The Sizewell C Project

6.5 Volume 4 Southern Park and Ride

Chapter 12 Groundwater and Surface Water

Revision:	1.0
Applicable Regulation:	Regulation 5(2)(a)
PINS Reference Number:	EN010012

May 2020

Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Contents

Tables

Plates

None provided.

Figures

Appendices

None provided.

12. Groundwater and Surface Water

12.1 Introduction

12.1.1 This chapter of **Volume 4** of the **Environmental Statement** (**ES**) presents an assessment of the potential effects on groundwater and surface water arising from the construction, operation, and removal and reinstatement of the southern park and ride at Wickham Market (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.

12.1.2 Detailed descriptions of the southern park and ride site (referred to throughout this volume as the 'site'), the proposed development, and the different phases of development are provided in **Chapters 1** and **2** 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**.

12.1.3 The Government's Good Practice Guide for Environmental Impact Assessment (EIA)[1] (Ref. 12.1) outlines the potential environmental effects that should be considered for groundwater and surface water, for example the physical effects of the development and effects on groundwater. Further information on these topics and those which have been scoped into the assessment can be found in **section 12.3** of this chapter**.**

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

- **Appendix 11A** of this volume: Southern Park and Ride Site, Wickham Market: Phase 1 Desk Study Report, 2020;
- **Appendix 11B** of this volume: Conceptual site models;
- **Appendix 11C** of this volume: Impact assessment tables;
- **Southern Park and Ride Flood Risk Assessment** (FRA) (Doc Ref. 5.4); and
- **Water Framework Directive** (WFD) **Compliance Assessment Report** (Doc Ref. 8.14).

[1] This document has been withdrawn but still constitutes good advice and should be referred to in the absence of alternative guidance.

12.2 Legislation, policy and guidance

12.2.1 **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.

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

a) International

12.2.3 International legislation or policy relevant to the groundwater and surface water assessment includes:

- Water Framework Directive 2000/60/EC (Ref.12.2).
- Groundwater Daughter Directive 2006/118/EC (Ref.12.3).
- The Discharge of Dangerous Substances into the Aquatic Environmental Directive 2006/11/EC (Ref.12.4).

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

b) National

i. Legislation

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

- Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref.12.5).
- WFD (Standards and Classification) Directions (England and Wales) 2015 (Ref.12.6).
- Environmental Permitting Regulations (England and Wales) 2016 (Ref.12.7).
- Water Resources Act 1991 (Ref.12.8).
- Water Act 2003 (Ref.12.9).

- Flood and Water Management Act 2010 (Ref.12.10).

12.2.6 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

12.2.7 The National Policy Statements (NPS) set out national policy for energy infrastructure. The overarching NPS for Energy (EN-1) (Ref. 12.11) and NPS for Nuclear Power Generation (EN-6) (Ref. 12.12) 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**.

12.2.8 Other national policies relevant to the groundwater and surface water assessment includes the National Planning Policy Framework (NPPF) (Ref. 12.13).

12.2.9 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

12.2.10 Regional policies relevant to the groundwater and surface water assessment includes:

- Environment Agency Anglian River Basin Management Plan (RBMP) (Ref.12.14).
- The East Suffolk Abstraction Licensing Strategy 2017 (Ref.12.15).
- Environment Agency East Suffolk Catchment Flood Management Plan 2009 (Ref.12.16).

12.2.11 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

12.2.12 Local policies relevant to the groundwater and surface water assessment includes:

- Suffolk Flood Risk Management Strategy (Ref.12.17).
- Strategic Flood Risk Assessment (Ref.12.18).

- Suffolk Coastal District Council (SCDC) Local Plan Core Strategy and Development Management Policies (Ref.12.19).
- SCDC Final Draft Local Plan (Ref.12.20).

