Table 2.18.1**.

2.18.26. The severity of the consequences is also assessed on a five-point scale. The defined consequence bands are presented in **Table 2.18.2**.

2.18.27. Following this, the risk level is determined using the risk matrix illustrated in **Table 2.18.3**.

Table 2.18.1 Frequency Bands

Rank	Description
1	Negligible
2	Extremely unlikely
3	Remote
4	Reasonably probable
5	Frequent

Table 2.18.2 Consequence Bands

Rank	People	Property	Environment	Business
1	Zero injury	Zero damage	Zero effect	Zero impact
2	Minor injury	Minor damage	Minor effect	Minor impact
3	Major injury	Moderate damage	Moderate effect	Considerable impact
4	Single fatality	Major damage	Major effect	Major national impact
5	Multiple fatalities	Extensive damage	Extensive effect	Major international impact

Table 2.18.3 Risk Matrix

	Frequency				
Severity rating	1	2	3	4	5
1	Broadly acceptable	Broadly acceptable	Broadly acceptable	Broadly acceptable	Broadly acceptable
2	Broadly acceptable	Broadly acceptable	Broadly acceptable	Tolerable	Tolerable
3	Broadly acceptable	Tolerable	Tolerable	Tolerable	Unacceptable
4	Tolerable	Tolerable	Tolerable	Unacceptable	Unacceptable
5	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable

Broadly Acceptable (low risk) Tolerable (intermediate risk) Unacceptable (high risk)

i) Construction

Increased collision risk (passing vessels & vessels actively fishing with installation vessels)

2.18.28. An increased collision risk is created during the construction phase for all passing traffic, the majority of which is fishing and recreational, due to the presence of vessels associated with the construction of the infrastructure and delivery of AILs. In addition, vessels actively engaged in fishing activities also present an increased collision risk.

2.18.29. Vessels likely to be involved in the construction works include dredgers, crane vessels, a jack-up barge and support vessels. These vessels will have restricted manoeuvrability and therefore may have limited capability in taking avoidance action from a passing vessel on a collision course, should such a situation arise. The duration of dredging works required for the deliveries and installation of headworks is estimated to be 12 weeks each. The placement of the headworks and drilling operations included is intended to be completed in one calendar year.

2.18.30. There is expected to be a total of 120 beach landings between the campaign period of 31 March and 31 October. It is estimated that the number of AIL landings per campaign, accounting for weather downtime, is 30. Therefore, these campaigns are expected to increase the risk for passing vessels.

2.18.31. Three ports are being considered as transhipment facilities for the AIL deliveries including Great Yarmouth, Harwich and the Netherlands (Rotterdam/Vlissingen). Therefore, there is potential for three different routes to be taken during the life of the project.

2.18.32. The collision risk is likely to be greater in higher density shipping areas. This includes coastal areas where a higher level of fishing and recreational activity is carried out. In addition, the north/south route utilised by transiting traffic in the study area is also an area of higher collision risk.

2.18.33. Due to the low number of vessels involved in deliveries relative to the number of vessels transiting within the area between each of the potential transhipment options, the increased risk of collision is not considered to be significant.

2.18.34. It is expected that the majority of vessels in the area will be aware of the construction work before encountering the project vessel(s) through embedded mitigation (circulation of information such as NtMs, Radio Navigation Warnings and NAVTEX).

2.18.35. The frequency of this effect is considered to be Extremely Unlikely, and the overall severity Moderate, resulting in a ranking of Broadly Acceptable.

Increased risk of vessel grounding/foundering

2.18.36. Vessels involved in the AIL deliveries may have an increased risk of grounding or foundering due to the shallow water depths of the surrounding area and reduced under keel clearance due to the cooling water outfall/intake subsea infrastructure. This risk may be increased through avoidance of fishing and recreational activities at the beachfront during AIL deliveries.

2.18.37. Damage may occur to the vessel and outfall/intake structures, as well as having an environmental impact on the beach due to the close proximity. Mitigation such as promulgation of information of cooling water headwork positions and temporary safety zones around BLF will limit risk.

2.18.38. The frequency of this effect is considered to be Extremely Unlikely, and the severity Moderate resulting in a ranking of Broadly Acceptable.

Disruption to fishing and recreational activities

2.18.39. Fishing and recreational activity is observed in the vicinity of the proposed development. One fishing vessel in particular was recorded operating regularly within close proximity to the BLF and cooling water outfall/intake head positions, with another three recorded operating within 1nm of the cooling water outfall/intake head positions. A high level of recreational activity was also observed. Fishing activity was observed during both winter and summer periods, whilst the majority of recreational activity was observed in summer. Therefore, the presence of vessels associated with the construction of the proposed development, may cause a disruption to local fishermen and recreational users.

2.18.40. The impact is likely to be greatest in the higher density areas of fishing and recreational activity, i.e. within waters close to shore. It is expected that embedded mitigation measures such as promulgation of information (including Kingfisher and NtM), and consultation with local fisheries through a FLO could help reduce this disruption.

2.18.41. The frequency of this effect is considered to be Reasonably Probable, and the severity Minor, resulting in a ranking of Tolerable.

ii) Operation

Increased collision risk

2.18.42. Following construction, there will be periodic AIL deliveries scheduled during the life of the project. It is estimated that AILs would occur once every five years and comprise very few individual deliveries.

2.18.43. The frequency of this effect is considered to be Extremely Unlikely, and the overall severity Moderate, resulting in a ranking of Broadly Acceptable.

Increased risk of vessel grounding/foundering

2.18.44. Vessels involved in the periodic AIL deliveries may have an increased risk of grounding or foundering due to the shallow water depths of the surrounding area and reduced under keel clearance due to the cooling water outfall/intake subsea infrastructure. This risk may be increased through avoidance of fishing and recreational activities at the beachfront during AIL deliveries.

2.18.45. Damage may occur to the vessel and outfall/intake structures, as well as having an environmental impact on the beach due to the close proximity. Mitigation such as promulgation of information of cooling water headwork positions and temporary safety zones around BLF will limit risk.

2.18.46. The frequency of this effect is considered to be Extremely Unlikely, and the severity Moderate resulting in a ranking of Broadly Acceptable.

Fishing gear snagging

2.18.47. Fishing vessels carrying demersal gear that interacts with the seabed when deployed pose a snagging risk to subsea infrastructure such as the cooling water intake/outfall heads. If a snagging incident occurs, damage may occur to the infrastructure and/or the gear. Should a snagging occur, it is safest for the gear to be abandoned; however, some vessels have been known to attempt to free their gear. This can result in a loss of stability and potential risk to crew members.

2.18.48. The baseline identifies at least two demersal trawlers operating within proximity to the proposed subsea infrastructure, however, it is again noted vessels under 15m in length are likely under-represented in the area.

2.18.49. The cooling water headwork structures cover a relatively small area of seabed and thus can easily be avoided by vessels actively fishing if locations are known. Embedded mitigation measures such as circulation of information (e.g. NtM) as well as details provided in fishermen's awareness charts issued by Kingfisher, and the locations being marked on nautical charts, will notify fishermen of positions and therefore avoid fishing in close proximity.

2.18.50. The frequency of this impact is considered to be Remote, and the severity Serious, resulting in a ranking of Tolerable.

Risk from vessel anchors

2.18.51. Following the construction of the subsea cooling water intake/outfall heads, there is a risk that an anchored vessel will lose its holding ground, and subsequently drag anchor towards the infrastructure. It is also possible that a vessel suffers engine failure, and thus may drop anchor to avoid drifting into an emergency situation such as collision or grounding. This may occur in the vicinity of the cooling water outfall/intake positions and thus the anchor may come into contact with the subsea infrastructure.

2.18.52. Anchoring activity was observed to be generally low in the baseline analysis, and therefore an anchor dragging event is considered to be low frequency. It is noted anchoring from smaller craft may be under-represented in the baseline analysis; however, these vessels carry smaller anchors which are typically less risk than larger vessel anchors to subsea structures. Due to the design of the headworks, the structure is likely to topple if commercial vessels with larger anchors snag.

2.18.53. A vessel suffering engine failure is only likely to drop anchor if there is immediate danger nearby. This is likely to occur in shallower, coastal waters and thus within proximity to the subsea infrastructure. Review of maritime incidents between 2005 and 2014 (MAIB and RNLI) revealed machinery failure was the most frequently recorded incident type within the area, particularly within coastal waters.

2.18.54. Review of baseline shipping in the area shows the majority of vessels transiting within proximity of the headwork positions are small craft such as fishing and recreational vessels. The main commercial route is located approximately 6nm east of the headwork positions however some cargo vessels were also recorded within 2-4nm.

2.18.55. Embedded mitigation such as circulation of information as well up to date hydrographic charts detailing the location of the subsea structures would prevent vessels anchoring directly over the headworks.

2.18.56. The frequency of either of these effects is considered to be Extremely Unlikely, and the severity estimated to be Moderate, resulting in a ranking of Tolerable.

Third-party vessel foundering

2.18.57. Foundering refers to a vessel losing structural integrity, and subsequently sinking over the cooling water intake/outfall head positions. Areas where fishing and recreational levels are higher generally correspond to areas of higher foundering risk. Higher density of traffic is seen over the cooling water intake/outfall infrastructure in the summer period in particular.

2.18.58. Historically, fishing vessels have been seen to have the greatest risk of foundering, particularly in bad weather. From the baseline analysis, fishing accounted for 10% of traffic in both summer and winter periods. Recreational craft also have a higher risk of foundering compared to larger vessels, and accounted for 34% of traffic in summer. These vessels are the most frequently recorded transiting within proximity of the headwork structures.

2.18.59. Review of maritime incident data (MAIB and RNLI) over ten years between 2005 and 2014 revealed foundering was a low frequency event within the study area (12nm of proposed development).

2.18.60. The frequency of this effect is considered to be Extremely Unlikely, and the severity Moderate, resulting in a ranking of Broadly Acceptable.

d) Additional mitigation and monitoring

2.18.61. Additional mitigation measures that could be in implemented include:

- The subsea infrastructure (cooling water outfall/intake heads) could be clearly marked on nautical charts in line with UKHO standards, with associated note/warning.
- Safety zones may be applied around the outfall/intake headworks.
- Navigation warning installations (e.g. buoys) may also be installed around these headworks.

e) Preliminary assessment of residual effects

2.18.62. The additional mitigation measures presented above will benefit fishing gear snagging and the risk from vessel anchors however the overall ranking remains tolerable.

f) Completing the assessment

2.18.63. Once the proposals for the Sizewell C development as a whole are finalised, a full navigation assessment of the proposals will be undertaken as part of the EIA and the results presented in the ES. The ES will present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 2.18.4 Summary of effects for the construction phase

Marine navigation

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
	Increased collision risk	Circulation of information such as Radio Navigation Warnings and NAVTEX. Compliance with COLREGS. Advisory Safety Zone.	Broadly acceptable	n/a	n/a
	Disruption to fishing & recreational activities	Circulation of information (including Kingfisher awareness charts and NtM). Consultation with local fisheries community.	Tolerable	Navigation warning installations (buoys) around headworks. Infrastructure to be marked on nautical charts.	Tolerable

Table 2.18.5 Summary of effects for the operational phase

Marine navigation

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
	Increased collision risk.	Circulation of information. 500m safety zone.	Broadly acceptable	n/a	n/a
	Increased risk of vessel grounding/foundering.	Circulation of information. 500m safety zone.	Broadly acceptable	n/a	n/a
	Fishing gear snagging.	Kingfisher awareness charts. Circulation of information. Liaison with FLO.	Tolerable	Navigation warning installations (buoys) around headworks. 500m safety zones around the headworks. Infrastructure to be marked on nautical charts.	Tolerable
	Risk from vessel anchors.	Circulation of information. NtM.	Tolerable	Infrastructure to be marked on nautical charts. Navigation warning installations (buoys).	Tolerable
	Vessels foundering.	Circulation of information (including Kingfisher awareness charts and NtM).	Broadly acceptable	n/a	n/a

2.19. Comparison between rail-led and road-led strategies

2.19.1. The layout of the main development site during operation would be the same, irrespective of whether the construction of Sizewell C is based upon a road-led or a rail-led strategy. There are therefore no differences in the environmental effects associated with the operational phase arising from the difference in construction transport strategies. However, the construction layouts and activities do vary between the rail-led and road-led strategies as summarised below and set out in more detail in **Volume 1, Chapter 7**.

Temporary construction area

2.19.2. Under the rail-led strategy, a railway line and associated terminal would be constructed within the temporary construction area (green rail route). This infrastructure would form part of a new branch line off the existing Saxmundham-Leiston line. Earth bunds would be created adjacent to the green rail route and once constructed this terminal would be used to support up to five freight deliveries per day (ten train movements). The junction of the B1122 (Abbey Road) and Lover's Lane would also be relocated.

2.19.3. Under the road-led strategy this infrastructure is not needed.

Land east of Eastlands Industrial Estate

2.19.4. Development at the LEEIE would differ between the road and rail-led strategies as set out in **Table 2.19.1**:

2.19.5. The assessments of construction impacts presented in the chapter in relation to landscape and visual, terrestrial ecology, amenity and recreation, terrestrial historic environment, soils and agriculture, geology and land quality, groundwater, surface water and flood risk are equally valid under both rail-led and road-led strategies. However, there might be slight differences in the impacts associated with the two layouts and activities, for example the layout of the temporary construction area is slightly more congested under a rail-led strategy and there is more likely to be a requirement to include a more substantial retaining structure immediately to the north of the Sizewell Marshes SSSI (see **Volume 1, Chapter 8** for more details). However, at this stage it is considered unlikely that there would be major differences in the significance of effects between the two strategies for these topics.

2.19.6. The traffic and transport assessment presented in the chapter is valid for road traffic under both strategies although there are differences (as noted earlier in the section):

- On a typical day under the road-led strategy, daily traffic volumes on the B1122 are projected to increase by 2,850 vehicles north of the main development site entrance, and by 3,500 vehicles to the south. An additional 600 vehicles per day would travel along Lover's Lane.
- On a typical day under the rail-led strategy, daily traffic volumes on the B1122 are projected to increase by 2,300 vehicles north of the main development site entrance, and by 3,700 vehicles to the south. An additional 450 vehicles per day would travel along Lover's Lane.

2.19.7. There would be no differences in the significance of traffic effects on local roads and similarly the significance of the air quality effects is unlikely to differ. However, the variation in the use of Sizewell Halt (or the LEEIE rail bend) particularly in the duration of use and the number and location of trains between the road-led and rail-led strategies does mean that differences in the significance of adverse noise effects are possible for various receptors in Leiston. Further consideration will be given to these effects in the ongoing EIA as relevant.

Table 2.19.1 Rail works within the main development site, required under rail-led and road-led strategies

Rail works required for a rail-led strategy	Rail works required for a road-led strategy
Two alternative options which would be used in the early years of construction (prior to completion of the green rail route) for up to two freight deliveries per day (four movements): **Option 1: Sizewell Halt** Use of the existing Sizewell Halt rail terminal located south of King George's Avenue. Reconfiguration of the existing railhead in order to accommodate longer trains. An overhead conveyor to transfer freight material back into the LEEIE. OR **Option 2: New rail siding** Construction of a new rail siding adjacent to the existing branch line on the LEEIE.	Two alternative options which would be used throughout the construction period for up to two freight deliveries per day (four movements): **Option 1: Sizewell Halt** Use of the existing Sizewell Halt rail terminal located south of King George's Avenue. Reconfiguration of the existing railhead in order to accommodate longer trains. An overhead conveyor to transfer freight material back into the LEEIE. OR **Option 2: New rail siding** Construction of a new rail siding adjacent to the existing branch line on the LEEIE.

3. Green Rail Route PEI

3.1. Introduction to Preliminary Environmental Information (PEI)

3.1.1. The green rail route is proposed as part of the rail-led strategy only. The proposals for the green rail route are set out in detail in **Volume 1, Chapter 8** and shown on **Figures 8.5** and **8.6**. The route would run from west to east, from Saxmundham Road to Buckleswood Road; Buckleswood Road to B1122 (Abbey Road); and B1122 (Abbey Road) to the main development site.

3.1.2. Provision of the green rail route would require:

- part of Buckleswood Road to be stopped up to vehicular traffic and the construction of a new footbridge connecting the intersected parts of Buckleswood Road or a new level crossing on Buckleswood Road;
- the north-south footpath between Saxmundham Road and Abbey Lane (E-363/003/0) to be diverted across the new railway line via the new Buckleswood Road level crossing or footbridge;
- the construction of a new level crossing where the new railway line crosses the B1122 (Abbey Road); and
- the north-south footpath linking Abbey Lane and Westward Ho (E-363/006/0) to be diverted across the new railway line via the new level crossing on the B1122 (Abbey Road).

3.1.3. It is anticipated that the green rail route line would be privately owned and operated by EDF Energy, with its construction, operation and maintenance being EDF Energy's responsibility. The rail line would be designed and constructed to Network Rail's standards. A maximum train speed of 25 miles per hour (mph) has been assumed along the length of the route, although trains would run at lower speeds on certain sections.

3.1.4. Under the rail-led strategy, the railway line would be constructed early in the construction phase of the project. It is envisaged that construction of the rail infrastructure itself would start at the eastern end and progress westwards, with the main contractor's compound situated at the eastern end (within the main construction area) and a smaller compound at the western end.

3.1.5. Once construction of the Sizewell C development is complete, the green rail route would be removed and the land on which it was located would be restored.

3.1.6. The green rail route is likely to have some effects on the environment during construction, operation and removal and reinstatement. The principal likely significant adverse and beneficial effects are explained below.

3.1.7. This chapter presents each of the topics relevant to the site in turn, under the following sub-headings: (a) Baseline Environment, (b) Environmental design and embedded mitigation, (c) Preliminary assessment of effects, (d) Additional mitigation and monitoring, (e) Preliminary assessment of residual effects and (f) Completing the assessment.

3.2. Landscape and visual

3.2.1. The figure for landscape and visual is presented in **Volume 3** as **Figure 3.2.1**.

a) Baseline environment

3.2.2. The land use within the study area selected for the landscape and visual impact assessment (LVIA) of two kilometres (km) from the site boundary is predominantly arable farmland, with well-defined hedgerow field boundaries and interspersed with scattered woodlands and copses. The site itself is in arable use and comprises several adjoining fields, with a total area of approximately 21.8 hectares (ha). The site boundary and rail route extension would extend in a north-eastwards direction, from Saxmundham Road to Abbey Road (at the intersection of Lover's Lane).

3.2.3. The northern boundary of the site follows Abbey Lane, which has a hedgerow containing mature trees along its length. Part of the eastern boundary follows Abbey Road, which has a less defined hedgerow along it, with a further stretch of the hedgerow following the garden boundaries of properties along Abbey Road and continuing westwards along an existing field boundary hedgerow. Part of the southern boundary of the site follows the Saxmundham to Leiston railway branch line, which has vegetation predominantly along its northern edge. Part of the site boundary towards the south-west also follows Buckleswood Road, which is lined by hedgerows and small woodland blocks. The remainder of the boundaries of the site do not follow any features currently defined on the ground.

3.2.4. As the site runs across a number of existing fields, the route would cut across existing hedgerows and close to existing small woodlands or copses. Some of these would need to be removed, fully or partially, as part of the proposed works. Footpaths that run across these fields would also need to be diverted for the duration of the works, as discussed further in **section 3.4**.

3.2.5. The topography of the site slopes steadily from west to east. The land just to the west of Abbey Road is undulating and the gradient is more than 1% in places and a cutting would be required to accommodate the rail route extension.

3.2.6. At a national level, the site and much of the study area are situated within National Character Area 82 (NCA82): South Coast and Heaths (Ref. 3.2.1). NCA82 shows characteristics of gently undulating farmland with areas of woodland and forest plantation in the surrounding area. To the west the study area begins to transition into NCA83: South Norfolk and High Suffolk Claylands.

3.2.7. At a local level, the site is located in the 'Ancient Estate Claylands' landscape character type, as identified in the Suffolk County Landscape Character Assessment (Ref. 3.2.2), with the north-eastern corner of the site located within the 'estate sandlands' landscape character type. The 'Ancient Estate Claylands', as shown on **Figure 3.2.1**, is an ancient wooded landscape of arable farms, associated with low lying valley floors and undulating glacial plateaus. The key characteristics are described in the Landscape Character Assessment as:

- *"Dissected Boulder Clay plateau;*
- *Organic pattern of field enclosures;*
- *Straight boundaries where influence of privately owned estates is strongest;*
- *Enclosed former greens and commons;*
- *Parklands;*
- *WWII airfields;*
- *Villages with dispersed hamlets and farmsteads;*
- *Timber framed buildings;*
- *Distinctive estate cottages; and*
- *Ancient semi-natural woodland".*

3.2.8. The 'estate sandlands' landscape character type, as shown on **Figure 3.2.1**, is a flat or very gently rolling landscape of sandy soils covering the Brecks and parts of the Suffolk coast. The site is less characteristic of this character type, but the key characteristics are described in the Landscape Character Assessment as:

- *"Flat or very gently rolling plateaux of free-draining sandy soils, overlying drift deposits of either glacial or fluvial origin;*
- *Chalky in parts of the Brecks, but uniformly acid and sandy in the south-east;*
- *Absence of watercourses;*
- *Extensive areas of heathland or acid grassland;*
- *Strongly geometric structure of fields enclosed in the 18^{th} & 19^{th} century;*
- *Large continuous blocks of commercial forestry;*

- *Characteristic 'pine lines' especially, but not solely, in the Brecks;*
- *Widespread planting of tree belts and rectilinear plantations;*
- *Generally a landscape without ancient woodland, but there are some isolated and very significant exceptions;*
- *High incidence of relatively late, estate type, brick buildings;*
- *North-west slate roofs with white or yellow bricks. Flint is also widely used as a walling material; and*
- *On the coast red brick with pan-tiled roofs, often black-glazed".*

3.2.9. The locations of different groups of people within the 2km study area who may experience views of the green rail route are shown on **Figure 3.2.1**. The key visual receptors within the study area include the following:

- The settlements of Leiston, Theberton, Aldringham, Coldfair Green and Knodishall. Viewpoints will be provided on the western edge of Leiston in the final Environmental Impact Assessment (EIA).
- Transport routes including the B1122 to the north and east, the B1119 to the south and the existing Saxmundham to Leiston branch line to the south. Viewpoints will be provided from the B1122 and adjacent to the railway line in the final EIA.
- Recreational routes including three footpaths crossing the site; Sustrans Regional Cycle Route (41/42) and Suffolk Coastal Cycle Route follow the same alignment, running in a north-east/south-west direction along Abbey Road, past Leiston Abbey and along Abbey Lane adjacent to the northern boundary of the site (east of Aldhurst Farm); a bridleway to the east of the site, which runs in an east to west direction from the B1122 Abbey Road along Lover's Lane; and a section of the Sandlings Walk located approximately 800m to the north-east of the site. Viewpoints will be provided from the public footpaths that cross the site in the final EIA.
- Dispersed farmsteads, with the closest residential properties being along Abbey Lane to the west; along Saxmundham Road to the south; and near Leiston Abbey to the north. Viewpoints will be provided from Leiston Abbey, adjacent to Fisher's Farm and adjacent to Aldhurst Farm in the final EIA.

3.2.10. Visibility from many of these locations is likely to be limited due to a combination of landform, woodland and established hedgerows. In most cases, visibility is likely to be limited to approximately 500m to the east and west of the site due to the presence of existing mature vegetation, intermittently up to approximately 1km to the south-west where the landscape is more open and approximately 800m to the north around Leiston Abbey.

3.2.11. The Suffolk Coasts and Heaths Area of Outstanding Natural Beauty (AONB) is located approximately 800m to the east of the green rail route. It covers a band along the eastern edge of the study area.

3.2.12. Locally designated landscapes cover the Minsmere River valley 600m north-east and the Hundred River valley 1.9km south. These are referred to as Special Landscape Areas (SLAs), and cover relatively small parts of the study area.

b) Environmental design and embedded mitigation

3.2.13. A number of mitigation measures have been identified and incorporated into the design for both the construction and operation phase of the green rail route, which would help to manage and reduce potential environmental effects. These include the following:

- Existing woodlands, scrub and hedgerows within the site and adjoining the site boundaries would be retained, except for sections where the rail route crosses Buckleswood Road, the B1122, and three other field boundaries which would be removed.Grassed bunding would be created along the length of the north side of the rail line, and south of the rail line at its eastern end, and sections of the route would be within cuttings which would provide some screening.
- Three Public Rights of Way (PRoWs) (all footpaths – E-363/003/0, E-363/006/0 and E-363/010/0) would be diverted for the construction and operation of the rail route. These would not be stopped or curtailed, and the establishment of safe crossings over the rail route would be provided.
- Any effects on residential amenity would be mitigated via planting as appropriate to each case as part of the embedded landscape proposals.
- When the rail route extension is removed the footpath diversions would no longer be required, and they would be returned to their original state.

c) Preliminary assessment of effects

i) Construction

3.2.14. During construction, there would be a localised change to the landscape character of the green rail route corridor and its immediate context. There would also be localised visual effects for users of roads, footpaths and bridleways in close proximity to the site. Given the short-term duration of these effects, it is unlikely that they would be significant.

ii) Operation

3.2.15. During operation, there would be a localised effect on the character of the landscape within the site, arising from the change from arable fields to a stretch of railway line with associated earthworks and infrastructure. The proposed mounding along the sides of the track would also create a change to the gently undulating nature of the site at present. Effects would be significant and adverse but temporary in nature.

3.2.16. Beyond the site boundaries, effects on landscape character would rapidly reduce. Beyond the boundaries created by Abbey Lane, Abbey Road, the northern edge of Leiston and Saxmundham Road, effects on landscape character would have reduced so that they are not significant. The key characteristics of the surrounding landscape would be largely unchanged beyond this area.

3.2.17. Desk and field study has confirmed that the green rail route would not be visible from Theberton, Aldringham, Coldfair Green and Knodishall due to a combination of intervening settlement, landform and vegetation. The green rail route may be visible from properties on the northern edge of Leiston, along Abbey Road and Buckleswood Road. Although the edge of Leiston is generally well-enclosed by boundary vegetation, there may be filtered views of the taller elements of the green rail route (such as gantries and overbridges), over and above intervening field boundaries. There are unlikely to be any significant visual effects for residents of or visitors to any settlements.

3.2.18. For users of roads in the surrounding area, there are likely to be views of the green rail route from the B1122 to the east of the site, as it passes the eastern end of the proposed rail route. Further north and south along the road, a combination of existing vegetation and buildings would prevent views towards the proposed route. Views from the B1119 to the south are likely to be limited due to intervening vegetation and buildings. From the existing Saxmundham to Leiston branch line to the south, views for passengers are likely to be limited to the stretch where the new route would branch off and run north-eastwards, due to the direction the trains would travel. Given the relatively limited extent of visibility from these routes, there are unlikely to be any significant visual effects for users of any of the existing routes.

3.2.19. There would be direct effects on users of the three footpaths that currently cross the site (E-363/003/0, E-363/006/0 and E-363/010/0). All routes would be diverted for the duration of the operation of the proposed rail route, with the most southerly route (E-363/003/0) diverted over a new footbridge and the two more northerly routes diverted to Abbey Road and over a new level crossing over the proposed rail route. For all of these routes, views would be changed for the full extent of where they cross the fields immediately surrounding the site. This is likely to result in localised significant visual effects for users of the footpaths.

3.2.20. For all other recreational routes in the vicinity of the site, including Sustrans Regional Cycle Route (41/42) and the Suffolk Coastal Cycle Route; the bridleway to the east of the site; and the section of the Sandlings Walk 800m to the north-east, views of the site itself would be largely screened by intervening vegetation. Additional screening would be provided by the temporary mounding along the proposed rail route. There are unlikely to be any significant visual effects for users of these routes.

3.2.21. The green rail route may be visible from a limited number of properties near to the route, including the closest individual properties to the south and west, along Abbey Lane and Saxmundham Road. From Leiston Abbey there are likely to be glimpsed views of parts of the proposed railway line from elevated areas within the Abbey, over and through intervening vegetation.

3.2.22. The green rail route is unlikely to be visible from either the Suffolk Coasts and Heaths Area of Outstanding Natural Beauty or from any Special Landscape Areas. There are unlikely to be any significant effects on the special qualities of the designated landscapes, or the purposes for their designation.

iii) Removal and reinstatement

3.2.23. During restoration of the land back to agricultural use, the track, perimeter earth bunds and temporary landscaping would be removed, and the landscape and visual impacts experienced would be very similar to those of the construction phase. Given the temporary duration of these effects, they are unlikely to be significant.

iv) Additional mitigation and monitoring

3.2.24. The preliminary assessment of effects presented above identifies potential significant effects on the landscape character of the site and its immediate surroundings during operation, as well as for users of localised stretches of the PRoWs that cross the site.

3.2.25. The localised effects on landscape character are unlikely to be able to be mitigated by any additional mitigation measures as there will remain a fundamental change in the character of the site and its immediate surroundings.

v) Preliminary assessment of residual effects

3.2.26. During the operational stage of the green rail route, it is considered that there will be significant residual effects on the character of the landscape within and immediately around the site. There are also likely to be significant residual localised effects for users of the public footpaths that currently cross the site.

vi) Completing the assessment

3.2.27. The Environmental Statement (ES) will present a full LVIA underpinning the conclusions drawn above in relation to significant effects, updated where relevant to account for any design changes. It will utilise the methodology, study area and viewpoint locations previously discussed with stakeholders.

Table 3.2.1 Summary of effects for construction phase

Landscape and visual

Topic/ receptor	Potential impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Landscape character.	Changes to landscape character and landscape features within the site and surrounding landscape.	None required.	Not significant.	None required.	Not significant.
Visual receptors.	Changes to views for users of roads, footpaths and bridleways in close proximity to the site.	None required.	Not significant.	None required.	Not significant.

Table 3.2.2 Summary of effects for operational phase

Landscape and visual

Topic/ receptor	Potential impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Landscape character within the site and its immediate context.	Changes to landscape character and landscape features along the route.	Retention of established vegetation. Introduction of appropriate landscape proposals.	Significant	None	Significant
Landscape character beyond the boundaries created by Abbey Lane, Abbey Road, the northern edge of Leiston and Saxmundham Road.	Changes to landscape character and key characteristics within the surrounding landscape.	None required.	Not significant.	None required.	Not significant.
Users of footpaths that cross or immediately adjoin the site, for short stretches.	Views of new stretch of railway line with associated earthworks and infrastructure, and proposed mounding along the track.	Retention of established vegetation. Introduction of appropriate landscape proposals.	Significant	None	Significant
Other visual receptors.	Changes to views for local residents and users of roads, other footpaths and bridleways in close proximity to the site.	None required.	Not significant.	None required.	Not significant.

Table 3.2.3 Summary of effects for removal and instatement phase

Landscape and visual

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Landscape character.	Changes to landscape character and landscape features within the site and surrounding landscape.	None required.	Not significant.	None required.	Not significant.
Visual receptors.	Changes to views for users of roads, footpaths and bridleways in close proximity to the site.	None required.	Not significant.	None required.	Not significant.

3.3. Terrestrial ecology and ornithology

3.3.1. The figures for terrestrial ecology and ornithology are presented in **Volume 3** as **Figures 3.3.1** and **3.3.2**.

a) Baseline environment

3.3.2. There are two statutory designated sites of nature conservation importance within 2km of the green rail route corridor, these being Sizewell Marshes Site of Special Scientific Interest (SSSI) (930m east) and Minsmere to Walberswick Heaths and Marshes SAC, Special Protection Area (SPA), Ramsar site and SSSI (2.29km north-east). A further three sites are within 5km: Leiston to Aldeburgh SSSI (2.2km south-east at the nearest point); Sandlings SPA (2.2km south-east) and Outer Thames Estuary SPA (3km east). Three non-statutory designated Country Wildlife Sites (CWSs) are within 2km of the green rail route corridor: Buckle's Wood CWS (adjacent to the western boundary of the green rail route corridor), Sizewell Levels and Associated Areas CWS (750m to the east) and Leiston Common CWS (1.3km south-east). Other than Sizewell Marshes SSSI, Buckle's Wood CWS and Sizewell Levels and Associated Areas CWS, statutory and non-statutory designated sites have been scoped out of further assessment given the distance of the other sites from the green rail route corridor and the lack of impact pathways.

3.3.3. The green rail route corridor comprises predominantly intensively managed arable fields with no scarce arable weeds or other notable plant species recorded within the red line boundary. The fields are bounded by fences and hedgerows, with the majority of the hedgerows present being species-poor with large gaps. Hedgerows are a habitat of Principal Importance[1]. Three of the hedgerows support a diverse mix of shrub species including elm (*Ulmus sp.*), hawthorn (*Crataegus monogyna*) and field maple (*Acer campestre*) and are classified as 'important' (Ref. 3.3.1, Schedule 1 Part II).

3.3.4. Several blocks of lowland mixed deciduous woodland (a habitat of Principal Importance (Ref. 3.3.2, section 41)) are present within the vicinity. Buckle's Wood CWS is ancient semi-natural woodland located adjacent to the green rail route corridor and is approximately 4.3ha in extent. A small, broadleaved copse, 0.1ha in extent is located immediately east of Buckle's Wood CWS on the opposite side of Buckleswood Lane, the lane separating the two areas. A further small copse, 0.4ha in extent, is located approximately 150m east of the green rail route corridor, located in the middle of a large arable field to the north of Buckleswood Lane.

3.3.5. There are records of several notable, and/or legally protected, invertebrate species within 2km of the site but there are no records of these from within or adjacent to the green rail route corridor.

3.3.6. There are 33 ponds within 500m of the green rail route corridor, of which 14 were found to have historic potential for great crested newts (*Triturus cristatus*)[2]. The presence of great crested newts was confirmed in 12 of these ponds during 2011-2014 and as great crested newts have been found throughout the area they are likely to form a single 'meta-population'. Although the majority of the green rail route corridor is arable fields of limited suitability for foraging great crested newts, the field margins, hedgerows and blocks of woodland are likely to provide suitable foraging habitat and hibernation features, whilst hedgerows and associated margins provide connectivity between breeding ponds and woodland blocks.

3.3.7. Both grass snake (*Natrix natrix*) and common lizard (*Zootoca vivipara*) have been recorded within 200m of green rail route corridor. Suitable habitat for reptiles is generally restricted to arable margins and the majority of the green rail route corridor is considered sub-optimal for reptiles.

3.3.8. Six bird species listed on Schedule 1 of the Wildlife and Countryside Act[3] have been recorded within 2km of the green rail route corridor although none of these species were recorded during breeding and wintering bird surveys of the site.

3.3.9. During breeding bird surveys, no Schedule 1 species were recorded; however, six species of Principal Importance[3] were recorded, these being: herring gull (*Larus argentatus*), skylark (*Passer domesticus*), song thrush (*Turdus philomelos*), yellowhammer (*Emberiza citronella*), dunnock (*Prunella modularis*) and bullfinch (*Pyrrhula pyrrhula*). Herring gulls forage widely over large areas and do not breed within the red line boundary. The other species recorded are typical of intensively managed arable areas.

[1] Species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

[2] Great crested newts are a European Protected Species (EPS), receiving protection under the Conservation of Habitats and Species Regulations (2017) (Ref. 3.3.3). They are also protected under the Wildlife and Countryside Act 1981 (Ref. 3.3.4) and are a species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

[3] All wild birds, their eggs and nests are protected under Section 1 of the Wildlife and Countryside Act 1981. Certain species are also listed on Schedule 1 of the Wildlife and Countryside Act 1981, which affords them extra protection against disturbance whilst nesting.

3.3.10. Three species listed on Schedule 1 were recorded during the winter bird surveys. There were peregrine (*Falco peregrinus*), fieldfare (*Turdus pilaris*) and redwing (*Turdus iliacus*). Redwing and fieldfare are widespread winter visitors that utilise hedgerow and woodland for foraging and are included on Schedule 1 due to the rarity of breeding within the UK. Peregrines nest on the Sizewell A and B Stations and the habitat within the green rail route corridor is likely to form part of their extensive foraging territory.

3.3.11. Another eight species of Principal Importance were recorded during winter bird surveys, these being: herring gull, house sparrow (*Passer domesticus*), lapwing (*Vanellus vanellus*), skylark, song thrush, starling (*Sturnus vulgaris*), yellowhammer and dunnock. All of the species recorded during the winter months are considered to be using the green rail route site as part of a larger winter foraging resource.

3.3.12. A maternity roost of Natterer's bats[4] (*Myotis nattereri*) was identified in 2011 at Leiston Abbey, approximately 300m north of the red line boundary, and a common pipistrelle (*Pipistrellus pipistrellus*) maternity roost was identified in 2011 in Gypsy Lodge, located approximately 360m to the west of the green rail route corridor. In addition, the level and timing of soprano pipistrelle (*Pipistrellus pygmaeus*) activity during the same surveys was considered indicative of the presence of a soprano pipistrelle roost in close proximity. The bat activity surveys did not suggest that the habitat within the green rail route corridor was of critical importance for foraging bats using the identified roosts.

3.3.13. Areas of woodland, hedgerows and scattered mature trees within and adjacent to the green rail route corridor are considered to have some potential for roosting bats. Surveys identified 16 trees with bat roost potential and of these, ten trees were of high potential, three were of medium potential, and three were of low potential.

3.3.14. During the bat activity surveys, up to ten species of bat were recorded, with the most frequently recorded species being common pipistrelle and soprano pipistrelle. All other species (barbastelle (*Barbastellus barbastellus*) serotine (*Eptesicus serotinus*), Natterer's bat, noctule (*Nyctalus noctula*), Nathusius pipistrelle (*Pipistrellus nathusii*), *Myotis* spp, big bat[5] and brown long-eared bat[6] (*Plecotus auratus*)) were recorded at very low levels of activity. The surveys did not suggest that the habitats within the footprint of the green rail route corridor are of critical importance to foraging bats and abundant similar habitats are present within the local vicinity.

3.3.15. There are records of European otter[7] (*Lutra lutra*), badger[8] (*Meles meles*), Western European hedgehog (*Erinaceus europaeus*), brown hare (*Lepus europaeus*), water shrew (*Neomys fodiens*), water vole[9] (*Arvicola terrestris*) and harvest mouse (*Micromys minutus*) within 2km of the green rail route corridor. There are no records of these species within the green rail route corridor itself although water shrew has been recorded in Buckle's Wood CWS.

b) Environmental design and embedded mitigation

i) Construction

3.3.16. A summary of the measures that have been incorporated into the design of the green rail route corridor and that would protect the existing features of ecological interest during construction is set out below:

- Buckle's Wood CWS would be retained in its entirety.
- The majority of hedgerows would be retained and only four small sections of defunct, species-poor hedgerow and one section of species-rich 'important' hedgerow would be removed and there would therefore be only limited direct loss of hedgerow habitat.
- The Construction Environmental Management Plan (CEMP) would define any ecological constraints and specify any measures required during enabling works and construction in relation to the presence of protected species and any required vegetation clearance works. The CEMP and the lighting strategy would also define measures to control lighting (see below).
- Temporary construction lighting would be designed to prevent spill to surrounding habitats. These measures would minimise impacts on nocturnal species such as bats that may use the nearby tree lines or habitats for roosting or foraging.

[4] All species of bat in the UK are EPSs, receiving protection under the Conservation of Habitats and Species Regulations (2017). They are also protected under the Wildlife and Countryside Act 1981. Several bat species, including soprano pipistrelle, brown long-eared bat, noctule and barbastelle bat are species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006). Barbastelle bats are also listed in the European Commission (EC) Habitats Directive (1992) (Ref. 3.3.5, Annex II), requiring the establishment of SACs to conserve this species..

[5] Big bat is a group classification consisting of noctule, Leisler's bat and serotine. These species are often grouped due to the similarities and overlapping characteristics of their echolocation calls making species-specific identifications difficult and unreliable.

[6] All long-eared bat recordings are considered to relate to brown long-eared bat echolocation calls due to the absence of grey long-eared bat from Suffolk based on their current known distribution and Suffolk Bat Group.

[7] Otter is an EPS, receiving protection under the Conservation of Habitats and Species Regulations (2017). Otter are also protected under the Wildlife and Countryside Act 1981 and are a species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006). [8] Badgers are protected under the Protection of Badgers Act (1992) (Ref. 3.3.6).

[8] Otter is an EPS, receiving protection under the Conservation of Habitats and Species Regulations (2017). Otter are also protected under the Wildlife and Countryside Act 1981 and are a species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

[9] The water vole is protected under Schedule 5 of the Wildlife and Countryside Act 1981 and is included within Section 41 of the NERC Act (2006).

- Measures outlined within the CEMP would be overseen by an Environmental Clerk of Works who would also brief construction staff concerning the legal protection and sensitivities afforded to both great crested newts and bat species.

ii) Operation

3.3.17. A summary of the measures that have been incorporated into the design and that would protect the existing features of ecological interest during operation are set out below:

- Grassed earthwork bunds and topsoil storage areas, approximately 3m in height, would be located along the western margin of the rail corridor and would help screen the adjacent landscape.

- Operational lighting would be limited to the level crossing on Abbey Road. The lighting design would comply with the lighting strategy and use light fittings chosen to limit stray light. These measures would minimise impacts on nocturnal species such as bats that may use the nearby tree lines or habitats for roosting or foraging.

- Soft landscaping would be maintained for the lifetime of the green rail route before being removed when the agricultural use is reinstated.

iii) Removal and reinstatement

3.3.18. No additional embedded mitigation is proposed.

c) Preliminary assessment of effects

3.3.19. Given the embedded mitigation measures proposed, this preliminary assessment only considers the habitats and species for which significant effects are considered likely to occur. Where no significant effects are considered likely they are not considered further in the paragraphs below but are summarised in **Table 3.3.1** and will be described within the ES as appropriate.

3.3.20. Despite the embedded mitigation measures included within the design, the potential for significant effects on bats and great crested newts cannot be excluded and these effects are considered further below.

i) Construction

3.3.21. The construction of the green rail route would result in the temporary loss of arable land and four small sections of defunct, species-poor hedgerow and one section of species-rich 'important' hedgerow. Most of the habitat that would be lost is arable land, which is of low value for foraging great crested newts. The construction phase would also cause temporary severance of a number of hedgerows, which would reduce the availability for foraging and hibernation habitat. Construction works could also affect great crested newts through incidental injury or mortality. Overall, great crested newts are likely to experience a significant adverse effect at the local level from the combination of habitat loss, habitat severance, and incidental mortality.

3.3.22. The construction phase would also lead to the loss of up to 16 trees with the potential to support roosting bats. Foraging bats use arable areas within the red line to a limited extent, but the hedgerows may be used as linear features along which bats commute or forage. The loss of the trees and other habitats are not considered to be significant due to the presence of extensive areas of alternative habitat of at least the same quality in the surrounding area. Bats may also be temporarily affected by construction noise and lighting although given that the bats using the green rail route corridor are not considered to be dependent on the sub-optimal habitats present, the effect of noise and lighting on the bat assemblage during construction would not be significant.

ii) Operation

3.3.23. During operation, the railway would not have a significant effect on great crested newts. The species is regularly encountered on both sides of operational rail infrastructure and railway lines do not present major barriers to the movement and dispersal of the species.

3.3.24. While disturbance caused by the increased lighting and noise levels of the operational railway could potentially deter bats from foraging, given the small number of trains expected at night, the primary mitigation embedded in the design, and the fact that the rail line itself would be unlit, no major effects are expected on neighbouring habitats. No significant adverse effects on the bat assemblage are anticipated as a result of light or noise generated by the operation of the green rail route.

iii) Removal and reinstatement

3.3.25. The green rail route including rail infrastructure, railway ballast, topsoil bunding and any hard standing would be removed and the rail corridor returned to agricultural use. Railway ballast provides potentially suitable hibernating habitat for great crested newts and removal of this ballast could lead to incidental mortality of this species, which could have a significant adverse effect. In addition, the restoration phase would have many of the same effects as construction such as incidental injury or mortality from being run over by vehicles. However, restoration and reinstatement of habitats, such as hedgerows, would re-establish habitat connectivity for this species, leading to an overall no significant effect on great crested newts during the post-operational phase.

d) Additional mitigation and monitoring

3.3.26. The assessment has identified a limited potential for significant effects to occur if great crested newts or bats are present despite the embedded mitigation measures. Additional mitigation measures may therefore be required to minimise impacts so that significant effects are avoided. Furthermore, additional mitigation measures may also be required in relation to habitats and species for which a significant effect is not anticipated, but which are nonetheless legally protected, to ensure compliance with the legislation. Under the CEMP, pre-construction surveys will be required and may result in mitigation measures such as micro-siting of specific elements of the project and/or licences for protected species. Monitoring of mitigation measures may also be required to ensure its effectiveness. These measures will be presented in the ES if required.

i) Construction

3.3.27. Works affecting great crested newts would be carried out under a licence from Natural England, following agreement with Natural England on an appropriate mitigation strategy. Mitigation could include provision of new ponds and foraging habitat or compensation measures that are of benefit to great crested newts in the wider landscape.

3.3.28. The sections of hedgerow to be removed would be cleared outside of the amphibian hibernation period (October to February inclusive). If this is not possible, vegetation would be cut to the ground (to remove potential bird nesting habitat), but the roots would remain intact until hibernation is complete. The root system of vegetation would then be removed once the great crested newt hibernation season is over.

3.3.29. Felling of trees with bat potential would be undertaken in September/October, to avoid the maternity and hibernation periods during which bats are more vulnerable to disturbance as well as avoiding the bird-nesting season. Tree inspections would be undertaken sufficiently in advance of tree felling to enable Natural England licence application(s) to be submitted with the application for development consent as required. A final inspection of these trees would be undertaken as close to the timing of felling as possible to take into account the regular roost-switching behaviour displayed by tree-roosting bat species. Should bats be identified using these trees at this time, the mitigation strategies laid out in the licence application(s) would be implemented.

3.3.30. Although no signs of occupation by badgers were identified during baseline surveys, there is limited potential for badgers to enter the green rail route corridor during construction or for new setts to be excavated within the earthwork bunds. Appropriate measures to safeguard badgers would be outlined within the CEMP.

ii) Operation

3.3.31. An ecological watching brief of the earthworks would be undertaken to monitor for any signs of badger activity. No other mitigation during the operational phase is envisioned.

iii) Removal and reinstatement

3.3.32. The removal of the railway ballast could potentially affect great crested newts (and reptiles) and the works would be carried out under a licence from Natural England, following agreement on an appropriate mitigation strategy with Natural England. Mitigation would involve considerate timing of works, such as removal of the railway ballast outside of amphibian and reptile hibernation period (October to February inclusive). Other measures would include reinstating habitats to their original state prior to construction, such as the replanting of hedgerows.

3.3.33. Prior to restoration, a walkover of the site would be conducted to confirm the presence/absence of any new badger setts within or adjacent to where works would be conducted. Should any setts require closure or would be disturbed, all works would need to be conducted in accordance with a licence from Natural England.

3.3.34. Hedgerows would be replanted on a like-for-like basis to replace those lost at the start of construction and to return the site to its pre-construction condition.

e) Preliminary assessment of residual effects

3.3.35. No significant residual effects on great crested newt populations or any other protected species groups or habitats are expected for any phase of the green rail route. The measures described above would ensure that any potential for significant effects is removed and the additional mitigation measures described would ensure protected species obligations, particularly in relation to great crested newts, are met.

f) Completing the assessment

3.3.36. The ES will present the full assessment underpinning the conclusions drawn in relation to the significance of effects. Any further embedded mitigation measures which would be required to mitigate these effects would also be defined and incorporated into the design.

3.3.37. New licensing policies were introduced by Natural England in 2016 and a district licensing approach is being rolled out nationally. Great crested newt mitigation and licensing requirements are therefore subject to change and the approach to mitigation will be reviewed in further detail in the ES.

Table 3.3.1 Summary of effects for construction phase

Terrestrial ecology and ornithology

Topic/ receptor	Potential impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
European and nationally designated sites: Sizewell Marshes SSSI.	Changes in air quality. Changes in water quality, hydrology and hydrogeology.	Appropriate air and surface water control and chemical management outlined in the CEMP.	Not significant.	None required.	Not significant.
Other European and nationally designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Non-statutory designated sites: Buckle's Wood CWS & Sizewell Levels and Associated Areas CWS.	Changes in air quality. Changes in water quality, hydrology and hydrogeology.	Appropriate air and surface water control and chemical management outlined in the CEMP.	Not significant.	None required.	Not significant.
Other non-statutory designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Hedgerows	Habitat loss.	None required, area lost not considered significant.	Not significant.	None required.	Not significant.
Great crested newts.	Habitat loss and severance; and incidental injury and mortality.	Retention of woodland blocks and, where possible, hedgerows. Measures for great crested newt mitigation outlined in CEMP.	Potential adverse significant effect.	Potential mitigation measures under Natural England licence.	Not significant.
Reptiles	Habitat loss and incidental mortality.	Measures for reptile mitigation outlined in CEMP.	Not significant.	None required.	Not significant.
Breeding birds.	Loss of habitat for nesting and foraging.	Measures for nesting birds and vegetation clearance outlined in the CEMP.	Not significant.	None required.	Not significant.
Wintering birds.	Loss of habitat.	Measures for wintering birds and vegetation clearance outlined in the CEMP.	Not significant.	None required.	Not significant.
Bat assemblage.	Habitat loss through loss of arable field, hedgerow and trees.	Retention of woodland blocks and, where possible, hedgerows.	Potential adverse significant effect.	Potential mitigation measures under Natural England licence.	Not significant.
	Disturbance from noise and lighting.	Noise and lighting control measures set out in CEMP. Earthwork bund along western edge of alignment.	Not significant.	Potential mitigation measures under Natural England licence.	Not significant.
Badgers	Loss and severance of habitat. Disturbance or damage to existing setts.	Measures to protect badgers from construction works detailed in CEMP.	Not significant.	Potential mitigation measures under Natural England licence.	Not significant.

Table 3.3.2 Summary of effects for operational phase

Terrestrial ecology and ornithology

Topic/ receptor	Potential impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
European and nationally designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Non-statutory designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Great crested newts.	Habitat severance.	None required.	Not significant.	None required.	Not significant.
Reptiles	Habitat severance.	None required.	Not significant.	None required.	Not significant.
Breeding birds.	Incidental mortality from rail collisions.	Infrequent train movements.	Not significant.	None required.	Not significant.
Wintering birds.	Incidental mortality from rail collisions.	Infrequent train movements.	Not significant.	None required.	Not significant.
Bat assemblage.	Habitat severance for foraging and commuting bats; and incidental mortality.	Infrequent train movements.	Not significant.	None required.	Not significant.
	Disturbance from noise and lighting.	Railway line unlit. Infrequent number of trains expected at night.	Not significant.	None required.	Not significant.

Table 3.3.3 Summary of effects for removal and reinstatement phase

Terrestrial ecology and ornithology

Topic/ receptor	Potential impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
European and nationally designated sites: Sizewell Marshes SSSI.	Changes in air quality. Changes in water quality, hydrology and hydrogeology.	Appropriate air and surface water control and chemical management outlined in the CEMP.	Not significant.	None required.	Not significant.
Other European and nationally designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Non-statutory designated sites: Buckle's Wood CWS & Sizewell Levels and Associated Areas CWS.	Changes in air quality. Changes in water quality, hydrology and hydrogeology.	Appropriate air and surface water control and chemical management outlined in the CEMP.	Not significant.	None required.	Not significant.
Non-statutory designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Hedgerows	Habitat reinstatement.	Hedgerows lost to construction would be reinstated.	Not significant but there would be a slight beneficial effect.	None required.	Not significant but there would be a slight beneficial effect.
Great crested newts.	Incidental injury and mortality.	None detailed.	Potential adverse significant effect.	Potential mitigation measures under Natural England licence, including removal of the railway ballast outside of amphibian and reptile hibernation period (October to February inclusive).	Not significant.
	Reinstatement of hibernation and foraging habitat.	Restoration and reinstatement of habitats, such as hedgerows.	Not significant but there would be a slight beneficial effect.	None required.	Not significant but there would be a slight beneficial effect.
Reptiles	Incidental injury and mortality.	None detailed.	Significant adverse.	Removal of the railway ballast outside of amphibian and reptile hibernation period (October to February inclusive).	Not significant.
Bat assemblage.	Disturbance from noise and lighting.	Earthwork bund along western edge of alignment and lighting design measures to ensure minimal light spill onto adjacent habitats.	Not significant.	Potential mitigation measures under Natural England licence.	Not significant.
Badgers	Disturbance or damage to existing setts.	Measures to protect badgers from decommissioning works detailed with environmental management plan.	Not significant.	Potential mitigation measures under Natural England licence.	Not significant.

3.4. Amenity and recreation

3.4.1. The figure for amenity and recreation is presented in **Volume 3** as **Figure 3.4.1**.

a) Baseline environment

3.4.2. Amenity and recreation resources within the 1km study area adopted for the amenity and recreation assessment comprise PRoWs and cycle routes passing through the rural, predominantly arable agricultural landscape on the edge of Leiston as shown on **Figure 3.4.1**.

3.4.3. Users of the following PRoWs and cycle routes are most likely to be affected by the green rail route:

- Footpath E-363/003/0 which runs north from the B1119 Saxmundham Road, crossing the Saxmundham-Leiston rail line and Buckleswood Road to Fishers Farm, before turning west to Abbey Lane.
- Footpath E-363/006/0 which runs north from Leiston across arable fields, through the site before crossing Abbey Lane to the east of Aldhurst Farm. It continues in a northerly direction terminating at Hill Farm.
- Footpath E-363/010/0 which runs north from the B1122 Abbey Road. It passes to the rear of properties on the B1122 Abbey Road, through the north-eastern part of the site, across Abbey Lane and on to Leiston Abbey. It continues northwards before turning into the E-515/011/0 and terminating at the B1122 Abbey Road.

3.4.4. There are other recreational resources within the 1km study area around the site but the green rail route is unlikely to be perceptible from most of these and, if it is, it would be a minor change.

3.4.5. Resources located in the vicinity of the site are as follows:

- Sustrans Regional Cycle Route (41/42) and Suffolk Coastal Cycle Route follow the same alignment, running in a north-east/south-west direction along Abbey Road, past Leiston Abbey and along Abbey Lane adjacent to the northern boundary of the site (east of Aldhurst Farm).
- Bridleway E-363/013/0 runs in an east to west direction from the B1122 Abbey Road along Lover's Lane.

b) Environmental design and embedded mitigation

3.4.6. A number of mitigation measures have been identified and incorporated into the design of the green rail route. This will contribute to the management and reduction of environmental effects. These measures would, where possible, be introduced at an early stage of the construction process and so contribute to the management and reduction of environmental effects for both construction and operational phases:

- Existing woodlands, scrub and hedgerows within the site and adjoining the site boundaries would be retained, except for sections discussed below.
- Sections of hedgerow where the rail route crosses Buckleswood Road, the B1122, and three other field boundaries would be removed. Grassed bunding would be created along the length of the north side of the rail line, and south of the rail line at its eastern end, and sections of the route would be within cuttings which would provide some screening and noise attenuation.
- Measures to minimise noise and changes to air quality would be implemented as described in **section 3.7** and **section 3.8**.
- Three PRoWs (all footpaths) would be diverted for the construction and operation of the rail route. These may require temporary short-term closures while construction works occur. The establishment of safe crossings over the rail route would be provided for PRoWs that cross the rail route.
- The western footpath, E-363/003/0, would be diverted over a new footbridge across the proposed rail route. The eastern two footpaths, E-363/006/0 and E-363/010/0 would be diverted eastwards onto the footway on Abbey Road (B1122). They would cross the proposed rail route via a new level crossing on Abbey Road, which would accommodate pedestrians, cyclists and equestrians as well as motor vehicles, allowing all categories of road user to cross the rail line safely. The level crossing is anticipated to be closed to road users for approximately three minutes no more than approximately ten times per day. The footpath would be diverted along Abbey Lane to reconnect to the existing network.
- When the rail route extension is removed the footpath diversions would no longer be required, and they would be returned to their original state.

c) Preliminary assessment of effects

3.4.7. People using the recreational resources may experience impacts due to physical changes to recreational resources such as PRoWs diversions including changes in terrain and surfaces, or changes to views and noise caused by the green rail route. Users of the two diverted eastern two footpaths, E-363/006/0 and E-363/010/0 are likely to experience change to air quality due to road traffic fumes while on the footway on Abbey Road (B1122); it is not anticipated that other recreational receptors would be affected by changes to air quality caused by the green rail route.

i) Construction

3.4.8. Users of footpaths E-363/003/0, E-363/006/0 and E363/010/0 would be directly affected as they would be diverted, and would experience construction related noise, changes in visual amenity with views into the construction site, and localised changes to air quality while on footpaths E-363/006/0 and E363/010/0. Effects are likely to be significant and temporary.

3.4.9. Users of Sustrans National Cycle Route (41/42) and Suffolk Coastal Cycle Route, and of bridleway E-363/013/0 are likely to have views of and potentially hear noise from the construction works but effects are unlikely to be significant.

ii) Operation

3.4.10. Users of footpaths E-363/003/0, E-363/006/0 and E363/010/0 would be directly affected as they would be diverted and would experience changes to their views and noise levels. Users of footpaths E-363/006/0 and E363/010/0 would experience brief delays in crossing the level crossing on Abbey Lane. Users of footpath E-363/003/0 would have elevated views into the railway line as a result of using the proposed footbridge. Effects on users of these footpaths are likely to be significant.

3.4.11. Users of Sustrans National Cycle Route (41/42) and Suffolk Coastal Cycle Route, and of bridleway E-363/013/0 could potentially experience noise from trains. Views of the green rail route are likely to be largely screened. Effects are unlikely to be significant.

3.4.12. Users of other recreational resources are unlikely to experience significant effects.

iii) Removal and reinstatement

3.4.13. During restoration of the land back to agriculture, the railway would be removed, and the amenity and recreation impacts experienced would be very similar to those of the construction phase. All PRoWs would be reverted to the pre-operational routes. Effects on users of footpaths E-363/003/0, E-363/006/0 and E363/010/0 are likely to be significant and temporary. Users of other recreational resources are unlikely to experience significant effects.

d) Additional mitigation and monitoring

3.4.14. No additional mitigation is proposed.

e) Preliminary assessment of residual effects

3.4.15. During the construction, operational and post-operational stages of the green rail route there are likely to be significant residual effects on users of footpaths E-363/003/0, E-363/006/0 and E363/010/0. There are unlikely to be significant residual effects on users of other recreational resources.

f) Completing the assessment

3.4.16. The ES would present a full amenity and recreation impact assessment underpinning the conclusions drawn above in relation to significant effects, updated where relevant to account for any design changes.

Table 3.4.1 Summary of effects for construction phase
Amenity and recreation

Topic/ receptor	Potential impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Users of footpaths E-363/003/0, E-363/006/0 and E363/010/0.	Physical changes to routes. Changes to views and noise.	Retention of established vegetation. Soil storage and screening bund. Measures to minimise noise and changes to air quality.	Significant	None	Significant
Users of other amenity and recreation resources.	Users of some other amenity and recreation resources would experience changes to views and noise.	Retention of established vegetation. Soil storage and screening bund. Measures to minimise noise and changes to air quality.	Not significant.	None	Not significant.

Table 3.4.2 Summary of effects for operational phase and removal and restoration phase
Amenity and recreation

Topic/ receptor	Potential impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Users of footpaths E-363/003/0, E-363/006/0 and E363/010/0.	Physical changes to routes. Changes to views and noise.	Retention of established vegetation. Planting. Soil storage and screening bund. Measures to minimise noise and changes to air quality.	Significant	None	Significant
Users of other amenity and recreation resources.	Users of some other amenity and recreation resources would experience changes to views and noise.	Retention of established vegetation. Planting. Soil storage and screening bund. Measures to minimise noise and changes to air quality.	Not significant.	None	Not significant.

3.5. Terrestrial historic environment

3.5.1. The figure for terrestrial historic environment is presented in **Volume 3** as **Figure 3.5.1**.

a) Baseline environment

3.5.2. An initial Desk Based Assessment (DBA) was undertaken for the rail options in 2015, covering both the Blue Route (northern), and Green Route (southern) options presented at Stage 1 consultation. A study area covering the two routes was agreed in consultation with Suffolk County Council Archaeological Services (SCCAS). The DBA considered existing records of archaeological features and investigations as well as historic mapping, aerial photography and documentary sources. Searches of Suffolk Historic Environment Record (HER), Historic England's (HE) Archives Monuments Information England and the National Heritage List for England were undertaken. The DBA divided the land into parcels in order to understand the potential for archaeology and potential direct impacts within the different areas.

3.5.3. New searches of the above datasets for a 500m buffer from the green rail route were undertaken in August 2018. The 500m study area incorporates the relevant parcels and heritage assets within the original Suffolk County Council (SCC) rail route options study area requested by SCCAS in order to ensure that the assessment and discussion are up to date and focused on the current option. A geophysical survey was undertaken on part of the site in 2016. This chapter is based upon the 2015 DBA, updated data searches and initial findings from the geophysical survey.

3.5.4. There are no designated heritage assets within the site boundary.

3.5.5. There are nine listed buildings within the 500m study area. St Mary's Abbey (LB 1215753) is listed at Grade I. One building is listed at Grade II* – Leiston House Farmhouse (LB 1287646). All other listed buildings within the study area are listed at Grade II and primarily comprise houses and shops within Leiston, or individual farmhouses and associated buildings within the surrounding countryside.

3.5.6. One scheduled monument lies within the study area – Leiston Abbey (second site) and moated site (SM 1014520).

3.5.7. Four HER records are located within the site boundary, and a further 31 HER records are located within the study area. The HER records comprise a variety of heritage features ranging from undated burnt flint scatters and Roman coins to a former Second World War (WWII) military airfield. These records are discussed more fully in the site chronology section below.

3.5.8. There are a number of hedgerows across the site, which reflect boundaries shown on the Tithe mapping, which pre-date the Inclosure Act 1845 (Ref. 3.5.1) and would therefore be considered important under the Hedgerow Regulations 1997 (Ref. 3.5.2, Schedule 1, fn 8). These are best considered as heritage assets of low significance for historic and aesthetic interest resulting from their contribution to historic landscape character.

3.5.9. The HER includes 19 records of previous archaeological investigations undertaken across the study area including geophysical survey, trial trench evaluation and the archaeological monitoring of construction works.

i) Prehistoric

3.5.10. There are presently no observations of archaeological material dating from the Palaeolithic or Mesolithic period within the site boundary or study area. There are records of Mesolithic activity to the east of the study area, particularly on the well-drained Sandlings and the wetland margins in the coastal marshes.

3.5.11. Within the study area, there are Portable Antiquities Scheme (PAS) records dating to the Neolithic and Bronze Age. There is no confirmed evidence of Iron Age activity within the site boundary.

3.5.12. The types of settlement and activity associated with earlier prehistory in this area tend not to be readily apparent on aerial photography or geophysical survey. The general lack of evidence for this period in the area may reflect the relative absence of previous investigation, rather than a genuine absence of prehistoric activity. Archaeological investigation carried out in advance of the construction will allow for a more detailed understanding of this potential.

ii) Romano-British

3.5.13. Evidence for Romano-British activity within the study area largely comprises artefact scatters and chance finds recorded within the HER (e.g. MSF11528) and PAS north and north-west of Leiston. A kiln was found in a garden along Abbey Road (MSF24065), 200m south of the eastern end of the rail route; ceramic roofing and flue tiles have been found in the wider vicinity to the south of the site, suggesting a villa or building.

3.5.14. Known records from the vicinity of the site would suggest an increased potential for Romano-British remains particularly towards the southern part of the route towards

Bucklewood Road. Any remains would likely be of moderate significance, but further archaeological investigation will allow for a greater understanding of the potential and value of any remains.

iii) Early-medieval and medieval

3.5.15. There is limited evidence for activity dating from the early-medieval period within the study area, although artefact scatters include possible late-Saxon to medieval pottery (c.850AD to 1100 AD) (MSF16786). The settlements of Leiston and Theberton are both recorded in the Domesday survey of 1086, which records manorial holdings at the time of the Norman Conquest in 1066. The settled manorial geography, which is likely to have provided the basis for the later medieval settlement pattern, is likely to have been established during the early-medieval period.

3.5.16. Evidence of medieval activity can be found close to the site. In addition to a small number of scattered small finds dating to the medieval period found during field walking (e.g. MSF14283, MSF12090), the second site of Leiston Abbey, which includes Leiston Abbey Scheduled Monument (SM 1014520) and associated listed buildings, lies to the north of the route. While the monastic site itself would not have encroached onto the site, there would also have been wider monastic landholdings which are hinted at in the extent of tithe-exempt land which is not shown by the Tithe Maps of Leiston and Theberton. These would have comprised primarily agricultural land, but there is a potential for evidence of associated industrial activities.

iv) Post-medieval

3.5.17. The basic settlement geography established in the medieval period remained through the post-medieval period, with the former monastic site at Leiston becoming a secular manorial centre. The principal change in this period was in terms of the use and demarcation of land, with a long-established trend of hedgerow loss and the amalgamation of smaller fields into larger units better suited for mechanised cultivation with the majority of these changes occurring in the later 19th century.

3.5.18. Heritage assets within the study area from this period primarily comprise agricultural features and buildings, including marl or gravel pits and enclosure period field boundaries (e.g. MSF34586).

v) Modern period

3.5.19. The modern period saw a general continuity of land use from the post-medieval period, with no major changes to the established patterns of settlement or land use.

3.5.20. There are some observed features of modern date, primarily those associated with the military airfield at RAF Leiston (MSF22764). Work commenced at this airfield in 1942 and it was occupied by the 357th and 358th Fighter Groups of the Eighth Air Force USAAF, flying offensive missions over occupied Europe. Following the cessation of hostilities, RAF Leiston reverted to use as an RAF technical training centre, before it was closed in 1953.

3.5.21. There is no evidence of the presence of anti-invasion defences within the study area, although possible practice trenches were uncovered during evaluation trenching at Aldhurst Farm (MSF31543). It is likely that this area immediately behind the coastal 'crust' (the heavily fortified defensive line along the coast), was never as heavily fortified as the coastal strip and that any defensive military features present would be associated with RAF Leiston.

vi) Archaeological potential

3.5.22. The areas of highest potential for the survival of archaeological remains within the green rail route can be summarised as:

- Artefact scatters from a range of periods are located in the south-east of the study area, and indicate an increased potential for the presence of Romano-British and medieval remains in the area and the potential for further, as yet unknown, remains which are likely to be of medium significance.
- Elements of pre-modern field systems. These are best considered as of Low significance, but may contribute to the setting of designated heritage assets such as Leiston Abbey and the listed farmhouses at Hill Farm andFisher's Farm.
- The historic under-representation of prehistoric remains on the claylands suggests that the presence of further archaeological remains cannot be discounted.

