The Sizewell C Project

6.3 Volume 2 Main Development Site

Chapter 19 Groundwater and Surface Water

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Contents

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Plates

None provided.

Figures

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19 Groundwater and Surface Water

19.1 Introduction

19.1.1 This chapter of **Volume 2** of the **Environmental Statement** (**ES**) (Doc Ref. 6.3) presents an assessment of the groundwater and surface water effects arising from the construction and operation of the Sizewell C power station at the main development site (referred to throughout this volume as the 'proposed development'). This includes an assessment of potential impacts, the significance of effects, the requirements for mitigation and the residual effects.

19.1.2 Detailed descriptions of the main development site (referred to throughout this volume as the 'site'), the proposed development and the different phases of development are provided in **Chapters 1** to **4** of this volume of the **ES**. A description of the anticipated activities for the decommissioning of the Sizewell C power station, including a summary of the types of environmental effects likely to occur is provided in **Chapter 5** of this volume. A glossary of terms and list of abbreviations used in this chapter is provided in **Volume 1, Appendix 1A** of the **ES**.

19.1.3 The Government's Good Practice Guide for Environmental Impact Assessment (EIA)[1] (Ref. 19.1) outlines the potential environmental effects that should be considered for groundwater and surface water, e.g. physical effects of the development, effects on groundwater etc. Further information on these topics and those which have been scoped into the assessment can be found in **section 19.3** of this chapter**.**

19.1.4 This assessment has been informed by data from other assessments as follows:

- **Chapter 3** of this volume: Description of Construction of the Main Development Site.
- **Appendix 18A** of this volume: Main Development Site Phase 2 Geo-Environmental Interpretative Report 2018.
- **Appendix 18B** of this volume: Conceptual Site Models.
- **Appendix 18C** of this volume: Impact Assessment Tables.

[1] This document has been withdrawn but still constitutes good advice and should be referred to in the absence of alternative guidance.

- **Appendix 18E** of this volume: Borrow Pit Hydrogeological Risk Assessment, 2019.
- **Appendix 19A** of this volume: Sizewell C Numerical Modelling Report, October 2019.
- **Appendix 19B** of this volume: Sizewell C Conceptual Site Model of the Hydrogeological Regime, June 2015.
- **Appendix 19B1** of this volume: Sizewell C Conceptual Site Model of the Hydrogeological Regime Addendum, January 2020.
- **Appendix 19C** of this volume: Sizewell Drain diversion outline design information.
- **Appendix 19D** of this volume: Off-site Developments Assessment.
- **Appendix 19E** of this volume: Sizewell C Main Development Site Surface Water Conceptualisation Report, July 2019.
- **Appendix 19F** of this volume: Water Monitoring and Response Strategy.
- **Sizewell C Main Development Site Flood Risk Assessment** (FRA) (Doc Ref. 5.2).
- **Water Framework Directive (WFD) Compliance Assessment Report** (Doc Ref. 8.14).
- **Appendix 2A** of this volume: Sizewell C Outline Drainage Strategy.
- Sizewell C **Code of Construction Practice (CoCP)** (Doc Ref. 8.11).
- **Appendix 3B** of this volume: Sizewell C Material Management Strategy.
- **Appendix 8A** of this volume: Sizewell C **Waste Management Strategy**.

19.1.5 A standalone ES was prepared for the Sizewell B relocated facilities works for submission with the hybrid planning application under the Town and Country Planning Act 1990 (East Suffolk Council application ref.

DC/19/1637/FUL). Chapters 13 and 14 of the Sizewell B relocated facilities ES, as seen in **Volume 1, Appendix 2A** of the **ES**, included an assessment of likely significant effects associated with groundwater and surface water and identified mitigation specific to Sizewell B relocated facilities works. However, as the Sizewell B relocated facilities works form part of the Sizewell C Project and consent is sought for these works through the Development Consent Order (DCO), an updated assessment of the likely significant effects of these works is also set out in this chapter.

19.2 Legislation, policy and guidance

19.2.1 **Volume 1, Appendix 6O** of the **ES** identifies and describes legislation, policy and guidance of relevance to the assessment of the potential groundwater and surface water impacts associated with the Sizewell C Project across all **ES** volumes.

19.2.2 This section provides an overview of the specific legislation, policy and guidance specific to the assessment of the proposed development.

a) International

19.2.3 International legislation relevant to the groundwater and surface water assessment includes:

- Water Framework Directive 2000/60/EC (Ref. 19.2).
- Groundwater Daughter Directive 2006/118/EC (Ref. 19.3).
- The Discharge of Dangerous Substances into the Aquatic Environmental Directive 2006/11/EC (Ref. 19.4).

19.2.4 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1**, **Appendix 6O** of the **ES**.

b) National

i. Legislation

19.2.5 National legislation relevant to the groundwater and surface water assessment includes:

- Water Environment (WFD) (England and Wales) Regulations 2017 (Ref. 19.5).

- WFD (Standards and Classification) Directions (England and Wales) 2015 (Ref. 19.6).
- Environmental Permitting Regulations (England and Wales) 2016 (Ref. 19.7).
- Water Resources Act 1991 (Ref. 19.8).
- Water Act 2003 (Ref. 19.9).
- Flood and Water Management Act 2010 (Ref. 19.10).

19.2.6 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1, Appendix 6O** of the **ES.**

ii. Planning policies

19.2.7 The National Policy Statements (NPS) set out national policy for energy infrastructure. The overarching NPS for Energy (EN-1) (Ref. 19.11) and NPS for Nuclear Power Generation (EN-6) (Ref. 19.12) provide the primary policy framework within which the development will be considered. A summary of the relevant planning policy, together with consideration of how these have been taken into account, is provided in **Volume 1, Appendix 6O** of the **ES**.

19.2.8 Other national policies relevant to the groundwater and surface water assessment includes the National Planning Policy Framework (NPPF) (Ref. 19.13).

19.2.9 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1, Appendix 6O** of the **ES**.

c) Regional

19.2.10 Regional policies relevant to the groundwater and surface water assessment include:

- Environment Agency Anglian River Basin Management Plan (RBMP) (Ref. 19.14).
- The East Suffolk Abstraction Licensing Strategy 2017 (Ref. 19.15).
- Environment Agency East Suffolk Catchment Flood Management Plan 2009 (Ref. 19.16).

19.2.11 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1, Appendix 6O** of the **ES**.

d) Local

19.2.12 Local policies relevant to the groundwater and surface water assessment include:

- Suffolk Flood Risk Management Strategy (Ref. 19.17).
- Strategic FRA (Ref. 19.18).
- Suffolk Coastal District Council Local Plan Core Strategy and Development Management Policies (Ref. 19.19).
- Suffolk Coastal District Council (SCDC) Final Draft Local Plan (Ref.12.20).
- Leiston Surface Water Management Plan (Ref. 19.21).

19.2.13 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1, Appendix 6O** of the **ES**.

e) Guidance

19.2.14 Guidance relevant to the groundwater and surface water assessment includes:

- Planning Practice Guidance (Ref. 19.22).
- Government's 25 Year Environment Plan (Ref. 19.23).
- The Government's Good Practice Guide (Ref. 19.24) for EIAs.
- The Groundwater Protection Position Statements Guidance (Ref. 19 .25).
- Control of water pollution from construction sites: A guide to good practice, Construction Industry Research and Information Association (CIRIA) (2001) (Ref. 19.26).
- Environment Agency's Pollution Prevention Guidelines: Working on construction sites (Ref. 19.27).

- The Design Manual for Roads and Bridges (DMRB) (2008) Volume 11, Section 2, Part 5 Assessment and Management of Environmental Effects (Ref. 19.28).

- DMRB (2009) Volume 11, Section 3, Environmental Assessment Techniques (Ref. 19.29).

19.2.15 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1, Appendix 6O** of the **ES**.

19.3 Methodology

a) Scope of the assessment

19.3.1 The generic EIA methodology is detailed in **Volume 1**, **Chapter 6** of the **ES**.

19.3.2 The full method of assessment for groundwater and surface water that has been applied for the Sizewell C Project is included as an appendix in **Volume 1**, **Appendix 6O** of the **ES**.

19.3.3 This section provides specific details of the groundwater and surface water methodology applied to the assessment of the proposed development and a summary of the general approach to provide appropriate context for the assessment that follows. The scope of this assessment considers the impacts of the construction and operational phases of the proposed development.

19.3.4 The scope of this assessment has been established through a formal EIA scoping process undertaken with the Planning Inspectorate (PINS). A request for an EIA Scoping Opinion was initially issued to the PINS in 2014, with an updated request issued in 2019, see **Volume 1, Appendix 6A** of the **ES**.

19.3.5 Comments raised in the EIA Scoping Opinion received in 2014 and 2019 have been taken into account in the development of the assessment methodology. These are detailed in **Volume 1**, **Appendices 6A** to **6C** of the **ES**.

19.3.6 The Government's Good Practice Guide for EIA states that the following potential environmental effects should be considered for the water environment:

- levels and effects of emissions to water from the development;

- abstractions of/effects on surface or groundwater resources;

- effects of development on drainage or run-off pattern in the area;
- changes to groundwater level, watercourses and flow of underground water;
- crossings of watercourses; and
- effects of pollutants on water quality.

19.3.7 Additionally, consideration should be given to flood risk as well as WFD compliance, and their interactions with other assessments such as geology and land quality, and terrestrial ecology and ornithology assessments.

19.3.8 Potential impacts from existing and new contamination sources on controlled waters have been considered as part of the geology and land quality assessment in **Chapter 18** of this volume to determine and classify potential effects associated with ground contamination. Further assessment of identified effects from contamination of groundwater and surface waters is reported in this chapter.

b) Consultation

19.3.9 The scope of the assessment has also been informed by ongoing consultation and engagement with statutory consultees throughout the design and assessment process. A summary of the comments of consultation relating to the groundwater and surface water assessment is provided in **Volume 1, Appendix 6O** of the **ES**. A summary of comments relevant to the main development site is provided **Table 19.1.**

19.3.10 SZC Co. has held workshops with the Environment Agency, Natural England, Royal Society for the Protection of Birds (RSPB), Water Management Alliance Internal Drainage Board (IDB), Suffolk County Council (SCC), SCDC (now East Suffolk Council (ESC)), Coastal Partnership East and Suffolk Wildlife Trust (SWT) to discuss the approach of the groundwater and surface water assessments, the impacts on groundwater and surface water resources and the potential ecological implications.

Table 19.1: Summary of consultation responses that have informed the scope and methodology of the groundwater and surface water assessment.

Consultee	Date	Comment	SZC Co. Response
Environment Agency, Natural England, RSPB, SWT.	09 April 2014	Need to understand how effects of changes to groundwater environment will be considered.	Workshop held to establish and agree approach to groundwater assessment.

Consultee	Date	Comment	SZC Co. Response
Environment Agency, Natural England, RSBP, SCC, SCDC, SWT.	14 October 2014	Need to agree conceptual understanding of groundwater environment, including interaction with surface water and ecology.	Workshop held to discuss and agree hydrogeological conceptual site model.
Environment Agency, Natural England, RSPB, SCC, SCDC, SWT.	09 December 2014	Need to understand how numerical modelling will be used to represent the groundwater system and inform assessment.	Workshop held to discuss and agree groundwater numerical modelling approach.
Environment Agency, Natural England, RSPB, SCC, SCDC, SWT.	01 March 2015	Need to understand approach to assessing effects of changes in surface water environment.	Workshop held to discuss and agree approach to surface water assessment.
Environment Agency, Natural England.	12 May 2015	Review implementation of numerical model representation of conceptual understanding.	Workshop held to discuss numerical modelling progress with technical specialist stakeholders.
Environment Agency, Natural England.	07 July 2015	Review implementation of numerical model representation of conceptual understanding.	Teleconference held to discuss numerical modelling progress with technical specialist stakeholders.
Environment Agency, Natural England, RSBP, SCC, SCDC, SWT.	06 August 2015	Need to understand effects of changes to groundwater and surface water resulting from site of special scientific interest (SSSI) crossing options.	Workshop held to discuss SSSI crossing options.
Environment Agency, Natural England, IDB, RSBP, SCC, SCDC, SWT.	15 September 2015	Need to understand how groundwater and surface water assessments interact.	Combined groundwater and surface water workshop held to demonstrate alignment between assessments.
Environment Agency, Natural England.	07 December 2015	Review implementation of numerical model representation of conceptual understanding.	Workshop held to discuss numerical modelling progress with technical specialist stakeholders.
Environment Agency, Natural England. IDB, RSBP, SCC, SCDC, SWT.	16 December 2015	Need to understand effects of changes to groundwater and surface water resulting from preferred SSSI crossing option.	Workshop held to discuss and agree preferred SSSI crossing option.
Environment Agency, Natural England.	07 June 2016	Review implementation of numerical model representation of conceptual understanding.	Workshop held to discuss numerical modelling progress with technical specialist stakeholders.

Consultee	Date	Comment	SZC Co. Response
Environment Agency, Natural England, RSBP, SWT.	27 July 2016	Need to understand how numerical model outputs are taken into account by ecological assessment.	Workshop held to discuss and agree approach to eco-hydrological assessment.
Environment Agency, ESC, SCC.	27 February 2019	Request to understand the scope of work for each site.	Workshop held to discuss the scope of work for all forms of flooding, application of climate change scenarios, permitting approach and drainage.
Environment Agency, Natural England, ESC, RSPB, SCC, SWT.	28 February 2019	Need to understand how numerical model outputs are taken into account by ecological assessment.	Workshop held to discuss groundwater, surface water and eco-hydrological assessment, and present worked example.
Environment Agency, Natural England.	03 April 2019	Review implementation of numerical model representation of conceptual understanding.	Workshop held to discuss numerical modelling progress with technical specialist stakeholders.
Environment Agency.	18 April 2019	Request for update on progress and review of outstanding technical queries.	Telephone call held to discuss joint probability analysis in coastal environment and application of climate change in breach analysis.
Environment Agency, SCC, Water Management Alliance.	18 April 2019	Request to understand the scope of drainage assessment.	Telephone call held to discuss outline scope for a drainage strategy.
Environment Agency, SCC, Water Management Alliance.	9 May 2019	Request for update on progress and to share preliminary findings.	Workshop held with detailed discussions on progress in modelling fluvial, coastal and breach for the main development site and principles with regard to flood compensatory storage.
Environment Agency, SCC, Water Management Alliance.	17 May 2019	Request for more detail on the drainage strategy.	Telephone call held to present key principles in approaching the management of stormwater drainage.
Environment Agency, Natural England, ESC, RSBP, SCC, SWT.	21 May 2019	Request for early sight of numerical model outputs and ecological assessment.	Workshop held to discuss groundwater, surface water and eco-hydrological assessment and present initial results.
SCC	11 June 2019	Request for information on highways drainage.	Workshop held to discuss approach to management of highways drainage, considering

Consultee	Date	Comment	SZC Co. Response
			sustainable drainage system (SuDS) and infiltration potential.
Environment Agency, SCC, Water Management Alliance.	24 June 2019	Request to understand approach to stormwater drainage and foul drainage, per site.	Workshop held to discuss strategic approach at each site for stormwater management and preliminary discussion on foul drainage arrangements.
Environment Agency, Natural England, ESC, RSBP, SCC, SWT.	18 July 2019	Request for early sight of numerical model outputs and ecological assessment.	Workshop held to discuss groundwater, surface water and eco-hydrological assessment and present results.
Environment Agency, Natural England, ESC, RSBP, SCC, Coastal Partnership East, Water Management Alliance.	14 August 2019	Request to close out key technical issues prior to finalising flood modelling.	Telephone call held to agree key technical approach and individual issues, and enable completion of flood modelling.
Environment Agency, Natural England.	18 September 2019	Review implementation of numerical model representation of conceptual understanding.	Teleconference held to close out comments on numerical modelling with technical specialist stakeholders.
Environment Agency, ESC, SCC.	23 September 2019	Request for further detail on drainage strategy outputs.	Workshop held to share interim findings of the drainage strategy, including design parameters and constraints for each site. Discussion on monitoring and maintenance requirements and implementation through **CoCP** (Doc Ref. 8.11).
Environment Agency.	11 November 2019	Request to review draft **ES** chapter on groundwater and surface water.	Draft chapter provided.
Environment Agency.	19 November 2019	Request to review the numerical modelling report.	Numerical modelling report provided.
Environment Agency.	6 February 2020	Request to review the monitoring and response strategy.	Monitoring and response strategy provided.

c) Study area

19.3.11 The study area for the consideration of effects from contaminative sources on controlled waters is discussed in **Chapter 18** of this volume and includes

the site and land immediately beyond it to a distance of 500 metres (m) from the site boundary. This is hereafter referred to as the inner study area. The site boundary of the proposed development is presented in **Chapter 1** of this volume.

19.3.12 The size of the inner study area takes into account the transport of potential contaminants of concern in the environment and the connectivity of these contaminants via pathways of migration or exposure to the receptors and resources identified.

19.3.13 The general methodology adopted for the consideration of effects on groundwater and surface water levels and flows, and water dependent receptors and resources extends beyond this inner study area to a distance of 1 kilometre (km) from the site boundary. This is termed the outer study area.

19.3.14 The size of the outer study area allows for any potential physical changes resulting from the proposed development that may propagate through the water environment and beyond the inner study area to be assessed.

d) Assessment scenarios

19.3.15 The assessment of effects on the water environment includes the assessment of both the construction phase and operational phase of the proposed development, rather than the assessment of any specific peak years. The worst-case assessment has been applied.

e) Assessment criteria

19.3.16 As described in **Volume 1**, **Chapter 6** of the **ES**, the EIA methodology considers whether impacts of the proposed development would have an effect on any receptors or resources. Assessments broadly consider the magnitude of impacts and value/sensitivity of receptors/resources that could be affected in order to classify effects.

i. Assessment of physical impacts

19.3.17 Physical impacts include:

- changes or alterations to water levels and flow regimes of groundwater and surface water receptors and resources; and
- changes to water dependent groundwater and surface water receptors and resources.

19.3.18 The assessment criteria of physical impacts on groundwater and surface water resources and receptors are based on the methodology provided in **Volume 1, Appendix 6O** of the **ES** and summarised in the following sub-sections.

Sensitivity

19.3.19 The assessment of assigning the levels of sensitivity to receptors and resources is set out in **Table 19.2**.

Table 19.2: Assessment of the value or sensitivity of receptors and resources for groundwater and surface water

Value Or Sensitivity	Description
High	An attribute with a high quality/rarity, international or national significance that has a low capacity to accommodate disturbance or change.
Medium	An attribute with high quality/rarity, national scale and some resilience to disturbance or change. An attribute with high quality/rarity, at a regional scale that has a low capacity to accommodate disturbance or change. An attribute with medium quality/rarity, national scale that has a low capacity to accommodate disturbance or change.
Low	An attribute with medium quality/rarity, national or regional scale and some resilience to disturbance or change. An attribute with low quality/rarity, national or regional scale and some resilience to disturbance or change.
Very Low	An attribute with low quality/rarity, regional and local scale and resilience to disturbance or change.

Magnitude

19.3.20 The magnitude of a potential impact is estimated based on the likely level of change and is independent of the importance of the feature. The definitions of magnitude classifications are provided in **Table 19.3**.