12.2.13 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

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

- Planning Practice Guidance (Ref. 12.21).
- Government's 25 Year Environment Plan (Ref. 12.22).
- The Government's Good Practice Guide (Ref. 12.23) for EIAs.
- The Groundwater Protection Position Statements Guidance (Ref. 12.24).
- Control of water pollution from construction sites: A guide to good practice, Construction Industry Research and Information Association (2001) (Ref. 12.25).
- Environment Agency's Pollution Prevention Guidelines: Working on construction sites (Ref. 12.26).
- The Design Manual for Roads and Bridges (DMRB) (2008) Volume 11, Section 2, Part 5 Assessment and Management of Environmental Effects (Ref. 12.27).
- DMRB (2009) Volume 11, Section 3, Environmental Assessment Techniques (Ref. 12.28).

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

12.3 Methodology

a) Scope of the assessment

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

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

12.3.3 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, operation, and removal and reinstatement phases of the proposed development.

12.3.4 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**.

12.3.5 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.**

12.3.6 The Government's Good Practice Guide for EIA states that the following potential environmental effects should be considered for 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.

12.3.7 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.

12.3.8 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 11** of this volume to determine, and classify, potential

effects associated with ground contamination. Further assessment of effects from contamination to groundwater and surface water is reported in this chapter.

b) Consultation

12.3.9 The scope of the assessment has also been informed by ongoing consultation and engagement with statutory consultees throughout the design and assessment process as outlined in **Volume 1 Appendix 6O** of the **ES**.

c) Study area

12.3.10 The study area for the consideration of effects from contaminative sources on controlled waters is discussed in **Chapter 11** 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.

12.3.11 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.

12.3.12 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.

12.3.13 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.

12.3.14 The site boundary and study areas are presented in **Figure 12.1** of this volume.

d) Assessment scenarios

12.3.15 The assessment of effects on the water environment includes the assessment of the construction, operational, and the removal and reinstatement phases of the proposed development, rather than the assessment of any specific years.

e) Assessment criteria

12.3.16 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

12.3.17 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.

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

Sensitivity

12.3.19 The approach to assigning levels of sensitivity to receptors and resources is set out in **Table 12.1**.

Table 12.1: 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

12.3.20 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 12.2**.

Table 12.2: 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 (such as 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.
Low	Noticeable but small-scale change, permanent or temporary changes over a partial area, to key characteristics or features of the particular environmental aspect's character or distinctiveness.
Very Low.	Noticeable, but very small-scale change, or barely discernible changes for any length of time, over a small area, to key characteristics or features of the particular environmental aspect's character or distinctiveness.

12.3.21 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.

12.3.22 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 definition

12.3.23 The classification of the likely effect for groundwater and surface water are determined using the matrix presented in **Table 12.3**.

Table 12.3: 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

12.3.24 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.

12.3.25 Following the classification of an effect as presented in **Table 12.3**, 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

12.3.26 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 (PCSM) to determine and classify potential effects.

12.3.27 Further details on the methodology applied is provided in **Volume 1, Appendix 6N** of the **ES**, and summarised in **Chapter 11** of this volume.

iii. Water Framework Directive compliance

12.3.28 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.

12.3.29 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.

12.3.30 The **WFD Compliance Assessment Report** (Doc Ref. 8.14) has been provided as a separate document 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

12.3.31 The **Southern Park and Ride Flood Risk Assessment** (FRA) (Doc Ref. 5.4) has been provided as a separate document 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

12.3.32 **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

12.3.33 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 receptors and resources from the construction, operation, and removal and reinstatement 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.

12.3.34 The assessment also considers the findings of the **WFD Compliance Assessment Report** and **Southern Park and Ride FRA**.

ii. Existing baseline

12.3.35 Existing baseline conditions are defined based on available published and site-specific information.

12.3.36 The baseline assessment has relied on existing data, previous desk study and historical records. The following sources have been reviewed:

- publicly available information from the British Geological Survey (BGS) online mapping resource (Ref. 12.29);
- publicly available information from the Environment Agency (Ref. 12.30 and Ref. 12.31);
- publicly available information from the Defra's Multi-Agency Geographic Information for the Countryside (MAGIC) website (Ref. 12.32); and
- **Appendix 11A** of this volume: southern park and ride Desk Study report which includes the Landmark Envirocheck Report for the site and study area, and details of the site walkover.