3.5.23. Geophysical survey identified possible linear features or enclosures of archaeological interest towards the southern end of the route, on the northern side of Buckleswood Road. These features may extend into the field to the south of Buckleswood Road. Unfortunately, a combination of adverse weather and poor ground conditions prevented survey on the field to the south. Additional geophysical survey and trial trenching is proposed, which would enable a better understanding of the presence and nature of any features.

vii) Modern disturbance

3.5.24. Arable cultivation during the 20th century is likely to have disturbed the upper layers of any buried archaeology.

Repeated ploughing, particularly subsoil ploughing, can be expected to have disturbed near surface features. More substantial features, such as ditches and pits, are likely to be relatively well-preserved, particularly in any areas of meadow or permanent pasture. It is also possible for ploughing and natural processes to result in the development of colluvial deposits, which may preserve earlier features.

b) Environmental design and embedded mitigation

3.5.25. Change to setting of designated heritage assets arising from visibility of the green rail route, and construction noise or changes to air quality, could give rise to loss of or harm to heritage significance. Design has sought to minimise visibility of the proposed rail route from Leiston Abbey, with the route following a line downhill of a slight crest. This topographical feature will be accentuated by landscaping to create a grassed bund and the retention of existing hedgerow planting to reduce visibility of the rail route. Noise mitigation will be afforded by the use of standard best practice construction methods and during operation by the use of continuous welded rails and limited rail curvature to avoid wheel squeal.

c) Preliminary assessment of effects

i) Construction

3.5.26. Intrusive groundworks would take place across the site, including topsoil stripping and subsoil disturbance during the construction of the rail route. Invasive works of this nature would adversely affect any surviving sub-surface archaeological remains, reducing or removing their ability to be further interpreted, resulting in the loss of archaeological interest.

3.5.27. DBA and geophysical survey has suggested the presence of previously unrecorded archaeological remains that are likely to be of low to moderate significance, and planned trial trenching will help to further understand this potential and the likely significance of any archaeological remains. Any archaeological remains within the proposed route would be substantially disturbed, if not removed entirely, by the green rail route. This would give rise to a large magnitude of change which could, in the absence of further mitigation, be significant.

3.5.28. Any loss of hedgerows is therefore best understood in terms of change to the historic landscape as a whole. This change is assessed as of medium magnitude, which would not give rise to a significant adverse effect.

3.5.29. Change to setting would occur during the construction period. In this case, the construction works would be of sufficient duration and present a sufficient increase in magnitude of change over those occurring during the operation of the green rail route.

3.5.30. An initial study has been undertaken to identify designated assets which have the potential to be affected by the green rail route in accordance with Step 1 of the HE guidance (Good Practice Advice in Planning Note 3) (Ref. 3.5.3), and full assessment will be presented to support the application for development consent. These comprise Scheduled Monument (SM 1014520), Grade I and Grade II listed buildings at Leiston Abbey (LB 1215753, LB 1215754, LB 1216380 and LB 1268290), the Grade II listed Fisher's Farmhouse (LB 1216275) and Wood Farmhouse (LB 1227752).

3.5.31. Visibility of the construction of the proposed rail route could have an adverse effect on the historic interest of Leiston Abbey by changing how this part of its setting is perceived. The works would be at least partially screened by the location of the rail route on the downhill side of the ridge along Abbey Lane, and by planting on the southern edge of the Abbey site and along either side of Abbey Lane. Construction activities could also be audible from the Abbey site. When taken in combination with potential change to setting arising from the main development site and increased traffic movements along the B1122, there is the potential for effects to become moderate and therefore significant.

3.5.32. The Grade II listed Fishers Farmhouse has views southwards from the house, and construction activities would be visible in these views as well as in views northwards towards the farmhouse from Buckleswood Road. However, this visibility would not affect the historic or architectural interest of the house, and any effect is anticipated to be not significant.

3.5.33. The proposed rail route and construction activities would be visible in heavily filtered views from the Grade II listed Wood Farmhouse (LB 1227752). However, this visibility would not affect the historic or architectural interest of the house, and any effect is anticipated to be not significant.

ii) Operation

3.5.34. Disturbance of any archaeological remains within the site would have occurred, and have been effectively mitigated, during construction. Therefore, no direct effects on heritage assets are anticipated during the operation of the rail route.

3.5.35. Adverse change may occur to the setting of the scheduled monument, Grade I and Grade II listed buildings at Leiston Abbey. The rail route and rail traffic to the south of the Abbey site would introduce new visible and perceptual elements to the setting of the Abbey, particularly from elevated viewpoints in the Abbey ruins and from upper floors of the Retreat House. Trains will be visible and audible as they pass to the south of the Abbey, the proposed level crossing to the B1122 Abbey Road will be visible from some parts of the asset group and the green rail route will be clearly visible cutting across the existing field pattern to the east of the B1122 from a number of locations in the Abbey ruins. The level of effect would vary by individual asset within the cluster from being a low magnitude of effect where the railway would be visible only within the upper floors of the Retreat House through the abbey remains, to a moderate magnitude of effect on St Mary's Abbey and the scheduled monument. There the effect would be moderate and therefore potentially significant. When taken in combination with potential change to setting arising from the main development site and increased traffic movements along the B1122, there is the potential for effects to become moderate and therefore significant.

3.5.36. The Grade II listed Fisher's Farmhouse has views southwards from the house, and elements of the rail infrastructure would be visible in these views as well as in views northwards towards the farmhouse from Buckleswood Road. However, the visibility of the rail route would affect neither the historic nor architectural interests of the house. It would remain in a regionally distinct rural context, and any effect is anticipated to be not significant.

iii) Removal and reinstatement

3.5.37. Any disturbance of archaeological remains within the site would have occurred and been effectively mitigated during construction. Therefore, no direct effects on heritage assets are anticipated during the decommissioning of the rail route.

3.5.38. It is anticipated that any adverse effects arising through change to setting during decommissioning of the rail route would be of equivalent magnitude to those experienced during construction, with a potentially significant adverse effect arising on Leiston Abbey.

d) Additional mitigation and monitoring

3.5.39. Additional mitigation of direct effects on heritage assets would comprise the adoption of an agreed written scheme of archaeological investigation to ensure that the archaeological interest of any significant deposits and features could be appropriately investigated, recorded and disseminated. This would ensure that the effect on buried archaeological remains from the green rail route could be adequately mitigated, resulting in a low adverse residual effect, which would be not significant.

3.5.40. A suitable mitigation strategy and written scheme of archaeological investigation will be agreed with SCCAS once all pre-application archaeological fieldwork has been completed and the results are known. Monitoring of the agreed programme of archaeological investigation would be carried out by SCCAS during the implementation of the scheme. Publication and popular dissemination of the results would allow any informative and historic value to be fully realised.

3.5.41. A settings assessment, which will be consulted on ahead of submission of the application for development consent, with HE and Suffolk Coastal District Council's (SCDC) Conservation Officer, will be undertaken. It will consider heritage assets where setting may potentially be subject to effects, their current setting, the potential change, the magnitude of effect the green rail route may have on their setting and any mitigation measures required.

e) Preliminary assessment of residual effects

3.5.42. The loss of archaeological interest through disturbance of archaeological remains within the site could have a significant adverse effect. However, following the implementation of an agreed scheme of archaeological investigation any residual effect is not expected to be significant.

3.5.43. Potential significant adverse effects on individual heritage assets within Leiston Abbey arising from change to setting cannot be ruled out at this stage, particularly in combination with the main development site and increased traffic along the B1122.

f) Completing the assessment

3.5.44. A full archaeological assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant direct effects, and would draw upon LVIA, noise, air quality and other assessments where appropriate.

3.5.45. This would include a settings assessment, which would be consulted on ahead of application with HE and the SCDC's Conservation Officer. It would consider heritage assets where setting may potentially be subject to effects, their current setting, the potential change, and the magnitude of effect the green rail route may have on their setting. Any mitigation required would also be consulted upon.

3.5.46. In advance of construction field evaluation would be undertaken and this would include geophysical survey and trial trenching, the scope and extent of which would be agreed with SCCAS.

3.5.47. Once the intrusive archaeological investigation (trial trenching) is complete, an appropriate mitigation scheme for buried archaeological remains, if present, would be agreed with SCCAS.

Table 3.5.1 Summary of effects for construction phase

Terrestrial historic environment

Topic/ receptor	Potential impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Previously unrecorded archaeological remains.	Disturbance or removal as a result of topsoil stripping and subsoil disturbance.	None	Significant	Agreed written scheme of archaeological investigation to ensure that the archaeological interest of any significant deposits and features could be appropriately investigated, recorded and disseminated.	Not significant.
Historic Hedgerows.	Loss due to construction activities/location of rail route.	Retain where possible.	Not significant.	None	Not significant.
Designated Assets at Leiston Abbey, including scheduled monument and listed buildings.	Change in setting due to construction activities/proximity to site.	Retention of screening planting along Abbey Lane. Standard CEMP to limit noise and air quality disturbance.	Possibly significant.	Details to be developed.	May be significant, particularly in combination with effects of main development site and traffic on the B1122.
Grade II listed Fisher's Farmhouse.	Change in setting due to construction activities/proximity to site.	Standard code of construction practice measures to limit noise and air quality disturbance.	Not significant.	None	Not significant.

Table 3.5.2 Summary of effects for operational phase

Terrestrial historic environment

Topic/ receptor	Potential impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Designated Assets at Leiston Abbey, including scheduled monument and listed buildings.	Change in setting due to proximity to site.	Retention of planting, bunding and location of rail route on downhill side of crest. Use of continuous welded rail and limits to track curvature.	Possibly significant.	Likely to be required but not yet defined.	Possibly significant.
Grade II listed Fisher's Farmhouse.	Change in setting due to proximity to site.	None	Not significant.	None	Not significant.

Table 3.5.3 Designated heritage assets within study area: listed buildings

Historic England list entry	Name	Grade	Easting	Northing
1215753	St Mary's Abbey.	I	644521	264174
1215753	Retreat House.	I	644521	264172
1216275	Fisher's Farmhouse.	II	643539	263680
1216380	Barn at Abbey Farm.	II	644442	264252
1227752	Wood Farmhouse.	II	643691	263044
1268290	The Guesten Hall at Abbey Farm.	II	644412	264266
1287528	24, Westward Ho.	II	644008	262959
1287643	Hill Farmhouse.	II	644019	264414
1287646	Leiston House Farmhouse.	II*	642829	262928

Table 3.5.4 Designated heritage assets within study area: scheduled monuments

Historic England list entry	Name	Easting	Northing
1014520	Leiston Abbey (second site) and moated site.	644456	264188

3.6. Soils and agriculture

3.6.1. The figures for soils and agriculture are presented in **Volume 3** as **Figures 3.6.1** and **3.6.2**.

a) Baseline environment

3.6.2. The site is underlain by an area mapped as the Crag Group (quaternary sand), which in places is overlain with drift deposit of Lowestoft Formation (comprising sands, silts and clays) (Ref. 3.6.1).

3.6.3. The distribution of soil types is shown in **Figure 3.6.1** (Ref. 3.6.2). In the eastern part of the site the soils are shown as being freely draining slightly acid sandy soils. These belong to the Newport Soil Association (representing a group of soil types which are typically found occurring together in a landscape). The main land use on these soils is described as being arable crops such as barley, other cereals and sugar beet, with some coniferous woodland and lowland heath habitats.

3.6.4. In the central part of the site the soils can be described as being freely draining slightly acidic but base-rich soils. These belong to the Melford Soil Association. The main land use on these soils where they occur in eastern England is described as being arable crops.

3.6.5. In the western part of the site the soils are described as slowly permeable seasonally wet slightly acidic but base-rich loamy and clayey soils. These belong to the Ragdale Soil Association. The main land use on these soils is described as being winter cereals.

3.6.6. Published Agricultural Land Classification (ALC) maps (Ref. 3.6.3; See **Figure 3.6.2**) show the land to comprise predominantly Grade 2 land. Under the ALC system land is graded between Grade 1 and 5, with Grade 3 subdivided into 3a and 3b.

3.6.7. Land in grades 1, 2 and 3a is considered to be 'best and most versatile' land.

3.6.8. There is no published detailed ALC mapping available for the land within the site. Based on the provisional ALC mapping the proportions of land of each grade would be as seen in **Table 3.6.1** (noting that the full assessment would be based on detailed survey data).

3.6.9. Land within the site boundary, from aerial photographs, appears to be predominantly under arable production and amenity grassland. None of the land is under an agri-environment or forestry scheme.

Table 3.6.1 Agricultural Land Classification grade distribution

Agricultural Land Classification Grade	Area (ha)
2	20.39
3 (undifferentiated)*	1.43
Non-agricultural	0
Total	**21.82**

*Based on available provisional ALC maps

b) Environmental design and embedded mitigation

3.6.10. A summary of the measures that have been incorporated into the design of the green rail route and that would protect the existing features of soil and agricultural interest is set out below.

i) Construction

3.6.11. The sustainable re-use of the soil resource would be undertaken in line with the Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (Ref. 3.6.4). This would be achieved by the development of a Soil Management Plan (SMP) identifying the soils present, proposed storage locations and handling methods and how the resource would be re-used. The SMP would form part of the CEMP. Measures which would be implemented include (but are not limited to):

- complete of a Soil Resources Survey and incorporate results into an SMP;
- link the SMP to the Site Waste Management Plan (SWMP);
- ensure soils are stripped and handled in the driest condition possible;
- confine vehicle movements to defined haul routes until all the soil resource has been stripped;
- protect stockpiles from erosion and tracking over; and
- ensure physical condition of the entire replaced soil profile is sufficient for the post-construction use.

3.6.12. All soils would be stored away from watercourses (or potential pathways to watercourses) and any potentially contaminated soil would be stored on an impermeable surface and covered to reduce leachate generation and potential migration to surface waters.

3.6.13. Industry standard measures would be put in place to control pollution, including from fuel or chemical stores, silt-laden run-off or dust.

3.6.14. A considerate construction approach would be used to minimise potential impacts on the remainder of the landholding and on neighbouring landholdings during the construction phase. Toolbox talks would be used to inform all those working on the site of the requirements for soil handling and minimisation of disturbance to agricultural activities. All fencing around the green rail route would be sufficient to resist damage by livestock and would be regularly checked and maintained in a suitable condition. Any damage to boundary fencing would be repaired immediately.

3.6.15. Measures contained in relevant Department for Environment, Food and Rural Affairs (Defra) and Environment Agency best practice guidance on the control and removal of invasive weed species would be implemented where appropriate.

3.6.16. Works would cease, and the Animal Health Regional Office would be advised, should animal bones be discovered which indicate a potential burial site.

3.6.17. All movement of plant and vehicles between fields would cease in the event of a disease outbreak and official Defra advice would be followed to minimise the biosecurity risk associated with the continuation of works.

3.6.18. In relation to temporary and permanent land take requirements EDF Energy would liaise with landowners to understand and, where possible, address their concerns.

ii) Operation

3.6.19. The measures described for the construction phase would be maintained throughout the operational phase, as appropriate.

iii) Removal and reinstatement

3.6.20. Following completion of operations, all agricultural land taken temporarily would be fully reinstated as near as practically possible to its former condition. Topsoil would be prepared and seeded using an appropriate seed mix or returned immediately to cultivation depending on the time of year. Permanent surface water/agricultural drains would be reinstalled to reinstate any pre-existing field drainage systems as near as possible to pre-construction condition.

c) Preliminary assessment of effects

3.6.21. The potential for significant effects on soils and agriculture is discussed in this section. The assessment of significance is based on the embedded mitigation measures outlined above being in place.

i) Construction

3.6.22. The proposals for this site would result in the temporary loss of 21.82ha of agricultural land. From the provisional mapping it is considered likely that a large proportion would be best and most versatile (BMV) land (likely to be within Grade 2).

3.6.23. Given the potential extent of BMV land to be lost on a temporary basis this preliminary assessment considers that this would be a significant temporary effect.

3.6.24. There would also be an impact on the agricultural enterprise because of the loss of a proportion of the productive land. This would be assessed on a case by case basis as required.

3.6.25. On the assumption that landowners’ concerns are addressed, through appropriate mitigation, this preliminary environmental assessment considers that significant effects on the agricultural enterprise are unlikely to occur and so are not considered further.

ii) Operation

3.6.26. There would be no additional operation phase effects on the soil resource or agricultural enterprise.

iii) Removal and reinstatement

3.6.27. The infrastructure would be removed in accordance with a demolition plan, which would maximise the potential for re-use of all materials.

3.6.28. The area would then be returned to its existing use through a methodology defined in a restoration plan and contained within the SMP. The restoration of the land to its existing use would be considered to be a beneficial effect.

d) Additional mitigation and monitoring

3.6.29. There are no mitigation measures available for the loss of BMV land. The effect would however be temporary and the land would be returned to agriculture post-operation.

e) Preliminary assessment of residual effects

3.6.30. The embedded mitigation measures would ensure that the potential for significant effects is removed with the exception of the temporary loss of agricultural land.

f) Completing the assessment

3.6.31. Once the proposals for the development as a whole are finalised, a full assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant effects. An ALC survey would be undertaken across the part of the site which has not been surveyed to fully inform the assessment of impacts. In addition, the landowner interview would be repeated to identify any changes in the operation of the agricultural business.

Table 3.6.2 Summary of effects for construction phase

Soils and agriculture

Topic/ receptor	Impacts	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Agricultural land.	Temporary loss of approximately 21.82ha of which at least a proportion is likely to be the BMV land.	The loss is temporary, and all land would be returned to agriculture.	Significant but temporary.	There are no additional mitigation measures available.	Significant but temporary.
Agricultural businesses.	Temporary impact due to the loss of a proportion of the productive land.	EDF Energy will liaise with landowners to understand and address their concerns.	Not significant.	Additional mitigation measures are therefore not required.	Not significant.

Table 3.6.3 Summary of effects for operational phase and restoration and removal

Soils and agriculture

Topic/ receptor	Impacts	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Agricultural land.	There are no impacts identified during the operational phase.				
Agricultural businesses.	There are no impacts identified during the operational phase.				

3.7. Noise and vibration

3.7.1. The figures for noise and vibration are presented in **Volume 3** as **Figures 3.7.1** and **3.7.2**.

a) Baseline environment

3.7.2. Noise survey locations which provide baseline data for areas which have the potential to be affected by noise associated with the construction and operation of the green rail route along with a summary of the levels measured. A plan showing the locations of these monitoring locations is shown in **Table 3.7.1**.

3.7.3. Vibration baseline surveys were carried out at locations shown in **Figure 3.7.2**.

3.7.4. Vibration data at all sites except Leiston Abbey was very low, with the highest Vibration Dose Value (VDV) reading in any axis being <0.05 $ms^{-1.75}$ and the majority of readings being between 0.01 and 0.02 $ms^{-1.75}$. At Leiston Abbey, measured VDV values were higher, being in the range 0.03 to 0.10 $ms^{-1.75}$ during the day and between 0.03 and 0.05 $ms^{-1.75}$ at night. The reason for these higher readings at Leiston Abbey is not known, but, although higher than elsewhere, the levels here remain well below the lowest observable adverse effect level for both day and night.

Table 3.7.1 Baseline survey data for the green rail route

Survey location reference	Location name	Typical sound levels – day (decibel (dB))			Typical sound levels – night (dB)		
		LAmax	LAeq, 16hour	LA90*	LAmax	LAeq, 16hour	LA90*
MS11	Hill Farm.	70	47	37	60	40	25
MS12	Leiston Abbey, rear.	60	42	38	50	33	28
MS15	Old Abbey Care Home.	62	47	43	50	34	30
MS18	Cakes and Ale Caravan Site.	65	50	42	55	40	33
MS19	Leiston North.	90	70	40	80	60	30
MS21	Gatehouse, Saxmundham Road.	87	70	45	75	60	30
MS33	Leiston West.	60	45	38	55	35	28
MS38	Leiston Abbey Courtyard.	60	43	35	50	35	26
MS39	Leiston Abbey residential block.	65	48	37	50	35	26
MS40	Cakes and Ale Entrance.	75	53	36	60	40	26

3.7.5. Since the various receptors are at different distances from sources such as road traffic, the noise readings from the surveys summarised above can be used to provide an estimate of existing ambient levels for each group of receptors. **Table 3.7.2** shows a list of receptors and groups of receptors, which have the potential to be affected by noise from construction and operation of the green route (during the main site construction phase), along with measured or estimated ambient levels for day and night.

Table 3.7.2 List of receptors with measured/ estimated ambient noise levels

Location name	Period	Typical ambient level, LAeq, dB
Leiston House Farm Aldhurst Farm Cottage Fisher's Farm.	0700-2300	49
	2300-0700	40
Buckleswood House.	0700-2300	50
	2300-0700	40
Leiston Abbey residential accommodation.	0700-2300	47
	2300-0700	30
Leiston Abbey music school courtyard and rear garden.	0700-2300	40
	2300-0700	30
Dwellings on Abbey Road.	0700-2300	59
	2300-0700	52
Harling Way Bucklesham Road Westward Ho.	0700-2300	43
	2300-0700	37

b) Environmental design and embedded mitigation

i) Construction

3.7.6. The standard of good practice outlined in BS 5228-1 (Ref. 3.7.1) would be followed. Primary mitigation for the control of noise and vibration could therefore include, but not be restricted to the following measures:

- restrictions on piling;
- selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earth moving activities;
- switching off equipment when not required;
- use of reversing alarms that give proper warning whilst minimising noise impacts off-site; and
- provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts.

3.7.7. BS 5228-2 gives detailed advice on standard good construction practice for minimising impacts from construction vibration. It is expected that it would be a requirement for the contractors to adhere to this guidance and that it would be set out in the CEMP.

3.7.8. For the construction of the green rail route, noisy activities would only take place during Monday to Friday, 07:00 to 19:00 hours and Saturday 07:00 to 13:00 hours.

3.7.9. EDF Energy would have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.

ii) Operation

3.7.10. Track would be continuously welded rail in order to reduce noise at source. Radius of curvature of the line would be such as to avoid the likelihood of wheel squeal.

c) Preliminary assessment of effects

3.7.11. This section presents the findings of the noise and vibration assessment for the construction, operation and post-operational use of the green rail route. Construction and operation of areas within land to the east of Eastlands Industrial Estate (LEEIE) and Sizewell Halt are considered within **Chapter 2** of this Volume and noise and vibration impacts associated with the proposed level crossings are dealt with in **Chapter 4** of this Volume.

3.7.12. Noise and vibration levels have been predicted by calculation and modelling. A "significant" effect has been identified where levels are predicted to exceed a specified threshold value. Appropriate threshold levels are based on various standards and a relevant guidance and depend on the type of source; the sensitivity of the receptors; the time of day when it might occur; and, in some situations, on the existing noise levels in the area.

i) Construction

3.7.13. An initial assessment has been carried out to consider noise from construction of the green rail route. Based on the information currently available, construction noise is not considered likely to have a significant effect at any receptor.

3.7.14. On the basis of initial calculations and given the distances between source and receptors, it is unlikely that vibration impacts from construction of the green rail route would be significant.

ii) Operation

3.7.15. Assumptions used to predict impacts from trains using this line are as follows:

- trains would move at a constant speed assumed of 40km per hour;
- continuously welded rail would be used for all track;
- all locomotives would be under normal power (i.e. not at full power); and
- it is assumed that the train would pull 'KQA pocket wagons'; it is likely that 'FEA wagons' would be used, but noise data for these is not currently available and 'KQA pocket wagons' are likely to provide a worse case level, so the predicted level is robust.

3.7.16. Due to limited availability of data, no account has been made in calculations at this stage for train dynamics: accelerating, decelerating, stopping, starting etc., and no correction has currently been applied for bridges and crossings. Predictions would therefore need to be updated if additional information becomes available.

3.7.17. If the green rail route is progressed, up to five trains (totalling ten rail movements) would occur during both night and day. During the day, there would be no significant impacts but at night there would be a significant adverse effect at the four closest receptors: Kelsale Covert, Westhouse Crossing Cottage, Crossing Cottages and Gatehouse on the existing branch line between Saxmundham and the western end of the proposed green rail route.

3.7.18. Vibration and ground borne noise impacts from the operational phase need further, more detailed consideration but initial calculations indicate that vibration is unlikely to be significant but that ground borne noise level may be significant for some premises within 20 metres (m) from the line, depending on ground conditions and coupling between the structure and the ground.

d) Additional mitigation and monitoring

i) Construction

3.7.19. No mitigation would be needed for the construction of the green rail route in order to reduce levels below significant.

3.7.20. In order to reduce impact from ground borne noise for dwellings which may be affected (within 20m of the track), speed reduction and track isolation may result in some reduction in level.

3.7.21. Routine monitoring would be carried out through a scheme to be agreed with local authorities. Provision would be made as necessary for monitoring of noise and vibration levels in the event of complaints being received from occupiers of noise sensitive receptors, or on request of the local authorities.

e) Preliminary assessment of residual effects

3.7.22. It is possible that significant ground borne noise effects could occur at some premises within 20m of the rail line during the operational phase.

f) Completing the assessment

3.7.23. Further assessment of impacts will be needed, with further consideration of the construction methodology, local topographical features and layouts. In particular, further consideration of vibration impacts will be needed.
The ES will present a full noise and vibration assessment for the green rail route and will consider any new information such as amended design or construction methodologies which might be relevant, although it is anticipated that the assessment will support the preliminary conclusions drawn above.

Table 3.7.3 Summary of effects for construction phase

Noise and vibration

Topic/ receptor	Impacts	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Construction of the green rail route.	Noise impact.	Selection of plant and methodology in accordance with good practice. Avoid night time work, where possible.	Not significant.	None	Not significant.
Sensitive receptors within 10m of construction work.	Vibration impact.	Selection of plant and methodology in accordance with good practice. Avoid night time work, where possible.	May be significant (for short-term) – further work needed to review this.	Not yet known.	Not yet known.
Other receptors.	Vibration impact.	Selection of plant and methodology in accordance with good practice. Avoid night time work, where possible.	Not significant.	None	Not significant.

3.8. Air quality

a) Baseline Environment

3.8.1. The closest human receptors to the green rail route are located at properties on Harling Way, Phoenix Cottage, Wood Farm Cottages, Fisher's Farm, Aldhurst Farm Cottage, properties on Westward Ho, properties of Abbey Lane and Old Abbey Farm.

3.8.2. The closest ecological receptor to the site is the Sizewell Marshes SSSI, which exists within 350m of the green rail route, and will therefore require consideration.

3.8.3. Suffolk Coastal District Council (SCDC) has declared two Air Quality Management Areas (AQMAs) within its boundary (Ref. 3.8.1) due to elevated monitored concentrations of ambient Nitrogen Dioxide (NO_2), the nearest of which is approximately 8km from the site, along the A12 at Stratford St. Andrew. A third AQMA, at Dooley Inn, was revoked in 2016.

3.8.4. The nearest monitoring data (for a pollutant relevant to the assessment) is approximately 800m south-east at the NO_2 diffusion tube on Park Hill, Leiston, (Ref. 3.8.2), which in 2016 (the most recently reported year) monitored 20µg/m3, which is below the annual mean air quality strategy objective of 40µg/m3 (Ref. 3.8.3). As NO_2 concentrations are generally more elevated in urban areas, concentrations at site are likely to be lower than this, given the more rural location.

3.8.5. Background concentrations of NO_2 and Particulate Matter of a diameter of 10 microns or below (PM_{10}) across the proposed development in 2018 were 6.7µg/m^3 to 6.9µg/m^3 for NO_2 and 13µg/m^3 to 13.5µg/m^3 for PM_{10} respectively (Ref. 3.8.4), all concentrations being considerably below statutory objectives (Ref. 3.8.5, Ref. 3.8.6).

3.8.6. Dust levels are related to the action of wind on exposed soils and climatic conditions year to year, but existing levels are likely to be low given the arable nature of the land use.

3.8.7. Air quality is predicted to improve before 2027, the anticipated year of peak construction, because it is anticipated that improvements in vehicular emission rates and background concentrations will offset a general trend for an increase in vehicle numbers. Lower concentrations of road traffic-related pollutants may therefore be expected by the time the green rail route is commenced. For example, NO_2 and PM_{10} 2027 background concentrations in the area are predicted to be between 5.3µg/m^3 and 5.4µg/m^3 for NO_2 and 12.5µg/m^3 to 13.0µg/m^3 for PM_{10}, a reduction in both pollutants.

3.8.8. No notable changes are expected in land use in the surrounding area and it is expected that rates of dust deposition are likely to be similar to current levels.

b) Environmental design and embedded mitigation

i) Construction

3.8.9. The following mitigation measures have been embedded into the construction of the green rail route:

- site access located as far as practicable, and preferably at least 10m, from receptors;
- any potential use of concrete batching plant located as far as practicable from receptors;
- ballast stockpiling (if required), located as far as practicable from receptors; and
- mobile crushing & screening plant located as far as practicable from receptors.

3.8.10. Air quality impacts arising from the construction phase would be managed through a range of control measures detailed in the CEMP, supplemented by the measures appropriate to the level of risk designated to the green rail route under Institute of Air Quality Management (IAQM) Guidance (Ref. 3.8.7).

ii) Operation

3.8.11. The creation of the new level crossings described in **Chapter 4** of this Volume would enable more efficient movements along the branch line and could reduce idling.

3.8.12. The potential for further operational mitigation for air quality for train movements is limited in part by the rolling stock. Further consideration will be given to any opportunities to reduce emissions during the ongoing EIA.

iii) Removal and reinstatement

3.8.13. It is expected that the effects on air quality during the removal of the green rail route will be similar to the construction phase. As such, the embedded mitigation employed would reflect that within the construction phase.

3.8.14. Once the land is returned to arable use, further air quality measures would not be required.

c) Preliminary assessment of effects

i) Construction

3.8.15. The potential impacts associated with the construction of the green rail route include fugitive emissions of dust, emissions from non-road mobile machinery (NRMM) on the site, emissions from heavy goods vehicles (HGVs) accessing the site and emissions from vehicles carrying workers to and from the site. However, given the embedded mitigation measures described above, the adverse effects would likely be negligible and would therefore not be significant for any of the proposed construction activities at the site.

3.8.16. The principal risk is anticipated to be related to earthworks, as this phase of construction can typically require a high volume of material to be moved. A high level of activity could potentially place the dust emissions category as 'large' by IAQM classification, with the likelihood of a 'medium' risk based on the number and sensitivity of local receptors. Each risk category has the potential to lead to proportional adverse, albeit temporary, impacts which have the potential to be significant without mitigation.

3.8.17. However, assuming all mitigation measures are effectively implemented and monitored through an effective CEMP, at the level recommended by the dust risk assessment, no significant dust effects resulting from demolition and construction activities are anticipated.

3.8.18. It is expected that the number of Heavy Duty Vehicle (HDV)[10] movements required to develop the site in the construction phase would not exceed the IAQM screening threshold (Ref. 3.8.8) of more than 100 Annual Average Daily Traffic required for a detailed dispersion modelling assessment and there would therefore not likely be a significant air quality effect.

ii) Operation

3.8.19. There is potential for increases in pollutant concentrations at receptors located in the vicinity of the green rail route during operation. The green rail route would accommodate up to five locomotives per day (a total of ten movements). However, this sum would unlikely result in a significant effect to pollutant concentrations at receptors.

3.8.20. A potentially significant source of emissions associated with the green rail route could be as a result of road vehicles idling at level crossings.

3.8.21. Accordingly, whilst IAQM guidance is not explicit with regard to rail emissions, it has been used to determine the necessity for an Air Quality Impact Assessment, and it is expected that the proposed green rail route would require a detailed assessment, given that it meets the IAQM criteria of adding a new junction (in this case a level crossing) near to receptors. The proposed embedded mitigation, in conjunction with the low baseline concentrations across the study area, indicates that there is unlikely to be a significant adverse effect on air quality at receptors during operation.

3.8.22. There are not anticipated to be any impacts on AQMAs from the green rail route, given their lack of proximity.

3.8.23. The principal benefit of the green rail route is that the impact of main development site related rail traffic passing through Leiston to Sizewell Halt (or the LEEIE bend) would be reduced. This would, overall, also likely reduce the number of construction vehicles required for the main development site as a result of an increased rail capacity, thereby reducing vehicular emissions.

iii) Removal and reinstatement

3.8.24. It is expected that the effects on air quality during the removal of the green rail route will be similar to the initial construction phase.

3.8.25. Once the land is reinstated to the original agricultural use, there will be no significant effects on air quality.

d) Additional mitigation and monitoring

3.8.26. No significant adverse effects are predicted for any phase of development and no additional mitigation measures are therefore proposed.

e) Preliminary assessment of residual effects

3.8.27. No significant residual effects are predicted during the construction, operation or the removal and reinstatement phases.

f) Completing the assessment

3.8.28. Once the proposals are finalised, the potential air quality effects of the green rail route will be re-evaluated to confirm whether the preliminary conclusions presented above are applicable. The ES will present the full assessment considered necessary for the green rail route, underpinning the conclusions drawn in relation to the absence of significant adverse effects, and the presence of significant beneficial effects.

[10] HDVs include buses >3.5 tonnes in weight

Table 3.8.1 Summary of effects for construction phase

Air quality

Topic/ receptor	Impacts	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Construction dust					
Human	Potential generation of nuisance dust.	As recommended in CEMP and appropriate to level of risk identified by IAQM criteria.	Considered likely to be 'Medium' risk, though not significant provided CEMP mitigation measures are adhered to.	None	Not significant.
Ecological	Potential dust soiling for sensitive species.	As recommended in CEMP and appropriate to level of risk identified by IAQM criteria.	Considered likely to be 'Medium' risk, though not significant provided CEMP mitigation measures are adhered to.	None	Not Significant.
Vehicle/NRMM emissions					
Human	Potential increase in emissions.	As recommended in CEMP.	Unlikely to meet IAQM screening criteria requiring assessment.	None	Not Significant.
Ecological	Potential increase in emissions.	As recommended in CEMP.	Unlikely to meet IAQM screening criteria requiring assessment.	None	Not significant.
Vehicle Emissions					
Human	Emissions at receptors.		Not likely to be significant.	None	Not significant.
Ecological	Emissions at receptors.		Not likely to be significant.	None	Not Significant.

Table 3.8.2 Summary of effects for operational phase

Air quality

Topic/ receptor	Impacts	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Vehicle Emissions					
Human	Emissions at receptors.		Not likely to be significant.	None	Not significant.
Ecological	Emissions at receptors.		Not likely to be significant.	None	Not Significant.

Table 3.8.3 Summary of effects for removal and reinstatement

Air quality

Topic/ receptor	Impact	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
Construction dust during removal					
Human	Potential generation of nuisance dust.	As recommended in CEMP and appropriate to level of risk identified by IAQM criteria.	Considered likely to be 'Medium' risk, though not significant provided CEMP mitigation measures are adhered to.	None	Not significant.
Ecological	Potential dust soiling for sensitive species.	As recommended in CEMP and appropriate to level of risk identified by IAQM criteria.	Considered likely to be 'Medium' risk, though not significant provided CEMP mitigation measures are adhered to.	None	Not Significant.
Vehicle/NRMM emissions during removal					
Human	Potential increase in emissions.	As recommended in CEMP.	Unlikely to meet IAQM screening criteria requiring assessment.	None	Not Significant.
Ecological	Potential increase in emissions.	As recommended in CEMP.	Unlikely to meet IAQM screening criteria requiring assessment.	None	Not Significant.
Once reinstated to arable land					
All Receptors	No impact.	None required.	Not significant.	None	Not Significant.

3.9. Geology and land quality

a) Baseline environment

i) Geology

3.9.1. The following provides a summary of the geology and geological characteristics within the site and site vicinity:

- made ground: likely to be present associated with the existing Saxmundham-Leiston Branch railway line and roads crossing the route or other small-scale structures including unmapped farmer's tips. Made ground will also be present associated with the old sand pit/Abbey Pit landfill located 50m to the south of the site;
- superficial deposits: Lowestoft Formation (diamicton deposits present in the west and sand and gravels in the east);
- bedrock: Crag Group;
- important geological sites: none present;
- identified geological hazards: none present;
- mining, quarrying and natural cavities: small scale historical sand pits identified 50m south of site;
- ground stability hazards: none present; and
- unexploded ordnance (UXO) risks: moderate risk.

3.9.2. A borehole was identified within 500m of the site located adjacent to the north west of the site. It generally corresponded with the mapped geology.

ii) Hydrology and hydrogeology

3.9.3. The following provides a summary of the hydrological and hydrogeological characteristics within the site and site vicinity:

- surface water features: the site crosses a drain which runs parallel to Abbey Road (the B1122) and there are two small ponds within 50m of the site;
- superficial aquifer: the Lowestoft Formation is classified as a Secondary A and Secondary Undifferentiated Aquifer;
- bedrock aquifer: the Crag Group is classified as a Principal Aquifer;
- groundwater vulnerability: there are three groundwater Source Protection Zones (SPZ) including a SPZ Zone 1 (inner zone), a SPZ Zone 2 (outer zone) and SPZ Zone 3 (total catchment) crossed by and within 500m of the site associated with a SPZ borehole located at Leiston Old Abbey 300m south of the site. The site contains soils of low, intermediate and high leaching potential;
- groundwater/surface water abstractions: one abstraction license present 350m south-east of the site within the Sizewell Belts;
- groundwater/surface water discharge consents: no available data;
- pollution incidents: no available data; and
- flood risk: very low to low risk throughout the site, with a small are of high flooding risk along the Abbey road crossing section.

iii) Site history

3.9.4. The site currently supports minimal development and this extends back into the 19th century at least. The surrounding area has a principal feature of an old sand pit, historically named Abbey Pit, located 50m south of the site, which dates back into the 19th century. There are no details of fill materials or operational dates available. The existing Saxmundham-Leiston Branch railway line is indicated to be present in the south of the site in its current layout. A number of farms have been located in the surrounding area since the 19th century including Aldhurst Farm, located adjacent to the north-west of the site.

iv) Landfills and waste management sites

3.9.5. There are several historical landfills located within 500m of the site. Abbey Pit (infilled old sand pit) is located 50m to the south of the site along Abbey Lane. The type of waste accepted at this landfill is unknown. Aldhurst Farm is located 150m north of site and Carr's Pit landfill is located 500m south of site. Carr's Pit received inert and industrial waste from 1990 and Aldhurst Farm received inert, industrial, commercial and household waste from 1976 to 1987.

v) Spreading of sediment from Leiston Brook

3.9.6. Consultation with the Environment Agency has confirmed that sediment from Leiston Brook and the Leiston Wastewater Treatment Works 800m to the south-east of the green rail route is periodically spread on an area of land adjacent to Lover's Lane, this material 'may contain sanitary waste'. It is not known the extent of land over which this material may be spread.

vi) Sensitive land uses

3.9.7. Buckle's Wood which is designated as an ancient woodland is present 100m north-west of the green rail route. Various archaeology finds have been recorded along the route corridor, including those dating from the Bronze Age, Romano-British and medieval periods.

vii) Previous investigations

3.9.8. There have been no previous ground investigations undertaken at the site.

viii) Key hazards

3.9.9. Key hazards present within the site vicinity include the following:

- made ground (on-site and off-site) associated with the construction and operation of the existing Saxmundham-Leiston Branch railway line and minor roads crossing the site;
- agricultural activities (on-site and off-site) including the potential for un-mapped farmers tips;
- historical landfills located off-site including Abbey Pit historic landfill located 50m south of the site and Aldhurst Farm approximately 150m north;
- potential spreading of sediment from sewage works located 800m south of the site including sanitary waste into adjacent fields;
- changes in soil compaction and soil erosion; and
- moderate UXO risk across the site.

ix) Summary of preliminary conceptual site model

3.9.10. A summary of potential contamination sources, pathways and receptors identified within the Preliminary Conceptual Site Model is provided in **Table 3.9.1**.

Table 3.9.1 Potential sources of contamination

Potential source of contamination	Potential contamination	Approximate location
Made ground associated with the construction and operation of the existing Saxmundham-Leiston Branch railway line and minor roads crossing the site.	Fuels and oils attributed to spills from vehicles on the roads included within the site boundary, plus exhaust particulates. A range of inorganic and organic contaminants including the potential for asbestos.	On-site
Farmland within site boundary. Potential for un-mapped farmers tips.	Contamination risk from herbicides, pesticides, silage, effluent, and fuel oils. Risk of inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos, etc.	
Historical landfills including Abbey Pit historic landfill located 50m south of the site and Aldhurst Farm approximately 150m north.	Accepted waste is unknown but potential contaminants may include metals, inorganic and organic contaminants, fuels, oils, asbestos and a potential for vapour and/or ground gas generation.	Off-site
Farmland surrounding the site. Potential for un-mapped farmers tips.	Contamination risk from herbicides, pesticides, silage, effluent, and fuel oils. Risk of inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos, etc.	
Leiston Wastewater Treatment Works 800m south of the site and additional potential spreading of sediment including sanitary waste into adjacent fields.	Potential contamination may comprise metals, inorganic contaminants, fuels and oils, PCBs, treatment chemicals, and a potential for hazard gas generation from sludges (as well as sanitary waste).	

3.9.11. Potential receptors and pathways as summarised in **Table 3.9.2** comprise:

Table 3.9.2 Potential receptors and pathways

Receptor group	Receptor	Principal contaminant migration pathways
Human health (on-site).	Commuters/pedestrians/cyclists/horse riders accessing roads and PRoWs crossing the rail route.	Dermal contact with and ingestion of contaminants in soils, soil-derived dusts and water; and Inhalation of soil-derived dust, fibres, gas and vapours.
	Agricultural workers.	
	Construction/maintenance workers.	
	Users of the new railway line.	
Human health (off-site).	Residents in adjacent properties.	Dermal contact with and ingestion of contaminants in soils, soil-derived dusts and water; and Inhalation of soil-derived dust, fibres, gas and vapours which may have migrated off-site.
	Pedestrians/cyclists/horse riders accessing PRoWs.	
	Farmers on adjacent agricultural land.	
Controlled waters: groundwater.	Groundwater within principal bedrock aquifer, Secondary A and Secondary Undifferentiated Superficial Aquifers.	Leaching of contaminants in soil to groundwater in underlying aquifers; Migration of contaminated water through preferential pathways such as underground services, pipes and granular material to groundwater in underlying aquifers; and Discharge of contaminants entrained in groundwater and/or surface water run-off followed by overland flow and discharge.
Controlled waters: surface waters (on-site and off-site).	Ponds within 50m of the site and drain parallel to Abbey Road (250m south of Lover's Lane crossing).	
Property (on-site and off-site).	Existing on-site services and structures. Existing off-site services and structures (including archaeological features).	Direct contact of contaminants in soil and/or groundwater with existing and proposed structures and buried services; and Migration of contaminated groundwater, ground gas and/or vapours along strata and preferential pathways such as service routes or differentially permeable strata.
	Crops and livestock.	Direct contact, ingestion, inhalation and uptake of soil and water contamination by crops and/or livestock; and Migration of contaminated waters/dust/fibres and subsequent uptake.
Ecological receptors (off-site)	Sizewell Marshes SSSI and Buckle's Wood Ancient Woodland	Direct contact, ingestion, inhalation and uptake of soil and water contamination by flora and/or fauna; and Migration of contaminated waters/dust/fibres and subsequent uptake by flora or ingestion/inhalation/dermal contact by fauna.

b) Environmental design and embedded mitigation

i) Construction

3.9.12. A summary of the measures that have been incorporated into the design of the green rail route and that would protect the land quality during construction is set out below.

- A piling risk assessment in accordance with Environment Agency guidance may be required to ensure that piling techniques for the track bed and/or the bridge structures implemented at the site are deemed appropriate by identifying and managing potential risks as a result of creating pathways to groundwater.
- The CEMP would specify measures required during construction including the following:minimising the area and duration of soil exposure and timely reinstatement of vegetation or hardstanding to prevent soil erosion and reduce temporary effects on soil compaction:
  - stockpile management (such as water spraying and avoiding over stockpiling to reduce compaction of soil and loss of integrity) to prevent windblown dust and surface water run-off;
  - implementation of appropriate dust suppression measures to prevent migration of contaminated dust;
  - implementation of working methods during construction to ensure that there is no surface water run-off from the works or any stockpiles into adjacent surface watercourses/leaching into underlying groundwater in accordance with best practice;
  - implementation of appropriate pollution incident control e.g. plant drip trays and spill kits; implementation of appropriate and safe storage of fuel, oils and equipment during construction;
  - implementation of an appropriate Materials Management Plan (MMP) to document how the excavated materials will be dealt with and a verification plan to record the placement of materials at the site; and
  - implementation of a site SWMP.
- The CEMP would incorporate the information required of a Design Environmental Management Plan in accordance with the Network Rail Standard NR/L2/ENV/015.
- Remediation of soil/groundwater contamination (e.g. source removal, treatment or capping) and ground stabilisation/improvement works would be undertaken if further investigation and risk assessments deem necessary.
- Gas protection measures would be incorporated within relevant proposed structures, if monitoring and risk assessments deem them to be necessary.
- Design of the rail route and associated structures and the selection of construction materials would be in accordance with the suite of Network Rail standards and the Governance for Railway Investment Projects GRIP process, and best practice guidance at the time of the design. The design would be required to take into account the ground conditions including the potential for ground movement, compaction, ground gas and ground aggressivity.
- The drainage/flood prevention strategies would consider the ground conditions including the permeability of the strata and the level of contamination present on-site.
- Additional assessment of the potential risks posed by UXO across the site and implementation of mitigation measures as appropriate.

ii) Operation

3.9.13. To protect land quality, the green rail route would be operated in accordance with the relevant regulations (including Network Rail standards) and good practice including:

- the incorporation of petrol/oil interceptors within the drainage design where considered necessary; and
- the use of appropriate drainage for the proposed rail infrastructure including where relevant an appropriate Sustainable Urban Drainage System (SuDS) scheme.

iii) Removal and reinstatement

3.9.14. A summary of the measures that have been incorporated into the post-operational phase of the green rail route and that would protect the land quality is set out below:

- the use of a CEMP as detailed above to cover the removal of the rail infrastructure, the drainage infrastructure and the reinstatement of top soils;
- use of a MMP to allow suitable materials to be placed back on-site;
- implementation of a SWMP and removal of all wastes from site;
- validation of the site and comparison against baseline conditions to assess the contamination status of the site following operation; and
- remediation of soil/groundwater contamination (e.g. source removal, treatment or capping) if investigation and risk assessments deem necessary.

c) Preliminary assessment of effects

i) Construction

Ground contamination

3.9.15. The construction works would potentially introduce new sources of contamination and disturb any existing sources of contamination through excavation and exposure of contaminated soil, remobilisation of contaminants through soil disturbance and the creation of preferential pathways for surface water run-off and ground gas migration pathways. With the embedded mitigation measures in place, construction activities should not increase the contamination risks presented at the site and neutral to minor beneficial effects are predicted. These effects would not be significant.

3.9.16. A preliminary assessment of the effects during the construction phase is provided in **Table 3.9.3**.

Physical effects

3.9.17. The development may also cause physical effects including changes in soil erosion, soil compaction and ground instability issues associated with stripping of topsoil, vegetation clearance, earthworks, stockpiling, movement of heavy plant, piling, temporary works and construction of the new rail route and associated infrastructure.

3.9.18. Earthworks along the rail route are anticipated with temporary stockpiles likely to be required on-site to allow earthworks along the road to progress and temporary works areas/haul roads to be constructed. There is also the potential for increased run-off during earthworks with a high sediment load likely to impact local surface waters. Earthworks would be planned to minimise soil exposure as far as practicable and areas required for temporary works would be reinstated as soon as possible after they are no longer required. With embedded mitigation, the effects on soil erosion are considered to be temporary and neutral and would not be significant.

Table 3.9.3 Construction phase contamination effects for the proposed development

Receptor	Value/Sensitivity	Baseline risk	Construction risk	Effect
Human	High	Low	Very low.	Minor beneficial.
Controlled waters (ground water).	Medium	Low	Very low.	Minor beneficial.
Controlled waters (surface water).	Low	Very low.	Very low.	Neutral
Property (existing/future structures and services, including archaeological remains).	Medium	Very low.	Very low.	Neutral
Property (existing/future crops and livestock).	Medium	Low	Very low.	Minor beneficial.
Ecological	High	Low	Very low.	Minor beneficial.

3.9.19. There do not appear to be any ground stability hazards (landslides, historical earthquakes, modern instrument recorded earthquakes). In addition, the Coal Authority has confirmed that the site is not in an area affected by coal mining. The site is identified as having a moderate UXO risk. Ground conditions have not yet been confirmed but embedded mitigation would provide additional information on ground stability, compaction and the competence of the ground. Additional assessment of the potential risks posed by UXO across the site will be undertaken and mitigation measures would be implemented as appropriate. Effects on soil compaction and ground stability are therefore considered to be neutral to minor beneficial and would not be significant.

3.9.20. With the embedded mitigation including ground investigation to confirm the ground conditions, inform the detailed design, and implementation of remedial/ground improvement works, physical effects are assessed to be neutral to minor beneficial. These effects would not be significant.

ii) Operation

Ground contamination

3.9.21. The operation of the green rail route would potentially introduce new sources of contamination. Spillages and leaks may occur and below ground services could create additional potential pathways for the migration of potential contamination that were not present at baseline. With embedded mitigation, neutral to minor beneficial effect are anticipated. These effects would not be significant.

3.9.22. Effects during the operational phase are provided in **Table 3.9.4**.

Physical effects

3.9.23. Impacts in relation to physical effects including soil erosion, compaction and changes in ground stability would be mainly related to the construction phase of the development and there are not considered to be any significant effects during the operational phase.

Table 3.9.4 Operational phase contamination effects for the proposed development

Receptor	Value/Sensitivity	Baseline risk	Construction risk	Effect
Human	High	Low	Very low.	Minor beneficial.
Controlled waters (ground water).	Medium	Low	Very low.	Minor beneficial.
Controlled waters (surface water).	Low	Very low.	Very low.	Neutral
Property (existing/future structures and services, including archaeological remains).	Medium	Very low.	Very low.	Neutral
Property (existing/future crops and livestock).	Medium	Low	Very low.	Minor beneficial.
Ecological	High	Low	Very low.	Minor beneficial.

iii) Removal and reinstatement

Ground contamination

3.9.24. The green rail route would be re-instated to the existing condition. With embedded mitigation incorporated into the design and effectively implemented during the construction and operation of the green rail route, there would be an overall neutral effect. These effects would not be significant.

3.9.25. Effects during the post-operational phase are provided in **Table 3.9.5**.

Physical effects

3.9.26. Impacts in relation to physical effects including soil erosion, compaction and changes in ground stability would be mainly related to the construction phase of the development and there are not considered to be any significant effects during the post-operational phase.

d) Additional mitigation and monitoring

3.9.27. The preliminary assessment of effects presented above identifies no adverse significant effects during construction, operation and post-operation in relation to land quality. Additional measures to mitigate significant adverse effects are not therefore required.

Table 3.9.5 Post-operational phase effects for the proposed development

Topic/Receptor	Value/Sensitivity	Baseline risk	Post operation risk	Impact effect
Human	High	Low	Very low.	Minor beneficial.
Controlled waters (ground water).	Medium	Low	Very low.	Minor beneficial.
Controlled waters (surface water).	Low	Very low.	Very low.	Neutral
Property (existing/future structures and services, including archaeological remains).	Medium	Very low.	Very low.	Neutral
Property (existing/future crops and livestock).	Medium	Low	Very low.	Minor beneficial.
Ecological	High	Low	Very low.	Minor beneficial.

e) Preliminary assessment of residual effects

3.9.28. No additional mitigation is proposed beyond the embedded measures described above and the residual effects for all phases of development would remain the same as those described above in the preliminary assessment of effects. The effects would be neutral to minor beneficial.

f) Completing the assessment

3.9.29. Once the proposals for the Sizewell C project development as a whole are finalised, a full land quality assessment of the proposals will be undertaken as part of the EIA and the results presented in the ES. The ES will present the full assessment underpinning the conclusions drawn in relation to significant effects.

3.9.30. A summary of the significance of overall effects is provided in **Table 3.9.6**, **Table 3.9.7** and **Table 3.9.8**.

Table 3.9.6 Summary of effects for construction phase

Geology and land quality

Topic/Receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Ground contamination: Current and future on-site and off-site human health receptors.	Contamination from on-site sources.	Undertake further ground investigation and risk assessment to define risks and undertake remediation and/or ground improvement works if required.	Not significant.	No adverse significant effects identified during construction works. Additional mitigation measures are not therefore required.	Not significant.
Ground contamination: Controlled waters receptors (groundwater and surface water).	Contamination from on-site sources.	Incorporate mitigation measures into the construction process, as set out in the CEMP, including the adoption of working methods to appropriately manage dust generation, pollution incidents, surface water run-off and groundwater during construction.	Not significant.		Not significant.
Ground contamination: Property receptors (services/ structures, archaeological remains, crops and livestock).	Contamination from on-site sources.		Not significant.		Not significant.
Ground contamination: Ecological receptors.	Contamination from on-site sources.		Not significant.		Not significant.
Physical effects: Ground conditions.	Soil erosion, soil compaction, impacts on ground stability.		Not significant.		Not significant.

Table 3.9.7 Summary of effects for operational phase

Geology and land quality

Topic/Receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Ground contamination: Current and future on-site and off-site human health receptors.	Contamination from on-site sources.	Construction methodology and associated mitigation measures would prevent impacts during operation. The project would be operated in accordance with the relevant regulations and best practice guidance in applying BAT.	Not significant.	No adverse significant effects identified during construction works. Additional mitigation measures are not therefore required.	Not significant.
Ground contamination: Controlled waters receptors (groundwater and surface water).	Contamination from on-site sources.		Not significant.		Not significant.
Ground contamination: Property receptors (services/ structures, archaeological remains, crops and livestock).	Contamination from on-site sources.		Not significant.		Not significant.
Ground contamination: Ecological receptors.	Contamination from on-site sources.		Not significant.		Not significant.
Physical effects: Ground conditions.	Soil erosion, soil compaction, impacts on ground stability.		Not significant.		Not significant.

Table 3.9.8 Summary of effects for removal and restoration phase

Geology and land quality

Topic/Receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Ground contamination: Current and future on-site and off-site human health receptors.	Contamination from on-site sources.	Incorporate mitigation measures into the CEMP, including the adoption of working methods to appropriately manage dust generation, pollution incidents, surface water run-off and groundwater during deconstruction/demolition. Validation of the site and remediation of soil/ groundwater contamination if investigation and risk assessments deem necessary.	Not significant.	No adverse significant effects identified during construction works. Additional mitigation measures are not therefore required.	Not significant.
Ground contamination: Controlled waters receptors (groundwater and surface water).	Contamination from on-site sources.		Not significant.		Not significant.
Ground contamination: Property receptors (services/ structures, archaeological remains, crops and livestock).	Contamination from on-site sources.		Not significant.		Not significant.
Ground contamination: Ecological receptors.	Contamination from on-site sources.		Not significant.		Not significant.
Physical effects: Ground conditions.	Soil erosion, soil compaction, impacts on ground stability.		Not significant.		Not significant.

3.10. Groundwater

a) Baseline environment

3.10.1. Details of the geology of the green rail route are provided in **section 3.9**.

3.10.2. The sand and gravel of the Lowestoft Formation is classified as a Secondary A Aquifer[11] and the diamicton of the Lowestoft Formation is classified as a Secondary Aquifer (undifferentiated)[12] (Ref. 3.10.1).

3.10.3. The Crag Group bedrock underlying the site is classified as a Principal Aquifer[13] (Ref. 3.10.2).

3.10.4. The western half of the site is within the Outer zone (Zone 2)[14], or Total catchment (Zone 3)[15] of a SPZ[16]; but the eastern half of the site is not within a SPZ.

3.10.5. The diamicton of the Lowestoft Formation at the site is expected to be of relatively low permeability and therefore have a limited hydraulic connection to the underlying Crag groundwater. It is likely that there are perched water tables in permeable lenses within the Lowestoft Formation.

3.10.6. In March 2014, groundwater monitoring installations were installed at four locations adjacent to the green rail route and groundwater level monitoring is ongoing. The maximum observed groundwater levels are summarised in **Table 3.10.1**.

3.10.7. Given the local geology and depth to groundwater there is not considered to be a connection between groundwater and surrounding surface water features. See **section 3.11**.

3.10.8. Permeability testing has been undertaken across the wider area and is summarised in **Table 3.10.2**.

Table 3.10.1 Summary of groundwater levels

Location	Response zone	Maximum GWL (mbgl)	Maximum GWL (mAOD)
GR2	Probable Lowestoft Till/Probable Crag.	16.85	4.99
GR3	Probable Crag.	15.14	4.74
GR6	Lowestoft Till Formation.	3.68	12.10
GR11	Crag Group.	7.05	3.79

Table 3.10.2 Summary of permeability testing

Permeability Test	Response zone	Permeability range
Falling head (during drilling).	Not specified.	3.84×10^{-4} to 1.33×10^{-6} m/s.
Falling head tests (in installations).	Not specified.	6.76×10^{-6} to 2.23×10^{-7} m/s.
Soakaway tests.	Cohesive soils of Lowestoft Till Formation.	6.22×10^{-6} to 9.94×10^{-9} m/s.
Soakaway tests.	Granular soils of Lowestoft Till Formation and Crag.	2.17×10^{-3} to 2.09×10^{-5} m/s.

[11] Secondary A Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

[12] Secondary (Undifferentiated) Aquifers are designated in cases where it has not been possible to attribute either category Secondary A or Secondary B to a rock type.

[13] Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability – meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

[14] Outer zones (Zone 2) are defined by a 400 day travel time from a point below the water table. The previous methodology gave an option to define SPZ2 as the minimum recharge area required to support 25 per cent of the protected yield. This option is no longer available in defining new SPZs and instead this zone has a minimum radius of 250 or 500m around the source, depending on the size of the abstraction.

[15] Total catchments (Zone 3) are defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75. There is still the need to define individual source protection areas to assist operators in catchment management.

[16] Groundwater Source Protection Zones are areas defined around groundwater sources used for public drinking water supply. The SPZ shows the risk of contamination from activities that might cause pollution in the area. The closer the activity, the greater the risk.

3.10.9. The green rail route is located on the Waveney and East Suffolk Chalk and Crag groundwater body Water Framework Directive (WFD) reference GB40501G400600 (Ref. 3.10.3). This groundwater body has been classified by the Environment Agency as being of Poor Quantitative and Poor Chemical status, with an objective to being of Good Quantitative and Good Chemical status by 2027. The Poor Chemical status is attributed to impacts from agriculture as evidenced by elevated nitrate concentrations in groundwater. The green rail route falls within a groundwater nitrate vulnerable zone.

3.10.10. A groundwater abstraction is indicated 620m north-east of the green rail route, however, further details of this abstraction are unknown. Given the environmental setting and land use in the area it is considered likely that the abstraction is used for crop irrigation during the summer months.

3.10.11. The Suffolk Coastal and Waveney District Strategic Flood Risk Assessment makes no reference to groundwater flooding across the Suffolk Coastal and Waveney District (Ref. 3.10.4). Flood risk is discussed further in **section 3.12**.

3.10.12. There is no known existing land contamination on the site. Further information on land quality is presented in **section 3.9**.

3.10.13. Sizewell Belts SSSI is located approximately 950m east of the site (see **section 3.3**).

b) Environmental design and embedded mitigation

i) Construction

3.10.14. A piling risk assessment, in accordance with Environment Agency guidance, may be required to ensure that appropriate piling techniques are implemented at the site (by identifying and managing potential risks as a result of creating pathways to groundwater).

3.10.15. The CEMP would specify the measures required during construction, which could include, but not be limited to:

- implementation of working methods during construction to ensure there would be no surface water run-off from the works, or any stockpiles, into adjacent surface watercourses/leaching into underlying groundwater, in accordance with best practice;
- implementation of appropriate pollution incident control e.g. plant drip trays and spill kits;
- implementation of appropriate and safe storage of fuel, oils and equipment during construction;
- implementation of an appropriate MMP to document how the excavated materials will be dealt with; and
- implementation of a SWMP.

3.10.16. Remediation of soil/groundwater contamination (e.g. source removal, treatment or capping) and ground stabilisation/improvement works would be undertaken if further investigation and risk assessments deemed it necessary.

3.10.17. The drainage/flood prevention strategies will consider the ground conditions including the permeability of the strata and the level of contamination present on-site.

ii) Operation

3.10.18. Appropriate drainage would be used, including the incorporation of SuDS measures.

3.10.19. Petrol/oil interceptors would be incorporated within the drainage design where considered necessary.

iii) Removal and reinstatement

3.10.20. The removal of the green rail route would include the removal of any related drainage and SuDS measures. Any measures used to protect groundwater during construction would also be applied during the removal and reinstatement phase.

c) Preliminary assessment of effects

i) Construction

3.10.21. Given the shallow excavation depths and low permeability of the superficial deposits, the construction of the embankments, level crossing and spoil bunding would not likely have an impact on the groundwater level and flow regime.

3.10.22. The construction would include a section of cutting of up to 3.2mbgl, with a minimum elevation of +10.50m Above Ordnance Datum (AOD). Groundwater level monitoring within the vicinity of the cutting has established a peak groundwater level of +12.10m AOD within the Lowestoft Till Formation. Significant groundwater control would unlikely be required due to the limited lateral extent of groundwater within the Lowestoft Till, and the depth to groundwater in the Crag at approximately +4.5m AOD. The effect of this impact to groundwater in the Lowestoft Till would therefore not be significant.

3.10.23. Cutting activities create a potential pathway for contamination generated during the construction process to reach groundwater. It is unlikely that the cutting would extend beyond the base of the low permeability Lowestoft Till aquifer and into the underlying Crag aquifer. It is therefore likely that, should contamination be introduced, it would be confined to the superficial aquifer. The impact on the Lowestoft Till groundwater would be low and the effect not significant. The effect on the Crag groundwater would not be significant.

3.10.24. Were a spill or leak to occur during construction, the impact on groundwater within superficial deposits would be low and the effect on the Lowestoft Formation groundwater would not be significant.

3.10.25. The Crag groundwater would be protected from any spills or leaks by the overlying low permeability superficial deposits. The impact on the Crag groundwater would therefore be low and the effect would not be significant.

3.10.26. It is anticipated that, due to its distance from the site and the nature of the works, the impact on groundwater abstraction would be low and the effect would not be significant.

3.10.27. Considering both the baseline conditions of the site and the environmental design and embedded mitigation, there would be no significant effect on groundwater at the site during construction of the green rail route.

ii) Operation

3.10.28. Contamination from any fuel spills or leaks from trains using the route would be of limited magnitude and longevity, and would be mitigated through the incorporation of SuDS measures and it is unlikely there would be a significant effect on groundwater.

3.10.29. Instances where cuttings intercept the water table could have an impact on the groundwater flow and flow direction, although long-term groundwater control would unlikely be required given the limited lateral extent of groundwater within the Lowestoft Till, and the depth to groundwater in the Crag. The impact to groundwater in the Lowestoft Till would be low and the effect would not be significant.

3.10.30. The proposed works would not significantly increase the impermeable area of ground cover at the site as the material used for the green rail route would be highly permeable, allowing infiltration to groundwater. The drainage design would intercept run-off from adjacent areas, avoiding flooding of lengths of the railway that are in cutting and preventing increased run-off to adjacent areas where the railway is embanked. This design would avoid, or minimise, impacts to groundwater receptors.

3.10.31. Considering both the baseline conditions of the site and the environmental design and embedded mitigation, there would be no significant effects on groundwater at the site during operation of the green rail route.

iii) Removal and reinstatement

3.10.32. The green rail route would be re-instated to the existing condition. With embedded mitigation incorporated into the design and effectively implemented during the construction and operation of the green rail route, these effects would not be significant.

d) Additional mitigation and monitoring

3.10.33. Periodic inspection and maintenance of the drainage infrastructure would be required to ensure the continued efficacy of the surface water drainage system.

e) Preliminary assessment of residual effects

3.10.34. There would be no significant adverse residual effects during the construction, operation or post-operational phases.

f) Completing the assessment

3.10.35. Groundwater level monitoring would continue at the existing monitoring borehole locations along the proposed rail route extension to inform detailed design. Once the proposals for the Sizewell C development are finalised, a full groundwater assessment of the proposals will be undertaken as part of the EIA and the results presented in the ES. The ES will present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 3.10.3 Summary of effects for construction phase

Groundwater

Receptor	Impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Crag groundwater (Principal Aquifer); Lowestoft Formation sand and gravel (Secondary A Aquifer); Groundwater abstraction (within 1km of site boundary). Ground contamination: Controlled waters receptors (groundwater and surface water). Ground contamination: Property receptors (services/structures, archaeological remains, crops and livestock).	Leaching and migration of existing contaminants (free and dissolved phase) from soils in the unsaturated zone into groundwater in underlying aquifers.	Piling risk assessment (if required). Ensuring all site activities are carried out in accordance with the CEMP. Remediation of on-site contamination if required. Appropriate drainage design.	Not significant.	Groundwater level monitoring.	Not significant.
	Migration of contaminants via preferential pathways to deeper groundwater.		Not significant.		Not significant.
	Construction materials and the use of construction vehicles have the potential to introduce contamination to groundwater via drips and spillages and infiltration of run-off from the construction site.		Not significant.		Not significant.
Lowestoft Formation diamicton (Secondary Aquifer (undifferentiated)).	Localised reduction in groundwater level and flow regime of the aquifer during dewatering to facilitate the construction of the rail cutting.	Piling risk assessment (if required). Ensuring all site activities are carried out in accordance with the CEMP. Remediation of on-site contamination if required. Appropriate drainage design.	Not significant.		Not significant.
	Creation of preferential pathways for contamination to reach groundwater during construction of the rail cutting.		Not significant.		Not significant.
	Leaching and migration of existing contaminants (free and dissolved phase) from soils in the unsaturated zone into groundwater in underlying aquifers.		Not significant.		Not significant.
	Construction materials and the use of construction vehicles have the potential to introduce contamination to groundwater via drips and spillages and infiltration of run-off from the construction site.		Not significant.		Not significant.