Table 19.3: Assessment of magnitude of impact on groundwater and surface water

Magnitude	Criteria
High	Large-scale permanent/irreversible, or long-term temporary, changes over the whole development area and potentially beyond (i.e. off-site), to key characteristics or features of the particular environmental aspect's character or distinctiveness.
Medium	Medium-scale permanent/irreversible, or medium-term temporary, changes over the majority of the development area and potentially beyond, to key characteristics or features of the particular environmental aspect's character or distinctiveness.

Magnitude	Criteria
Low	Noticeable but small-scale changes, permanent or temporary changes over a partial area, to key characteristics or features of the particular environmental aspect's character or distinctiveness.
Very Low	Noticeable, but very small-scale changes, or barely discernible changes for any length of time, over a small area, to key characteristics or features of the particular environmental aspect's character or distinctiveness.

19.3.21 Where the assessment of potential impact concludes that through careful design and the application of appropriate mitigation, there will be no discernible change (no impact) to a receptor or resource, then a conclusion of no effect will be drawn.

19.3.22 Given the timescales of the Sizewell C Project, the nature of potential changes to the water environment from the proposed development and their reversibility, the definitions of temporary impacts are categorised as follows:

- short-term = less than six months;
- medium-term = between six months and six years; and
- long-term = more than six years.

Effect definitions

19.3.23 The classification of the likely effects for groundwater and surface water are determined using the matrix presented in **Table 19.4.**

Table 19.4: Classification of effects

		Value / Sensitivity of Receptor			
		Very Low	Low	Medium	High
Magnitude	Very Low	Negligible	Negligible	Minor	Minor
	Low	Negligible	Minor	Minor	Moderate
	Medium	Minor	Minor	Moderate	Major
	High	Minor	Moderate	Major	Major

19.3.24 An effect can be 'adverse' or 'beneficial' depending on the nature of impact on the quality and integrity on the receptor or resource. For example, an adverse effect would be where there would be a loss or damage to the quality or integrity of an attribute, whereas a beneficial effect would arise from the creation of a new or an improvement to an attribute.

19.3.25 Following the classification of an effect as presented in **Table 19.4**, a clear statement is made as to whether the effect is 'significant' or 'not significant'. As a general rule, major and moderate effects are considered to be significant and minor and negligible effects are considered to be not significant. However, professional judgement is also applied where appropriate.

ii. Assessment of contamination to controlled waters

19.3.26 The assessment of potential impacts from existing and new contamination sources on controlled waters has been considered as part of the geology and land quality assessment in the production of the preliminary conceptual site model to determine and classify potential effects.

19.3.27 Further details on the methodology applied is provided in **Volume 1, Appendix 6N** of this volume, and summarised in **Chapter 18** of this volume.

iii. Water Framework Directive compliance

19.3.28 WFD impacts are assessed differently to the approach conventionally used within the EIA process and require an assessment of whether a project (or an element of a project) is compliant or non-compliant with the environmental objectives outlined in Article 4 of the WFD.

19.3.29 The significance of effects on WFD status relates only to compliance or non-compliance. Non-compliance will only occur because of permanent impacts that cannot be mitigated, irrespective of the degree of vulnerability to change of the receptor. The assessment in this context will be restricted to either compliance or non-compliance.

19.3.30 The **WFD Compliance Assessment Report** (Doc Ref. 8.14) has been provided as a separate document submitted as part of this application for development consent. The main conclusions with relevance to the activities considered as part of the EIA are summarised in this chapter.

iv. Flood risk assessment

19.3.31 The **Sizewell C Main Development Site Flood Risk Assessment (FRA)** (Doc Ref. 5.2) has been provided as a separate document submitted as part of this application for development consent. The main conclusions from the **FRA** with relevance to the potential flood sources affecting the site, and the impacts that the proposed development would have on altering the flood risk levels relating to the surrounding surface water receptors are summarised in this chapter.

f) Assessment methodology

19.3.32 **Volume 1, Chapter 6** of the **ES** sets out the broad approach to impact assessment employed within the overall **ES**. This section details the approach to the assessment of impacts specifically relating to groundwater and surface water.

i. General approach

19.3.33 The approach to the groundwater and surface water assessment comprises:

- establishing the baseline conditions for the study area with respect to geology, hydrology, hydrogeology, and water dependent resources and receptors;
- identification of potential impacts on identified water dependent resources and receptors from the construction and operational phases of the proposed development;
- assessment of the significance of likely effects from the proposed development including the consideration of primary and tertiary mitigation measures; and
- identification of any residual effects and secondary mitigation where required.

19.3.34 The assessment also considers the findings of the **WFD Compliance Assessment Report** (Doc Ref. 8.14) and the **Sizewell C Main Development Site FRA** (Doc Ref. 5.2).

ii. Existing baseline

19.3.35 Existing baseline conditions are defined based on available published and where available, site-specific information.

19.3.36 A numerical groundwater model has been produced to inform the understanding of the groundwater and surface water regime at the site. Details on this model are provided in **Appendix 19A** of this volume. The model has been built using more than four years of groundwater and surface water level and flow monitoring data. The model has been used to represent baseline conditions and anticipated changes to the baseline through all phases of development and under selected climatic conditions.

19.3.37 The baseline assessment has relied on existing data, previous desk study and ground investigation (GI) reports, groundwater monitoring data and historical records. The following sources have been reviewed:

- publicly available information from the British Geological Survey (BGS) online mapping resource (Ref. 19.30);
- publicly available information from the Environment Agency (Ref. 19.31 and Ref. 19.32);
- publicly available information from the Department for Environment, Food and Rural Affairs' Multi-Agency Geographic Information for the Countryside (MAGIC) website (Ref. 19.33);
- **Appendix 18A** of this volume: Main Development Site Phase 2 Geo-environmental Interpretative Report 2018;
- **Appendix 19A** of this volume: Sizewell C Numerical Modelling Report, October 2019;
- **Appendix 19B** of this volume: Sizewell C Conceptual Site Model of the Hydrogeological Regime, June 2015; and
- **Appendix 19B1** of this volume: Sizewell C Conceptual Site Model of the Hydrogeological Regime Addendum, October 2019.

iii. Future baseline

19.3.38 The future baseline is typically established upon extrapolating the current baseline using technical knowledge of changes (for example changes in rainfall), and future climate forecasts to predict the environmental conditions at a future point in time. This assessment considers future baseline conditions solely in the context of known future developments, and predictable changes in the quality of receptors (for example forecast improvements in the status of WFD water bodies). The numerical modelling report, provided in **Appendix 19A** of this volume, has been used to inform the assessment of future baseline, taking into account published climate change forecasts.

iv. Assessment

19.3.39 Potential changes to the water environment in terms of water levels, flow and quality are considered qualitatively against baseline conditions in a preliminary assessment. Where a significant effect was identified at the end

of this qualitative assessment, a more detailed quantitative appraisal of potential impacts on water levels and flow has been undertaken to determine the magnitude and extent of potential changes.

g) Assumptions and limitations

19.3.40 The following assumptions have been made in this assessment:

- This assessment takes into account the assumptions of design made for the proposed development as presented in **Chapters 2** to **4** of this volume. Details of assumptions for specific elements of the design, and how they have been represented in the model, are described in **Appendix 19A** of this volume.

- Surface water discharge will be managed so it does not exceed the predetermined greenfield run-off rates in accordance with the **Outline Drainage Strategy**, provided in **Appendix 2A** of this volume.

- Environmental Quality Standards prescribed for downstream designated WFD water bodies have been adopted for upstream, non-designated watercourses for the purposes of this assessment, in order to consider the worst case scenario.

- Groundwater abstracted during dewatering will be discharged to sea under a Water Discharge Activity permit or reused on site in such a way that it will not pose a contaminative risk to surrounding surface water receptors. Further details are provided in **Chapter 21** of this volume.

19.3.41 The following limitations have been identified:

- There is a lack of extreme climatic events in the monitoring records used to calibrate the model. This is not uncommon given the high return periods for such events and standard modelling practice, using artificially generated extreme climatic inputs in lieu of observed data, has been followed during model calibration.

- There is some data missing from the monitoring record caused by occasional access issues during manual monitoring rounds, as detailed in **Appendix 19B1** of this volume, or from temporary equipment malfunction. There is a sufficient monitoring record to allow generation of synthetic datasets to address data gaps where necessary.

- GI data is not available for the majority of the temporary construction area and the Land to the East of the Eastlands Industrial Estate

(LEEIE). Publicly available information from the BGS such as historical borehole logs has been used to inform the assessment.

19.4 Baseline environment

19.4.1 This section presents a description of the baseline environmental characteristics within the footprint of the proposed development and in the surrounding area.

19.4.2 Further detail can be found in **Appendix 18A** of this volume – the Phase 1 Desk Study Report.

19.4.3 Baseline information for the Sizewell B relocated facilities is set out in Chapters 13 and 14 of Sizewell B relocated facilities ES, included in **Volume 1, Appendix 2A** of the **ES**. The baseline description presented in this chapter provides an update to the description of baseline conditions presented within the Sizewell B relocated facilities ES.

19.4.4 Baseline information for off-site development areas, including the off-site sports facilities at Leiston, fen meadow compensation sites south of Benhall and east of Halesworth and, if required, the marsh harrier habitat improvement area (Westleton), is set out in **Appendix 19D** of this volume.

a) Current baseline

i. Geology

19.4.5 Online BGS mapping shows that the superficial geology present within the footprint of the site includes Marine Beach Deposits (sands and gravels), Tidal Flat Deposits (clay and silt), Lowestoft Formation (sand and gravel), Peat Deposits and Lowestoft Formation (diamicton).

19.4.6 Made Ground is also present at the site, mainly within the main platform area. This Made Ground is likely to be leftover spoil resulting from the construction of the Sizewell B power station. Made Ground is also likely to be present within the LEEIE associated with the railway line and within the temporary construction area associated with sand and clay pits located in this area.

19.4.7 Online BGS mapping shows that the bedrock geology beneath the site comprises the Crag Formation. The Crag Formation is made up of shallow water marine and estuarine sands, gravels, silts and clays. The Crag Formation is characterised by high hydraulic conductivities. Beneath the Crag Formation is the London Clay Formation and the Chalk Group.

19.4.8 Whilst the Chalk Group is present below the site, it is hydraulically isolated by the presence of the overlying low permeability London Clay Formation. It is therefore not considered further as a receptor.

19.4.9 Further detail on the geology of the site is presented in **Chapter 18** of this volume.

ii. Hydrogeology

19.4.10 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 by the Environment Agency as Secondary A Aquifers[2]. The Lowestoft Formation (diamicton) deposits are classified by the Environment Agency as a Secondary Aquifer (undifferentiated)[3]. 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.

19.4.11 The Peat Deposits are classified by the Environment Agency as Unproductive Strata. However, they store and transmit water originating from groundwater, surface water and precipitation which is important in sustaining the SSSI habitats, particularly the reedbeds, fen meadows and rush pastures. Subsequently, due to their ecological importance associated with the Sizewell Marshes SSSI they are considered as a high value receptor for the purpose of the impact assessment.

19.4.12 The Crag and the Chalk bedrock aquifers are classified as Principal Aquifers and are hydraulically separated by the presence of the London Clay Formation (Paleogene Deposits). The thickness of the low permeability London Clay Formation aquiclude means that there is not considered to be the potential for significant environmental effects on the Chalk aquifer. The Chalk aquifer is therefore not considered in this assessment.

19.4.13 In addition to the aquifers identified above, other natural and anthropogenic deposits will act to modify, constrain or retard the movement of groundwater. Made Ground at the site, principally material deposited during excavation for the neighbouring Sizewell B power station, comprises a mix of granular and cohesive material which will modify recharge to the underlying strata relative to the surrounding area. Groundwater in the Made Ground, where present,

[2] 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.
[3] 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.

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. Where present, low hydraulic conductivity deposits such as Alluvium, Marine Deposits and the Paleogene Deposits will restrict the movement of groundwater and potentially cause confined conditions in underlying aquifers.

19.4.14 The proposed development is located on the Waveney and East Suffolk Chalk and Crag groundwater body (water body ID GB40501G400600). The Environment Agency catchment data explorer 2016 classification shows that 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 (NVZ).

19.4.15 There are no groundwater Source Protection Zones (SPZs)[4] within the site. There is an SPZ3[5] approximately 340m south-west of the LEEIE sub-area of the site, with its SPZ2[6] a further 360m south-west. The inner protection zone of the SPZ[7] is outside of the study area at approximately 1.2km south-west of the LEEIE and 3km south-west of the main platform. The SPZs are presented on **Figure 19.1** of this volume.

19.4.16 The Suffolk Coastal and Waveney District Strategic FRA makes no reference to groundwater flooding across the Suffolk Coastal and Waveney District. Flood risk is discussed further in the **Sizewell C Main Development Site FRA** (Doc Ref. 5.2).

19.4.17 An east to west cross section through the site is shown on drawing 5129919/SZC/010 of **Appendix 19B** of this volume and this illustrates the relationship between the main groundwater aquifer units and shows the lack

[4] 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

[5] Zone 3: (Total catchment) - This zone is defined as the total area needed to support the abstraction or discharge from the protected groundwater source

[6] Zone 2: (Outer Protection Zone) - This zone is defined by the 400-day travel time from a point below the water table. Additionally, this zone has a minimum radius of 250 or 500 m, depending on the size of the abstraction. The travel time is derived from consideration of the minimum time required to provide delay, dilution and attenuation of slowly degrading pollutants.

[7] Zone 1: (Inner Protection Zone) - This zone is defined by a travel time of 50-days or less from any point within the zone at, or below, the water table. Additionally, the zone has as a minimum a 50-metre radius. It is based principally on biological decay criteria and is designed to protect against the transmission of toxic chemicals and water-borne disease.

of hydraulic continuity between the Principal Chalk aquifer and the overlying Crag Formation.

iii. Water abstractions

Groundwater

19.4.18 The Phase 2 Geo-Environmental Interpretative Report in **Appendix 18A** of this volume and the numerical modelling report in **Appendix 19A** of this volume indicate multiple licensed groundwater abstractions within 1km of the site. These are detailed in **Table 19.5** and presented on **Figure 19.1** of this volume.

Table 19.5: Groundwater abstractions within the outer study area

Licence Number	Location (Including National Grid Reference, (NGR))	Source	Purpose	Maximum Annual Abstraction (m^3)
7/35/03/*G/0045 (potentially revoked).	645320, 264570. Well At Upper Abbey Farm, Leiston. On-site.	Crag	General farming and domestic.	Not supplied.
7/35/03/*G/0074 (potentially revoked).	647000, 263400. Wellpoint at Sizewell Power Station. On-site.	Marine Deposits.	Make-up or top up water.	Not supplied.
7/35/03/*G/0051	645050, 264250 (on-site). Bore Nr Leiston Old Abbey, Leis.	Glacial sand and gravel.	General farming and domestic.	Unknown
7/35/03/*G/0046	645950 265900. Well At Lower Abbey Farm, Leiston. On-site.	Crag	General farming and domestic.	Not supplied.
An/035/0003/007	645100, 263500 (20m east of site). Groundwater Basin A at Aldhurst Farm, Leiston.	Glacial sand and gravel groundwater.	Environmental: non-remedial river/wetland support: transfer between sources.	Unknown
7/35/03/*G/0089	646700 262900, 86m south-west of site.	Groundwater	General farming and domestic.	28,500
An/035/0003/007	645342, 263431 (85m east of site). Groundwater Basin B at Aldhurst Farm, Leiston.	Groundwater	Environmental: non-remedial river/wetland support: transfer between sources.	Not supplied.

Licence Number	Location (Including National Grid Reference, (NGR))	Source	Purpose	Maximum Annual Abstraction (m^3)
An/035/0003/007	645297, 263362 (100m east of site). Groundwater Basin B at Aldhurst Farm, Leiston.	Groundwater	Environmental: non-remedial river/wetland support: transfer between sources.	Not supplied.
7/35/03/*G/0049	645100 263500. 15 Wellpts Of Brick Works Farm. 160m south of the site.	Glacial sand and gravel.	Stream augmentation.	27,000
An/035/0003/009	645050, 263234 (220m north of site). Borehole at Aldhurst Farm.	Groundwater	Non-remedial river/wetland support: supply to a leat for throughflow.	Not supplied.
7/35/03/*g/044	644450, 263310. Bore, Coldfair Green, Knodish. 280m south of the site.	Glacial sand and gravel.	Public water supply.	909,000
An/035/0003/003	645575 261785. Bore At Hawsells Farm Sizewell Leiston – Part 1. 450m south-west from site.	Groundwater	General agriculture: spray irrigation – storage.	Not supplied
An/035/0003/003	645591 261747. Bore At Hawsells Farm Sizewell Leiston – Part 2. 475m south-west from site.	Groundwater	General agriculture: spray irrigation – storage.	Not supplied
An/035/0003/003	645606, 261708. Bore At Hawsells Farm Sizewell Leiston – Part 3. 500m south-west from site.	Groundwater	General agriculture: spray irrigation – storage.	Not supplied.
7/35/03/*G/0065 (potentially revoked).	644200, 263200 (500m south of site). Ten Well pits North of Westward House.	Crag groundwater.	General agriculture: spray irrigation. Seasonal – 01 March to 30 September.	Not supplied.
7/35/03/*G/0025	644000 263100. Bore At West End Nurseries. 640m south of the site.	Crag	Spray irrigation.	205,000

Licence Number	Location (Including National Grid Reference, (NGR))	Source	Purpose	Maximum Annual Abstraction (m^3)
7/35/03/*G/0064	645200 266200. 26 Well parts At East Bridge, Theberton. 660m north of the site.	Groundwater	General agriculture: spray irrigation – direct.	Not supplied.
An/035/0003/003	646349, 261508. Bore At Square Covert Sizewell Leiston – Part 4. 790m south of site.	Groundwater	General agriculture: spray irrigation – storage.	Not supplied.
An/035/0003/003	646314, 261458. Bore At Square Covert Sizewell Leiston – Part 5. 815m south of site.	Groundwater	General agriculture: spray irrigation – storage.	Not supplied.
An/035/0003/003	646291, 261427. Bore At Square Covert Sizewell Leiston – Part 6. 830m south of site.	Groundwater	General agriculture: spray irrigation – storage.	Not supplied.
7/35/03/*G/0051	644500 265800. 20 Well Parts At Holly Tree Farm, Th. 850m north-west of the site.	Glacial sand and gravel.	Spray irrigation – direct seasonal abstraction (Apr to Sep).	Not supplied.
An/035/0003/007	645315, 263419 (890m east of the site). Groundwater Basin C at Aldhurst Farm, Leiston.	Groundwater	Environmental: non-remedial river/wetland support: transfer between sources.	Not supplied.

19.4.19 Further detailed information on groundwater abstractions is presented in **Appendix 19A** of this volume.

Surface Water

19.4.20 There are two licensed surface water abstractions in the study area, within the Leiston Drain and lower Minsmere River systems. These are detailed in **Table 19.6** and are presented on **Figure 19.2** of this volume.