12.3.37 It is noted that the Envirocheck report was obtained in 2012. Updated information has therefore been obtained from publicly available sources of information. Information obtained during the site walkover undertaken in 2019 was also used to determine whether there had been any substantial changes between 2012 and present day. No substantial changes have been identified.

iii. Future baseline

12.3.38 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).

iv. Assessment

12.3.39 Potential changes to the water environment in terms of water levels, flow and quality are considered qualitatively against baseline conditions. Should a significant effect be identified at the end of the 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

12.3.40 The following assumptions have been made in this assessment:

- Excavation works carried out as part of the proposed development will mostly involve soil stripping and the construction of Sustainable Drainage System (SuDS) features, and would likely be shallow and therefore it is assumed that they will not intercept the water table.
- 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 **Volume 2** of the **ES**.
- 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.

12.3.41 The following limitations have been identified:

- Ground investigation has not been carried out at the site at the time of writing but will be undertaken prior to the commencement of construction. Therefore, no observed information about the ground conditions at the site or encountered groundwater levels were available for the production of this assessment. Publicly available information from the BGS such as historical borehole logs has been used to inform the assessment.
- No groundwater quality data is available for the site, however, given the site setting and historical land use there is a low risk of poor quality groundwater. Potential sources of contamination have been considered in **Chapter 11** of this volume and this has informed the assessment.

12.4 Baseline environment

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

12.4.2 Further detail can be found in southern park and ride site, Wickham Market: Phase 1 Desk Study Report **Appendix 11A** of this volume.

a) Current baseline

i. Site walkover

12.4.3 A site walkover was undertaken during March 2019 to gain further information on the site setting and study area, to consider the context of the site, and to support the desk-study mapping and aerial photographs. The site is currently open arable fields, with an overgrown and wooded area located along the western site boundary, in the area identified on available mapping as a disused sand pit. The site is bounded to the south by the A12. Further details on observations made during the site walkover including photographs can be found in the desk study in **Appendix 11A** of this volume.

ii. Topography

12.4.4 The site is located on the watershed between the River Deben and the River Ore. Light Detection and Ranging data shows that the highest ground levels, slightly above 29m Above Ordnance Datum (AOD), are located in the north-east corner of the site. Ground levels become progressively less through a moderate slope to the south and west of the site, with the lowest ground levels slightly below 25m AOD at the south-west edge.

iii. Geology

12.4.5 Although not shown on the online BGS mapping, there is the potential for Made Ground to be encountered in the disused sand pit which is likely to have been infilled, and in the areas associated with the construction of the: B1078 (Main Road); B1078 slip road; and the A12 to the south and south-west of the site.

12.4.6 Online BGS mapping indicates that the superficial geology underlying the south-eastern and north-western areas of the site is the sands and gravels of the Lowestoft Formation, which is formed of a sheet of chalky till, together with outwash sands and gravels, silts and clays whereas the central portion of the site is underlain by diamicton (boulder clay) deposits of the Lowestoft Formation.

12.4.7 The bedrock geology beneath the site comprises the Crag Group. The Crag Group is made up of shallow water marine and estuarine sands, gravels, silts and clays.

12.4.8 BGS borehole logs located along the A12 indicate that sand and gravel deposits are present within the south of the site. Lithological descriptions detailed within the trial pit logs and borehole logs generally include clay, sand and gravel with occasional chalk up to approximately 6m below ground level (m bgl). The underlying material becomes denser and sandier with depth, with bedrock not proven up to a depth of 20m bgl.

12.4.9 Further detail on the geology of the site is presented in **Chapter 11** of this volume.

iv. Hydrogeology

12.4.10 The Environment Agency classifies the sand and gravel of the Lowestoft Formation as a secondary A aquifer[2] and the diamicton of the Lowestoft Formation as a secondary aquifer (undifferentiated)[3]. The Crag Group bedrock underlying the site is classified as a principal aquifer[4].