Table 3.10.4 Summary of effects for operational phase

Groundwater

Receptor	Impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Crag groundwater (Principal Aquifer); Lowestoft Formation – sand and gravel (Secondary A Aquifer); Lowestoft Formation – diamicton (Secondary Aquifer (undifferentiated)); Groundwater Abstraction (within 1km of site boundary).	Increase in the impermeable area of ground cover at the development site.	Water draining from the rail infrastructure will pass through appropriate drainage, including the incorporation of SuDS and petrol/oil interceptors where necessary. This will allow infiltration to the superficial aquifer, whilst also protecting the underlying groundwater from hydrocarbon contamination.	Not significant.	Periodic inspection and maintenance of the SuDS infrastructure.	Not significant.
	Fuel spills or leaks infiltrating to groundwater.		Not significant.		Not significant.

Table 3.10.5 Summary of effects for removal and reinstatement phase

Groundwater

Receptor	Impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Crag groundwater (Principal Aquifer); Lowestoft Formation – sand and gravel (Secondary A Aquifer); Lowestoft Formation – diamicton (Secondary Aquifer (undifferentiated)); Groundwater Abstraction (within 1km of site boundary).	Leaching and migration of existing contaminants (free and dissolved phase) from soils in the unsaturated zone into groundwater in underlying aquifers.	Ensuring all site activities are carried out in accordance with the CEMP. Remediation of on-site contamination if required. Appropriate drainage design.	Not significant.	Additional mitigation measures are not required.	Not significant.
	Migration of contaminants via preferential pathways to deeper groundwater.		Not significant.		Not significant.
	Construction materials and the use of construction vehicles have the potential to introduce contamination to groundwater via drips and spillages and infiltration of run-off from the construction site.		Not significant.		Not significant.

3.11. Surface water

a) Baseline environment

i) Surface water features

3.11.1. Light detection and ranging data show that the highest ground levels, slightly above 23m Ordnance Datum Newlyn (ODN), are located in the south of the site. Ground levels become progressively lower towards the north of the site, with the lowest ground levels slightly below 7m ODN at its north-east edge.

3.11.2. The majority of the green rail route is located within the Leiston Beck catchment (water body reference GB105035046271) (Ref. 3.11.1). A series of ditches cross the site, which in turn feed the upper reaches of the Leiston Beck to the east of Abbey Road. The upper reaches of the channel are classed as ordinary watercourse, whilst the main river limit is at Lover's Lane, approximately 950m from the site of the green rail route. The reported WFD (Ref. 3.11.2) reach of the Leiston Beck aligns with the main river. Both the B1122 Abbey Road and Lover's Lane separate the green rail route from this watercourse. There are no permanent ponds in the vicinity of the green rail route.

3.11.3. The south-eastern boundary of the site of the green rail route lies within the catchment of the Hundred River (water body reference GB105035046260) (Ref. 3.11.3). The river channel is approximately 500m south of the site at its closest point.

ii) Fluvial geomorphology

3.11.4. Geomorphology and hydromorphology underpin the WFD, being key factors contributing to whether a water body can achieve or maintain Good ecological status.

3.11.5. The drainage network on the site is largely manmade, albeit formalising what would most likely have been ephemeral water features. Downstream of the site, the Leiston Beck is designated as a Heavily Modified Water Body (HMWB) which has been straightened, over-deepened and over-widened. The hydrological regime is of sufficient quality to support Good ecological status, but necessary WFD mitigation measures have not been fully delivered. Overall, it is at moderate ecological potential.

3.11.6. The Hundred River is also a HMWB and is at moderate ecological potential. All prescribed WFD mitigation measures have been implemented and the hydrological regime is of sufficient quality to support Good ecological status.

iii) Water quality

3.11.7. Physico-chemical and Chemical data presented on Catchment Data Explorer have been reviewed for the River Leiston Beck. The chemical status for the river is Good, however the status for the physico-chemical elements is classified as moderate.

3.11.8. Physico-chemical data indicate that the River Leiston Beck is Good or High WFD status for ammonia, pH and temperature, and are not adversely affected by pollutants such as copper, zinc and triclosan. The water body is at Moderate physico-chemical status as a result of 'bad' dissolved oxygen (DO) and 'poor' phosphate concentrations, and as a result the overall ecological status is classified as Moderate. This suggests that water quality in the catchment is under stress, either from diffuse or point sources of pollution as there is evidence of eutrophication (high nutrient levels and low DO). Channel morphology may be exacerbating the effects of pollution.

3.11.9. Physico-chemical data indicate that the Hundred River in the vicinity of the site boundary is at Good or High WFD status for ammonia, pH and temperature. DO is at 'Bad' WFD status and phosphate is at Moderate status. Overall, the water body is at Moderate physico-chemical status. As with Leiston Beck, this suggests that water quality in the catchment is under stress, either from diffuse of point sources of pollution. Channel morphology may be exacerbating the effects of pollution.

b) Environmental design and embedded mitigation

i) Construction

3.11.10. A surface water management system would be constructed early in the construction period. This drainage system would intercept site run-off before infiltrating it to ground. It would also prevent the supply of sediment and other contaminants to the surface drainage network

3.11.11. The potential effects of surface water contamination on groundwater receptors are considered in **section 3.10**.

3.11.12. Mitigation measures would be incorporated into the construction and removal and reinstatement phases and could include (but are not limited to):

- The wheels of all vehicles would be washed before leaving site.

- Concrete and cement mixing and washing areas would be situated at least 10m away from surface water receptors. These would incorporate settlement and recirculation systems to allow water to be re-used. All washing out of equipment would be undertaken in a contained area, and all water would be collected for off-site disposal.
- All fuels, oils, lubricants and other chemicals would be stored in an impermeable bund with at least 110% of the stored capacity. Spill kits would be available at all times, and damaged containers should be removed from site. All refuelling would take place in a dedicated impermeable area, using a bunded bowser. Biodegradable oils would be used where possible.
- Spill kits would be available on-site at all times. Sand bags or stop logs would also be available for deployment on the outlets from the site drainage system in case of emergency spillages.

ii) Operation

3.11.13. The operational drainage system would incorporate SuDS measures where appropriate to minimise potential impacts on surface water receptors.

3.11.14. The proposed works would not significantly increase the impermeable area at the site, as the material used for the railway line would be permeable, allowing infiltration to ground. The drainage design would intercept run-off from adjacent areas, avoiding flooding of lengths of the railway that are in cutting and preventing increased run-off to adjacent areas where the railway is embanked.

iii) Removal and reinstatement

3.11.15. Once the operation of the green rail route has ceased, the site would be returned to its existing agricultural use. During the works, the construction mitigation measures would be applied as necessary.

c) Preliminary assessment of effects

i) Construction

3.11.16. During construction the site would be isolated from adjacent land areas. Surface water run-off would be intercepted and infiltrated to ground, and as a result there would be no significant effects.

ii) Operation

3.11.17. The proposed works would not significantly increase surface water run-off from the site, whilst SuDS would intercept run-off and promote infiltration to ground. Mitigation would prevent any fuel spills polluting the ground. As a result, there would be no significant effects.

iii) Removal and reinstatement

3.11.18. The environmental design and embedded mitigations would ensure that there would be no significant effects at the site with respect to surface water during this phase of development.

d) Additional mitigation and monitoring

3.11.19. Once operational, periodic inspection and maintenance of the drainage infrastructure may be required to ensure the continued efficacy of the surface water drainage system.

e) Preliminary assessment of residual effects

3.11.20. No significant adverse residual effects are expected during the construction, operation or removal and reinstatement phases.

f) Completing the assessment

3.11.21. Additional investigations will be undertaken at the site to inform further detailed design and environmental assessment.

3.11.22. Once the proposals for the Sizewell C development are finalised, a full assessment of potential effects on the surface water environment will be completed as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 3.11.1 Summary of effects for construction phase

Surface Water

Topic/ receptor	Impacts	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
River Leiston Beck and Hundred River.	Contamination of the rivers.	The site will be isolated from adjacent land areas, with drainage to ground.	Not significant.	Adoption of pollution prevention measures (e.g. wheel washing and separation of working areas from surface waters), enforced through construction code of practice.	Not significant.
Existing land drainage on the site.	Loss of onsite drainage network. Pollution of the onsite land drainage.	Traditional drainage along the railway line to maintain land drainage of adjacent areas.	Not significant.		Not significant.

Table 3.11.2 Summary of effects for operational phase

Surface Water

Topic/ receptor	Impacts	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
River Leiston Beck and Hundred River.	Contamination of the rivers.	Infiltration on the railway, with a combination of SuDS and traditional drainage of adjacent to the railway line.	Not significant.	Active management and maintenance of the drainage system to maximise its efficacy.	Not significant.
Existing land drainage on the site.	Loss of onsite drainage network. Pollution of the onsite land drainage.	Traditional drainage along the railway line to maintain land drainage of adjacent areas.	Not significant.		Not significant.

Table 3.11.3 Summary of effects for removal and reinstatement phase

Surface Water

Topic/ receptor	Impacts	Environmental design and embedded mitigation	Assesment of effects	Additional mitigation	Residual efects
River Leiston Beck and Hundred River.	None	The site would be returned to its existing agricultural use. Mitigation measures would be applied as necessary.	Not significant.	None	Not significant.
Existing land drainage on the site.			Not significant.		Not significant.

3.12. Flood risk

3.12.1. The figures for flood risk are presented in **Volume 3** as **Figures 3.12.1** to **3.12.2**.

a) Baseline environment

3.12.2. The green rail route is predominantly flat or gently undulating agricultural land.

3.12.3. The dominant solid geology of the area is the Crags (marine deposits) and the superficial geology is the Lowestoft Formation. This geology presents variable ground permeability.

3.12.4. The Soilscapes map (Ref. 3.12.1) indicates slowly permeable loamy and clayey soils along approximately the first 500m long section from the branch line. After this section, freely draining soils are present up to and beyond Abbey Road.

3.12.5. A small roadside watercourse is located along Buckleswood Road, which is considered to be an ordinary watercourse. Another ordinary watercourse is identified along the west of Abbey Road, which then crosses Abbey Road before flowing into Leiston Drain.

3.12.6. The site is entirely in Flood Zone 1 and so the risk of flooding from rivers or the sea is low (**Figure 3.12.1**).

3.12.7. The Environment Agency 'flood risk from surface water' map indicates the majority of the site is at very low risk of surface water flooding. In a field to the west of Abbey Road is an area of low to high surface water flood risk along the southern and eastern field boundary (**Figure 3.12.2**).

3.12.8. **Table 3.12.1** summarises the flood risk to the site from the rivers, sea, groundwater, sewers and reservoirs, which are assessed as generally very low except for a small piece of the field adjacent to Abbey Road.

b) Environmental design and embedded mitigation

3.12.9. The Sequential Test aims to steer new developments away from areas of high flood risk. The positioning of the site in Flood Zone 1 complies with this requirement. There would be no loss of functional floodplain as a result of the development.

i) Construction

3.12.10. Early construction of shallow perimeter bunding would likely be in place to stop any surface water run-off from leaving the site. Water held behind the bunding would be infiltrated to the ground.

Table 3.12.1 Summary of flood risk at the main development site

Source of flooding	Flood risk
Fluvial	Low: less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%).
Tidal/coastal	Low: less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%).
Surface water (pluvial)	Majority of site – Very Low: less than 1 in 1,000 annual probability of surface water flooding in any year (<0.1%). Field adjacent to Abbey Road – High: greater than 1 in 30 annual probability of surface water flooding in any year (>3.3%).
Groundwater	Low: soil is permeable but groundwater levels recorded in historic borehole south of site as 4 – 5m below ground levels.
Sewers	Low: greenfield site, surrounded by arable land and sewers have not currently been identified on the site.
Reservoirs	Not at risk of flooding from reservoirs.

3.12.11. Monitoring and maintenance of the construction drainage system would be carried out to preserve integrity and design capacity.

ii) Operation

3.12.12. The proposed works would not significantly increase the impermeable area at the site, as the material used for the railway line would be permeable, allowing infiltration to ground. The drainage design would intercept run-off from adjacent areas, avoiding flooding of lengths of the railway that are in cutting and preventing increased run-off to adjacent areas where the railway is embanked.

3.12.13. Climate change will be considered in the detailed drainage design, in particular future changes in rainfall intensity. The drainage design will also consider exceedance flows to limit water depths. This would be achieved by using the site topography to direct excess surface water flows to less critical areas of the site before infiltrating to ground.

3.12.14. Monitoring and maintenance of the operational drainage system would be carried out to preserve integrity and design capacity.

iii) Removal and reinstatement

3.12.15. All structures associated with the green rail route would be removed and the site returned to agricultural use. There are not anticipated to be any flood risk related measures required for this phase.

c) Preliminary assessment of effects

3.12.16. Although the drainage design needs further development, the embedded mitigation principles outlined above would likely ensure there would be no increase to the generally low baseline flood risk at the site and therefore there are no likely significant effects.

d) Additional mitigation and monitoring

3.12.17. No further mitigation or monitoring is required.

e) Preliminary assessment of residual effects

3.12.18. Monitoring and maintenance of the drainage infrastructure, together with suitable design for exceedance flows, would manage residual flood risk, so there would be no significant residual effects.

f) Completing the assessment

3.12.19. A flood risk assessment (FRA) for this site will be submitted as part of the application for development consent after the proposals for the Sizewell C development as a whole are finalised.

Table 3.12.2 Summary of effects for construction phase

Flood risk

Topic/ receptor	Impacts	Environmental design and embedded mitigation	Assesment of flood risk	Additional mitigation	Residual efects
Surface water.	Increase in impermeable area and associated surface water run-off during construction of site.	Shallow perimeter bunds constructed to contain surface water run-off on-site.	Not significant.	Monitoring and maintenance of bund to preserve integrity and maintain design capacity construction code of practice.	Negligible

Table 3.12.3 Summary of effects for operation phase

Flood risk

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assesment of flood risk	Additional mitigation	Residual efects
Surface water.	Increase in impermeable area and associated surface water run-off from the site.	Surface water from impermeable areas discharged to infiltration SuDS including an allowance for climate change and incorporates the management of existing areas flood risk. Permeable surfaces used for railway track areas.	Not significant.	None	Negligible

Table 3.12.4 Summary of effects for removal and reinstatement phase

Flood risk

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assesment of flood risk	Additional mitigation	Residual efects
Surface water.	Decrease in impermeable area.	Embedded mitigation principles outlined as part of the surface water drainage scheme .	Not significant.	None	Negligible

3.13. Traffic and transport

a) Baseline environment

3.13.1. The green rail route would extend approximately 4.5km in a north-easterly direction from the existing Saxmundham-Leiston branch line into the main development site. The proposed route would branch off from the existing railway line about 375m east of the existing Saxmundham Road level crossing and 230m south of Buckle's Wood, west of Leiston.

3.13.2. The route would intersect with the existing road network in two locations (Buckleswood Road and Abbey Road) and with existing footpaths in three locations. The impacts of the green rail route on the existing roads and footpaths are described earlier in this chapter in **section 3.4**.

i) Highway network

3.13.3. Buckleswood Road runs in a north-west to south-east alignment from Abbey Lane to Westward Ho in Leiston. Buckleswood Road is a single carriageway road with a 60mph speed limit outside of the Leiston built up area. Existing traffic volumes are approximately 300 vehicles per day. There have been no personal injury accidents in this area in the period 2013-2017.

3.13.4. The green rail route would intersect with Buckleswood Road to the east of Buckle's Wood. The speed limit is 60mph at this location, and no footways are present. Hedgerows are present along the road and there are some moderate curves along its route, though its alignment is relatively straight at the point where it would intersect with the green rail route.

3.13.5. Abbey Road is a single carriageway road running north from Leiston town centre. The road has a slight upwards gradient at the point where it would intersect the green rail route. Existing traffic volumes are approximately 4,460 vehicles per day. The speed limit is 30mph at this location and increases to 60mph about 50m north of Abbey Lane. A footway is present along the western side of Abbey Road from Leiston town centre until a short distance north of Leiston Abbey.

3.13.6. Lover's Lane currently meets Abbey Road at a priority junction about 100m south of Leiston Abbey.

ii) Public rights of way network

3.13.7. The green rail route option would cross a number of footpaths and recreational routes, further details of which are provided in **section 3.4.**

b) Environmental design and embedded mitigation

i) Construction

3.13.8. It is anticipated that the construction of the green rail route would start from the eastern end of the route in the main construction site and work west along the route corridor towards the branch line. Some limited access may be required at the western end, around Buckleswood Road. An area of land has been identified in this location for use as a contractor's laydown area. This area is bounded to the east by Buckleswood Road, to the south by the existing rail line, and to the north by the proposed rail extension. Vehicular access to the area would be provided off Buckleswood Road.

3.13.9. During the construction of the proposed new level crossing on Abbey Road, the B1122 would follow a temporary alignment just west of the existing carriageway, so that disruption to through traffic is minimised.

3.13.10. The construction of the green rail route would minimise impacts on adjacent roads and the following measures are included:

- construction would commence from the eastern end, which has better road access for construction equipment and workers along the alignment from the main development site. This would also minimise impacts at the western end alongside Buckle's Wood; and
- where vehicles are required at the western end of the route, an access from Buckleswood Road will be provided, thereby reducing the need for vehicles to drive along the entire length of the route.

ii) Operation

3.13.11. Under the rail-led strategy and once the green rail route is operational, it would enable up to five trains a day to make deliveries of aggregates and other materials to the main development site, replacing up to 50 HGVs per train, equivalent to 250 HGV trips per day in each direction that would otherwise need to use the strategic road network and nearby local roads.

3.13.12. The green rail route would therefore form part of the rail-led strategy to reduce the impacts of construction movements on the existing roads. The alternative road-led strategy would be to improve the existing road network to reduce the impacts of additional HGVs.

3.13.13. The green rail route has been designed to minimise impacts on drivers, pedestrians and cyclists during its operation, including the following measures:

- the proposed alignment of the green rail route minimises the interfaces with the existing road network, as well as providing some separation with Leiston to minimise noise and other effects (see **section 3.7**);
- a new shared footway and cycleway would be constructed alongside Lover's Lane, with a controlled crossing place on Lover's Lane and another north of the level crossing on Abbey Road; and
- where possible, trains will be timed to avoid peak periods of traffic movements such as school start and end times.

3.13.14. Buckleswood Road intersects with the proposed green rail route west of Leiston. Two alternative options are proposed at this location:

- providing a level crossing for vehicles, pedestrians and cyclists; or
- closing Buckleswood Road to vehicles and providing a footbridge for pedestrians and cyclists.

3.13.15. In the event of Buckleswood Road being stopped-up either side of the railway, turning heads would be provided on both sides to allow vehicles to turn.

3.13.16. The presence of a level crossing would have a small benefit for pedestrians and cyclists compared to the bridge, because using the level crossing is at grade, and would impose less delay with the exception of times when it would be closed to allow trains to pass. However, in the event of the closure of Buckleswood Road being the preferred option, the bridge would enable pedestrians and cyclists to continue using Buckleswood Road with only a small deviation.

3.13.17. At Buckleswood Road the provision of a bridge, in the event of the road being closed to vehicles, would minimise delay and diversion for pedestrians and cyclists using Buckleswood Road and footpath E-363/003/0. The provision of this bridge would allow pedestrians and cyclists to continue using Buckleswood Road throughout the green rail route's operational period, even when trains are passing on the railway line. In the event of the level crossing being the preferred option, pedestrians and cyclists would not experience any delay except for the short periods when the level crossing is closed to allow trains to pass.

3.13.18. Whilst pedestrians and cyclists would be inconvenienced by using the footbridge compared to, for example, an open crossing, the latter would carry significant safety risks. Pedestrians and cyclists would be able to use cross the railway at grade whenever the barriers are open, which would be the vast majority of the time.

3.13.19. No bridges would be provided for the other two footpaths between Buckleswood Road and Abbey Lane, since it is considered that a diversion to the east – in order to cross the green rail route by means of the Abbey Road level crossing and then travel west to resume the previous course of the footpath – does not give rise to significant loss of amenity (see **section 3.4**).

3.13.20. The Abbey Road level crossing would have a footpath and cycle path on both approaches, allowing pedestrians and cyclists to wait in safety while a train passes.

c) Preliminary assessment of effects

i) Construction

3.13.21. During construction of the level crossing at Abbey Road, a temporary road alignment would be used to maintain traffic flow. Consequently, it is anticipated that displacement of traffic to other, less suitable roads would be minimal. The temporary alignment would also allow pedestrians, cyclists and equestrians to continue to use Abbey Road.

3.13.22. The western portion of Lover's Lane would be diverted to intersect with Abbey Road a short distance south of the existing junction, in order to achieve a sufficient distance from the Abbey Road level crossing. Construction of this new junction would require some short-term closures of Abbey Road and Lover's Lane which would temporarily disrupt traffic.

3.13.23. The main effect during construction is expected to be a modest increase in traffic volumes generated by construction trips that are included in the traffic forecasts set out in **Volume 1, Chapter 7**. This effect is not considered to be significant.

ii) Operation

3.13.24. The green rail route would be used by up to five trains per day in each direction.

3.13.25. The B1122 Abbey Road level crossing would be closed for up to ten times per day; each closure would last approximately two minutes. Traffic volumes along this section of Abbey Road are forecast to be approximately 8,550 vehicles on a typical day during the peak construction year in the rail-led strategy. The resulting queue, even for a three-minute closure, would not extend back to the main construction site entrance approximately 0.4 miles to the north. The queue would extend across the Lover's Lane and Abbey Lane junctions during each closure. However, for at least 95% of the period 07:00 to 19:00 each day, the crossing would be open to vehicles and not impose any delay on road users. This is a robust estimate as some level crossing closures could take place between 19:00 and 23:00.

3.13.26. The effect on traffic on Abbey Road of a level crossing closing up to ten times per day is not considered to be significant.

3.13.27. If the level crossing were the option taken forward at Buckleswood Road, this would also be closed up to ten times per day. However, while this would delay Buckleswood Road users, the traffic volume here is low and the queuing would not impact on other locations.

3.13.28. If the road closure option at Buckleswood Road were taken forward, this would lead to a diversion of approximately 1.5 miles for vehicles travelling between Abbey Lane and Westward Ho. However, a proportion of existing traffic on Buckleswood Road currently travels between the Saxmundham Road level crossing and Leiston, as an alternative to the B1119; for vehicles travelling to Leiston town centre the two routes are of similar length. The B1119 would also remain as an alternative route and does not involve crossing the railway. Abbey Lane would also remain open for vehicles travelling between Saxmundham Road and the B1122.

3.13.29. In the event of Buckleswood Road being closed to vehicles, the effect on the relatively small number of vehicles requiring access to Westward Ho would be significant. For the remainder of traffic using Buckleswood Road as a through route, the diversionary effect would not be significant. Pedestrians and cyclists would experience a positive effect in the event of Buckleswood Road being closed to vehicular through traffic as a result of a reduction in conflict between vehicles and vulnerable road users.

iii) Removal and reinstatement

3.13.30. Once the Sizewell C development has been built, the green rail route including the track bed would be removed and returned to its original topography, using the excavated material stored alongside the line in bunding. This would generate some vehicle movements associated with the earthworks, though these would generally be along the line of the route rather than on public roads. These effects would be comparable in nature and duration to those of the green rail route construction phase. However, they would take place towards the end of the Sizewell C development construction phase when large scale earthworks and movements of freight would be lower compared to the period when the green rail route would be constructed.

3.13.31. The relocated junction of Abbey Road and Lover's Lane would remain in place following completion of the project.

d) Additional mitigation and monitoring

i) Construction

3.13.32. No additional traffic and transport mitigation measures are proposed during construction, except for the temporary diversion of Abbey Road and Lover's Lane as described.

ii) Operation

3.13.33. All signage required by SCC as the local highway authority would be installed on the approaches to Abbey Road level crossing, and at the Buckleswood Road level crossing, if that solution is taken forward. Network Rail signage would also be installed at both of these vehicular level crossings as well as the footpath crossings.

iii) Removal and reinstatement

3.13.34. No monitoring would be required during this phase as the green rail route would be removed.

e) Preliminary assessment of residual effects

i) Construction

3.13.35. The residual effects during construction are anticipated to be the same as those set out under preliminary effects described above.

ii) Operation

3.13.36. The residual effects during operation are anticipated to be the same as those set out under preliminary effects described above.

iii) Removal and reinstatement

3.13.37. There would be no residual effects as the green rail route would be removed.

f) Completing the assessment

3.13.38. Once a preferred option for Buckleswood Road is selected, further assessment of the traffic and transport effects would be undertaken. Methods to minimise construction impacts through modular construction of the footbridge would be investigated.

3.14. Comparison between rail-led and road-led strategies

3.14.1. The green rail route would only be built under the rail-led strategy. If the road-led strategy is taken forward, the effects described in this chapter would not arise.

4. Other Rail Improvements PEI

4.1. Introduction

a) Overview

4.1.1. If the rail-led strategy is adopted, infrastructure upgrades and changes to level crossings will be required to the East Suffolk line in order to accommodate up to five freight trains per day which are expected at peak construction once the green rail route is operational. These upgrades would include:

- a passing loop at a location between Ipswich and Saxmundham;
- a track crossover at Saxmundham;
- up to 45 level crossings to be upgraded or closed, and rights of way to be diverted;
- strengthening works to six bridges; and
- signalling upgrades.

4.1.2. EDF Energy does not currently expect that any upgrades to this line will be required in a road-led strategy. However, Network Rail is carrying out further assessments and it is possible that some of the infrastructure upgrades required under the rail-led strategy may also be required under the road-led strategy.

4.1.3. All of these upgrades would be retained following completion of construction of Sizewell C.

4.1.4. In both the rail-led and road-led strategies, there would be a need for the existing track on the Saxmundham to Leiston branch line to be repaired or replaced to the standard required for freight transport. There would also be a need for nine level crossings to be upgraded. These changes would be retained following completion of construction of Sizewell C.

4.1.5. The rationale for the works and the nature and extent of the rail upgrade works is explained further in **Volume 1, Chapter 8.** The green rail route, which would be required only under a rail-led strategy, is also covered in **Volume 1, Chapter 8** and in a separate Preliminary Environmental Information (PEI) chapter. Similarly, the works that would be required to the rail infrastructure at Sizewell Halt and/or the Land to the east of Eastlands Industrial Estate (LEEIE) are covered in **Volume 1, Chapter 7.**

b) Chapter structure

4.1.6. Given the unusually scattered nature of the improvement works and the scope of the assessments undertaken to reflect the rather limited potential for significant effects, this PEI chapter is structured in a slightly different way to other PEI chapters as follows:

- traffic and transport;
- noise;
- amenity and recreation;
- landscape and visual;
- terrestrial ecology and ornithology;
- terrestrial historic environment;
- air quality;
- groundwater;
- surface water; and
- flood risk

c) Scope of assessments

4.1.7. The scope of the assessments presented for the rail improvements has been determined based on review of the Governance Railway Investment Projects (GRIP) 2A report provided by Network Rail and consideration of the potential for significant adverse effects by Environmental Impact Assessment (EIA) professionals and technical specialists.

4.1.8. In the second section of this chapter, a preliminary traffic assessment is presented which considers the traffic effects of all of the rail improvements within a single assessment. The preliminary assessment for traffic and transport enables further context to be given to the chapters that follow, particularly in relation to the level crossing proposals.

4.1.9. In the third section of this chapter, a preliminary noise assessment is presented which considers the noise effects of the rail improvements within a single assessment and considers all elements of the rail improvements defined above. Noise during both construction and operation of the upgraded branch lines has the potential to introduce significant effects at a large number of residential receptors and so has been considered for all improvements. A similar approach has been used for air quality.

4.1.10. For a further four topics in this chapter: landscape and visual, terrestrial ecology and ornithology, groundwater and surface water, the scope of the preliminary assessment covers only the passing loop and the track cross-over works as these more substantive works are more likely to lead to significant adverse effects.

4.1.11. For the remaining topics in this chapter, high level consideration is given to the level crossings works but the focus of the assessments is on the passing loop and the track cross-over works as these more substantive works are more likely to lead to significant adverse effects.

4.1.12. The following topics have been scoped out:

- geology and land quality has been scoped out given the limited extent of excavation that is likely; and
- soils and agriculture has been scoped out given both the limited extent of excavation but also that most of the permanent land take would be within existing railway land and that any impacts to agricultural land would be temporary (for example, use of temporary compounds).

4.2. Traffic and transport

4.2.1. EDF Energy is proposing to run up to two freight trains each way per day to and from Sizewell Halt or the LEEIE during the early years phase of construction at the main development site. In the road-led strategy, this arrangement would continue throughout the construction of Sizewell C. In the rail-led strategy, the green rail route would connect the Saxmundham-Leiston branch line directly to the main development site. This would be used by up to five freight trains each way per day during the main construction phase.

4.2.2. The origins of freight trains transporting construction materials are not yet known but EDF Energy anticipates that they would travel via Ipswich and along the East Suffolk line.

4.2.3. At present, discussions between EDF Energy and Network Rail are still ongoing to determine the upgrades which may be required to the existing Saxmundham-Leiston branch line and East Suffolk line. Any effects described in this section relate to parts of the rail network which are the responsibility of Network Rail who own and operate rail infrastructure in Great Britain. EDF Energy will continue to liaise with Network Rail to develop the rail proposals, but EDF Energy would only be responsible for undertaking work on the green rail route (see **Chapter 3** of this volume) and Sizewell Halt (see **Chapter 2** of this volume).

4.2.4. The condition of the track on the existing Saxmundham-Leiston branch line is poor, and would be unsuitable for the transit of frequent heavy trains. It is therefore likely that the track along the entire length of the branch line would need to be repaired or replaced to the standard required for freight transport. Additionally, the level crossings along the route would need to be upgraded.

4.2.5. The principal upgrades to infrastructure at specific locations on the East Suffolk line are envisaged to be:

- installation of a passing loop on the East Suffolk line between Melton and Wickham Market;
- signalling upgrades between Wickham Market and Saxmundham;
- installation of a track crossover at Saxmundham Junction;
- closure of 12 level crossings and diversion of Public Rights of Way (PRoWs) between Westerfield Junction and Saxmundham Junction;
- upgrades to a further 33 level crossings between Westerfield Junction and Saxmundham Junction; and
- strengthening works to six bridges.

4.2.6. The scope of the assessment that follows considers the impacts on road users (for example, additional delays at level crossings), pedestrians and PRoW users (for example, closure of rural level crossings and related diversions) and also impact on rail users (for example, delays during construction).

a) Baseline environment

4.2.7. A single-track branch line runs from Saxmundham to Leiston, terminating at Sizewell Halt. The line previously ran as far as Aldeburgh. The line branches off the East Suffolk line, running between Ipswich and Lowestoft, at Saxmundham.

4.2.8. The East Suffolk line has both single- and double-track sections. A passenger service runs approximately hourly in each direction between Ipswich and Lowestoft. Occasional rail tours and Network Rail maintenance trains also use the line, though following the end of nuclear flask trains serving Sizewell A, the usage is negligible.

4.2.9. Following the end of nuclear flask trains serving Sizewell A, there are no regular freight services on the Saxmundham-Leiston branch line which is now only used by occasional maintenance trains or rail tours.

4.2.10. **Table 4.2.1** below lists all the level crossings between Westerfield Junction (where the line to Felixstowe branches off the East Suffolk line) and Sizewell Halt, including the existing crossing type and EDF Energy's proposals for changes that would be undertaken by Network Rail who own and operate the railway infrastructure.

b) Environmental design and embedded mitigation

i) Construction

4.2.11. Where feasible, engineering trains could be used to transport some of the materials required for upgrade work (for example, rails or other heavy equipment) so as to minimise the construction road traffic trip generation.

4.2.12. Undertaking the upgrade works along the railway would require the East Suffolk line to be closed at certain times. Wherever possible work would be undertaken overnight when there is no passenger service. If this is not possible then work would be prioritised at weekends so as to minimise the impact on commuters.

4.2.13. It may be possible to synchronise any upgrades required to the East Suffolk line, including level crossing upgrades, such that they could take place during a single period with replacement buses in operation to minimise impacts to passengers.

Table 4.2.1 Level crossings on the East Suffolk line and Saxmundham to Leiston branch line

Crossing ID	Crossing Name	Crossing Type	Trains per day[1]	Current usage per day[2]	Proposed Change
SWC01	Westerfield Footpath	Footpath	133	7 Pedestrians or Cyclists	Divert
SWC02	Westerfield Station AHB	AHB	133	118 Vehicles 54 Pedestrians or Cyclists	MCB-CCTV
SWC03	Lacy's Footpath	Footpath	35	5 Pedestrians or Cyclists	Divert
SWC04	Stennetts 1	Footpath	35	Less than 5 Pedestrians or Cyclists	Divert
SWC05	Stennetts 2	Footpath	35	Less than 5 Pedestrians or Cyclists	Divert
SWC06	Gamekeepers	Footpath	35	Less than 5 Pedestrians or Cyclists	Divert
SWC07	Lox Farm	Footpath	35	9 Pedestrians or Cyclists	MSL
SWC08	Bealings	ABCL	35	99 Vehicles 81 Pedestrians or Cyclists	MCB-OD
SWC09	Martlesham	Footpath	37	7 Pedestrians or Cyclists	Divert
SWC10	Notcutts Nursery	Footpath	34	Private unused crossing	MSL
SWC11	Kingston Farm	Footpath	35	4 Pedestrians or Cyclists	MSL
SWC12	Kingston Farm	UWC	35	Vehicles 226 Pedestrians or Cyclists	MSL
SWC13	Jetty Avenue	Footpath	35	219 Pedestrians or Cyclists	MSL
SWC14	Jetty Avenue	UWC	35	9 Vehicles 98 Pedestrians or Cyclists	MSL
SWC15	Ferry Quay	AOCL+B	35	62 Vehicles 216 Pedestrians or Cyclists	MCB-OD
SWC16	Haywards/Tide Mill Way	AOCL+B	35	78 Vehicles 297 Pedestrians or Cyclists	MCB-OD
SWC17	Lime Kiln Quay	AOCL+B	35	32 Vehicles 211 Pedestrians or Cyclists	None but assume MCB-OD pending risk assessment
SWC18	Sun Wharf	AOCL+B	35	7 Vehicles 199 Pedestrians or Cyclists	MCB-OD
SWC19	Maltings	UWC	35	6 Vehicles 36 Pedestrians or Cyclists	MSL
SWC20	Melton Sewage	UWC	35	1 Vehicles 7 Pedestrians or Cyclists	MSL
SWC21	Dock Lane	Footpath	35	87 Pedestrians or Cyclists	MSL
SWC22	Dock Lane	UWC	35	0 Vehicles 16 Pedestrians or Cyclists	MSL
SWC23	Bloss	UWC	35	0 Vehicles Infrequent Pedestrian use	MSL
SWC24	Melton Station	AOCL+B	35	561 Vehicles 339 Pedestrians or Cyclists	None but assume MCB-OD pending risk assessment
SWC25	Ellingers	Footpath	35	7 Pedestrians or Cyclists	MSL

Crossing ID	Crossing Name	Crossing Type	Trains per day[1]	Current usage per day[2]	Proposed Change
SWC26	Ellingers	UWC	35	0 Vehicles 3 Pedestrians or Cyclists	MSL
SWC27	Melton Bromswell	Footpath	34	6 Pedestrians or Cyclists	Divert
SWC28	Ufford	ABCL	35	94 Vehicles Infrequent Pedestrian use	MCB-OD/CCTV
SWC29	Uffold	UWC	35	Infrequent vehicular use Infrequent Pedestrian use	MSL
SWC30	Pettistree	Footpath	35	Less than 5 Pedestrians or Cyclists	Divert
SWC31	Orchard	Footpath	35	Less than 5 Pedestrians or Cyclists	Divert
SWC32	Wickham Market	Footpath	35	Less than 5 Pedestrians or Cyclists	Divert
SWC33	Blackstock	Footpath	35	Infrequent Pedestrian use	MSL
SWC34	Blackstock	UWC	35	Unspecified	None but assume MSL
SWC35	Red House Farm	UWC	34	Unspecified	MSL
SWC36	Blaxhall	AOCL+B	35	6 Vehicles 15 Pedestrians or Cyclists	MCB-OD
SWC37	Blaxhall	Footpath	34	8 Pedestrians or Cyclists	Divert
SWC38	Beversham	ABCL	35	24 Vehicles 14 Pedestrians or Cyclists	MCB-OD
SWC39	Snape	Footpath	35	Infrequent Pedestrian use	MSL
SWC40	Snape	UWC	35	3 Vehicles 17 Pedestrians or Cyclists	MSL
SWC41	Farnham	Footpath	35	Less than 5 Pedestrians or Cyclists	MSL
SWC42	Benhall/Grays Lane	Footpath	32	Unspecified	Bridleway with MSL
SWC43	Brick Kiln	Footpath	34	10 Pedestrians or Cyclists	MSL
SWC44	Brick Kiln	UWC	35	10 Vehicles 243 Pedestrians or Cyclists	MSL
SWC45	Rendham Road (Chantry Lane)	MCB-R	35	10 Vehicles 243 Pedestrians or Cyclists	Following risk assessment no changes proposed
SWC46	Albion Street	MCB	35	539 Vehicles 1026 Pedestrians or Cyclists	Following risk assessment no changes proposed
SWC47	Saxmundham	Footpath	33	Less than 5 Pedestrians or Cyclists	Divert
SWC48	Bratts Black House	UWC	2	5 Vehicles 2 Pedestrians or Cyclists	MSL
SWC49	Knodishall	TOG	2	8 Vehicles 54 Pedestrians or Cyclists	ABCL
SWC50	Westhouse	TOG	2	8 Vehicles Infrequent Pedestrian use	ABCL
SWC51	Snowdens	UWC	2	Infrequent vehicular use Infrequent Pedestrian use	MSL

Crossing ID	Crossing Name	Crossing Type	Trains per day[1]	Current usage per day[2]	Proposed Change
SWC52	Saxmundham Road	TOG	2	83 Vehicles 54 Pedestrians or Cyclists	ABCL
SWC53	Buckles Wood	Footpath	2	Unspecified	MSL
SWC54	Summerhill	Footpath	2	6 Pedestrians or Cyclists	MSL
SWC55	Leiston	TOG	2	483 Vehicles 189 Pedestrians or Cyclists	TOB
SWC56	Sizewell	TOG	2	484 Vehicles 243 Pedestrians or Cyclists	None but assume TOB pending risk assessment

[1]Train count at the time of the most recent survey for this crossing
[2]Based on recent census data

4.2.14. Track upgrade work could take place on the Saxmundham-Leiston branch line without disruption to passenger services on the East Suffolk line, with the possible exception of at Saxmundham Junction. Track renewal along the branch line would have some environmental impacts close to Buckle's Wood, as well as through Leiston town centre where the railway passes through a built-up area.

ii) Operation

4.2.15. EDF Energy proposes that up to five trains per day each way (in the rail-led strategy) would serve the main development site, travelling along the East Suffolk line and the Saxmundham to Leiston branch line. During the early years of construction, and throughout the construction period in the road-led strategy, up to two trains per day each way would serve the railhead at Sizewell Halt or east of Eastlands Industrial Estate.

4.2.16. Provision of a passing loop on the East Suffolk line increases the resilience of the passenger service in case of disruption, by allowing trains to pass each other or overtake each other between Melton and Wickham Market. This mitigates negative effects on rail service reliability arising from an increased number of trains using the line, which might otherwise lead to longer delays in the event of service disruption.

4.2.17. The increased number of trains on the East Suffolk line and the Saxmundham to Leiston branch line would increase the number of times that the level crossings along the route are closed to vehicles, leading to some additional delays for road traffic.

4.2.18. EDF Energy is proposing that Network Rail closes 12 footpath crossings on the East Suffolk line. For a further 33 level crossings on the East Suffolk line and 9 on the Saxmundham-Leiston branch line, EDF Energy is proposing that Network Rail upgrades the existing level crossings.

4.2.19. By upgrading the vehicular level crossings rather than permanently closing them, the proposals reduce inconvenience to drivers arising from diversion. At some locations, retention of a level crossing rather than providing a bridge avoids increasing the travel time permanently, instead retaining the existing travel time which is only lengthened at times when trains are passing. However, by providing more efficient methods of level crossing control (for example, the use of obstacle detection and a reduced need for staff to operate gates manually), the level crossing closure times can be minimised.

4.2.20. Where possible, level crossing upgrades have been proposed which minimise the need for level crossing barriers to be closed and reopened manually, since this method of control necessitates longer road closures than when automatic methods of control are in operation. Automatic level crossings in particular are able to reopen to traffic soon after a train has safely passed.

4.2.21. Each method of level crossing control has different impacts on traffic and transport and therefore a selection of particular upgrades represents a different form of embedded mitigation in each case. These are summarised below:

- **Automatic Barrier Crossing Locally Monitored (ABCL) to Manually Controlled Barriers with Obstacle Detection (MCB-OD):** provision of obstacle detection uses technology to check that the track is clear before a train passes.
- **Train Crew Operated Gates (TOG) to ABCL:** automated barriers reduce the duration of the crossing closure to vehicles, particularly when the barriers can

reopen shortly following the passage of a train as opposed to remaining closed until the train stops and the train crew have walked to the gates to reopen them manually.

- **User Worked Crossing (UWC) to Miniature Stop Lights (MSL):** this provides crossing users with a more efficient means of checking that there are no trains due before crossing.
- **Footpath to MSL:** this increases safety for footpath users without imposing additional physical methods of control and therefore does not increase delay.

c) Preliminary assessment of effects

i) Construction

4.2.22. Closure of the East Suffolk line at certain times to enable construction would cause disruption to passengers using the line. The impacts on the passengers will be considered as part of the ongoing EIA and reported in the Environmental Statement (ES). The major works on the Sizewell-Leiston branch line do not have a passenger service.

4.2.23. Level crossing upgrades would necessitate short-term road closures while barriers, signage and other lineside equipment are installed. This would cause some localised traffic disruption and may require diversion along nearby alternative routes. The impact of these upgrade works would not be significant.

4.2.24. The greatest amount of construction traffic generated by the proposed upgrades would be associated with the track renewal along the Saxmundham-Leiston branch, as well as the doubling of Saxmundham Junction and installation of the passing loop between Melton and Wickham Market.

4.2.25. These works would involve transporting sections of rail and other heavy equipment. Whilst some of this material could be transported on engineering trains, the remainder would need to be road hauled. This would give rise to some increases in traffic levels causing delays to drivers. The impact on traffic on the wider road network would not be significant.

4.2.26. At the locations closest to the track access points where Heavy Goods Vehicles (HGVs) may need to park or manoeuvre in order to unload materials, the impacts on other traffic would be significant as there may be recurring instances of deliveries of materials. Track replacement is likely to require large and slow vehicles to transport materials over several months.

4.2.27. Bridge strengthening works are proposed at six locations and these would generate construction traffic as well as necessitating short-term road closures. It would be necessary for vehicles to take a diversionary route during these closures. This would give rise to minor impacts on the roads concerned.

4.2.28. The construction traffic generated by the installation of mid-section signals between Wickham Market and Saxmundham would not be significant, with only minor impacts on general traffic.

ii) Operation

Train users

4.2.29. During the construction of Sizewell C, EDF Energy proposes to run two trains per day each way along the East Suffolk line and Saxmundham to Leiston branch lines. This would increase to five trains per day each way in the rail-led strategy, with trains using the green rail route.

4.2.30. The number of train movements on the East Suffolk line would increase by up to ten per day.

Level crossings

4.2.31. The principal effects in transport terms of the increased trains would be experienced at the level crossings. The extra movements would close the crossings to vehicles up to ten additional times per day, and consequently users of these crossings would experience an increase in the number of times when they are delayed due to the passage of trains.

4.2.32. Network Rail's proposals include upgrades to level crossings along the route. The effects of each type of level crossing conversion on users of these crossings varies.

4.2.33. Installation of MSL at 11 existing UWCs and 13 existing footpath crossings could benefit them by providing an additional means of determining when a train is due. This reduces the delay prior to crossing whilst at the same time maintaining safety standards for all crossing users. No users would be required to divert to alternative routes. Whilst the number of trains, and therefore the number of closures, would increase, the duration of each closure would be reduced at UWCs and would remain broadly unchanged at footpath crossings.

4.2.34. Nine existing vehicle level crossings (of types Automatic Half Barrier (AHB), AOCL+B or ABCL) on the East Suffolk line are proposed to be converted to MCB-OD or with CCTV. The addition of these measures would improve safety by providing additional means of detecting obstructions. This also carries a network resilience benefit by reducing the likelihood of the level crossing being closed to traffic due to an obstruction. The number of trains, and therefore closures, would increase, but the duration of each crossing would not increase.

4.2.35. Overall, the impacts of upgrading level crossings on the East Suffolk line on other users are not considered to be significant.

4.2.36. The two Manually Controlled Barrier (MCB) level crossings in Saxmundham (Chantry Lane and Albion Street) would not be changed.

4.2.37. Three existing TOG crossings between Saxmundham and Leiston would be converted to ABCL crossings: Knodishall, Westhouse and Saxmundham Road. The number of trains, and therefore the number of closures, would increase, but waiting times for traffic during each closure would be reduced significantly compared to the existing situation.

4.2.38. The existing Leiston (Abbey Road) and Sizewell (King George's Avenue) TOG crossings are proposed to be amended to Train Crew Operated Barrier (TOB) crossings, with broadly no change in closure duration, though the number of closures would increase.

4.2.39. Twelve footpath crossings on the East Suffolk line are proposed to be closed and their users diverted to alternative routes and crossings. For the crossings for which usage data is available, the number of pedestrians and cyclists using the crossings are low.

Footpath crossings

4.2.40. Existing users of the footpath crossings proposed to be closed would need to use an alternative route. The difference between the existing and diverted routes in each case, as identified in the Network Rail GRIP 2A report, are as follows (in cases with multiple options, the shortest one is cited):

- Westerfield: 210 metres (m);
- Lacy's: 340m;
- Stennet's 1: 275m;
- Stennet's 2: 250m;
- Gamekeepers: 310m;
- Martlesham: 40m;
- Melton Bromswell: 300m;
- Pettistree: 440m;
- Orchard: 580m;
- Wickham Market: 170m;
- Blaxhall: 700m; and
- Saxmundham: 562m.

4.2.41. The maximum diversion for pedestrians or cyclists currently using any of the footpath crossings proposed to be closed is 700m (at Blaxhall). The availability of alternative means of crossing the railway within a short distance of the current crossings, coupled with the existing low footfall at each of these, means that the inconvenience caused by the proposed footpath crossing closures would be low. Therefore, the effects are not considered to be significant.

4.2.42. Following the completion of the Sizewell C construction programme, it is anticipated that the rail infrastructure improvements on the East Suffolk line and Saxmundham to Leiston branch line would remain in place.

4.2.43. The retention of mid-section signals and a passing loop on the East Suffolk line would bring a minor benefit to passenger services on the East Suffolk line in terms of greater resilience in the event of delays. This effect is not considered to be significant as there are existing passing loops elsewhere on the line where trains can pass.

4.2.44. It is anticipated that the proposed level crossing upgrades or closures along the East Suffolk line would remain in place following the completion of the Sizewell C construction. If the 12 footpath crossings proposed for closure were to remain closed following the completion of the Sizewell C construction programme, there may be a residual minor negative impact for previous users of these crossings insofar as crossings which pedestrians previously used would no longer be open, even once the number of trains returns to its original level. The effect would not be significant, given the existing low footfall and the short diversion distance.

d) Additional mitigation and monitoring

i) Construction

4.2.45. No additional mitigation measures are proposed during construction.

ii) Operation

4.2.46. No additional mitigation measures are proposed during operation but will be considered when further design is progressed in relation to each of the changes to the crossings.

4.2.47. Following the completion of the Sizewell C construction programme, usage of the upgraded level crossings would be monitored by Network Rail.

e) Preliminary assessment of residual effects

i) Construction

4.2.48. The residual effects during construction are anticipated to be the same as those set out under the preliminary assessment of effects described above.

ii) Operation

4.2.49. The residual effects during operation are anticipated to be the same as those set out under the preliminary assessment of effects described above.

4.2.50. The residual effects once Sizewell C construction has been completed are anticipated to be the same as those set out under the preliminary assessment of effects described above.

f) Completing the assessment

4.2.51. Once further details regarding the proposed railway upgrades are made available by Network Rail, the PEI assessment for each location where work is proposed can be undertaken in greater detail.

4.3. Noise and vibration assessment

4.3.1. The figures for noise and vibration assessment are presented in **Volume 3** as **Figures 4.3.1** to **4.3.5.**

4.3.2. The noise and vibration assessment for the other rail improvements is divided into two parts: the first part covers track replacement and branch line upgrades (such as the passing loop and track crossovers) and the second part covers level crossing upgrades.

a) Track replacements, passing loop and track cross-over

i) Baseline environment

4.3.3. Noise survey locations which provide baseline data for areas which have the potential to be affected by noise associated with the upgrading and use of branch line from Saxmundham junction to Sizewell Halt and the upgrading and increased use of the East Suffolk line are identified in **Table 4.3.1,** along with a summary of the levels measured. A plan showing the locations of these monitoring locations is shown in **Volume 3** as **Figure 4.3.1.**

4.3.4. Since the various receptors are at different distances from sources such as road traffic, the noise readings from the surveys summarised above can be used to provide an estimate of existing ambient levels for each group of receptors. **Table 4.3.2** shows a list of receptors and groups of receptors which have the potential to be affected by noise from upgrading the track between Saxmundham and the boundary of the rail with LEEIE, by noise from construction and operation of the green route (during the main site construction phase) and by operations on the branch line between Saxmundham and LEEIE (during the early phase of main site construction work), along with measured or estimated ambient levels for day and night.

ii) Environmental design and embedded mitigation

Construction

4.3.5. The standard of good practice outlined in BS5228-1 (Ref. 4.3.1) would be followed. Primary mitigation for the control of noise and vibration could therefore include, but not be restricted to the following measures:

- selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earth moving activities;
- switching off equipment when not required;
- use of reversing alarms that give proper warning whilst minimising noise impacts off-site; and
- provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts.

4.3.6. BS5228-2 gives detailed advice on standard good construction practice for minimising impacts from construction vibration. It is expected that it would be a requirement for the contractors to adhere to this guidance and that it would be set out in the Code of Construction Practice (CCP). Wherever possible, construction work would take place during the day.

4.3.7. For the branch line repair and replacement: noisy activities to take place only during Monday to Friday 07:00 to 19:00 hours and Saturday 07:00 to 13:00 hours.

Table 4.3.1 Baseline survey data

Survey Location Reference	Location name	Typical sound levels – Day decibels (dB)			Typical sound levels – Night decibels (dB)		
		L_{Amax}	$L_{Aeq,16hour}$	L_{A90*}	L_{Amax}	$L_{Aeq,8hour}$	L_{A90*}
MS21	Gatehouse, Saxmundham Road	87	70	45	75	60	30
MS22	Leiston Station	85	66	45	80	55	30
MS23	Leiston Centre	65	47	40	55	40	30
MS24	Valley Road, Leiston	65	45	40	47	35	28
MS33	Leiston West	60	45	38	55	35	28
RR8	Clay Hills	75	51	38	60	48	31

Table 4.3.2 List of receptors with measured/estimated ambient noise levels

Location name	Period	Typical ambient level, L_{Aeq}, dB
Line between Saxmundham and Leiston, dwellings more than 15 metres (m) from road	0700-2300	44
	2300-0700	38
Line between Saxmundham and Leiston, dwellings within 15m from road	0700-2300	50
	2300-0700	45
Harling Way Bucklesham Road Westward Ho	0700-2300	43
	2300-0700	37
Carr Ave Buller Road	0700-2300	42
	2300-0700	36
Valley Road	0700-2300	43
	2300-0700	37

4.3.8. EDF Energy would have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors and procedures for investigating and acting appropriately as necessary upon those complaints.

Operation

4.3.9. The track would be continuously welded rail in order to reduce noise at source. The radius of the curvature of the line would be such as to avoid the likelihood of wheel squeal. There would be no movements of trains at night through Leiston.

4.3.10. At night, during early years or if the road-led scheme is progressed, trains would need to wait at specified locations prior to moving onto the East Suffolk line. Whilst waiting at these locations, trains would not leave engines running so there would be no adverse noise impact from this.

iii) Preliminary assessment of effects

4.3.11. Sections below present the findings as follows:

- Construction noise, vibration and ground borne noise;
  - upgrades to East Suffolk line; and
  - upgrades on the Saxmundham branch line between Saxmundham and the boundary with LEEIE.
- Operational noise;
  - branch line from Saxmundham to the boundary with LEEIE; and
  - branch line from Saxmundham using the green route to the site boundary.
- Operational vibration and ground borne noise;
  - branch line from Saxmundham to the boundary with LEEIE; and
  - branch line from Saxmundham using the green route to the site boundary.

4.3.12. Noise and vibration levels have been predicted by calculation and modelling. A "significant" effect has been identified where levels are predicted to exceed a specified threshold value. Appropriate threshold levels are based on various standards and relevant guidance and depend on the type of source; the sensitivity of the receptors; the time of day when it might occur; and, in some situations, on the existing noise levels in the area.

Construction

4.3.13. This section considers the impacts from construction of the passing loop and Saxmundham track cross-over. There is insufficient information available at present to enable analysis of the noise and vibration impact from any bridge strengthening which may be needed.

4.3.14. A detailed analysis of noise and vibration impacts from the rail improvements has not been carried out but an initial overview of likely working techniques has enabled some high level conclusions to be outlined in this section.

4.3.15. Construction work on the passing loop would be more than 300m from the closest noise sensitive receptor.

For the majority of the construction work this would mean that there would be no significant noise or vibration impacts. However, if the noisiest activity (rail cutting) were to take place at night within the southernmost 50m of the construction area of the passing loop, then the noise impact at Wingfield House in Ufford may be significant whilst this is occurring. Other than this, there would be no significant noise or vibration impacts from construction work.

4.3.16. For the track cross-over, a noise propagation model has been produced to provide an initial estimate of the impact from noise in this area. Assuming that construction work would take place at night (between 23:00 and 07:00 hours), a significant noise effect may occur at levels above 50dB. For weekend and evening work (Monday to Friday 19:00 to 23:00 hours; Saturday 13:00 to 23:00 hours and Sunday 07:00 to 23:00 hours), a significant effect would occur above 60dB and during Monday to Friday 07:00 to 19:00 hours and Saturday 07:00 to 13:00 hours at above 70dB. Indicative noise contours are shown in **Figure 4.3.2.**

4.3.17. During the repair and replacement of track on the Saxmundham branch line between Saxmundham and the boundary with LEEIE, and assuming that complete replacement of the track may be necessary along the whole of this line and that all work would take place only during weekdays and Saturday morning (Monday to Friday 07:00 to 19:00 and Saturday 07:00 to 13:00 hours), the dwellings shown within the hatched areas in **Figure 4.3.2** have the potential to experience a significant noise effect. Such impacts would be short-term only; when track replacement or repair takes place immediately adjacent to these areas.

4.3.18. There is not enough information currently available about the proposed rail repair and upgrade to enable a reliable prediction to be made of vibration impact. However, given the distances and the likely vibration sources, it is possible that vibration would be significant at sensitive receptors within 10m of the work.

Operation

4.3.19. During the early phase of construction, the branch line from Saxmundham to the boundary with LEEIE would be operational with up to two trains per day (between 07:00 and 23:00 hours). If the road-led transportation strategy is followed, this pattern would continue throughout the construction period.

4.3.20. Since trains would be expected to use the East Suffolk line during the night, they would need to wait on the branch line to avoid travelling through Leiston between 23:00 and 07:00 hours. A detailed analysis of noise and vibration impacts from these waiting areas has not been carried out but an initial review has enabled some high level conclusions to be drawn.

4.3.21. Assumptions used to predict impacts from trains using this line are as follows:

- trains would move at a constant speed assumed of 40 kilometres (km) per hour;
- continuously welded rail would be used for all track;
- all locomotives would be under normal power (i.e. not at full power);
- it is assumed that the train would pull pocket wagons and a worse case noise level has been assumed, so the predicted level is robust;
- during early years, each train would comprise of one Class 66 locomotive pulling 19 wagons (fully loaded one way and empty the other) and
- after early years, if a rail-led scheme were chosen, each train would comprise of one Class 66 locomotive pulling 31 wagons (fully loaded one way and empty the other).

4.3.22. Due to limited availability of data, no account has been made in calculations at this stage for train dynamics: accelerating, decelerating, stopping and starting, and no correction has currently been applied for bridges and crossings. Predictions would therefore need to be updated when additional information becomes available.

4.3.23. Based on these assumptions, with two trains running during the day, there would be no significant adverse impact from noise during the operation of the line between the train waiting points and LEEIE. However, noise impact at the Kelsale Covert and Westhouse Crossing Cottage on the existing branch line would be significant as the trains travel past these locations on the way to the main line at night.

4.3.24. On the East Suffolk line, where trains wait at the passing loop, train engines may idle whilst waiting. Given the distances between the train and the closest noise sensitive receptors (in East Lane, and Low Road, Ufford), no significant effect is likely from this.

4.3.25. Vibration and ground borne noise impacts from the operational phase of the rail options need further, more detailed consideration but initial calculations indicate that vibration is unlikely to be significant but that ground borne noise level may be significant for some premises within 20m from the line, depending on ground conditions and coupling between the structure and the ground. There are approximately 100 premises within this distance.

iv) Additional mitigation and monitoring

Construction

4.3.26. Local screening may be possible for construction work to the Saxmundham junction. No mitigation would be necessary for the construction of the passing loop. Avoidance of rail cuttings within 50m of the southern end of the loop at night would be desirable, if possible.

4.3.27. Local screening may be possible for construction work on the Saxmundham branch line between Saxmundham and the boundary with LEEIE. Details of such screening would depend on site specific constraints. The duration of exposure to significant effects would need to be taken into account when considering the benefit to be derived from screening.

Operation

4.3.28. Speed reduction and track isolation may reduce the effect of ground borne noise on affected dwellings within 20m of the track.

4.3.29. Routine monitoring would be carried out through a scheme to be agreed with local authorities. Provision would be made as necessary for monitoring of noise and vibration levels in the event of complaints being received from occupiers of noise sensitive receptors, or on request of the local authorities.

v) Preliminary assessment of residual effects

4.3.30. Significant airborne noise impacts are likely to remain during night time train movements on the branch line.

4.3.31. It is possible that significant ground borne noise impact would occur at some premises within 20m of the rail line during the operational phase.

vi) Completing the assessment

4.3.32. Further assessment of impacts will be needed, along with further consideration of the construction methodology, local topographical features and layouts. In particular, further consideration of vibration impacts will be needed. The ES will present a full noise and vibration assessment and will consider any new information such as amended design or construction methodologies which might be relevant, although it is anticipated that the assessment will support the preliminary conclusions drawn above.

Table 4.3.3 Summary of effects for construction phase for track replacements, passing loop and track cross-over

Noise and vibration

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
East Suffolk line upgrade: Passing loop – Wingfield House, Ufford.	Noise during line cutting at night within 50m of southern boundary of loop.	Selection of plant and methodology in accordance with good practice.	Significant, short-term.	Avoid cutting in this location at night, if possible.	Unlikely to be significant.
East Suffolk line upgrade: Passing loop.	All other noise and vibration.	Selection of plant and methodology in accordance with good practice.	Not significant.	None	Not significant.

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
East Suffolk line: Saxmundham junction upgrade, receptors within the 70+dB contour shown in **Figure 4.3.2.**	Noise impact during Monday to Friday 07:00 to 19:00 hours and Saturday 07:00 to 13:00 hours.	Selection of plant and methodology in accordance with good practice.	Significant, short-term.	Some localised screening may be possible.	Significant, short-terms remain likely for many receptors.
East Suffolk line: Saxmundham junction upgrade, receptors outside the 70+dB contour shown in **Figure 4.3.2.**	Noise impact during Monday to Friday 07:00 to 19:00 hours and Saturday 07:00 to 13:00 hours.	Selection of plant and methodology in accordance with good practice.	Not significant.	None	Not significant.
East Suffolk line: Saxmundham junction upgrade, receptors within the 60-70 and 70+dB contours shown in **Figure 4.3.2.**	Noise impact during Monday to Friday 19:00 to 23:00 hours; Saturday 13:00 to 23:00 hours and Sunday 07:00 to 23:00 hours.	Selection of plant and methodology in accordance with good practice. Avoid night time work, where possible.	Significant, short-term.	Some localised screening may be possible.	Significant, short-terms remain likely for many receptors.
East Suffolk line: Saxmundham junction upgrade, receptors outside of the 60-70 and 70+dB contours shown in **Figure 4.3.2.**	Noise impact during Monday to Friday 19:00 to 23:00 hours; Saturday 13:00 to 23:00 hours and Sunday 07:00 to 23:00 hours.	Selection of plant and methodology in accordance with good practice.	Not significant.	None	None
East Suffolk line: Saxmundham junction upgrade, receptors within the 50-60, 60-70 and 70dB contours shown in **Figure 4.3.2.**	Noise impact at night: 23:00 to 07:00 hours.	Selection of plant and methodology in accordance with good practice.	Significant, short-term.	Some localised screening may be possible.	Significant, short-terms remain likely for many receptors.
East Suffolk line: Saxmundham junction upgrade, receptors outside of the 50-60, 60-70 and 70dB contours shown in **Figure 4.3.2.**	Noise impact at night: 23:00 to 07:00 hours.	Selection of plant and methodology in accordance with good practice.	Not significant.	None	Not significant.
Branch line repair and upgrading work.	Noise impact.	Selection of plant and methodology in accordance with good practice. Work to take place only during Monday to Friday 07:00 to 19:00 hours and Saturday 07:00 to 13:00 hours.	Significant effect may occur for short period whilst noisiest activities are immediately adjacent.	Some localised screening may be possible.	Significant effect may occur for short period whilst noisiest activities are immediately adjacent.

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Branch line repair and upgrading work.	Noise impact.	Selection of plant and methodology in accordance with good practice. Avoid night time work, where possible.	Not significant.	None	Not significant.
Sensitive receptors within 10m of construction work.	Vibration impact.	Selection of plant and methodology in accordance with good practice. Avoid night time work, where possible.	May be significant (for short-term) – further work needed to review this.	Not yet known.	Not yet known.
Other receptors.	Vibration impact.	Selection of plant and methodology in accordance with good practice. Avoid night time work, where possible.	Not significant.	None	Not significant.

Table 4.3.4 Summary of effects for operational phase Summary of effects for construction phase for track replacements, passing loop and track cross-over

Noise and vibration

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Kelsale Covert and Westhouse Crossing Cottage during early years or if road-led transportation strategy is selected.	Night time noise impact.	Track would be continuously welded rail. There would be no movements of trains at night through Leiston. Trains would not leave engines running whilst waiting on the branch line at night.	Significant	None	Significant
All other receptors along branch line during early years or if road-led transportation strategy is selected.	Noise impacts at any time.	Track would be continuously welded rail. There would be no movements of trains at night through Leiston. Trains would not leave engines running whilst waiting on the branch line at night.	Not significant.	None	Not significant.
Receptors near to the proposed passing loop.	Noise from trains waiting with engines running.	None	Not significant.	None	Not significant.
Any receptor within 20m of an operational rail line.	Ground borne noise.	None	May be significant - further work needed to review this.	None	Not significant.
Receptors greater than 20m from an operational rail line.	Ground borne noise.	None	Unlikely to be significant.	None	Not significant.
All receptors.	Vibration	None	Unlikely to be significant.	None	Not significant.

b) Level crossing upgrades

i) Baseline environment

4.3.33. Baseline survey work has yet to be undertaken for upgrades to level crossings. However, an initial consideration of the noise and vibration impact can be made without reference to existing baseline values.

4.3.34. Since there are a number of different locations where level crossing upgrades are being proposed (see traffic and transport **section 4.2** above), and each has a different local topography and different distances between noise and vibration sources and receptors, a generic assessment has been carried out for the three different types of proposed crossing. It has been assumed in each situation that existing ambient noise is low (thus representing a worst case) and that there are no obstacles which would provide effective screening and thus reduce noise propagation (again to represent a worst case).

ii) Environmental design and embedded mitigation

Construction

4.3.35. The standard of good practice outlined in BS5228-1 would be followed. Embedded mitigation for the control of noise and vibration could include, but not be restricted to the following measures:

- selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earth moving activities;
- avoiding unnecessary revving of engines and switching off equipment when not required;
- use of reversing alarms that ensure proper warning whilst minimising noise impacts off-site; and
- provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts.

4.3.36. BS5228-2 gives detailed advice on standard good construction practice for minimising impacts from construction vibration. It is expected it would be a requirement of the contractors to adhere to this guidance and that it would be set out in the CCP.

4.3.37. EDF Energy would also have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.

Operation

4.3.38. There is no embedded noise mitigation for the operation of the crossings.

iii) Preliminary assessment of effects

4.3.39. Noise and vibration levels have been predicted by calculation and modelling. A "significant" effect has been identified where levels are predicted to exceed a specified threshold value. Appropriate threshold levels are based on various standards and relevant guidance and depend on the type of source; the sensitivity of the receptors; the time of day when it might occur; and, in some situations, on the existing noise levels in the area.

Construction

4.3.40. A detailed analysis of noise and vibration impacts has not been carried out, but an initial overview of likely working techniques has enabled some high level conclusions to be drawn. These are described below.

4.3.41. Three generic crossing upgrades have been considered, as follows:

- upgrade from footpath or UWC to MSL or MSL plus Power Operated Gate Openers (POGO);
- upgrade from ABCL or Automatic Open Crossings, Locally Monitored (with or without barrier) (AOCL or AOCL+B) to Manually Controlled Barriers (MCB); and
- upgrade from TOG to ABCL.

4.3.42. In order to consider the impact from these upgrades it has been assumed that some activity may take place during the day, some in the evening and some may be required at night. The noise level threshold at which a significant effect might occur is different for noise depending on when it occurs and therefore the distance at which a significant effect arising from noise has been calculated for all three periods: day, evening and night.

4.3.43. It is assumed that some break of tarmac or concrete may be required in each case, since this has the potential to produce the highest noise levels. **Table 4.3.5** shows the distances over which a significant noise effect may occur, using the assumptions above and taking no account of any noise reduction from any existing structures which might provide screening.

4.3.44. The distances are the same for both ABCL and MCB crossings as the significant noise sources would be the same for both. It is estimated that the duration of the significant effect for MSL would be one to two days and the duration for the other types would be approximately 10 to 15 days.

4.3.45. A detailed analysis of vibration from construction of the crossings has yet to be carried out. It is possible that a significant effect might occur where significant sources of vibration (such as vibratory compactors) are used within 10m of vibration sensitive receptors. Such effects would be short-term only. Further work is required to consider this in detail.

4.3.46. Noise and vibration levels at receptors beyond these distances during construction are unlikely to have a significant effect.

Operation

4.3.47. Based on the information available, potential noise impacts from the proposed crossings would be from audible alarms which are designed to warn pedestrians when barriers are about to be lowered. It is assumed that trains would not be required to sound horns at any additional locations as a result of the introduction of upgrades to crossings.