Table 19.6: Surface water abstractions within the outer study area

Licence Number	Location (Including NGR)	Source	Purpose	Maximum Annual Abstraction (m^3)
7/35/03/*S/0051	645600, 263770. Spr Fed Drain at Sizewell Belt. 230m east of site.	Surface	General agriculture: spray irrigation – direct.	Not supplied.
7/35/03/*S/0075	646000, 263800. Res at Leiston-Cum-Sizewell, 500m south of site.	Surface	General agriculture: spray irrigation – direct.	Not supplied.

iv. Groundwater and surface water monitoring

19.4.21 Groundwater level and quality monitoring has been undertaken at the site and surrounding area for the Crag and overlying superficial deposits for the purpose of both refining the characterisation of the hydrogeological regime and to provide a robust baseline dataset for input to the groundwater model. It also acts to provide better understanding of the groundwater conditions which influence the sustainability of the designated sites located on and in the vicinity of the site, including the Sizewell Marshes SSSI.

19.4.22 Groundwater monitoring has been undertaken since October 2013. The monitoring network is comprehensive and adaptive such that, at the time of preparation of this **ES**, it incorporates approximately 90 monitoring boreholes and 46 data loggers. Manual readings have been generally taken on a monthly basis to provide a robust dataset and to validate the data logger information. In order to provide further understanding of the flows and surface water levels within the SSSI, velocity and stage monitoring has been undertaken at seven monitoring locations. The available monitoring network is presented on **Figure 19.3** of this volume. Further detail on the monitoring programme and how it has developed over time is presented in the Conceptual Model Report and its Addendum in **Appendix 19B** of this volume.

v. Groundwater levels

19.4.23 Detailed information on groundwater level data collected as part of the ongoing baseline monitoring has been provided in the Conceptual Model Report and its Addendum in **Appendix 19B** of this volume and is summarised in this section of the report.

19.4.24 Groundwater monitoring data in the vicinity of the main platform record a maximum groundwater level in the Crag Group of 2.28m Above Ordnance Datum (AOD). This maximum groundwater level occurred during a storm surge event in December 2013, provided in **Appendix 19B** and **19B1** of this volume. Under standard winter conditions, maximum groundwater levels typically reach up to 1.4m AOD.

19.4.25 Groundwater levels in the Peat Deposits have been monitored from October 2013 to present. Winter maximum water levels in the Peat piezometers are typically between 0.6m and 0.7m AOD. Summer minimum water levels vary markedly between monitoring locations; displaying values that range from approximately 0.5m AOD, to close to 0m AOD, with P4 displaying values of less than -0.1m AOD on occasion. Typically, piezometers with the lowest summer minima are those closest to permanent drainage channels, at the north-eastern corner of Sizewell Marshes.

19.4.26 Hydrographs for the Peat Deposits are presented in **Appendix 19B1** of this volume. These indicate that whilst the Peat Deposits are not tidally influenced, they are highly responsive to rainfall. Groundwater levels within the Peat Deposits were noted to be highly responsive to temporary pumping during maintenance works at the Minsmere Sluice from October 2013 to February 2014 suggesting a high degree of connectivity between the surface water network and the Peat groundwater system.

19.4.27 Groundwater levels in the Crag Formation typically rise with increased distance inland from the coast and the low-lying wetland areas of Sizewell Marshes SSSI and the Minsmere to Walberswick Heaths and Marshes SSSI, Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site. The highest observed groundwater levels within the site occur in the far north of the site, in the vicinity of the borrow pits, with a maximum recorded value of 2.66m AOD in borehole C7. Maximum water levels typically exceed 1.5m AOD in the northern and western parts of the site, while to the south, in piezometers GW20 and GW21, groundwater levels generally vary between 0.8m and 1.3m AOD.

19.4.28 Hydrographs of the observed groundwater level data are presented in **Appendix 19B1** of this volume. Tidal influence is observed within the Crag, with the influence between 0.3 and 1.2m, dependent on the distance of the borehole from the coast. The tidal influence does not extend far inland. Detailed information on tidal influence can be seen in the Conceptual Model Report in **Appendix 19B** of this volume.

19.4.29 Hydrographs comparing groundwater levels in the Crag and nearby Peat piezometers show groundwater levels in the Peat and Crag have similar underlying trends and responses to recharge, and temporary pumping at the

Minsmere Sluice, suggesting a strong degree of connectivity. Groundwater levels within the Peat are generally slightly lower than those for the Crag suggesting that there is potential for upward flow from the Crag into the Peat. During periods of heavy rainfall, the Peat and Crag water levels are closer and on occasion Peat groundwater levels are above those in the Crag, indicating a temporary downward gradient between the Peat and Crag.

19.4.30 There is no evidence of tidal influence on the Peat groundwater levels, whilst a tidal influence is observed in the Crag. This suggests that the Peat and Crag are in limited continuity although it is considered that, given the relative groundwater levels between the Peat and the Crag, there is some upward flow from the Crag into the Peat. This apparent lack of tidal influence in the Peat may be due to its high storage capacity, which will act to buffer any tidal signal.

19.4.31 The hydrochemistry results indicate that a saline interface and therefore mixed water types are typical in the Crag beneath the site. However, it is likely that a wedge of fresher calcium carbonate water will be present above the more chloride rich Crag water and that the chloride concentration typically increases with depth.

19.4.32 The silt and clay of the alluvium and Lowestoft Formation (where present) are considered to form an aquitard[8] limiting the vertical movement of groundwater between the Crag and Peat aquifer. The more sandy and gravelly layers at the base of these superficial deposits are in some cases indistinguishable from the Crag Formation and as such are considered to be in hydraulic continuity with the Crag.

19.4.33 The Crag Formation is not homogeneous and contains many layers of sand, silt and clay. The available borehole logs however do not show evidence of any clay layers which could be considered to be laterally continuous beneath the site and surrounding marsh area.

19.4.34 On a local scale, groundwater levels within the Crag aquifer will have an influence on shallower groundwater bodies within superficial deposits. Therefore, there is the potential that should the groundwater regime be changed due to the Sizewell C development, which includes cut-off walls, change in ground levels and potential changes to infiltration rates, this could impact on the groundwater levels at Sizewell Marshes SSSI and Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site, which are both sensitive to such changes.

[8] An aquitard is rock with limited permeability that allows some water to pass through it, but at a very reduced rate.

19.4.35 Groundwater levels in the Crag are slightly elevated upgradient of Sizewell A and Sizewell B, and there is evidence of a greater presence of high moisture indicator plant species in this area. It should be noted that the water levels in the SSSIs are managed with surface water levels and therefore groundwater levels in the Peat are maintained using various siphons and weirs across the drainage network.

vi. Groundwater flow

19.4.36 Groundwater contour plots for the Peat and Crag Deposits are presented in **Appendix 19B1** of this volume. The contours present the observed groundwater levels within the Peat and Crag Deposits under various conditions. Groundwater contours within the Peat Deposits show that the general flow direction is to the east, with localised interactions with the surface water network including apparent groundwater discharge to, and recharge from, surface watercourses. Groundwater within the Crag is observed to flow eastwards towards the coast. During periods when high water levels are recorded across the monitoring network, groundwater levels within the site are significantly elevated relative to the surrounding area. The higher water levels observed in this locality may be a result of the Sizewell B cut-off wall to the south causing water levels to rise locally, or it may be a result of Made Ground causing delayed recharge to the underlying Crag aquifer.

19.4.37 The available groundwater level data indicate regional flow towards the coast and more locally, flow from the Crag to the adjacent, low-lying wetlands, especially in the eastern sections of the SSSI and close to the Leiston Drain.

vii. Groundwater quality

19.4.38 Detailed information on groundwater quality data available as part of historical groundwater sampling and ongoing baseline monitoring has been provided in the Conceptual Model Report and its Addendum in **Appendix 19B** and in **Appendix 18A** of this volume. The outcomes of these assessments are summarised in this section of the report.

19.4.39 Groundwater chemistry analysis of available water quality data was undertaken to inform the Hydrogeological Regime Conceptual Site Model Report, provided in **Appendix 19B** of this volume. This indicated a transition from fresh calcium carbonate water to the west of the site towards more saline waters at the coast and beneath the main platform. This saline influence typically increases with depth, with fresher calcium carbonate water present above. However, there is also evidence of some mixing of water types. Detailed information on tidal influence can be seen in the Conceptual Model Report in **Appendix 19B** of this volume.

19.4.40 A contamination assessment of available data was undertaken as part of the Geo-environmental Interpretative Report in **Appendix 18A** of this volume. The assessment identified elevated concentrations of contaminants of concern, with the groundwater underlying the main platform and parts of the temporary construction area subject to significant saline intrusion, with a degree of additional effect from the underlying geology, adjacent marshes and farming activities.

19.4.41 Nitrate concentrations in groundwater to the west of the site exceed drinking water standards and the area falls within a NVZ.

viii. Groundwater sensitive areas

19.4.42 The Sizewell Marshes SSSI is located within the western boundary of the main platform and adjacent to the south and north of the temporary construction area. Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site lie to the north-east of the site with further descriptions provided in **Chapter 14** of this volume.

19.4.43 Aldhurst Farm is a habitat creation area that has been established. It is a site of managed wetland and grassland that was created to compensate for losses to Sizewell Marshes SSSI due to the proposed development.

19.4.44 These ecological receptors are sensitive to changes in both groundwater and surface water and therefore form part of the existing baseline environment. Further detail on ecological receptors and their interactions with groundwater and surface waters can be seen in **Chapter 14** of this volume.

ix. Groundwater and surface water sensitive development proposals

19.4.45 This chapter focuses primarily on features which may affect groundwater and surface water in the vicinity of the proposed development and Sizewell Marshes SSSI and on those impacts with the potential to lead to significant effects. These features include the following elements of the proposed development:

- SSSI Crossing – A permanent causeway over the Sizewell Marshes SSSI will link the proposed development to Goose Hill and provide vehicle access to Sizewell C during construction, operation and decommissioning. The crossing, which is proposed for construction at the start of construction works, would be located directly to the north of the main platform, centred on NGR TM473645. The works would involve the installation of sheet piling, piles and a culvert structure, excavation and replacement of natural materials and laying of impermeable road surfaces.

- Sizewell Drain realignment (**Figure 19C.1** of this volume) – As part of the construction of the proposed development, a small parcel of the SSSI known as Goodram's Fen (centred on NGR: TM471643), to the north-west of the current platform area would be used. The land-take requires Sizewell Drain to be permanently realigned to flow along the western edge of the proposed platform, tying in with Leiston Drain to the north-west of the site.

- Sheet pile walls – During construction, the main platform would be raised above natural ground level, with embankments along its boundaries. At the toe of the western and northern embankments, immediately adjacent to the site, sheet piles would extend from ground level into the underlying geology, providing structural stability to the embankments and preventing slumping of the adjacent Peat Deposits.

- The hydraulic cut-off wall – Along the perimeter of the main platform (centred on NGR: TM473642), a low-permeability cut-off wall would be constructed to isolate the main platform from the surrounding groundwater regime. This cut-off wall would be anchored into the low permeability London Clay Formation at depth limiting the hydraulic connection with the wider groundwater regime in the overlying geological strata. Dewatering can then take place to facilitate the construction of the new reactors and associated ancillary buildings.

- Borrow pits – The borrow pits would be located to the north-west of Kenton Hills, centred on NGR TM455653. They would provide granular Crag material for construction purposes, and receive material excavated from the main platform.

- Temporary construction area – The temporary construction area would be located to the north of the Sizewell Marshes SSSI, between the B1122 to the west and the North Sea to the east. It would house a number of facilities required for the construction of the power station, including an accommodation campus, a rail terminal and construction contractors' compounds.

- Water management zones – Ponds would be constructed within the water management zones that would act as storage or infiltration ponds to enable infiltration to groundwater, surface water and sea when excess surface run-off is generated, as seen in **Chapter 3** of this volume.

- LEEIE – Construction of a new rail head at LEEIE to accommodate longer trains. LEEIE will be constructed and mobilised as early as possible to receive and stockpile materials delivered by rail prior to the construction and commissioning of the green rail route.

19.4.46 Further information relating to proposed developments associated with the site are outlined in **Chapters 2, 3** and **4** of this volume.

x. Groundwater and surface water modelling

19.4.47 To inform the later assessment of the potential effects of the development, a transient 3D numerical groundwater model has been constructed and calibrated using the conceptual model and the combined groundwater and surface water monitoring data set. This numerical model was built using a combined FeFlow / MIKE11 modelling platform. Details of the modelling are presented in the numerical modelling report in **Appendix 19A** of this volume.

19.4.48 The numerical model predicts the potential change in the water environment resulting from the development aspects for the construction and operational phases of the development. The numerical model has also been used to predict change under different future climate scenarios.

19.4.49 Full details on the groundwater modelling scenarios and results can be seen in **Appendix 19A** of this volume. The significance of these changes with respect to the ecological receptors is discussed in detail in **Chapter 14** of this volume.

xi. Overview of the surface water drainage network

19.4.50 Surface water drainage in the Sizewell C study area comprises two, heavily modified low energy lowland river systems - the Leiston Drain and Minsmere River which discharge to the sea via the Minsmere sluice as presented on **Figure 19E.2** of this volume. The Minsmere sluice is located at the downstream end of the Minsmere New Cut. Flows in the Leiston Drain are influenced by the consented discharge of treated effluent from Leiston water recycling centre.

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

19.4.52 Minsmere sluice is the most important structure governing the surface water drainage systems. The sluice is divided into two chambers, each with its own

gravity outlet culvert. The northern chamber receives flows from the northern culvert of the Minsmere New Cut, while the southern chamber receives flows from Leiston Drain and Scott's Hall Drain. The southern chamber is also connected to the Minsmere New Cut through its southern culvert, which includes a penstock at its upstream face. The penstock is opened to alleviate high water levels in the catchment. When river levels exceed sea levels, water flows from river to sea. When sea levels exceed river levels, flow will cease, and water stored upstream of the sluice. Some ingress of seawater into the freshwater system has been factored into the design.

xii. Hydrology

19.4.53 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 Marshes SSSI and Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site, are drained by a network of drains. These drains are manually controlled by SWT and regulated by the operation of over 100 control structures such as sluiced pipes, siphons, stop boards and blind bunds/earthen crossings. Water levels are regulated to maintain optimal fen meadow inundation. In upland areas, rainfall drains to streams and channels under the influence of gravity before discharging to larger watercourses.

19.4.54 In some places, animal movements (deer movement around the Sizewell Marshes SSSI) has led to the deterioration of the blind bunds. Surface water levels within the SSSI have thus not been maintained according to the original design specifications of the blind bunds.

19.4.55 Surface waters are strongly influenced by the water levels and flows within the groundwater systems. 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.

xiii. Surface water receptors

19.4.56 There are a series of surface water channels and drainage units within the study area which are discussed in the following paragraphs and presented on **Figure 19.2** of this volume.

19.4.57 The Minsmere New Cut river, designated as the Minsmere Old River (water body ID GB105035046270) (Ref. 19.34) by the Environment Agency, is the largest hydrological input to the study area (79% by area). The Minsmere New Cut River rises to the north-west of Saxmundham (upstream of the study area) as the River Yox. The Minsmere Old River Water Body comprises of

the Minsmere New Cut and Minsmere Old River, a remnant course of the original Minsmere River, prior to the construction of the Minsmere New Cut, the Minsmere River and the River Yox. IDB Drain No. 7 (IDB Drain DRN163G0101) drains the Minsmere South Levels Drainage Unit to the south of Minsmere New Cut River.

19.4.58 The Leiston Drain, designated as the Leiston Beck (water body ID GB105035046271) (Ref. 19.35) by the Environment Agency, 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. Flows enter the site from Aldhurst Farm via culverts under Lover's Lane. These culverts form a key hydraulic constriction point for the town of Leiston. Sizewell Drain (IDB Drain DRN163G0202) is the primary watercourse draining the Sizewell Marshes SSSI. 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 main platform area, before joining the Leiston Drain to the north of the site of the proposed Sizewell C power station. IDB Drain DRN163G0201 bisects the land between Leiston Drain and Sizewell Drain. It is an artificial land drain that has a major influence on water levels in the adjacent land parcels.

19.4.59 Scott's Hall Drain discharges into Minsmere sluice from the north, running parallel to the coast and draining The Scrape drainage unit.

19.4.60 The Sizewell Marshes SSSI covers the network of drains (including Sizewell Drain) to the west of the main platform area. The Sizewell Marshes receives water from the catchment draining the higher ground to the south and south-west and 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.

19.4.61 The Sizewell Marshes SSSI also receive 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 Marshes are controlled by a series of interconnecting drains, which ultimately discharge to the Leiston Drain.

19.4.62 The Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site represents the large area to the south of the Minsmere New Cut River. 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 to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site 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 the Leiston Drain.

xiv. Surface water quality

19.4.63 Although water quality in the drainage catchments generally meets WFD 'good' status, there are failures. Parts of Leiston beck are affected by consented discharges from the Leiston water recycling centre 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.

19.4.64 Water quality in the drainage systems surrounding the site has been monitored over several years. The results of the water quality sampling have been compared to the standards set out in the River Basin Districts Typology, Standards and Groundwater threshold values (WFD) (England and Wales) Directions 2015 (where applicable). Refer to **Appendix 19E** of this volume for further details.

19.4.65 Water quality in the surface watercourses is influenced by the input of saline water from Minsmere sluice, which results in elevated salinity and sulphate levels in the surface waters in the immediate vicinity of the sluice.

19.4.66 In order to provide further understanding of the water levels and flows within the Sizewell Marshes SSSI, a programme of flow monitoring at six locations has been in place since December 2013. A seventh monitoring location was added to the network in 2015. Initial analysis of the data obtained from the monitoring network outlined above has been used in determining the hydrological baseline. This is particularly of use in generating an understanding of the groundwater system and its interaction with the surface water drainage system. Refer to **Appendix 19B1** and **19E** of this volume for further details.

19.4.67 Water quality within the surface watercourses is also noted to be moderate to poor which is attributed to marine influences, discharges from the Leiston water recycling centre and farming activities in the surrounding areas.

xv. Fluvial geomorphology

19.4.68 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.

19.4.69 Sediment deposition and, when flows have sufficient energy, sediment transportation are likely to be the dominant fluvial processes which operate in the watercourses.

xvi. Flood risk

19.4.70 The ESC Strategic FRA maps show the main development site to be located partly within an area affected by an unidentified historical flood event. The flood study of River Minsmere and Leiston Drain suggests that flooding reached Reckford Bridge (approximately 400m downstream of the Middleton village) in 1968 and 1993 during extreme storm surge events.

19.4.71 The Environment Agency's Flood Map for Planning indicates that the majority of the site is located in Flood Zone 1, 2 and 3 and has a low to high risk of flooding from rivers or the sea without defences, as shown on **Figure 19.2** of this volume.

19.4.72 The ESC Strategic FRA shows 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 in 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 LEEIE boundary. The surface water flood risk to the main platform area is very low. There are areas of increased surface water flood risk within the main platform area, which appear to be associated either with the existing Sizewell B power station layout or existing watercourses. There is woodland within the main platform area with an increased surface water flood risk that is mostly 'low' risk with a couple of small 'medium' to 'high' risk spots. For the SSSI crossing there is a small area of 'low' surface water flood risk is associated with the Leiston Drain.

19.4.73 A small surface water flow path in the central area of the temporary construction area runs from near Ash Wood Cottages to near Sandling Walk, following the local topography. The flow path pools water behind specific landscape features, including access tracks and a woodland strip, before discharging into an area with land drains at the north-east end of the Sizewell Belts.