12.4.11 The site lies within the Total Catchment (Zone 3)[5] of a groundwater Source Protection Zone (SPZ)[6]. An inner protection zone (Zone 1)[7] is approximately 500m south of the site and within the study area. The SPZs are shown on **Figure 12.1**. The study area is not within a groundwater drinking water safeguard zone.

12.4.12 Current groundwater levels at the site are not known. Contours shown on BGS hydrogeological mapping (Ref. 12.33) suggest that groundwater levels within the Crag Group may be around 7m AOD (approximately 20mbgl) at the site. These contours are based on data from 1976, and are only indicative of current levels, however the hydrogeological regime is not considered likely to have changed significantly in the intervening years. Further ground investigation would be needed to establish current groundwater levels at the site.

12.4.13 The Lowestoft Formation (diamicton) at the site is expected to be of relatively low permeability and therefore have a limited hydraulic connection to the underlying Crag groundwater. It is likely that there are perched water tables in permeable lenses within the Lowestoft Formation (diamicton).

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[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.
[4] Principal aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
[5] Total catchments (Zone 3) are defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75. There is still the need to define individual source protection areas to assist operators in catchment management.
[6] 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.
[7] Inner Protection Zones (Zone 1) are 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 50m radius. It is based principally on biological decay criteria and is designed to protect against the transmission of toxic chemicals and water-borne disease.

12.4.14 The site is located above the Waveney and East Suffolk Chalk and Crag groundwater body (groundwater body ID GB40501G400600). The Environment Agency catchment data explorer 2016 classification shows that this groundwater body has been classified as being of poor quantitative and poor chemical status, with an objective to be 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 site falls within a groundwater Nitrate Vulnerable Zone.

v. Surface water features

12.4.15 The River Deben is located approximately 800m south-west of the site at its closest point. The B1116 separates the site from this watercourse. The Environment Agency's Catchment Data Explorer (Ref. 12.34) defines the reach in the vicinity of the site as Deben (Brandeston Bridge - Melton) water body (water body ID GB105035046310). The Deben River (Brandeston Bridge – Melton) has received an overall 2016 classification of moderate ecological potential. The River Deben floodplain includes a network of drainage ditches and small storage reservoirs, located approximately 250m to the south of the site around Lower Hacheston, which lie between the primary river channel and the B1116. A tributary of the River Deben also flows in a southerly direction to the west of the B1116, and approximately 340m west of the site. This is an ordinary watercourse.

12.4.16 The River Ore is located approximately 480m north-east of the site at its closest point. The dismantled Great Eastern Railway and Marlesford Road separate the site and this watercourse. The Environment Agency's Catchment Data Explorer (Ref. 12.35) defines the reach in the vicinity of the site as the Ore water body (water body ID GB105035045970). The River Ore has received an overall 2016 classification of poor ecological potential.

12.4.17 There are several ponds in the vicinity of the site, including one pond within the site boundary located to the south of Whin Belt within the disused sand pit, and two ponds adjacent to the north-west corner of the site in the unnamed woodland.

vi. Water quality

12.4.18 The 2016 physico-chemical and chemical data presented on the Environment Agency's Catchment Data Explorer have been reviewed for the Rivers Deben and Ore in the vicinity of the proposed site boundary. The chemical status for both rivers is good.

12.4.19 Physico-chemical data indicate that the River Deben in the vicinity of the site boundary is at good or high status for ammonia, biochemical oxygen demand, dissolved oxygen, pH and temperature, and are not adversely affected by pollutants such as copper, iron, zinc and various pesticides. The

water body is at moderate physico-chemical status as a result of high phosphate concentrations. This suggests that water quality in the catchment is generally good, although it is limited by high nutrient loadings from agricultural run-off and/or treated sewage effluent.

12.4.20 Physico-chemical data for the River Ore indicate that the river is also at good or high status for all quality elements, with the exception of phosphate, which is at poor status. This is likely to be a result of high nutrient loadings from agricultural run-off and/or treated sewage effluent.