4.3.48. A significant effect could occur during operation of the alarms at a distance of 10m. Since it should be possible to site all such alarms at a distance greater than this from noise sensitive premises, is unlikely that there would be significant adverse impacts from the operation of the proposed level crossings.

4.3.49. For all other receptors the noise and vibration impact during the sites' operational phase are not expected to be significant.

iv) Additional mitigation and monitoring

Construction

4.3.50. Mitigation in the form of screening may be necessary where construction work takes place within the distances shown in **Table 4.3.5** from a noise sensitive receptor. Details of the screening would need to be designed once the construction methodology is known, taking local circumstances into account.

4.3.51. Routine monitoring would be carried out through a scheme to be agreed with local authorities. Provision would be made as necessary for monitoring of noise and vibration levels in the event of complaints being received from occupiers of noise sensitive receptors, or on request of the local authorities.

Table 4.3.5 Distances to significant noise effects for different crossing types

Crossing type	Period	Distance within which a significant noise effect may occur during construction
MSL	Day (07:00 to 19:00 hours).	25m
	Evening (19:00 to 23:00 hours).	70m
	Night (23:00 to 07:00 hours).	180m
MCB	Day (07:00 to 19:00 hours).	40m
	Evening (19:00 to 23:00 hours).	100m
	Night (23:00 to 07:00 hours).	200m
ABCL	Day (07:00 to 19:00 hours).	40m
	Evening (19:00 to 23:00 hours).	100m
	Night (23:00 to 07:00 hours).	200m

Operation

4.3.52. No mitigation is likely to be necessary unless the audible alarms are within 10m of a noise sensitive receptor.

v) Preliminary assessment of residual effects

4.3.53. With mitigation in place, it is possible that some significant, short-term impact from noise would occur during construction. Short-term vibration impacts are also possible.

vi) Completing the assessment

4.3.54. Further assessment of impacts will be needed, with further consideration of the construction methodology, local topographical features and layouts. The ES will present a full noise and vibration assessment and will consider any new information such as amended design or construction methodologies which might be relevant, although it is anticipated that the assessment will support the preliminary conclusions drawn above.

Table 4.3.6 Summary of effects for construction phase for level crossings
Noise and vibration

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Noise sensitive receptors within distances shown in **Table 4.3.5** above, for each crossing type.	Noise from construction works during the day.	Selection of plant and methodology in accordance with good practice.	Short-term significant noise effect possible depending on local circumstances.	Screening	Short-term significant noise effect possible depending on local circumstances.
Receptors within 10m of vibratory compaction.	Vibration from construction.	Selection of plant and methodology in accordance with good practice.	Short-term significant vibration impact possible.	None	Short-term significant vibration impact possible.
All other receptors.	Noise and vibration from construction activity.	Selection of plant and methodology in accordance with good practice.	No significant noise or vibration impacts.	None	Not significant.

Table 4.3.7 Summary of effects for operational phase for level crossings
Noise and vibration

Topic / Receptor	Impacts	Environmental Design and Embedded Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Any noise sensitive premises within 10m of a crossing alarm.	Noise from audible alarm.	Ensure alarms are sited at a distance greater than 10m from noise sensitive receptors.	Significant noise effect unlikely.	Screening may be possible, depending on local circumstances.	Significant noise effect unlikely.
All other receptors.	Noise and vibration impact from operation of crossings.	None	Significant noise effect unlikely.	None	Not significant.

4.4. Amenity and recreation

4.4.1. The assessment below focuses on the 12 PRoWs which would be closed (see **Volume 1**, **Chapter 9**) and diverted under the proposed rail improvements for the rail-led strategy. Neither the passing loop nor the track cross-over would directly impact upon any PRoW.

a) Baseline environment

4.4.2. Amenity and recreation resources comprise PRoWs that pass through open countryside/edge of settlement locations that are predominantly arable/agricultural in character.

b) Environmental design and embedded mitigation

4.4.3. Existing trees and hedgerows adjoining the site boundary would be retained where possible. The proposed diversions have been aligned to avoid sensitive habitats and minimise the need to remove trees and hedgerows as much as possible. Where it is unavoidable to connect to an adjoining PRoW, the most direct routes have been selected. Pre-commencement site assessment work would be required to minimise impacts.

4.4.4. The diversions are set out in the table below. The usage figures have been collected from Network Rail using information collected in 2016 or estimations from the 2014 census (Ref. 4.4.1).

Table 4.4.1 List of PRoWs

Crossing name	Public Right of Way	Usage (per day)	Stage 3 proposal
Westerfield Footpath (SWC01)	E-014/018/0	7 pedestrians	Closure – Diversion
Lacy's Footpath (SWC03)	E-531/015/A	5 pedestrians	Closure – Diversion
Stennets 1 (SWC04)	Crossing not listed as PRoW	<5 pedestrians	Closure – Diversion
Stennets 2 (SWC05)	E-431/013/0	<5 pedestrians	Closure – Diversion
Gamekeepers (SWC06)	E-431/009/0	<5 pedestrians	Closure – Diversion
Martlesham (SWC09)	E-388/009/0	7 pedestrians	Closure – Diversion
Melton Bromswell (SWC27)	E-534/012/0	18 pedestrians	Closure – Diversion
Pettistree (SWC30)	E-430/008/0	>5 pedestrians	Closure – Diversion
Orchard (SWC31)	E-178/008/0	>5 pedestrians	Closure – Diversion
Wickham Market (SWC32)	E-178/020/0	>5 pedestrians	Closure – Diversion
Blaxhall (SWC37)	E-141/037/0	8 pedestrians	Closure – Diversion
Saxmundham (SWC47)	E-460/001/0	>5 pedestrians	Closure – Diversion

c) Preliminary assessment of effects

i) Construction

4.4.5. People using the PRoWs at the level crossing locations listed above would experience impacts due to diversions. They may also experience small temporary changes to views and noise levels but are unlikely to experience any changes to air quality caused by the proposed development. Therefore, the effects would not be significant.

4.4.6. The proposed passing loop and track cross-over works would be located within the existing railway boundary and would not result in any direct impact upon any PRoW. Therefore, the effects are not considered to be significant.

ii) Operation

4.4.7. Users of each footpath listed above may experience some changes to views and noise due to the construction and operation of the proposed development. These effects would not be significant.

4.4.8. The proposed passing loop and track cross-over works would be located within the existing railway boundary and would not result in any direct impact upon any PRoW. Therefore, the effects are not considered to be significant.

d) Additional mitigation and monitoring

4.4.9. No additional mitigation is proposed.

e) Preliminary assessment of residual effects

4.4.10. No significant residual effects are expected for any phase of the development.

f) Completing the assessment

4.4.11. The ES would present a full amenity and recreation impact assessment underpinning the conclusions drawn above in relation to significant effects, updated where relevant to account for any design changes.

4.5. Landscape and visual

4.5.1. The figures for landscape and visual are presented in **Volume 3** as **Figures 4.5.1** and **4.5.2.**

4.5.2. The following assessment considers the landscape and visual effects of the passing loop and track cross-over works only. The EIA will consider any impacts at the required level crossing works and the interface with amenity and recreation (**section 4.4**) and terrestrial historic environment (**section 4.7**).

a) Baseline environment

4.5.3. At the passing loop location, the existing railway line is in cutting at the south-western end, then passes along an embankment towards the centre of the location where it crosses a localised valley feature and then is in cutting at the north-eastern end. Much of the existing railway line is lined by intermittent vegetation, including some mature trees and a wooded area to the south-east of the track.

4.5.4. The underlying topography along the proposed passing loop is gently undulating, running across a series of localised valley features associated with the valley of the River Deben.

4.5.5. At a national level, the proposed passing loop and much of the surrounding area are situated within National Character Area 82 (NCA82): Suffolk Coast and Heaths (Ref. 4.5.1). NCA82 comprises low-lying gently undulating farmland with areas of woodland, heath and forest plantation.

4.5.6. At the local level, the proposed passing loop would be located within the 'rolling estate sandlands' landscape character type, as identified in the Suffolk County Landscape Character Assessment (Ref. 4.5.2) and shown on **Figure 4.5.1.** The key characteristics are described in the Suffolk County Landscape Character Assessment as:

- *"Rolling river terraces and coastal slopes;*
- *sandy and free draining soils with areas of heathland;*
- *late enclosure with a pattern of tree belts and straight hedges;*
- *landscape parklands;*
- *a focus of settlement in the Estate Sandlands landscape;*
- *19th century red brick buildings with black glazed pantiles in the east;*
- *Lark valley buildings are frequently of brick or flint with tiled or slate roofs;*
- *tree belts and plantations throughout;*
- *occasional and significant semi-natural woodlands and ribbons of wet woodland; and*
- *complex and intimate landscape on valley sides".*

4.5.7. Visibility of the proposed passing loop is unlikely to extend any further than views of the existing railway line and trains using it. There are no settlements, long distance routes, local roads or PRoWs that are likely to have visibility of the proposals where the existing track is not currently visible.

4.5.8. The Suffolk Coasts and Heaths Area of Outstanding Natural Beauty (AONB) is located approximately 1.2km to the east of the proposed passing loop at its closest point.

4.5.9. The proposed passing loop is located within a locally designated landscape covering the valley of the River Deben. This is referred to as a Special Landscape Area (SLA).

4.5.10. The proposed track cross-over would be located at the existing junction of the East Suffolk line with the Saxmundham-Leiston branch line, north-east of Saxmundham. The majority of the existing railway line is on an embankment at this junction, changing to being in cutting north of the junction on the East Suffolk line and west of the junction on the branch line. The majority of the existing route is lined with areas of mature trees, particularly to the east of the existing junction.

4.5.11. The underlying topography along the proposed track cross-over slopes up towards the north-east, from approximately 12m Above Ordnance Datum (AOD) at the River Fromus on the edge of Saxmundham to approximately 35m AOD at the eastern edge of the proposed improvements on the branch line.

4.5.12. At a national level, the proposed track cross-over and much of the surrounding area are situated within National Character Area 83 (NCA83): South Norfolk and High Suffolk Claylands (Ref. 4.5.3). NCA83 covers a large area of central East Anglia and is a predominantly flat clay plateau incised by numerous small-scale wooded river valleys. The valley of the River Fromus is slightly less wooded than the characteristic wooded river valleys of NCA83.

4.5.13. At the local level, the proposed track cross-over would be located across three separate landscape character types as identified in the Suffolk County Landscape Character Assessment and shown on Figure 4.5.1. They would run across the 'ancient estate claylands', 'rolling estate claylands' and 'rolling estate sandlands'.

4.5.14. The key characteristics of the Ancient Estate Claylands are described in the Landscape Character Assessment as:

- *"Dissected Boulder Clay plateau;*
- *organic pattern of field enclosures;*
- *straight boundaries where influence of privately owned estates is strongest;*
- *enclosed former greens and commons;*
- *parklands;*
- *WWII airfields;*
- *villages with dispersed hamlets and farmsteads;*
- *timber-framed buildings;*
- *distinctive estate cottages; and*
- *ancient semi-natural woodland."*

4.5.15. The rolling estate clayland is a valley side landscape of clay loams with parklands and fragmented woodland. The key characteristics are described in the Landscape Character Assessment as:

- *"Flat landscape of light loams and sandy soils;*
- *rolling valley-side landscape;*
- *medium clay and loamy soils;*
- *organic pattern of fields;*
- *occasional areas of more rational planned fields;*
- *numerous landscape parks;*
- *substantial villages;*
- *fragmented woodland cover, both ancient and plantation; and*
- *winding hedged and occasionally sunken lanes."*

4.5.16. The key characteristics of the rolling estate sandlands landscape character type are described in the Landscape Character Assessment as:

- *"Rolling river terraces and coastal slopes;*
- *sandy and free draining soils with areas of heathland;*
- *late enclosure with a pattern of tree belts and straight hedges;*
- *landscape parklands;*
- *a focus of settlement in the Estate Sandlands landscape;*
- *19thC red brick buildings with black glazed pantiles in the east;*
- *Lark valley buildings are frequently of brick or flint with tiled or slate roofs;*
- *tree belts and plantations throughout;*
- *occasional and significant semi-natural woodlands and ribbons of wet woodland; and*
- *complex and intimate landscape on valley sides".*

4.5.17. Visibility of the proposed track cross-over is unlikely to extend any further than views of the existing railway line and trains using it. It is unlikely that there will be any settlements, long distance routes, local roads or PRoWs that are likely to have visibility of the proposals where the existing track and associated earthworks is not currently visible.

4.5.18. The Suffolk Coasts and Heaths AONB is located approximately 5.8km to the east of the proposed track cross-over.

4.5.19. The SLA designations are all located outside the area where visibility of the proposed track cross-over is considered likely.

b) Environmental design and embedded mitigation

4.5.20. Existing trees and hedgerows adjoining the boundaries of the sites would be retained where possible. Where vegetation or hedgerow removals are required for any of the improvement schemes, replacement planting would be undertaken beyond the edge of the improvement works.

c) Preliminary assessment of effects

i) Construction

4.5.21. During construction, there would be a localised change to the landscape character of the site and its immediate context for both of the rail improvement schemes. This would be as a result of the potential removal of existing vegetation at both locations and the potential earthworks at Saxmundham Junction.

4.5.22. There would also be localised visual effects for residents and visitors to the eastern edge of Saxmundham, as well as potentially users of the B1121 where it passes the railway line, users of Clay Hills to the north of the site and the public footpath that currently runs along the northern edge of the railway line. These visual effects would predominantly be views of machinery undertaking the proposed works and the proposed earthworks associated with the line improvements.

4.5.23. Given the temporary duration of these effects, the effects are unlikely to be significant.

ii) Operation

4.5.24. For both of the rail improvement schemes, during operation, there is unlikely to be any additional effect on landscape character to that experienced during construction. Given the localised effect of the proposals and the existing presence of rail infrastructure within the sites, these effects are unlikely to be significant.

4.5.25. Given that the proposals would be relatively minor features in locations where rail infrastructure is already present, there are unlikely to be any significant visual effects as a result of the proposed improvement works.

d) Additional mitigation and monitoring

4.5.26. No additional mitigation is proposed.

e) Preliminary assessment of residual effects

4.5.27. No significant residual effects are expected during the construction or operational phases of proposed developments.

f) Completing the assessment

4.5.28. The ES would present a full EIA Landscape and Visual Impact Assessment (LVIA) underpinning the conclusions drawn above in relation to significant effects, updated where relevant to account for any design changes. Further consideration will be given to the level crossing works, particularly if any hedges or major tree groups are likely to be lost or if works are likely to be prominent from viewpoints or the wider landscape.

4.5.29. A study area, viewpoints and selected visualisations of the proposals would be agreed with the Local Planning Authority and key stakeholders, as necessary.

4.6. Terrestrial ecology and ornithology

4.6.1. The figures for terrestrial ecology and ornithology are presented in **Volume 3** as **Figures 4.6.1** and **4.6.2.**

4.6.2. The following assessment considers the terrestrial ecology and ornithological effects of the passing loop and track cross-over works only. The EIA will consider any impacts at the required level crossing works although given the limited extent of the works, significant effects are unlikely in these locations.

a) Baseline environment

4.6.3. The baseline for each of the locations described above has been compiled following a detailed review of the GRIP 2A Environmental Appraisal from Network Rail, a data request from the Suffolk Biodiversity Information Service (SBIS) and a review of aerial photographs and Ordnance Survey (OS) maps.

4.6.4. There is one statutory designated site within a 5km radius of the proposed track cross-over at Saxmundham, this being Gromford Meadow Site of Special Scientific Interest (SSSI) located over 4.5km to the south. There are two non-statutory designated County Wildlife Site (CWS) within 2km of the site, these being Kelsale Morio Meadow CWS (identified for supporting green winged orchids (*Anacamptis morio*)), located approximately 400m north-east, and Benhall Green Meadows CWS located approximately 1.5km to the south.

4.6.5. Habitats alongside the rail track at the proposed track cross-over at Saxmundham comprise scrub, rough grassland, tall ruderal species and linear belts of trees. The section of railway line also crosses the River Fromus. Habitat in the vicinity of the proposed crossover is predominately arable farmland divided by hedgerows. A small area of planted broadleaved woodland is located adjacent to the southern side of the branch line where it departs from the East Suffolk line, with rough grassland adjacent to the woodland planting. There are a number of ponds in the surrounding area. Hedgerows, broadleaved woodland, wood pasture and parkland, rivers and ponds are all habitats of principal importance.

4.6.6. There are a number of records of notable butterfly species, although the data provided only locates most records to a 1km square. A single six figure grid reference is provided for a white-letter hairstreak butterfly (*Satyrium w-album*) from the outskirts of Saxmundham approximately 450m north-west. Habitats alongside the rail track are likely to support common and widespread species and are unlikely to be of particular importance to other notable invertebrate species.

4.6.7. There was a single record of a great crested newt[3] (*Triturus cristatus*) from within the 500m search area. This 2005 record was from a pond located approximately 400m north-east of the proposals. There are a further ten ponds within 500m of the proposals that could support breeding great crested newts. Habitats alongside the railway track, such as rough grassland and scrub, provide suitable habitat for the terrestrial phase of this species and aid connectivity to the wider landscape.

4.6.8. Scrub, rough grassland and tall ruderal habitats adjacent to the railway track provide suitable foraging and basking habitat for reptiles. The arable farmland habitat in the wider area is suboptimal habitat for reptiles. There are records of common reptile species in the vicinity, the closest being a record of a slow-worm (*Anguis fragilis*) and a common lizard (*Zootoca vivipara*) from near Saxmundham Station.

4.6.9. Based on SBIS records, breeding birds[4] typical of an agricultural environment are present, including linnet (*Linaria cannabina*) and yellowhammer (*Emberiza citronella*), as well as species more associated with a suburban environment such as house sparrow (*Passer domesticus*). The scrub and broadleaved woodland adjacent to the railway line is likely to provide suitable habitat for nesting bird species.

4.6.10. Common pipistrelle (*Pipistrellus pipistrellus*) and brown long-eared bats (*Plecotus auritus*)[5] have been recorded within 500m of the proposed track cross-over. The linear vegetation adjacent to the railway line and the surrounding hedgerows could be of value to foraging and commuting bats. Mature trees could also be of value to roosting bats. No statutory designated site within 10km cites bats as a designated interest feature.

[3]Great crested newts are a European Protected Species (EPS), receiving protection under the Conservation of Habitats and Species Regulations (2017) (Ref. 4.6.2). They are also protected under the Wildlife and Countryside Act 1981 and are a species of principal importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

[4]All wild birds, their eggs and nests are protected under Section 1 of the Wildlife and Countryside Act 1981 (Ref. 4.6.3).

[5]All species of bat in the UK are EPSs, receiving protection under the Conservation of Habitats and Species Regulations (2017). They are also protected under the Wildlife and Countryside Act 1981. Several bat species, including soprano pipistrelle (*Pipistrellus pygmaeus*), brown long-eared, noctule (*Nyctalus noctula*) and barbastelle bat (*Barbastella barbastellus*) are species of principal importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006). Barbastelle bats are also listed in the European Commission (EC) Habitats Directive (1992) (Ref. 4.6.4, Annex II), requiring the establishment of SACs to conserve this species

4.6.11. There are records of otter[6] (*Lutra lutra*) from the River Fromus, which the railway line crosses. There are no records of water vole[7] (*Arvicola amphibious*) from within 500m of the proposed track cross-over, although they could be present along the River Fromus if the habitat is suitable.

4.6.12. Although no records of badgers[8] (*Meles meles*) were provided by SBIS, badger setts could be present on the railway embankments or close to the proposed track cross-over.

4.6.13. At the location of the proposed passing loop, there are three European designated sites comprising Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites within a 5km radius of the passing loop location (some sites carry more than one designation). These are: Deben Estuary SPA and Ramsar, located approximately 2.2km from the proposed passing loop; Sandlings SPA, located approximately 1.8km from the proposed passing loop; and Staverton Park and the Thicks SAC, located approximately 4.6km from the proposed passing loop.

4.6.14. There are three nationally designated sites SSSI within 5km of the proposed passing loop, these are: Sandlings SSSI; Deben Estuary SSSI; and Staverton Park and the Thicks SSSI.

4.6.15. There are seven non-statutory designated CWS within 2km of the proposed passing loop, all of which are located over 500m from the proposals. These are: The Oaks CWS; Copperas Wood CWS; Ashe Abbey Decoy Pond CWS; Eyke Meadows CWS; Reves Hall Meadow CWS; Boon's Meadow CWS; and Rowanwood Cottage Marsh CWS.

4.6.16. Trackside vegetation comprises scrub and rough grassland. Habitats in the vicinity of the proposed passing loop comprise floodplain grazing marsh to the south and east and a network of ditches associated with the River Deben, which the railway line crosses further south (300m away). In addition, a small area of deciduous woodland is present immediately to the east. Floodplain grazing marsh, deciduous woodland and rivers are habitats of principal importance. To the west, the habitat is predominantly arable farmland.

4.6.17. There are a number of records of notable butterfly species (small heath (*Coenonympha pamphilus*), grayling (*Hipparchia semele*) and wall (*Lasiommata megera*)), all of which were from Sandpit Farm located approximately 250m to the south-west. Habitats alongside the rail track are likely to support common and widespread species and are unlikely to be of particular importance to notable invertebrate species.

4.6.18. There are no records of great crested newts from within 500m of the proposed passing loop although there are two ponds within 500m that could potentially support this species. Habitats alongside the railway track such as rough grassland and scrub provide suitable terrestrial foraging habitat and hibernation sites and aid connectivity to the wider landscape.

4.6.19. There are no records of reptiles from within 500m of the proposals. Scrub, rough grassland and tall ruderal habitats adjacent to the railway track could provide suitable foraging and basking habitat for reptiles.

4.6.20. Based on SBIS records, breeding birds typical of an agricultural environment are present, including linnet and yellowhammer. The scrub and trees adjacent to the railway line are likely to provide suitable habitat for nesting bird species.

4.6.21. There is a record of a Daubenton's bat (*Myotis daubentonii*) from within 500m of the proposed passing loop. The linear vegetation adjacent to the railway line could be of value to foraging and commuting bats. Mature trees could also be of value to roosting bats. The surrounding arable farmland habitat is suboptimal habitat for foraging bats. No statutory designated site within 10km cites bats as a designated interest feature.

4.6.22. There are records of otter from the River Deben, located approximately 300m south of the proposed passing loop. There are no records of water vole from within 500m of the proposed passing loop. There is no habitat suitable for otters or water voles within the proposed red line boundary.

4.6.23. Desk study records confirm that badgers are present in the area, and there is a record of a single entrance badger sett along the railway embankment within the site from 2004. Additional badger setts could be present on the railway embankments, or close to the proposed passing loop.

[6]Otter are an EPS, receiving protection under the Conservation of Habitats and Species Regulations (2017). Otter are also protected under the Wildlife and Countryside Act 1981 and are a species of principal importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

[7]Water vole is protected under Schedule 5 of the Wildlife and Countryside Act 1981 and is a species of principal importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

[8]Badgers are protected under the Protection of Badgers Act (1992) (Ref. 4.6.5).

b) Environmental design and embedded mitigation

4.6.24. A summary of the measures that have been incorporated into the design of the proposed development and that will protect the existing features of ecological interest during construction are set out below:

- Access tracks and site compounds would avoid sensitive habitats.
- The Construction Environmental Management Plan (CEMP) would define any ecological constraints and specify any measures required during construction in relation to the presence of protected species and any required vegetation clearance works. It would specify the need for an Ecological Clerk of Works (ECoW) to undertake and oversee specific tasks.
- Temporary construction lighting would minimise light-spill into adjacent habitats. This would reduce impacts on nocturnal species such as bats that may use nearby habitats for roosting or foraging.
- A buffer zone from the toe of the bank of the River Fromus would be maintained in order to avoid impacts on water voles.

4.6.25. No embedded measures are envisaged as being required during operation.

c) Preliminary assessment of effects

4.6.26. This section considers both the track cross-over and passing loop together, given that the constraints associated with both sites are similar, so as to avoid repetition. Where constraints are specific to a particular location, this is stated below.

4.6.27. Significant effects on designated sites, plants and habitats, invertebrates, reptiles, breeding birds, otters, water voles and badgers are not anticipated and they are not discussed further in this section of the report. However, a detailed impact assessment will be presented for these habitats and species within the ES and further details of the embedded mitigation required to offset any significant effects would similarly be provided, as appropriate

4.6.28. Significant effects on great crested newts and roosting bats are possible. A preliminary assessment of effects on these species is provided below.

4.6.29. Waterbodies in the vicinity of the proposed track cross-over are known to support breeding great crested newts and there are two ponds within 500m of the proposed passing loop that could support this species. Suitable terrestrial habitat (such as scrub and rough grassland) adjacent to the track will be lost during construction, potentially resulting in injury or mortality of great crested newts and loss of resting places. There is the potential for a significant adverse effect if the ponds and related terrestrial habitats support great crested newts.

4.6.30. If any trees with features suitable to support roosting bats require removal, then there is the potential for incidental mortality and loss of roost features. This could potentially be a significant adverse effect depending on the nature and status of any bat roost (if present). Impacts from noise and lighting are unlikely to be significant as bats are already exposed to existing levels of noise and light from train operation.

4.6.31. No significant operational effects are envisaged.

d) Additional mitigation and monitoring

4.6.32. The assessment has identified the potential for significant effects on bats and great crested newts to occur despite the embedded mitigation measures. Additional mitigation measures may therefore be required to minimise impacts so that significant effects are avoided. Furthermore, additional mitigation and monitoring measures may also be required in relation to habitats and species for which a significant effect is not anticipated, but which are nonetheless legally protected, to ensure compliance with legislation. Under the CEMP, pre-construction surveys will be required and may result in mitigation measures such as micro-siting of specific elements of the project and/or licences for protected species. Monitoring of mitigation measures may also be required to ensure its effectiveness. These mitigation and monitoring measures will be presented in the ES, if relevant.

e) Preliminary assessment of residual effects

4.6.33. Significant residual effects are not envisaged.

f) Completing the assessment

4.6.34. To inform the development of appropriate mitigation measures and complete the ES, an extended Phase 1 habitat survey will be undertaken. The focus of the survey will be to identify any ecological constraints such as the presence of legally protected species particularly bats and great crested newts. Further consideration will be given to the level crossing works in the ongoing EIA, particularly if any semi-natural vegetation is likely to be lost.

4.6.35. An ecological assessment for the ES will then be progressed, clarifying whether significant adverse effects are likely. Any further embedded mitigation measures which would be required to mitigate these effects will also be defined and incorporated into the design.

4.7. Terrestrial historic environment

4.7.1. The following assessment considers the historic environment effects of the passing loop and track cross-over works within the main assessment as well as giving preliminary consideration to the improvement works to level crossings.

4.7.2. At the level crossings, the scope and extent of this would generally comprise limited works which would be confined to the existing rail and highways boundaries wherever possible. These works would present limited potential for disturbance of archaeological remains. The works have a low potential to give rise to change of setting except where they are located within particularly sensitive locations, such as conservation areas. In principle, any such effects could be mitigated through design. A more detailed assessment will be presented within the ES.

4.7.3. It is not anticipated that any significant adverse effects would arise in respect of the level crossings work. However further assessment will be required to establish the need for any additional archaeological mitigation of intrusive construction works and identify any requirements for design to respond to the setting of designated heritage assets or the character of conservation areas. The level crossing works are not considered further below.

a) Baseline environment

4.7.4. A review of designated heritage data held by Historic England and Conservation Area designations held by Suffolk Coastal District Council (SCDC) within the 500m of the proposed passing loop and Saxmundham track cross-over was undertaken.

4.7.5. The track cross-over is located immediately to the west of the Saxmundham conservation area, and there are a small number of listed buildings which are located close to the proposed works, including the Grade II listed Lynwood House (LB1365994) and the Grade II* listed The Beeches (LB1365996). There are no designated heritage assets within 500m of the proposed passing loop, which is located between Ufford and Eyke.

b) Preliminary assessment of effects

4.7.6. The proposed works would be located within the existing railway boundary, where a degree of prior disturbance can be expected and would involve limited intrusive works that are unlikely to result in any disturbance of archaeological remains. More detailed assessment will be presented within the ES and measures to mitigate any disturbance of archaeological remains will be set out where necessary.

4.7.7. Construction works would be of limited duration and would not result in any significant change to setting. During operation the proposed passing loop and track cross-over would have a limited effect on the settings of heritage assets and no lasting change to setting would arise.

4.7.8. Other rail improvements, including improvement work to level crossings signalling upgrades, strengthening works to bridges and branch upgrades on the Saxmundham to Leiston branch would also be undertaken. The scope and extent of this would generally comprise limited works which would be confined to the existing rail and highways boundaries wherever possible. These works would present limited potential for disturbance of archaeological remains. The works have a low potential to give rise to change to setting except where they are located within particularly sensitive locations, such as conservation areas. In principle, any such effects could be mitigated through design. More detailed assessment will be presented within the ES.

4.7.9. It is not anticipated that any significant adverse effects would arise, although further work will be required to establish the need for any additional archaeological mitigation of intrusive construction works and identify any requirements for design to respond to the setting of designated heritage assets or the character of conservation areas.

4.8. Air quality

4.8.1. The following assessment considers the air quality effects of the rail improvement works as a whole.

a) Baseline environment

4.8.2. The rail lines, as they currently operate, serve local communities and accordingly, there are many receptors in close proximity to the proposed developments, principally residential properties in Ufford, Saxmundham and Leiston.

4.8.3. For the East Suffolk line, the rail line as a whole currently passes close to two Air Quality Management Areas (AQMAs) (Ref. 4.8.1) across two local authorities, as follows:

- Woodbridge Junction AQMA <200m, declared by SCDC (Ref. 4.8.2); and
- The Roads around Bridge Street (referred to as AQMA 3 in Ipswich Borough Council Annual Status Report 2016, (Ref. 4.8.3)) 400m, declared by Ipswich Borough Council.

4.8.4. The East Suffolk line upgrade site, east of Ufford, is closest to the Woodbridge Junction AQMA, being approximately 4.5km north-east, so is unlikely to have a significant effect on this AQMA.

4.8.5. In addition to several Local Nature Reserves in Ipswich, the East Suffolk line is proximal to the Deben Estuary SPA in Woodbridge and Sandlings Forest SSSI. However, it is considered unlikely that the line upgrade will have a significant air quality impact on these locations.

4.8.6. The Saxmundham to Leiston branch upgrade site is closest to the Stratford St Andrew AQMA declared by SCDC and the proposed development site is approximately 5km north-east of this, so is unlikely to have a significant effect on this AQMA. There are no statutory declared sites of ecological interest within 5km of the proposed development site.

4.8.7. There are a number of nearby council-operated pollutant monitoring sites along the rail lines which are relevant; including those located in Ipswich, Woodbridge, Melton, Saxmundham and Leiston. The closest monitoring sites in each of those locations is as follows, all of which are below the Nitrogen Dioxide (NO2) annual mean Air Quality Strategy objective of 40µg/m3 (Ref 4.8d):

- in Ipswich, NO2 diffusion tube on Bramford Road (within 0.6km of the current line) had a reported concentration of 32.6µg/m3 in 2015;
- in Woodbridge, NO_2 diffusion tube WBG12 (110m from the current line) had a reported concentration of 22µg/m^3 in 2016;
- in Melton, NO_2 diffusion tube MEL5, (87m away from the current line) had a reported concentration of 25µg/m^3 for 2016;
- in Saxmundham, NO_2 diffusion tube SAX1 (210m from the current line) had a reported concentration of 31.5µg/m^3 in 2016; and
- in Leiston, NO_2 diffusion tube LEI2 (400m from the current line) had a reported concentration of 18.8µg/m^3 in 2016.

4.8.8. Department for Environment, Food & Rural Affairs (Defra) background concentrations of pollutants vary significantly over the area covered by the existing rail lines. The greatest background concentrations along the current line exist around Ipswich, where the NO_2 concentration was 17.7µg/m^3 and the Particulate Matter of a diameter of 10 microns or below (PM_{10}) concentration was 19.5µg/m^3 (Ref. 4.8.4), both well below statutory objectives (Ref. 4.8.5, Ref. 4.8.6).

4.8.9. As stated in Local Air Quality Management Technical Guidance 16 (Ref. 4.8.7), certain railway lines with a heavy traffic of Diesel Passenger Trains may require further assessment to establish whether there is a risk of poor air quality due to railway locomotive emissions of sulphur dioxide (SO_2). The Ipswich-Lowestoft and Saxmundham-Leiston branch lines are not listed as part of the 11 rail lines for which this should be a consideration, and air quality along the branch line is considered to be good, with SO_2 background concentrations of 3.8µg/m^3 according to Defra background maps. Therefore, further consideration of the small number of mobile railway locomotive engines associated with the proposed development (up to 5 in bound and 5 outbound per day) is not considered to be required and significant air quality effects are not expected.

4.8.10. Dust levels are related to the action of wind on exposed soils and climatic conditions year to year but existing levels are likely to be low given the arable nature of the existing land use.

4.8.11. Ongoing achievement of air quality objective values is likely to occur within the study area in future years. Indeed, air quality is predicted to improve before 2027, the anticipated operational year for the main development site, because it is expected that improvements in vehicular emission rates and background concentrations will offset a general trend for an increase in vehicle numbers. Lower concentrations of pollutants may therefore be expected by the time the proposed development is commenced.

4.8.12. No notable changes are expected in land use in the surrounding area and it is expected that rates of dust deposition in future are likely to be similar to current levels.

b) Environmental design and embedded mitigation

i) Construction

4.8.13. Mitigation for the air quality impacts arising from the construction phase has been embedded into the design and construction of the proposed development and should include:

- site access located as far as practicable, and preferably at least 10m, from receptors;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- potentially dusty loads (loose earth, spoil, aggregates etc.) to be covered in transit;
- any potential use of concrete batching plant located as far as practicable from receptors; and
- mobile crushing & screening plant located as far as practicable from receptors.

4.8.14. Air quality impacts arising from the construction phase would be managed through a range of control measures as detailed in the CEMP.

ii) Operation

4.8.15. The creation of the new level crossings described in this section would enable more efficient movements along the branch line and could reduce idling.

4.8.16. The potential for further operational mitigation for air quality for train movements is limited in part by the rolling stock. Further consideration will be given to any opportunities to reduce emissions during the ongoing EIA.

c) Preliminary assessment of effects

i) Construction

4.8.17. The potential impacts associated with the construction of the proposed development include fugitive emissions of dust, emissions from Non Road Mobile Machinery (NRMM) on the site, emissions from HGVs accessing the site and emissions from vehicles carrying workers to and from the site. However, given the embedded mitigation measures described above, the adverse effects are likely to be negligible and would therefore not be significant for any of the proposed construction activities at the site.

4.8.18. The principal risk is anticipated to be related to earthworks, as this phase of construction can typically require a high volume of material to be moved. A high level of activity could potentially place the dust emissions category as 'Large' under the Institute of Air Quality Management (IAQM) classification (Ref. 4.4.8), with the likelihood of a 'Medium' risk based on the number and sensitivity of local receptors. Each risk category has the potential to lead to proportional adverse, albeit temporary, impacts which have the potential to be significant without mitigation.

4.8.19. However, assuming all mitigation measures are effectively implemented and monitored through an effective CEMP, at the level recommended by the dust risk assessment, no significant dust effects resulting from demolition and construction activities are anticipated.

4.8.20. It is highly likely that the number of HGV movements required to develop the site would not exceed the threshold for detailed dispersion modelling assessment (Ref. 4.8.9), and as such it can be considered that the effects on air quality would not be significant.

ii) Operation

4.8.21. There is potential for increases in pollutant concentrations at existing receptors located in the vicinity of proposed development during operation as well as additional receptors created by construction of the passing loop. The proposed development will accommodate up to five locomotives per day (a total of ten movements). It is unlikely this sum would result in a significant effect on pollutant concentrations at receptors. It is not expected there would be any incidences of stationary locomotives during operation of the proposed development.

4.8.22. A potentially significant source of emissions associated with the proposed development could be as a result of road vehicles idling at new level crossings constructed as a result of the passing loop. Accordingly, whilst IAQM guidance is not explicit with regard to rail emissions, it has been used to determine the necessity for an air quality impact assessment and it is expected that the proposed development would require a detailed assessment, given that it meets the IAQM criteria of adding a new junction (in this case a level crossing) near to receptors. The proposed embedded mitigation, in conjunction with the low baseline concentrations across the study area, indicates that there are unlikely to be significant adverse air quality effects at receptors during operation.

4.8.23. There are not anticipated to be any significant effects on AQMAs from the proposed development.

4.8.24. The effects on both Deben Estuary SPA and Sandlings Forest SSSI of the East Suffolk line upgrades would likely be negligible as a percentage of the overall background deposition rates. Whilst there may be exceedances of critical loads immediately adjacent to roads and/or railway lines, this would be attributable to background deposition, and not the proposed development itself, and would in addition be expected to fall off rapidly with increased distance from the source. This would therefore not be significant.

4.8.25. The principal benefit to the proposed development is that the impact of main development site related rail and road traffic passing through Leiston would be less than would otherwise be necessary. Whilst this is not expected to be significant in air quality terms, it is still a benefit of the proposed development.

d) Additional mitigation and monitoring

4.8.26. No significant adverse effects are predicted for any phase of development and no additional mitigation measures are therefore proposed.

e) Preliminary assessment of residual effects

4.8.27. No significant residual effects are predicted during the construction or operational use phases.

f) Completing the assessment

4.8.28. Once the proposals are finalised, the potential air quality effects of the rail improvements will be re-evaluated to confirm whether the preliminary conclusions presented above are applicable. The ES will present the full assessment considered necessary, underpinning the conclusions drawn in relation to the absence of significant adverse effects, and the presence of significant beneficial effects.

4.9. Groundwater

4.9.1. The following assessment considers the groundwater effects of the passing loop and track cross-over works only. The EIA will consider any impacts at the required level crossing works although given the limited extent of the works, significant effects are unlikely in these locations.

a) Baseline environment

4.9.2. The sand and gravel of the Lowestoft Formation and Kesgrave Catchment Sub-Group is classified as a Secondary A Aquifer[9] and the diamicton of the Lowestoft Formation is classified as a Secondary Aquifer (undifferentiated)[10] .

4.9.3. The Red Crag Group bedrock underlying the sites is classified as a Principal Aquifer[11] .

4.9.4. Both sites are located within the Total Catchment Zone (Zone 3)[12] of a groundwater Source Protection Zone (SPZ)[13] .

4.9.5. The diamicton of the Lowestoft Formation at the sites is expected to be of relatively low permeability and therefore have a limited hydraulic connection to the underlying Crag groundwater. It is likely there are perched water tables in permeable lenses within the Lowestoft Formation. It is anticipated there is a good hydraulic connection between the sand and gravel superficial aquifers.

4.9.6. Contours shown on the British Geological Survey (BGS) hydrogeological mapping (Ref. 4.9.1) suggest that Crag groundwater levels at the sites may be between 5m and 10m AOD. These contours are based on data from 1976 and are only indicative of current levels, however, the hydrogeological regime is unlikely to have changed significantly in the intervening years.

4.9.7. Given the local geology and depth to groundwater there is not considered to be a connection between groundwater and surrounding surface water features. Surface water features are discussed further in **section 4.10**.

4.9.8. Both sites are located on the Waveney and East Suffolk Chalk and Crag groundwater body (Water Framework Directive (WFD) reference GB40501G400600) (Ref. 4.9.2). This groundwater body has been classified by the Environment Agency as being of Poor Quantitative and Poor Chemical status, with an objective to being of Good Quantitative and Good Chemical status by 2027. The Poor Chemical status is attributed to impacts from agriculture as evidenced by elevated nitrate concentrations in groundwater. Both sites fall within a groundwater Nitrate Vulnerable Zone (NVZ).

4.9.9. There is no information available on groundwater abstractions for either of the sites.

4.9.10. The Suffolk Coastal and Waveney District Strategic Flood Risk Assessment (SFRA) makes no reference to groundwater flooding across the Suffolk Coastal and Waveney District (Ref. 4.9.3). Flood risk is discussed further in **section 4.11**.

4.9.11. There is no known existing land contamination on either site.

4.9.12. There are no ecological or historic receptors within 1km of either site.

b) Environmental design and embedded mitigation

i) Construction

4.9.13. A piling risk assessment, in accordance with Environment Agency guidance, may be required to ensure that appropriate piling techniques are implemented at the site (by identifying and managing potential risks as a result of creating pathways to groundwater).

4.9.14. Petrol/oil interceptors will be incorporated within the drainage design where considered necessary.

4.9.15. The CEMP would specify measures required during enabling works and construction and could include, but not be limited to:

- implementation of working methods during construction to ensure that there is no surface water run-off from the works or any stockpiles into adjacent surface watercourses/leaching into underlying groundwater in accordance with best practice;

[9] Secondary A Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

[10] Secondary (Undifferentiated) Aquifers are designated in cases where it has not been possible to attribute either category Secondary A or Secondary B to a rock type.

[11] Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability – meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

[12] Total catchments (Zone 3) are defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75.

[13] Groundwater Source Protection Zones are areas defined around groundwater sources used for public drinking water supply. The SPZ shows the risk of contamination from activities that might cause pollution in the area. The closer the activity, the greater the risk.

- implementation of appropriate pollution incident control, for example, plant drip trays and spill kits;
- implementation of appropriate and safe storage of fuel, oils and equipment during construction;
- implementation of an appropriate Materials Management Plan (MMP) to document how the excavated materials will be dealt with; and
- implementation of a Site Waste Management Plan (SWMP).

4.9.16. Remediation of soil/groundwater contamination (for example, source removal, treatment or capping) and ground stabilisation/improvement works would be undertaken if further investigation and risk assessments deemed it necessary.

4.9.17. The drainage/flood prevention strategies would consider the ground conditions including the permeability of the strata and the level of contamination present on-site.

ii) Operation

4.9.18. Appropriate drainage will be used, including the incorporation of Urban Sustainable Drainage Systems (SuDS) measures.

4.9.19. Petrol/oil interceptors will be incorporated within the drainage design where considered necessary.

c) Preliminary assessment of effects

i) Construction

4.9.20. Due to the shallow excavation depths anticipated at the sites, the construction phase would not likely have an impact on the groundwater level and flow regime.

4.9.21. Were a spill or leak to occur during construction, the impact on groundwater within superficial deposits would be low. The effect of this impact on the Lowestoft Formation sand and gravel aquifer and on groundwater within the Lowestoft diamicton would not be significant.

4.9.22. The groundwater in Principal Aquifers would be protected from any spills or leaks where they are overlain by low permeability superficial deposits. In areas where the Principal Aquifers are overlain by sand and gravel of the Lowestoft Formation there is a potential pathway for contamination. However, given the relatively low volumes of potentially contaminative material the scale of any spill or leak would be small hence the impact on groundwater would be low and the effect would not be significant.

4.9.23. Considering both the baseline conditions of the sites and the environmental design and embedded mitigation, it is unlikely there would be any significant effects on groundwater at the site.

ii) Operation

4.9.24. Contamination from any fuel spills or leaks from trains using the upgraded line would be of limited magnitude and longevity and would be mitigated through effective drainage.

4.9.25. The proposed works would not significantly increase the impermeable area of ground cover at the sites as the material used for the railway line would be highly permeable, allowing the infiltration to groundwater. The drainage design would intercept run-off from adjacent areas, avoiding flooding of lengths of the railway and preventing increased run-off to adjacent areas where the railway is embanked. This design will avoid, or minimise, impacts to groundwater receptors.

4.9.26. Considering both the baseline conditions of the sites and the environmental design and embedded mitigation, it is unlikely there would be any significant effects on groundwater.

d) Additional mitigation and monitoring

4.9.27. Periodic inspection and maintenance of the drainage infrastructure may be required to ensure the continued efficacy of the surface water drainage system.

e) Preliminary assessment of residual effects

4.9.28. There are not expected to be any significant adverse residual effects during the construction or operation.

f) Completing the assessment

4.9.29. Further studies will be undertaken to define potential risks in relation to groundwater.

4.9.30. Once the proposals for the Sizewell C development as a whole are finalised, the full groundwater assessment of the proposals will be completed as part of the EIA and the results presented in the ES. The ES will present the full assessment underpinning the conclusions drawn in relation to significant effects.

4.10. Surface water

4.10.1. The following assessment considers the surface water effects of the passing loop and track cross-over works only. The EIA will consider any impacts at the required level crossing works although given the limited extent of the works, significant effects are unlikely in these locations.

a) Baseline environment

4.10.2. The proposed passing loop is located in the Deben (Brandeston Bridge – Melton) river catchment (water body reference GB105035046310), approximately 200m from the River Deben at its closest point (Ref. 4.10.1). A network of drains and a small pond are located to the east of the proposed site boundary. A reservoir is located to the west of the proposed site boundary, just east of Ufford Road.

4.10.3. The track cross-over is located in the Fromus river catchment (water body reference GB105035045980) (Ref. 4.10.2). The proposed site boundary intersects the River Fromus approximately 120m downstream of the confluence of the Gull Stream and River Fromus. Two drains are crossed by the proposed temporary construction area; to the east of the Saxmundham Junction and to the south of the railway at Cottage Farm. Several ponds are located in the vicinity of the proposed site boundary.

4.10.4. Geomorphology and hydromorphology are key factors contributing to whether a water body can achieve or maintain Good ecological status. The Deben (Brandeston Bridge – Melton) water body (water body reference GB105035046310) is designated as a Heavily Modified Water Body (HMWB). However, the hydrological regime is of sufficient quality to support Good ecological status.

4.10.5. The Fromus water body (water body reference GB105035045980) is not designated artificial or heavily modified.

4.10.6. Physico-chemical and chemical data presented on Catchment Data Explorer have been reviewed for the Deben (Brandeston Bridge – Melton) and Fromus.

4.10.7. Physico-chemical data indicate that the Deben (Brandeston Bridge – Melton) is at High or Good WFD status for ammonia, biochemical oxygen demand (BOD), dissolved oxygen (DO), pH, phosphate and temperature. However, the status for phosphate is at Moderate. It is therefore likely that the overall ecological status of Deben (Brandeston Bridge – Melton) is Moderate due to the status of DO and/or phosphate.

4.10.8. Physico-chemical data for the Fromus indicate that it is at High status for all quality elements, with the exception of phosphate, which is at Poor status, and DO, which is at Bad status. The latter is likely to be due to high nutrient loadings from agricultural run-off and/or treated sewage effluent and eutrophication processes. The Poor overall ecological status is likely to be the result of the Bad status of DO.

b) Environmental design and embedded mitigation

i) Construction

4.10.9. Surface water run-off would be contained within the sites, with drainage to ground wherever feasible. Intercepting site drainage and discharging to ground would prevent the supply of sediment and other contaminants to the surface drainage network during construction.

4.10.10. Petrol/oil interceptors would be incorporated within the drainage design where considered necessary.

4.10.11. Mitigation measures would be incorporated into the proposed construction process and could include, but not be limited to:

- The wheels of all vehicles would be washed before leaving site.
- Concrete and cement mixing and washing areas would be situated at least 10m away from surface water receptors. These areas would incorporate settlement and recirculation systems to allow water to be re-used. All washing out of equipment would be undertaken in a contained area and all water would be collected for off-site disposal.
- All fuels, oils, lubricants and other chemicals would be stored in an impermeable bund with at least 110% of the stored capacity. Spill kits should be available at all times, and damaged containers would be removed from site. All refuelling would take place in a dedicated impermeable area, using a bunded bowser. Biodegradable oils would be used where possible.
- Sand bags or stop logs would also be available for deployment on the outlets from the site drainage system in case of emergency spillages.

ii) Operation

4.10.12. The operational drainage system would incorporate SuDS measures where appropriate, to minimise potential impacts on surface water receptors.

4.10.13. Petrol/oil interceptors would be incorporated within the drainage design where considered necessary.

c) Preliminary assessment of effects

i) Construction

4.10.14. The sites would be isolated from adjacent land areas, with drainage to ground. As a result, run-off from the site would be intercepted and hence it is considered that the construction phase of the development would be unlikely to have an impact on the River Deben or River Fromus.

4.10.15. Further assessment will be required to determine the effect of the temporary construction compound area on surface water where it crosses the two drains. However, these drains are not designated as main rivers, nor are they located in a designated area and therefore they would not likely give rise to any significant effects.

4.10.16. Considering both the baseline conditions of the site and the environmental design and embedded mitigation, it is unlikely there would be any significant surface water effects at the sites.

ii) Operation

4.10.17. The proposed works would not significantly increase run-off from the site to the River Deben or River Fromus. There would be infiltration along the railway, plus a combination of SuDS and traditional drainage adjacent to the railway line, which would intercept run-off. The drainage network would ensure the proposals do not adversely affect existing land drainage systems for adjacent land.

4.10.18. Considering both the baseline conditions of the sites and the environmental design and embedded mitigation, there would be no significant adverse surface water effects at the sites.

d) Additional mitigation and monitoring

4.10.19. Periodic inspection and maintenance of the drainage infrastructure would be required to ensure its continued efficacy.

e) Preliminary assessment of residual effects

4.10.20. No significant adverse residual effects are expected.

f) Completing the assessment

4.10.21. EDF Energy believes that effective mitigation can be provided for the proposed development that would minimise surface water impacts. Additional investigations will be undertaken at the proposed development to inform design. The final design of the proposed development, the need for mitigation and its form will be determined in liaison with the relevant authorities.

4.10.22. Once the proposals for the Sizewell C development are finalised, a full assessment of potential effects on the surface water environment from the proposals will be undertaken as part of the EIA and the results presented in the ES. The ES will present the full assessment underpinning the conclusions drawn in relation to significant effects.

4.11. Flood risk

4.11.1. The figure for flood risk is presented in **Volume 3** as **Figure 4.11.1**.

4.11.2. The following assessment considers the flood risk effects of the passing loop and track cross-over works, the bridge strengthening works and the level crossing works.

a) Baseline environment

4.11.3. The requirements to assess each location's flood risk are outlined in **Table 4.11.1**.

4.11.4. A summary of the baseline flood risk for the sites, excluding the signal upgrades, is presented in **Table 4.11.2** (level crossings), **Table 4.11.3** (rail loop improvements) and **Table 4.11.4** (bridge strengthening).b) Environmental design and embedded mitigation

4.11.5. The Sequential Test[14] aims to steer development away from areas of high flood risk. The positioning of the majority of the rail improvement works in Flood Zone 1 complies with this requirement. The minor works relating to the majority of the level crossings are unlikely to require specifically embedded flood risk mitigation.

c) Preliminary assessment of effects

4.11.6. Any increases in off-site and/or on-site flood risk would be unlikely during all phases of development, as long as appropriate drainage measures are provided. Significant adverse effects are therefore unlikely.

d) Additional mitigation and monitoring

4.11.7. The existing asset owners would remain the asset owners and would continue to be responsible for the monitoring and maintenance of the assets.

e) Preliminary assessment of residual effects

4.11.8. Monitoring and maintenance of the improvement works by the asset owners would manage the residual risk. Significant adverse effects are unlikely.

f) Completing the assessment

4.11.9. There are a number of sites that would require further assessment to comply with planning policy. A Flood Risk Assessment (FRA) for these selected sites will be submitted as part of the application for development consent after the proposals for the Sizewell C development as a whole are finalised. Due to the low impact nature of many of these sites, the FRA will address flood risk for multiple sites and follow a proportionate risk-based approach.

Table 4.11.1 Summary of rail improvement schemes and their flood risk

Improvement Description	Locations	Flood Risk Assessment Requirement
Passing Loop – Upgrade from single line to two lines.	East Suffolk line between Melton Station and Wickham Market Station.	Simple FRA will be required. The site is partly in an area of 'high' surface water flood risk.
Signalling upgrades.	Various along East Suffolk line.	No FRA required. No increase in impermeable area.
Bridge strengthening works.	Bramford Road (B1067), Ipswich. Norwich Road, Ipswich. River Flynn Viaduct, west of Woodbridge. Two on the River Debden, Ufford. Abbey Bridge, Ufford.	FRA will be required for all bridge strengthening works. Sites are located in Flood Zone 3 or in areas of 'high' surface water flood risk.
Level crossings – upgrades/closures or rights of way diversions.	Various along East Suffolk line and Saxmundham to Leiston Branch Line.	FRA may be required which covers all the sites located in Flood Zone 2 or 3 or at high surface water flood risk.

[14]The Sequential Test aims to steer new development toward areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for that development in areas of lower probability of flood risk.

Table 4.11.2 Summary of the baseline flood risk for the level crossing improvements

Description	Fluvial	Tidal	Surface Water	Ground-water	Sewers	Reservoirs and others
20 level crossings.	Low Flood Zone 1.	Low Beyond tidal extent.	'Very Low' Less than 0.1% annual chance.	Likely Low to Medium. No records in the SFRA. Proposed improvements are unlikely to have a significant effect on groundwater.	Likely Low to Medium. Sewers could be found in roads.	Low. Not at risk of flooding from reservoirs.
13 level crossings.			'Low' Between 0.1% – 1% annual chance.			
1 level crossing.			'Medium' Between 1% – 3.3% annual chance.			
6 level crossings.			'High' Greater than 3.3% annual chance.			
2 level crossings.	Medium Flood Zone 2.		'Very Low' Less than 0.1% annual chance.			
2 level crossings.			'Low' Between 0.1% – 1% annual chance.			
6 level crossings.	High Flood Zone 3.		Very Low' Less than 0.1% annual chance.			
4 level crossings.			'Low' Between 0.1% – 1% annual chance.			
2 level crossings.			Medium' Between 1% – 3.3% annual chance.			

Table 4.11.3 Summary of the baseline flood risk for the rail loop improvements

Description	Fluvial	Tidal	Surface Water	Ground-water	Sewers	Reservoirs and others
Saxmundham track cross-over.	Low Flood Zone 1.	Low Beyond tidal extent.	Predominantly 'Very Low' with small areas of 'Low', 'Medium' and 'High'.	Likely Low to Medium. No records in the SFRA. Proposed improvements are unlikely to have a significant effect on groundwater.	Likely Low to Medium. Sewers could be found in roads.	Low Not at risk of flooding from reservoirs.
Passing loop between Melton Station and Wickham Market Station on the East Suffolk line.	Low Flood Zone 1.		Predominantly 'Very Low' with small area of 'High'.			

Table 4.11.4 Summary of the baseline flood risk for the bridge strengthening improvements

<table>
<tr><th>Description</th><th>Fluvial</th><th>Tidal</th><th>Surface Water</th><th>Ground-water</th><th>Sewers</th><th>Reservoirs and others</th></tr>
<tr><td>Bramford Road (B1067)
Ipswich</td><td rowspan="2">Low
Flood Zone 1.</td><td rowspan="6">Low
Beyond tidal extent.</td><td rowspan="2">High
Greater than 3.3% annual chance.</td><td rowspan="6">Likely Low to Medium.
No records in the SFRA. Proposed improvements are unlikely to have a significant effect on groundwater.</td><td rowspan="6">Likely Low to Medium.
Sewers could be found in roads.</td><td rowspan="6">Low
Not at risk of flooding from reservoirs.</td></tr>
<tr><td>Norwich Road Bridge
Ipswich</td></tr>
<tr><td>River Flynn Viaduct
West of Woodbridge</td><td rowspan="4">High
Flood Zone 3.</td><td rowspan="2">Medium
Between 1% – 3.3% annual chance.</td></tr>
<tr><td>River Debden (Ufford) No. 1
Ufford</td></tr>
<tr><td>River Debden (Ufford) No. 2
Ufford</td><td rowspan="2">Low
Between 0.1% – 1% annual chance.</td></tr>
<tr><td>Abbey Bridge
Ufford</td></tr>
</table>

4.12. Comparison between rail-led and road-led strategies

4.12.1. The rail improvements assessed in this chapter would only be built under the rail-led strategy (potentially with some local exceptions, see **section 4.1**). If the road-led strategy is taken forward, the effects described in this chapter would not arise.

5. Sizewell Link Road PEI

5.1. Introduction to Preliminary Environmental Information (PEI)

5.1.1. The Sizewell link road (see **Figure 2.10** in **Volume 1, Chapter 2**) is proposed as part of the road-led strategy only and details of the proposals are set out in **Volume 1, Chapter 10**. The proposed route incorporates a bypass around Theberton, which is also proposed as part of the rail-led strategy (see Preliminary Environmental Information (PEI) in **Chapter 6** of this volume) and extends the route further to bypass Middleton Moor, joining the A12 south of Yoxford.

5.1.2. The road would be 7.3 metres (m) wide with 1m hardstrips, 2.5m wide verges, earthworks, where needed, and a 5m berm. EDF Energy is however consulting on a wider area during this Stage 3 consultation including the buffer zone shown as the faded aerial area on **Figure 2.11** in **Volume 1, Chapter 2**, as the design and landscaping mitigation has yet to be fully finalised, and in particular EDF Energy wishes to engage with land owners in relation to works which might accommodate the access works for their retained land.

5.1.3. The Sizewell link road would be open for public use alongside construction traffic associated with the project. After completion of the power station, it would be retained as a lasting legacy of the project. Sizewell link road is expected to become part of the adopted highway network and there would be no decommissioning or 'removal and reinstatement' phase. The assessment has been undertaken on this basis. In the longer term, Suffolk County Council (SCC) may give consideration to amending the interfaces between the Sizewell link road and other roads, footpaths and bridleways along its route, following the completion of Sizewell C construction works when traffic flows would decrease.

5.1.4. The construction and operation of the Sizewell link road is likely to have some effects on the environment. The likely significant adverse and beneficial effects during the construction and operational phases are explained below. The scope of the preliminary assessment includes landscape and visual, terrestrial ecology and ornithology, amenity and recreation (A&R), geology and soils, land quality and agriculture, terrestrial historic environment, noise and vibration, air quality, groundwater, surface water, flood risk and traffic and transport and no topics have been 'scoped out' of the assessment. The chapter concludes with a short comparison between the road-led and rail-led strategies as relevant to the Sizewell Link Road.

5.1.5. This chapter presents each of the topics relevant to the proposals in turn, under the following sub-headings: (a) Baseline environment, (b) Environmental design and embedded mitigation, (c) Preliminary assessment of effects, (d) Additional mitigation and monitoring, (e) Preliminary assessment of residual effects and (f) Completing the assessment.

5.2. Landscape and visual

5.2.1. The figure for landscape and visual is presented in **Volume 3** as **Figure 5.2.1.**

a) Baseline environment

5.2.2. The proposed link road route would be approximately 6.8 kilometres (km) long and will descend gradually from approximately 40m Above Ordnance Datum (AOD) at the A12 at the western end to approximately 10m AOD at the B1122 at the eastern end. The land use in the vicinity of the route is predominantly arable farmland, with well-defined hedgerow field boundaries, interspersed with scattered woodlands and copses.

5.2.3. At a national level, the site sits on the boundary between National Character Area 83 (NCA83) South Norfolk and High Suffolk Claylands (Ref. 5.2.1) which form the higher ground to the west, and National Character Area 82 (NCA82) Suffolk Coast and Heaths to the east (Ref. 5.2.2). NCA83 covers a large area of central East Anglia and is a predominantly flat clay plateau incised by numerous small-scale wooded river valleys. NCA82 comprises low-lying gently undulating farmland with areas of woodland, heath and forest plantation. The western part of the site comprises one of the river valleys that are typical of the transition between these character areas.

5.2.4. At a local level, the majority of the site is located within the ancient estate claylands, as identified in the Suffolk County Landscape Character Assessment (Ref. 5.2.3) and shown on **Figure 5.2.1**. The key characteristics are described in the Landscape Character Assessment as:

- *"Dissected Boulder Clay plateau;*
- *Organic pattern of field enclosures;*
- *Straight boundaries where influence of privately owned estates is strongest;*
- *Enclosed former greens and commons;*
- *Parklands;*
- *WWII airfields;*
- *Villages with dispersed hamlets and farmsteads;*
- *Timber framed buildings;* and
- *Distinctive estate cottages; and Ancient semi-natural woodland".*

5.2.5. Small sections of the site in the east however, can be characterised as the rolling estate claylands type, as shown on **Figure 5.2.1**. This is a valley side landscape of clay loams with parklands and fragmented woodland. The key characteristics are described in the Landscape Character Assessment as:

- *"Flat landscape of light loams and sandy soils;*
- *Rolling valley-side landscape;*
- *Medium clay and loamy soils;*
- *Organic pattern of fields;*
- *Occasional areas of more rational planned fields;*
- *Numerous landscape parks;*
- *Substantial villages;*
- *Fragmented woodland cover, both ancient and plantation;* and
- *Winding hedged and occasionally sunken lanes".*

5.2.6. The locations of different groups of people within the study area who may experience views of the proposed link road are shown on **Figure 5.2.1**. The key visual receptors within the study area include the following:

- The settlements of Middleton, Theberton and Yoxford.
- Long distance routes including the A12, the B1122, the railway line between Saxmundham and Darsham, and the Sandlings Walk Long Distance Walking Route (which is also a Sustrans National Cycle Route and lies approximately 1km to the east of the eastern end of the route).
- The proposed link road intersects a number of public rights of way (PRoWs) and local roads as shown on **Figure 5.2.1**. In addition, there are a number of PRoWs where walkers may see the proposed link road (or traffic using the proposed link road).
- Individual dwellings and farms along the route, with the closest residential properties being at Fir Tree Farm, Fordley Hall, Gardenhouse Farm, Oakfield house, Coronation Cottages, Annesons Cottage, Hawthorn Cottages, Trust Farm, Valley Farm, Theberton Hall and Theberton House.

5.2.7. Visibility of the proposed link road from many of these locations is likely to be limited due to a combination of landform, woodland and established hedgerows. In most cases, visibility is likely to be limited to between 500m and

1km, particularly south of Yoxford where woodland cover is high and west of Theberton where the valley landform would begin to screen visibility. However, there are likely to be more distant views of the embankments which cross the small valleys in the eastern part of the route from the south-west facing valley sides beyond the River Yox; and more limited distant views from higher ground to the west and south.

5.2.8. The Suffolk Coasts and Heaths Area of Outstanding Natural Beauty (AONB) is located approximately 1.1km to the east of the eastern end of the proposed link road.

5.2.9. The Yox river valley and part of the valley sides to the north-east of the site are locally designated as a Special Landscape Area (SLA). Some of the link roads at the eastern end of the proposed link road would be adjacent to this area.

b) Environmental design and embedded mitigation

i) Construction

5.2.10. During the construction of the proposed link road, mitigation to help to manage and reduce potential landscape and visual effects would be difficult. However, the following measures would be implemented:

- Construction compounds to be located in close proximity to existing road or rail infrastructure, in areas already disturbed by traffic or trains. Existing vegetation to be retained around the compound areas to reduce visibility of the compound area.
- Undertaking landscape proposals for localised screening and areas of new planting early on, allowing such screening and planting to become established throughout construction and for the operational stage. Early planting would be likely to include locations in the vicinity of settlements and residential properties such as Theberton and Valley Farm.
- Existing woodlands, scrub and hedgerows within the site and adjoining the site boundaries would be retained where possible.
- Eleven PRoWs (all footpaths) would be diverted for the construction of the proposed link road, with a further two PRoWs potentially requiring temporary diversions, as discussed in **section 5.4** of this chapter.

ii) Operation

5.2.11. A number of mitigation measures have been identified and incorporated into the design for the operational phase of the proposed link road, which would help to manage and reduce potential environmental effects. These include the following:

- Existing woodlands, scrub and hedgerows would be retained where possible.
- New planting would be used to screen and contain the proposed highway from adjoining properties and PRoWs but also to ensure the scheme is anchored into the existing landscape. This includes linear tree and hedgerow planting in keeping with existing hedgerow boundaries, as well as woodland blocks where existing fields are severed by the route and would otherwise create isolated pockets of land. These are characteristics of the existing landscape and would provide benefits in terms of screening and biodiversity.
- New planting would be used around attenuation features to ensure they integrate with the surrounding landscape.
- Detailed design consideration would be given to each of the interfaces and crossing points with other access routes.
- Eleven PRoWs (all footpaths) would be diverted to ensure safe crossing points of the proposed road, as discussed in **section 5.4** of this chapter. A further two PRoWs may also require temporary diversions.

c) Preliminary assessment of effects

i) Construction

5.2.12. During construction of the proposed link road, there would be a localised change to the landscape character of the link road and its immediate context. For example, it is likely that a section of a linear woodland belt to the west of the proposed link road to the B1122 and Leiston Road would be removed, along with sections of hedgerows along the proposed route. There would also be localised effects on landscape character from the presence of the temporary construction compound(s). Within all landscape character types, given the localised extent of the effects and the short-term duration of the construction period, effects are unlikely to be significant.

5.2.13. During construction, there would also be localised visual effects for users of roads and railways, including the A12, B1122 and the Saxmundham to Darsham railway line, and the footpaths crossed by or in close proximity to the site. These effects are difficult to mitigate unless planting of off-site vegetation can begin in advance of the construction works. However, given the localised extent of the effects and the short-term duration of these effects, they are unlikely to be significant.

ii) Operation

5.2.14. During the first years of operation, the proposed link road would be used by a mix of construction traffic for the Sizewell C project and normal road users. Once the construction of Sizewell C is complete, the reduction in traffic, combined with the establishment of new planting associated with the new link road, would result in reduced effects beyond the medium to long-term.

5.2.15. The route would lead to a localised effect on the landscape character of each of the existing fields that it passes through, arising from the change from arable fields to a road and associated changes such as embankments, bridges, cuttings, junctions, planting and/or drainage ponds. Effects on the landscape character of each of the existing fields that the proposed link road passes through would be significant and adverse due to the permanency of the physical changes to the landscape. However, these significant effects would not be widespread, as a result of the embedded mitigation measures.

5.2.16. Beyond the immediate vicinity of the route itself, the significance of the effects on landscape character would rapidly reduce. Roads are frequent in the local landscape and apart from more frequent use by larger construction vehicles during the construction of Sizewell C, the use of the proposed link road is not anticipated to be more intensive than other roads in the study area. Within approximately 500m of the proposed link road, or closer where existing roads are present (i.e. beyond the A12 to the west and beyond the B1122 to the north and east), effects on landscape character would reduce so that they are not significant. This would be the case within both the 'ancient estate claylands' and the 'rolling estate claylands'.

5.2.17. Desk and field study has confirmed that the proposed link road would not be visible from Middleton, Yoxford and much of Theberton due to a combination of intervening buildings, landform and vegetation.