19.4.74 The majority of the LEEIE is at very low risk of surface water flooding. Small localised areas of 'low' to 'medium' surface water flood risk are present and are associated with topographical low spots.

19.4.75 Further information on flood risk at the site is provided in the **Sizewell C Main Development Site FRA** (Doc Ref. 5.2) which has been submitted as part of this application for development consent.

xvii. Groundwater and surface water interaction

19.4.76 The Peat Deposits show hydraulic connectivity with the surface water drainage system, with the groundwater levels responding quickly to rainfall events and in response to a period of temporary pumping within the drainage system. In the western (upstream) part of the Sizewell Marshes SSSI, the Peat groundwater level is slightly lower than the surface water levels indicating that surface water recharges the groundwater. In the eastern (downstream) part of the Sizewell Marshes SSSI, the groundwater levels appear to have a similar pattern of change in levels as the nearby surface water levels.

19.4.77 During dry periods, the surface water level is slightly lower than the groundwater level. This indicates that groundwater contributes to the surface water system during dry conditions in the eastern (downstream) part of the Sizewell Marshes SSSI.

19.4.78 There is a reasonable correlation in the variations observed in ecology, hydrochemistry and water levels in the surface water drains and Peat with distribution of indicator plant species coinciding with variations in water level and chemistry. The water types observed across the site indicate that there is continuity between the Peat Deposits and the surface water drains, with proximity to the drains influencing the observed water type within the Peat.

19.4.79 Surface waters and Crag groundwater are both of calcium carbonate water type with some mixing occurring close to the coast. There are two potential mechanisms by which the Peat groundwater chemistry could be explained:

- surface water within the drains, which are generally similar to or slightly higher than the Peat, provides water to the Peat. Mixed waters within the Peat are located in areas where flow within the ditches is relatively low and it is possible that during very high tides and storm surges more chloride rich waters flow into the Leiston Drain. During these periods, surface water levels are higher than the Peat groundwater levels and the more saline, chloride rich waters migrate into the Peat where it mixes with the Peat groundwater. When the water levels in the ditches drop, they are at similar levels to the Peat and migration of the mixed

groundwater is limited. Thereby creating a situation where the Peat waters have a higher chloride component than the ditches under normal conditions; and

- groundwater within the Crag migrates vertically into the Peat, although it should be noted that it is generally the deeper Crag groundwater which are of chloride type close to the sea and it is likely that a fresher wedge of water is present in the upper part of the Crag.

xviii. Historic and environmentally sensitive sites

19.4.80 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. Refer to **Figure 14A2.1** and **Figure 14A2.2** of this volume.

19.4.81 Further consideration of historic and ecological designated sites, both statutory and non-statutory is given in **Chapters 14** and **16** of this volume.

xix. Existing buildings

19.4.82 Depending on the local ground conditions there is potential for changes in groundwater levels to destabilise structures.

19.4.83 There are no buildings in the footprint of the main platform. There are several structures present on the Sizewell B site, including the reactor housing and associated ancillary buildings, however these are within an existing cut-off wall that was left *in situ* following construction. This, along with the founding strata, will act to mitigate any subsidence risk.

xx. Summary of key receptors

19.4.84 The key receptors for potential effects are summarised in **Table 19.7.**

Table 19.7: Key groundwater and surface water receptors within the study area

Receptor	Receptor Sensitivity to Physical Effects	Receptor Sensitivity to Contaminative Effects
Sizewell Marshes SSSI.	High	Medium
Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.	High	Medium

Receptor	Receptor Sensitivity to Physical Effects	Receptor Sensitivity to Contaminative Effects
Aldhurst Farm (habitat creation area).	High	Medium
Lowestoft Formation (sand and gravels).	Low	Medium
Lowestoft Formation (diamicton).	Very Low	Medium
Peat Deposits.	High	Medium
Crag Formation.	Medium	Medium
Groundwater abstractions.	Medium	Medium
Existing buildings.	Low	Medium
Leiston Drain (Main River).	Medium	Medium
Sizewell Drain (ordinary watercourse).	Low	Medium
IDB Drain DRN163G0201.	Low	Medium
IDB Drain No.7.	Low	Medium
Scott's Hall Drain (ordinary watercourse).	Low	Medium

b) Future baseline

19.4.85 Committed developments have been considered as future receptors in the assessment of ground and surface water impacts during the construction and operation of the proposed development. There are several committed developments which have been identified within the study area as summarised in **Table 19.8.**

Table 19.8: Committed developments

Planning Application Ref.	Site Address	Description of Development	Date of Approval	Status	Distance (m)
DC/18/3897/FUL	11 Eastlands Industrial Estate Eastlands Road Leiston Suffolk IP16 4LL.	To construct a new building for use as a storage and distribution (B8) facility on a vacant site similar to an earlier building destroyed by fire.	16/11/2018	Construction not commenced.	83
DC/17/4645/OUT	The Mill 22 Carr Avenue Leiston Suffolk IP16 4JA.	Outline application for 7 dwellings comprising 2 new flats maximum 7.5m to ridge, 1 duplex unit max 6.5m to ridge, Conversion of existing Eastern range to 1 dwelling, conversion to former mill to 3 flats.	19/04/2018	Construction not commenced.	382
DC/17/3773/FUL	Land at Colonial House Station Road Leiston Suffolk.	Erection 6 no. 1 bed flats.	02/11/2017	Construction not commenced.	493
DC/17/1617/FUL	Abbey View Lodges Orchard House 105 Abbey Road Leiston Suffolk IP16 4TA.	Redevelopment of the site for 8 dwellings.	16/08/2017	Construction commenced.	83
DC/16/5035/OUT	Part Side Garden 2 Abbey Road Leiston Suffolk.	Use of land for erection of two dwellings.	24/07/2017	Construction not commenced.	430
DC/16/2111/FUL	15 High Street Leiston Suffolk IP16 4EL.	Residential development of three dwellings (plots 1-2-3) following demolition of existing bus depot building (including first floor residential flat).	28/06/2016	Construction not commenced.	348
DC/16/1322/OUT	Land East of Abbey Road Leiston Suffolk.	Outline application - 100 new residential units (C3) with employment floorspace (B1) (approx. 1000m^2) and family orientated public house / restaurant (A3/A4) (approx.770m^2).	07/06/2017	Construction not commenced.	431

Planning Application Ref.	Site Address	Description of Development	Date of Approval	Status	Distance (m)
DC/16/0931/FUL	Land West of Mill Cottage Valley Road Leiston Suffolk.	Erection of 18 dwellings including parking and external works.	18/08/2017	Construction not commenced.	165
DC/16/0527/OUT	Gas Works Carr Avenue Leiston Suffolk IP16 4AT.	Erection of 20 dwellings with associated paths, landscaping and boundary walls, gates and fences. Re-positioning of existing vehicular access to new drive and parking area.	23/06/2017	Construction not commenced.	21
DC/15/2817/FUL	27A Heath View Leiston Suffolk IP16 4JW.	Proposed semi-detached dwelling comprising of 1 No. 3 bedroom dwelling and 1 No. 2 bedroom dwelling.	21/09/2015	Construction not commenced.	275
DC/14/3166/OUT	Abbey View Lodges Orchard House 105 Abbey Road Leiston Suffolk IP16 4TA.	Application for outline planning permission with all matters reserved for redevelopment of the site for 10 dwellings.	10/04/2015	Construction commenced.	96

19.4.86 The construction timeline for these committed developments is unconfirmed. However, planning permissions generally require construction to commence within three years of the grant of planning permission or reserved matters approval before the planning permission lapses. As such, and for the purposes of this assessment, it has been assumed that the developments will have been constructed prior to 2022. These committed developments have therefore been considered as future receptors as part of the baseline for the groundwater and surface water assessments.

19.4.87 There is not anticipated to be any change to aquifer classification as a result of any stage of the development. Further detail on the future baseline for various climate change scenarios both with and without development can be seen in **Appendix 19A** of this volume.

19.4.88 As the length of the construction phase of the proposed development will cover a 10+ year period, changes to the WFD status of the Minsmere Old River and Leiston beck water bodies could be realised, relating to the default 'good status' been achieved by 2027 and beyond. Although WFD status is only relevant to the **WFD Compliance Assessment Report** (Doc Ref. 8.14), by-products, such as improved water quality, geomorphology or biology as a result of WFD implementation should be considered within the evolution of the future baseline.

19.4.89 The future baseline of the Minsmere Old River and Leiston beck water bodies from a WFD perspective do not envisage any change to the status of the water bodies as a result of the development. Factors confirming that the existing ecological qualities of the Minsmere Old River will be maintained as the future baseline include:

- the Minsmere Old River already supports good hydromorphological elements, thus this quality cannot be improved;
- biological quality elements will remain poor due to the unfavourable balance of costs and benefits to improve the status of fish within the system. This is due to physical modifications such as hard barriers and land drainage for agriculture and rural land management; and
- due to the poor biological status that is not anticipated to improve, the ecological status will remain as moderate throughout the construction phase.

19.4.90 Factors confirming that the existing ecological qualities of the Leiston beck will be maintained as the future baseline include:

- the Leiston beck already supports good hydromorphological elements, thus this quality cannot be improved;
- the physico-chemical quality of the Leiston beck will remain moderate due to the continued consented discharge from the Leiston water recycling centre, meaning phosphate levels within the system will remain elevated and dissolved oxygen will remain low; and
- due to the moderate physico-chemical quality that is not anticipated to change, the ecological status will remain as moderate throughout the construction phase.

19.5 Environmental design and mitigation

19.5.1 As detailed in **Volume 1**, **Chapter 6** of the **ES**, primary mitigation measures have been identified through the iterative EIA process and have been incorporated into the design and construction planning of the proposed development. Tertiary mitigation measures are legal requirements or are standard practices that would be implemented as part of the proposed development.

19.5.2 The assessment of likely significant effects of the proposed development assumes that primary and tertiary mitigation measures are in place. For groundwater and surface water, these measures are identified below, with a summary provided on how the measures contribute to the mitigation and management of potentially significant environmental effects.

19.5.3 **Appendix 19D** of this volume demonstrates that the marsh harrier habitat improvement area (Westleton) and the off-site sports facilities at Leiston would not result in effects on groundwater and surface water receptors, and therefore, would not require site-specific mitigation. Mitigation for works associated with fen meadow compensation sites south of Benhall and east of Halesworth is described in **Appendix 19D** of this volume.

a) Environmental design and mitigation for the Sizewell B relocated facilities works during Phase 0

19.5.4 In line with the project programme set out in **Chapter 3** of this volume, it is anticipated that the first phase of the Sizewell B relocated facilities works, which is referred to as ‘Phase 0’, would be carried out pursuant to the planning permission granted by ESC on 13 November 2019 (application ref. DC/19/1637/FUL). The second phase of the Sizewell B relocated facilities works would take place in Phases 1 and 2 in parallel with other DCO works due to take place at this time and would be carried out pursuant to the DCO.

19.5.5 Under the existing planning permission, mitigation measures for groundwater and surface water effects that occur as a result of Phase 0 of the Sizewell B relocated facilities works include the following:

- Primary mitigation:
  - use of SuDS to prevent the pollution of controlled waters and to match greenfield run-off rates with an allowance for climate change.
- Tertiary mitigation:
  - all construction works would be conducted in accordance with the Outline Construction Environmental Management Plan submitted with the application, which set out measures for pollution prevention, and requirements for the implementation of a Pollution Incident and Control Plan and construction drainage strategy.
  - If required, any groundwater extracted from the proposed outage store basement would be discharged under a suitable environmental permit. Prior to excavation of the basement, a temporary sheet-piled wall would be constructed to provide a water-resistant seal. This would allow dewatering of the construction footprint of this building, while limiting the potential for dewatering to cause drawdown within Sizewell Marshes SSSI. A piling risk assessment would be undertaken to manage the risk of introducing new contamination pathways as a result of piling.
- Monitoring:
  - Monitoring of groundwater and surface water quality during construction.

19.5.6 Details of these measures are provided in Chapters 13 and 14 of the Sizewell B relocated facilities ES, provided in **Volume 1, Appendix 2A** of the **ES**. In addition, under the planning conditions to the consent granted by the ESC, the existing Sizewell B flood emergency plan would need to be updated to take into account works associated with the Sizewell B relocated facilities.

19.5.7 It is anticipated that the mitigation measures summarised above would largely be in place or under way by the end of Phase 0. However, in order to allow for this mitigation to be implemented in Phases 1 and 2, if required (or if the works are instead carried out entirely under the DCO) - see **Volume 2, Appendix 6A** of the **ES**, these measures have also been incorporated within the DCO.

b) Environmental design and mitigation for the DCO

i. Primary mitigation

Construction phase

19.5.8 The following measures have been embedded within the design to mitigate effects during construction:

- The SSSI crossing would be constructed using impermeable sheet piling to anchor the road through the Peat Deposits and approximately 3m into the underlying Crag Formation. This structure will increase impermeable surface area and potentially alter the local groundwater flow regime in this area. Therefore, engineered drainage will be incorporated into the design and construction to manage surface run off.

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

- Construction fill material would be sourced from on-site borrow pits, which are currently proposed to the north-west of Kenton Hills, centred on NGR TM455653. The excavation of borrow pits would likely increase the potential for surface run-off reaching groundwater aquifers unimpeded and increasing the risk of contamination. Engineered drainage installed in the area of the borrow pits would manage surface run-off and protect groundwater.

- The borrow pits would likely be reinstated by filling the excavated area with alluvium excavated from the main platform area. Further detail on the borrow pits material and reinstatement is included in **Appendix 18E** of this volume. Filling the borrow pit with these materials returns the land profile to pre-existing conditions.

- As part of the construction works on the main platform, there would be a requirement to dewater part of the site to facilitate construction. The dewatering of the platform would require localised dewatering of the groundwater below the main platform only. Detailed information on the dewatering methodology is provided in the numerical modelling report, provided in **Appendix 19A** of this volume. To prevent major changes to water levels in the Peat and Crag outside of the main construction platform, a hydraulic cut off wall would be constructed to prevent, or

significantly reduce, change induced by dewatering outside of the main platform. The low permeability cut-off wall would be anchored into the London Clay Formation.

- There may be a requirement for localised, short term, construction dewatering outside the cut off wall. These dewatering activities would be managed using local control measures, such as cofferdams, as appropriate. The need for such dewatering, and associated control measures, would be assessed as required as the design progresses to ensure there is no unacceptable change to the water environment.

- There is a potential for slumping to occur of the Peat adjacent to the main platform, which could have a detrimental effect on the Sizewell Marshes SSSI. A secondary cut-off wall would be installed at the toe of the embankment slope leading to the main platform. This cut-off wall would utilise sheet pile methods to prevent the surrounding Peat and Crag formations from slumping.

- Sizewell Drain would be diverted north, parallel to the base of the platform slope, provided in **Appendix 19C** of this volume. At its northern extent, it would discharge to the Leiston Drain upstream of the SSSI crossing. In addition, revised water level management may be required for the drainage units and watercourses adjacent to the construction site. This would require the inclusion of water level control structures along the realigned Sizewell Drain and the revised operation of other existing structures. The enhanced water level control would allow for fine tuning of the management regime over time. The control structures will act to prevent any detrimental impacts on groundwater from the Sizewell Drain. The specific position, nature and operational parameters of the control structures will be determined in conjunction with stakeholders. This information could form part of an update to the **Water Level Management Plan** for the Sizewell Marshes SSSI, as discussed in **Appendix 19F** of this volume.

- During initial stages of construction, a temporary reinforced coastal flood defence with crest level of 7m AOD would be built to form a haul road used for construction until the main sea defence is completed.

- Ditches, swales and bunds would be constructed where required to prevent untreated surface water run-off from leaving the site. Oil/petrol interceptors would be incorporated into the drainage design. Construction phase drainage system implemented, incorporating SuDs measures such as open ditches and swales would promote infiltration to ground in accordance with the **Outline Drainage Strategy**, provided in **Appendix 2A** of this volume.

- Water management zones have been embedded into the design as an integral part of the surface water management system, provided in **Chapter 3** of this volume. The water management zones would collect surface water run-off, sediment and contaminants. The water management zones would incorporate an underground piped network, infiltration trenches, storage tanks and ponds. These systems would be designed to discharge treated water to the surface water drainage network and to ground at greenfield run-off rates (water management zones 1 to 6 and 10) or to sea at a rate that can exceed greenfield run-off rates (water management zones 7 and 8).

- All foul water generated during construction from the main and temporary construction areas would be pumped to construction sewage treatment plants and the treated water would then enter the site drainage systems before being discharged to sea such that there will not be a risk to groundwater or surface water receptors. Temporary arrangements will be required until the construction sewage treatment plant is operational. The provision of foul sewage treatment is included in the design of the LEEIE, with a packaged treatment plant being preferred for the Mobile Site Welfare Units that are proposed to serve the caravan pitches.

- The drainage/flood prevention strategies will consider the ground conditions of the site, including the permeability of the strata and the level of on-site contamination.

19.5.9 As the construction phase concludes, temporary facilities would be removed, and the temporary construction area restored. The construction phase temporary drainage would remain operational until the land is restored or until permanent site drainage and associated outfalls are commissioned. Where appropriate, temporary drainage would be incorporated into the permanent drainage. The temporary construction area would be restored in accordance with the **Outline Landscape and Ecological Management Plan (oLEMP)** (Doc Ref. 8.2). The site access arrangements and the construction entrance hub would be removed, although the new roundabout would be retained. The permanent access road, along the alignment of the arterial construction access road, would be completed with a final surfacing, lighting and signage.

Operational phase

19.5.10 As described in relation to the final construction activities, significant reinstatement of temporary construction areas is proposed in accordance with the **oLEMP** (Doc Ref. 8.2). Completion of the Sizewell C power station and associated permanent structures (both reactors, ancillary building and car parking areas) will increase the impermeable surface area at the site,

compared to the baseline. For the remaining areas of the proposed development, an operational phase drainage system would be implemented, including SuDS measures to intercept water, sediment and contaminants in accordance with the **Outline Drainage Strategy**, provided in **Appendix 2A** of this volume.

19.5.11 The following measures have been embedded within the permanent drainage design to minimise effects on groundwater and surface water receptors - refer to **the Outline Drainage Strategy** included in **Appendix 2A** of this volume for further information:

- Rainfall falling onto the Sizewell C power station platform would be managed through an engineered drainage system. Rainfall events at least up to the 1 in 1,000 year would be significantly within the embedded design parameters. Furthermore, up to 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.

- 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.

- Both permeable paving and impermeable surfacing will be used for car parks, and in the latter case are supplemented with infiltration trenches and/or swales. Where the risk of contamination of runoff exists the approach is supplemented with the use of silt traps, barriers or in some cases bypass separators.

- 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 surface water body. Bypass separators are also required for other areas where there is a risk of oil/hydrocarbon contamination in surface water run-off. This water would be discharged to the sea with the cooling water.

- At the western perimeter of the Sizewell C power station platform, 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 as described in the construction phase.

- The Sizewell C access road that passes over Goose Hill and is linked to the power station car park of 1,370 spaces would drain to the north,

diverting run-off away from the Sizewell Marshes SSSI. Its design would be compliant with the DMRB. Drainage will be provided to collect surface water run-off from the road and discharge to the north where it will outfall into a swale and infiltrate to ground.