12.4.21 No groundwater quality data is available for the site.

vii. Groundwater and surface water interaction

12.4.22 Given the local geology and assumed depth to groundwater it is not considered that there is a substantial connection between groundwater and the surface water features identified. There may be local interaction between discrete water bodies in the Lowestoft Formation (diamicton) aquifer and surface water.

viii. Water abstractions

Groundwater

12.4.23 The Landmark Envirocheck Report in **Appendix 11A** of this volume identifies four licensed groundwater abstractions within the outer study area. These are detailed in **Table 12.4** and shown on **Figure 12.1**.

Table 12.4: Licensed groundwater abstractions within the outer study area.

Licence Number.	Location (including National Grid Reference (NGR)).	Source	Purpose	Maximum Annual Abstraction (m3).
An/035/0004/015	631980, 257670 (60m east of site boundary). Borehole at Hacheston, Suffolk.	Grounwater	General Agriculture: Spray Irrigation – Direct. Seasonal - Abstraction only 01 Apr to 31 Oct.	31,700
An/035/0004/013	632281, 256818 (630m south-east of site boundary). Bridge Farm, Woodbridge, Suffolk.	Groundwater	General Agriculture: Spray Irrigation – Direct. Seasonal - Abstraction only 01 Apr to 31 Oct.	68,000
7/35/04/*G/0092	631560, 258477 (650m north of site boundary).	Groundwater	General Agriculture: Spray Irrigation –	135,000

Licence Number.	Location (including National Grid Reference (NGR)).	Source	Purpose	Maximum Annual Abstraction (m3).
	Wellpoints at Hacheston, Suffolk.		Direct. Seasonal - Abstraction only 01 Apr to 30 Nov.	
7/35/06/*G/0103	631790, 255900 (830m south-east of site boundary). Bore Ashmorr Hall, Campsea Ash.	Groundwater	General Farming and Domestic.	Not provided in Envirocheck.

12.4.24 There is the potential for unknown Private Water Supplies (PWS) to be in use within the groundwater study area. Should any PWS exist, they would likely be associated with the isolated farm buildings and residential properties in the study area. It is likely that the properties within the villages of Lower Hacheston and Wickham Market villages obtain their water from a mains supply source.

Surface water

12.4.25 The Landmark Envirocheck Report in **Appendix 11A** of this volume indicates that there are two licensed surface water abstraction within the outer study area. These are detailed in **Table 12.5** and shown on **Figure 12.1.**

Table 12.5: Licensed surface water abstractions within outer study area.

Licence Number.	Location (including NGR).	Source	Purpose	Maximum Annual Abstraction (m3).
7/35/06/*S/0062	630770, 256720 (420m west of site boundary). Marsh Drain at Bridge Farm, Hacheston.	Surface	General Agriculture: Spray Irrigation – Storage. Seasonal – abstraction only 01 May to 30 Sept.	Not provided in Envirocheck.
7/35/06/*S/0061	631610, 256180 (510m south-east of site boundary). Marsh Drains at Campsey Ash.	Surface	General Agriculture: Spray Irrigation – Direct. Seasonal – abstraction only 01 Apr to 31 Oct.	Not provided in Envirocheck.

ix. Fluvial geomorphology

12.4.26 Geomorphology and hydromorphology are key factors contributing to whether a water body can achieve or maintain good ecological status.

12.4.27 The River Deben (Brandeston Bridge - Melton) water body is designated as a Heavily Modified Water Body. The geomorphology and the hydrological regime of the River Deben are of sufficient quality to support good ecological status.

12.4.28 The geomorphology of the River Ore is sufficient to support good ecological status, however, the hydrological regime 'does not support good' status. In lowland rivers where the hydrological regime does not support good status, this is due to the effect of surface water or groundwater abstraction.

x. Flood Risk

12.4.29 The East Suffolk Council Strategic FRA did not identify any historic flooding as having occurred within the site.