5.2.18. For users of longer distance routes in the surrounding area, including the A12, the B1122, the railway line between Saxmundham and Darsham; and the Sandlings Walk Long Distance Walking Route, there are likely to be views of the proposed link road. The road and rail routes tend to be lined by vegetation such that views would be limited to glimpses and connecting junctions or crossing points. Glimpsed views of traffic using a road would have very limited visual impact on other users of these routes. Views from Sandlings Walk Long Distance Walking Route would be at distances of over 1km, from beyond both the B1122 and areas of woodland. There are unlikely to be any significant visual effects for users of any of these more distant routes.

5.2.19. Users of local roads and PRoWs which cross or closely approach the proposed link road would experience some localised visual effects. The impact on views from the routes is likely to be significant and adverse due to the permanency of the introduction of road infrastructure. However, these effects would only occur at the points where the PRoWs cross the proposed bypass and for short stretches either side of the proposed link road. These effects would diminish with distance as most routes are hedge-lined, limiting outward views, and would also diminish with time as described above. Occasional more distant views would arise where routes cross open, higher ground or descend slopes which face towards the proposed link road, such as south-west facing valley sides beyond the River Yox and higher ground to the west and south. These views of relatively distant road traffic would be unlikely to give rise to significant effects.

5.2.20. The proposed link road may be visible from a limited number of properties near the route. The majority of rural properties already have hedges and/or trees around them which would provide screening mitigation. Effects on residential amenity would be mitigated via planting, as appropriate to each case, as part of the embedded landscape proposals.

5.2.21. Given the distance of the Suffolk Coast and Heaths AONB from the site, and the relatively limited extent of visual effects, the proposed link road would have no significant effect on the special qualities of the AONB or the purposes of its designation.

5.2.22. There are likely to be some localised effects on the SLA. For the most part, the SLA lies more than 0.5km from the proposed link road. At most of the points where it is closest, there would either be limited visibility (south of and around Theberton) or it is at points close to existing roads, where the proposed link road would have limited impact on the SLA. It is however unlikely that there would be any significant effects on the special qualities of the SLA or the purposes of its designation.

d) Additional mitigation and monitoring

5.2.23. The preliminary assessment of effects presented above identifies potential significant effects on the landscape character of the route and its immediate surroundings, and localised significant adverse effects on views from local roads and PRoWs. Planting included within the link road design would reduce these effects and limit the extent of adverse effects. Beyond this 'designed in' mitigation, and normal measures to ensure the establishment of planting, further mitigation or monitoring measures are unlikely to be beneficial in reducing effects.

e) Preliminary assessment of residual effects

5.2.24. During construction, there are unlikely to be any significant residual effects on landscape character, visual effects or effects on designated landscapes.

5.2.25. During the operational stage of the proposed link road, there are likely to be significant residual adverse effects on the character of the landscape within, and immediately around, the route and on some views from existing local roads and PRoWs which cross or closely approach the route.

f) Completing the assessment

5.2.26. The Environmental Statement (ES) will include a Landscape and Visual Impact Assessment (LVIA) underpinning the conclusions drawn above in relation to significant effects, updated where relevant to account for any design changes.

5.2.27. Viewpoints and selected visualisations of the proposals would be agreed with the Local Planning Authorities and key stakeholders. Viewpoints are likely to include the following locations:

- Viewpoints will be provided at Theberton to assess the likely significant effects on views to the south and south-west and on views to the north-west from the settlement.
- Viewpoints will be selected along the link road route to assess the likely significant effects on users of PRoWs and local roads rerouted as part of the proposals or with views of the proposed link road, as well as nearby residents.

Table 5.2.1 Summary of effects for construction phase
Landscape and visual

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Landscape character.	Changes to landscape character and landscape features along the route and the surrounding landscape.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.
Visual receptors.	Changes to views for users of roads, railways and footpaths in close proximity to the site.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.
Suffolk Coast and Heaths AONB.	Effects on special character and purposes of designation.	None required.	Not significant.	None required.	Not significant.
Special Landscape Area – River Yox valley.	Effects on special character and purposes of designation.	None required.	Not significant.	None required.	Not significant.

Table 5.2.2 Summary of effects for operational phase

Landscape and visual

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Landscape character within the site and its surrounding context.	Introduction of a new road and with associated earthworks and infrastructure.	Retention of established vegetation. Introduction of appropriate landscape proposals.	Significant	None required.	Significant
Landscape character beyond approximately 500m of the route.	Changes to landscape character and key characteristics within the surrounding landscape.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.
Users of the footpaths and local roads that currently cross the proposed route.	Direct change to existing routes and localised views of new road with associated infrastructure.	Retention of established vegetation. Short diversions of existing routes.	Significant	None required.	Significant
Other visual receptors.	Changes to views for local residents and users of roads, railways and other footpaths and bridleways in close proximity to the site.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.
Suffolk Coast and Heaths AONB.	Effects on special character and purposes of designation.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.
Localised area of the Special Landscape Area – River Yox valley.	Effects on special character and purposes of designation.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.

5.3. Terrestrial ecology and ornithology

5.3.1. The figure for terrestrial ecology and ornithology is presented in **Volume 3** as **Figure 5.3.1**.

a) Baseline environment

5.3.2. This baseline has been compiled following a detailed review of desk study information, including a data request from the Suffolk Biodiversity Information Service (SBIS), a review of aerial photographs and Ordnance Survey (OS) maps, and a preliminary assessment of habitats from PRoWs.

5.3.3. There are three European sites comprising Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites within a 5km radius of the proposed link road (some sites carry more than one designation). These are: Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Ramsar located approximately 1.5km north-east, Sandlings SPA located approximately 3.5km south-east and Dews SAC located approximately 4.4km north.

5.3.4. There are five nationally designated sites (Sites of Special Scientific Interest (SSSI)) within 5km of the proposed link road: Minsmere-Walberswick Heaths and Marshes SSSI located approximately 0.9km east; Sizewell Marshes SSSI located approximately 2km south-east; Leiston-Aldeburgh SSSI located approximately 3.5km south; Potton Hall Fields, Westleton SSSI located approximately 4.4km north-east; and Dew's Ponds SSSI located approximately 4.4km north.

5.3.5. There are 11 non-statutory designated County Wildlife Sites (CWS) within a 2km radius of the proposed link road. These are: Kiln Grove and Meadow CWS, Theberton Woods CWS, and Minsmere Valley Reckford Bridge to Beveriche Manor CWS all located within 0.5km from the proposed route alignment; Leiston Airfield CWS, Minsmere Valley Eastbridge to Reckford Bridge CWS, Darsham Marshes CWS (which is also a Suffolk Wildlife Trust (SWT) reserve) and Suffolk Coastal 212 CWS (which is also a Roadside Nature Reserve (RNR) Number 102) all located approximately 1km from the proposed route alignment; Coe Wood CWS, RNR 197, Sizewell Levels and Associated Areas CWS and Buckle's Wood CWS located approximately 1-2km from the proposed route alignment. Another SWT reserve, Sizewell Belts SWT, is also located within 2km of the proposed link road, approximately 1.9km south-east.

5.3.6. The habitat within the proposed route alignment is predominantly arable farmland. Semi-improved species-poor grassland, a block of deciduous woodland (Plumtreehills Covert), hedgerows (including species-rich hedgerows with mature trees), and a number of drains and small watercourses are also present. Deciduous woodland and hedgerows are habitats of principal importance (Ref. 5.3.1, section 41). Other habitat types within 500m of the proposed route alignment include a number of ponds, wood pasture, lowland meadows, semi-improved grassland and coastal and floodplain grazing marsh. Coastal and floodplain grazing marsh, lowland meadows, ponds and wood pasture are habitats of principal importance. Data from SBIS identified the presence of a number of veteran trees within 1km of the proposed route alignment.

5.3.7. The drains and small watercourses within the proposed route alignment provide a hydrological link to the Minsmere River, which in turn flows into the Minsmere to Walberswick Heaths and Marshes SPA, SAC and Ramsar site.

5.3.8. A number of notable invertebrate species have been recorded in the wider area, predominantly associated with the surrounding designated sites. Based on the information to date and given that the habitat within the proposed route alignment is predominantly arable farmland, the habitats within and in close proximity to the proposed route alignment are unlikely to be of particular importance to notable invertebrate species.

5.3.9. There are records of great crested newt[1] (*Triturus cristatus*) from within 2km of the proposed route alignment, and Theberton Woods CWS located approximately 650m west of the proposed route alignment contains ponds which support a population of great crested newts. Approximately 60 ponds that could support this species are present within 500m of the proposed route alignment. Habitats within the proposed route alignment such as the woodland blocks, and the field and woodland margins, provide suitable habitat for the terrestrial phase of the species, including potential hibernation sites, and aid connectivity to the wider landscape.

5.3.10. The majority of the proposed route alignment consists of suboptimal habitat for reptiles[2] although field and woodland margins could provide suitable foraging habitat for a small number of reptiles, and there are records of common reptile species in the wider area. The proposed route alignment comprises predominantly arable farmland. The habitats within and in close proximity to the proposed route alignment are unlikely to be of particular importance to reptiles.

1 Great crested newts are a European Protected Species (EPS), receiving protection under the Conservation of Habitats and Species Regulations (2017) (Ref. 5.3.2). They are also protected under the Wildlife and Countryside Act 1981 (Ref. 5.3.3) and are a species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

2 All UK species of reptiles are protected under the Wildlife and Countryside Act 1981, making it an offence to kill or injure these species. They are also species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

5.3.11. Breeding birds[3] typical of open agricultural habitats are present, including linnet (*Linaria cannabina*) and yellowhammer (*Emberiza citronella*), as well as ground-nesting birds such as skylark (*Alauda arvensis*). Barn owl[3] (*Tyto alba*) is also present in the wider area of the proposed route alignment, with the majority of records from the Minsmere Valley Reckford Bridge to Beveriche Manor CWS.

5.3.12. Serotine (*Eptesicus serotinus*), Daubenton's bat (*Myotis daubentonii*), Natterer's bat (*Myotis nattereri*), noctule (*Nyctalus noctule*), common and soprano pipistrelle bats (*Pipistrellus pipistrellus* and *Pipistrellus pygmaeus*), and brown long-eared bat (*Plecotus auritus*)[4] have been recorded in the wider area, with records of both roosts and foraging activity. In addition, there are three records of the rare barbastelle (*Barbastella barbastellus*) from the Leiston area to the south of the proposed route alignment, the closest of which is from a location approximately 1.2km away. This species is also present within the Sizewell C main development site, approximately 2km to the east of the proposed route alignment.

5.3.13. Linear features, such as hedgerows within the proposed route alignment and the wider area, will be of value to foraging and commuting bats; and woodland, wood pasture and parkland will also provide important foraging habitat. Mature trees, particularly veteran trees which are predominantly located at the western extent of the proposed route alignment in Rookery Park and to the north of Fordley Hall, are likely to be of value to roosting bats, as are buildings within and in close proximity to the proposed route alignment. Overall, habitats and features along and within proximity of the proposed route alignment are likely to be of value to a number of bat species, including barbastelle. No statutory designated site within 10km cites bats as a designated interest feature.

5.3.14. There are records of otter[5] (*Lutra lutra*) from within the area, predominantly from the Minsmere Valley. Whilst otters may travel along the small watercourses and drains within the proposed route alignment, the site is unlikely to be of value to otters.

5.3.15. There are records of water vole[6] (*Arvicola amphibious*) from within the proposed route alignment area. Both the Minsmere to Walberswick Heaths and Marshes SSSI and Sizewell Marshes SSSI support a nationally important population of water voles (Ref. 5.3.5). It is possible that water voles are present on the two small watercourses crossed by the proposed route alignment.

5.3.16. Badgers[7] (*Meles meles*) are widespread along the proposed route alignment.

b) Environmental design and embedded mitigation

5.3.17. A summary of the measures that have been incorporated into the design of the proposed development and that will protect the existing features of ecological interest are set out below:

i) Construction

- The proposed route alignment has avoided direct land take from designated sites. Mitigation for the loss of any valuable habitats, including woodland and hedgerows, would be incorporated into the scheme design, as far as possible.
- The Construction Environmental Management Plan (CEMP) would define any ecological constraints and specify any measures required during enabling works and construction in relation to the presence of protected species and any required vegetation clearance works. It would specify the need for an Ecological Clerk of Works to undertake and oversee specific tasks.
- Should a great crested newt population be identified that could be fragmented by the proposed route alignment, then design measures such as newt tunnels would be included to maintain connectivity.
- Should confirmed barn owl nest sites or potential nest sites be identified within the proposed route alignment, it would be appropriate to install replacement nesting feature(s). It may be necessary to install these some distance from the road, so that barn owls are not encouraged to forage along the verge, which could result in collisions with vehicles.
- Temporary construction lighting would be designed to minimise light-spill into adjacent habitats. This would reduce impacts on nocturnal species such as bats that may use nearby habitats for roosting or foraging.

3 All wild birds, their eggs and nests are protected under Section 1 of the Wildlife and Countryside Act 1981. Barn owls are also listed on Schedule 1 of the Wildlife and Countryside Act 1981, which affords them extra protection against disturbance whilst nesting.

4 All species of bat in the UK are EPSs, receiving protection under the Conservation of Habitats and Species Regulations (2017). They are also protected under the Wildlife and Countryside Act 1981. Several bat species, including soprano pipistrelle, brown long-eared bat, noctule and barbastelle bat are species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006). Barbastelle bats are also listed in the Habitats Directive (Ref. 5.3.4, Annex II), requiring the establishment of SACs to conserve this species.

5 Otter is an EPS on Schedule 2 of the Conservation of Habitats and Species Regulations (2017) and protected under Schedule 5 and 6 of the Wildlife and Countryside Act 1981 and is included within Section 41 of the NERC Act (2006).

6 Water vole is protected under Schedule 5 of the Wildlife and Countryside Act 1981 and included within Section 41 of the NERC Act (2006).

7 Badgers are protected under the Protection of Badgers Act (1992) (Ref. 5.3.6).

- If habitat loss for foraging bat species is considered significant, then habitat enhancement measures would need to be incorporated to replace the foraging resource available to bat species.
- If confirmed to be present along the route alignment, passage for otters and water voles would be maintained during construction along the ditches and small watercourses.

ii) Operation

- It may be necessary to incorporate measures to deter barn owls from foraging along the road verge, as this could result in incidental mortality through collisions with road traffic. Such measures may include dense landscape planting.
- Should lighting be required along the link road, a lighting scheme would be designed to minimise light-spill into adjacent habitats. This would reduce impacts on nocturnal species such as bats that may use nearby habitats for roosting or foraging.
- If predicted noise levels are likely to significantly adversely affect key habitat features supporting sensitive species (e.g. woodland supporting roosting bats), then acoustic fencing or similar would be constructed between the road alignment and habitat supporting these species.
- Safe crossing points to facilitate the passage of bats across the road alignment would be incorporated if key foraging or commuting routes are identified, to reduce the potential for incidental mortality as a result of bats crossing the road and colliding with vehicles. These features would also facilitate the passage of other species, such as great crested newts and badgers, should this be required.
- The crossing points at the ditches and small watercourses would ensure passage for otters and water voles is maintained with fencing to guide otters to crossing points.

c) Preliminary assessment of effects

5.3.18. Significant effects on designated sites, plants and habitats, invertebrates, reptiles, breeding birds, otters, water voles and badgers are not anticipated and they are not discussed further in this section of the PEI. However, a detailed ecological impact assessment will be presented for these habitats and species within the ES, and further details of the embedded mitigation required to offset any significant effects would similarly be provided.

5.3.19. Significant effects on great crested newts and bats are possible. A preliminary assessment of effects on these species is provided below.

i) Construction

5.3.20. Waterbodies in the vicinity of the proposed route alignment are known to support breeding great crested newts. Based on current understanding (through OS maps and aerial imagery), some ponds are close to the proposed alignment although it is unlikely that any would be lost as a result of the road. However, suitable terrestrial habitat would be lost, potentially resulting in injury or mortality of great crested newts and loss of resting places. The proposed route alignment could also result in fragmentation of great crested newt populations. There is the potential for a significant adverse effect if the ponds and related terrestrial habitats are important for great crested newts.

5.3.21. Noise and lighting could potentially temporarily disturb roosting and foraging bats, in particular within Plumtreehills Covert and other, unnamed woodland blocks nearby. In addition, the construction of the proposed route alignment could impact bat roosts and foraging areas through the loss of habitat and mature trees, as well as potential population fragmentation should this loss of habitat result in the severance of commuting routes. There is the potential for a significant adverse effect if hedgerows and adjacent woodland areas are important for bats.

ii) Operation

5.3.22. Due to the embedded mitigation, effects on bats are not considered likely to be significant. Great crested newts would continue to experience the fragmentation effect from construction. This impact would be minimised through the embedded mitigation to include habitat mitigation, newt tunnels and other measures, that will be fully described within the ES. Operational phase effects on great crested newts are unlikely to be significant.

d) Additional mitigation and monitoring

5.3.23. The assessment has identified the potential for significant effects to occur if great crested newts or bats are present, despite the embedded mitigation measures. Additional mitigation measures may therefore be required to minimise impacts so that significant effects are avoided. Furthermore, additional mitigation measures may also be required in relation to habitats and species for which a significant effect is not anticipated, but which are nonetheless legally protected, to ensure compliance with legislation. Under the CEMP, pre-construction surveys will be required and may result in mitigation measures such as micro-siting of specific elements of the project and/or licences for protected species. Monitoring of mitigation measures may also be required to ensure its effectiveness. The mitigation and monitoring measures would be presented in the ES, if relevant.

e) Preliminary assessment of residual effects

5.3.24. Following the implementation of the additional mitigation measures, significant residual effects are not envisaged during either the construction or operational phases.

f) Completing the assessment

5.3.25. To inform the development of appropriate mitigation measures and complete the ES, an extended Phase 1 habitat survey would be undertaken within the proposed route alignment. The focus of the surveys would be to identify any ecological constraints such as the presence of legally protected species.

5.3.26. Once the surveys have been completed, the detailed ecological assessment for the ES would then be progressed, clarifying whether significant adverse effects are likely, particularly in respect of great crested newts and bats. Any further embedded mitigation measures which would be required to mitigate these effects will also be defined and incorporated into the design.

Table 5.3.1 Summary of effects for construction phase

Terrestrial ecology and ornithology

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
European and nationally designated site: Minsmere to Walberswick Heaths and Marshes SAC, SPA, Ramsar site and SSSI.	Pollutants entering the Minsmere river upstream of the designated site.	Appropriate surface water control and chemical management outlined in the CEMP.	Not significant.	None required.	Not significant.
Other European and nationally designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Non-statutory designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Deciduous woodland.	Habitat loss within 'Plumtreehills Covert'.	Mitigation for habitat loss incorporated into scheme design.	Not significant.	None required.	Not significant.
Hedgerows	Habitat loss.	Mitigation for habitat loss incorporated into scheme design.	Not significant.	None required.	Not significant.
Watercourses and ditches.	Potential pollution from surface water run-off and spillages.	Appropriate surface water control and chemical management outlined in the CEMP.	Not significant.	None required.	Not significant.
Coastal floodplain grazing marsh.	Potential pollution from surface water run-off and spillages.	Appropriate surface water control and chemical management outlined in the CEMP. Construction Surface Water Management Plan.	Not significant.	None required.	Not significant.

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Great crested newts.	Habitat loss and severance; and incidental injury and mortality.	Design measures, such as newt tunnels, to facilitate maintaining connectivity within any identified metapopulation.	Potential adverse significant effect.	Potential mitigation measures under Natural England licence.	Not significant.
Reptiles	Habitat loss and incidental mortality.	Measures for reptile mitigation outlined in CEMP.	Not significant.	None required.	Not significant.
Barn owl	Loss of nest sites.	Installation of replacement nest sites.	Not significant.	None required.	Not significant.
Other breeding birds	Loss of habitat for nesting and foraging	Measures for nesting birds and vegetation clearance outlined in the CEMP	Not significant	None required	Not significant
Bat assemblage.	Severance of commuting routes and incidental mortality.	Retention of majority of tree resource. Safe crossing points to facilitate the passage of bats across the road alignment.	Potential adverse significant effect.	Potential mitigation measures under Natural England licence.	Not significant.
	Loss of roosting resource (trees).	Retention of majority of tree resource. Early provision of new roost resource (e.g. bat boxes).	Potential adverse significant effect.	Potential mitigation measures under Natural England licence.	Not significant, but subject to a detailed assessment during ongoing Environmental Impact Assessment (EIA).
	Noise and lighting disturbance causing fragmentation and displacement of resident bat populations.	Noise and lighting control measures set out in CEMP.	Potential adverse significant effect.	Potential mitigation measures under Natural England licence.	Not significant.
Otters	Habitat loss and severance.	Passage for otter maintained.	Not significant.	Potential mitigation measures under Natural England licence.	Not significant.
Water vole.	Habitat loss and severance.	Passage for water vole maintained.	Not significant.	Potential mitigation measures under Natural England licence.	Not significant.
Badgers	Loss and severance of habitat. Disturbance or damage to existing setts.	Measures to protect badgers from construction works detailed with CEMP.	Not significant.	Potential mitigation measures under Natural England licence.	Not significant.

Table 5.3.2 Summary of effects for operational phase

Terrestrial ecology and ornithology

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
European and nationally designated site: Minsmere to Walberswick Heaths and Marshes SAC, SPA, Ramsar site and SSSI.	Pollutants entering the Minsmere river upstream of the designated site.	Sustainable Drainage System (SuDS).	Not significant.	None required.	Not significant.
Other European and nationally designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Non-statutory designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Coastal floodplain grazing marsh.	Potential pollution from surface water run-off and spillages.	SuDS	Not significant, but subject to a detailed assessment at ES stage.	None required, but subject to a detailed assessment at ES stage.	Not significant, but subject to a detailed assessment during ongoing EIA.
Watercourses and ditches.	Potential pollution from surface water run-off and spillages.	SuDS	Not significant.	None required.	Not significant.
Great crested newts.	Habitat severance.	Safe crossing points to facilitate the passage of animals.	Not significant.	None required.	Not significant.
Barn owl.	Incidental mortality from road collisions.	Incorporate measures to deter barn owls from foraging along road verge, e.g. dense landscape planting.	Not significant.	None required.	Not significant.
Bat assemblage.	Habitat severance for foraging and commenting bats; and incidental mortality.	Safe crossing points to facilitate the passage of bats. This would reduce incidental mortality of bats crossing the road and colliding with vehicles.	Not significant.	None required.	Not significant.
	Impacts from noise and lighting.	Sensitive lighting scheme Acoustic fence or similar between road alignment and habitats supporting sensitive species.	Not significant.	None required.	Not significant.
Otters	Habitat severance.	Safe crossing points to facilitate the passage of animals. Fencing would guide otters to crossing points.	Not significant.	None required.	Not significant.
Water vole.	Habitat severance.	Safe crossing points to facilitate the passage of animals.	Not significant.	None required.	Not significant.

5.4. Amenity and recreation

5.4.1. The figure for amenity and recreation is presented in **Volume 3** as **Figure 5.4.1**.

a) Baseline environment

5.4.2. Amenity and recreation resources comprise PRoWs and cycle routes passing through the rural, predominantly arable agricultural landscape surrounding Yoxford and Theberton as shown on **Figure 5.4.1**. Users of the PRoWs discussed below are likely to be affected to a greater degree and impacts are assessed below. There are other recreational resources within the 1km study area but the proposed development is unlikely to be perceptible from most of these and, if it is, effects would not be significant.

5.4.3. The following footpaths, with the majority occurring towards the east, cross the line of the proposed link road and would therefore require local changes to the paths including potential diversions (named from west to east): E-344/014/0, E-344/013/0, E-584/016/0 and E396/014/0, E-396/017/0, E-396/023/0, E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0 and E-515/013/0.

5.4.4. The following footpaths pass within the proposed site boundary and may be affected by the proposed link road, but they do not cross the route of the road: E-396/020/0 and E-515/007/0. They may also require local changes including potential diversions.

5.4.5. A number of other PRoWs as well as registered common land at Yoxford Common, Open Access Land at Theberton Woods, and Suffolk Coastal Cycle Route and Sustrans Regional Cycle Route (41/42) lie within the 1km study area as shown in **Figure 5.4.1**.

b) Environmental design and embedded mitigation

5.4.6. All PRoW crossings of the proposed link road would be at grade (i.e. at the same level as the track). Designs for these crossings would be undertaken and may include gates, stiles and short diversions to ensure minimal impact on users. Temporary diversions would be required during construction and permanent diversions during operation; the length of these would be kept to a minimum and they would be agreed with SCC and Suffolk Coastal District Council (SCDC).

5.4.7. Existing woodland, tree belts, scrub and hedgerows within the road corridor and adjoining the site boundary would be retained where possible. Some wooded areas, trees and sections of hedgerows would be removed, though this would be kept to a minimum. Detailed design would include native tree and hedgerow planting to screen and contain the proposed bypass in views from recreational resources and to integrate it into the existing landscape, where possible.

c) Preliminary assessment of effects

5.4.8. People using the recreational resources may experience impacts due to physical changes to recreational resources such as PRoW diversions, changes to views and increases in noise levels, dust and other emissions caused by the proposed development.

i) Construction

5.4.9. Users of footpaths E-344/014/0, E-344/013/0, E-584/016/0 and E396/014/0, E-396/017/0, E-396/023/0, E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0, E-515/013/0, E-396/020/0 and E-515/007/0 would cross or potentially be affected by the proposed development. Users would have direct views into the road corridor and would experience construction related noise and potentially small changes to air quality. There are likely to be temporary diversions during construction. These effects are likely to be significant but temporary during the construction phase.

5.4.10. Users of some other recreational resources outside the site would be likely to have views of and potentially hear noise from the construction works but these effects are unlikely to be significant.

ii) Operation

5.4.11. Users of footpaths E-344/014/0, E-344/013/0, E-584/016/0 and E396/014/0, E-396/017/0, E-396/023/0, E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0, E-515/013/0, E-396/020/0 and E-515/007/0 would cross or potentially be affected by the proposed development, including some permanent diversions. Users would have direct views of the proposed link road and would hear traffic-related noise and potentially experience small temporary changes to air quality. These effects are likely to be significant.

5.4.12. Users of some other recreational resources outside the site are likely to have views of the development and potentially hear traffic-related noise but these effects are unlikely to be significant.

5.4.13. The link road would take traffic off existing roads bringing some benefits to users of recreational resource in the vicinity of those roads and settlements, in the form of reduced visual and noise disturbance from traffic. These effects are unlikely to be significant.

d) Additional mitigation and monitoring

5.4.14. No additional mitigation is proposed.

e) Preliminary assessment of residual effects

5.4.15. During the construction and operational stages of the proposed link road there are likely to be significant residual effects on users of footpaths E-344/014/0, E-344/013/0, E-584/016/0 and E396/014/0, E-396/017/0, E-396/023/0, E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0, E-515/013/0, E-396/020/0 and E-515/007/0, subject to detailed design of the road and footpath diversions. There are unlikely to be significant residual effects on users of other recreational resources.

f) Completing the assessment

5.4.16. The ES would present an amenity and recreation impact assessment which is expected to underpin the preliminary conclusions drawn above in relation to significant effects, updated where relevant to account for any design changes and assessment.

Table 5.4.1 Summary of effects for construction phase

Amenity and recreation

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Users of footpaths E-344/014/0, E-344/013/0, E-584/016/0 and E396/014/0, E-396/017/0, E-396/023/0, E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0, E-515/013/0, E-396/020/0 and E-515/007/0.	Physical changes to routes. Changes to views and noise.	Native tree and hedgerow planting to screen and contain the proposed bypass in views from recreational resources and to integrate it into the existing landscape, where possible. Measures to minimise noise and changes to air quality.	Significant	None	Significant
Users of other A&R resources.	Users of some PRoWs, and other recreational resources are likely to experience changes to views and noise.	Native tree and hedgerow planting to screen and contain the proposed bypass in views from recreational resources and to integrate it into the existing landscape, where possible. Measures to minimise noise and changes to air quality.	Not significant.	None	Not significant.

Table 5.4.2 Summary of effects for operational phase

Amenity and recreation

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Users of footpaths E-344/014/0, E-344/013/0, E-584/016/0 and E396/014/0, E-396/017/0, E-396/023/0, E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0, E-515/013/0, E-396/020/0 and E-515/007/0.	Physical changes to routes. Changes to views and noise.	Native tree and hedgerow planting to screen and contain the proposed bypass. Measures to minimise noise and changes to air quality.	Significant	None	Significant
Users of other A&R resources.	Users of some PRoWs, and other recreational resources are likely to experience changes to views and noise.	Native tree and hedgerow planting to screen and contain the proposed bypass. Measures to minimise noise and changes to air quality.	Not significant.	None	Not significant.

5.5. Terrestrial historic environment

5.5.1. The figures for terrestrial historic environment are presented in **Volume 3** as **Figures 5.5.1** and **5.5.2**.

a) Baseline environment

5.5.2. An archaeological Desk Based Assessment (DBA) has been undertaken for the route of the Sizewell link road. The DBA considered existing records of archaeological features and investigations as well as historic mapping, aerial photography and documentary sources. Searches of the Suffolk Historic Environment Record (HER), Historic England's (HE's) Archives Monuments Information England (AMIE), and the National Heritage List for England (designated assets) were undertaken in April 2018. A study area of 750m from the site boundary was agreed with Suffolk County Council Archaeology Service (SCCAS) for the assessment, with consideration given to assets beyond this distance, which may be subject to settings effects.

5.5.3. One designated heritage asset lies within the site boundary, the Grade II listed Gate and Gate Piers at the junction of Leiston Road and Onner's Lane (LB 1287303).

5.5.4. Forty-five listed buildings lie within the 750m study area. One of these is listed at Grade I (The Church of St Peter; LB 1227756), one at Grade II* (Theberton House; LB 1228378), with the remainder being listed at Grade II and comprising buildings associated with Theberton House and buildings within Theberton village, as well as farmhouses and associated buildings and cottages. One scheduled monument extends into the south-eastern part of the study area – Leiston Abbey (second site) and moated site (SM 1014520).

5.5.5. Two HERs lie within the site boundary. The East Suffolk Railway (MSF34987) runs north to south across the western part of the site. In addition, a bronze spout in the form of a dog's head (MSF2059) from a medieval cauldron or aquamanile (a water container in the form of a mammal or bird), was found in fields to the south of Theberton. A further 38 HERs are located within the study area. These records comprise a variety of heritage features ranging from prehistoric flint artefact scatters to the Second World War (WWII) Theberton airfield. The SCC HERs also include one non-designated park identified in SPG6 – Rookery Park (MSF17530). These records are discussed more fully below.

5.5.6. There is a strong continuity in the field patterns around Theberton, evident from an analysis of Tithe maps and modern satellite imagery. As a result, it is likely that the majority of surviving hedgerows within the site would be considered important under the Hedgerow Regulations 1997.

5.5.7. The HER includes nine records of archaeological investigations undertaken across parts of the study area, although none within the site boundary itself. These include evaluations, monitoring works and historic building recording.

5.5.8. The AMIE includes 22 records within the study area, (16 monument records, and six archaeological events). Many of these duplicate the HER data, designated data and events records, and have been used to support the baseline chronology and understanding of the archaeological potential of the site.

i) Prehistoric to Iron Age

5.5.9. No remains dating to the earlier prehistoric periods have been found within the site boundary or study area. An artefact scatter, which included a single sherd of struck flint dating to the later prehistoric period was found during evaluation trenching in 2015 at land adjoining Green Garth in Middleton (ESF23184; MSF33545). The AMIE records a flint arrowhead within the study area (AMIE 392009), just south of the HER, and it is possible that it may relate to the same artefact.

5.5.10. A number of undated cropmarks are known within the 750m study area, including a probable ring ditch bisected by a linear feature to the south-west of Middleton which has been suggested to be the remains of a prehistoric burial mound (MSF14165).

5.5.11. Sherds of an Early Bronze Age cinerary urn were found "in a mound" in the garden of Theberton Old Rectory at the western edge of the village before 1962 (MSF2060), although the HER notes that a later site visit revealed that the mound had been mutilated, with a path cut through and had been landscaped.

5.5.12. The contextual evidence would suggest that there is the potential for prehistoric activity, both in terms of settlement as well as funerary activity, within the area. The topographic location on the southern edge of the river valley would also provide a favourable location for such activity.

5.5.13. No finds dating to the Iron Age are known within the site boundary or study area.

5.5.14. There is the potential for remains of these periods to be present within the proposed route, though the nature of any such remains cannot be established with any confidence at this stage. Further archaeological investigation will allow for a more detailed understanding of this potential.

ii) Romano-British

5.5.15. No finds dating to the Romano-British period are known within the site boundary.

5.5.16. A multiphased field system was identified through cropmarks at the eastern end of the 750m study area (MSF33481) close to Eastbridge, during the Suffolk Coast and Heaths National Mapping Programme (NMP), the earlier phases of which may date to the Roman period. Within the study area, a number of small finds dating to the Roman period have also been found including sherds of pottery, a coin and brooch.

5.5.17. The A1120, which comes into Yoxford from the north-west, runs in part along stretches of Roman road, and it is possible that Yoxford, to the north-east of the study area may have been at the junction of potential Roman roads. One of these roads may have run to Sitomagus, for which locations at East Green, Knodishall and Dunwich have tentatively been proposed. In either of these scenarios, any Roman road is likely to have passed over or close to the site and study area, although no specific location or route can be identified.

5.5.18. Settlements dating to the Roman period are usually readily apparent on geophysical survey and aerial photography, and are frequently evidenced by surface scatters of artefactual material in arable land. There is no specific evidence for remains of this date to be present within the proposed route, although this possibility cannot be ruled out.

iii) Early-medieval and medieval

5.5.19. No remains dating to the early-medieval period are known to be located along the land required for the proposed link road. However, a chance find dating to the medieval period was found – a bronze spout in the form of a dog's head (MSF2059) from a medieval cauldron or aquamanile (a water container in the form of a mammal or bird) (MSF2059) was found in fields to the south of the eastern end of the route.

5.5.20. The church of St Peter (LB I 1227756) in Theberton, dates to the 12th-century with early C14th, C15th and C19th additions. The church may have been included in Domesday as one of the three churches in the parish of Leiston which Scarfe proposes as a possible minster site (MSF14148), suggesting earlier origins.

5.5.21. The scheduled area for Leiston Abbey (SM 1014520) falls within the 750m study area. Monastic sites would have comprised relatively small and tightly grouped complexes and would not have extended onto the site, although this part of the site may include elements of the wider monastic landholdings. Field systems identified through the NMP at the south-eastern edge of the study area (MSF16787), to the north-west of the Leiston Abbey site, are currently undated but the HER notes that these could be associated with Leiston Abbey.

5.5.22. A number of further records for artefact scatters and chance finds dating to the medieval period are known within the wider 750m study area. These include metalwork and coins (MSF13174) found just outside Theberton. Evaluation trenching (ESF20192) at Theberton Hall Farm reservoir uncovered a number of features, two of which contained medieval pottery, and one sherd of medieval pottery was found during trenching for a small residential development within Theberton (ESF22179).

5.5.23. The absence of any stratified material of this date within the study area suggests that the potential for further, as yet unknown remains with the site boundary dating to the early-medieval and medieval periods is low.

5.5.24. It is clear that a settled manorial geography, which is likely to have provided the basis for the medieval settlement pattern, was established during the early medieval period. It is unlikely that further, as yet unknown, substantial medieval remains lie within the site boundary, although potential remnants of field systems and/or Abbey landholdings may be present; and the potential for further medieval remains is therefore considered to be low. Further archaeological investigation will allow for a more detailed understanding of this potential.

iv) Post-medieval

5.5.25. The post-medieval period is well represented within the study area. Recorded assets include village buildings, agricultural buildings, and larger estate houses. Farms of this period include Dovehouse Farmhouse (LB 1199213), Valley Farmhouse and outbuildings (LB 1283470 and LB 1377245).

5.5.26. Large estate houses including Theberton House (LB 1228378) are also present within the site boundary. A post-medieval post mill (MSF12570) once lay to the south of Middleton, and a five storey tower mill (MSF12516) in fields to the east of Theberton built in the 18th century, further attest to the agricultural nature of the study area during this period. Both were demolished in the early 1900s.

5.5.27. The basic settlement geography established in the medieval period remained through the post-medieval period. The principal change in this period in East Anglia was in terms of the use and demarcation of land, with the steady enclosure and 'improvement' of lands, and subsequent merging of fields. However, an analysis of historic mapping and satellite imagery revealed a large degree of continuity in field patterns within the study area. The field system therefore represents an historic landscape.

5.5.28. The potential for further and as yet unknown heritage assets dating to this period is considered low. The existing pattern of farmsteads and settlements appears to have been established by the late 18th century, and mapping evidence does not suggest the presence of any significant sites other than these farmsteads which are still extant. It is not anticipated that there would be significant remains of this date present within the proposed route, although elements of dispersed farmsteads or industrial sites may be present. Further archaeological investigation will allow for a more detailed understanding of this potential.

5.5.29. Designated heritage assets dating to this period are of high significance. The majority of non-designated remains dating to this period would be of archaeological interest primarily for their contribution to historic landscape character and development rather than as individual assets, and are likely to be of low significance.

5.5.30. There are also a number of hedgerows, which could be considered important under the Hedgerow Regulations 1997 (Ref. 5.5.1). These are best considered as heritage assets of low significance for historic and aesthetic interest resulting from their contribution to historic landscape character.

v) Modern

5.5.31. The HER area for Leiston airfield (MSF22764) extends into the study area to the south of Theberton. It was built in 1934 and was an operational site for the USAAF during World War II. It is unlikely that any related but as yet unknown remains are present within the site.

5.5.32. The modern period experienced a general continuity of settlement and agricultural land use from the post-medieval period. Remains dating to this period have a degree of archaeological and historic interest, but are likely to be of low significance.

vi) Modern disturbance

5.5.33. There is little substantial modern disturbance; the majority of the site has been in agricultural use for some time, probably since the medieval period. The continuous ploughing in this area will have had an impact on the survival of the below ground archaeology. This impact will have increased over time as the depth of ploughing gradually increased. However, it is also possible for ploughing and natural processes to result in the development of colluvial deposits, which may preserve earlier features.

b) Environmental design and embedded mitigation

5.5.34. Change to setting of designated heritage assets arising from visibility of the proposed link road, and construction noise or changes to air quality, could give rise to loss of or harm to heritage assets. Detailed design would seek to minimise perceptual change, for example, existing hedgerow planting would be retained where practicable, and new planting and landscaping used to tie the road into the existing landscape and maximise screening; treatment of the road verges would be aimed at minimising the perceptibility of the proposed route as a new road where this can be achieved consistently with requirements for highways design. Standard good practice construction methods would be used to minimise construction noise.

c) Preliminary assessment of effects

i) Construction

5.5.35. Intrusive groundworks would take place along the land required for the proposed link road, including topsoil stripping and sub-soil disturbance during the construction of the proposed road. Invasive works of this nature could have an adverse effect on any surviving sub-surface archaeological remains, reducing or removing their ability to be further interpreted, resulting in the loss of archaeological interest.

5.5.36. As part of the embedded mitigation, where practicable, any surviving hedges would be retained and maintained. As a result, the change to the important hedgerows is considered to be medium, with a resulting minor effect, which would be not significant.

5.5.37. Construction activities could potentially affect the settings of designated heritage assets within and beyond the proposed route. An initial study has been undertaken to identify designated assets which have the potential to be affected by the construction of the proposed link road in accordance with Step 1 of the HE guidance (Good Practice Advice in Planning Note 3) (Ref. 5.5.2), and a full assessment will be presented in the ES.

5.5.38. The Grade II listed Gate and Gate Piers at the junction of Leiston Road and Onner's Lane (LB 1287303) lies within the site boundary to the east of Theberton, at a proposed junction with the B1122. The proximity to the proposed link road means a degree of change would occur, particularly during the construction period. However, the nature of the asset and its current location means that while the proposed road would be of a greater scale than at present, it would not alter the ability to appreciate its historical function as a private access from Theberton House onto the public road.

5.5.39. The listed buildings at Anneson's corner (LB 1283470; LB 1377245) lie just outside the western edge of the site boundary where the proposed link road route leaves the B1122. The proximity to the proposed link road means a degree of change would occur, particularly during the construction period, although these effects would be temporary. However, the nature of these assets and their current location means that while the proposed road would be of a greater scale than at present, it would not the perception of these structures as historic roadside buildings.

5.5.40. Theberton Hall (LB 1287529) and associated structures (LB 1227753) lie between the proposed link road and the current B1122. While there is a degree of screening surrounding the buildings, particularly to the northern, western and eastern sides due to planting, there are longer ranging views to the south, which may take in the construction of the road but any change to setting is anticipated to be minimal and not result in a significant effect.

5.5.41. Theberton House (LB 1228378) and associated listed buildings lie to the east of the proposed link road, just beyond the point at which it rejoins the B1122. These structures are well screened from the road by trees within the parkland as well as a buffer of trees along the B1122. It is not anticipated that significant effects would arise.

5.5.42. There are a number of other listed buildings in proximity to the site, including Hill Farmhouse (LB 1030643), Moat Farmhouse (LB 1287643). These structures are generally well screened from the proposed link road and it is not anticipated that significant effects would arise.

5.5.43. The proposed development is not anticipated to give rise to any change in the setting of Leiston Abbey (second site).

ii) Operation

5.5.44. As any disturbance of archaeological heritage assets within the site would have occurred, and been effectively mitigated, during the construction of the proposed development, no direct effects on heritage assets within the site are anticipated during the operation of the proposed development.

5.5.45. The nature of the listed buildings at Anneson's corner (LB 1283470; LB 1377245) and the listed Gate Piers at Onner's Lane (LB 1287303) and their current location close to the roads edge means that during the operational phase of the proposed link road, would not alter the understanding of the assets nor the ability to appreciate their historical function.

5.5.46. Many of the listed buildings within Theberton lie towards the centre of the village. It is anticipated that the reduction in traffic during operation would result in a positive effect on the setting of these buildings.

5.5.47. Change to setting of other designated heritage assets including Hill Farmhouse (LB 1030643), Moat Farmhouse (LB 1287643) and the listed buildings at Theberton Hall (LB 1287529) and Theberton House (LB 1228378) can be expected to reduce on completion of construction activities. Visibility of the new road may persist from some locations, although these structures are all generally well screened. Effects arising from change to setting are therefore anticipated to reduce further from the already non-significant effect experienced during the construction phase. Theberton Hall may retain some visibility in views to the south, but these are not anticipated to be sufficient to result in a significant effect. The proposed development is not anticipated to give rise to any change in the setting of Leiston Abbey (second site).

d) Additional mitigation and monitoring

5.5.48. Mitigation of direct effects on buried archaeology within the land required for the proposed link road would comprise the adoption of an agreed written scheme of archaeological investigation to ensure that the archaeological interest of any significant deposits and features could be appropriately investigated, recorded and disseminated.

5.5.49. A suitable mitigation strategy will be agreed with SCCAS once all trial trenching has been completed and the results are known. Monitoring of the agreed programme of archaeological investigation would be carried out by SCCAS during the implementation of the scheme. Publication and popular dissemination of the results of mitigation works would allow any informative and historic value to be fully realised.

e) Preliminary assessment of residual effects

5.5.50. The loss of archaeological interest through material disturbance within the site could have a significant adverse effect. However, following the implementation of an agreed scheme of archaeological investigation residual effect is not expected to be significant.

5.5.51. No significant adverse effects arising from change to setting of heritage assets are anticipated. There are likely to be a number of non-significant positive effects arising through the removal of through traffic from Theberton village.

f) Completing the assessment

5.5.52. A full archaeological assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant direct effects, and would draw upon LVIA, Noise, Air Quality and other assessments where appropriate.

5.5.53. This would include a settings assessment, which would be consulted on ahead of application with HE and SCDCs Conservation Officer. It would consider heritage assets where setting may potentially be subject to effects, their current setting, the potential change, and the magnitude of effect the proposed development may have on their setting. Any mitigation required would also be consulted upon.

5.5.54. In advance of construction field evaluation would be undertaken and this would include geophysical survey and trial trenching, the scope and extent of which would be agreed with SCCAS.

5.5.55. Once the intrusive archaeological investigation (trial trenching) is complete, an appropriate mitigation scheme for buried archaeological remains, if present, would be agreed with SCCAS.

Table 5.5.1 Summary of effects for construction phase

Terrestrial historic environment

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Previously unrecorded archaeological remains.	Disturbance or removal as a result of topsoil stripping and subsoil disturbance.	None	Significant	Agreed written scheme of archaeological investigation to ensure that the archaeological interest of any significant deposits and features could be appropriately investigated, recorded and disseminated.	Not significant.
Historic Hedgerows.	Loss due to construction activities/location of road.	Retain where possible.	Not significant.	None	Not significant.
Grade II listed Gate and Gate Piers at junction of Leiston Road and Onner's Lane.	Change in setting due to construction activities/proximity to site.	CEMP measures to limit noise and air quality disturbance.	Unlikely to be significant.	None	Unlikely to be significant.
Listed buildings at Anneson's corner.	Change in setting due to construction activities/proximity to site.	CEMP measures to limit noise and air quality disturbance.	Unlikely to be significant.	None	Unlikely to be significant.
Theberton Hall and associated structures.	Views to south.	None	Not significant.	None	Not significant.
Other listed buildings including Theberton House, Hill Farmhouse, Moat Farmhouse.	Lie in proximity to the site but all well screened.	None	Not significant.	None	Not significant.

Table 5.5.2 Summary of effects for operational phase

Terrestrial historic environment

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Grade II listed Gate and Gate Piers at junction of Leiston Road and Onner's Lane.	Change in setting due to increased scale of road.	None	Not significant.	None	Not significant.
Listed buildings at Anneson's corner.	Change in setting due to increased scale of road.	None	Not significant.	None	Not significant.
Listed Buildings within Theberton Village.	Positive effect on setting due to reduction in traffic.	None	Not significant.	None	Not Significant.
Theberton Hall and associated structures.	Some visibility of the new road to the south.	None	Not significant.	None	Not significant.
Other listed buildings including Theberton House, Hill Farmhouse, Moat Farmhouse.	Lie in proximity to the site but all well screened.	None	Not significant.	None	Not significant.

Table 5.5.3 Designated heritage assets within link road study area (listed buildings)

Historic England list entry	Name	Grade	Easting	Northing
1030593	Beveriche Manor Farmhouse	II	640671	268567
1030642	Packway Farmhouse	II	641769	266371
1030643	Hill Farmhouse	II	642580	266998
1030644	Fenn Farmhouse	II	643527	267081
1030645	Thatched House	II	641694	267675
1183433	Bark Barn	II	639419	268080
1198833	Kelsale Lodge	II	638034	267220
1199213	Dovehouse Farmhouse	II	642609	266146
1199224	Fordley Hall	II	640840	266980
1199307	Moor Farmhouse	II*	641728	267783
1199326	Pine Tree Cottage	II	642068	267327
1227753	Gates, Gateway, Walling and Wall Head 30 metres West of Theberton Hall	II	643270	266199
1227755	1-4, Church Road	II	643941	266238
1227756	Church of St Peter	I	643729	265918
1227758	The Old Rectory	II	643566	265973
1227759	Stable Block 10 metres to south of the Lion Public House	II	643764	265806
1227920	Lilycot	II	644005	266242

Historic England list entry	Name	Grade	Easting	Northing
1228180	Thatched House	II	643773	265872
1228246	Moat Farmhouse	II	643186	265115
1228262	The Cottage	II	644676	265713
1228263	Flash Cottages	II	644646	265705
1228265	Woodview	II	644673	265856
1228266	Bob's Cottage	II	644601	265220
1228267	Potter's Farmhouse	II	644981	265185
1228268	Theberton House Stables	II	644550	265161
1228269	Gateway 45 metres north of Main Entrance to Theberton House	II	644526	265146
1228270	Barn 30 metres south-east of Old Manor House	II	643632	265883
1228378	Theberton House	II*	644524	265111
1228384	Old Manor House	II	643618	265920
1283440	Manor House	II	643482	267324
1283443	The Cottage	II	641544	267762
1283470	Valley Farmhouse Anneson's Corner	II	642748	266835
1287235	Walls Enclosing Garden 60 metres to north of Theberton House and Greenhouse at North End	II	644511	265184
1287237	Gate and Gate Piers 105 metres south-east of Main Entrance to Theberton House	II	644567	265011
1287260	Gate and Gate Piers 80 metres north-west of Main Entrance to Theberton House	II	644432	265129
1287282	Flint House	II	643814	265810
1287303	Gate and Gate Piers at junction of Leiston Road and Onner's Lane	II	644023	265523
1287529	Theberton Hall	II	643310	266180
1287533	The Lion Public House	II	643764	265824
1287643	Hill Farmhouse	II	644019	264414
1377217	Barn 50 metres south-east of Kelsale Lodge	II	638053	267168
1377236	Rookery Farmhouse	II	639712	267877
1377243	Laurel Farmhouse	II	638505	266868
1377244	Vale Farmhouse	II	640883	266964
1377245	Farm Buildings 30 metres east of Valley Farmhouse, Anneson's Corner	II	642780	266838

Table 5.5.4 Designated heritage assets within link road study area (scheduled monument)

Historic England list entry	Name	Easting	Northing
1014520	Leiston Abbey (second site) and moated site	644457	264189

5.6. Soils and agriculture

5.6.1. The figures for soils and agriculture are presented in **Volume 3** as **Figures 5.6.1** to **5.6.3**.

a) Baseline environment

5.6.2. The site is underlain by an area mapped as the Crag Group (quaternary sand), which in places is overlain with drift deposit of Lowestoft Formation (comprising sand and gravel) (Ref. 5.6.1).

5.6.3. The distribution of soil types is shown in **Figure 5.6.1** (Ref. 5.6.2). In the eastern part of the site the soils are shown as being predominantly slowly permeable seasonally waterlogged clayey and fine loamy over clayey soils. These belong to the Ragdale Soil Association (which represents a group of soil types which are typically found occurring together in a landscape). The main land use on these soils where they occur in Eastern England is described as being Winter cereals.

5.6.4. In the western part of the site the soils are predominantly described as freely draining slightly acidic but base-rich soils. These belong to the Melford Soil Association. The main land use on these soils is described as being cereals, sugar beet and other arable crops.

5.6.5. Published Agricultural Land Classification (ALC) maps ((Ref. 5.6.3): See **Figure 5.6.2**) show the land within the site to comprise a mix of Grade 2 and Grade 3 land, potentially with a small amount of grade 4 land. Under the ALC system land is graded between Grade 1 and 5, with Grade 3 subdivided into 3a and 3b.

5.6.6. Land in grades 1, 2 and 3a is considered to be 'best and most versatile' (BMV) land.

5.6.7. There is no published detailed ALC mapping available for the land within the site. Based on the provisional mapping the proportions of land of each grade would be as shown in **Table 5.6.1** (noting that the full assessment would be based on detailed survey data).

5.6.8. Land within the scheme boundary, from aerial photographs, appears to be predominantly under arable production, with small woodland blocks or strips also present.

5.6.9. Land to the north and west of Theberton is under Entry Level plus Higher Level Stewardship, with some land immediately to the south-west of the scheme boundary to the south-west of Theberton under Organic Entry Level plus Higher Level Stewardship (See **Figure 5.6.3**). A linear woodland block to the west of Theberton, crossed by the scheme, is in a Woodland Grant Scheme.

b) Environmental design and embedded mitigation

5.6.10. A summary of the measures that have been incorporated into the design of the proposed development and that would protect the existing features of soil and agricultural interest is set out below.

i) Construction

5.6.11. The sustainable reuse of the soil resource would be undertaken in line with the Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (Ref. 5.6.4). This would be achieved by the development of a Soil Management Plan (SMP) identifying the soils present, proposed storage locations and handling methods and how the resource would be reused. The SMP would form part of the CEMP. Measures which would be implemented include (but are not limited to):

- complete a Soil Resources Survey and incorporate results into an SMP;
- link the SMP to the Site Waste Management Plan (SWMP);
- ensure soils are stripped and handled in the driest condition possible;
- confine vehicle movements to defined haul routes until all the soil resource has been stripped;
- protect stockpiles from erosion and tracking over; and
- ensure physical condition of the replaced soil profile is sufficient for post-construction use.

Table 5.6.1 Agricultural Landscape Classification grade distribution

Agricultural Landscape Classification Grade	Area hectare (ha)
2	60.12
3 (undifferentiated)*	54.95
4	5.20
Total	**120.26**

*Based on available provisional ALC maps

5.6.12. Permanent surface water/agricultural drains would be re-installed to reinstate any pre-existing field drainage systems as close as possible to pre-construction condition.

5.6.13. All soils would be stored away from watercourses (or potential pathways to watercourses) and any potentially contaminated soil would be stored on an impermeable surface and covered to reduce leachate generation and potential migration to surface waters.

5.6.14. Industry standard measures would be put in place to control pollution, including from fuel or chemical stores, silt-laden run-off or dust.

5.6.15. Following completion of construction operations all agricultural land taken temporarily would be reinstated as near as practically possible to its former condition.

5.6.16. A considerate construction approach would be used to minimise potential impacts on the remainder of the landholding and on neighbouring landholdings during the construction phase. Toolbox talks would be used to inform all those working on the site of the requirements for soil handling and minimisation of disturbance to agricultural activities.

5.6.17. All fencing around the proposed development would be sufficient to resist damage by livestock and will be regularly checked and maintained in a suitable condition. Any damage to boundary fencing would be repaired immediately.

5.6.18. Measures contained in relevant Department for Environment, Food and Rural Affairs (Defra) and Environment Agency best practice guidance on the control and removal of invasive weed species would be implemented where appropriate (Ref. 5.6.5).

5.6.19. Works would cease, and the Animal Health Regional Office would be advised, should animal bones be discovered which indicate a potential burial site.

5.6.20. All movement of plant and vehicles between fields would cease in the event of a disease outbreak and official Defra advice would be followed to minimise the biosecurity risk associated with the continuation of works.

5.6.21. In relation to temporary and permanent land take requirements, EDF Energy would liaise with landowners to understand and, where possible, address their concerns.

ii) Operation

5.6.22. The measures described for the construction phase would be maintained throughout the operational phase, as appropriate.

c) Preliminary assessment of effects

i) Construction

5.6.23. The proposals for this site would result in the loss of 120.26ha of land from primary agricultural productivity. Based on the provisional mapping it is likely that a proportion of this will be BMV land, likely to comprise Grade 2 and 3a.

5.6.24. Given the potential extent of BMV land to be lost on a permanent basis this preliminary assessment considers that this could be a significant effect.

5.6.25. There would also be an impact on the agricultural enterprise because of the loss of a proportion of the productive land. This would be assessed on a case by case basis as required.

5.6.26. On the assumption that landowners' concerns are addressed through appropriate mitigation, this preliminary assessment considers that significant effects on the agricultural enterprise are unlikely to occur and so are not considered further.

ii) Operation

5.6.27. There would be no additional operational phase effects on the soil resource or agricultural enterprise.

d) Additional mitigation and monitoring

5.6.28. There are no mitigation measures available for the loss of BMV land.

e) Preliminary assessment of residual effects

5.6.29. The embedded mitigation measures would ensure that the potential for significant effects is removed, with the exception of the permanent loss of agricultural land which results in a significant effect for both construction and operational phases.

f) Completing the assessment

5.6.30. Once the proposals for the development as a whole are finalised, a full assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant effects. An ALC survey would be undertaken across the site to fully inform the assessment impacts. In addition, landowner interviews would be undertaken.

Table 5.6.2 Summary of effects for construction phase

Soils and agriculture

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Agricultural land.	Loss of approximately 120.26ha of which at least a proportion will be BMV land.	There are no mitigation measures available for the loss of agricultural land.	Significant	There are no additional mitigation measures available.	Significant
Agricultural businesses.	Temporary impact due to the loss of a proportion of the productive land.	EDF Energy would engage with all affected landowners.	Not significant.	No adverse significant effects identified and additional mitigation measures are therefore not required.	Not significant.

Table 5.6.3 Summary of effects for operational phase

Soils and agriculture

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Agricultural land.	There are no impacts identified during the operational phase.				
Agricultural businesses.	There are no impacts identified during the operational phase.				

5.7. Noise and vibration

5.7.1. The figure for noise and vibration is presented in **Volume 3** as **Figure 5.7.1**.

a) Baseline environment

5.7.2. Baseline survey work has yet to be undertaken for the Sizewell link road. However, a preliminary consideration of the noise and vibration impact can be made without reference to existing baseline values. It is likely that existing noise levels along the route will be relatively low since the area is predominantly rural.

5.7.3. The noise and vibration sensitive receptors which are closest to the route are shown in **Figure 5.7.1**. The receptors have been numerically coded, with the names of dwellings (where known) also shown. **Table 5.7.1** shows the coding and corresponding names of locations.

Table 5.7.1 Noise and vibration receptors in the vicinity of the proposed Sizewell link road

Location code	Location name
1	Fir Tree Farm
2	Buskie Farm
3	Fordley Hall
4	Norwood House
5	Cross Roads
6	Garden House Farm
7	Mill Street
8	Yoxford Road
9	Hill Farm
10	Valley Farm
11	Hawthorn Road (1)
12	Trust Farm
13	Dovehouse Farm
14	Theberton Hall
15	Church Farm
16	Doughty Wylie Crescent
17	Theberton Grange
18	Theberton House
19	Vale Cottage
20	Hawthorn Cottages
21	Hawthorn Road (2)
22	Annesons Corner

b) Environmental design and embedded mitigation

i) Construction

5.7.4. The standard of good practice outlined in 'British Standard BS5228-1 Noise: 2009 + A1 2014 – Code of Practice for noise and vibration control at open construction sites' (Ref. 5.7.1) would be followed. Embedded mitigation for the control of noise and vibration would include, but not be restricted to, the following measures:

- selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earth moving activities;
- switching off equipment when not required;
- use of reversing alarms that ensure proper warning whilst minimising noise impacts off-site; and
- provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts.

5.7.5. With respect to vibration, BS 5228-2, gives detailed advice on standard good construction practice for minimising impacts from construction vibration. It is expected that this would be set out in the CEMP and contractors would be required to adhere to this guidance.

5.7.6. EDF Energy would also have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.

ii) Operation

5.7.7. A proposed 50 mph on the link road would result in lower noise levels than if the national speed limit were applied. At this stage, it is not anticipated that any further controls would be required.

c) Preliminary assessment of effects

5.7.8. Noise and vibration levels have been predicted by calculation and modelling. A "significant" effect has been identified where levels are predicted to exceed a specified threshold value. Appropriate threshold levels are based on various standards and a relevant guidance and depend on the type of source; the sensitivity of the receptors; the time of day when it might occur; and, in some situations, on the existing noise levels in the area.

i) Construction

5.7.9. A detailed analysis of noise and vibration impacts will be undertaken as part of the ongoing EIA, however an initial overview of likely working techniques has enabled some initial high level conclusions to be drawn. It is assumed that no noisy construction work would take place at night.

5.7.10. Noise from activities within the compound area and from road construction work would be likely to have a significant adverse effect on Fir Tree Farm (location 1 shown in **Figure 5.7.1**).

5.7.11. There would be a short-term significant adverse noise effect during breaking out of the road near to Annesons Corner, Trust Farm and Hawthorn Cottages (locations 22, 12 and 20 in **Figure 5.7.1**) and a significant adverse noise effect from road construction work at Hawthorn Road (1) and Hawthorn Road (2) (locations 11 and 21 in **Figure 5.7.1**).

5.7.12. Noise and vibration levels at other receptors during construction are unlikely to have a significant adverse effect.

ii) Operation

5.7.13. An initial review has been carried out to consider the noise levels produced during the worst case hour for a typical and busiest day and a typical and busiest night. The highest noise levels would occur during the busiest day.

5.7.14. A significant effect from road traffic noise is likely at Hawthorn Road (1) and Hawthorn Road (2) (locations 11 and 21 in **Figure 5.7.1**) during both a typical and busiest day.

5.7.15. For other receptors and scenarios, the noise and vibration effect would not be significant. It is likely that significant beneficial noise effects would arise as traffic flows through bypassed areas, particularly Theberton and Middleton Moor, would be lower.

d) Additional mitigation and monitoring

i) Construction

5.7.16. Mitigation may be possible in the form of screening around construction areas. This would need to be considered when further information about the construction methods and site constraints is known. It is anticipated that some localised screening using portable acoustic panels would be possible around all affected noise sensitive receptors.

ii) Operation

5.7.17. Screening may be required in order to reduce noise levels at any locations where the effect is predicted to be significant. The need for screening would be determined by further assessment.

iii) Monitoring

5.7.18. Routine monitoring of Sizewell C traffic would be carried out through a scheme to be agreed with local authorities. Provision would be made as necessary for monitoring of noise and vibration levels in the event of complaints being received from occupiers of noise sensitive receptors, or on request of the local authorities.

e) Preliminary assessment of residual effects

i) Construction

5.7.19. With mitigation in place, it is likely that some significant, short-term effect from noise would occur during construction at Fir Tree Farm, Annesons Corner, Hawthorn Cottages, Hawthorn Road (1) and Hawthorn Road (2). Principal noise sources are likely to be from excavators and breakers during removal and replacement of existing road surfaces and from tipper lorries, dump trucks and concrete pumping and pouring activities. Initial estimates suggest that significant impacts are likely for four to six weeks although this may vary as construction planning evolves.

5.7.20. At all other receptors, with mitigation in place, noise and vibration effects would not be significant.

ii) Operation

5.7.21. With the proposed screening, noise effects on nearby receptors during the operation of the road would not be significant. It is likely that significant beneficial effects may arise from the proposed development with reduced traffic through Theberton and Middleton Moor.

f) Completing the assessment

5.7.22. Further assessment of impacts will be undertaken as part of the ongoing EIA, with establishment of the baseline noise environment and further consideration of the construction methodology, local topographical features and layouts. The ES will present a full noise and vibration assessment and will consider any new information such as amended design or construction methodologies which might be relevant, although it is anticipated that the assessment would support the preliminary conclusions drawn above.

Table 5.7.2 Summary of effects for construction phase

Noise and vibration

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Fir Tree Farm.	From compound activity.	Selection of plant and methodology in accordance with good practice.	Significant noise effect.	Screening	Significant noise effect.
Annesons Corner and Hawthorn Cottages.	From breaking out during road construction: short-term significant noise effect.	Selection of plant and methodology in accordance with good practice.	Short-term significant noise effect.	Screening	Significant noise effect.
Trust Farm.	From breaking out during road construction: short-term significant noise effect.	Selection of plant and methodology in accordance with good practice.	Short-term significant noise effect.	Screening	No significant noise effect.
Hawthorn Road (1) and Hawthorn Road (2).	Significant effect from road construction.	Selection of plant and methodology in accordance with good practice.	Significant noise effect.	Screening	Significant noise effect.
All other receptors.	Construction activity.	Selection of plant and methodology in accordance with good practice.	No significant noise or vibration impacts.	None required.	No significant effect.

Table 5.7.3 Summary of effects for operational phase

Noise and vibration

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Hawthorn Road (1) and Hawthorn Road (2).	Operation of road during road and rail typical and worst case day.	Speed limit of 50mph.	Significant noise effect.	Roadside screening.	No significant effect.
All other receptors.	Operation of road at any time.	Speed limit of 50mph.	No significant effects from noise or vibration.	Roadside screening.	No significant effect.

5.8. Air quality

a) Baseline environment

5.8.1. The closest human receptors to the proposed development are located at properties on Harling Way, Phoenix Cottage, Wood Farm Cottages, Fisher's Farm, Aldhurst Farm Cottage, properties on Westward Ho, properties of Abbey Lane, Old Abbey Farm, Vale Cottage, Oakfield house, Coronation Cottages, Annesons Cottage, Hawthorn Cottages, Trust Farm and Fir Tree Farm. These locations are all within 700m of the proposed development.

5.8.2. Minsmere-Walberswick Heaths and Marshes SSSI is within 900m of the proposed development site (see **section 5.3** of this chapter).

5.8.3. SCDC has declared two Air Quality Management Areas (AQMAs) within its boundary (Ref. 5.8.1) due to elevated monitored concentrations of ambient nitrogen dioxide (NO2), the nearest of which is approximately 7.8km from the site, along the A12 at Stratford St. Andrew. A third AQMA, at Dooley Inn, was revoked in 2016.

5.8.4. The current baseline along the proposed route alignment has been informed by reference to Defra estimates of background concentrations for sulphur dioxide (SO_2), Nitrogen Dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) (Ref. 5.8.2) and local authority measurement data for NO2 (Ref. 5.8.3). Baseline concentrations of all pollutants are less than half statutory objective values (Ref. 5.8.4, Ref. 5.8.5).

5.8.5. Dust levels are related to the action of wind on exposed soils and climatic conditions year to year, but existing levels are likely to be low given the arable nature of the land use.

b) Environmental design and embedded mitigation

i) Construction

5.8.6. The following mitigation measures would be embedded into the construction of the proposed development:

- site access located as far as practicable, and preferably at least 10m, from receptors;
- potentially dusty loads (loose earth, spoil, aggregates etc) to be covered in transit;
- any potential use of concrete batching plant located as far as practicable from receptors; and
- mobile crushing & screening plant located as far as practicable from receptors.

5.8.7. Air quality impacts arising from the construction phase would be managed through a range of control measures detailed in a CEMP, supplemented by the measures appropriate to the level of risk designated to the proposed development under Institute of Air Quality Management (IAQM) Guidance (Ref. 5.8.6).

ii) Operation

5.8.8. The following mitigation measures have been embedded into the operation of the proposed development:

- maintain Sizewell C construction vehicles using the link road to high standard, so as to avoid excess pollution or possibility of breakdowns; and
- optimise traffic flows related to the main development site, in such a manner that the impact on the local road network at peak times is minimised.

c) Preliminary assessment of effects

i) Construction

5.8.9. The potential impacts associated with the construction of the Sizewell link road include fugitive emissions of dust, emissions from Non-Road Mobile Machinery (NRMM) on the site, emissions from Heavy Goods Vehicles (HGVs) accessing the site and emissions from vehicles carrying workers to and from the site. However, given the embedded mitigation measures described above, the adverse effects would likely be negligible and would therefore not be significant for any of the proposed construction activities at the site.

5.8.10. The principal risk is anticipated to be related to both earthworks and track-out (the transit of material), as the earthworks phase of construction is expected to require a high volume of material to be moved. A high level of activity could potentially place the dust emissions category as 'Large' by IAQM classification, with the likelihood of a 'Medium' risk based on the number and sensitivity of local receptors.

5.8.11. Each risk category has the potential to lead to proportional adverse, albeit temporary, impacts which have the potential to be significant without mitigation.

5.8.12. However, assuming all mitigation measures are effectively implemented and monitored through an effective CEMP, at the level recommended by the dust risk assessment, no significant dust effects resulting from demolition and construction activities are anticipated.