19.5.12 The permanent realignment of the Sizewell Drain could lead to a change in groundwater flow patterns, that could have an associated effect on the groundwater dependent ecological receptors (e.g. the Sizewell Marshes SSSI). To mitigate this, the realignment has been engineered to maintain a surface water level that will prevent alteration of the groundwater flow regime. Control structures would be installed along the realigned Sizewell Drain to manage water flow and prevent changes to groundwater. The specific position, nature and operational parameters of the control structures will be determined in conjunction with stakeholders. This information could form part of an update to the **Water Level Management Plan** for the Sizewell Marshes SSSI, as discussed in **Appendix 19F** of this volume.

19.5.13 The engineered drainage design will act to mitigate any risk of contamination of groundwater abstractions in the operational phase.

19.5.14 The operational phase sewage treatment plant will receive and treat all domestic foul water generated within the Sizewell C power station site and from the training centre and relay store buildings which will be retained after construction within the temporary construction areas. The treated effluent would be pumped to the main cooling water outfall from where it is disposed to sea in accordance with consented standards. Disposal to sea has been selected as the dilution of the treated effluent is much greater than for a watercourse and hence environmental impact of discharge is much reduced.

19.5.15 Specification of a minimum platform and SSSI crossing height at 7.3m AOD, which would reduce the risk of the main platform and access to it from being flooded. This has been set above the still water level for 1 in 1,000-year return period events for the theoretical maximum lifetime of Sizewell C with an allowance for sea level rise with climate change – see the **Sizewell C Main Development Site FRA** (Doc Ref. 5.2) for further information. An adaptive design for the SSSI crossing to enable future raising from 7.3m AOD to 10.5m AOD to reduce the risk of overtopping.

19.5.16 Provision of a continuous hard coastal sea defence feature which would tie into Sizewell B sea defences, including the rebuilt Northern Mound, and the provision of a sacrificial soft coastal defence feature which would be replenished when it erodes.

19.5.17 Specification of a minimum sea defence crest height at 10.2m AOD with adaptive design to potentially raise the defence up to 14.2m AOD to reduce the risk of overtopping, if required. The crest height has been set above the

still water level for 1 in 10,000 year return period events over the lifetime of the proposed development with an allowance for sea level rise with climate change – see **Sizewell C Main Development Site FRA** (Doc Ref. 5.2) for further information.

ii. Tertiary mitigation

19.5.18 Tertiary mitigation will likely be required regardless of any EIA assessment, as it is imposed, for example, as a result of legislative requirements and/or standard sectoral practices.

19.5.19 Tertiary mitigation measures to be incorporated into the proposed development during construction, as set out in the **CoCP** (Doc Ref 8.11) include:

- Implementation of working methods 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. 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.
- Implementation of appropriate and safe storage of fuel, oils and equipment during works. For example, all fuels, oils, lubricants and other chemicals would be stored in an impermeable bund with at least 110% of the stored capacity. All refuelling would take place in a dedicated impermeable area, using a bunded bowser. Biodegradable oils would be used where possible.
- The wheels of all vehicles would be free of contamination before arriving at site. All vehicles would be inspected prior to leaving site and should contaminative substances be identified, suitable measures (e.g. wheel washing) would be implemented.
- Concrete and cement mixing and washing areas would be situated at least 10m away from surface water receptors. These would incorporate settlement, pH correction, 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.
- Stockpiles would be located a minimum of 10m from the nearest watercourse.

- The location of all existing observation boreholes within the areas to be excavated will be recorded by GPS. The boreholes will be backfilled and capped to remove potential pathways to underlying strata.

- Implementation of a contamination watching brief by suitably qualified and experienced personnel would be completed for the proposed development when excavating areas of potential contamination risk.

19.5.20 The following measures would be incorporated into the construction works to minimise flood-related health and safety risks:

- Weather monitoring and evacuation procedures would be prepared to manage the short period while the temporary flood defence is being constructed and the construction site of the main platform would be at risk of wave overtopping.

- Construction works for activities within or adjacent to watercourses should employ weather monitoring to predict potential extreme events and halt initial construction works, if required.

- A groundwater control strategy would manage the groundwater flood risk to the site during construction.

19.5.21 Additional tertiary mitigation referenced in the **CoCP** (Doc Ref. 8.11) includes:

- Implementation of an appropriate materials management strategy with associated materials management plans to document how the excavated materials would be dealt with and a verification plan to record the placement of materials at the site. Further details are provided in the Materials Management Strategy, provided in **Appendix 3B** of this volume.

- Implementation of a site waste management plan in accordance with the **Conventional Waste Management Strategy**, provided in **Appendix 8A** of this volume.

- Plan and design piling activities in compliance with Environment Agency guidance. This guidance may highlight the need for a piling risk assessment 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 groundwater).

- For the operational phase, storage and disposal of wastes and hazardous substances would be managed in accordance with current guidance and legislative requirements. Furthermore, Sizewell C power station would be subject to a Control of Major Accidents and Hazards Consent and a Hazardous Substances Consent which set out requirements for the storage and use of hazardous materials. Radioactive materials would be managed in accordance with the requirements of the Radioactive Substances Regulations, environmental permit and Nuclear Site Licence. Operational drainage from the power station would be discharged into the North Sea under an Operational Water Discharge Activity permit. Operational management arrangements would be set out within an integrated environmental management system for the proposed development.

19.6 Assessment

a) Introduction

19.6.1 This section presents the findings of the groundwater and surface water assessment for the construction and operation of the proposed development.

19.6.2 This section identifies any likely significant effects that are predicted to occur and **section 19.7** of this chapter then defines any secondary mitigation and monitoring measures that will be implemented to minimise any significant adverse effects (as required).

b) Sizewell B relocated facilities effects during Phase 0

19.6.3 An assessment of effects on groundwater and surface water that would occur due to Sizewell B relocated facilities works prior to the implementation of the DCO (referred to as 'Phase 0') is presented in Chapters 13 and 14 of the Sizewell B relocated facilities ES, which is provided in full at **Volume 1, Appendix 2A** of the **ES**. The following receptors were scoped into the assessment:

- Sizewell Drain and surface watercourses associated with the Sizewell Marshes SSSI;
- Crag Formation (Principal Aquifer);
- Peat Deposits;
- Sizewell Marshes SSSI; and
- existing groundwater abstractions.

19.6.4 The assessment considered effects likely to arise due to a change in groundwater levels associated with temporary dewatering for the proposed outage store, changes to surface water flows and effects on groundwater and surface water quality. All effects were identified as minor adverse or negligible (**not significant**) (refer to **section 19.8** of this chapter for a summary of effect categories).

19.6.5 An assessment of the likely significant effects of the Sizewell B relocated facilities works that would occur concurrently with Phases 1 and 2 of construction and once the Sizewell C Project is operational is provided in the sections below.

c) Main development site effects (including the Sizewell B relocated facilities works from Phase 1 onwards)

19.6.6 The aspects of the construction and operational phases which are relevant to groundwater and surface waters have been identified in **Table 19.9**. The construction phase assessment includes the removal and reinstatement of the temporary construction area and LEEIE.

19.6.7 Relevant mitigation measures specified for the main development site would also be applied for the construction of the water resource storage area and associated infrastructure, as appropriate. Management of groundwater levels and connectivity with the adjacent wetlands will be considered during design development of the water resource storage area and associated infrastructure. With mitigation in place, the construction and operation of the water resource storage area and associated infrastructure is not considered to result in new significant effects on groundwater and surface water receptors.

19.6.8 The assessment of effects associated with off-site developments is set out in **Appendix 19D** of this volume. An environmental screening exercise was undertaken to identify which of the off-site development works may give rise to environmental effects that could potentially be significant. This concluded that the fen meadow compensation sites south of Benhall and east of Halesworth should be taken forward to the assessment of likely effects on groundwater and surface water receptors.

19.6.9 The off-site sports facilities at Leiston and marsh harrier habitat improvement area (Westleton) have been screened out of the groundwater and surface water assessment, as they are not likely to give rise to significant environmental effects. Further details are provided in **Appendix 19D** of this volume.

Table 19.9: Activities and the potential mechanisms for impact on groundwater and surface water receptors

Activity	Affected Receptors	Potential Mechanisms For Impact on Groundwater and Surface Water Receptors
Contamination of groundwater receptors.	• Lowestoft Formation (sand and gravel). • Lowestoft Formation (diamicton). • Crag Formation. • Peat Deposits. • Groundwater abstractions.	• Borrow pit excavation / exposure of aquifer. • General construction activities. • Borrow pit reinstatement using Peat, alluvium and Made Ground. • Stockpiling of material. • Excavation of material during construction.
Alteration of groundwater flow regime.	• Lowestoft Formation (sand and gravel). • Lowestoft Formation (diamicton). • Crag Formation. • Peat Deposits. • Groundwater abstractions. • Sizewell Marshes SSSI. • Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.	• Removal of aquifer material during excavation of borrow pits. • Reinstatement of the borrow pit with material otherwise unsuitable for construction. • Installation of hydraulic cut-off wall altering groundwater flow. • Building foundations and structures constructed below the water table. • Construction dewatering lowering groundwater table. • SSSI crossing changing groundwater flow. • Realignment of Sizewell Drain. • Reduction in yield from abstraction due to a change in the hydrogeological regime.
Contamination of surface water receptors.	• Leiston Drain. • Sizewell Drain. • IDB Drain No. 7. • IDB Drain DRN163G0201. • Sizewell Marshes SSSI. • Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.	• Initial site preparation. • Earthworks for platform development. • Winning and placement of materials for platform height. • Potential breach of the cut-off wall and the recovery of water levels. • Dismantling and landscaping of temporary construction areas. • Removal and reinstatement of main platform. • Borrow pit reinstatement.
Alteration of the surface water flow regime.	• Leiston Drain. • Sizewell Drain. • Scott's Hall Drain. • IDB Drain No. 7.	• Changes in surface water quantity and distribution associated with land use change.

Activity	Affected Receptors	Potential Mechanisms For Impact on Groundwater and Surface Water Receptors
	• Sizewell Marshes SSSI. • Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.	• Surface water drainage from the power station and road infrastructure, together with topographical changes. • Alteration of surface water level management. • Dewatering of main platform. • Coastal inundation or breach the sea defences.
Alteration of surface water morphological processes.	• Leiston Drain. • Sizewell Drain. • Sizewell Marshes SSSI.	• Earthworks for platform development. • Sizewell Drain diversion. • SSSI crossing.

i. Construction

19.6.10 This section assesses the potential impacts of the construction phase of the proposed development on surface water hydrology, geomorphology, hydrogeology (groundwater levels and flow regimes) and water quality.

Groundwater level and flow regime

19.6.11 The construction of the temporary construction area and LEEIE will increase impermeable surface area and hence reduce the amount of rainwater that infiltrates to groundwater aquifers and potentially have a temporary effect on groundwater levels.

19.6.12 The implementation of surface water drainage will act to manage and control discharge of surface water to groundwater at an acceptable rate. Groundwater modelling results have indicated there will be no discernible change in groundwater levels or flow from increased impermeable surface area. The impact to groundwater from these activities would therefore be very low, resulting in a negligible effect for the very low value Lowestoft Formation (diamicton) and low value Lowestoft Formation (sand and gravels) and a minor adverse effect for both the medium value Crag Formation, groundwater abstractions and high value receptors (Peat Deposits, Sizewell Marshes SSSI, Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site and Aldhurst Farm habitat creation area). These effects would be **not significant**.

19.6.13 The realignment of the Sizewell Drain has the potential to alter groundwater flow and potentially affect the associated Sizewell Marshes SSSI. However, the design includes control structures that would be installed along the realigned Sizewell Drain, which will manage water levels within Sizewell Drain and hence manage groundwater flow in the area, as seen in **Appendix**

19C of this volume. This has the potential to provide greater control over water levels in the SSSI and therefore provide greater resilience to future climatic variation. The impact to groundwater from the realignment activity would therefore be very low, resulting in minor beneficial effect for the medium value groundwater abstractions and Crag Formation. It is also minor beneficial for the high value Peat Deposits and Sizewell Marshes SSSI. These effects would be **not significant**.

19.6.14 The excavation and backfilling of material from the northern borrow pits is likely to have a temporary effect on the groundwater flow in this area. The Borrow Pit Hydrogeological Risk Assessment, provided in **Appendix 18E** of this volume, found this effect would be limited. It will also be managed by engineered drainage in this area. The impact on groundwater in the area of the borrow pits would therefore be very low, resulting in a negligible effect for the low value Lowestoft Formation (sands and gravels) and a minor adverse effect for the medium value Crag Formation. There is an anticipated no effect for other identified groundwater receptors from these activities. These effects would be **not significant**.

19.6.15 Dewatering is required in the footprint of the main platform, in order to reduce groundwater levels to facilitate construction. A low permeability cut-off wall will act to hydraulically separate the main platform from the surrounding area, hence managing the risk of unnecessary dewatering outside of the cut-off wall. Groundwater modelling results have shown there is a limited and localised impact from the construction dewatering on the surrounding groundwater receptors.

19.6.16 Therefore, with the mitigation measures outlined in **section 19.5** of this chapter, the impact on groundwater receptors would be very low, resulting in a negligible effect for the low value Lowestoft Formation (sands and gravels) and very low value Lowestoft Formation (diamicton). The impact would be minor adverse for the medium value Crag Formation and groundwater abstractions and high value Sizewell Marshes SSSI, Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site and Peat Deposits. There is an anticipated no effect at the Aldhurst Farm habitat creation area due to its distance from the main platform. These effects would be **not significant**. Further information on impact to ecological receptors is detailed in **Chapter 14** of this volume.

19.6.17 The risk of slumping of the Peat Deposits (and hence change to groundwater flow or level in Sizewell Marshes SSSI) will be effectively mitigated by the construction of the sheet piled support wall at the embankment toe. Therefore, the impact on the Peat Deposits and associated Sizewell Marshes SSSI would be very low, resulting in a minor adverse effect for both. These effects would be **not significant**.

19.6.18 The construction of the permanent Sizewell C access road has the potential to alter groundwater flow within given receptors, i.e. the Peat Deposits and Crag Formation. Groundwater modelling results indicate that this structure would have a limited effect on groundwater flow. Therefore, based on the groundwater modelling report, the impact on the groundwater receptors in this area would be very low, resulting in a minor adverse effect for both the high value Peat Deposits and medium value Crag formations. These effects would be **not significant**.

19.6.19 Lowering of the groundwater table has the potential to change the physical properties of the ground material and may lead to subsidence of buildings. Given the ground conditions, with structures founded on engineered granular material, and the presence of the cut-off wall used during construction of Sizewell B the impact to the low value Sizewell B identified structures would be very low, resulting in a negligible effect. These effects would be **not significant**.

19.6.20 The temporary construction area and LEEIE would be restored in accordance with the **oLEMP** (Doc Ref. 8.2).

19.6.21 The removal of hardstanding and compaction of soils may locally reduce the rate at which rainfall makes its way into the groundwater for a short duration, however, the overall volume of water discharging to ground is unlikely to change. The impact to groundwater from these activities would be localised and very low, resulting in a negligible effect for the low and very low value superficial aquifers and a minor adverse effect for the medium value Crag aquifer. These effects would be **not significant**.

19.6.22 It has been assumed that groundwater in the underlying aquifers would not be encountered during the removal and reinstatement of the temporary features and therefore groundwater dewatering control measures would not be required. Therefore, there is no effect to groundwater levels, and to existing buildings, from the removal and reinstatement of the temporary features with respect to dewatering.

19.6.23 The level and flow effects on groundwater receptors from construction activities is summarised in **Table 19.10**.

Table 19.10: Sensitivity of the receptors potentially affected by construction activities, magnitude of impacts post mitigation and the predicted residual effect for groundwater level and flow regime

Receptor	Sensitivity	Magnitude Of Impact	Residual Effect
Crag Formation.	Medium	Very low.	Minor beneficial to minor adverse. (**not significant**).

Receptor	Sensitivity	Magnitude Of Impact	Residual Effect
Peat Deposits.	High	Very low.	Minor beneficial to minor adverse. (**not significant**).
Lowestoft Formation (diamicton).	Very low.	Very low.	Negligible. (**not significant**).
Lowestoft Formation (sands and gravels).	Low	Very low.	Negligible. (**not significant**).
Groundwater abstractions.	Medium	Very low.	Minor beneficial to minor adverse. (**not significant**).
Sizewell Marshes SSSI.	High	Very low.	Minor beneficial to minor adverse. (**not significant**).
Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.	High	Very low.	Minor adverse. (**not significant**).
Aldhurst Farm habitat creation area.	High	Very low.	No effect to minor adverse. (**not significant**).
Sizewell B existing structures.	Low	Very low.	Negligible. (**not significant**).

Groundwater quality and contamination of groundwater

19.6.24 As presented in **Chapter 18** of this volume and its appendices, the construction phase and the removal and reinstatement of the temporary facilities would potentially introduce new sources of contamination to the site through spills or leaks of contaminants used during construction. Construction works, such as excavation and stockpiling, can pose a risk to groundwater receptors through leaching and run-off of contaminants. Intrusive activities and removal of low permeability material can pose a risk to groundwater by creating new contaminant pathways or mobilising existing contamination through exposure of contaminated soil or remobilisation of contaminants through soil disturbance. The potential contaminant linkages assessed in **Chapter 18** of this volume which have been carried forward into this assessment are:

- The potential for mobilising contaminants by excavation and stockpiling of material, increasing the risk to controlled water receptors through leaching and run-off. Earthworks could provide opportunities for run-off

to contain suspended solids if not carried out in line with required management procedure.

- The potential for introducing new sources of contamination i.e. from spillages and leaks.

- The potential for creation of new pathways to groundwater during groundworks, through opening up ground temporarily and construction activities, such as earthworks, installation of drainage and other below-ground services and foundations.

19.6.25 The dewatering of the main platform is not anticipated to present a groundwater contamination risk. All abstracted water will be managed and disposed of as per best practice and guidance outlined in the **CoCP** (Doc Ref. 8.11).

19.6.26 The implementation of surface water drainage will act to manage and control discharge of surface water to groundwater at an acceptable rate. The **CoCP** (Doc Ref. 8.11) further outlines best practise to prevent contamination of groundwater from construction activities.

19.6.27 The construction of the embankment toe, cofferdam and SSSI crossing sheet piles have the potential to push contamination present in surface or near surface to underlying groundwater receptors. Construction best practice and robust testing of material in the area of any proposed sheet piling will effectively mitigate the risk of groundwater contamination. Plan and design piling activities in compliance with Environment Agency guidance; undertake a piling risk assessment, if needed.

19.6.28 The backfilling of the borrow pits, using material deemed otherwise unsuitable for construction, has the potential to contaminate the groundwater receptors located in the footprint of the borrow pits. The Borrow Pit Hydrogeological Risk Assessment, presented in **Appendix 18E** of this volume, indicates there will be limited potential for contamination. Tertiary mitigation such as chemical testing of material will also limit the emplacement of contaminated materials.

19.6.29 The Crag groundwater would be protected from any spills or leaks where it is overlain by low permeability superficial deposits. However, in areas where the superficial deposits are more permeable or absent, there is a potential pathway for contamination to reach the Crag groundwater.

19.6.30 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers, the SSSIs and the groundwater abstractions from the leaching/migration of contaminants through the soil is

slightly increased during the construction phase and the effect is classified as negligible to minor adverse. The effects would be **not significant**.