12.4.30 The Environment Agency's Flood Map for Planning and the Environment Agency long-term flood risk mapping indicate that the site is located in Flood Zone 1 and has a low risk of flooding from rivers or the sea without defences as shown in **Figure 12.1** of this volume.

12.4.31 Within the study area, the River Ore located approximately 480m north-east of the site, is located in a Flood Zones 2 and 3, and at high risk of extreme flooding from rivers or the sea without defences. The network of drains located 250m south of the site are also indicated to be within Flood Zones 2 and 3.

12.4.32 The Environment Agency's long-term flood risk mapping shows that the majority of the site is also at very low risk of flooding from surface water.

12.4.33 However, there are four isolated areas of low risk of surface water flooding within the site:

- across the proposed access road;
- along the southern boundary with the A12;
- along the site boundary beyond the eastern extent of the parking area; and
- at the north-east boundary outside of the grassed spoil bunds.

12.4.34 There are two areas of combined medium and high risk in the park and ride site. One covers the lower section of one of the swales in the proposed layout and a small section of the parking area. It is located in the north-west corner of the main parking block. The second area is adjacent to the north-bound A12 slip road.

12.4.35 Towards the southern extent of the wider proposed development, there is a large area of high surface water flood risk, situated on the A12 at the B1078 junction.

12.4.36 Further information on flood risk at the site is provided in the **Southern Park and Ride FRA** (Doc Ref. 5.4) which has been submitted as part of this application for development consent.

xi. Historic and environmentally sensitive sites

12.4.37 A review of the MAGIC website has confirmed that there are no internationally or nationally designated water dependent ecological sites within the outer study area as shown in **Figure 7.1** of this volume.

12.4.38 Further consideration of designated historic and ecological sites, both statutory and non-statutory is given in terrestrial ecology and ornithology and terrestrial historic environmental chapters, **Chapters 7** and **9** of this volume respectively.

xii. Existing buildings

12.4.39 Changes in groundwater levels have the potential to affect building foundations. There are no existing buildings present on-site, however, there are several residential properties, farms and associated buildings within the study area, including the village of Wickham Market to the west. The closest building to the site is Ash View Cottage, approximately 65m west of the site boundary.

xiii. Potential for existing contamination

12.4.40 The following potential existing contamination sources are considered within the geology and land quality assessment, provided in **Chapter 11** of this volume:

- historical site usage;
- waste management sites;
- service stations;

- industrial and other potentially contaminative land uses; and
- potential for unexploded ordnance.

12.4.41 The potential sources of contamination at the proposed development are presented in the PCSM in **Appendix 11B** of **Chapter 11** of this volume.

xiv. Summary of key receptors

12.4.42 The key receptors for potential effects are summarised in **Table 12.6.**

Table 12.6: Key receptors within the study area.

Receptor	Receptor Sensitivity To Physical Effects.	Receptor Sensitivity To Contaminative Effects.
Crag groundwater (principal aquifer).	Medium	Medium
Lowestoft Formation groundwater-sand and gravel (secondary A aquifer).	Low	Medium
Lowestoft Formation (diamicton) groundwater (secondary aquifer (undifferentiated)).	Very low.	Medium
Groundwater abstractions.	Medium	Medium
Potential PWS.	Medium	Medium
Existing buildings.	Medium	Low
River Deben (Main River).	Medium	Low
River Ore (Main River).	Medium	Low
Existing pond within the site.	Very Low.	Low
Surface water abstractions.	Low	Low

b) Future baseline

12.4.43 There are no committed development(s) or forecasted changes that would materially alter the baseline conditions during the construction, operation, and removal and reinstatement phases of the proposed development.

12.4.44 There is not anticipated to be any change to aquifer classification as a result of any stage of the development.

12.4.45 As the length of the construction, operational and removal and reinstatement phases of the proposed development will cover a period of 9-12 years, changes to the WFD status of the River Deben (Brandeston Bridge – Melton), and River Ore 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.