5.8.13. It is expected that the number of Heavy Duty Vehicle (HDV) movements required to develop the site in the construction phase would not exceed the IAQM screening threshold (Ref. 5.8.7) of more than 100 Annual Average Daily Traffic required for a detailed dispersion modelling assessment and there is unlikely to be a significant effect on local air quality.

ii) Operation

5.8.14. There is potential for increases in pollutant concentrations at receptors located along the Sizewell link road during construction of Sizewell C. The primary source of these pollutants would be as a result of the additional vehicles using the link road for construction of Sizewell C.

5.8.15. Construction of the link road would also have a consequential effect on the amount of traffic using the original B1122 road, which would be significantly reduced. As a result, despite the total net increase in traffic, the majority of receptors would see a reduction in ambient concentrations, and are likely to see a significant beneficial effect.

5.8.16. IAQM guidance has been used to determine the appropriate scale of an air quality impact assessment. It is expected that the proposed development would require a detailed assessment, given that it meets a number of IAQM criteria, including the introduction/realignment of a road. However, the proposed routing of the proposed link road, in conjunction with the low baseline concentrations across the study area, indicates that it is unlikely that there would be significant adverse air quality effects at receptors during operation, though there would likely be significant beneficial air quality effects on receptors along the B1122 in both Theberton and Middleton Moor.

5.8.17. No significant effects on AQMAs are anticipated due to their distance from the proposed link road.

5.8.18. The effects on both Minsmere-Walberswick SPA/SSSI and Sizewell Marshes SSSI of the proposed development would likely be negligible as a percentage of the overall background deposition rates. Whilst there may be exceedances of critical loads immediately adjacent to roads, this would be attributable to background deposition, and not the development itself, and would in addition be expected to fall off rapidly with increased distance from the road. This effect would therefore not be significant.

5.8.19. The principal benefit of the proposed development is in reducing the traffic from the Sizewell C construction through Yoxford and bypassing of the villages of Middleton Moor and Theberton, thus reducing pollutant concentrations at receptors in those locations. Whilst it is acknowledged that there would be a negligible adverse effect at some receptors close to the proposed development, the scheme has an overall significant beneficial effect on the air quality in the area.

d) Additional mitigation and monitoring

5.8.20. No significant adverse effects are predicted for any phase of development and no additional mitigation measures are therefore proposed.

e) Preliminary assessment of residual effects

5.8.21. No significant adverse residual effects are predicted during the construction or operational phases. It is likely that significant beneficial effects would arise with reduced traffic through Theberton and Middleton Moor.

f) Completing the assessment

5.8.22. Once the proposals are finalised, the potential air quality effects of the proposed link road will be re-evaluated to confirm whether the preliminary conclusions presented above are applicable. The ES will present the full assessment, underpinning the conclusions drawn in relation to the absence of significant adverse effects on local air quality, and the presence of significant beneficial effects on receptors along the existing alignment of the B1122.

Table 5.8.1 Summary of effects for construction phase

Air quality

Topic/receptor	Impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Construction dust					
Human	Potential generation of nuisance dust.	Measures in CEMP appropriate to level of risk identified by IAQM criteria.	Considered likely to be 'Medium' risk, though not significant provided CEMP mitigation measures are adhered to.	None	Not Significant.
Vehicle/NRMM emissions					
Human	Potential change in air pollutant concentrations at receptors.	Measures in CEMP.	Unlikely to meet IAQM screening criteria requiring assessment, therefore not significant.	None	Not Significant.

Table 5.8.2 Summary of effects for operational phase

Air quality

Topic/receptor	Impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Vehicle emissions					
Human	Potential change in air pollutant concentrations at receptors.	Maintaining vehicles to high standard, avoid peak time travel and reducing traffic through Theberton.	Unlikely to have significant adverse effects, likely to have significant beneficial effects.	None	Significant Beneficial.
Ecological	n/a	n/a	n/a	n/a	n/a

5.9. Geology and land quality

a) Baseline environment

i) Geology

5.9.1. The following provides a summary of the geology and geological characteristics within the site and site vicinity:

- made ground: potentially present, related to construction of existing railway and roads and farmer's tips;
- superficial deposits: predominantly Lowestoft Formation. Head deposits present in the centre and east of site;
- bedrock: the Crag Group;
- important geological sites: none present;
- identified geological hazards: none present;
- mining, quarrying and natural cavities: small scale historical sand and gravel pits identified 220m north and 150m south respectively;
- ground stability hazards: none present; and
- unexploded ordnance (UXO) risks: low risk.

5.9.2. Borehole logs have been recorded within 500m of the site. The borehole logs generally correspond with the mapped geology. Groundwater was identified at depths of between 9.45 metres below ground level (m bgl.) and 30.48m bgl.

ii) Hydrology and Hydrogeology

5.9.3. The following provides a summary of the hydrological and hydrogeological characteristics within the site and site vicinity:

- surface water features: tributaries of the Minsmere New Cut River present crossing the site and several small ponds within 250m of the site;
- superficial aquifer: the Lowestoft Formation is classified as a Secondary (Undifferentiated) Aquifer and the head deposits are classified as a Secondary A Aquifer;
- bedrock aquifer: the Crag Group is classified as a Principal Aquifer;
- groundwater vulnerability: the site contains soils of low, intermediate and high leaching potential;
- groundwater/surface water abstractions: two private and one licensed groundwater abstractions located 200m west of site's eastern extent;
- groundwater/surface water discharge consents: no available data;
- pollution incidents: no available data; and
- flood risk: very low risk, with areas of low to high risk in the western section of the site.

iii) Site history

5.9.4. The route and surrounding areas currently supports agricultural land; this land use extends back into the 19th century at least. The Great Eastern Railway/East Suffolk railway line, Main Road (A12) and Leiston Road (B1122) are also present from 1883 in their current layout. Potentially contaminating historical activities within 500m of the site include an Old Kiln (1950 – 1957), as well as several small roads and various farms.

5.9.5. Potentially contaminating historical activities within 500m of the site include a sand pit (1884), a gravel pit (1883), a garage (1977 – present), St Peter's Cemetery (1884 – present) as well as several small roads and various farms.

iv) Landfills and waste management sites

5.9.6. A former landfill (Middleton Landfill) is located approximately 100m north-east.

v) Previous investigations

5.9.7. There have been no previous ground investigations along the proposed route alignment.

vi) Key hazards

5.9.8. Key hazards present within the site vicinity include the following:

- Made Ground (on-site and off-site) associated with the construction and operation of the A12, B1122 and minor connecting roads.
- Made Ground (on-site and off-site) associated with the construction and operation the Great Eastern railway/East Suffolk railway line.
- Made Ground associated with the disused sand and gravel pits (approximately 220m and 150m north of the site, south of Theberton).

- Made Ground associated with the Old Kiln present 50m north of the northern section of the site.
- Middleton historical landfill.
- Farmland on-site and within the site vicinity and the potential for un-mapped farmers tips.
- Changes in soil compaction, soil erosion and ground compaction.

vii) Summary of preliminary conceptual site model

5.9.9. A summary of potential contamination sources, pathways and receptors identified within the Preliminary Conceptual Site Model is provided in **Table 5.9.1**.

5.9.10. Potential receptors and pathways as summarised in **Table 5.9.2**.

Table 5.9.1 Potential sources of contamination

Potential source of contamination	Potential contamination	Approximate location
Made ground associated with the construction of the Great Eastern railway and East Suffolk railway line crossing the site south of Yoxford and activities associated with its operation.	A range of organic contaminants including hydrocarbons, PCBs, PAHs, solvents and creosote; metals; and ash and fill used in the construction of the railway.	On-site.
Made ground associated with the construction of the roads including A12 Road, Littlemoor Road, Fordley Road, Pretty Road, Moat Road, B1122 Road and activities associated with their operation.	Fuels and oils attributed to spills from vehicles on the roads included within the site boundary, plus exhaust particulates. A range of inorganic and organic contaminants including the potential for asbestos.	
Farmland within site boundary. Potential for un-mapped farmers tips.	Contamination risk from herbicides, pesticides, silage, effluent, and fuel oils. Risk of inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos, etc.	
Made ground associated with the Old Kiln present 50m north of the northern section of site.	Ground gas and a range of inorganic and organic contaminants including the potential for asbestos.	Off-site.
Farms around the site boundaries. Potential for un-mapped farmers tips.	Contamination risk from herbicides, pesticides, silage effluent, and fuel oil. Risk of inorganic and organic contamination.	
Middleton Historical Landfill (National Grid Reference TM 414 673).	Ground gas and a range of inorganic and organic contaminants including the potential for asbestos.	

Table 5.9.2 Potential Receptors and Pathways

Receptor Group	Receptor	Principal Contaminant Migration pathways
Human health (on-site).	Pedestrians and road users using existing and future roads, footpaths and fields within the site. Agricultural workers. Construction/maintenance workers.	Dermal contact with, and ingestion of, contaminants in soils, soil-derived dusts and water; and Inhalation of soil-derived dust, fibres, gas and vapours.
Human health (off-site).	Occupants of nearby residential and commercial properties. Pedestrians accessing surrounding roads and footpaths. Agricultural workers.	Dermal contact with, and ingestion of, contaminants in soils, soil-derived dusts and water; and Inhalation of soil-derived dust, fibres, gas and vapours.

Receptor Group	Receptor	Principal Contaminant Migration pathways
Controlled Waters: Groundwater (on-site and off-site).	Groundwater in Principal Bedrock Aquifer; and Secondary A and Secondary Undifferentiated Superficial Aquifer.	Leaching of contaminants in soil to groundwater in underlying aquifers; migration of contaminated water through preferential pathways such as underground services, pipes and granular material to groundwater in underlying aquifers; and discharge of contaminants entrained in groundwater and/or surface water run-off followed by overland flow and discharge.
Controlled Waters: Surface waters (on-site and off-site).	Tributaries of the Minsmere New Cut River on-site. Ponds off-site within 250m of the site.	
Property (on-site and off-site).	Existing on-site services and structures on and off-site. Proposed on-site services and structures.	Direct contact of contaminants in soil and/or groundwater with existing and proposed structures and buried services; and migration of contaminated groundwater, ground gas and/or vapours along strata and preferential pathways such as service routes or differentially permeable strata.
	Crops and livestock.	Direct contact, ingestion, inhalation and uptake of soil and water contamination by crops and/or livestock; and migration of contaminated waters/dust/fibres and subsequent uptake by crops or ingestion/inhalation/dermal contact by livestock.

b) Environmental design and embedded mitigation

i) Construction

5.9.11. A summary of the measures that have been incorporated into the design of the proposed link road and that would protect the land quality during construction are set out below.

- A piling risk assessment in accordance with Environment Agency guidance may be required to ensure that piling techniques deemed appropriate are implemented at the site by identifying and managing potential risks as a result of creating pathways to the aquifer.
- The CEMP would specify measures required during enabling works and construction such as the following:
  - Minimising the area and duration of soil exposure and timely reinstatement of vegetation or hardstanding to prevent soil erosion and reduce temporary effects on soil compaction.
  - Stockpile management (such as water spraying and avoiding over stockpiling to reduce compaction of soil and loss of integrity) to prevent windblown dust and surface water run-off.
  - Implementation of appropriate dust suppression measures to prevent migration of contaminated dust.
  - Implementation of working methods during construction to ensure that there would be no surface water run-off from the works or any stockpiles into adjacent surface watercourses/leaching into underlying groundwater in accordance with best practice such as the Pollution Prevention Guideline, Working at Construction and Demolition sites.
  - Implementation of appropriate pollution incident control e.g. plant drip trays and spill kits.
  - Implementation of appropriate and safe storage of fuel, oils and equipment during construction.
  - Implementation of an appropriate Materials Management Plan to document how the excavated materials would be dealt with and a verification plan to record the placement of materials at the site.
  - Implementation of a SWMP.
- Remediation of soil/groundwater contamination (e.g. source removal, treatment or capping) and ground stabilisation/improvement works would be undertaken if deemed necessary.
- Gas protection measures would be incorporated within proposed structures, if monitoring and risk assessments deem them to be necessary.
- Design of the road and associated structures and the selection of construction materials would be in accordance with good practice at the time of the design. The design would be required to take into account the ground conditions including the potential for ground movement, compaction, ground gas and ground aggressivity.

- The drainage/flood prevention strategies would consider the ground conditions including the permeability of the strata and the level of contamination present on-site.

ii) Operation

5.9.12. To protect land quality, the link road would be operated in accordance with good practice including:

- the incorporation of petrol/oil interceptors within the drainage design where considered necessary; and
- the use of appropriate SuDS schemes (refer to **section 5.11** of this chapter).

c) Preliminary assessment of effects

i) Construction

Ground contamination

5.9.13. The construction works would potentially introduce new sources of contamination and disturb and mobilise existing sources of contamination through excavation and exposure of contaminated soil, remobilisation of contaminants through soil disturbance and the creation of preferential pathways for surface water run-off and ground gas migration pathways. With the embedded mitigation, construction activities should not increase the contamination risks presented at the site and an overall neutral to minor beneficial effect is predicted given that any contamination would have been removed. These effects are considered to be not significant.

5.9.14. A preliminary assessment of the effects associated with ground contamination during the construction phase is summarised in the table below.

Physical effects

5.9.15. The construction of the proposed link road may also cause physical effects including changes in soil erosion, soil compaction and ground instability issues associated with stripping of topsoil, vegetation clearance, earthworks, stockpiling, movement of heavy plant, piling, temporary works and construction of the new infrastructure.

5.9.16. Bulk Earthworks along the proposed link road are anticipated with temporary stockpiles likely to be required on-site to allow earthworks along the road to progress and temporary works areas/haul roads to be constructed. There is also the potential for increased run-off during earthworks with a high sediment load likely to impact local surface waters. Earthworks would be planned to minimise soil exposure as far as practicable and areas required for temporary works would be reinstated as soon as possible after they are no longer required. With embedded mitigation, the effects on soil erosion are considered to be temporary and therefore neutral and would not be significant.

5.9.17. There do not appear to be any ground stability hazards (landslides, historical earthquakes or modern instrument recorded earthquakes). The site is not in an area affected by coal mining. The site is also identified as having a low UXO risk. Ground conditions have not yet been confirmed. Effects on soil compaction and ground stability are considered to be neutral to minor beneficial and would not be significant.

5.9.18. With the embedded mitigation, physical effects are assessed to be neutral to minor beneficial. These effects would not be significant.

Table 5.9.3 Construction phase contamination effects for the proposed development

Receptor	Value/Sensitivity	Baseline risk	Construction risk	Effect
Human	High	Low	Very low.	Not significant.
Controlled waters (groundwater).	Medium	Low	Very low.	Not significant.
Controlled waters (surface water).	High	Very low.	Very low.	Not significant.
Property (existing/future structures and services).	Low	Very Low.	Very low.	Not significant.
Property (crops and livestock).	Medium	Low	Very low.	Not significant.

ii) Operation

Ground contamination

5.9.19. The use of the link road would potentially introduce new sources of contamination. Spillages and leaks may occur and below ground services could create additional potential pathways for the migration of potential contamination that were not present at baseline. With embedded mitigation, an overall neutral to minor beneficial effect is anticipated. These effects would not be significant.

5.9.20. Effects associated with ground contamination during the operational phase are summarised in the table below.

Physical effects

5.9.21. Impacts in relation to physical effects including soil erosion, compaction and changes in soil stability would be mainly related to the construction of the link road and there are not considered to be any significant effects during the operational phase.

d) Additional mitigation and monitoring

5.9.22. The preliminary assessment of effects presented above identifies no adverse significant effects during construction and operation in relation to land quality. Additional measures to mitigate significant adverse effects are not therefore required.

e) Preliminary assessment of residual effects

5.9.23. No additional mitigation is proposed beyond the embedded measures described above and the residual effects for all phases of development would remain the same as those described above in the preliminary assessment of effects. The effects would be minor beneficial to neutral and would not be significant.

f) Completing the assessment

5.9.24. Once the proposals for the Sizewell C Project development as a whole are finalised, a full land quality assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 5.9.4 Operational phase contamination effects for the proposed development

Receptor	Value/Sensitivity	Baseline risk	Operation risk	Effect
Human	High	Low	Very low.	Not significant.
Controlled waters (groundwater).	Medium	Low	Very low.	Not significant.
Controlled waters (surface water).	High	Very low.	Very low.	Not significant.
Property (existing/future structures and services).	Low	Very Low.	Very low.	Not significant.
Property (existing/future crops and livestock).	Medium	Low	Very low.	Not significant.

Table 5.9.5 Summary of effects for construction phase

Geology and land quality

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Ground Contamination: Current and future on-site and off-site human health receptors.	Contamination from on-site sources.	Incorporate mitigation measures into the construction process, as set out in the CEMP.	Not significant.	Not required.	Not significant.
Ground Contamination: Controlled Waters receptors (groundwater and surface water).	Contamination from on-site sources.		Not significant.		Not significant.
Ground Contamination: Property receptors (services/ structures, crops and livestock).	Contamination from on-site sources.		Not significant.		Not significant.
Physical Effects: Ground conditions.	Soil erosion, soil compaction and ground stability impacts.		Not significant.		Not significant.

Table 5.9.6 Summary of effects for operational phase

Geology and land quality

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Ground Contamination: Current and future on-site and off-site human health receptors.	Contamination from on-site sources.	Construction methodology and associated mitigation measures would prevent impacts during operation. The project would be operated in accordance with the relevant regulations and good practice.	Not significant.	Not required.	Not significant.
Ground Contamination: Controlled Waters receptors (groundwater and surface water).	Contamination from on-site sources.		Not significant.		Not significant.
Ground Contamination: Property receptors (services/ structures, crops and livestock).	Contamination from on-site sources.		Not significant.		Not significant.
Physical Effects: Ground conditions.	Soil erosion, soil compaction and ground stability impacts.		Not significant.		Not significant.

5.10. Groundwater

a) Baseline environment

5.10.1. Details on the geology of the Sizewell link road route are provided in **section 5.9** of this chapter.

5.10.2. The head deposits and the diamicton of the Lowestoft Formation are classified as Secondary (undifferentiated)[9] (Ref. 5.10.1).

5.10.3. The Lowestoft Formation – sand and gravels is classified as a Secondary A Aquifer[10].

5.10.4. The Crag Group bedrock underlying the route corridor is classified as a Principal Aquifer[11].

5.10.5. The route of the link road does not lie within or adjacent to a groundwater Source Protection Zone (SPZ)[12].

5.10.6. Contours shown on British Geology Survey (BGS) hydrogeological mapping (Ref. 5.10.2) suggest that Crag groundwater levels at the site may be around 5m AOD (approximately 15m below ground level (bgl). These contours are based on data from 1976 and are only indicative of current levels, however the hydrogeological regime is not considered likely to have changed significantly in the intervening years.

5.10.7. The Lowestoft Formation along the route corridor is expected to be of relatively low permeability and have a limited hydraulic connection to the underlying Crag groundwater. It is likely there are perched water tables in permeable lenses within the Lowestoft Formation.

5.10.8. The proposed link road is located on the Waveney and East Suffolk Chalk and Crag groundwater body (Water Framework Directive reference GB40501G400600) (Ref. 5.10.3). This groundwater body has been classified by the Environment Agency as being of Poor Quantitative and Poor Chemical status, with an objective of being of Good Quantitative and Good Chemical status by 2027. The Poor Chemical status is attributed to impacts from agriculture. The proposed development falls within a groundwater Nitrate Vulnerable Zone.

5.10.9. There is no data available on groundwater abstractions within 1km of the site.

5.10.10. Given the local geology and depth to groundwater there is not considered to be a connection between groundwater and surrounding surface water features. Surface water features are discussed further in **section 5.11** of this chapter.

5.10.11. The Suffolk Coastal and Waveney District Strategic Flood Risk Assessment makes no reference to groundwater flooding across the Suffolk Coastal and Waveney District (Ref. 5.10.4). Flood risk is discussed further in **section 5.12** of this chapter.

5.10.12. There is no known existing land contamination on the site. Further information on Land Quality is presented in **section 5.9** of this chapter.

5.10.13. The Minsmere-Walberswick Heaths and Marshes SSSI is approximately 800m north-east of site (see **section 5.3** of this chapter).

b) Environmental design and embedded mitigation

i) Construction

5.10.14. Construction drainage would likely be contained within the construction sites, with drainage to ground where possible.

5.10.15. A piling risk assessment, in accordance with Environment Agency guidance, may be required to ensure appropriate piling techniques are implemented at the site (by identifying and managing potential risks as a result of creating pathways to groundwater).

5.10.16. The CEMP would specify measures required during enabling works and construction which could include, but not be limited to, the measures already listed under **section 5.9** of this chapter.

5.10.17. Remediation of soil/groundwater contamination (e.g. source removal, treatment or capping) and ground stabilisation/improvement works would be undertaken if further investigation and risk assessments deem it necessary.

5.10.18. The drainage and flood prevention strategies would consider the ground conditions including the permeability of the strata and the level of contamination present on-site.

[9] A Secondary (Undifferentiated) Aquifer is designated in cases where it has not been possible to attribute either category Secondary A or Secondary B to a rock type.

[10] Secondary A Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

[11] Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

[12] Groundwater Source Protection Zones are areas defined around groundwater sources used for public drinking water supply. The SPZ shows the risk of contamination from activities that might cause pollution in the area. The closer the activity, the greater the risk.

ii) Operation

5.10.19. There would be appropriate drainage for the road infrastructure, including the incorporation of SuDS measures where appropriate.

5.10.20. Where considered necessary, the site would incorporate petrol/oil interceptors which would be included within the drainage design.

c) Preliminary assessment of effects

i) Construction

5.10.21. The construction of the proposed development would require earthworks, including the excavation of cuttings. Due to the shallow nature of the cuttings and the anticipated depth to the Crag, it is considered that the construction phase would not have an impact on the groundwater levels or flow of groundwater in the Crag.

5.10.22. A small area of Lowestoft sand and gravels outcrop within the footprint of the scheme, and groundwater within the head deposits and Lowestoft Formation diamicton aquifer would be likely to occur in discontinuous perched lenses. As such, extensive dewatering is unlikely to be required during construction.

5.10.23. Construction works, such as excavation and stockpiling of contaminated materials, can pose a risk to groundwater receptors through leaching and run-off. Intrusive activities and removal of low permeability material can pose a risk to groundwater by creating new contaminant pathways or mobilising existing contamination.

5.10.24. The Crag groundwater would be protected from any spills or leaks by the overlying low permeability superficial deposits. Therefore, the impact on the Crag groundwater would be low, and the effect not significant.

5.10.25. Considering both the baseline conditions of the site and the environmental design and embedded mitigation, there would be no significant effects on groundwater at the site.

ii) Operation

5.10.26. Considering both the baseline conditions of the site and the environmental design and embedded mitigation, there would be no significant effects on groundwater at the site.

d) Additional mitigation and monitoring

5.10.27. Periodic inspection and maintenance of the drainage infrastructure would be required to ensure its continued efficacy.

e) Preliminary assessment of residual effects

5.10.28. There are not expected to be any significant adverse residual effects during the construction or operational phases.

f) Completing the assessment

5.10.29. The current road and drainage design would be developed further prior to the submission of the application for development consent.

5.10.30. Once the proposals for the Sizewell C development as a whole are finalised, the full groundwater assessment of the proposals would be completed as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 5.10.1 Summary of effects for construction phase

Groundwater

Receptor	Impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Crag groundwater (Principal Aquifer); Lowestoft Formation sand and gravel (Secondary A Aquifer); Head and Lowestoft Formation diamicton (Secondary Aquifer (undifferentiated)).	Leaching and migration of existing contaminants (free and dissolved phase) from soils in the unsaturated zone into groundwater in underlying aquifers.	Piling risk assessment (if required). Ensuring all site activities are carried out in accordance with the CEMP. Remediation of on-site contamination if required. Appropriate drainage design.	Not significant.	No adverse significant effects identified during construction works. Additional mitigation measures are not therefore required.	Not significant.
	Migration of contaminants via preferential pathways to deeper groundwater.		Not significant.		Not significant.
	Construction materials and the use of construction vehicles have the potential to introduce contamination to groundwater via drips and spillages and infiltration of run-off from the construction site.		Not significant.		Not significant.

Table 5.10.2 Summary of effects for operational phase

Groundwater

Receptor	Impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Crag groundwater (Principal Aquifer); Lowestoft Formation sand and gravel (Secondary A Aquifer); Head and Lowestoft Formation diamicton (Secondary Aquifer (undifferentiated)).	Increase in the impermeable area of ground cover at the development site.	Water draining from the road would pass through appropriate drainage, including the incorporation of SuDS and petrol/oil interceptors where necessary. This would allow infiltration to the superficial aquifer, whilst also protecting the underlying groundwater from hydrocarbon contamination.	Not significant.	Periodic inspection and maintenance of the SuDS infrastructure.	Not significant.
	Fuel spills or leaks infiltrating to groundwater.		Not significant.		Not significant.

5.11. Surface water

a) Baseline environment

i) Surface water features

5.11.1. The proposed link road is located within the Minsmere Old River watershed. Light detection and ranging data show that the highest ground levels are located in the north-west area of the site at approximately 40m AOD. Ground levels slope to the south and east of the site, with the lowest ground levels slightly less than 7m AOD in the south-east of the site.

5.11.2. The Minsmere Old River catchment (water body reference GB105035046270) is located approximately 2000m north-east of the proposed development at its closest point. The existing B1122 road separates the proposed development from this watercourse; however, two tributary reaches of the Minsmere Old River that would be intersected by the proposed link road are designated as Main Rivers by the Environment Agency. From the west, the first Main River reach would be crossed at the Fordley Road junction with the B1122. The second Main River reach would be crossed in Theberton.

5.11.3. There are several ordinary watercourses that would be crossed by the proposed link road. These are tributaries of Minsmere Old River.

ii) Fluvial geomorphology

5.11.4. Geomorphology and hydromorphology are key factors contributing to whether a water body can achieve or maintain Good ecological status.

5.11.5. The Minsmere Old River water body (water body reference GB105035046270) is designated as a Heavily Modified Water Body (HMWB). The geomorphology and the hydrological regime are of sufficient quality to support Good ecological status.

iii) Water quality

5.11.6. Physico-chemical and chemical data presented on Catchment Data Explorer have been reviewed for the Minsmere Old River in the vicinity of the proposed site boundary.

5.11.7. The physico-chemical status of the Minsmere Old River is Good or High for ammonia, biochemical oxygen demand (BOD), dissolved oxygen , pH and temperature. These variables are not adversely affected by pollutants such as ammonia, copper, triclosan and zinc and hence the physico-chemical status of the water body is Good. However, the overall ecological status of the Minsmere Old River is Moderate, due to the Poor status of the biological quality elements.

b) Environmental design and embedded mitigation

i) Construction

5.11.8. Surface water run-off would be contained within the construction site with drainage to ground, wherever feasible. Intercepting site drainage and discharging it to ground would prevent the supply of sediment and other contaminants to the surface drainage network during construction. There are several areas currently at risk from surface water flooding along the site and the construction phase drainage design would take this into account.

5.11.9. Petrol/oil interceptors would be incorporated within the drainage design where necessary.

5.11.10. Mitigation measures would be incorporated into the proposed development construction process and could include, but would not be limited to:

- The wheels of all vehicles would be washed before leaving site.
- Concrete and cement mixing and washing areas would be situated at least 10m away from surface water receptors. These areas would incorporate settlement and recircula-tion systems to allow water to be reused. The washing of equipment would be undertaken in a contained area and all water would be collected for off-site disposal.
- All fuels, oils, lubricants and other chemicals would be stored in an impermeable bund with at least 110% of the stored capacity. Spill kits would be available at all times, and damaged containers would be removed from site. All refuelling would take place in a dedicated impermeable area, using a bunded bowser. Biodegradable oils would be used where possible.
- Sand bags or stop logs would also be available for deploy-ment at the outlets from the site drainage system in case of emergency spillages
- Carefully phased construction to minimise impacts on the river.
- Implementation of buffer strips and exclusion areas on the river and floodplain ditches within the construction site.

ii) Operation

5.11.11. The operational drainage system would incorporate SuDS measures where appropriate, to minimise potential impacts on surface water receptors. The drainage infrastructure would comprise drainage retention and/or infiltration areas. These are currently based on broad assumptions and the final areas required may change as the design progresses.

5.11.12. Drainage retention areas would discharge to the existing watercourses at a flow rate that mimics the existing greenfield rate. Infiltration areas would, subject to geotechnical testing, infiltrate into the ground.

5.11.13. Where the link road crosses existing ordinary watercourses, new culverts would be built to maintain the existing flow of surface water. The size and form of the culverts would be determined via further assessment and once liaison has been undertaken with the Lead Local Flood Authority (SCC) and the Environment Agency.

5.11.14. Channel realignment of Main River would be incorporated into the design. The span of the new crossing would be designed with reference to the Design Manual for Roads and Bridges (DMRB). The design would include features to allow 'natural' process to continue (e.g. clear-spanning bridges with 'natural' banks so that the disruption to morphological processes is minimised). The realigned channel would be engineered so that the crossing point is perpendicular to the proposed development, with further measures to offset the loss and fragmentation of aquatic habitats (e.g. retention of remnant reaches of the previous alignment, establishment of buffer strips established).

c) Preliminary assessment of effects

i) Construction

5.11.15. Surface water run-off would be contained within the site, with drainage to ground wherever feasible. However, two main rivers and some ordinary watercourses would be intersected by the proposed road. As a result, a number of impacts, such as loss and fragmentation of riverine habitat, disruption of riverine processes and loss of floodplain habitats would need mitigation. The road alignment may also disrupt in-channel and floodplain flows and morphological processes.

5.11.16. No significant adverse effects have been identified at this stage although further detailed assessment is required.

ii) Operation

5.11.17. No significant adverse effects have been identified at this stage although further assessment is required. The potential for effects relates to the loss of riverine and floodplain habitats and the fragmentation of remnant habitats of the Minsmere Old River water body. The road alignment may also disrupt in-channel and floodplain flows and morphological processes.

d) Additional mitigation and monitoring

5.11.18. Once operational, periodic inspection and maintenance of the SuDS infrastructure may be required to ensure the continued efficacy of the surface water drainage system.

e) Preliminary assessment of residual effects

5.11.19. The residual effects would be unchanged from the effects described above.

f) Completing the assessment

5.11.20. The current assessment is conservative, based on the design information currently available. EDF Energy anticipates that effective mitigation can be provided for the proposed development that would minimise surface water impacts. The final design of the proposed development, the need for mitigation and its form would be determined in liaison with the relevant authorities.

5.11.21. Once the proposals for the Sizewell C development are finalised, a full assessment of potential effects on the surface water environment from the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES will present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 5.11.1 Summary of effects for construction phase

Surface water

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Main rivers and ordinary watercourses that drain into Minsmere Old River.	Loss of riverine habitat.	Realigned channel would be incorporated into the design.	No significant effects yet identified.		No significant effects yet identified.
	Fragmentation of riverine habitats.	The span of the new crossing would be designed with reference to the DMRB, ensuring potential effects are minimised.	No significant effects yet identified.		No significant effects yet identified.
	Disruption of riverine processes.		No significant effects yet identified.		No significant effects yet identified.
	Loss of floodplain habitat.	New culverts would be designed with reference to the DMRB, ensuring the effects are minimised.	No significant effects yet identified.		No significant effects yet identified.
	Fragmentation of floodplain and drain habitats.		No significant effects yet identified.		No significant effects yet identified.

Table 5.11.2 Summary of effects for operational phase

Surface water

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Main rivers and ordinary watercourses that drain into Minsmere Old River.	Fragmentation of riverine habitats.	The span of the new crossing would be designed with reference to the DMRB, ensuring potential effects are minimised. The realigned channel would be engineered so that the crossing point is perpendicular to the proposed development.	No significant effects yet identified.		No significant effects yet identified.
	Disruption of riverine processes.		No significant effects yet identified.		No significant effects yet identified.
	Loss of floodplain habitat.	New culverts would be designed with reference to the DMRB, ensuring the effects are minimised. Clear-spanning bridges to allow for 'natural' channel banks. Retention of remnant reaches of the previous alignment.	No significant effects yet identified.		No significant effects yet identified.
	Fragmentation of floodplain habitats.	New culverts would be designed with reference to the DMRB, ensuring the effects are minimised. Measures to offset habitat loss and fragmentation (e.g. buffer strips).	No significant effects yet identified.		No significant effects yet identified.

5.12. Flood risk

5.12.1. The figures for flood risk are presented in **Volume 3** as **Figures 5.12.1** and **5.12.2**.

a) Baseline environment

5.12.2. The proposed link road route has an undulating topography, with elevations generally higher at the western extent of the link road at the A12 and lower at the eastern end at its connection with the B1122.

5.12.3. The route corridor crosses two 'Main Rivers' (Middleton Watercourse and Theberton Watercourse) and three unnamed 'Ordinary Watercourses'. Further unmapped drainage ditches may also intersect the link road route and these would also be classified as ordinary watercourses. The Middleton Watercourse and Theberton Watercourse are tributaries to the Minsmere River.

5.12.4. The link road route is located entirely in Flood Zone 1 (**Figure 5.12.1**), although existing fluvial modelling does not extend to the proposed crossing points of the main rivers. Therefore, flood zones are not fully defined at the crossings.

5.12.5. The site area is located adjacent to the East Suffolk Internal Drainage Board (IDB) with only a very minor area being in the IDB area.

5.12.6. Overall, fluvial flood risk is low along the link road route, with localised areas of medium to high fluvial flood risk associated with the watercourse crossings.

5.12.7. The Environment Agency 'flood risk from surface water' map identifies the majority of the site to be at 'very low' surface water flood risk, with several localised areas having a 'low' to 'high' risk (**Figure 5.12.2**). Areas of 'low' to 'high' risk appear to be associated with watercourses, drainage features or low topographic areas.

5.12.8. The BGS Geology Map of Britain identifies the bedrock geology of the area as the Crag Group, formed of sand and is a permeable geology. Superficial geology in the area is geographically variable. Areas of higher permeability are found predominantly along watercourses, and areas with a more varied permeability found away from watercourses.

5.12.9. The risk of flooding from groundwater is slightly increased in the vicinity of the watercourses. However, given the site elevations and permeable geology, the overall risk of groundwater flooding to any significant depth across the site is considered to be low.

5.12.10. Sewers may be located within the proposed site area, however with a rural location and no recorded incidents of sewer flooding, the risk of sewer flooding is likely to be low.

5.12.11. The Environment Agency's Flood Map from Reservoirs indicates that the link road route is outside of the maximum reservoir flood extents. In addition, no canals are located near to the proposed link road. The flood risk to the site from reservoirs and canals is therefore considered low. A summary of the baseline flood risk is presented in **Table 5.12.1**.

Table 5.12.1 Summary of flood risk at the site

Source of flooding	Flood risk
Fluvial	Predominately low risk, based on limited existing modelling: less than 1 in 1,000 annual probability of river flooding in any year (<0.1%). Localised areas of high risk near watercourses: greater than 1 in 100 annual probability of river flooding in any year (>1%).
Tidal/coastal.	Low: less than 1 in 1,000 annual probability of sea flooding in any year (<0.1%).
Surface water (pluvial).	Majority of site Very Low: less than 1 in 1,000 annual probability of surface water flooding in any year (<0.1%). Seven areas associated with watercourses, ditches and valley bottoms, High: greater than a 1 in 30 annual probability of surface water flooding in any year (>3.3%).
Groundwater	Low: soil is permeable (pending further investigation) and no records of groundwater flooding.
Sewers	Low: greenfield site with highways and isolated farmsteads. Sewers likely to be located on-site.
Reservoirs	Not at risk of flooding from reservoirs.

b) Environmental design and embedded mitigation

5.12.12. The Sequential Test[13] aims to steer new development away from areas with a higher risk of flooding. Under the vulnerability classification, the proposed development would be considered as *'Essential Infrastructure'*.

5.12.13. The proposed development is predominantly in Flood Zone 1, although there are five watercourse crossings; two watercourses are Main Rivers and three are Ordinary Watercourses. These watercourses have not been modelled, however, surface water modelling has been undertaken and a narrow flood extent is shown on either side of these five watercourses. In addition, two other surface water flow paths are identified which are not associated with the Ordinary Watercourses identified using OS mapping.

5.12.14. Monitoring and maintenance of the drainage system would be carried out to preserve its integrity and maintain its design capacity.

i) Construction

5.12.15. A perimeter bund would likely be built to retain any surface water run-off on the site. Appropriate construction phase drainage would be designed to ensure surface water run-off does not increase off-site flood risk or create on-site flood risk. Detention ponds would likely be required to manage the run-off. Significant effects on flood risk are unlikely.

ii) Operation

5.12.16. Culverts are proposed over watercourses and would be sized to ensure appropriate flows and capacity are maintained in the watercourses.

5.12.17. A permanent drainage system would be constructed in accordance with DMRB (Ref. 5.12.1). The drainage system would consist of a combination of channels, kerb drains or gullies that would convey the surface water run-off to attenuation basins that infiltrate to ground, or discharge to a local watercourse at a controlled rate. Any existing surface water flooding experienced by existing roads, would be sought to be managed, where possible within the proposed Sizewell link road drainage system.

5.12.18. Climate change would be considered in the highway drainage design. The design would also consider exceedance flows to limit water depths in extreme rainfall events.

5.12.19. Flood storage compensation may be required to ensure the development does not increase flood risk elsewhere as a result of floodplain loss and there would be no significant effect on flood risk.

c) Preliminary assessment of impacts

5.12.20. Further assessment is required to fully understand the flood risk associated with the proposed link road, however, EDF Energy anticipates it will be possible to avoid any significant changes in flood risk through careful design. Culverts would be designed large enough to ensure that appropriate flows and capacity are maintained. Further assessment will indicate whether flood storage compensation would be required. Relatively standard drainage measures would be employed to manage surface water run-off. The implementation of these measures means it is likely there would be no significant effects on flood risk.

d) Additional mitigation and monitoring

5.12.21. The management of exceedance flows and the associated risks they present will be considered as part of the drainage design.

e) Preliminary assessment of residual effects

5.12.22. Monitoring and maintenance of the drainage infrastructure, together with suitable design for exceedance flows, would manage the minor residual risk resulting in negligible effects that would not be significant.

f) Completing the assessment

5.12.23. Further investigations will be required to progress the drainage design. A full FRA for this site will be submitted as part of the application for development consent after the proposals for the Sizewell C development as a whole are finalised.

[13] The sequential test aims to steer new development toward areas with the lowest probability of flooding. Under this policy, development should not be allocated or permitted if there are reasonably available sites appropriate for that development in areas of lower probability of flood risk.

Table 5.12.2 Summary of effects for construction phase

Flood risk

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Fluvial	The new road crossing an undetermined floodplain may increase flood risk both on-site and off-site.	Temporary works in the construction phase to maintain flow at the watercourse crossings. Monitoring and maintenance of temporary works to preserve integrity and maintain design standard.	Not significant.	Management of exceedance flows.	Not significant.
Surface Water.	Increase in impermeable area and associated surface water run-off during construction of site.	Shallow perimeter bunds constructed to contain surface water run-off on-site. Monitoring and maintenance of bund to preserve integrity and maintain design standard.	Not significant.	Management of exceedance flows.	Not significant.
	Off-site surface water flow crossing the site.	Perimeter ditch constructed outside of the perimeter bunds to intercept off-site surface water flows to infiltrate to ground. Monitoring and maintenance of ditch and bunds to preserve integrity and maintain design standard.	Not significant.	Management of exceedance flows.	Not significant.

Table 5.12.3 Summary of effects for operational phase

Flood risk

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Fluvial	Road crossing undetermined floodplain may increase flood risk both on-site and off-site.	Through culvert sizes and road design, minimise the road encroachment into the floodplain (and the provision of flood storage compensation if required).	Not significant.	Management of exceedance flows.	Not significant.
Surface Water.	Increase in impermeable area and associated surface water run-off from the site.	Surface water from impermeable areas discharged to infiltration SuDS including an allowance for climate change and incorporate the management of existing areas flood risk.	Beneficial	Management of exceedance flows.	Not significant.

5.13. Traffic and transport

a) Baseline environment

5.13.1. At present the most direct route from the A12 to the main development site is via the B1122 through Middleton Moor and Theberton.

5.13.2. The B1122 is a single carriageway road with a speed limit of 30mph in the villages together with 40mph and 60mph zones outside of built-up areas. The B1122 through Theberton currently has an average daily two-way traffic flow of 5,150 vehicles.

5.13.3. The A12 between Dorley's Corner (the junction of the A12 Saxmundham bypass and Main Road) and Yoxford is a single carriageway road with a 60mph speed limit. It currently carries approximately 14,700 vehicles per day.

5.13.4. Town Farm Lane runs eastwards from the A12 from a priority junction approximately 1.3 miles south of Yoxford. The road carries low volumes of traffic.

5.13.5. Littlemoor Road and Fordley Road are both minor routes with low volumes of traffic, running south-westwards from the B1122 at Middleton Moor towards Saxmundham. Hawthorn Road and Pretty Road also run westwards from the B1122 from Theberton and carry low volumes of traffic.

5.13.6. The A12 and B1122 are designated as a High and Heavy Load Route by Highways England; this route runs from Lowestoft Docks to Sizewell.

5.13.7. The section of the A12 between Dorley's Corner and Yoxford has 10 recorded highway collisions in the period between 2013 and 2017, of which two were serious in nature. A further five accidents (of which one was serious) occurred at Dorley's corner, while four accidents of slight severity occurred at the A12/B1122 junction at Yoxford.

5.13.8. There have been eleven accidents on the B1122 between the A12 and the MDS between 2013 and 2017. Three of these were serious in nature and occurred along the sections of the B1122 outside of built-up areas.

i) Public rights of way network

5.13.9. There are a number of public footpaths and bridleways which would intersect the proposed Sizewell link road route alignment, details of which are provided in **section 5.4**. of this chapter.

b) Environmental design and embedded mitigation

5.13.10. The proposed design of the Sizewell link road includes junctions with several existing minor roads. By providing these junctions, the design would mitigate against potential loss of amenity and increased mileage which would otherwise be experienced by existing users of these local roads.

5.13.11. Provision of a road overbridge where the Sizewell link road crosses the East Suffolk line would provide safety benefits by eliminating any possibility of a collision between vehicles and trains. This is because once the link road is operational vehicles travelling to and from the south would use this overbridge rather than the existing Middleton level crossing on the B1122.

i) Construction

5.13.12. It is anticipated that the main contractor's compound for the construction of the link road would be located at the western end of the scheme, close to the A12. There are likely to be two smaller compounds, one west of the railway bridge and the other at the junction of the B1122 and the Middleton Moor link.

5.13.13. Construction from the western end would lead to less disruption caused by construction traffic since these vehicles would maximise use of the A12 and avoid use of smaller roads where possible.

5.13.14. There would most likely be some short-term disruption to rail passengers while the road overbridge is installed. This disruption could be minimised by pre-fabricating the major components of the bridge and transporting them to the site for final assembly. Constructing the western section of the Sizewell link road prior to the bridge installation would, in turn, minimise the road disruption associated with the transport of large components of the bridge, since this transport could avoid using local roads.

5.13.15. Construction of the bridge over the railway is likely to take place early in the construction stage. The eastern section of the Sizewell link road would be constructed with access at the Middleton Moor link. While this would necessitate some use of the B1122, it would minimise the overall construction period.

ii) Operation

5.13.16. On a typical day at peak construction of Sizewell C in 2027, the predicted traffic flows on Sizewell link road are

9,650 vehicles per day to the east of the B1125 junction, the busiest section. Between the B1125 and the Middleton Moor link the predicted flow is 7,150 vehicles per day and west of the Middleton Moor link the forecast flow is lower at some 2,300 vehicles per day.

5.13.17. Sizewell C construction worker traffic, heavy and light goods vehicles and park and ride buses are forecast to make up 2,750, 2,150 and 1,150 vehicles per day of these totals respectively. The remainder of the forecast number of vehicles would be general traffic, including that associated with Sizewell B outages. As outages only occur approximately every 18 months, flows outside of outage periods would be lower.

5.13.18. The existing B1122 (which would be downgraded to an unclassified road once the Sizewell link road is operational) would remain in place and accessible from the existing Yoxford junction at the west and via a new priority junction with the Sizewell link road east of Theberton.

5.13.19. Sizewell link road would reduce traffic flows on the existing B1122 by 90%. In Theberton, the residual traffic flow through the village is forecast to be 650 vehicles per day while at Middleton Moor some 450 vehicles per day would remain on the existing road.

c) Preliminary assessment of effects

i) Construction

5.13.20. The environmental effects of construction of the Sizewell link road are anticipated to be modest. At peak, 175 HGVs per day would serve the construction compounds. The uplift in traffic on the surrounding highway network would be minimal compared to the existing traffic volumes on the A12. Up to 300 construction staff would be working on the construction of the Sizewell link road at peak times.

5.13.21. It is anticipated that the Sizewell link road would be built during the early years of project construction, while construction of the accommodation campus, both park and ride sites, the freight management facility and other associated development works such as the two villages bypass are also being built. The traffic modelling work undertaken has included the concurrent construction of these associated development schemes in this period.

5.13.22. Initial analysis suggests that the Sizewell link road would take about 24 months to build. It would be completed and opened to use before Sizewell C construction traffic reaches a peak in 2027.

5.13.23. Construction of the Sizewell link road carries transport-related environmental benefits since traffic flow along the existing A12 and B1122 would be largely unaffected during the construction period, with the exception of when work at the junctions at either end of the new road is taking place. This results in less disruption during the construction period compared to on-line alternatives (where upgrades are made to existing roads along their present alignments).

5.13.24. A small amount of short-term traffic delay would be experienced along the A12 when the new Sizewell link road would be tied in to the existing road. There is likely to be short-term traffic management needed at the B1122 at Theberton to allow construction of the junction with the Sizewell link road. The effect of this short-term disruption is not anticipated to be significant.

5.13.25. In the event of off-site construction and on-site assembly of the overbridge across the railway line, there may need to be occasional, short-term closures of the A12 to allow abnormal indivisible loads to access the construction site. The effect of this disruption would not be expected to be significant.

ii) Operation

5.13.26. The Sizewell link road would carry cars, buses and goods vehicles to and from the main development site, thereby removing the need for these vehicles to use the existing B1122.

5.13.27. By diverting through traffic away from the B1122, residents of nearby villages would experience the benefits of reduced traffic volumes which in turn improve the pedestrian amenity, reduce the risk of accidents, and facilitate access to and from side roads with reduced waiting times. Overall these would represent significant beneficial effects.

5.13.28. The Sizewell link road would also be open to general traffic both during and after the construction of Sizewell C. Drivers accessing the area would benefit from quicker journey times compared to the existing route via Yoxford and the B1122. There may also be associated benefits for users of local roads such as the B1069 since the presence of the Sizewell link road would make it less advantageous for vehicles to seek alternative routes, for example towards Leiston via Saxmundham Road. This would represent a moderate beneficial effect.

5.13.29. The presence of the Sizewell link road would also increase the resilience of the local road network. In case of disruption on the Sizewell link road, traffic serving the main development site may occasionally use the B1122 through Middleton Moor. This would represent a moderate beneficial effect.

d) Additional mitigation and monitoring

i) Construction

5.13.30. No additional mitigation measures are currently anticipated to be required during the construction of the Sizewell link road.

ii) Operation

5.13.31. The proposed design of the Sizewell link road includes a new roundabout on the B1122 west of Middleton Moor, with a new link road running south to join the Sizewell link road. It is likely that this would become the favoured route for traffic to and from the A12 north to access the Sizewell area, given that it would be shorter than travelling along the full length of the Sizewell link road and through to Yoxford at the A12.

5.13.32. Monitoring would ensure that Sizewell C buses and HGVs use the Sizewell link road rather than the existing B1122 through Theberton.

5.13.33. The existing volumes of traffic accessing the Sizewell area are modest, and the addition of an alternative route would further reduce the negative impacts on any single route by providing resilience whilst not generating additional demand.

e) Preliminary assessment of residual effects

i) Construction

5.13.34. The residual effects during construction are anticipated to be the same as those set out under preliminary assessment of effects described above.

ii) Operation

5.13.35. The residual effects during operation are anticipated to be the same as those set out under the preliminary assessment of effects described above.

f) Completing the assessment

5.13.36. Once the design for the Sizewell link road is developed further and in more detail, a traffic and transport assessment will be undertaken and will be used to inform the ongoing EIA and the ES.

5.14. Comparison between rail-led and road-led strategies

5.14.1. The Sizewell link road as assessed above would be built under the road-led strategy. However, that element of the Sizewell link road which comprises a bypass around Theberton, effectively the *eastern* section of the link road, would be similar under both the road-led and rail-led strategies and a short comparison is provided in the PEI for the Theberton bypass in **Volume 2**, **Chapter 6**.

5.14.2. The western section of the link road, the 4.2km length between the A12 and the western edge of Theberton would only be built under the road-led strategy. The assessment presented above does not separate out those effects which are likely to arise across the western section from those which would arise from the eastern section, i.e. the bypass around Theberton. Clearly, the effects which arise from land take of the western section would not arise if this section of the link road is not built. These include the local effects in this area associated with landscape and visual, terrestrial ecology, A&R, terrestrial historic environment, soils and agriculture, geology and land quality, groundwater, surface water and flood risk. The ongoing EIA will consider the differences between the effects arising from the two strategies, particularly in relation to the western section and they will help inform the decision on whether to pursue a road-led or a rail-led strategy.

5.14.3. The traffic-related effects, including both noise and air quality, are slightly different. If the link road is built, properties along the existing B1122, west of Theberton, such as those at Middleton Moor would benefit from reduced traffic levels, reduced road noise and reduced vehicle related emissions compared to the existing situation. The extent to which these beneficial effects would be significant will be assessed during the EIA and reported in the ES.

5.14.4. In the event that the western section is not built, i.e. under the rail-led strategy, the road traffic, including the Sizewell C construction traffic traveling between the A12 at Theberton, would continue to use the existing B1122. Under this strategy, there would be the potential for additional traffic-related effects, particularly noise effects, along the existing B1122 west of Theberton which would require mitigation. The extent to which these adverse effects would be significant will be assessed during the EIA and reported in the ES.

6. Theberton Bypass PEI

6.1. Introduction to Preliminary Environmental Information (PEI)

6.1.1. The Theberton bypass (refer to **Figure 2.11** in **Volume 1, Chapter 2**) is proposed as part of the rail-led strategy only although a bypass around Theberton is also included as part of the Sizewell Link Road, proposed under the road-led strategy. Details of the proposals are set out in full in **Volume 1, Chapter 11**.

6.1.2. The road would be 7.3 metres (m) wide with 1m hard strips, 2.5m wide verges, earthworks where needed and a 5m berm. EDF Energy is however consulting on a wider area during this Stage 3 consultation including the buffer zone shown as the faded aerial area on **Figure 2.11** in **Volume 1, Chapter 2**, as the design and landscaping mitigation has yet to be fully finalised, and in particular EDF Energy wishes to engage with land owners in relation to works which might accommodate the access works for their retained land.

6.1.3. The Theberton bypass would be open to public use alongside construction traffic associated with the project. After completion of the power station, it would be retained as a lasting legacy of the project. The bypass would become part of the adopted highway network and there would be no decommissioning or 'removal and reinstatement' phase. In the longer term, Suffolk County Council (SCC) may give consideration to amending the interfaces between the bypass and other roads, footpaths and bridleways along its route, following the completion of Sizewell C construction works when traffic flows would decrease.

6.1.4. This PEI chapter does not include detailed consideration of the highway improvements on Mill Street at Middleton Moor. These are covered in **Volume 2B, Chapter 12.**

6.1.5. The construction and operation of the Theberton bypass is likely to have some effects on the environment. The likely significant adverse and beneficial effects during the construction and operational phases are explained below. The scope of the preliminary assessment includes landscape and visual, terrestrial ecology and ornithology, amenity and recreation, geology and soils, land quality and agriculture, terrestrial historic environment, noise and vibration, air quality, groundwater, surface water, flood risk and traffic and transport and no topics have been 'scoped out' of the assessment. The chapter concludes with a short comparison between the road-led and rail-led strategies as relevant to the Theberton bypass.

6.1.6. This chapter presents each of the topics relevant to the proposals in turn, under the following sub-headings: (a) Baseline environment, (b) Environmental design and embedded mitigation, (c) Preliminary assessment of effects, (d) Additional mitigation and monitoring, (e) Preliminary assessment of residual effects and (f) Completing the assessment.

6.2. Landscape and visual

6.2.1. The figure for landscape and visual is presented in **Volume 3** as **Figure 6.2.1.**

a) Baseline environment

6.2.2. The proposed Theberton bypass would be approximately 2.6 kilometres (km) long and would run across a series of valleys associated with tributaries of the River Yox, that undulate from a high point of approximately 22m Above Ordnance Datum (AOD) on Pretty Road to low points of approximately 8m AOD near Valley Farm and on the B1122 at the eastern end of the route. The land use within the study area is predominantly arable farmland, with well-defined hedgerow field boundaries, interspersed with scattered woodlands and copses.

6.2.3. At a national level, the proposed route lies within National Character Area 82 (NCA82): Suffolk Coast and Heaths (Ref. 6.2.1). NCA82 comprises low-lying gently undulating farmland with areas of woodland, heath and forest plantation. The proposed route is located along the edge of one of the river valleys that are typical of the transition between NCA82 and the adjacent NCA83: South Norfolk and High Suffolk Claylands.

6.2.4. At a local level, the majority of the proposed route runs along the edge of two landscape types, as identified in the Suffolk County Landscape Character Assessment (Ref. 6.2.2). The first of these is the ancient estate claylands, as shown on **Figure 6.2.1.** The key characteristics are described in the Landscape Character Assessment as:

- *"Dissected Boulder Clay plateau;*
- *Organic pattern of field enclosures;*
- *Straight boundaries where influence of privately owned estates is strongest;*
- *Enclosed former greens and commons;*
- *Parklands;*
- *WWII airfields;*
- *Villages with dispersed hamlets and farmsteads;*
- *Timber framed buildings; and*
- *Distinctive estate cottages; and Ancient semi-natural woodland".*

6.2.5. The second landscape type is characterised as rolling estate claylands, as shown on **Figure 6.2.1**. This is a valley side landscape of clay loams with parklands and fragmented woodland. The key characteristics are described in the Landscape Character Assessment as:

- *"Flat landscape of light loams and sandy soils;*
- *Rolling valley-side landscape;*
- *Medium clay and loamy soils;*
- *Organic pattern of fields;*
- *Occasional areas of more rational planned fields;*
- *Numerous landscape parks;*
- *Substantial villages;*
- *Fragmented woodland cover, both ancient and plantation; and*
- *Winding hedged and occasionally sunken lanes".*

6.2.6. The locations of different groups of people within the study area who may experience views of the proposed development are shown on **Figure 6.2.1**. The key visual receptors within the study area include the following:

- The settlement of Theberton.
- Long distance routes including the B1122 and the Sandlings Walk Long Distance Walking Route (which is also a Sustrans Regional Cycle Route and lies approximately 1km to the east of the eastern end of the proposed route).
- The route intersects a number of Public Rights of Way (PRoWs) and local roads as shown on **Figure 6.2.1**. In addition, there are a number of PRoWs further away where walkers may see the proposed development (or traffic using the proposed development).
- Individual dwellings and farms along the route, with the closest residential properties being at Valley Farm, Theberton Hall and Theberton House.

6.2.7. Visibility of the proposed development from many of these locations is likely to be limited due to a combination of landform, woodland and established hedgerows. In most cases, visibility is likely to be limited to between 500m and 1km due to the presence of these existing features, particularly west of Theberton where the valley landform would begin to screen visibility. However, there are likely to be more distant views of the embankments crossing the small valleys along the proposed route from the south-west facing valley sides beyond the river Yox, which are approximately 1.6km from the route.

6.2.8. The Suffolk Coast and Heaths Area of Outstanding Natural Beauty (AONB) is located approximately 1.1km to the east of the proposed road at its closest point.

6.2.9. The Yox River valley and part of the valley sides to the north-east of the site are locally designated as a Special Landscape Area (SLA). Some parts of the proposed route would be adjacent to this area, at its eastern end and at the proposed junction with the B1125.

b) Environmental design and embedded mitigation

i) Construction

6.2.10. During the construction of the road, mitigation to help to manage and reduce potential landscape and visual effects would be difficult. However, potential mitigation measures during construction include providing localised screening and areas of new planting early on, allowing such screening and planting to become established throughout construction and for the operational stage. Early planting would be likely to include locations in the vicinity of settlements and residential properties such as Theberton and Valley Farm.

6.2.11. Existing woodlands, scrub and hedgerows within the site and adjoining the site boundaries would be retained where possible.

6.2.12. Construction compound to be located in close proximity to existing road infrastructure, in areas already disturbed by traffic. Existing vegetation to be retained around the compound area where possible to reduce visibility of the compound area.

6.2.13. Five PRoWs (all footpaths) would be diverted for the construction of the Theberton bypass (E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0 and E-515/013/0 as discussed in **section 6.4**).

ii) Operation

6.2.14. A number of mitigation measures have been identified and incorporated into the design for the operation phase of the proposed development, which would help to manage and reduce potential landscape and visual effects. These include the following:

- Existing woodlands, scrub and hedgerows within the site and adjoining the site boundaries would be retained where possible.
- New planting (carried out early on during construction where considered beneficial) would be used to screen and contain the proposed highway from adjoining properties/ PROWs but also to ensure the scheme is anchored into the existing landscape. This includes linear tree and hedgerow planting in keeping with existing hedgerow boundaries, as well as woodland blocks where existing fields are severed by the route and would otherwise create isolated pockets of land. These are characteristics of the existing landscape and would provide benefits in terms of screening and biodiversity.
- New planting (carried out early on during construction where considered beneficial) would be used around attenuation features to ensure they integrate with the surrounding landscape.
- Detailed design consideration would be given to each of the interfaces and crossing points with other access routes.
- During the operation of the Theberton bypass, short diversions of the PRoWs would be proposed to ensure safe crossing points of the Theberton bypass, as discussed in **section 6.4**.

c) Preliminary assessment of effects

i) Construction

6.2.15. During construction, there would be a localised change to the landscape character of the bypass and its immediate context. For example, it is likely that a section of a linear woodland belt to the west of the proposed development and Leiston Road would be removed, along with sections of hedgerows along the proposed route. Within both landscape character types, given the localised extent of the effects and the very short-term duration of the construction period, effects are unlikely to be significant.

6.2.16. During construction, there would also be localised visual effects for users of roads, including the B1122, and the footpaths crossed by or in close proximity to the site. These effects are difficult to mitigate unless there is an option for planting of off-site vegetation to begin in advance of the construction works. However, given the temporary duration of these effects, they are unlikely to be significant.

6.2.17. Given the distance of the Suffolk Coast and Heaths AONB from the site, and the relatively limited extent of visual effects, the construction of the proposed development would have no effect on the AONB.

6.2.18. For the most part, the SLA lies more than 0.5km from the route and at most of the points where it is closest there would either be limited visibility (south of and around

Theberton) or it is already close to existing roads. Given the localised extent of the effects and the very short-term duration of the construction period, effects on the special qualities of the SLA or the purposes of its designation during construction are unlikely to be significant.

ii) Operation

6.2.19. During the first years of operation, the route would be used by a mix of construction traffic for the Sizewell C project and members of the public. Once the construction of Sizewell C is complete, the removal of the Sizewell C construction traffic, combined with the establishment of new planting associated with Theberton bypass would result in reduced effects as described further below.

6.2.20. The route would lead to a localised effect on the landscape character of each of the existing fields that it passes through, arising from the change from arable fields to a road and associated changes such as embankments, cuttings, junctions, planting and/or drainage ponds. Effects would be significant and adverse due to the permanency of the physical changes to the landscape resulting from the introduction of the road infrastructure. However, these significant effects would not be widespread as a result of the embedded mitigation measures.

6.2.21. Beyond the immediate vicinity of the route itself, effects on landscape character would rapidly reduce. Roads are frequent in the local landscape and apart from more frequent use by larger construction vehicles during the construction of Sizewell C, the use of the route is not anticipated to be different to other roads in the study area. Within approximately 500m of the route, or closer where existing roads are present (i.e. beyond B1122 to the north and east), effects on landscape character would reduce so that they are not significant. Effects would also further reduce over time as indicated later in this chapter. This would be the case within both the 'ancient estate claylands' and the 'rolling estate claylands'.

6.2.22. Desk and field study has confirmed that the new route would not be visible from much of Theberton due to a combination of intervening buildings, landform and vegetation. Where any elements of the new infrastructure or traffic using the route would be visible, views are only likely to be possible from a limited extent of the village and consequently visual effects for residents of Theberton are unlikely to be significant.

6.2.23. For users of longer distance routes in the surrounding area, including the B1122 and the Sandlings Walk Long Distance Walking Route, there are likely to be views of the proposed route. The B1122 tends to be lined by vegetation such that views would be limited to glimpses and connecting junctions or crossing points. Glimpsed views of traffic using a road would have very limited visual impact on other users of the B1122. Views from Sandlings Walk Long Distance Walking Route would be at distances of over 1km, from beyond both the B1122 and areas of woodland. There are unlikely to be any significant visual effects for users of any of these longer distance routes.

6.2.24. Users of local roads and the five PRoWs which cross or closely approach the proposed development would experience some localised visual effects which are likely to be significant and adverse due to the permanency of the introduction of road infrastructure in views from the routes. However, these effects would only occur at the points where the PRoWs cross the proposed bypass and for short stretches either side of the proposed route. These effects would diminish with distance as most routes are hedge-lined, limiting outward views, and would also diminish with time as described above. Occasional more distant views would arise where routes cross open, higher ground or descend slopes which face towards the site. These views of relatively distant road traffic would be unlikely to give rise to significant effects.

6.2.25. The proposed development may be visible from a limited number of properties near to the route. The majority of rural properties already have hedges and/or trees around them which would provide mitigation. Effects on residential amenity would be mitigated via planting as appropriate to each case as part of the embedded landscape proposals.

6.2.26. Given the distance of the Suffolk Coast and Heaths AONB from the site, and the relatively limited extent of visual effects, the proposed development would have no significant effect on the AONB.

6.2.27. There are likely to be some localised effects on the SLA. For the most part, the SLA lies more than 0.5km from the route and at most of the points where it is closest there would either be limited visibility (south of and around Theberton) or it is already close to existing roads. Therefore, the proposed development would have limited impacts on the SLA. It is unlikely that there would be any significant effects on the special qualities of the SLA or the purposes of its designation.

d) Additional mitigation and monitoring

6.2.28. No additional measures are proposed.

e) Preliminary assessment of residual effects

6.2.29. During construction, there are unlikely to be any significant residual effects on landscape character, visual effects or effects on designated landscapes.

6.2.30. During the operational stage of the proposed bypass, there are likely to be very localised significant residual adverse effects on the character of the landscape within and immediately around the route, and on some views from existing local roads and PRoWs which cross or closely approach the route.

f) Completing the assessment

6.2.31. The ES will include a Landscape and Visual Impact Assessment (LVIA) underpinning the conclusions drawn above in relation to significant effects, updated where relevant to account for any design changes.

6.2.32. Viewpoints and selected visualisations of the proposals would be agreed with the Local Planning Authorities and key stakeholders. Viewpoints are likely to include the following locations:

- Viewpoints will be provided at Theberton to capture the likely effects on views to the south and south-west and on views to the north-west from the settlement.
- Viewpoints will be selected along the bypass route to represent users of PRoWs and local roads rerouted as part of the proposals or with views of the proposed bypass, as well as nearby residents.

Table 6.2.1 Summary of effects for the construction phase

Landscape and visual

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Landscape character.	Changes to landscape character and landscape features along the route and the surrounding landscape.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.
Visual receptors.	Changes to views for users of roads and footpaths in close proximity to the site.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.
Suffolk Coast and Heaths AONB.	Effects on special character and purposes of designation.	None required.	Not significant.	None required.	Not significant.
Localised area of the the SLA - River Yox valley.	Effects on special character and purposes of designation.	None required.	Not significant.	None required.	Not significant.

Table 6.2.2 Summary of effects for the operational phase

Landscape and visual

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Landscape character within the site and its surrounding context.	Introduction of a new road with associated earthworks and infrastructure.	Retention of established vegetation. Introduction of appropriate landscape proposals.	Significant	None	Significant
Landscape character beyond approximately 500m of the route.	Changes to landscape character and key characteristics within the surrounding landscape.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.
Users of the five footpaths and local roads that currently cross the proposed route.	Direct change to existing routes and localised views of new road with associated infrastructure.	Retention of established vegetation. Short diversions of existing routes.	Significant	None	Significant
Other visual receptors.	Changes to views for local residents and users of roads, other footpaths and bridleways in close proximity to the site.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.
Suffolk Coast and Heaths AONB.	Effects on special character and purposes of designation.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.
Localised area of the the SLA - River Yox valley.	Effects on special character and purposes of designation.	Retention of established vegetation. Introduction of appropriate landscape proposals at an early stage.	Not significant.	None required.	Not significant.

6.3. Terrestrial ecology and ornithology

6.3.1. The figure for terrestrial ecology and ornithology is presented in **Volume 3** as **Figure 6.3.1**.

a) Baseline environment

6.3.2. This baseline has been compiled following a detailed review of desk study information, including a data request from the Suffolk Biodiversity Information Service (SBIS), a review of aerial photographs and Ordnance Survey (OS) maps; and a preliminary assessment of habitats from PRoWs.

6.3.3. There are two European designated sites comprising Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites within a 5km radius of the proposed Theberton bypass (some sites carry more than one designation). These are: Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Ramsar located approximately 1.5km north-east; and Sandlings SPA located approximately 3.5km south-east.

6.3.4. There are four nationally designated sites (Sites of Special Scientific Interest (SSSI)) within 5km of the proposed Theberton bypass, these being: Minsmere-Walberswick Heaths and Marshes SSSI located approximately 0.9km east; Sizewell Marshes SSSI located approximately 2km south-east; Leiston-Aldeburgh SSSI located approximately 3.5km south; and Potton Hall Fields, Westleton SSSI located approximately 4.4km north-east.

6.3.5. There are eight non-statutory designated County Wildlife Sites (CWS) within a 2km radius of the proposed Theberton bypass. These are: Kiln Grove and Meadow CWS and Theberton Woods CWS, located within 0.5km; Leiston Airfield CWS, Minsmere Valley Reckford Bridge to Beveriche Manor CWS and Minsmere Valley Eastbridge to Reckford Bridge CWS, all located approximately 1km away; Sizewell Levels and Associated Areas CWS, Buckle's Wood CWS and Darsham Marshes CWS (which is also a Suffolk Wildlife Trust (SWT) reserve) all located approximately 1.5-2km away. Another SWT reserve, Sizewell Belts, is also located within 2km of the Theberton bypass, approximately 1.9km south-east.