19.6.31 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers, the SSSIs and the groundwater abstractions from the migration of contaminants through preferential pathways created by the construction activities is slightly increased during the construction phase and the effect is classified as negligible to minor adverse. The effects would be **not significant**.

19.6.32 It is considered that there is no pathway for contaminative sources from the construction and removal and reinstatement activities to impact groundwater receptors beyond the inner study area of 500m. Groundwater receptors identified in the baseline environment in **section 19.4** of this chapter, which are situated outside of the inner study area are therefore not assessed for the effects from contaminative sources during the construction and removal and reinstatement phase.

Alteration of the surface water flow regime

19.6.33 Construction activities have the potential to increase existing pressures and adversely affect the hydromorphology of the receptors listed in **Table 19.11**.

19.6.34 Where construction increases the extent of bare and compacted ground for a prolonged period, there is the potential for an increase in surface run-off and increase in flood peaks in the nearest receptor. The proposed development will create new areas of bare ground for prolonged periods during the construction phase.

19.6.35 Dewatering activities associated with the platform have the potential to alter the existing flow regime characteristics. The dewatering activities have the potential to increase or lower the water levels of the Sizewell and Leiston Drains and the Sizewell Marshes SSSI.

19.6.36 The Leiston Drain, Sizewell Drain and the IDB Drain No. 7 have the potential to be directly affected by run-off originating from the main development site areas. If the flows within the Leiston Drain are increased, this has the potential to cause excessive back flooding of the Scott's Hall Drain.

19.6.37 The Leiston Drain and Scott's Hall Drain are hydrologically linked as they share the southern chamber of the Minsmere sluice. The only credible cause of an observable effect on Scott's Hall Drain is if the increased discharge flows are sufficient to reduce available capacity in the southern chamber of the Minsmere sluice. In this case, back flooding may be caused within the Scott's Hall Drain. The back flooding could lead to adverse impacts on the Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.

19.6.38 Water level management would be required for the Sizewell Marshes SSSI and watercourses adjacent to the construction site. This would require the inclusion of new water level control structures on the realigned Sizewell Drain and potentially the revised operation of other existing structures. Greater volumes of water may need to discharge down the Leiston Drain to ensure the SSSI water levels behind the water management structures are maintained due to the change in hydraulics of the realigned Sizewell Drain. The specific position, nature and operational parameters of the control structures will be determined in conjunction with stakeholders. This information could form part of an update to the **Water Level Management Plan** for the Sizewell Marshes SSSI, as discussed in **Appendix 19F** of this volume.

19.6.39 The proposed water management zones would intercept surface water run-off prior to discharge into a surface water receptor. These systems would be designed to discharge treated water to the surface water drainage network at greenfield run-off rates and potentially at higher discharge rates when discharging to sea.

19.6.40 Based on the mitigation embedded into the design of the proposed development, **Table 19.11** indicates the level of predicted effect for the surface water receptors that have the potential to be affected during the construction phase.

Table 19.11: Sensitivity of the receptors potentially affected by an altered flow regime, magnitude of construction phase impacts and the predicted residual effect

Receptor	Sensitivity	Magnitude Of Impact	Residual Effect
Leiston Drain.	Medium	Very low.	Minor adverse (**not significant**).
Sizewell Drain.	Low	Very low.	Negligible (**not significant**).
IDB Drain No.7.	Low	Very low.	Negligible (**not significant**).
Scott's Hall Drain.	Low	Very low.	Negligible (**not significant**).
Sizewell Marshes SSSI.	High	Very low.	Minor adverse (**not significant**).

19.6.41 There is potential for the Leiston and Sizewell drains, Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site and the Sizewell Marshes SSSI to be affected by a breach or overtopping of the sea defences north of the main development site. The breach modelling results with a breach at the tank traps, presented in **Sizewell C Main Development**

Site FRA (Doc Ref. 5.2) shows the greatest difference in maximum flood depth is located close to the breach location near the SSSI crossing. A maximum change in water depth for the 1 in 1,000-year event at 2034 climate change epoch was 0.21m. Another potential breach location was tested at Sizewell Gap south of Sizewell A. The modelled results show less impact than from a breach at the tank traps. The results from a breach at the main Sizewell C sea defence show no change in impact to the receptors.

19.6.42 The results of the breach modelling suggest that once the SSSI crossing is constructed, it would restrict flow between the Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site and the Sizewell Marshes SSSI when the whole system is significantly inundated. The results show the maximum water depths for the 1 in 200-year and 1 in 1,000-year for 2034 increase occurs in the Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site, while there is a slight reduction in Sizewell Marshes SSSI. The impact of the development on the receptors is very low with maximum change in water depths of 0.1m over the development's lifetime.

19.6.43 As such the effects from a breach or over topping of the sea defences on the Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site is classified as minor adverse and for the lower reach of the Leiston Drain (downstream of the SSSI crossing) is classified as negligible and considered to be **not significant**. The effects on the Sizewell Marshes SSSI and the upper reach of the Leiston Drain (upstream of the SSSI crossing) and Sizewell Drain are classified as minor beneficial and considered to be **not significant**.

Contamination of surface waters

19.6.44 Contamination of surface waters arising from construction activities and the removal and reinstatement of the temporary construction areas through the disturbance/mobilisation of existing sources of contamination or the introduction of new sources/contaminants have the potential to adversely affect the water quality of the Leiston, Sizewell, IDB Drain No.7, IDB Drain DRN163G0201 Drains and the Sizewell and Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.

19.6.45 Where excavations and the introduction of contaminants to a site take place, there is the potential for an increase in the risk of contaminating the nearest receptor. The proposed development will involve excavations and potentially the introduction of contaminants during the construction and removal and reinstatement phase.

19.6.46 Earthworks such as excavation, stockpiling and construction of the cut-off wall and ancillary buildings and structures can pose a risk to surface water receptors through sediment laden or contaminated run-off (e.g. elevated pH).

19.6.47 Arisings from the designated borrow pits and from within the power station cut-off wall, which would be mainly utilised for backfilling purposes, would be stored in temporary stockpiles with a high susceptibility to erosion and transportation.

19.6.48 The removal and landscaping of the temporary construction area (accommodation campus and associated access and parking facilities) and the LEEIE, towards the latter stages of the construction phase would have the potential to increase existing pressures and adversely affect the hydromorphology, biology and water quality of the Leiston Drain and the Sizewell Marshes SSSI.

19.6.49 The reinstatement of the borrow pits, post platform development, through filling with unsuitable material for re-use from excavations within the power station cut-off wall would have the potential to increase existing pressures and adversely affect the hydromorphology and water quality of the IDB Drain No.7 and Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.

19.6.50 The various construction areas (campus, borrow pits, etc.) would be isolated from the wider environment with appropriate drainage mechanisms, which include water management zones, until the proposed SuDS are operational. Implementation of appropriate pollution incident control will further minimise the impacts of site construction activities on the surface drainage network.

19.6.51 All foul water generated during construction from the main and temporary construction areas would be pumped to a construction sewage treatment plant, prior to discharge to sea. This would ensure segregation of surface waters and sewage effluent during construction. Temporary arrangements will be required until the construction sewage treatment plant is operational. The provision of foul sewage treatment is included in the design of the LEEIE.

19.6.52 Control measures adopted during the removal/landscaping stages of the temporary construction area and LEEIE would be as described for the construction phase.

19.6.53 As detailed in **Appendices 18B** and **18C** of this volume, the risk to the surface water receptors from both lateral migration of existing contamination and discharge of contaminants from construction activities is considered to slightly increase compared to the baseline risk. The effects from both impacts on these surface water receptors are classified as negligible to minor adverse and considered to be **not significant**.

19.6.54 It is considered that there is no pathway for contaminative sources from the construction and removal and reinstatement activities to impact surface water receptors beyond the inner study area of 500m. Surface water receptors are identified in the baseline environment in **section 19.4** of this chapter which are situated outside of the inner study area are therefore not assessed for the effects from contaminative sources during the construction and removal and reinstatement phase.

Alteration of surface water morphological processes

19.6.55 Construction activities have the potential to adversely affect the hydromorphology of the Leiston Drain, Sizewell Drain and Sizewell Marshes SSSI. Construction works, such as cut and fill operations, can pose a risk to surface water receptors by way of impeding flow through the system. Detailed information is provided in **Appendix 19B, 19B1, 19C and 19E** of this volume.

19.6.56 The proposed development would encroach into the Sizewell Drain and Marshes to accommodate the new Sizewell C platform. The Leiston Drain and Sizewell Marshes SSSI will be further impacted upon by the SSSI crossing from the platform to Goose Hill. Detailed information is provided in **Appendix 19B, 19B1, 19C and 19E** of this volume.

19.6.57 The SSSI crossing would comprise a causeway over a culvert for both the temporary and permanent crossings. The crossing would include an embankment sufficiently wide to accommodate both access routes. Following the conclusion of the construction phase, the western-most access route across the causeway would be maintained to provide operational access to the Sizewell C power station. The eastern-most access route would be removed, although that section of the causeway would remain and would be appropriately landscaped. Further information is provided in **Volume 2**, **Chapters 2-4**.

19.6.58 The Sizewell Drain would be diverted north adjacent to the south-western corner of the platform. A single channel is proposed that retains the line, channel bank characteristics and capacity of the existing channel and minimises incursion into the SSSI fen meadow habitat. Open connections would remain at the intersection of the drain with the existing floodplain ditches. Towards the north-western corner of the Sizewell C power station platform a new flow path would be created through Goodram's Fen and new drain connections are proposed in five locations, in the form of open connections and pipe dams to provide pollution control and manage water levels. Beyond this to the north, the diverted drain would tie in with the retained Leiston Drain upstream of its current confluence and the proposed SSSI crossing. The specific position, nature and operational parameters of the control structures will be determined in conjunction with stakeholders.

This information could form part of an update to the **Water Level Management Plan** for the Sizewell Marshes SSSI, as discussed in **Appendix 19F** of this volume.

19.6.59 Based on the proposed platform and SSSI crossing design, the effect is classified as minor adverse for the Sizewell Marshes SSSI and the Leiston and Sizewell drains. The effect would be **not significant**.

Discharge of foul sewage

19.6.60 A new sewage collection network would be installed for the management of foul water from the construction site. Foul water would be pumped to the construction sewage treatment plant and the treated water would then be discharged to sea. The temporary treatment plant would provide treatment to ensure acceptable discharge quality in compliance with the limits set out in a Construction Water Discharge Activity Permit. The effects on the marine environment from construction water discharges are assessed in **Chapters 20** to **22** of this volume.

Flood risk

19.6.61 The embedded design and construction methods of the proposed main platform and SSSI crossing manages the risk of flooding from coastal, fluvial, groundwater, surface water and sewers. However, the residual risk of flooding from a breach of the shingle ridge during the early phases of construction is limited but present. Once the main sea defences are built in the later phases of construction, the coastal breach flood risk to the main platform and SSSI crossing area would be reduced to low. **No significant** effect is predicted.

19.6.62 The proposed development activities on the remaining area of the temporary construction area would marginally raise the risk of flooding from surface water and sewers. The risk of groundwater flooding would be unaltered. However, the embedded design approach provides suitable mitigation to maintain a low flood risk while the site is in use during the construction phase before returning the area to the former land use. **No significant** effect is predicted.

19.6.63 The LEEIE would marginally increase the localised risk of flooding from surface water and sewers. The embedded design approach for surface water and foul water provides suitable mitigation to maintain a low flood risk while the site is in use in the construction phase. **No significant** effect is predicted.

19.6.64 Further information on flood risk at the site is provided in the **Sizewell C Main Development Site FRA** (Doc Ref. 5.2) which has been submitted as part of this application for development consent.

WFD compliance

19.6.65 The site is located within five water bodies. For the purposes of this assessment only the Minsmere Old River and Leiston beck WFD river water bodies and the Waveney and East Suffolk Chalk and Crag groundwater body have been scoped into this assessment of groundwater and surface water. Details relating to WFD compliance assessment of the Suffolk Coastal and Walberswick Marshes Coastal water bodies which have been scoped out of this assessment is provided in **WFD Compliance Assessment Report** (Doc Ref. 8.14).

19.6.66 The following construction phase activities have the potential to affect the WFD status of these waterbodies and any adjoining waterbodies:

- C1 - Initial site preparations.
- C3 - Earthworks for the platform development.
- C4 - Discharge of foul, surface and any other water.

19.6.67 During the implementation of initial site preparations, there could be a temporary interruption to river continuity during the realignment of the Sizewell Drain but following completion, the realignment will be engineered to prevent changes to surface and groundwater flows.

19.6.68 There is a suite of mitigation measures embedded in the **CoCP** (Doc Ref. 8.11). These measures would prevent significant changes to the hydrological geomorphological regime, physico-chemistry and water quality, biology and groundwater dependent terrestrial ecosystems of the waterbodies during the construction phase.

19.6.69 Only the RBMP mitigation sediment management (in place for Leiston beck and not in place for Minsmere Old River) and floodplain connectivity (not in place for Leiston beck) were identified as being at risk. However, given the mitigation measures outlined in **CoCP** (Doc Ref. 8.11) and the assessment outcome for hydromorphology, the implementation or ongoing application of the sediment management RBMP mitigation measure in either water body would not be at risk.

19.6.70 The construction of the platform (C3) would result in the loss of parts of the existing functional floodplain of the Leiston beck. This would result in a loss of floodplain connectivity that is contrary to the aim of the 'floodplain connectivity' mitigation measure. When comparing the maximum water levels for the baseline with the development scheme scenarios, the loss contributes to a maximum relative difference of less than 15mm across the floodplain. Advice provided by the Environment Agency confirms that

compensatory storage is not required where the change in flood depth is less than 30mm, and these changes would not therefore be mitigated. Furthermore, the proposed activities would not prevent existing barriers to floodplain inundation being removed or breached in the future. On this basis, it is assumed that the implementation of the 'floodplain connectivity' would not be at risk in the Leiston beck water body.

19.6.71 Effects on protected areas and adjoining WFD water bodies during the construction phase are not anticipated.

19.6.72 The proposed construction activities would not lead to a change in the overall status of the water bodies; hence the proposed activities are deemed compliant with the WFD.

19.6.73 Further information on WFD compliance is provided in the **WFD Compliance Assessment Report** (Doc Ref. 8.14) which has been submitted as part of this application for development consent.

Inter-relationship effects

19.6.74 This section provides a description of the identified inter-relationship effects that are anticipated to occur on groundwater and surface water receptors between the individual environmental effects arising from construction of the proposed development.

19.6.75 There are anticipated to be inter-relationship effects between groundwater and surface water (i.e. groundwater providing baseflow to surface watercourses); geology and land quality (i.e. naturally elevated concentration of contaminants in certain geologies); and terrestrial ecology and ornithology (i.e. groundwater dependent ecosystems). This is in relation to potential receptors which could be impacted during the construction of the proposed development.

19.6.76 The assessment of groundwater and surface water flows and levels is considered in this chapter and there are no further combined effects beyond those stated in the preceding section.

19.6.77 The assessment of contamination of groundwater and surface water is considered inherently within the geology and land quality assessment, as also summarised within this chapter, and no further combined effects are anticipated.

19.6.78 The assessment of terrestrial ecology is considered in **Chapter 14** of this volume.

19.6.79 The assessment of construction water discharges on the marine environment is considered in **Chapters 20 to 22** of this volume.

ii. Operation

19.6.80 This section assesses the potential impacts of the operational phase of the proposed development on surface water hydrology, geomorphology and water quality.

Groundwater level and flow regime

19.6.81 The completed development site will increase the impermeable surface area at the site compared to baseline conditions. This will likely reduce infiltration to identified groundwater aquifers in these areas.

19.6.82 Engineered drainage that is incorporated into the proposed development will act to channel water falling on impermeable surface into SuDS infrastructure during normal operation. Therefore, the spatial distribution of infiltration would be changed by the proposed development but the total volume of infiltration entering the ground would not be significantly changed. Furthermore, groundwater modelling scenarios indicate that the new development will not have any noticeable effect on overall groundwater recharge during operation.

19.6.83 **Appendix 18E** of this volume found that the backfilling would not have a detrimental effect on groundwater flow or quality. Therefore, there should be no knock-on effect on any associated groundwater dependent eco systems, such as the Sizewell Marshes SSSI.

19.6.84 The impact from the permanent increase in impermeable surface area on groundwater would be very low, resulting in a negligible effect for the very low value Lowestoft Formation (diamicton) and low value Lowestoft Formation (sands and gravels). It would have a minor adverse effect on the medium value groundwater abstractions and Crag Formation and high value receptors (Peat Deposits, Aldhurst Farm habitat creation area, Sizewell Marshes SSSI and Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site). These effects would be **not significant**.

19.6.85 Dewatering will not be required during the operational phase as there will be a gradual return to normal groundwater conditions following completion of the construction phase. Therefore, no effect is predicted from dewatering for any identified groundwater receptor during the operational phase.

19.6.86 The hydraulic cut-off wall and sheet piled support wall would be left in-situ for the operational phase of the development. This has the potential to alter the groundwater flow regime below the operational site and may have a detrimental effect on the groundwater levels. However, groundwater modelling was undertaken to assess the effect of the cut-off wall on groundwater flow during normal operation of the development. The modelling found it would have no discernible effect on groundwater flows.

19.6.87 Therefore, with the mitigation measures previously outlined the impact would be very low resulting in a minor beneficial effect for medium value Crag Formation and high value receptors (Sizewell Marshes SSSI and Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site). These effects would be **not significant**.

19.6.88 The presence of the Sizewell Drain control structures will act to manage water levels within Sizewell Drain and adjacent groundwater level. This has the potential to provide greater control over water levels in the SSSI and therefore provide greater resilience to future climatic variation.

19.6.89 The impact to groundwater from the realignment activity would therefore be very low, resulting in minor beneficial effect for the medium value groundwater abstractions, Crag Formation, and high value receptors (Peat Deposits and Sizewell Marshes SSSI). These effects would be **not significant.**

19.6.90 Following completion of the construction phase, the borrow pit areas will have been reinstated. The Borrow Pit Hydrogeological Risk Assessment, provided in **Appendix 18E** of this volume, indicates there will be no anticipated impact on groundwater flow in these areas due to emplacement of ex-situ material. Due to this there is anticipated to be no effect from reinstatement during the operational phase on any of the identified groundwater receptors.

19.6.91 The sheet pile wall is anticipated to remain in situ during the operational phase. The groundwater modelling report has indicated there will be a return to near baseline conditions during the operational phase and hence there is no effect anticipated for slumping of the Peat Deposits.

19.6.92 The level and flow effects on groundwater receptors from operation is summarised in **Table 19.12**.

Table 19.12: Sensitivity of the receptors potentially affected by operation, magnitude of impacts post mitigation and the predicted residual effect for groundwater level and flow regime

Receptor	Sensitivity	Magnitude Of Impact	Residual Effect
Crag Formation.	Medium	Very low.	Minor beneficial to minor adverse (**not significant**).
Peat Deposits.	High	Very low.	Minor beneficial to minor adverse (**not significant**).
Lowestoft Formation (diamicton).	Very low.	Very low.	Negligible (**not significant**).

Receptor	Sensitivity	Magnitude Of Impact	Residual Effect
Lowestoft Formation (sands and gravels).	Low	Very low.	Negligible (**not significant**).
Groundwater abstractions.	Medium	Very low.	Minor beneficial to minor adverse (**not significant**).
Sizewell Marshes SSSI.	High	Very low.	Minor beneficial to minor adverse (**not significant**).
Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.	High	Very low.	Minor beneficial to minor adverse (**not significant**).
Aldhurst Farm habitat creation area.	High	Very Low.	Minor beneficial to minor adverse (**not significant**).

Contamination of groundwater

19.6.93 As presented in **Chapter 18** of this volume and its appendices, the operation of the proposed development could introduce new sources of contamination to the site and create additional potential pathways for the migration of potential contamination. The implementation of the primary and tertiary mitigation measures identified in **section 19.5** of this chapter and in **Chapter 18** of this volume, would reduce this risk.

19.6.94 Surface run-off from impermeable surfaces will occur throughout the operational phase of the proposed development. With the described primary and tertiary mitigations, the impact on groundwater quality would be reduced.

19.6.95 During operation the main risks from contamination are fuel spills or leaks within the main car parks and surface run-off from impermeable surfaces.

19.6.96 It is not anticipated that significant spills or leaks will occur from vehicles used for commuting purposes. The presence of silt traps and hydrocarbon interceptors within the drainage design would prevent the supply of sediment and other contamination to the drainage network. It is understood that contamination from these sources would be of limited magnitude and longevity and would be mitigated through tertiary mitigation methods. The presence of silt traps and hydrocarbon interceptors within the drainage design would prevent the supply of sediment and other contamination to the drainage network. The provision of infiltration and attenuation ponds would protect the underlying groundwater from hydrocarbon contamination.

19.6.97 The backfilling of the borrow pits, using material deemed otherwise unsuitable for construction, has the potential to contaminate the groundwater receptors located in the footprint of the borrow pits. The results outlined in the Borrow Pit Hydrogeological Risk Assessment, presented in **Appendix 18E** of this volume, indicate there will be limited potential for contamination. Tertiary mitigation such as chemical testing of material will also limit the emplacement of contaminated materials.

19.6.98 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers, the SSSIs and the groundwater abstractions from the leaching/migration of contaminants through the soil is slightly increased during the operation phase and the effect is classified as negligible. The effects would be **not significant**.

19.6.99 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers, the SSSIs and the groundwater abstractions from the migration of contaminants through preferential pathways created by the construction activities is slightly increased during the operation phase and the effect is classified as negligible. The effects would be **not significant**.

19.6.100 It is considered that there is no pathway for contaminative sources from the operation activities to impact groundwater receptors beyond the inner study area of 500m. Groundwater receptors identified in the baseline environment in **section 19.4** of this chapter which are situated outside of the inner study area are therefore not assessed for the effects from contaminative sources during the operation phase.

Alteration of the surface water flow regime

19.6.101 Any changes to the flow regime have the potential to adversely affect the hydromorphology and biology of the surface water receptors listed in **Table 19.13**.

19.6.102 An increase in the extent of hardened surfaces (e.g. roofs, parking lots, etc.) within a catchment lowers the infiltration rate and therefore the greater the surface water run-off and increase in flood peaks.

19.6.103 The Leiston Drain, Sizewell Drain and the IDB Drain No. 7 have the potential to be directly affected by run-off originating from the proposed development. Additional flows with the Leiston Drain could influence the Scott's Hall Drain. Additionally, increased flows within the Sizewell Drain and Leiston Drain could induce change to the water levels within the Sizewell Mashes.

19.6.104 A key water management structure (pipe dam/tilting weir) is planned for the northern end of the Sizewell Drain as seen in **Appendix 19C** of this volume. The design of the structure considered the interfaces with other drains and

ditches and would aim to ensure the existing water balance of the surrounding wetland areas was maintained. The enhanced water level control within the Sizewell Marshes SSSI would allow for fine tuning of the management regime over time. The specific position, nature and operational parameters of the control structures will be determined in conjunction with stakeholders. This information could form part of an update to the **Water Level Management Plan** for the Sizewell Marshes SSSI, as discussed in **Appendix 19F** of this volume.

19.6.105 There would be potential for hydrological impacts in the vicinity of the SSSI crossing, due to the crossing infrastructure and cut-off wall, which would propagate into the upstream and downstream reaches of Leiston Drain. The hydrological impacts will result in increases to the groundwater levels to the west, and reductions to the east of the crossing, resulting in additional flow in the channel in the vicinity of the crossing.

19.6.106 The proposed development has numerous mitigation measures embedded into its design to nullify the possible effects of increased run-off. SuDS measures to intercept run-off would operate to attenuate and then release flows at a preferred rate no greater than greenfield runoff rates. The SuDS would control water discharge from the proposed development to either sea or nearest surface water receptor. Along the western perimeter of the main platform, a filter drain would be installed to capture surface water run-off and prevent direct discharge to the diverted Sizewell Drain. The access road from the SSSI, through the forested Goose Hill would drain to the north, diverting run-off away from the SSSI marshes towards the Minsmere Marshes. Further information on drainage is provided in the **Outline Drainage Strategy** in **Volume 2, Appendix 2A** of the **ES**.

19.6.107 Based on the protection afforded by the proposed design, **Table 19.13** indicates the level of predicted effect for the surface water receptors that have the potential to be affected by an altered flow regime.

Table 19.13: Sensitivity of the receptors potentially affected by an altered flow regime, magnitude of operational phase impacts and the predicted residual effect.

Receptor	Sensitivity	Magnitude Of Impact	Residual Effect
Leiston Drain.	Medium	Very low.	Minor adverse (**not significant**).
Sizewell Drain.	Low	Very low.	Minor adverse (**not significant**).
IDB Drain No.7.	Low	Very low.	Minor adverse (**not significant**).

Receptor	Sensitivity	Magnitude Of Impact	Residual Effect
Scott's Hall Drain.	Low	Very low.	Negligible (**not significant**).
Sizewell Marshes SSSI.	High	Very low.	Minor adverse (**not significant**).
Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.	High	Very low.	Minor adverse (**not significant**).

19.6.108 As the SSSI crossing is a permanent feature the modelling results of a breach or over topping of the sea defences would be valid for the operational phase. As such the effects from a breach or over topping of the sea defences on the Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site is classified as minor adverse and for the lower reach of the Leiston Drain (downstream of the SSSI crossing) is classified as negligible and considered to be **not significant**. The effects on the Sizewell Marshes SSSI and the upper reach of the Leiston Drain (upstream of the SSSI crossing) and Sizewell Drain is classified are minor beneficial and considered to be **not significant**.

Contamination of surface waters

19.6.109 Contamination of surface waters may arise from the operation of the proposed development due to the introduction of new sources of contaminants or the disturbance and mobilisation of existing sources of contamination. If this occurs, these have the potential to adversely affect the biology and water quality of the Leiston, Sizewell, IDB Drain No.7, IDB Drain DRN163G0201 and the Sizewell and Minsmere Marshes. There are a number of potential sources of contaminants (fuel and/or chemical spills, foul sewage spills/leaks, discarded waste products) and existing that can lead to a decline in surface water quality.

19.6.110 As described in relation to the final construction activities, significant reinstatement of temporary construction areas is proposed. For remaining areas of the power station site, an operational phase drainage system would be implemented, including SuDS measures to intercept water, sediment and contaminants.

19.6.111 The power station site would be managed through an engineered surface water drainage network. 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. This water would be discharged to sea with the cooling water.

19.6.112 At the western perimeter of the main platform, a filter drain would be installed to capture surface water run-off and prevent direct discharge to Sizewell Drain. The discharge of water from the main platform shall be directly to the sea via the main cooling water outfall. The realigned Sizewell Drain would remain during the operational phase as described in the construction phase.

19.6.113 The site access road would be compliant with the DMRB standards, using impermeable surfacing which would drain via surface water gullies to the infiltration trenches/swales alongside the road, allowing storage and infiltration.

19.6.114 The operational phase sewage treatment plant will be used to treat domestic sewage generated during the operation of the Sizewell C facility. Treated effluent would be discharged to sea via the main cooling water system in accordance with the Operational Water Discharge Activity Permit.

19.6.115 As detailed in **Appendices 18B** and **18C** of this volume, on the basis of the primary and tertiary mitigation measures, the risk on surface waters would remain the same as the baseline risk. The effects from lateral migration and discharge of contaminants on these surface water receptors are classified as negligible to minor beneficial and considered to be **not significant**.

19.6.116 It is considered that there is no pathway for contaminative sources from the operational activities to impact surface water receptors beyond the inner study area of 500m. Surface water receptors identified in the baseline environment in **section 19.4** of this chapter which are situated outside of the inner study area are therefore not assessed for the effects from contaminative sources during the operation phase.

Discharge of foul sewage

19.6.117 Wastewater generated from operation of the proposed development is anticipated to be treated at the operational phase sewage treatment plant to treat waste prior to discharge to sea in compliance with the requirements of an Operational Water Discharge Activity Permit. There is therefore no impact anticipated for groundwater or surface water receptors from wastewater discharge during normal operation of the site. Effects on the marine environment as a result of operational discharges to the sea are considered within **Chapters 20** to **22** of this volume.

Flood risk

19.6.118 The embedded design of the main platform would reduce the risk to the proposed development from coastal, breach, fluvial, surface water, sewer and groundwater flooding until the end of the operational phase. There would be residual risk of flooding were the main sea defences to fail, although management approaches would be in place to reduce the likelihood of this and the associated impact.

19.6.119 At the end of the operation phase, the SSSI crossing could be at a gradually rising risk of coastal overtopping, which would begin to pose a danger to people and vehicles using the crossing during an extreme storm event. The adaptive flood defence at the SSSI crossing would be constructed at an appropriate point in time to ensure safe vehicle operation on the causeway throughout the lifetime of the site. Therefore, **no significant** effects associated with flood risk have been identified.

19.6.120 Further information on flood risk at the site is provided in the **Sizewell C Main Development Site FRA** (Doc Ref. 5.2) which has been submitted as part of this application for development consent.

WFD compliance

19.6.121 The site is located within the Minsmere Old River and Leiston Beck WFD river water bodies and on the Waveney and East Suffolk Chalk and Crag groundwater body.

19.6.122 The following operational phase activities have the potential to affect the WFD status of these waterbodies and any adjoining waterbodies:

- O1 – Presence of the power station.
- O2 – Presence of the permanent SSSI crossing.

19.6.123 The operational phase would also not lead to any significant effects on the flow regime of the Sizewell Drain, Leiston Beck, IDB Drain 7. The proposed water management structures which would allow for easy manipulation of the water levels and flows and thus levels/flows within Leiston Beck can be reduced as and when required to allow for the Scott's Hall Drain to discharge efficiently when required.

19.6.124 The SSSI crossing comprises a causeway with a half-round box culvert, through which Leiston beck would flow. The SSSI crossing would be constructed at a size appropriate to avoid restricting the current range of flows that are conveyed through the channel from Leiston beck and Sizewell drain systems. The crossing would require sheet piling along the banks of

Leiston Drain to create ledges within the culvert. The installation of sheet piling will result in the permanent loss of the existing bank geomorphology and associated habitats in Leiston Drain within the box culvert.

19.6.125 The proposed causeway would result in the loss of approximately 68m river channel along Leiston Drain. However, the length of channel lost and replaced with a culvert is very small in comparison to the total length of Leiston beck (5.75km from Abbey Road to Minsmere sluice), accounting for 1.12% of the total watercourse length.

19.6.126 Any impacts that result in a non-temporary effect on hydromorphology have the potential to cause water body deterioration. Given the spatially constrained nature of the impact (limited to the culvert footprint), it is considered that any changes will be small-scale and would not have the potential to affect the wider geomorphological functionality of the river. The SSSI crossing is therefore not considered likely to have a significant effect on the hydromorphology status of the Leiston beck.

19.6.127 The presence of a culvert has the potential to cause changes to the geomorphology of Leiston beck in the water body reach upstream and downstream of the structure, altering erosion and sediment processes of the system. The proposed portal culvert would not include a base, leaving the natural bed undisturbed and facilitating natural sediment transport. The impact of the proposed SSSI crossing is therefore not considered likely to have a significant effect on the status of the Leiston beck.

19.6.128 Foul effluent would be discharged to the existing local foul water system located in the south east corner of the site. Treated effluent would be pumped to the cooling water outfall tunnel and disposed to sea. As a result, there will be no effects on flows to any of the surface waters.

19.6.129 For the Leiston beck WFD water body, only the RBMP mitigation measure ‘floodplain connectivity’ (not in place) was identified as being at risk. The presence of the platform would result in the permanent loss of parts of the existing functional floodplain of the Leiston beck. This would result in a loss of floodplain connectivity that is contrary to the aim of the ‘floodplain connectivity’ mitigation measure. When comparing the maximum water levels for the baseline with the development scheme scenarios, the loss contributes to a maximum relative difference of less than 15mm across the floodplain. Advice provided by the Environment Agency confirms that compensatory storage is not required where the change in flood depth is less than 30mm, and these changes would not therefore be mitigated. Furthermore, the proposed activities would not prevent existing barriers to floodplain inundation being removed or breached in the future. On this basis, it is assumed that the implementation of the ‘floodplain connectivity’ would not be at risk in the Leiston beck water body.

19.6.130 Effects on groundwater dependent terrestrial ecosystems, protected areas and adjoining water bodies during the construction phase are not anticipated.

19.6.131 The operational phase would not lead to a change in the overall status of the water bodies, hence the proposed activities are deemed compliant with the WFD.

19.6.132 Further information on WFD compliance is provided in the **WFD Compliance Assessment Report** (Doc Ref. 8.14) which has been submitted as part of this application for development consent.

Inter-relationship effects

19.6.133 This section provides a description of the identified inter-relationship effects that are anticipated to occur on groundwater and surface water receptors between the individual environmental effects arising from operation of the proposed development.

19.6.134 There are anticipated to be inter-relationship effects between groundwater and surface water (i.e. groundwater providing baseflow to surface watercourses); geology and land quality (i.e. naturally elevated concentration of contaminants in certain geologies); and terrestrial ecology and ornithology (i.e. groundwater dependent ecosystems). This is in relation to potential receptors which could be impacted during the operation of the proposed development.

19.6.135 The assessment of groundwater and surface water flows and levels is considered in this chapter and there are no further combined effects beyond those stated in the preceding section.

19.6.136 The assessment of contamination of groundwater and surface water is considered inherently within the geology and land quality assessment, as also summarised within this chapter, and no further combined effects are anticipated.

19.6.137 The assessment of terrestrial ecology is considered in **Chapter 14** of this volume.

19.6.138 The assessment of the marine environment is considered in **Chapters 20** to **22** of this volume.

19.7 Mitigation and monitoring

a) Introduction

19.7.1 Primary and tertiary mitigation measures which have already been incorporated within the design of the proposed development are detailed in **section 19.5** of this chapter.

19.7.2 Where additional mitigation is required to reduce or avoid a significant effect, this is referred to as secondary mitigation. This section describes the proposed secondary mitigation measures for the groundwater and surface water as well as describes any monitoring required of specific receptors/resources or for the effectiveness of a mitigation measure.

19.7.3 **Appendix 19D** of this volume demonstrates that the marsh harrier habitat improvement area (Westleton) and off-site sports facilities at Leiston would not result in effects on groundwater and surface water receptors, and therefore would not require site-specific mitigation. Mitigation for works associated with fen meadow compensation sites south of Benhall and east of Halesworth is described in **Appendix 19D** of this volume.

b) Mitigation

19.7.4 Additional GI would be undertaken for the proposed development to inform detailed design and confirm ground conditions, contamination status and other ground related risks in areas of the site where limited existing information is available. This would be completed prior to construction works. Where the GI identifies contamination and ground related risks, further detailed quantitative risk assessment and remediation of soil and groundwater contamination prior to construction may be required.

19.7.5 The additional GI would also include testing of marine sediments within the offshore area to provide additional information for materials re-use/disposal.

19.7.6 Intrusive GI would also be undertaken within the temporary construction area and LEEIE following the construction of the Sizewell C power station as part of the removal and reinstatement. Remediation of soil or ground contamination would then be undertaken if deemed necessary.

19.7.7 Active management and maintenance of the drainage infrastructure would be required to ensure the continued efficacy of the surface water drainage system.

19.7.8 In addition to designing sufficient redundancy into the surface water and groundwater pumping systems, there would be maintenance regimes in place to ensure the continued efficacy of operation.

19.7.9 A flood risk emergency plan in accordance with the standards set out in Appendix D of the Environment Agency and Office for Nuclear Regulation Joint Advice Note (Ref. 19.36) would be developed to identify safe access and escape routes, demonstrate free and safe movement of people during a design flood and set out the potential for evacuation before a more extreme event.

19.7.10 The beach landing facility has been designed to be highly transmissive to water and sediment flows, by incorporating a small number of marine piles, using slender piles and being of short length. However, the beach landing facility would be at risk of storm events. Usage of the facility would therefore generally be during the low wave energy season (between 31 March to 31 October) and used approximately once every 5 years during the operational phase.

19.7.11 Suspension of operation for a short time may be required during a breach of the sea defence during a very extreme sea level and would be part of the flood risk emergency plan in accordance with the standards set out in Appendix D of the Environment Agency and Office for Nuclear Regulation Joint Advice Note (Ref. 19.36) to ensure people on site are safe in the event of a flood.

c) Monitoring

19.7.12 A programme of short-term gas and groundwater monitoring would be designed as part of the additional GI for the site and would be required prior to construction works commencing. The results of this would determine the need for further long-term gas monitoring.

19.7.13 Reassurance monitoring would be carried out for groundwater and surface water in line with the **Monitoring and Response Strategy** provided in **Appendix 19F** of this volume.

19.7.14 The impacts of climate change and the associated changes in the sea levels would be monitored and assessed at set intervals (minimum 10 years) to determine the trajectory of the projections and consider whether there is any change from currently considered projections. This would aid the decision-making process on whether or when to raise the sea defence and SSSI crossing.

19.7.15 The residual flood risk due to wave overtopping would be managed on the main platform with site management protocols, warning system and weather forecasting. The sea defence would be inspected after an event to ensure the structure has not been damaged.

19.7.16 An appropriate maintenance schedule for the main coastal defence would be put in place to monitor structural integrity and overall asset condition to minimise the likelihood of breach during an extreme storm event.

19.8 Residual effects

19.8.1 The following tables present a summary of the groundwater and surface water assessment. They identify the receptor/s likely to be impacted, the level of effect and, where the effect is deemed to be significant, the tables include the additional/ secondary mitigation proposed and the resulting residual effect.

19.8.2 The off-site sports facilities at Leiston and marsh harrier habitat improvement area (Westleton) were screened out of the groundwater and surface water assessment as they are not likely to give rise to significant environmental effects. Further details are provided in **Appendix 19D** of this volume.

19.8.3 The assessment of effects for Sizewell B relocated facilities has not changed from the assessment provided in Chapters 13 and 14 of Sizewell B relocated facilities ES, provided in **Volume 1, Appendix 2A** of the **ES**.