6.3.6. The habitat within the proposed route alignment is predominantly arable farmland. Other habitats present include: semi-improved species-poor grassland; a block of deciduous woodland (Plumtreehills Covert) with several mature trees; hedgerows (including species-rich hedgerows with mature trees); and two minor watercourses. Deciduous woodland and hedgerows are habitats of principal importance (Ref. 6.3.1, section 41). Other habitat types within 500m of the proposed route alignment include a number of ponds, wood pasture, lowland meadows, semi-improved grassland and coastal and floodplain grazing marsh. Coastal and floodplain grazing marsh, lowland meadows, ponds and wood pasture are habitats of principal importance. Data from SBIS identified the presence of a number of ancient/veteran/notable trees within 1km of the proposed route alignment.

6.3.7. The two small watercourses within the proposed route alignment provide a hydrological link to the Minsmere River, which in turn flows into the Minsmere to Walberswick Heaths and Marshes SAC, SPA, Ramsar and SSSI.

6.3.8. A number of notable invertebrate species have been recorded in the wider area, predominantly associated with the surrounding designated sites. Based on the information to date, and given that the habitat within the proposed route alignment is predominantly arable farmland, the habitats within and in close proximity to the proposed route alignment are unlikely to be of particular importance to notable invertebrate species.

6.3.9. There are records of great crested newt[1] (*Triturus cristatus*) from within the 2km search area. Theberton Woods CWS, located approximately 650m west of the proposed route alignment, contains ponds which support a population of great crested newts. Approximately 26 ponds that could support this species are present within 500m of the proposed route alignment. Habitats within the proposed route alignment such as the woodland blocks, and the field and woodland margins, provide suitable habitat for the terrestrial phase of the species, including potential hibernation sites, and aid connectivity to the wider landscape.

6.3.10. The majority of the proposed route alignment consists of suboptimal habitat for reptiles[2] although field and woodland margins could provide suitable foraging habitat for a small number of reptiles, and there are records of common reptile species in the vicinity. The proposed route alignment and adjacent areas comprise predominantly arable farmland and the habitats are unlikely to be of particular importance to reptiles.

[1]Great crested newts are a European Protected Species (EPS), receiving protection under the Conservation of Habitats and Species Regulations (2017) (Ref. 6.3.2). They are also protected under the Wildlife and Countryside Act 1981 (Ref. 6.3.3) and are a species of principal importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

[2]All UK species of reptiles are protected under the Wildlife and Countryside Act 1981, making it an offence to kill or injure these species. They are also species of Principal Importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006).

6.3.11. Breeding birds typical of open agricultural habitats are present, including linnet (*Linaria cannabina*) and yellowhammer (*Emberiza citronella*), as well as ground-nesting birds such as skylark (*Alauda arvensis*). Barn owl[3] (*Tyto alba*) is also present in the vicinity of the proposed route alignment, with the majority of records from the Minsmere Valley Reckford Bridge to Beveriche Manor CWS.

6.3.12. Serotine (*Eptesicus serotinus*), Daubenton's bat (*Myotis daubentonii*), Natterer's bat (*Myotis nattereri*), noctule (*Nyctalus noctule*), common and soprano pipistrelle bats (*Pipistrellus pipistrellus* and *Pipistrellus pygmaeus*), and brown long-eared bat (*Plecotus auritus*)[4] have been recorded in the wider area, with records of both roosts and foraging activity. In addition, there are three records of the rare barbastelle (*Barbastella barbastellus*) from the Leiston area to the south of the proposed route alignment, the closest of which is from a location approximately 1.2km away. Barbastelle is also present within the main development site, approximately 2km to the east of the proposed route alignment. Linear features such as hedgerows within the proposed route alignment and the wider area are likely to be of value to foraging and commuting bats and woodland; wood pasture and parkland may also provide important foraging habitat. Mature trees and buildings may be of value to roosting bats. Overall, habitats and features along and within proximity of the proposed route alignment have the potential to be of value to a number of bat species. No statutory designated site within 10km cites bats as a designated interest feature.

6.3.13. There are records of otter[5] (*Lutra lutra*) from within the area, predominantly from the Minsmere Valley. Whilst otters may travel along the small watercourses within the proposed route alignment, the site is unlikely to be of particular value to otters.

6.3.14. There are records of water vole[6] (*Arvicola amphibious*) from within the area. Both the Minsmere to Walberswick Heaths and Marshes SSSI and Sizewell Marshes SSSI support a nationally important population of water voles (Ref. 6.3.5). It is possible that water voles are present on the two small watercourses crossed by the proposed route alignment, although they did not appear particularly suitable being relatively small ditches with little emergent or aquatic vegetation heavily shaded by scrub and bramble.

6.3.15. Badgers[7] (*Meles meles*) are widespread along the proposed route alignment.

b) Environmental design and embedded mitigation

6.3.16. A summary of the measures that have been incorporated into the design of the proposed development and that will protect the existing features of ecological interest are set out below.

i) Construction

- The proposed route alignment has avoided direct land take from designated sites. Mitigation for the loss of any valuable habitats, including woodland and hedgerows, would be incorporated into the scheme design, as far as possible.
- The Construction Environmental Management Plan (CEMP) would define any ecological constraints and specify any measures required during enabling works and construction in relation to the presence of protected species and any required vegetation clearance works. It would specify the need for an Ecological Clerk of Works to undertake and oversee specific tasks.
- Should a great crested newt population be identified that could be fragmented by the proposed route alignment, then design measures such as newt tunnels would be included to maintain connectivity.
- Should confirmed barn owl nest sites or potential nest sites be identified within the proposed route alignment, it would be appropriate to install replacement nesting feature(s). It may be necessary to install these some distance from the road, so that barn owls are not encouraged to forage along the verge, which could result in collisions with vehicles.
- Temporary construction lighting would be designed to minimise light-spill into adjacent habitats. This would reduce impacts on nocturnal species such as bats that may use nearby habitats for roosting or foraging.
- If habitat loss for foraging bat species is considered significant, then habitat enhancement measures would need to be incorporated to replace the foraging resource available to bat species.

[3]All wild birds, their eggs and nests are protected under Section 1 of the Wildlife and Countryside Act 1981. Barn owls are also listed on Schedule 1 of the Wildlife and Countryside Act 1981 and are afforded extra protection against disturbance whilst nesting.

[4]All species of bat in the UK are EPSs, receiving protection under the Conservation of Habitats and Species Regulations (2017). They are also protected under the Wildlife and Countryside Act 1981. Several bat species, including soprano pipistrelle (Pipistrellus pygmaeus), brown long-eared bat, noctule and barbastelle bat are species of principal importance for the conservation of biodiversity in England, as listed under Section 41 of the NERC Act (2006). Barbastelle bats are also listed in the European Commission (EC) Habitats Directive (1992) (Ref. 6.3.4, Annex II), requiring the establishment of SACs to conserve this species.

[5]Otter is an EPS on Schedule 2 of the Conservation of Habitats and Species Regulations (2017) and protected under Schedule 5 and 6 of the Wildlife and Countryside Act 1981 and is included within Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006).

[6]Water vole is protected under Schedule 5 of the Wildlife and Countryside Act 1981 and included within Section 41 of the NERC Act (2006).

[7]Badgers are protected under the Protection of Badgers Act (1992) (Ref. 6.3.6).

- If confirmed to be present along the route alignment, passage for otters and water voles would be maintained during construction along the small watercourses.

ii) Operation

- It may be necessary to incorporate measures to deter barn owls from foraging along the road verge, as this could result in incidental mortality through collisions with road traffic. Such measures may include dense landscape planting.
- Should lighting be required for the operational bypass it would be designed to minimise light-spill into adjacent habitats. This would reduce impacts on nocturnal species such as bats that may use nearby habitats for roosting or foraging.
- If predicted noise levels are likely to significantly adversely affect key habitat features supporting sensitive species (e.g. woodland supporting roosting bats), then acoustic fencing or similar would be constructed between the road alignment and habitat supporting these species.
- Safe crossing points to facilitate the passage of bats across the road alignment would be incorporated if key foraging or commuting routes are identified, to reduce the potential for incidental mortality as a result of bats crossing the road and colliding with vehicles. These features would also facilitate the passage of other species, such as great crested newts and badgers, should this be required.
- The crossing points at small watercourses would ensure passage for otters and water voles is maintained with fencing to guide otters to crossing points.

c) Preliminary assessment of effects

6.3.17. Significant effects on designated sites, plants and habitats, invertebrates, reptiles, breeding birds, otters, water voles and badgers are not anticipated and they are not discussed further in this section of the PEI. However, a detailed impact assessment will be presented for these habitats and species within the ES and further details of the embedded mitigation required to offset any significant effects would similarly be provided.

6.3.18. Significant effects on great crested newts and bats are possible. A preliminary assessment of effects on these species is provided below.

i) Construction

6.3.19. Waterbodies in the vicinity of the proposed route alignment are known to support breeding great crested newts. Based on the current understanding (through OS maps and aerial imagery), some ponds are close to the proposed alignment, although it is unlikely that any would be lost as a result of the road. However, suitable terrestrial habitat would be lost, potentially resulting in injury or mortality of great crested newts and loss of resting places. The proposed route alignment could also result in fragmentation of great crested newt populations. There is the potential for a significant adverse effect if the ponds and related terrestrial habitats are important for great crested newts.

6.3.20. Noise and lighting could potentially temporarily disturb roosting and foraging bats, in particular within Plumtreehills Covert and other, unnamed woodland blocks nearby. In addition, the construction of the proposed route alignment could impact bat roosts and foraging areas through the loss of habitat and mature trees, as well as potential population fragmentation should this habitat loss result in the severance of commuting routes. There is the potential for a significant adverse effect if hedgerows and adjacent woodland areas are important for bats.

ii) Operation

6.3.21. Due to the embedded mitigation, effects on bats are not considered likely to be significant. Great crested newts would continue to experience the fragmentation effect from construction. This impact would be minimised through the embedded mitigation to include habitat mitigation, newt tunnels and other measures, that will be fully described within the ES. Operational phase effects on great crested newts are unlikely to be significant.

d) Additional mitigation and monitoring

6.3.22. The assessment has identified the potential for significant effects to occur on bats and great crested newts during construction, despite the embedded mitigation measures. Additional mitigation measures may therefore be required to minimise impacts so that significant effects are avoided. Furthermore, additional mitigation measures may also be required in relation to habitats and species for which a significant effect is not anticipated, but which are nonetheless legally protected, to ensure compliance with legislation. Under the CEMP, pre-construction surveys will be required and may result in mitigation measures such as micro-siting of specific elements of the project and/or licences for protected species. Monitoring of mitigation measures may also be required to ensure its effectiveness. The mitigation and monitoring measures would be presented in the ES, if relevant.

e) Preliminary assessment of residual effects

6.3.23. Following the implementation of the additional mitigation, significant residual effects are not envisaged during either the construction or operational phases.

f) Completing the assessment

6.3.24. To inform the development of appropriate mitigation measures and complete the ES, an extended Phase 1 habitat survey would be undertaken within the proposed route alignment. The focus of the surveys would be to identify any ecological constraints, such as the presence of legally protected species.

6.3.25. Once the surveys have been completed, the detailed ecological assessment for the ES will then be progressed, clarifying whether significant adverse effects are likely, particularly in respect of great crested newts, bats, otters and water voles. Any further embedded mitigation measures which would be required to mitigate these effects will also be defined and incorporated into the design.

Table 6.3.1 Summary of effects for construction phase

Terrestrial ecology and ornithology

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
European and nationally designated site: Minsmere to Walberswick Heaths and Marshes SAC, SPA, Ramsar site and SSSI.	Pollutants entering the Minsmere river upstream of the designated site.	Appropriate surface water control and chemical management outlined in the CEMP. Construction Surface Water Management Plan.	Not significant.	None required	Not significant
Other European and nationally designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required	Not significant
Non-statutory designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required	Not significant
Deciduous woodland.	Habitat loss within 'Plumtreehills Covert'.	Mitigation for habitat loss incorporated into scheme design.	Not significant.	None required	Not significant
Hedgerows	Habitat loss.	Mitigation for habitat loss incorporated into scheme design.	Not significant.	None required	Not significant
Watercourses and ditches.	Potential pollution from surface water run-off and spillages.	Appropriate surface water control and chemical management outlined in the CEMP. Construction Surface Water Management Plan.	Not significant.	None required	Not significant
Coastal floodplain grazing marsh.	Potential pollution from surface water run-off and spillages.	Appropriate surface water control and chemical management outlined in the CEMP. Construction Surface Water Management Plan.	Not significant.	None required	Not significant

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Great crested newts.	Habitat loss and severance; and incidental injury and mortality.	Design measures, such as newt tunnels, to facilitate maintaining connectivity within any identified meta-population.	Potential adverse significant effect.	Potential mitigation measures under Natural England licence	Not significant
Reptiles	Habitat loss and incidental mortality.	Measures for reptile mitigation outlined in CEMP.	Not significant.	None required	Not significant
Barn owl.	Loss of nest sites.	Installation of replacement nest sites.	Not significant.	None required	Not significant
Other breeding birds.	Loss of habitat for nesting and foraging.	Measures for nesting birds and vegetation clearance outlined in the CEMP.	Not significant.	None required	Not significant
Bat assemblage	Severance of commuting routes and incidental mortality.	Retention of majority of tree resource. Safe crossing points to facilitate the passage of bats across the road alignment.	Potential adverse significant effect.	Potential mitigation measures under Natural England licence.	Not significant.
	Loss of roosting resource (trees).	Retention of majority of tree resource. Early provision of new roost resource (e.g. bat boxes).	Potential adverse significant effect.	Potential mitigation measures under Natural England licence	Not significant.
	Noise and lighting disturbance causing fragmentation and displacement of resident bat populations.	Noise and lighting control measures set out in CEMP.	Potential adverse significant effect.	Potential mitigation measures under Natural England licence.	Not significant.
Otters	Habitat loss and severance.	Passage for otter maintained.	Not significant.	Potential mitigation measures under Natural England licence.	Not significant.
Water vole	Habitat loss and severance.	Passage for water vole maintained.	Not significant.	Potential mitigation measures under Natural England licence.	Not significant.
Badgers	Loss and severance of habitat. Disturbance or damage to existing setts.	Measures to protect badgers from construction works detailed in CEMP.	Not significant.	Potential mitigation measures under Natural England licence.	Not significant.

Table 6.3.2 Summary of effects for operational phase

Terrestrial ecology and ornithology

Topic/receptor	Potential impact	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
European and nationally designated site: Minsmere to Walberswick Heaths and Marshes SAC, SPA, Ramsar site and SSSI.	Pollutants entering the Minsmere river upstream of the designated site.	Sustainable Drainage Systems (SuDS).	Not significant.	None required.	Not significant.
Other European and nationally designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Non-statutory designated sites.	No direct or indirect impact pathway identified.	None required.	Not significant.	None required.	Not significant.
Coastal floodplain grazing marsh.	Potential pollution from surface water run-off and spillages.	SuDS	Not significant.	None required.	Not significant.
Watercourses and ditches.	Pollutants entering watercourses and ditches.	SuDS	Not significant.	None required.	Not significant.
Great crested newts.	Habitat severance.	Safe crossing points to facilitate the passage of animals.	Not significant.	None required.	Not significant.
Barn owl.	Incidental mortality from road collisions.	Incorporate measures to deter barn owls from foraging along road verge, e.g. dense landscape planting.	Not significant.	None required.	Not significant.
Bat assemblage.	Habitat severance for foraging and commenting bats; and incidental mortality.	Safe crossing points to facilitate the passage of bats.	Not significant.	None required.	Not significant.
	Impacts from noise and lighting.	Sensitive lighting scheme acoustic fence or similar between road alignment and habitats supporting sensitive species.	Not significant.	None required.	Not significant.
Otters	Habitat severance.	Safe crossing points to facilitate the passage of animals. Fencing would guide otters to crossing points.	Not significant.	None required.	Not significant.
Water vole.	Habitat severance.	Safe crossing points to facilitate the passage of animals.	Not significant.	None required.	Not significant.

6.4. Amenity and recreation

6.4.1. The figure for amenity and recreation is presented in **Volume 3** as **Figure 6.4.1**.

a) Baseline environment

6.4.2. Amenity and recreation resources comprise PRoWs and cycle routes passing through the rural, predominantly arable agricultural landscape surrounding Theberton as shown on **Figure 6.4.1**. Users of PRoWs that are likely to be affected to a greater degree and impacts are assessed at subsection (c). There are other recreational resources within the 1km study area but the proposed development is unlikely to be perceptible from most of these.

6.4.3. The following footpaths cross the line of the proposed development and would therefore require local changes to the paths including potential diversions (named from west to east): E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0 and E-515/013/0.

6.4.4. The following footpaths pass within the proposed site boundary and may be affected by the proposed development, but they do not cross the route of the road: E-396/016/0 and E-515/007/0. They may also require local changes including potential diversions.

6.4.5. A number of other PRoWs as well as open access land at Theberton Woods and Suffolk Coastal Cycle Route and Sustrans Regional Cycle Route (41/42) lie within the 1km study area as shown on **Figure 6.4.1**.

b) Environmental design and embedded mitigation

6.4.6. All PRoWs crossings of the proposed road route would be at grade (at the same level as the road). Designs for these crossings would be undertaken prior to the application for development consent and may include gates, stiles and short diversions to ensure minimal impact on users. Temporary diversions would be required during construction; the length of these would be kept to a minimum and they would be agreed with SCC and Suffolk Coastal District Council (SCDC). Once the proposed development has been constructed and is operating, permanent diversions would be required.

6.4.7. Existing vegetation would be retained and new native tree and shrub planting implemented to screen and contain the proposed development in views from recreational resources and to integrate it into the existing landscape, where possible, as described in **section 6.2**. Measures to minimise noise and changes to air quality would be implemented as described in **section 6.7** and **section 6.8**.

c) Preliminary assessment of effects

6.4.8. People using the recreational resources may experience impacts due to physical changes to recreational resources such as PRoWs diversions, changes to views and increases in noise levels, dust and other emissions caused by the proposed development.

6.4.9. The preliminary assessment of effects presented below will be reviewed and, if necessary, modified when detailed information on project design is known.

i) Construction

6.4.10. Users of footpaths E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0, E-515/013/0, E-515/007/0 and E-396/016/0 would cross or potentially be affected by the proposed development. Users would have direct views into the proposed road corridor and would experience construction related noise and potentially small changes to air quality. There are likely to be temporary diversions during construction. Effects are likely to be significant and temporary.

6.4.11. Users of other recreational resources outside the site would be likely to have views of and potentially hear noise from the construction works but effects are unlikely to be significant.

ii) Operation

6.4.12. Users of footpaths E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0, E-515/013/0, E-515/007/0 and E-396/016/0 would cross or potentially be physically affected by the proposed development, including some permanent diversions. Users would have direct views of the Theberton bypass, hear traffic-related noise and potentially experience small changes to air quality. Effects are likely to be significant.

6.4.13. Users of other recreational resources outside the site are likely to have views of and potentially hear traffic-related noise but effects are unlikely to be significant.

6.4.14. The bypass would take traffic off existing roads bringing some benefits to users of recreational resource in the vicinity of those roads, in the form of reduced visual and noise disturbance from traffic. Effects are unlikely to be significant.

d) Additional mitigation and monitoring

6.4.15. No additional mitigation is proposed.

e) Preliminary assessment of residual effects

6.4.16. During the construction and operational stages of the proposed development there are likely to be significant residual effects on users of footpaths E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0 and E-515/013/0, E-515/007/0 and E-396/016/0, subject to detailed design of the road and footpath diversions. There are unlikely to be significant residual effects on users of other recreational resources.

f) Completing the assessment

6.4.17. The ES would present an amenity and recreation impact assessment which is expected to underpin the preliminary conclusions drawn above in relation to significant effects, updated where relevant to account for any design changes and assessment.

Table 6.4.1 Summary of effects for construction phase

Amenity and recreation

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0 and E-515/013/0, E-515/007/0, E-396/016/0 and E-515/007/0.	Physical changes to routes. Changes to views and noise.	Native tree and hedgerow planting to screen and contain the proposed bypass in views from recreational resources and to integrate it into the existing landscape, where possible. Measures to minimise noise and changes to air quality.	Significant	None	Significant
Users of other amenity and recreation resources.	Users of some PRoWs, and other recreational resources are likely to experience changes to views and noise.	Native tree and hedgerow planting to screen and contain the proposed bypass in views from recreational resources and to integrate it into the existing landscape, where possible. Measures to minimise noise and changes to air quality.	Not significant.	None	Not significant.

Table 6.4.2 Summary of effects for operational phase

Amenity and recreation

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Users of footpaths E-396/015/0 and E-515/005/0, E-515/003/0, E-515/004/0 and E-515/013/0, E-515/007/0, E-396/016/0 and E-515/007/0.	Physical changes to routes. Changes to views and noise.	Native tree and hedgerow planting to screen and contain the proposed bypass. Measures to minimise noise and changes to air quality.	Significant	None	Significant
Users of other amenity and recreation resources.	Users of some PRoWs, and other recreational resources are likely to experience changes to views and noise.	Native tree and hedgerow planting to screen and contain the proposed bypass. Measures to minimise noise and changes to air quality.	Not significant.	None	Not significant.

6.5. Terrestrial historic environment

6.5.1. The figure for terrestrial historic environment is presented in **Volume 3** as **Figure 6.5.1**.

a) Baseline environment

6.5.2. An archaeological Desk Based Assessment (DBA) has been undertaken for the Theberton bypass. The DBA considered existing records of archaeological features and investigations as well as historic mapping, aerial photography and documentary sources. Searches of Suffolk Historic Environment Record (HER), Historic England's Archives Monuments Information England (AMIE) (non-designated records), and the National Heritage List for England (designated assets) were undertaken in April 2018. A study area of 750m from the site boundary was considered for the assessment, with consideration given to assets beyond this which may be subject to settings effects.

6.5.3. One designated heritage asset lies within the site boundary. The Grade II listed Gate and Gate Piers at junction of Leiston Road and Onner's Lane (LB 1287303).

6.5.4. Thirty-two listed buildings lie within the 750m study area. One of these is listed at Grade I (The Church of St Peter; LB 1227756), one at Grade II* (Theberton House; LB 1228378), with the remainder being listed at Grade II and comprising buildings associated with Theberton House and buildings within Theberton village, as well as farmhouses and associated buildings and cottages. One scheduled monument extends into the south-eastern part of the study area – Leiston Abbey (second site) and moated site (SM 1014520).

6.5.5. One HER record lies within the site boundary – a bronze spout in the form of a dog's head (MSF2059) from a medieval cauldron or aquamanile (a water container in the form of a mammal or bird), was found in fields to the south of Theberton. A further 23 HER records are located within the study area. The records comprise a variety of heritage features ranging from prehistoric flint artefact scatters to the Second World War (WWII) Theberton airfield. The SCC HER also includes one non-designated park identified in SPG6 – Rookery Park (MSF17530). These records are discussed more fully below.

6.5.6. There is strong continuity in the field patterns around Theberton, evident from an analysis of Tithe maps and modern satellite imagery. A number of potentially important hedgerows are located within the site. As a result, it is likely that the majority of surviving hedgerows within the site would be considered important under the Hedgerow Regulations (1997), (Ref. 6.5.1, Schedule 1, fn8).

6.5.7. The HER includes seven records of archaeological investigations undertaken across parts of the study area, although none within the site boundary itself. These include evaluations, monitoring works and historic building recording.

6.5.8. The AMIE includes 14 records within the study area, (eight monument records, and six archaeological events). Many of these duplicate the HER data, designated data and events records, and have been used to support the baseline chronology and understanding of the archaeological potential of the site.

i) Prehistoric to Iron Age

6.5.9. No remains dating to the earlier prehistoric periods have been found within the site boundary or study area. An artefact scatter, which included a single sherd of struck flint dating to the later prehistoric period was found during evaluation trenching in 2015 at land adjoining Green Garth in Middleton (ESF23184; MSF33545).

6.5.10. A number of undated cropmarks are known within the 750m study area, including a probable ring ditch bisected by a linear feature to the south-west of Middleton which has been suggested to be the remains of a prehistoric burial mound (MSF14165). Shards of Early Bronze Age cinerary urn were found "in a mound" in the garden of Theberton Old Rectory at the western edge of the village before 1962 (MSF2060), although the HER record notes that a later site visit revealed that the mound had been mutilated, with a path cut through and had been landscaped.

6.5.11. The contextual evidence would suggest that there is the potential for prehistoric activity, both in terms of settlement as well as funerary activity, within the site. The topographic location on the southern edge of the river valley would also provide a favourable location for such activity.

6.5.12. No finds dating to the Iron Age are known within the site boundary or study area.

ii) Romano-British

6.5.13. No finds dating to the Romano-British period are known within the site boundary.

6.5.14. A multiphased field system was identified through cropmarks at the eastern end of the 750m study area (MSF33481) close to Eastbridge, during the Suffolk Coast and Heaths National Mapping Program (NMP), the earlier phases of which may date to the Roman period.

6.5.15. There is no specific evidence for remains of this date to be present within the proposed route, although this possibility cannot be ruled out and further archaeological investigation will allow for a clearer understanding of this potential.

iii) Early-medieval and medieval

6.5.16. No remains dating to the early-medieval period are known within the site boundary. A chance find dating to the medieval period was found within the site boundary – a bronze spout in the form of a dog's head (MSF2059) from a medieval cauldron or aquamanile (a water container in the form of a mammal or bird) (MSF2059) was found in fields to the south of the eastern end of the route.

6.5.17. The church of St Peter (LB I 1227756) in Theberton, dates to the 12th century with early 14th, 15th and 19th century additions. The church may have been included in Domesday as one of the three churches in the parish of Leiston which Scarfe proposes as a possible minster site (MSF14148), suggesting earlier origins.

6.5.18. The scheduled area for Leiston Abbey (SM 1014520) falls within the 750m study area. Monastic sites would have comprised relatively small and tightly grouped complexes and would not have extended onto the site, although the site may include elements of the wider monastic landholdings. Field systems identified through the NMP at the south-eastern edge of the study area (MSF16787), to the north-west of the Leiston Abbey site are currently undated, but the HER record notes that they could be associated with Leiston Abbey.

6.5.19. A number of further records for artefact scatters and chance finds dating to the medieval period are known within the wider 750m study area. These include metalwork and coins (MSF13174) found just outside Theberton. Evaluation trenching (ESF20192) at Theberton Hall Farm reservoir uncovered a number of features, two of which contained medieval pottery, and one shard of medieval pottery was found during trenching for a small residential development within Theberton (ESF22179).

6.5.20. The absence of any stratified material of this date within the study area suggests that the potential for further, as yet unknown remains with the site boundary dating to the early medieval period is low. However, early medieval settlement sites can be difficult to identify without detailed archaeological investigation.

6.5.21. It is clear that a settled manorial geography, which is likely to have provided the basis for the medieval settlement pattern, was established during the early-medieval period. It is unlikely that further, as yet unknown, substantial medieval remains lie within the site boundary, although potential remnants of field systems and/or Abbey landholdings may be present; and the potential for further medieval remains is therefore considered to be low. Further archaeological investigation will allow for a more detailed understanding of this potential.

iv) Post-medieval

6.5.22. The post-medieval period is well represented within the study area. Recorded assets include village buildings, agricultural buildings, and larger estate houses, as well as farms including Dovehouse Farmhouse (LB 1199213) and Valley Farmhouse and outbuildings (LB 1283470 and LB 1377245). Large estate houses including Theberton House (LB 1228378) are also present within the site boundary. A post-medieval post mill (MSF12570) once lay to the south of Middleton, and a five storey tower mill (MSF12516) in fields to the east of Theberton built in the 18th century, further attest to the agricultural nature of the study area during this period. Both were demolished in the early 1900s.

6.5.23. The basic settlement geography established in the medieval period remained through the post-medieval period. The principal change in this period in East Anglia was in terms of the use and demarcation of land, with the steady enclosure and 'improvement' of lands, and subsequent merging of fields. However, an analysis of historic mapping and satellite imagery revealed a large degree of continuity in field patterns within the study area.

6.5.24. The potential for further as yet unknown heritage assets dating to this period is considered low. The existing pattern of farmsteads and settlements appears to have been established by the late 18th century, and mapping evidence does not suggest the presence of any significant sites other than these farmsteads which are still extant.

6.5.25. Designated heritage assets dating to this period are of high significance. The majority of non-designated remains dating to this period are likely to be of archaeological interest primarily for their contribution to historic landscape character and development rather than as individual assets, and are likely to be of low significance.

6.5.26. There are also a number of hedgerows, which could be considered important under the Hedgerow Regulations 1997, across the site. These are best considered as heritage assets of low significance for historic and aesthetic interest resulting from their contribution to historic landscape character.

v) Modern

6.5.27. The HER area for Leiston airfield (MSF22764) extends into the study area to the south of Theberton. It was built in 1934 and was an operational site for the USA Air Force during World War II. It is unlikely that any related but as yet unknown remains are present with the site.

6.5.28. Within the remainder of the site and study area, the modern period experienced a general continuity of settlement and agricultural land use from the post-medieval period.

6.5.29. Remains dating to this period have a degree of archaeological and historic interest, but are likely to be of low significance.

vi) Modern disturbance

6.5.30. There is little substantial modern disturbance; the majority of the site has been in agricultural use for some time, probably since the medieval period. The continuous ploughing in this area will likely have had an impact on the survival of the below ground archaeology. This impact will have increased over time as the depth of ploughing gradually increased. However, it is also possible for ploughing and natural processes to result in the development of colluvial deposits, which may preserve earlier features.

b) Environmental design and embedded mitigation

6.5.31. Change to setting arising from visibility of the proposed development, and construction noise or changes to air quality, could give rise to loss of or harm to heritage significance. Detailed design would seek to minimise perceptual change, for example, existing hedgerow planting would be retained where practicable, and new planting and landscaping used to tie the road into the existing landscape and maximise screening; treatment of the road verges would be aimed at minimising the perceptibility of the proposed route as a new road where this can be achieved consistently with requirements for highways design. Standard good practice construction methods would be used to address construction noise and air quality.

c) Preliminary assessment of effects,

i) Construction

6.5.32. Intrusive groundworks would take place across the site, including topsoil stripping and sub-soil disturbance during the construction of the proposed road. Invasive works of this nature would adversely affect any surviving sub-surface archaeological remains, reducing or removing their ability to be further interpreted, resulting in the loss of archaeological interest.

6.5.33. As part of the embedded mitigation, where practicable, surviving hedges would be retained and maintained. As a result, the change to the important hedgerows is considered to be medium, with a resulting minor effect, which would be not significant.

6.5.34. Construction activities could potentially affect the settings of designated heritage assets within and beyond the proposed route. An initial study has been undertaken to identify designated assets which have the potential to be affected by the proposed development in accordance with Step 1 of the Historic England guidance (Good Practice Advice in Planning Note 3) (Ref. 6.5.2), and full assessment will be presented to accompany the application for development consent.

6.5.35. The Grade II listed Gate and Gate Piers at the junction of Leiston Road and Onner's Lane (LB 1287303) lie within the site boundary to the east of Theberton, at a proposed junction with the B1122. The proximity to the proposed development and construction works means a degree of change to the setting would occur during the construction period. However, the nature of the asset and its current location at a roads edge means that while the proposed road would be of a greater scale than at present, it would not alter the understanding of the asset or and the ability to appreciate its historical function as a private access from Theberton House onto the public road.

6.5.36. The listed buildings at Anneson's corner (LB 1283470; LB 1377245) lie just outside the western edge of the site boundary where the proposed development route leaves the B1122. The proximity to the proposed development and construction works means a degree of change would occur, although these effects would be temporary. However, the nature of these assets and their current location means that while the proposed road would be of a greater scale than at present, it would not affect the perception of these structures as historic roadside buildings.

6.5.37. Theberton Hall (LB 1287529) and associated structures (LB 1227753) lie between the proposed development and the current B1122. While there is a degree of screening surrounding the buildings, particularly to the northern, western and eastern sides due to planting, there are longer ranging views to the south, which may take in the proposed development. However, any change to setting is anticipated to be minimal and not result in a significant effect.

6.5.38. Theberton House (LB 1228378) and associated listed buildings lie to the east of the proposed development, just beyond the point at which the bypass rejoins the B1122. These structures are well screened from the proposed development by trees within the parkland as well as a buffer of trees along the B1122. It is not anticipated that significant effects would arise.

6.5.39. There are a number of other listed buildings in proximity to the site, including Hill Farmhouse (LB 1030643) and Moat Farmhouse (LB 1287643). The magnitude of any change would depend on the specific circumstances of each asset, but these structures are generally well screened from the proposed development. Therefore, it is not anticipated that significant effects would arise.

6.5.40. The proposed development is not anticipated to give rise to any change in the setting of Leiston Abbey (second site).

ii) Operation

6.5.41. In that any disturbance of archaeological heritage assets within the site would have occurred (as set out in additional mitigation and monitoring section below) during the construction of the proposed development, no direct effects on heritage assets within the site are anticipated during the operation of the proposed development.

6.5.42. The nature of the listed buildings at Anneson's corner (LB 1283470; LB 1377245) and the listed Gate Piers at Onner's Lane (LB 1287303) and their current location at the road edge means that the operation of the proposed development, would not alter the understanding of the assets nor the ability to appreciate their historical function.

6.5.43. Many of the listed buildings within Theberton lie towards the centre of the village. It is anticipated that the reduction in traffic during operation would result in a positive effect on the setting of these buildings.

6.5.44. Change to setting of other designated heritage assets including Hill Farmhouse (LB 1030643), Moat Farmhouse (LB 1287643) and the listed buildings at Theberton Hall (LB 1287529) and Theberton House (LB 1228378) can be expected to reduce on completion of construction activities. Visibility of the new road may persist from some locations, although these structures are all generally well screened. Effects arising from change to setting are anticipated to reduce from the non-significant effects experienced during the construction phase. Theberton Hall may retain some visibility in views to the south, but these are not anticipated to be sufficient to result in a significant effect. The proposed development is not anticipated to give rise to any change in the setting of Leiston Abbey (second site).

d) Additional mitigation and monitoring

6.5.45. Mitigation of direct effects on buried archaeology within the site would comprise the adoption of an agreed written scheme of archaeological investigation to ensure that the archaeological interest of any significant deposits and features could be appropriately investigated, recorded and disseminated.

6.5.46. A suitable mitigation strategy will be agreed with Suffolk County Council Archaeology Service (SCCAS) once all trial trenching has been completed and the results are known. Monitoring of the agreed programme of archaeological investigation would be carried out by SCCAS during the implementation of the scheme. Publication and popular dissemination of the results of mitigation works would allow any informative and historic value to be fully realised.

e) Preliminary assessment of residual effects

6.5.47. The loss of archaeological interest through material disturbance within the site could have a significant adverse effect. However, following the implementation of an agreed scheme of archaeological investigation the residual effect is not expected to be significant.

6.5.48. No significant adverse effects arising from change to setting of heritage assets are anticipated. There are likely to be a number of non-significant positive effects arising through the removal of through traffic from Theberton village.

f) Completing the assessment

6.5.49. A full archaeological assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant direct effects, and would draw upon the LVIA, noise, air quality and other assessments where appropriate.

6.5.50. This would include a settings assessment, which would be consulted on ahead of application with Historic England and Suffolk Coastal District Council's Conservation Officer. It would consider heritage assets where setting may potentially be subject to effects, their current setting, the potential change, and the magnitude of effect the proposed development may have on their setting. Any mitigation required would also be consulted upon.

6.5.51. In advance of construction field evaluation would be undertaken and this would include geophysical survey and trial trenching, the scope and extent of which would be agreed with SCCAS.

6.5.52. Once the intrusive archaeological investigation (trial trenching) is complete, an appropriate mitigation scheme for buried archaeological remains, if present, would be agreed with SCCAS.

Table 6.5.1 Summary of effects for construction phase

Terrestrial historic environment

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Previously unrecorded archaeological remains.	Disturbance or removal as a result of topsoil stripping and subsoil disturbance.	None	Significant	Agreed written scheme of archaeological investigation.	Not significant.
Historic Hedgerows.	Loss due to construction activities/location of road.	Retain where possible.	Not significant.	None	Not significant.
Grade II listed Gate and Gate Piers at junction of Leiston Road and Onner's Lane.	Change in setting due to construction activities/proximity to site.	Standard CEMP measures to limit noise and air quality disturbance.	Unlikely to be significant.	None	Unlikely to be significant.
Listed buildings at Anneson's corner.	Change in setting due to construction activities/proximity to site.	Standard CEMP measures to limit noise and air quality disturbance.	Unlikely to be significant.	None	Unlikely to be significant.
Theberton Hall and associated structures.	Change in views to south.	None	Not significant.	None	Not significant.
Other listed buildings including Theberton House, Hill Farmhouse, Moat Farmhouse.	Located in close proximity to the site but all well screened.	None	Not significant.	None	Not significant.

Table 6.5.2 Summary of effects for operational phase

Terrestrial historic environment

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Grade II listed Gate and Gate Piers at junction of Leiston Road and Onner's Lane.	Change in setting due to increased scale of road.	None	Not significant.	None	Not significant.
Listed buildings at Anneson's corner.	Change in setting due to increased scale of road.	None	Not significant.	None	Not significant.
Listed Buildings within Theberton Village.	Positive impact on setting due to reduction in traffic.	None	Not significant.	None	Not Significant.
Theberton Hall and associated structures.	Some visibility of the new road to the south.	None	Not significant.	None	Not significant.
Other listed buildings including Theberton House, Hill Farmhouse, Moat Farmhouse.	Located in close in proximity to the site but all well screened.	None	Not significant.	None	Not significant.

Table 6.5.3 Designated heritage assets within Theberton bypass study area

Listed buildings

Historic England list entry	Name	Grade	Easting	Northing
1030643	Hill Farmhouse	II	642580	266998
1030644	Fenn Farmhouse	II	643527	267081
1199213	Dovehouse Farmhouse	II	642609	266146
1227753	Gates, Gateway, Walling and Wall Head 30 metres west of Theberton Hall	II	643270	266199
1227755	1-4, Church Road	II	643941	266238
1227756	Church of St Peter	I	643729	265918
1227758	The Old Rectory	II	643566	265973
1227759	Stable Block 10 metres to south of the Lion Public House	II	643764	265806
1227920	Lilycot	II	644005	266242
1228180	Thatched House, The Cottage	II	643773	265872
1228246	Moat Farmhouse	II	643186	265115
1228262	The Cottage	II	644676	265713
1228263	Flash Cottages	II	644646	265705
1228265	Woodview	II	644673	265856
1228266	Bob's Cottage	II	644601	265220
1228267	Potter's Farmhouse	II	644981	265185
1228268	Theberton House Stables	II	644550	265161
1228269	Gateway 45 metres north of main entrance to Theberton House	II	644526	265146
1228270	Barn 30 metres south-east of Old Manor House	II	643632	265883
1228378	Theberton House	II*	644524	265111
1228384	Old Manor House	II	643618	265920
1283440	Manor House	II	643482	267324
1283470	Valley Farmhouse, Anneson's Corner	II	642748	266835
1287235	Walls Enclosing Garden 60 metremetres to north of Theberton House and Greenhouse at north end	II	644511	265184
1287237	Gate and Gate Piers 105 metremetres south-east of main entrance to Theberton House	II	644567	265011
1287260	Gate and Gate Piers 80 metres north-west of main entrance to Theberton House	II	644432	265129
1287282	Flint House	II	643814	265810
1287303	Gate and Gate Piers at junction of Leiston Road and Onner's Lane	II	644023	265523
1287529	Theberton Hall	II	643310	266180
1287533	The Lion Public House	II	643764	265824
1287643	Hill Farmhouse	II	644019	264414
1377245	Farm Buildings 30 metres east of Valley Farmhouse, Anneson's Corner	II	642780	266838
Scheduled monuments				
1014520	Leiston Abbey (second site) and moated site		644457	264189

6.6. Soils and agriculture

6.6.1. The figures for soils and agriculture are presented in **Volume 3** as Figures **6.6.1** to **6.6.4**.

a) Baseline environment

6.6.2. The site is underlain by an area mapped as the Crag Group (quaternary sand), which in places is overlain with drift deposit of Lowestoft Formation, comprising sand and gravel (Ref. 6.6.1).

6.6.3. The distribution of soil types is shown in **Figure 6.6.1**. Most of the site comprises soils described as freely draining slightly acid but base-rich soils (Ref. 6.6.2). These belong to the Melford Soil Association (representing a group of soil types which are typically found occurring together in a landscape). The main land use on these soils is described as being cereals, sugar beet and other arable crops.

6.6.4. In the central section the soils are shown as being predominantly slowly permeable, seasonally waterlogged, clayey, and fine loamy over clayey soils. These belong to the Ragdale Soil Association. The main land use on these soils where they occur in Eastern England is described as being winter cereals.

6.6.5. Published Agricultural Land Classification (ALC) maps (Ref. 6.6.3; see **Figure 6.6.2**) show the land within the scheme boundary to comprise a mix of Grade 2 and Grade 3 land, with a small amount of Grade 4 land. Under the ALC system land is graded between Grade 1 and 5, with Grade 3 subdivided into 3a and 3b. Land in Grades 1, 2 and 3a is considered to be 'best and most versatile' (BMV) land.

6.6.6. There is no published detailed ALC mapping available for the land within the site boundary. Based on the provisional mapping the proportions of land of each grade would be as follows (noting that the full assessment would be based on detailed survey data).

Table 6.6.1 Agricultural Land Classification grade distribution

ALC Grade	Area hectare (ha)
2	27.50
Grade 3 (undifferentiated)*	13.41
4	2.85
Total	**43.76**

*Based on available Provisional ALC maps

6.6.7. Land within the site boundary, from aerial photographs, appears to be predominantly under arable production, with small woodland blocks or strips also present. Land to the north and west of Theberton is under entry level plus higher level stewardship, with some land immediately to the south-west of Theberton under organic entry level plus higher level stewardship (Ref. 6.6.4; see **Figure 6.6.3**). A linear woodland block to the west of Theberton, crossed by the proposed development, is in a Woodland Grant Scheme see **Figure 6.6.4**.

b) Environmental design and embedded mitigation

6.6.8. A summary of the measures that have been incorporated into the design of the proposed development and that would protect the existing features of soil and agricultural interest is set out below.

i) Construction

6.6.9. The sustainable re-use of the soil resource would be undertaken in line with the Construction Code of Practice for the Sustainable Use of Soil on Construction Sites. This would be achieved by the development of a Soil Management Plan (SMP) identifying the soils present, proposed storage locations and handling methods and how the resource would be re-used. The SMP would form part of the CEMP. Measures which would be implemented include (but are not limited to):

- completion of a Soil Resources Survey and incorporate results into a Soil Management Plan;
- link the SMP to the Site Waste Management Plan (SWMP);
- ensure soils are stripped and handled in the driest condition possible;
- confine vehicle movements to defined haul routes until all the soil resource has been stripped;
- protect stockpiles from erosion and tracking over; and
- ensure physical condition of the entire replaced soil profile is sufficient for the post-construction use.

6.6.10. All soils would be stored away from watercourses (or potential pathways to watercourses) and any potentially contaminated soil would be stored on an impermeable surface and covered to reduce leachate generation and potential migration to surface waters, before testing and removal to an appropriately licensed facility.

6.6.11. Industry standard measures would be put in place to control pollution, including from fuel or chemical stores, silt-laden run-off or dust.

6.6.12. Following completion of construction operations all agricultural land taken temporarily would be reinstated as near as practically possible to its former condition.

6.6.13. A considerate construction approach would be used to minimise potential impacts on the remainder of the landholding and on neighbouring landholdings during the construction phase. Toolbox talks would be used to inform all those working on the site of the requirements for soil handling and minimisation of disturbance to agricultural activities.

6.6.14. All fencing around the proposed development would be sufficient to resist damage by livestock and will be regularly checked and maintained in a suitable condition. Any damage to boundary fencing would be repaired immediately.

6.6.15. Measures contained in relevant Department for Environment, Food and Rural Affairs (Defra) and Environment Agency best practice guidance on the control and removal of invasive weed species would be implemented where appropriate.

6.6.16. Works would cease, and the Animal Health Regional Office would be advised, should animal bones be discovered which indicate a potential burial site.

6.6.17. All movement of plant and vehicles between fields would cease in the event of a disease outbreak and official Defra advice would be followed to minimise the biosecurity risk associated with the continuation of works.

6.6.18. In relation to temporary and permanent land take requirements EDF Energy would liaise with landowners to understand and where possible address their concerns.

ii) Operation

6.6.19. The measures described for the construction phase would be maintained throughout the operational phase, as appropriate.

c) Preliminary assessment of effects

i) Construction

6.6.20. The proposals for this site would result in the loss of 43.76 hectares (ha) of land from primary agricultural productivity. Based on the provisional mapping it is likely that a proportion of this will be BMV land, likely to comprise Grade 2 and 3a.

6.6.21. Given the potential extent of BMV land to be lost on a permanent basis this preliminary assessment considers that this could be a significant effect.

6.6.22. There would also be an impact on the agricultural enterprise because of the loss of a proportion of the productive land. This would be assessed on a case by case basis as required.

6.6.23. On the assumption that landowners' concerns are addressed through appropriate mitigation, this preliminary assessment considers that significant effects on the agricultural enterprise are unlikely to occur and so are not considered further.

ii) Operation

6.6.24. There would be no additional operational phase effects on the soil resource or agricultural enterprise.

d) Additional mitigation and monitoring

6.6.25. There are no additional mitigation measures available for the loss of BMV land.

e) Preliminary assessment of residual effects

6.6.26. The embedded mitigation measures would ensure that the potential for significant effects is removed, with the exception of the permanent loss of agricultural land which results in a significant effect for both construction and operational phases.

f) Completing the assessment

6.6.27. Once the proposals for the development as a whole are finalised, a full assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant effects. An ALC survey would be undertaken across the site to fully inform the assessment impacts. In addition, landowner interviews would be undertaken.

Table 6.6.2 Summary of effects for construction phase

Soils and agriculture

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Agricultural land.	Loss of approximately 43.76ha of which at least a proportion is likely to be BMV land.	None available.	Significant	None available.	Significant
Agricultural businesses.	Loss of a proportion of the productive land.	EDF Energy will liaise with landowners to understand and address their concerns.	Not significant	Not required.	Not significant.

Table 6.6.3 Summary of effects for operational phase

Soils and agriculture

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Agricultural land.	As per the construction phase.				
Agricultural businesses.	As per the construction phase.				

6.7. Noise and vibration

6.7.1. The figure for noise and vibration is presented in **Volume 3** as **Figure 6.7.1**.

a) Baseline environment

6.7.2. Baseline survey work has yet to be undertaken for the Theberton bypass. However, a preliminary consideration of the noise and vibration impacts can be made without reference to existing baseline values.

6.7.3. The noise and vibration sensitive receptors which are closest to the route are shown in **Figure 6.7.1**. The receptors have been numerically coded, with the names of dwellings (where known) also shown. **Table 6.7.1** below shows the coding and corresponding names of locations, where known.

Table 6.7.1 Noise and vibration receptors in the vicinity of the proposed Theberton bypass

Location code	Location name
1	Hill Farm
2	Valley Farm
3	Hawthorn Road (1)
4	Dovehouse Farm
5	Theberton Hall
6	Church Farm
7	Doughty Wylie Crescent
8	Theberton Grange
9	Theberton House
10	Hawthorn Cottages
11	Hawthorn Road (2)
12	Annesons Corner

b) Environmental design and embedded mitigation

i) Construction

6.7.4. The standard of good practice outlined in 'British Standard BS5228-1 Noise: 2009 + A1 2014 – Code of Practice for noise and vibration control at open construction sites' (Ref. 6.7.1), would be followed. Embedded mitigation for the control of noise and vibration would include, but not be restricted to the following measures:

- selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earth moving activities;
- switching off equipment when not required;
- use of reversing alarms that ensure proper warning whilst minimising noise impacts off-site; and
- provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts.

6.7.5. With respect to vibration, BS 5228-2, gives detailed advice on standard good construction practice for minimising impacts from construction vibration. It is expected it would be a requirement of the contractors to adhere to this guidance and for it to be set out in the CEMP.

6.7.6. EDF Energy would also have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.

ii) Operation

6.7.7. A proposed 50 miles per hour (mph) on the bypass would result in lower noise levels than if the national speed limit were applied. At this stage, it is not anticipated that any further controls would be required.

c) Preliminary assessment of effects

6.7.8. Noise and vibration levels have been predicted by calculation and modelling. A "significant" effect has been identified where levels are predicted to exceed a specified threshold value. Appropriate threshold levels are based on various standards and a relevant guidance and depend on the type of source; the sensitivity of the receptors; the time of day when it might occur; and, in some situations, on the existing noise levels in the area.

i) Construction

6.7.9. A detailed analysis of noise and vibration effects will be undertaken as part of the ongoing EIA, however an initial overview of likely working techniques has enabled some initial high level conclusions to be drawn. It is assumed that no noisy construction work would take place at night.

6.7.10. There is likely to be a significant adverse noise effect during breaking out of the road at Annesons Corner, Hawthorn Cottages, Hawthorn Road (1) and Hawthorn Road (2) (locations 12, 10, 3 and 11 in **Figure 6.7.1**).

6.7.11. Noise and vibration levels at other receptors during construction are unlikely to have a significant effect.

ii) Operation

6.7.12. An initial review has been carried out to consider the noise levels produced for the worst case hours during a typical and busiest day and a typical and busiest night. The highest noise levels would occur from during the busiest day.

6.7.13. For all receptors and scenarios, the noise and vibration effect would not be significant. It is likely that significant beneficial noise effects would arise as traffic flows through Theberton would be lower.

d) Additional mitigation and monitoring

i) Construction

6.7.14. Mitigation may be possible in the form of screening around construction areas. This would need to be considered when further information about the construction methods and site constraints are known. It is anticipated that some localised screening using portable acoustic panels may be required at affected noise sensitive receptors.

ii) Operation

6.7.15. No mitigation is necessary.

e) Monitoring

6.7.16. Routine monitoring of Sizewell C traffic would be carried out in accordance with a scheme to be agreed with local authorities. Provision would be made as necessary for monitoring of noise and vibration levels in the event of complaints being received from occupiers of noise sensitive receptors, or on request of the local authorities.

f) Preliminary assessment of residual effects

i) Construction

6.7.17. Even with embedded and additional mitigation in place, it is likely that some significant, short-term effect from noise would occur during construction at Annesons Corner, Hawthorn Cottages, Hawthorn Road (1) and Hawthorn Road (2). Principal noise sources are likely to be from excavators and breakers during removal and replacement of existing road surfaces and from tipper lorries, dump trucks and concrete pumping and pouring activities. Initial estimates suggest that significant impacts are likely for four to six weeks although this may vary as construction planning evolves.

6.7.18. At all other receptors, with mitigation in place, noise and vibration effects would not be significant during construction.

ii) Operation

6.7.19. Noise and vibration effects during the operation of the road would not be significant. It is likely that significant beneficial effects may arise from the proposed development with reduced traffic through Theberton.

g) Completing the assessment

6.7.20. Further assessment of impacts will be undertaken as part of the ongoing EIA, with establishment of the baseline noise environment and further consideration of the construction methodology, local topographical features and layouts. The ES will present a full noise and vibration assessment and will consider any new information such as amended design or construction methodologies which might be relevant, although it is anticipated that the assessment would support the preliminary conclusions drawn above.

Table 6.7.2 Summary of effects for construction phase

Noise and vibration

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Annesons Corner, Hawthorn Cottages, Hawthorn Road (1) and Hawthorn Road (2).	Noise from road construction works.	Selection of plant and methodology in accordance with good practice.	Short-term significant effect.	Screening	Short-term significant effect.
All other receptors.	Construction activity – noise or vibration.	Selection of plant and methodology in accordance with good practice.	Not significant.	None	Not significant.

Table 6.7.3 Summary of effects for operational phase

Noise and vibration

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
All receptors.	Noise or vibration from operation of road.	Speed limit of 50mph.	Not significant.	None	Not significant.

6.8. Air quality

a) Baseline environment

6.8.1. The closest human receptors to the proposed development are Valley Farm bed and breakfast, the properties at the junction of Hawthorne Road and the B1122, Theberton Hall, Dovehouse Farm, Church Farm Cottage, Moat Farm, Granary t, 11 Doughty Wylie Crescent and dwellings on Potter's Street close to the B1122.

6.8.2. There are no sites of nature conservation interest (i.e. international, European and nationally designated sites of ecological interest) within 350m of the proposed development site or routes used by construction traffic and therefore no sites are included in the construction phase air quality assessment. However, both Minsmere-Walberswick and Sizewell Marshes SSSIs are within 2km of roads likely to be affected by the proposed development (see **section 6.3**) so will require consideration in the operational phase assessment.

6.8.3. SCDC has declared two Air Quality Management Areas (AQMAs) within its boundary (Ref. 6.8.1) due to elevated monitored concentrations of ambient Nitrogen Dioxide (NO_2), the nearest of which is approximately 9.2km south-west of the site, along the A12 at Stratford St. Andrew. A third AQMA, at Dooley Inn, was revoked in 2016.

6.8.4. The nearest monitoring site (for a pollutant relevant to the assessment) is approximately 2.8km south in the form of a single NO_2 diffusion tube on Main Street, Leiston (Ref. 6.8.2), which in 2016 (the most recently reported year) reported a concentration of 20 micrograms ($\mu g/m^3$). This value is below the annual mean air quality strategy objective of $40\mu g/m^3$ (Ref. 6.8.3). As NO_2 concentrations are generally more elevated in urban areas, concentrations at site are likely to be lower than this, given the rural location.

6.8.5. Background concentrations of NO_2 and Particulate Matter (PM10) of a diameter of 10 microns or below across the proposed development in 2018 were $6.7\mu g/m^3$ to $6.8\mu g/m^3$ for NO_2 and $12.8\mu g/m^3$ to $13.6\mu g/m^3$ for PM10 respectively, all concentrations being considerably below statutory objectives (Ref. 6.8.4, Ref. 6.8.5).

6.8.6. Dust levels are related to the action of wind on exposed soils and climatic conditions year to year, but existing levels are likely to be low given the arable nature of the existing land use.

b) Environmental design and embedded mitigation

i) Construction

6.8.7. The following mitigation measures would be embedded into the construction of the proposed development:

- site access located as far as practicable, and preferably at least 10m, from receptors;
- potentially dusty loads (loose earth, spoil, aggregates etc) to be covered in transit;
- any potential use of concrete batching plant located as far as practicable from receptors; and
- mobile crushing & screening plant located as far as practicable from receptors.

6.8.8. Air quality impacts arising from the construction phase would be managed through a range of control measures detailed in a CEMP, supplemented by the measures appropriate to the level of risk designated to the proposed development under Institute of Air Quality Management (IAQM) Guidance (Ref. 6.8.6).

ii) Operation

6.8.9. The following mitigation measures would be embedded into the operation of the proposed development:

- maintain Sizewell C construction vehicles using the link road to high standard so as to avoid excess pollution or possibility of breakdowns; and
- optimise traffic flows related to the main development site, in such a manner that the impact on the local road network at peak times is minimised.

c) Preliminary assessment of effects

i) Construction

6.8.10. The potential impacts associated with the construction of the Theberton bypass include fugitive emissions of dust, emissions from non-road mobile machinery (NRMM) on the site, emissions from Heavy Goods Vehicles (HGVs) accessing the site and emissions from vehicles carrying workers to and from the site. However, given the embedded mitigation measures described above, the adverse effects would likely be negligible and would therefore not be significant for any of the proposed construction activities at the site.

6.8.11. The principal risk is anticipated to be related to earthworks, as this phase of construction can typically require a high volume of material to be moved. A high level of activity could potentially place the dust emissions category as 'Large' by IAQM classification, with the likelihood of a 'Medium' risk based on the number and sensitivity of local receptors. Each risk category has the potential to lead to proportional adverse, albeit temporary, impacts which have the potential to be significant without mitigation.

6.8.12. However, assuming all mitigation measures are effectively implemented and monitored through an effective CEMP, at the level recommended by the dust risk assessment, no significant dust effects resulting from demolition and construction activities are anticipated.

6.8.13. It is expected that the number of Heavy Duty Vehicle (HDV) movements required to develop the site in the construction phase would not exceed the IAQM screening threshold of more than 100 Annual Average Daily Traffic required for a detailed dispersion modelling assessment and there is likely be a significant effect on local air quality.

ii) Operation

6.8.14. There is potential for increases in pollutant concentrations at receptors located along the Theberton bypass during construction of Sizewell C. The primary source of these pollutants would be as a result of the additional vehicles using the bypass for construction of Sizewell C.

6.8.15. Construction of this bypass would also have a consequential effect on the amount of traffic using the original B1122 road through Theberton, which would be significantly reduced. As a result, despite the total net increase in traffic, the majority of receptors would see a reduction in ambient concentrations, and are likely to see a significant beneficial effect.

6.8.16. IAQM guidance (Ref. 6.8.7) has been used to determine the necessity for an Air Quality Impact Assessment, and it is expected that the proposed development will require a detailed assessment, given it meets a number of IAQM criteria, including the introduction/realignment of a road. The proposed routing of the bypass, in conjunction with the low baseline concentrations across the Theberton bypass study area, indicates that there would unlikely be significant adverse air quality effects at receptors during operation, though there would likely be significant beneficial air quality effects on receptors within the town of Theberton itself.

6.8.17. There are no significant effects on AQMAs anticipated due to their distance from the proposed bypass.

6.8.18. The effects on both Minsmere-Walberswick SPA/SSSI and Sizewell Marshes SSSI of the proposed development would likely be negligible as a percentage of the overall background deposition rates. Whilst there may be exceedances of critical loads immediately adjacent to roads, this would be attributable to background deposition, and not the development itself, and would in addition be expected to fall off rapidly with increased distance from the road. This effect would therefore not be significant.

6.8.19. The principal benefit to the proposed development is in Sizewell C related construction traffic bypassing of the village of Theberton, thus reducing pollutant concentrations at receptors in that location. Whilst it is acknowledged that there would be a negligible adverse impact at some receptors close to the bypass itself, the scheme has an overall significant beneficial effect on the air quality in the area.

d) Additional mitigation and monitoring

6.8.20. No significant adverse effects are predicted for any phase of development and no additional mitigation measures are therefore proposed.

e) Preliminary assessment of residual effects

6.8.21. No significant adverse residual effects are predicted during the construction or operational phases. It is likely that significant beneficial effects would arise from the proposed development with reduced traffic through Theberton.

f) Completing the assessment

6.8.22. Once the proposals are finalised, the potential air quality effects of the proposed bypass will be re-evaluated to confirm whether the preliminary conclusions presented above are applicable. The ES will present the full assessment, underpinning the conclusions drawn in relation to the absence of significant adverse effects, and the presence of significant beneficial effects.

Table 6.8.1 Summary of effects for construction phase

Air quality

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Construction dust					
Human	Potential generation of nuisance dust.	As recommended in CEMP and appropriate to level of risk identified by IAQM criteria.	Considered likely to be 'medium' risk, though not significant provided CEMP mitigation measures are adhered to.	None required in addition to those already embedded.	Not significant.
Vehicle/NRMM emissions					
Human	Potential increase in emissions.	As recommended in CEMP	Unlikely to meet IAQM screening criteria requiring assessment, therefore not significant.	None	Not significant.

Table 6.8.2 Summary of effects for operational phase

Air quality

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Vehicle emissions					
Human	Emissions at receptors.	Maintaining vehicles to high standard, avoid peak time travel and reducing traffic through Theberton.	Unlikely to have significant adverse effects, likely to have significant beneficial impacts.	None	Significant beneficial.
Ecological	Emissions at receptors.	As above.	Unlikely to have significant adverse effects.	None	Not significant.

6.9. Geology and land quality

a) Baseline environment

i) Geology

6.9.1. The following provides a summary of the geology and geological characteristics within the site and site vicinity:

- made ground: potentially present, related to construction of existing railway and roads and farmer's tips.
- superficial deposits: predominantly Lowestoft Formation.
- bedrock: the Crag Group.
- important geological sites: none present.
- Identified geological hazards: none present.
- mining, quarrying and natural cavities: small scale historical sand pit identified 220m north.
- ground stability hazards: none present; and
- unexploded ordnance (UXO) risks: low risk.

6.9.2. Borehole logs have been recorded within 500m of the site. The borehole logs generally correspond with the mapped geology. Made Ground comprising 'Ballast' was identified in one borehole at a depth of 9.14 to 9.45 metres below ground level (m b.g.l). Groundwater was identified at a depth of 9.45m b.g.l.

ii) Hydrology and hydrogeology

6.9.3. The following provides a summary of the hydrological and hydrogeological characteristics within the site and site vicinity:

- surface water features: a tributary of the Minsmere New Cut River crosses the site and several small ponds within 250m of the site.
- superficial aquifer: the Lowestoft Formation is classified as a Secondary (Undifferentiated) Aquifer.
- bedrock aquifer: the Crag Group is classified as a Principal Aquifer.
- groundwater vulnerability: the site contains soils of low, intermediate and high leaching potential.
- groundwater/surface Water abstractions: two private and one licensed groundwater abstractions in the vicinity of Theberton Grange and Cottages.
- groundwater/surface water discharge consents: no available data.
- pollution incidents: no available data; and
- flood risk: very low risk.

iii) Site history

6.9.4. The route and surrounding areas currently support agricultural land and this land use extends back into the 19th century at least. The Leiston Road (B1122) and B1125 are present from the 1883 maps in their current layout and the site connects into these roads to the north of Theberton and into the B1122 to the south of Theberton. The route also crosses a number of smaller roads including Moat Road and Pretty Road which have also been present since publication of the 1883 maps.

6.9.5. Potentially contaminating historical activities within 500m of the site include a sand pit (1884), a gravel pit (1883), a garage (1977 – present), St Peter's Cemetery (1884 – present) as well as several small roads and various farms.

iv) Landfills and waste management sites

6.9.6. A former landfill (Middleton Landfill) was located approximately 100m north-east of the site boundary.

v) Previous Investigations

6.9.7. There have been no previous ground investigations along the proposed route alignment.

vi) Key hazards

6.9.8. Key hazards present within the site vicinity include the following:

- made ground (on-site and off-site) associated with the construction and operation of the B1122, B1125 and minor roads.
- the garage located within Theberton village.
- made ground associated with the disused sand and gravel pits (approximately 220m and 150m north of the site, south of Theberton).
- made ground (ballast) identified in historical borehole 500m south of Theberton Village.
- St Peter's Graveyard within Theberton Village.
- Middleton historical landfill.

- farmland on-site and within the site vicinity and the potential for unmapped farmers tips; and
- changes in soil compaction, soil erosion and ground compaction.

vii) Summary of preliminary conceptual site model

6.9.9. A summary of potential contamination sources, pathways and receptors identified within the Preliminary Conceptual Site Model (PCSM) is provided in **Tables 6.9.1** and **6.9.2**.

6.9.10. Potential receptors and pathways as summarised in **Table 6.9.2**.

b) Environmental design and embedded mitigation

i) Construction

6.9.11. A summary of the measures that have been incorporated into the design of the proposed development and that would protect the land quality during construction are set out below.

- A piling risk assessment in accordance with Environment Agency guidance may be required to ensure that piling techniques deemed appropriate are implemented at the site by identifying and managing potential risks as a result of creating pathways to the aquifer.
- The CEMP would specify measures required during enabling works and construction such as the following:
  - Minimising the area and duration of soil exposure and timely reinstatement of vegetation or hardstanding to prevent soil erosion and reduce temporary effects on soil compaction.
  - Stockpile management (such as water spraying and avoiding over stockpiling to reduce compaction of soil and loss of integrity) to prevent windblown dust and surface water run-off.
  - Implementation of appropriate dust suppression measures to prevent migration of contaminated dust.
  - Implementation of working methods during construction to ensure that there is would be no surface water run-off from the works or any stockpiles into adjacent surface watercourses/leaching into underlying groundwater in accordance with good practice.
  - Implementation of appropriate pollution incident control e.g. plant drip trays and spill kits.
  - Implementation of appropriate and safe storage of fuel, oils and equipment during construction.
  - Implementation of an appropriate Materials Management Plan to document how the excavated materials would be dealt with and a verification plan to record the placement of materials at the site.
  - Implementation of a SWMP.

Table 6.9.1 Potential sources of contamination

Potential source of contamination	Potential contamination	Approximate location
Made Ground associated with the construction of the roads including B1122, B1125, Moat Road and Pretty Road, and activities associated with their operation.	Fuels and oils attributed to spills from vehicles on the roads included within the site boundary, plus exhaust particulates. A range of inorganic and organic contaminants including the potential for asbestos.	On-site
Farmland within site boundary. Potential for unmapped farmers tips..	Contamination risk from herbicides, pesticides, silage, effluent, and fuel oils. Risk of inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos, etc..	
Garage within Theberton Village.	Inorganic and organic contaminants including metals, petroleum, petrol additives, diesel, oils/lubricants.	Off-site
Made Ground associated with the disused sand and gravel pits (approximately 220m and 150m north of the site). Made Ground (ballast) identified in historical borehole 500m south of Theberton Village.	Ground gas and a range of inorganic and organic contaminants including the potential for asbestos.	
St Peter's Graveyard within Theberton Village.	Metals, organic contaminants including bacterial contaminants.	
Middleton Historical Landfill (National Grid Reference TM 414 673).	Ground gas and a range of inorganic and organic contaminants including the potential for asbestos.	
Farms around the site boundaries. Potential for unmapped farmers tips..	Contamination risk from herbicides, pesticides, silage effluent, and fuel oil. Risk of inorganic and organic contamination.	

- Remediation of soil/groundwater contamination (e.g. source removal, treatment or capping) and ground stabilisation/improvement works would be undertaken if further investigation and risk assessments deem necessary.
- Gas protection measures would be incorporated within proposed structures, if monitoring and risk assessments deem them to be necessary.
- Livestock would be removed from the construction area and the site fenced to stop livestock trespass.
- Design of the bypass and associated structures and the selection of construction materials would be in accordance with good practice at the time of the design. The design would be required to take into account the ground conditions including the potential for ground movement, compaction, ground gas and ground aggressivity.
- The drainage/flood prevention strategies would consider the ground conditions including the permeability of the strata and the level of contamination present on-site.

ii) Operation

6.9.12. To protect land quality, the bypass would be operated in accordance with good practice including:

- The incorporation of petrol/oil interceptors within the drainage design where considered necessary; and
- the use of appropriate SuDS schemes (see **section 6.11**).

c) Preliminary assessment of effects

i) Construction

Ground contamination

6.9.13. The construction works would potentially introduce new sources of contamination and disturb and mobilise existing sources of contamination through excavation and exposure of contaminated soil, remobilisation of contaminants through soil disturbance and the creation of preferential pathways for surface water run-off and ground gas migration pathways. With the embedded mitigation, construction activities should not increase the contamination risks presented at the site and an overall neutral to minor beneficial effect is predicted given that any contamination present would have been removed. These effects are considered to be not significant.