Table 19.14: Summary of effects for the construction phase on the groundwater receptors

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Sizewell B relocated facilities effects during Phase 0					
Crag Formation (Principal Aquifer)	Locally reduced groundwater levels due to temporary dewatering for the construction of the proposed outage store basement	Measures included within the **Outline Construction Environmental Management Plan** submitted with the Sizewell B relocated facilities application. Construction drainage strategy. Temporary sheet piling for construction of outage store basement. Plan and design piling activities in compliance with Environment Agency guidance; undertake a piling risk assessment, if needed. Discharge of dewatered groundwater in compliance with an environmental permit. No discharge to Sizewell Marshes SSSI.	Minor adverse.	Groundwater level monitoring	Minor adverse (**not significant**).
	Effects on water quality from the discharge of pumped water from dewatering for the construction of outage store		Minor adverse.	Not required.	Minor adverse (**not significant**).
	Effects on water quality from construction leaks and spillages		Minor adverse.	Not required.	Minor adverse (**not significant**).
Peat Deposits	Locally reduced groundwater levels due to temporary dewatering for the construction of the proposed outage store basement		Negligible.	Not required.	Negligible (**not significant)**.
	Effects on water quality from the discharge of pumped water from dewatering for the construction of outage store		Minor adverse.	Not required.	Minor adverse (**not significant**).
	Effects on water quality from construction leaks and spillages		Negligible.	Not required.	Negligible (**not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Sizewell Marshes SSSI	Locally reduced groundwater levels due to temporary dewatering for the construction of the proposed outage store basement		Negligible.	Not required.	Negligible (**not significant)**.
	Effects on water quality from the discharge of pumped water from dewatering for the construction of outage store		Negligible/ no effect.	Not required.	Negligible/ no effect (**not significant)**.
	Migration of contaminants introduced by the construction works through groundwater flow		Minor adverse.	Not required.	Minor adverse (**not significant**).
Groundwater abstractions	Locally reduced groundwater levels due to temporary dewatering for the construction of the proposed outage store basement		Negligible.	Not required.	Negligible (**not significant)**.
	Effects on water quality from construction leaks and spillages		Negligible.	Not required.	Negligible (**not significant)**.
Main development site construction (including the Sizewell B relocated facilities works from Phase 1 onwards)					
Crag Formation (Principal Aquifer).	Reduction in the rate/volume of water discharging to ground.	Engineered Drainage, SuDS and water management zones.	Minor adverse.	Additional GI and risk assessment.	Minor adverse. (**not significant**).
	Lowering of groundwater levels.	Ensuring all site activities are carried out in accordance with **CoCP** (Doc Ref.	Minor adverse.	Remediation of soil and groundwater if necessary.	Minor adverse. (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Leaching/migration of contaminants through the soil to groundwater.	8.11), Materials Management Strategy and **Waste Management Strategy** . Construction of a permanent below ground bentonite cut-off wall to prevent dewatering outside of the main platform. Groundwater modelling was undertaken and showed little or no impacts to groundwater with primary mitigations. Engineered drainage in the borrow pit area. Control structures incorporated into Sizewell Drain realignment.	Negligible to minor adverse.	Longer term gas and groundwater monitoring if necessary.	Minor beneficial. (**not significant**).
	Migration of contaminants through preferential pathways.		Negligible to minor adverse.		Minor beneficial. (**not significant**).
	Reallignment of Sizewell Drain.		Minor beneficial.		Minor beneficial. (**not significant**).
Peat Deposits (unproductive).	Slumping	Construction of a sheet pile wall at the embankment toe to prevent slumping of the Peat. Engineered Drainage, SuDS and water managements zones. Ensuring all site activities are carried out in accordance with **CoCP** (Doc Ref. 8.11), Materials Management Strategy and **Waste Management Strategy**. Construction of a permanent below ground bentonite cut-off wall to prevent dewatering outside of the main platform. Groundwater modelling was undertaken and showed little or no	Minor adverse.		Minor adverse. (**not significant**).
	Alteration to groundwater flow direction.		Minor adverse.		Minor adverse. (**not significant**).
	Reduction in the rate/volume of water discharging to ground.		Minor adverse.		Minor adverse. (**not significant**).
	Lowering of groundwater levels.		Minor adverse.		Minor adverse. (**not significant**).
	Leaching/migration of contaminants through the soil to groundwater.		Negligible to minor adverse.		Minor beneficial (**not significant**).
	Migration of contaminants through preferential pathways.		Negligible to minor adverse.		Minor beneficial (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Reallignment of Sizewell Drain.	impacts to groundwater with primary mitigations. Control structures incorporated into Sizewell Drain realignment.	Minor beneficial.		Minor beneficial (**not significant**).
Lowestoft Formation (diamicton) groundwater (Secondary Aquifer (Undifferentiated).	Reduction in the rate/volume of water discharging to ground.	Engineered Drainage, SuDS and water managements zones. Ensuring all site activities are carried out in accordance with **CoCP** (Doc Ref. 8.11). Construction of a permanent below ground bentonite cut-off wall to prevent dewatering outside of the main platform. Groundwater modelling was undertaken and showed little or no impacts to groundwater with primary mitigations. Control structures incorporated into Sizewell Drain realignment.	Negligible		Negligible (**not significant**)
	Lowering of groundwater levels.		Negligible		Negligible (**not significant**)
	Leaching/migration of contaminants through the soil to groundwater.		Negligible to minor adverse.		Minor beneficial (**not significant**).
	Migration of contaminants through preferential pathways.		Negligible to minor adverse.		Minor beneficial (**not significant**).
Lowestoft Formation (sands and gravels) groundwater (Secondary Aquifer (Undifferentiated).	Reduction in the rate/volume of water discharging to ground.	Engineered Drainage, SuDS and water managements zones. Ensuring all site activities are carried out in accordance with **CoCP** (Doc Ref. 8.11). Construction of a permanent below ground bentonite cut-off wall to prevent	Negligible		Negligible (**not significant**).
	Lowering of groundwater levels.		Negligible		Negligible (**not significant**).
	Leaching/migration of contaminants through the soil to groundwater.		Negligible to minor adverse.		Minor beneficial (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Migration of contaminants through preferential pathways.	dewatering outside of the main platform. Groundwater modelling was undertaken and showed little or no impacts to groundwater with primary mitigations. Control structures incorporated into Sizewell Drain realignment.	Negligible to minor adverse.		Minor beneficial (**not significant**).
Groundwater abstractions.	Reduction in groundwater availability to the abstraction.	Construction of a permanent below ground bentonite cut-off wall to prevent dewatering outside of the main platform. Engineered Drainage, SuDS and water management zones. Ensuring all site activities are carried out in accordance with **CoCP** (Doc Ref. 8.11), Materials Management Strategy and **Water Management Strategy**. Groundwater modelling was undertaken and showed little or no impacts to groundwater with primary mitigations.	Minor adverse.		Minor adverse (**not significant**).
	Contamination mobilised during construction migrating to the abstraction.		Minor adverse.		Minor beneficial (**not significant**).
Sizewell Marshes SSSI, Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and	Reduction in groundwater availability to supported ecology.	Construction of a permanent below ground bentonite cut-off wall to prevent dewatering outside of the main platform. Groundwater modelling was undertaken and showed little or no	Minor adverse.		Minor adverse (**not significant**).
	Damage to ecology from contamination of groundwater.		Minor adverse.		Minor adverse (**not significant**).
	Destruction of habitat from slumping of Peat.		Minor adverse.		Minor adverse (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Ramsar site and Aldhurst Farm.	Adverse change to ecology from change to groundwater chemistry.	impacts to groundwater with primary mitigations. Engineered Drainage, SuDS and water management zones. Ensuring all site activities are carried out in accordance with **CoCP** (Doc Ref. 8.11). Sheet pile support structure. Control structures incorporated into Sizewell Drain realignment.	Minor adverse.		Minor adverse (**not significant**).
Existing buildings.	Groundwater control measures attributing to subsidence risk.	Subsidence monitoring of identified structures during dewatering phase of construction. Employ mitigation methods if subsidence is recorded.	Negligible		Negligible (**not significant**).

Table 19.15: Summary of effects for the construction phase on the surface water receptors

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Sizewell B relocated facilities effects during Phase 0					
Sizewell Drain and surface watercourses which form part	Locally reduced groundwater levels due to temporary dewatering for the construction of the proposed outage store basement	Measures included within the **Outline Construction Environmental Management Plan** submitted with the Sizewell B relocated facilities application.	Negligible.	Not required.	Negligible (**not significant).**

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
of Sizewell Marshes SSSI	Effects on water quality from the discharge of pumped water from dewatering for the construction of outage store	Construction drainage strategy. Temporary sheet piling for construction of outage store basement. Plan and design piling activities in compliance with Environment Agency guidance; undertake a piling risk assessment, if needed. Discharge of dewatered groundwater in compliance with an environmental permit. No discharge to Sizewell Marshes SSSI.	Negligible.	Not required.	Negligible (**not significant).**
	Effects on water quality from construction leaks and spillages		Negligible.	Not required.	Negligible (**not significant).**
	Alteration of surface water flows, geomorphology and water quality		Minor adverse.	Not required.	Minor adverse **(not significant).**
Main development site construction (including the Sizewell B relocated facilities works from Phase 1 onwards)					
Leiston Drain (Main River).	Contamination of the drain.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground. Adoption of pollution prevention measures. Foul water would be pumped to a central treatment plant.	Negligible to minor adverse.	Not required.	Negligible to minor adverse (**not significant**).
	Alteration of the surface water flow regime.	Construction phase temporary drainage.	Minor adverse.	Not required.	Minor adverse. (**not significant**).
	Alteration of surface water morphological processes.	N/A	Minor adverse.	Not required.	Minor adverse. (**not significant**).
Lower reach of Leiston Drain (Main River).	Alteration of the surface water flow regime cause by breach or over topping of sea defences.	N/A	Negligible.	Not required.	Negligible (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Upper reach of Leiston Drain (Main River).	Alteration of the surface water flow regime cause by breach or over topping of sea defences.	N/A	Minor beneficial.	Not required.	Minor beneficial (**not significant**).
Sizewell Drain (ordinary watercourse).	Contamination of the drain.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground. Adoption of pollution prevention measures. Foul water would be pumped to a central treatment plant.	Negligible to minor adverse.	Not required.	Negligible to minor adverse. (**not significant**).
	Alteration of the surface water flow regime.	Construction phase temporary drainage.	Negligible.	Not required.	Negligible (**not significant**).
	Alteration of the surface water flow regime cause by breach or over topping of sea defences.	N/A	Minor beneficial.	Not required.	Minor beneficial **(not significant).**
	Alteration of surface water morphological processes.	Diversion of the Sizewell Drain.	Minor adverse.	Not required.	Minor adverse (**not significant**).
IDB Drain No. 7.	Contamination of the drain.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground. Adoption of pollution prevention measures.	Negligible to minor adverse.	Not required.	Negligible to minor adverse (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Alteration of the surface water flow regime.	Foul water would be pumped to a central treatment plant.	Negligible.	Not required.	Negligible (**not significant**).
IDB Drain DRN163G0201.	Contamination of the drain.		Negligible to minor adverse.	Not required.	Negligible to minor adverse (**not significant**).
Scott's Hall Drain (ordinary watercourse).	Alteration of the surface water flow regime.		Negligible.	Not required.	Negligible (**not significant**).
Sizewell Marshes SSSI.	Contamination of the controlled waters.		Negligible to minor adverse.	Not required.	Negligible to minor adverse (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Alteration of the surface water flow regime.	Construction phase temporary drainage.	Minor adverse.	Not required.	Minor adverse (**not significant**).
	Alteration of the surface water flow regime cause by breach or over topping of sea defences.	N/A	Minor beneficial.	Not required.	Minor beneficial **(not significant).**
	Alteration of surface water morphological processes.	Habitat creation within Aldhurst Farm.	Minor adverse.	Not required.	Minor adverse **(not significant).**
Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site	Contamination of the controlled waters.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground. Adoption of pollution prevention measures. Foul water would be pumped to a central treatment plant.	Negligible to minor adverse.	Not required.	Negligible to minor adverse (**not significant**).
	Alteration of the surface water flow regime cause by breach or over topping of sea defences.	N/A	Minor adverse.	Not required.	Minor adverse **(not significant).**
Flood risk to surrounding areas.	Loss of functional floodplain storage or displacement of sea or river water.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground.	No effect.	Not required.	No effect (**not significant**).

Table 19.16: Summary of effects for the operation phase on the groundwater receptors

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Main development site operation (including the Sizewell B relocated facilities works)					
Crag Formation (Principal Aquifer).	Reduction in the rate/volume of water discharging to ground.	Water draining from the impermeable areas will pass through appropriate drainage, including the incorporation of SuDS and petrol/oil interceptors where necessary. Groundwater modelling was undertaken and showed little or no impacts to groundwater during operation. Package plant to treat sewage prior to discharge to sea.	Minor adverse.	Management and maintenance of the SuDS. Management and maintenance of the wastewater package plant. Maintain monitoring to ensure ongoing effectiveness of mitigation measures.	Minor adverse (**not significant**).
	Leaching/migration of contaminants through the soil to groundwater.		Negligible.		Minor beneficial (**not significant**).
	Migration of contaminants through preferential pathways.		Negligible.		Minor beneficial (**not significant**).
	Contamination from operational wastewater and sewage.		No effect.		No effect (**not significant**).
Peat Deposits (non-aquifer).	Reduction in the rate/volume of water discharging to ground.		Minor adverse.		Minor adverse (**not significant**).
	Leaching/migration of contaminants through the soil to groundwater.		Minor adverse.		Minor beneficial (**not significant**).
	Migration of contaminants through preferential pathways.		Minor adverse.		Minor beneficial (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Slumping		No effect.		No effect (**not significant**).
	Contamination from operational wastewater and sewage.		No effect.		No effect (**not significant).**
Lowestoft Formation sands and gravels (Secondary Aquifer).	Reduction in the rate/volume of water discharging to ground.		Negligible.		Negligible (**not significant**).
	Leaching/migration of contaminants through the soil to groundwater.		Minor adverse.		Minor beneficial (**not significant**).
	Migration of contaminants through preferential pathways.		Minor adverse.		Minor beneficial (**not significant**).
	Contamination from operational wastewater and sewage.		No effect.		No effect (**not significant**).
Lowestoft Formation diamicton (Secondary undifferentiated Aquifer)	Reduction in the rate/volume of water discharging to ground.		Negligible.		Negligible (**not significant**).
	Leaching/migration of contaminants through the soil to groundwater.		Minor adverse.		Minor beneficial (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Migration of contaminants through preferential pathways.		Minor adverse.		Minor beneficial (**not significant**).
	Contamination from operational wastewater and sewage.		No effect.		No effect (**not significant**).
Groundwater abstractions	Reduction in groundwater availability to the abstraction.		No effect.		No effect (**not significant**).
	Leaching/migration of contaminants through the soil to groundwater.		Minor adverse.		Minor beneficial (**not significant**).
	Migration of contaminants through preferential pathways.		Minor adverse.		Minor beneficial (**not significant**).
	Migration of existing contamination to abstraction.		Minor beneficial.		Minor beneficial (**not significant**).
Sizewell Marshes SSSI, Minsmere to Walberswick Heaths and	Damage to the SSSI sites, Aldhurst Farm habitat creation area and associated habitats from a reduction in groundwater levels.		No effect.		No effect (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Marshes SSSI, SAC, SPA and Ramsar site and Aldhurst Farm.	Damage to the SSSI sites and associated habitats from contamination during operation.		Minor adverse.		Minor adverse (**not significant**).
Existing buildings.	Subsidence of existing buildings from dewatering.	No dewatering during operational phase.	No effect.	Not required.	No effect (**not significant**).

Table 19.17: Summary of effects for the operational phase on the surface water receptors

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Main development site operation (including the Sizewell B relocated facilities works)					
Leiston Drain (Main River).	Contamination of the drain.	SuDS measures to intercept water, sediment and contaminants. Forecourt separators would be provided at all locations where fuel handling takes place. Foul effluent would be discharged to the existing local foul water system.	Negligible to minor beneficial.	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Negligible to minor beneficial **(not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Alteration of the surface water flow regime.	Construction phase temporary drainage.	Minor adverse.	Not required.	Minor adverse (**not significant**).
Lower reach of Leiston Drain (Main River).	Alteration of the surface water flow regime cause by breach or over topping of sea defences.	N/A	Negligible.	Not required.	Negligible (**not significant**).
Upper reach of Leiston Drain (Main River).	Alteration of the surface water flow regime cause by breach or over topping of sea defences.	N/A	Minor beneficial.	Not required.	Minor beneficial (**not significant**).
Sizewell Drain (ordinary watercourse).	Contamination of the Drain.	SuDS measures to intercept water, sediment and contaminants. Forecourt separators would be provided at all locations where fuel handling takes place. Foul effluent would be discharged to the existing local foul water system.	Negligible to minor beneficial.	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Negligible to minor beneficial (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Alteration of the surface water flow regime.	Construction phase temporary drainage.	Minor adverse.	Not required.	Minor adverse (**not significant**).
	Alteration of the surface water flow regime cause by breach or over topping of sea defences.	N/A	Minor beneficial.	Not required.	Minor beneficial. (**not significant**).
IDB Drain No. 7.	Contamination of the drain.	SuDS measures to intercept water, sediment and contaminants. Foul effluent would be discharged to the existing local foul water system.	Negligible to minor beneficial.	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Negligible to minor beneficial (**not significant**).
	Alteration of the surface water flow regime.		Minor adverse.	Not required.	Minor adverse (**not significant**).
IDB Drain DRN 163G0201.	Contamination of the drain.	SuDS measures to intercept water, sediment and contaminants. Forecourt separators would be provided at all locations where fuel handling takes place. Foul effluent would be discharged to the existing local foul water system.	Negligible to minor beneficial.	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Negligible to minor beneficial (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Scott's Hall Drain (ordinary watercourse).	Alteration of the surface water flow regime.	SuDS measures to intercept water, sediment and contaminants.	Negligible	Not required.	Negligible (**not significant**).
Sizewell Marshes SSSI.	Contamination of the controlled waters.	SuDS measures to intercept water, sediment and contaminants. Forecourt separators would be provided at all locations where fuel handling takes place. Foul effluent would be discharged to the existing local foul water system.	Negligible to minor beneficial.	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Negligible to minor beneficial (**not significant**).
	Alteration of the surface water flow regime.	SuDS measures to intercept water, sediment and contaminants.	Minor adverse.	Not required.	Minor adverse (**not significant**).
	Alteration of the surface water flow regime cause by breach or over topping of sea defences.	N/A	Minor beneficial.	Not required.	Minor beneficial **(not significant).**
Minsmere to Walberswick Heaths and Marshes SSSI, SAC, SPA and Ramsar site.	Contamination of the controlled waters.	SuDS measures to intercept water, sediment and contaminants. Foul effluent would be discharged to the existing local foul water system.	Negligible to minor beneficial.	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Negligible to minor beneficial (**not significant**).

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Alteration of the surface water flow regime.	SuDS measures to intercept water, sediment and contaminants.	Minor adverse.	Not required.	Minor adverse (**not significant**).
	Alteration of the surface water flow regime cause by breach or over topping of sea defences.	N/A	Minor adverse.	Not required.	Minor adverse **(not significant).**
Flood risk to surrounding areas.	Loss of functional floodplain storage or displacement of sea or river water.	Detention ponds and swales will be incorporated into the design.	No effect.	Not required.	No effect (**not significant**).

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