6.9.14. A preliminary assessment of the effects associated with ground contamination during the construction phase is summarised in **Table 6.9.3**.

Table 6.9.2 Potential receptors and Pathways

Receptor Group	Receptor	Principal Contaminant Migration pathways
Human health (on-site).	Pedestrians and road users using existing and future roads, footpaths and fields within the site.	Dermal contact with and ingestion of contaminants in soils, soil-derived dusts and water; and inhalation of soil-derived dust, fibres, gas and vapours.
	Agricultural workers.	
	Construction/maintenance workers.	
Human health (off-site).	Occupants of nearby residential and commercial properties	Dermal contact with and ingestion of contaminants in soil-derived dusts and water; and inhalation of soil-derived dust, fibres, gas and vapours.
	Pedestrians accessing surrounding roads and footpaths.	
	Agricultural workers.	
Controlled Waters: Groundwater (on-site and off-site).	Groundwater in Principal Bedrock Aquifer; and Secondary Undifferentiated Superficial Aquifer.	Leaching of contaminants in soil to groundwater in underlying aquifers; migration of contaminated water through preferential pathways such as underground services, pipes and granular material to groundwater in underlying aquifers; and discharge of contaminants entrained in groundwater and/or surface water run-off followed by overland flow and discharge.
Controlled Waters: Surface waters (on-site and off-site).	Tributaries of the Minsmere New Cut River on-site.	
	Ponds off-site within 250m of the site.	
Property (on-site and off-site).	Existing on-site services and structures on and off-site. Proposed on-site services and structures.	Direct contact of contaminants in soil and/or groundwater with existing and proposed structures and buried services; and migration of contaminated groundwater, ground gas and/or vapours along strata and preferential pathways such as service routes or differentially permeable strata.
	Crops and livestock	Direct contact, ingestion, inhalation and uptake of soil and water contamination by crops and/or livestock; and migration of contaminated waters/dust/fibres and subsequent uptake by crops or ingestion/inhalation/dermal contact by livestock.

Physical effects

6.9.15. The construction of the proposed bypass may also cause physical effects including changes in soil erosion, soil compaction and ground instability issues associated with stripping of topsoil, vegetation clearance, earthworks, stockpiling, movement of heavy plant, piling, temporary works and construction of the new infrastructure.

6.9.16. Bulk earthworks along the bypass are anticipated with temporary stockpiles likely to be required on-site to allow earthworks along the road to progress and temporary works areas/haul roads to be constructed. There is also the potential for increased run-off during earthworks with a high sediment load likely to impact local surface waters. Earthworks would be planned to minimise soil exposure as far as practicable and areas required for temporary works would be reinstated as soon as possible after they are no longer required. With embedded mitigation, the effects on soil erosion are considered to be temporary and therefore neutral and would not be significant.

6.9.17. There do not appear to be any ground stability hazards (landslides, historical earthquakes, modern instrument recorded earthquakes). The site is also identified as having a low UXO risk. Ground conditions have not yet been confirmed but embedded mitigation would provide additional information on ground stability, compaction and the competence of the ground. Effects on soil compaction and ground stability are therefore considered to be neutral to minor beneficial, given that any existing contamination would have been removed, and would not be significant.

6.9.18. With the embedded mitigation physical effects are assessed to be neutral to minor beneficial. These effects would not be significant.

ii) Operation

Ground contamination

6.9.19. The use of the bypass would potentially introduce new sources of contamination. Spillages and leaks may occur and below ground services could create additional potential pathways for the migration of potential contamination that were not present at baseline. With embedded mitigation, an overall neutral to minor beneficial effect is anticipated given that any contamination would have been removed. These effects would not be significant.

6.9.20. Effects associated with ground contamination during the operational phase are summarised in **Table 6.9.3**.

Physical effects

6.9.21. Impacts in relation to physical effects including soil erosion, compaction and changes in soil stability would be mainly related to the construction phase of the bypass and there are not considered to be any significant effects during the operational phase.

d) Additional mitigation and monitoring

6.9.22. The preliminary assessment of effects presented above identifies no adverse significant effects during construction and operation in relation to land quality. Additional measures to mitigate significant adverse effects are not therefore required.

e) Preliminary assessment of residual effects

6.9.23. No additional mitigation is proposed beyond the embedded measures described above and the residual

Table 6.9.3 Construction phase contamination effects for the proposed development

Receptor	Value/Sensitivity	Baseline risk	Construction risk	Effect
Human	High	Low	Very low.	Not significant.
Controlled waters (groundwater).	Medium	Low	Very low.	Not significant.
Controlled waters (surface water).	High	Very low.	Very low.	Not significant.
Property (existing and future structures and services).	Low	Very low.	Very low.	Not significant.
Property (crops and livestock).	Medium	Low	Very low.	Not significant.

effects for all phases of development would remain the same as those described above in the preliminary assessment of effects. The effects during construction and operation would be minor beneficial to neutral given that any contamination would have been removed and would not be significant.

f) Completing the assessment

6.9.24. Once the proposals for the Sizewell C project development as a whole are finalised, a full land quality assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 6.9.4 Operational phase contamination effects for the proposed development

Receptor	Value/Sensitivity	Baseline risk	Construction risk	Effect
Human	High	Low	Very low.	Not significant.
Controlled waters (groundwater).	Medium	Low	Very low.	Not significant.
Controlled waters (surface water).	High	Very low.	Very low.	Not significant.
Property (existing and future structures and services).	Low	Very low.	Very low.	Not significant.
Property (crops and livestock).	Medium	Low	Very low.	Not significant.

Table 6.9.5 Summary of effects for construction phase

Geology and land quality

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Ground Contamination: Current and future on-site and off-site human health receptors.	Contamination from on-site sources.	Incorporate mitigation measures into the construction process, as set out in the CEMP.	Not significant.	Not required.	Not significant.
Ground Contamination: Controlled Waters receptors (groundwater and surface water).	Contamination from on-site sources.		Not significant.		Not significant.
Ground Contamination: Property receptors (services/ structures, crops and livestock).	Contamination from on-site sources.		Not significant.		Not significant.
Physical Effects: Ground conditions.	Soil erosion, soil compaction and ground stability impacts.		Not significant.		Not significant.

Table 6.9.6 Summary of effects for operational phase

Geology and land quality

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Ground Contamination: Current and future on-site and off-site human health receptors.	Contamination from on-site sources.	Construction methodology and associated mitigation measures would prevent impacts during operation. Operation in accordance with good practice.	Not significant.	Not required.	Not significant.
Ground Contamination: Controlled Waters receptors (groundwater and surface water).	Contamination from on-site sources.		Not significant.		Not significant.
Ground Contamination: Property receptors (services/ structures, crops and livestock).	Contamination from on-site sources.		Not significant.		Not significant.
Physical Effects: Ground conditions.	Soil erosion, soil compaction and ground stability impacts.		Not significant.		Not significant.

6.10. Groundwater

a) Baseline environment

6.10.1. Details on the geology of the Theberton bypass route are provided in **section 6.9**.

6.10.2. The head deposits and the diamicton of the Lowestoft Formation are classified as Secondary Aquifers (Undifferentiated)[9].

6.10.3. The Lowestoft Formation – sand and gravel is classified as a Secondary A Aquifer[10].

6.10.4. The Crag Group bedrock underlying the site is classified as a Principal Aquifer[11].

6.10.5. The site does not lie within or adjacent to a groundwater Source Protection Zone (SPZ)[12].

6.10.6. Contours shown on British Geology Survey (BGS) hydrogeological mapping (Ref. 6.10.1) suggest that Crag groundwater levels at the site may be around 5m AOD (approximately 15m b.g.l). These contours are based on data from 1976 and are only indicative of current levels, however the hydrogeological regime is not considered likely to have changed substantially in the intervening years.

6.10.7. The Lowestoft Formation at the site is expected to be of relatively low permeability and have limited hydraulic connection to the underlying Crag groundwater. It is likely there are perched water tables in permeable lenses within the Lowestoft Formation.

6.10.8. The proposed development is located on the Waveney and East Suffolk Chalk and Crag groundwater body (Water Framework Directive) reference GB40501G400600) (Ref. 6.10.2). This groundwater body has been classified by the Environment Agency as being of Poor Quantitative and Poor Chemical status, with an objective of being of Good Quantitative and Good Chemical status by 2027. The Poor Chemical status is attributed to impacts from agriculture. The proposed development falls within a groundwater nitrate vulnerable zone.

6.10.9. Given the local geology and depth to groundwater there is not considered to be a connection between groundwater and surrounding surface water features. Surface water features are discussed further in **section 6.11**.

6.10.10. 6.10.10 The Suffolk Coastal and Waveney District Strategic Flood Risk Assessment (FRA) (Ref. 6.10.3) makes no reference to groundwater flooding across the Suffolk Coastal and Waveney District. Flood risk is discussed further in **section 6.12**.

6.10.11. There is no known existing land contamination on the site. Further information on land quality is presented in **section 6.9**.

6.10.12. The Minsmere-Walberswick Heaths and Marshes SSSI is approximately 800m north-east of site (see **section 6.3**).

b) Environmental design and embedded mitigation

i) Construction

6.10.13. It is proposed that construction drainage would be contained within the site, with drainage to ground wherever possible.

6.10.14. A piling risk assessment, in accordance with Environment Agency guidance, may be required to ensure that appropriate piling techniques are implemented at the site (by identifying and managing potential risks as a result of creating pathways to groundwater).

6.10.15. The CEMP would specify measures required during enabling works and construction which could include, but not be limited to the measures already listed under **section 6.9**.

6.10.16. Remediation of soil/groundwater contamination (e.g. source removal, treatment or capping) and ground stabilisation/improvement works would be undertaken if further investigation and risk assessments deemed it necessary.

6.10.17. The drainage/flood prevention strategies would consider the ground conditions, including the permeability of the strata and the level of contamination present on-site.

ii) Operation

6.10.18. There would be appropriate drainage for the road infrastructure, including the incorporation of SuDS measures where appropriate.

[9]A Secondary (Undifferentiated) Aquifer is designated in cases where it has not been possible to attribute either category secondary A or secondary B to a rock type.

[10]Secondary A Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

[11]Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

[12]Groundwater SPZ are areas defined around groundwater sources used for public drinking water supply. The SPZ shows the risk of contamination from activities that might cause pollution in the area. The closer the activity, the greater the risk.

6.10.19. Where considered necessary, the site would incorporate petrol/oil interceptors will be within the drainage design.

c) Preliminary assessment of effects

i) Construction

6.10.20. The construction of the proposed development would require earthworks, including the excavation of cuttings. Due to the shallow nature of the cuttings and the anticipated depth to the Crag, the construction phase would not have an impact on the groundwater levels or flow of groundwater in the Crag.

6.10.21. A small area of Lowestoft sand and gravels outcrop within the footprint of the scheme, and groundwater within the Head Deposits and Lowestoft Formation diamicton aquifer would be likely to occur in discontinuous perched lenses. As such, extensive dewatering is unlikely to be required during construction.

6.10.22. The Crag groundwater would be protected from any spills or leaks by the overlying low permeability superficial deposits. The impact on the Crag groundwater would be low and the effect would not be significant.

6.10.23. Considering both the baseline conditions of the site and the environmental design and embedded mitigation, there would be no significant effects on groundwater along the route of the bypass.

ii) Operation

6.10.24. Considering both the baseline conditions of the site and the environmental design and embedded mitigation, there would be no significant effects on groundwater at the site.

d) Additional mitigation and monitoring

6.10.25. Periodic inspection and maintenance of the drainage infrastructure would be required to ensure the continued efficacy of the surface water drainage system.

e) Preliminary assessment of residual effects

6.10.26. There are not expected to be any significant adverse residual effects during the construction or operational phases.

f) Completing the assessment

6.10.27. The current road and drainage design would be developed further prior to the application for development consent.

6.10.28. Once the proposals for Sizewell C as a whole are finalised, a full groundwater assessment of the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES would present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 6.10.1 Summary of effects for construction phase

Groundwater

Receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Crag groundwater (Principal Aquifer); Lowestoft Formation sand and gravel (Secondary A Aquifer); Head and Lowestoft Formation diamicton (Secondary Aquifer (Undifferentiated));	Leaching and migration of existing contaminants (free and dissolved phase) from soils in the unsaturated zone into groundwater in underlying aquifers.	Piling risk assessment (if required). Ensuring all site activities are carried out in accordance with the CEMP. Remediation of on-site contamination if required; Appropriate drainage design.	Not significant.	Not required.	Not significant.
	Migration of contaminants via preferential pathways to deeper groundwater.		Not significant.		Not significant.
	Construction materials and the use of construction vehicles have the potential to introduce contamination to groundwater via drips and spillages and infiltration of run-off from the construction site.		Not significant.		Not significant.

Table 6.10.2 Summary of effects for operational phase

Groundwater

Receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Crag groundwater (Principal Aquifer); Lowestoft Formation sand and gravel (Secondary A Aquifer); Head and Lowestoft Formation diamicton (Secondary Aquifer (Undifferentiated)));	Increase in the impermeable area of ground cover at the development site.	Water draining from the road would pass through appropriate drainage, including the incorporation of SuDS and petrol/oil interceptors where necessary.	Not significant.	Periodic inspection and maintenance of the SuDS infrastructure.	Not significant.
	Fuel spills or leaks infiltrating to groundwater.		Not significant.		Not significant.

6.11. Surface water

a) Baseline environment

i) Surface water features

6.11.1. The proposed bypass is located on the watershed of the Minsmere Old River. Light Detection and Ranging (LiDAR) data show that the highest ground levels are located in the west of the site, at approximately 23m AOD. Ground levels slope to the south and east of the site with the lowest ground levels slightly less than 7m AOD in the south-east.

6.11.2. The Minsmere Old River catchment (water body reference GB105035046270) (Ref. 6.11.1) is located approximately 2000m north-east of the proposed development at its closest point. The existing B1122 road separates the proposed development from this watercourse. However, one tributary of the Minsmere Old River that would be intersected by the proposed road is designated as a Main River in the Environment Agency Main River Map.

6.11.3. There are several ordinary watercourses that would be crossed by the proposed development. These are tributaries of Minsmere Old River.

ii) Fluvial geomorphology

6.11.4. Geomorphology and hydromorphology are key factors contributing to whether a water body can achieve or maintain Good ecological status.

6.11.5. The Minsmere Old River water body (water body reference GB105035046270) is designated as a heavily modified water body. The geomorphology and the hydrological regime are of sufficient quality to support Good ecological status.

iii) Water quality

6.11.6. Physico-chemical and chemical data presented on catchment data explorer have been reviewed for the Minsmere Old River in the vicinity of the proposed site boundary.

6.11.7. The physico-chemical status of the Minsmere Old River is Good or High for ammonia, biochemical oxygen demand, dissolved oxygen, pH and temperature. These variables are not adversely affected by pollutants such as ammonia, copper, triclosan and zinc and hence the physico-chemical status of the water body is Good. However, the overall ecological status of the Minsmere Old River is Moderate due to the poor status of the biological quality elements.

b) Environmental design and embedded mitigation

i) Construction

6.11.8. Surface water run-off would be contained within the construction site, with drainage to ground wherever feasible. Intercepting site drainage and discharging to ground would prevent the supply of sediment and other contaminants to the surface drainage network during construction. There are several areas at risk from surface water flooding along the site and the construction phase drainage design would need to take this into account.

6.11.9. Petrol/oil interceptors would be incorporated within the drainage design where necessary.

6.11.10. Mitigation measures would be incorporated into the proposed development construction process and could include, but not be limited to:

- The wheels of all vehicles would be washed before leaving site.
- Concrete and cement mixing and washing areas would be situated at least 10m away from surface water receptors. These areas would incorporate settlement and recirculation systems to allow water to be re-used. The washing of equipment would be undertaken in a contained area, and all water would be collected for off-site disposal.
- All fuels, oils, lubricants and other chemicals would be stored in an impermeable bund with at least 110% of the stored capacity. Spill kits would be available at all times, and damaged containers would be removed from site. All refuelling would take place in a dedicated impermeable area, using a bunded bowser. Biodegradable oils would be used where possible.
- Sand bags or stop logs would also be available for deployment at the outlets from the site drainage system in case of emergency spillages.
- Carefully phased construction to minimise impacts on the river.
- Implementation of buffer strips and exclusion areas on the river and floodplain ditches within the construction site.

ii) Operation

6.11.11. The operational drainage system would incorporate SuDS measures where appropriate, to minimise potential impacts on surface water receptors. The drainage infrastructure would comprise drainage retention and/or infiltration areas. These are currently based on broad assumptions and the final areas required may change as the design progresses.

6.11.12. Drainage retention areas would discharge to the existing watercourses at a flow rate that mimics the existing greenfield rate. Infiltration areas would, subject to geotechnical testing, infiltrate into the ground.

6.11.13. Where the bypass crosses existing ordinary watercourses, new culverts would be built to maintain the existing flow of surface water. The size and form of the culverts would be determined via further assessment and once liaison has been undertaken with the Lead Local Flood Authority (SCC) and the Environment Agency.

6.11.14. Where crossing Main River, channel realignment would be incorporated into the design. The span of the new crossing would be designed with reference to the Design Manual for Roads and Bridges (DMRB) (Ref. 6.11.2). The design would include features to allow 'natural' process to continue (e.g. clear-spanning bridges with 'natural' banks so that the disruption to morphological processes is minimised). The realigned channel would be engineered so that the crossing point is perpendicular to the proposed development, with further measures to offset the loss and fragmentation of aquatic habitats (e.g. retention of remnant reaches of the previous alignment, establishment of buffer strips established).

c) Preliminary assessment of effects

i) Construction

6.11.15. Surface water run-off would be contained within the site, with drainage to ground wherever feasible. However, a main river and some ordinary watercourses would be intersected by the proposed road. As a result, a number of impacts such as loss and fragmentation of riverine habitat, disruption of riverine processes and loss of floodplain habitats would need mitigation. The road alignment may also disrupt in-channel and floodplain flows and morphological processes.

6.11.16. No significant adverse effects have been identified at this stage although further detailed assessment is required.

ii) Operation

6.11.17. No significant adverse effects have been identified at this stage although further assessment is required. This potential for effects relates to the loss of riverine and floodplain habitats and the fragmentation of remnant habitats of the Minsmere Old River water body and the road alignment may also disrupt in-channel and floodplain flows and morphological processes.

d) Additional mitigation and monitoring

6.11.18. Once operational, periodic inspection and maintenance of the SuDs infrastructure may be required to ensure the continued efficacy of the surface water drainage system.

e) Preliminary assessment of residual effects

6.11.19. The residual effects would be unchanged from the effects described above.

f) Completing the assessment

6.11.20. The current assessment is conservative, based on the design information currently available. EDF Energy anticipates that effective mitigation can be provided for the proposed development that would minimise surface water impacts. The final design of the proposed development, the need for mitigation and its form would be determined in liaison with the relevant authorities.

6.11.21. Once the proposals for Sizewell C are finalised, a full assessment of potential effects on the surface water environment from the proposals would be undertaken as part of the EIA and the results presented in the ES. The ES will present the full assessment underpinning the conclusions drawn in relation to significant effects.

Table 6.11.1 Summary of effects for construction phase

Surface water

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Main rivers and ordinary watercourses that drain into Minsmere Old River.	Loss of riverine habitat.	Realigned channel would be incorporated into the design.	No significant effects yet identified.		No significant effects yet identified.
	Fragmentation of riverine habitats.	The span of the new crossing would be designed with reference to the DMRB, ensuring potential effects are minimised. The realigned channel would be engineered so that the crossing point is perpendicular to the proposed development.	No significant effects yet identified.		No significant effects yet identified.
	Disruption of riverine processes.		No significant effects yet identified.		No significant effects yet identified.
	Loss of floodplain habitat.	New culverts would be designed with reference to the DMRB, ensuring the effects are minimised.	No significant effects yet identified.		No significant effects yet identified.
	Fragmentation of floodplain and drain habitats.		No significant effects yet identified.		No significant effects yet identified.

Table 6.11.2 Summary of effects for operational phase

Surface water

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Main rivers and ordinary watercourses that drain into Minsmere Old River.	Fragmentation of riverine habitats.	The span of the new crossing would be designed with reference to the DMRB, ensuring potential effects are minimised. Clear-spanning bridges to allow for 'natural' channel banks. Retention of remnant reaches of the previous alignment.	No significant effects yet identified.		No significant effects yet identified.
	Disruption of riverine processes.		No significant effects yet identified.		No significant effects yet identified.
	Loss of floodplain habitat.	New culverts would be designed with reference to the DMRB, ensuring the effects are minimised.	No significant effects yet identified.		No significant effects yet identified.
	Fragmentation of floodplain habitats.	New culverts would be designed with reference to the DMRB, ensuring the effects are minimised. Measures to offset habitat loss and fragmentation (e.g. buffer strips).	No significant effects yet identified..		No significant effects yet identified.

6.12. Flood risk

6.12.1. The figures for flood risk are presented in **Volume 3** as **Figures 6.12.1** and **6.12.2**.

a) Baseline environment

6.12.2. The proposed Theberton bypass route has an undulating topography, with lower elevations associated with the watercourse crossings.

6.12.3. The site crosses a 'Main River' (Theberton Watercourse) and one unnamed 'Ordinary Watercourse'. Further drainage ditches may intersect the Theberton bypass which have not been identified using OS mapping, that would also be classified as ordinary watercourses.

6.12.4. The Theberton Watercourse is a tributary to the Minsmere River.

6.12.5. The bypass route is located entirely in Flood Zone 1 (**Figure 6.12.1**), although existing fluvial modelling does not extend to the proposed crossing points of the main rivers. Therefore, flood zones are not fully defined at the crossings.

6.12.6. The site area is located adjacent to the East Suffolk Internal Drainage Board (IDB) with only a very minor area being in the IDB area.

6.12.7. Overall, fluvial flood risk is low along the bypass route, with localised areas of medium to high fluvial flood risk associated with the watercourse crossings.

6.12.8. The Environment Agency 'flood risk from surface water' map identifies the majority of the site to be at 'very low' surface water flood risk, with several localised areas having a 'low' to 'high' risk (**Figure 6.12.2**). Areas of 'low' to 'high' risk appear to be associated with watercourses, drainage features or low topographic areas.

6.12.9. The BGS Geology Map of Britain identifies the bedrock geology of the area as the Crag Group, formed of sand and is a permeable geology. Superficial geology in the area is geographically variable. Areas of higher permeability are found predominantly along watercourses, and areas with a more varied permeability found away from watercourses.

6.12.10. The risk of flooding from groundwater is slightly increased near the watercourses. However, given the site elevations and permeable geology, the overall risk of groundwater flooding to any significant depth across the site is considered low.

6.12.11. Sewers may be located within the proposed site area, however with a rural location and no recorded incidents of sewer flooding, the risk of sewer flooding is likely to be low.

6.12.12. The Environment Agency's Flood Map from Reservoirs shows the proposed development is outside of the maximum reservoir flood extents. In addition, no canals are located near to the proposed Theberton bypass. The flood risk to the site from reservoirs and canals is considered low. A summary of the baseline flood risk is presented in **Table 6.12.1**.

Table 6.12.1 Summary of flood risk at the site

Source of flooding	Flood risk
Fluvial	Predominately low risk, based on limited existing modelling: less than 1 in 1,000 annual probability of river flooding in any year (<0.1%). Localised areas of high risk near watercourses: greater than 1 in 100 annual probability of river flooding in any year (>1%).
Tidal/coastal	Low: less than 1 in 1,000 annual probability of sea flooding in any year (<0.1%).
Surface water (pluvial)	Majority of site Very Low: less than 1 in 1,000 annual probability of surface water flooding in any year (<0.1%). Five areas associated with watercourses, ditches and valley bottoms, High: greater than a 1 in 30 annual probability of surface water flooding in any year (>3.3%).
Groundwater	Low: soil is permeable (pending further investigation) and no records of groundwater flooding.
Sewers	Low: greenfield site with highways and isolated farmsteads. Sewers likely to be located on-site.
Reservoirs	Not at risk of flooding from reservoirs.

b) Environmental design and embedded mitigation

6.12.13. The Sequential Test[13] aims to steer new development away from areas with a higher risk of flooding. Under the vulnerability classification, the proposed development would be considered as *'Essential Infrastructure'*.

6.12.14. The proposed development is predominantly in Flood Zone 1, although there are two watercourse crossings; one of these watercourses is Main River and one is an Ordinary Watercourse. These watercourses have not been modelled, however, surface water modelling has been undertaken and a narrow flood extent is shown on either side of these two watercourses. Two other surface water flow paths are identified which are not associated with the Ordinary Watercourses identified using OS mapping.

6.12.15. Monitoring and maintenance of the drainage system would be carried out to preserve its integrity and maintain its design capacity.

i) Construction

6.12.16. A perimeter bund would likely be built to retain any surface water run-off on the site. Appropriate construction phase drainage would be designed to ensure surface water run-off does not increase off-site flood risk or create on-site flood risk. Detention ponds would likely be required to manage the run-off. Significant effects on flood risk are unlikely.

ii) Operation

6.12.17. Culverts are proposed over watercourses and would be sized to ensure appropriate flows and capacities are maintained in the watercourses.

6.12.18. A permanent drainage system would be constructed in accordance with DMRB (Ref. 6.12.1). The drainage system would consist of a combination of channels, kerb drains or gullies that would convey the surface water run-off to attenuation basins that infiltrate to ground, or discharge to a local watercourse at a controlled rate. Any existing surface water flooding experienced by existing roads, would be sought to be managed, where possible within the proposed Sizewell link road drainage system.

6.12.19. Climate change will be considered in the highway drainage design. The design would also consider exceedance flows to limit water depths in extreme rainfall events.

6.12.20. Flood storage compensation may be required to ensure the development does not increase flood risk elsewhere as a result of floodplain loss and there would be no significant effect on flood risk.

c) Preliminary assessment of impacts

6.12.21. Further assessment is required to fully understand the flood risk associated with the proposed bypass, however, EDF Energy believes it will be possible to avoid any significant changes in flood risk through careful design. Culverts would be designed large enough to ensure that appropriate flows and capacity are maintained. Further assessment will indicate whether flood storage compensation would be required. Relatively standard drainage measures would be employed to manage surface water run-off. The implementation of these measures means it is likely there would be no significant effects on flood risk.

d) Additional mitigation and monitoring

6.12.22. The management of exceedance flows and the associated risks they present will be considered as part of the drainage design.

e) Preliminary assessment of residual effects

6.12.23. Monitoring and maintenance of the drainage infrastructure, together with suitable design for exceedance flows, would manage the minor residual risk resulting in negligible effects that would not be significant.

f) Completing the assessment

6.12.24. Further investigations will be required to progress the drainage design. A full FRA for this site will be submitted as part of the application for development consent after the proposals for the Sizewell C development as a whole are finalised.

13 The sequential test aims to steer new development toward areas with the lowest probability of flooding. Under this policy, development should not be allocated or permitted if there are reasonably available sites appropriate for that development in areas of lower probability of flood risk

Table 6.12.2 Summary of effects for construction phase

Flood risk

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Fluvial	The new road crossing an undetermined floodplain may increase flood risk both on-site and off-site.	Temporary works in the construction phase to maintain flow at the watercourse crossings. Monitoring and maintenance of temporary works to preserve integrity and maintain design standard.	Not significant.	Management of exceedance flows.	Not significant.
Surface Water	Increase in impermeable area and associated surface water run-off during construction of site.	Shallow perimeter bunds constructed to contain surface water run-off on-site. Monitoring and maintenance of bund to preserve integrity and maintain design standard.	Not significant.	Management of exceedance flows.	Not significant.
	Off-site surface water flow crossing the site.	Perimeter ditch constructed outside of the perimeter bunds to intercept off-site surface water flows including an allowance for climate change to infiltrate to ground. Monitoring and maintenance of ditch and bunds to preserve integrity and maintain design standard.	Not significant.	Management of exceedance flows.	Not significant.

Table 6.12.3 Summary of effects for operational phase

Flood risk

Topic/receptor	Impacts	Environmental design and embedded mitigation	Assessment of effects	Additional mitigation	Residual effects
Fluvial	Road crossing undetermined floodplain may increase flood risk both on-site and off-site.	Through culvert sizes and road design, minimise the road encroachment into the floodplain (and the provision of flood storage compensation if required). Monitoring and maintenance of road and culvert structures to preserve integrity and maintain design standard.	Not significant.	Management of exceedance flows.	Not significant.
Surface Water	Increase in impermeable area and associated surface water run-off from the site.	Surface water from impermeable areas discharged to infiltration SuDS including an allowance for climate change and incorporate the management of existing areas flood risk. Monitoring and maintenance of SuDS to preserve integrity and maintain design standard.	Not significant.	Management of exceedance flows.	Not significant.

6.13. Traffic and transport

a) Baseline environment

6.13.1. The section of the B1122 running through Theberton is characterised by close proximity to dwellings, constrained width in places, and incomplete footways. There are no marked crossing facilities within the village.

6.13.2. The B1122 is a single carriageway road with a speed limit of 30mph in the villages together with 40mph and 60mph zones outside of built-up areas.

6.13.3. The road through and approaching Theberton is generally flat with no significant gradients or tight bends for the existing vehicle speeds.

6.13.4. At the junction of the existing B1122 and Mill Street, the B1122 has poor vertical alignment just west of the junction with Mill Street: B1122 drivers approaching the junction from the west have difficulty seeing traffic at the junction, while traffic leaving Mill Street is not able to see B1122 traffic approaching from the west until it is near the junction.

6.13.5. Several minor roads join the B1122 in Theberton, including Church Road which runs to Eastbridge.

6.13.6. The B1122 currently carries approximately 5,150[14] vehicles per day through Theberton. If Sizewell C was not developed, this figure would rise to 5,550 vehicles by 2027. During the peak construction year of Sizewell C, up to 7,600 vehicles would travel along the B1122 through Theberton including an additional 450 HGVs compared to the present day.

6.13.7. The A12 and B1122 are designated as a high and heavy load route by Highways England; this route runs from Lowestoft Docks to Sizewell.

6.13.8. There have been eleven accidents on the B1122 between the A12 and the main development site between 2013 and 2017. Of these, seven were within or close to Theberton on the section of the existing B1122 which the proposed new road would bypass. Two of these collisions were serious in nature.

6.13.9. There are a number of PRoWs in the vicinity of the site, further details of which are provided in **section 6.4**.

b) Environmental design and embedded mitigation

i) Construction

6.13.10. Construction of a new bypass, as opposed to upgrading the existing road, carries transport-related environmental benefits during construction since traffic flow along the existing B1122 would be largely unaffected during the construction period, with the exception of when work at the junctions with the existing B1122 at either end of the new bypass would be taking place.

6.13.11. EDF Energy estimates that around 175 heavy goods vehicles and 300 construction workers would arrive each day during the construction of the Theberton bypass. It is anticipated that construction would be led from the western end of the Theberton bypass route, with the principal construction compound at that end.

6.13.12. It is expected that all vehicles involved in the construction of the Theberton bypass would travel along the A12 and B1122 as far as the western end of the proposed development, before turning off the B1122 and following the route of the proposed development. Construction traffic is therefore not expected to noticeably impact on Theberton, with the possible exception of construction vehicles which require access to the eastern junction of the bypass.

ii) Operation

6.13.13. The Theberton bypass would carry the construction traffic serving the main development site as well as other traffic which currently uses the B1122 through Theberton. The Theberton bypass would be built in the rail-led scenario and would carry up to 8,850 vehicles per day during the Sizewell C peak construction year (2027) of which 2,300 vehicles per day relate to Sizewell C. These traffic volumes are comfortably below the design capacity of the road.

6.13.14. The existing B1122 would remain as a through road with access to Theberton at both ends. In the event of disruption along the Theberton bypass, the existing B1122 could serve as a diversionary route. This could also allow Sizewell C construction traffic to be temporarily held on the Theberton bypass, in the event of short-term disruption to access to the main development site if they have already passed the temporary holding area at the southern park and ride site (see **Volume 2B, Chapter 9**), while through traffic uses the existing B1122.

14 Traffic counts for the highway modelling – see **Volume 1, Chapter 6**

6.13.15. Theberton bypass would reduce traffic flows on the existing B1122 by 95%. The residual traffic flow through the village is forecast to be 350 vehicles per day.

c) Preliminary assessment of effects

i) Construction

6.13.16. The transport-related effects of construction of the Theberton bypass are anticipated to be modest. The route would be located away from built-up areas and intersects only roads which generally carry low volumes of traffic. The PRoWs intersected by the bypass route are also lightly used.

6.13.17. During the early years of construction at the main development site, the Theberton bypass would still be under construction. In the traffic modelling work (presented in **Volume 1, Chapter 6**), EDF Energy has included an allowance for the construction traffic associated with building the Theberton bypass.

6.13.18. During the early years of construction of the Theberton bypass, there would be times when traffic flow along the B1122 would be disrupted in order to build the junctions at either end of the Theberton Bypass, as well as at the junction of the B1122 and B1125. During these periods, traffic using the existing B1122 would be disrupted due to the traffic management measures required to link the old B1122 to the new bypass. The disruption would be moderate but for relatively short periods of time, and so the overall effect would be minor and not significant.

6.13.19. The construction of the minor road junctions along the bypass would be less disruptive to existing traffic as the volumes of vehicles on these roads is low, giving rise to only a minor impact and the effect would not be significant.

ii) Operation

6.13.20. Provision of a new bypass designed to modern highway standards would represent an improvement to the traffic and transport infrastructure in the Theberton area. Vehicles would be able to travel at a more consistent speed, giving rise to more reliable journey times. This would have a minor beneficial effect for vehicles driving through Theberton once the bypass is operational.

6.13.21. Pedestrians in Theberton would benefit from significantly reduced traffic volumes which in turn facilitates crossing the existing B1122. A reduction in traffic through the village would also improve the pedestrian experience and reduce severance. This would represent a major beneficial effect for pedestrians within Theberton compared to the existing situation.

6.13.22. Local traffic travelling to and from Theberton from the west may experience a minor adverse effect as a result of the closure of certain direct routes, such as Pretty Road (traffic would instead be required to use the Theberton bypass, the B1125 and the B1122 to reach Theberton). Several junctions have been provided along the bypass in order to minimise such inconvenience.

d) Additional mitigation and monitoring

i) Construction

6.13.23. EDF Energy would consider undertaking the vertical realignment works for the B1122 at Mill Street west of Theberton prior to the commencement of the construction works at the Sizewell C main development site. This would reduce the disruption along the B1122 during the early years of construction when higher numbers of vehicles, including HGVs, would be using the road. Further details are provided in **Volume 1, Chapter 11**.

ii) Operation

6.13.24. No additional traffic and transport mitigation measures are proposed during the operational lifespan of the bypass.

e) Preliminary assessment of residual effects

6.13.25. The residual effects during construction and operation are anticipated to be the same as those set out under preliminary effects described above.

f) Completing the assessment

6.13.26. Once the design for the Theberton bypass is developed further and in more detail, a traffic and transport assessment will be undertaken and will be used to inform the EIA.

6.14. Comparison between rail-led and road-led strategies

6.14.1. The Theberton bypass as assessed above would be built under the rail-led strategy. However as the design of the Theberton bypass is similar under both the road-led strategy (as a component of the Sizewell Link road) and the rail-led strategy, the assessments presented in this chapter in relation to landscape and visual, terrestrial ecology, amenity and recreation, terrestrial historic environment, soils and agriculture, geology and land quality, groundwater, surface water and flood risk are valid under both strategies for the same length of road and there would be no differences in the significance of effects between the two.

6.14.2. The traffic and transport assessment presented above is based upon the rail-led scenario in which 'only' the Theberton bypass is built (rather than the full Sizewell link road, containing a bypass around Theberton. During the main peak year of construction of Sizewell C, approximately 8,850 vehicles per day would use the bypass. Under the road-led strategy approximately 9650 would use the 'bypass; (as part of the Sizewell link road, see **Chapter 5** of this Volume).

6.14.3. Under both strategies there would be significant beneficial reductions in traffic volumes through Theberton itself and related beneficial effects on noise and probably on air quality. However, there would be no differences in the significance of traffic, noise or air quality or vibration effects *between* the two strategies in the Theberton area given the relatively small difference in vehicle movements through the village between the two strategies.

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Volume 2 PEI Abbreviations

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Abbreviation	Term
AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekday Traffic
ABI	Annual Business Inquiry
ABCL	Automatic Barrier Crossing Locally Monitored
AD	Associated Development
AES	Annual Employment Survey
AHB	Automatic Half Barrier
AIL	Abnormal Indivisible Load
AIS	Automated Identification System
ALARP	as low as reasonably practicable
ALC	Agricultural Land Classification
AMIE	Archives Monuments Information England
ANPR	Automatic Number Plate Recognition
AOCL+B	Automatic Open Crossing locally monitored with barriers
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
AoS	Appraisal of Sustainability
AST	Assured Shorthold Tenancy
ATA	Apprenticeship Training Agency
ATC	Automatic Traffic Counts
AQMA	Air Quality Management Area
B&B	Bed and Breakfast
BAT	Best Available Techniques
BEIS	Department for Business, Energy and Industrial Strategy
bgl	below ground level
BGS	British Geological Survey
BLF	beach landing facility
BMV	best and most versatile
bn	billion
BP	before present
BREEAM	Building Research Establishment Environmental Assessment Method
BRES	Business Register and Employment Survey
BOD	Biological Oxygen Demand
BP	Borrow Pit
CABE	Commission for Architecture and the Built Environment at Design Council

Abbreviation	Term
CCA	Construction Contractor Area
CCP	Code of Construction Practice
CCSM	Chillesford Church Sand Member
CDCZ	Construction Daily Commuting Zone
CDO	Combined Drainage Outfall
DDO	Combined Drainage Outfall
CEEQUAL	Civil Engineering Environmental Quality Award
CES	Census of Employment
CEMP	Construction Environmental Management Plan
CDM	Construction Design and Management
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CGS	County Geodiversity Sites
CHP	Combined Heat and Power
CITB	Construction Industry Training Board
CoCP	Code of Construction Practice
CSM	Conceptual Site Model
CSN	Construction Skills Network
CSMP	Community Safety Management Plan
CTD	Conductivity, Temperature and Depth Sensor
CWS	County Wildlife Site
CWDA	Construction Water Discharge Activity (permit)
CWTP	Construction Worker Travel Plan
DAC	Design Acceptance Confirmation
DBA	Desk Based Assessment
DCLG	Department for Communities and Local Government
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DEHP	Bis(2-ethylhexyl) phthalate
DfT	Department for Transport
DIN	Dissolved Inorganic Nitrogen
DMO	Destination Management Organisation
DMS	Delivery Management System
DO	Dissolved Oxygen
DMRB	Design Manual for Roads and Bridges
DRS	Direct Rail Services
DWT	Deadweight Tonnage
DWP	Department for Work and Pensions

Abbreviation	Term
ECI	Early Contractor Involvement
ECoW	Ecological Clerk of Works
EDF	Electricité de France
EDG	Emergency Diesel Generator
EEEGR	East of England Energy Group
EEFM	East of England Forecasting Model
EERM	East of England Regional Model
EIA	Environmental Impact Assessment
EMU	Entrainment Mimic Unit
EPR	Evolutionary Pressurised Reactor
EPS	European Protected Species
EQS	Environmental Quality Standards
ES	Environmental Statement
ESL	English as a Second Language
EU	European Union
EQS	Environmental Quality Standard
FDP	Funded Decommissioning Programme
FLO	Fisheries Liaison Officer
FMF	freight management facility
FRA	Flood Risk Assessment
FRR	Fish Recovery and Return
GCSE	General Certificate of Secondary Education
GDA	Generic Design Assessment
GDP	Gross Domestic Product
GEP	Good Ecological Potential
GES	Good Ecological Status
GI	Ground Investigation
GIS	Geographical Information Systems
GRIP	Governance Railway Investment Projects
GSB	Greater Sizewell Bay
GVA	Gross Value Added
GW	Gigawatt
Ha	hectare
HAP	Health Action Plan
HAZID	Hazard Identification
HB	Home based
HCDF	Hard Coastal Defence Feature
HDV	Heavy Duty Vehicle
HE	Historic England

Abbreviation	Term
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HIA	Health Impact Assessment
HLC	Historic Land Characterisation
HMO	House in Multiple Occupation
HMOs	Houses in Multiple Occupation
HMWB	Heavily Modified Water Body
HRA	Habitats Regulations Assessment
HSA	Health and Safety Authority
HTL	Hold The Line
IAQM	Institute of Air Quality Management
ICES	International Council for the Exploration of the Seas
ICT	Information and Communications Technology
ICAG	Information, Career Advice and Guidance
IDB	Internal Drainage Board
IFCA	Inshore Fisheries and Conservation Authority
ILO	International Labour Organisation
ILW	Intermediate Level Waste
ILWSF	Intermediate Level Waste Storage Facility
IMO	International Maritime Organisation
ISFS	Interim Spent Fuel Store
IROPI	Imperative Reason of Overriding Public Interest
ITIS	Integrated Transport Information System
IPC	Infrastructure Planning Commission
JCP	Jobcentre Plus
JLAG	Joint Local Authority Group
JSA	Jobseekers Allowance
km	kilometre
KPI	Key Performance Indicator
kV	Kilovolt
kW	Kilowatt
LCA	Landscape Character Area
LEEIE	Land to the east of Eastlands Industrial Estate
LEMP	Landscape and Ecology Masterplan
LEP	Local Enterprise Partnership
LGV	Light Goods Vehicle
LiDAR	Light Detection and Ranging
LLW	Low Level Waste

Abbreviation	Term
LOAEL	Lowest observable adverse effect
Lo-Lo	lift-on lift-off
LOOP	Loss of On-site Power
LSE	Likely Significant Effect
LVIA	Landscape and Visual Impact Assessment
m	metre
M bgl	Metres below Ground Level
M&E	mechanical and engineering
MAID	Marine Accident Investigation Branch
MAS	Manufacturing Advisory Service
MCA	Main construction area
MCB	Manually Controlled Barrier
MCB-CCTV	Manually Controlled Barriers with CCTV
MCB-OD	Manually Controlled Barrier with obstacle detection
MCC	Manual Classified Counts
MDS	main development site
MHCLG	The Ministry for Housing, Communities and Local Government
MHWM	Mean High Water Mark
MHWN	Mean High-Water Neap Tide
MHWS	Mean High Water Spring
MMO	Marine Management Organisation
MMP	Materials Management Plan
MOD	Ministry of Defence
MOLF	Marine Offloading Facility
mph	miles per hour
MR	Managed Realignment
MSL	Miniature stop light
MUGA	Multi-Use Games Area
MW	Megawatt
NAI	No Active Intervention
NALEP	New Anglia Local Enterprise Partnership
NAMRAC	Nuclear Advanced Manufacturing Research Centre
NAMTEC	National Metals Technology Centre
NCA	National Character Area
NCA82	National Character Area 82
NCA83	National Character Area 83
NDA	Nuclear Decommissioning Authority
NEET	Not in Education, Employment and Training

Abbreviation	Term
NHB	Non-home based
NIA	Nuclear Industry Association
NERC Act	Natural Environment and Rural Communities Act 2006
nm	nautical miles
NNB	New Nuclear Build
NNR	National Nature Reserve
NMP	National Mapping Programme
NO2	Nitrogen Dioxide
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NPS EN-1	Overarching National Policy Statement for Energy (EN-1)
NPS EN-6	National Policy Statement for Nuclear Power Generation (EN-6)
NRA	Navigation Risk Assessment
NRMM	Non Road Mobile Machinery
NSAN	National Skills Academy for Nuclear
NSIP	Nationally Significant Infrastructure Project
NtM	Notice to Mariners
NTS	National Transmission System
NVZ	Nitrate Vulnerable Zone
ODN	Ordnance Datum (Newlyn)
O-D	Origin-Destination
OEMP	Outline Environmental Management Plan
OGV	Other Goods Vehicle
OND	Office for Nuclear Development
ONR	Office for Nuclear Regulation
ONS	Office for National Statistics
ODN	Ordnance Datum Newlyn
ORR	Office of Rail Regulation
OS	Ordnance Survey
OSC	Operational Service Centre
OWF	Offshore Windfarm
PAH	Polycyclic Aromatic Hydrocarbons
PAS	Portable Antiquities Scheme
PCB	Polychlorinated biphenyls
PCSM	Preliminary Conceptual Site Model
PDZ	Policy Development Zone
PEI	Preliminary Environmental Information

Abbreviation	Term
PHA	Preliminary Hazard Assessment
PHP	Personalised Housing Plan
PINS	Planning Inspectorate
PM_{10}	Particulates
POGO	Power operated gate opener
PRoW	Public Right of Way
PPE	Personal Protective Equipment
PRS	private rented sector
P&R	Park and Ride
PV	Photovoltaic
PWR	Pressurised Water Reactor
RAG	Red Amber Green
RBD	River Basin District
RBMP	River Basin Management Plan
RFID	Radio frequency identification
RHP	Registered Housing Provider
RIGS	Regionally Important Geodiversity Sites
RNLI	Royal National Lifeboat Institution
RNR	Roadside Nature Reserve
Ro-Ro	roll-on roll-off
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAL	Site Action Level
SBIS	Suffolk Biodiversity Information service
SCC	Suffolk County Council
SCCAS	Suffolk County Council Archaeological Service
SCDC	Suffolk Coastal District Council
SCT	Seascape Character Type
SECDB	Suffolk Energy Coast Delivery Board
SEGway	Suffolk Energy Gateway scheme
SCDF	Soft Coastal Defence Feature
SEP	Strategic Economic Plan
SFRA	Strategic Flood Risk Assessment
SIC	Standard Industrial Classification
SLA	Special Landscape Area
SLAF	Suffolk Local Access Forum
SLR	Sea Level Rise

Abbreviation	Term
SMP	Shoreline Management Plan / Soil Management Plan (as appropriate in context)
SO2	Sulphur Dioxide
SOLAS	Safety of Life at Sea
SoCC	Statement of Community Consultation
SoDA	Statement of Design Acceptability
SPA	Suspended Particulate Matter/Special Protection Area
SPZ	Source Protection Zones
SSA	Strategic Siting Assessment
SSA	Spoil Storage Area
SSC	Suspended Sediment Concentration
SSSI	Site of Special Scientific Interest
STEM	Science, Technology, Engineering and Maths
STW	Sewage Treatment Works
SuDS	Sustainable Urban Drainage System
SWMP	Site Waste Management Plan
SWT	Suffolk Wildlife Trust
TAG	Transport Analysis Guidance
TBNNBS	Triple Bar New Nuclear Build Sites
TCA	Temporary construction area
TIMA	Traffic Incident Management Area
TIMP	Traffic Incident Management Plan
TOB	Train crew operated barrier with assistance
TOG	Train crew operated crossing
tpa	throughput
TRO	Total Residual Oxidant
TSS	Traffic Separation Scheme
TWA	Temporary Worker Accommodation
UK	United Kingdom
UKCIP	United Kingdom Climate Impacts Programme
UKCP18	United Kingdom Climate Projections 2018
UK EPRTM	United Kingdom European Pressurised Reactor
UKHO	United Kingdom Hydrographic Office
UWC	User worked crossing
UWC+T	User worked crossing with telephone
UXO	Unexploded Ordnance
VAS	Vehicle Activated Signs
VDV	Vibration Dose Value

Abbreviation	Term
VISSIM/ VISUM	Micro-simulation
WDA	Water Discharge Activities
WDC	Waveney District Council
WFD	Water Framework Directive
WFDA	Water Framework Directive Assessment
WMZ	Water Management Zones
WSI	Written scheme of archaeological investigation
WWII	Second World War
ZOI	Zone of Influence
ZTV	Zone of Theoretical Visibility
ZVI	(Term as yet unknown)

Glossary

Term	Definition
General	
Aldhurst Farm habitat creation scheme	Land on which a habitat creation scheme has been created to help compensate for any future land-take from the Sizewell Marshes SSSI should Sizewell C be constructed. This land extends from the B1122 Abbey Road in Leiston to Lover's Lane. Permission was granted for the scheme in March 2015 and it has now been created.
application for development consent	The application to construct and operate Sizewell C. The term 'DCO application' should not be used.
existing Sizewell power station complex	The existing Sizewell A and B power stations together.
landscape strategy	The landscape strategy seeks to restore and enhance those areas subject to construction of the power station and enhance those remaining areas across the wider EDF Energy Estate.
proposed development	Should be used to describe the subject of that chapter. For example, in volume 2, chapter 1 it should be used to refer to the power station whilst in volume 3, chapter 13 it should be used to refer to the park and ride facility. The term will be clearly defined in the introductory chapter to the relevant site.
site	As above, should be used to describe the particular site under consideration within that volume. For example, in volume 2, chapter 1 "site" should be used to refer to the site for the construction/operation of the power station whilst in volume 3, chapter 13 it should be used to refer to the site for the construction/operation of the park and ride facility. A clear definition will be provided in the introductory chapter to the relevant site.
Sizewell A / Sizewell A power station	The existing Sizewell A power station and associated infrastructure, located to the south of the existing Sizewell B power station and the location of the proposed Sizewell C power station platform.
Sizewell B / Sizewell B power station	The existing Sizewell B power station and associated infrastructure, located to the south of the location of the proposed Sizewell C power station platform.
Sizewell C / Sizewell C power station	The proposed power station to be located to the north of the existing Sizewell A and Sizewell B power stations.
the Project	To be used when referring to the development as a whole. The term 'Sizewell C Project' can be used for clarity when required, for example when talking about other projects/plans. The terms 'SZC Project' and 'SZC' etc. should not be used.
Main development site	
accommodation campus	Would be located in the north-west of the main development site and take the form of modular blocks, with car parking, residential and recreational facilities. Sports facilities will now be located off-site likely in Leiston.
beach landing facility (BLF)	Proposed to be located to the north-east of the power station platform and is likely to take the form of a concrete structure embedded into the sea defences with a road running around the northern foot of the northern mound, connecting it to the power station platform. During periods of use the facility would be uncovered and the sand and shingle in front of the facility would be dredged to allow an access channel for the required ship. The excavated material would be replaced after use.
borrow pit	To allow for the extraction of existing sands and gravel for use as backfill material for the main construction. The pits would then be filled with excavated materials that are unsuitable for re-use in construction (principally the peaty materials). To be located at the north-west of the temporary construction area.
cooling water intake(s) **cooling water outfall(s)** **(collectively referred to as 'cooling water infrastructure')**	Two intake tunnels (one associated with each unit) each with one or two intake heads and one discharge tunnel with two outfall heads. The intake and outfall heads would be situated seaward of the Sizewell-Dunwich Bank, around 3km (subject to final engineering design) from the power station. The cooling water tunnels would be constructed beneath the foreshore and sea floor by tunnel boring machines operating from the landward side.
foreshore works	The works undertaken in the corridor to the east of main platform for the construction of the initial phase of the sea defence, the BLF with the associated access road and the permanent sea defence.
land east of Eastlands Industrial Estate (LEEIE)	Land to the east of the Eastlands Industrial Estate, which is directly north of Sizewell Halt, would be used to support construction on the power station platform and temporary construction area (for location see the illustrative plan at 2.3 below). The term 'Big Field', used as short-hand by EDF Energy and others, should not be used in any of the consultation documents.
main development site (MDS)	The total area needed for constructing the Sizewell C power station and made up of the power station platform, the temporary construction area and the land east of Eastlands Industrial Estate (for location see the illustrative plan at 2.3 below).

Term	Definition
power station platform (main platform)	The area that will become the permanent power station. The permanent features include: two UK EPR comprising of 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 buildings, offices and storage facilities; drainage infrastructure and National Grid 400kV Substation and one National Grid pylon (for location see the illustrative plan at 2.3 below).
post-operational phase	Once construction of the power station is complete, it is anticipated that the associated developments will no longer be required by EDF Energy. This stage is referred to as the post-operational phase.
Rochdale Envelope	The 'Rochdale Envelope' approach is employed where the nature of a proposed development means that some details of a project have not been confirmed (for instance the precise dimensions of structures) when an application is submitted, and flexibility is therefore sought to address uncertainty.
temporary construction area	The area within the main development site located primarily to the north and west of the SSSI crossing. This would be used to support construction activity on the power station platform. This would include the accommodation campus, borrow pit fields, contractors' compounds, site management facilities, entrance plaza, on-site car parking and the green rail route east of B1122 after it has crossed the redline into the temporary construction area (for location see the illustrative plan at 2.3 below).
Associated development	
A12/B1122 Yoxford roundabout	Roundabout at junction of the B1122 with the A12 at Yoxford. Presented as an option at Stage 2 (Option 1 of 2, chosen in preference to a signalised junction).
associated development(s)	Temporary development which is associated with a Nationally Significant Infrastructure Project (NSIP), as defined by the Planning Act 2008. What this includes is different under the rail-led strategy and the road-led strategy. See table at 2.2 below. Road improvements would be associated development but would be permanent.
East Suffolk Line	The railway line which runs hourly (Monday to Saturday and every other hour on Sundays) from Ipswich to Lowestoft passing through Wickham Market, Saxmundham and Darsham. Under the rail-led strategy this line will accommodate up to five freight trains per day when the green rail route is operational. Upgrade works on this line include a passing loop, signalling upgrades, track crossover at Saxmundham, level crossing works and bridge strengthening works. Under the road-led strategy this line will accommodate up to two freight trains per day. EDF Energy is working with Network Rail to identify upgrades needed under the road-led strategy.
freight management facility	This is only proposed as part of the road-led strategy. It is an area to manage HGV movements coming to the main development site from the south. A number of options of potential sites will be presented at Stage 3 but the specific sites are yet to be confirmed. Options were proposed in Stage 1 but this proposal was not included in Stage 2.
green rail route	Presented in Stage 2 and now only proposed as part of the rail-led strategy. This new branch line off the existing Saxmundham to Leiston line will be used to support up to five freight deliveries per day (ten movements). It would run from Saxmundham Road to Buckleswood Road; Buckleswood Road to B1122 (Abbey Road); and B1122 (Abbey Road) into the temporary construction area.
northern park and ride – Darsham	The northern park and ride site would require around 1,250 car parking spaces, together with other facilities and infrastructure to operate the park and ride, as well as on-site spoil storage areas from the construction of the facility. In Stage 2 access to the Darsham site was from the south, in this Stage 3 the proposed access is from a new roundabout north of Willow Marsh Lane.
other highway improvements	4 were proposed at Stage 2. Which works would be carried out in the early years of the rail-led strategy or the road-led strategy is still to be confirmed. These are the proposals presented in Stage 2 which may be taken forward: Mill Street – improvement to the B1122 to the west of the junction with Mill Street, near Middleton Moor–reducing the road level to the west of the junction would improve forward visibility for traffic on the B1122 and help traffic exiting Mill Street. Pump Cottages / Theberton / Theberton South – pedestrian enhancements including pedestrian crossing and footpath near Pump Cottages (provision of a new footpath on the eastern side of the B1122 that connects to the existing footpath and a new pedestrian crossing on the B1122 near Theberton, Pump Cottages)
rail-led strategy	The preferred proposal for transporting construction material to the main development site. A rail-led strategy will allow for up to 5 freight trains a day and 225 HGVs average at peak with 450 HGVs on the busiest day. HGVs will only operate between 7.00 and 23.00. This strategy includes the two village bypass, A12/B1122 Yoxford roundabout and Theberton bypass. The green rail route would allow trains to go directly to the temporary construction area. This strategy also includes upgrades to the East Suffolk Line and the Saxmundham – Leiston branch line and Sizewell Halt. Use of the beach landing facility for AILs is also part of this strategy.

Term	Definition
road-led strategy	In the event that the rail-led strategy is not deliverable in time, a road-led strategy would be proposed. A road-led strategy will allow for up to 2 freight trains a day and 375 HGVs average at peak with 750 HGVs on the busiest day. HGVs will be able to operate for extended hours. This strategy includes the two village bypass and A12/B1122 Yoxford roundabout. The Theberton bypass would be built as part of the Sizewell link road which would be south of the B1122 and travel from the A12 to the main development site. Additionally, a freight management facility would be included on A12/A14 junction near Ipswich. The limited use of rail only allows for upgrades to the Saxmundham – Leiston branch line and Sizewell Halt. Use of the beach landing facility for AILs is also part of this strategy.
Sizewell link road	New road which would bypass the B1122 with a new single carriageway road to the south west. Once operational, the bypass would form a new section of the B1122. The proposed route runs approximately 6.8 km across predominantly agricultural land to the south west of the existing B1122. The bypass would be a single carriageway 7.3m wide with 1m hardstrips and 2.5m verges. The side roads would be approximately 6m in width, with the exception of the new connections to the B1125 and to the B1122 west of Middleton Moor, which would be 7.3m wide. This would only be required in the road-led strategy whereas the smaller Theberton bypass (which forms part of the route of the longer Sizewell link road) would be required in the rail-led strategy.
southern park and ride – Wickham Market	The southern park and ride site would require around 1,250 car parking spaces, together with other facilities and infrastructure to operate the facility, as well as on-site soil storage areas from the construction of the facility. The site has changed since Stage 1, with the redline boundary moving to the fields adjacent to the eastern boundary of the original site.
Theberton bypass	New road which would bypass the village of Theberton with a new single carriageway road to the west. Once operational, the bypass would form a new section of the B1122. The proposed route runs approximately 2.6km across predominantly agricultural land to the west of the existing B1122, departing the B1122 via a new section of road that starts at the existing junction with Hawthorn Road and Annesons Corner and re-joins the B1122 approximately 420m south of the existing junction with Moat Road and Onner's Lane. The bypass would be a single carriageway 7.3m wide with 1m hardstrips and 2.5m verges. The side roads would be approximately 6m in width, with the exception of the new connection to the B1125, which would be 7.3m wide. This is a stand-alone development under the rail-led strategy but would also form part of the Sizewell link road under the road-led strategy.
two village bypass	New road which would bypass the villages of Farnham and Stratford St Andrew with a new single carriageway road to the south. Once operational, the bypass would form a new section of the A12. The proposed route runs approximately 2.4km across predominantly agricultural land to the south of the existing A12, departing the A12 to the west of Stratford St Andrew via a new three arm roundabout near Parkgate Farm and re-joining the A12 with a second roundabout to the east of Farnham at the A12/A1094 Friday Street junction. The bypass would be a single carriageway 7.3m wide with 3.5m verges. The side roads would be approximately 6m in width. This was presented as option 4 at Stage 2. This is proposed for both a rail-led or road-led strategy.
upgrades to Sizewell Halt	Upgrade of the existing rail facility to the east of Leiston, to facilitate its use as the primary rail delivery point in the early years of the power station construction programme.
upgrades to the existing Saxmundham-Leiston branch line	Proposed under rail-led strategy and road-led strategy. The existing track would be repaired or replaced to the standard required for freight transport and works will be carried out on the level crossings.
EIA and related assessment terms	
Additional mitigation	This is often referred to as 'secondary mitigation' and includes actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning consent or through inclusion in an ES topic chapters (e.g. describing certain lighting limits, which will be subject to the submission of a detailed lighting layout as a condition of approval; commitment to the implementation of an archaeological watching brief).
Additive impacts	These arise when impacts from the Project combine with impacts from other planned/potential third party development projects (normally in the vicinity of the site), resulting in a change to the overall impact and resulting effect.
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).

Term	Definition
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
Baseline	The environmental conditions, resources and receptors that currently exist on the site and in the surrounding area.
Bathing Water Directive Quality Standards	The microbial standards for water quality at popular beaches and inland bathing sites.
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.
Commissioning	Commissioning of a reactor involves a series of tests to demonstrate, to the extent practicable, that the plant, as built and including all components and systems, is capable of safe and reliable operation in accordance with its design specification, performance objectives and safety requirements.
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.
Cross-shore	On or across the shore.
Cumulative effects	Cumulative effects arise when impacts from the proposed development combine with impacts from other planned / potential third party plans or projects (normally in the vicinity of the site), resulting in a change to the overall magnitude of impact acting on a receptor and potentially a change in the resulting effect.
Cut-off wall	In order to excavate to a sufficient depth for the foundations of the power station buildings, it will be necessary to construct a cut-off wall to isolate the excavation from the surrounding hydrological environment.
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.
Decommissioning	At the end of its operational life, the power station buildings, other than the Interim Spent Fuel Store (ISFS) and the Intermediate Level Waste (ILW) building, would be removed. The process that is required to do this is known as decommissioning.
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	NNB Generation Company (SZC) Limited, whose registered office is at 90 Whitfield Street, London, W1T 4EZ (referred to in this document as 'EDF Energy').

Term	Definition
EDF Energy Estate	Land owned by EDF Energy in the Sizewell area.
Effects	Are defined as the consequences of impacts. For example, the opening of new views towards the new bypass or a change in the perception of a local landscape character.
Embedded mitigation	This is often referred to as 'primary mitigation' and includes modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project, become a fundamental part of the design for which consent is sought, and do not require additional action to be taken (e.g. architectural treatment of proposed facilities to be in keeping with similar adjacent buildings in its external appearance; reduction in the height of a building to reduce visual impact; identifying a key habitat that should remain unaffected by the development's layout and operation e.g. retaining a hedgerows as bat foraging routes; developing a transport strategy that reduces trips, avoiding the need for junction improvements).
Entrainment	Term used to describe the passage of marine organisms small enough to go through the cooling water filtration 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).
Environmental Statement	The document reporting the process and outcomes of the EIA.
Fauna	Animals
Fish Recovery and Return (FRR)	A system specifically designed to remove fish from the cooling water system and return them, in good condition, to the sea. Such systems have now been in use for many years: an early version is already in place at Sizewell B and was specifically designed to return juvenile sole quickly to sea, although the measured survival of other species is high also. Given the risk of damage due to turbulence, shear, pressure and physical impact this type of system only succeeds well for more robust species such as flatfish and eel
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 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 Regulations Assessment (HRA)	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).
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 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.

Term	Definition
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.
Historic England	A Government Agency which promotes conservation and understanding of the historic environment and 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.
Hold the Line	One of several policy options that may be identified for separate lengths of coastline under the Shoreline Management Plan (SMP) (q.v.). A 'hold the line' policy chooses to provide some level of coastal defence, keeping the position of the defence approximately where it is now. This does not automatically mean that defences will be improved to counteract climate change as this will be considered in more detail by Flood Risk management strategies and individual defence schemes. Other such policies in include 'no active intervention' and 'managed realignment'.
Impact	Are defined as the changes 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 filtration 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 effects	Effects that occur when different individual environmental impacts of the proposed development combine together synergistically to influence particular receptors and have the potential to lead to significant effects. If considered in isolation the individual environmental impacts may not lead to significant effects.
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.
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.
Managed realignment	One of several policy options that may be identified for separate lengths of coastline under the Shoreline Management Plan (SMP) (q.v.). A 'managed realignment' policy allows managed landward movement of defences, giving up some land to the sea to form a more sustainable defence line in the future. This option may create additional habitat such as mud flats or saltmarsh which provide a natural flood risk defence.
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.
National Grid	National Grid run and operate the high voltage electric power transmission network in Great Britain, connecting power stations and major substations and ensuring that electricity generated anywhere in Great Britain can be used to satisfy demand elsewhere.
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.
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.
Nearshore	In the sea, but close to the shore.

Term	Definition
No Active Intervention	One of several policy options that may be identified for separate lengths of coastline under the Shoreline Management Plan (SMP) (q.v.). A 'no active intervention' strategy assumes that no investment in the maintenance, repair or replacement of existing defence structures takes place. It is a 'do nothing' scenario against which different policies can be tested but it is also a viable policy for some stretches of shoreline e.g. where there is a low risk of flooding or erosion now or in the future.
NPS EN-1	Overarching National Policy Statement for Energy (July 2011) published by Department for Energy and Climate Change pursuant to Section 5(9) of the Planning Act 2008
NPS EN-6	National Policy Statement for Nuclear Power Generation (July 2011) published by Department for Energy and Climate Change pursuant to Section 5(9) of the Planning Act 2008
Nuclear Island	National Policy Statement for Nuclear Power Generation (July 2011) published by Department for Energy and Climate Change pursuant to Section 5(9) of the Planning Act 2008
Ordnance Datum (Newlyn) (ODN)	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 any time.
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.
Relocated Facilities	Sizewell B own and operate several buildings which are located on the Sizewell C main development site. To release the land for Sizewell C, Sizewell B will relocate these facilitates. It is proposed that these facilities are relocated to the Sizewell B compound or to land currently owned by Sizewell A. This decision is tbc.
Resources	Defined as bio-physical features or items of 'environmental capital'. For example, species and their habitats, aquifers, access routes and community facilities.
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 importance may still merit protection.
Sea protection and flood defence (sea defences)	The integrated coastal protection and flood defences are a set of hard and soft engineering features designed to safeguard the station during periods of elevated water levels on the coast (e.g. from storm surges and high waves).
Secondary Aquifer	Layers of rock or deposits providing lower levels of groundwater storage than a Principal Aquifer.

Term	Definition
Shoreline Management Plan (SMP)	A SMP is a non-statutory document containing policies that suggest how specific lengths of shoreline should be managed over the next 100 years. It follows from a large scale assessment of the risks associated with coastal processes which seeks to reduce these risks to people and the developed, historic and natural environments. On the basis of technical studies and consultation, one of several policy options are chosen for each time period (epoch) covered by the SMP: 0-20, 20-50 and 50-100 years: we are currently half way through the first of these 'epochs'. The current version of the SMP for the area around Sizewell may be found at: http://www.suffolksmp2.org.uk/ and covers the coast from Lowestoft Ness to Felixstowe Landguard Point. This most recent version was formally adopted by the operating authorities and published in 2012.
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	The timeframe over which the environmental impact assessment is undertaken.
Tertiary mitigation	Will be required regardless of any EIA assessment, as it is imposed, for example, as a result of legislative requirements and/or standard sectoral practices. For example, applying emission controls to an industrial stack to meet the requirements of the Industrial Emissions Directive (Directive 2010/75/EU); those measures contained within the Code of Construction Practice/Construction Method Statement that have been reviewed and agreed).
Trammel Net	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.