12.4.46 The future baseline of the River Deben (Brandeston Bridge – Melton) water body from a WFD perspective does not envisage any change to the status of the water body as a result of the proposed development. Factors confirming that the existing ecological qualities of the River Deben (Brandeston Bridge – Melton) water body will be maintained as the future baseline include:

- the disproportionate burdens of the mitigation measures assessment; and
- no technical solution is available to improve the status of phosphate, which is currently moderate.

12.4.47 Due to the moderate supporting elements (surface water) status, and the moderate physico-chemical status which are not anticipated to improve, the ecological status would remain as moderate throughout the construction, operation, and removal and reinstatement phases of the proposed development.

12.4.48 The future baseline of the River Ore water body from a WFD perspective does not envisage any change to the status of the water body as a result of the proposed development. Factors confirming that the existing ecological qualities of the River Ore water body will be maintained as the future baseline include:

- the disproportionate burdens to improve the status of fish and macrophytes and phytobenthos; and
- no technical solution is available to improve the status of phosphate, which is currently poor.

12.4.49 Due to the poor biological status and the moderate physico-chemical status which are not anticipated to improve, the ecological status would remain as poor throughout the construction, operation, and removal and reinstatement phases of the proposed development.

12.5 Environmental design and mitigation

12.5.1 As detailed in **Volume 1**, **Chapter 6** of the **ES**, a number of 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 will be implemented as part of the proposed development.

12.5.2 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 later, with a summary provided on how the measures contribute to the mitigation and management of potentially significant environmental effects.

a) Primary mitigation

12.5.3 Primary mitigation is often referred to as 'embedded mitigation' and includes modifications to the location or design to mitigate impacts; these measures become an inherent part of the proposed development.

i. Construction phase

12.5.4 The existing pond within the site would be retained within the site layout and a buffer zone established around this surface water feature.

ii. Operational phase

12.5.5 The proposed drainage system would incorporate SuDS measures as set out in the **Outline Drainage Strategy** in **Appendix 2A** of **Volume 2** of the **ES**. This includes provision for permeable surfaces, swale and infiltration pond features within the site. Through these measures, it is envisaged there would be no overall change in run-off characteristics of the site.

12.5.6 Bypass separators would be incorporated into the drainage design, where considered necessary, to protect both the underlying groundwater and surface water receptors, and to maintain the efficacy of the SuDS measures. Active management and maintenance of the drainage infrastructure is required to ensure the continued efficacy of the surface water drainage system.

12.5.7 It is proposed to introduce a package plant and to drain the effluent to ground through SuDS infiltration devices. Low flow rates are likely to impact on the functionality of a package treatment plant, and a low flow package treatment plant shall be specified. There would also be a small cess pit serving the more isolated security booth, on the access road at the entrance to the site, with field drain infiltration. Tankering to works is an alternative option should the flow be insufficient for the low-flow package treatment plant.

iii. Removal and reinstatement

12.5.8 The removal of the proposed development would include the removal of any related drainage and SuDS measures within the site.

b) Tertiary mitigation

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

12.5.10 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.

12.5.11 Tertiary mitigation measures to be incorporated into the proposed development during enabling works, construction, operation and the removal and reinstatement phases, as set out in the **Code of Construction Practice** (**CoCP**) (Doc Ref. 8.11) include:

- Temporary SuDS to be implemented early in the construction phase. Construction phase water management zones (WMZ) to intercept surface water run-off, sediment and contaminants from the construction compound and laydown areas, and incorporate sustainable drainage measures such as swales, bypass separators, infiltration ponds and soakaways to promote infiltration.

- Construction drainage to be contained within the site, with infiltration to ground. A low bund would be constructed to achieve this with an external toe drain to intercept off-site run-off that may otherwise be impeded by the presence of the proposed bund. Only if full infiltration is not possible, would these systems discharge into the surface drainage network at greenfield run-off rates to minimise the potential for impact.

- Hardstanding to be constructed within the construction compounds where required to mitigate potential spills and leaks. Water falling onto impermeable surfaces to pass through a bypass separator.

- Active management and maintenance of the drainage infrastructure is required to ensure the continued efficacy of the surface water drainage system.

- It is envisaged that foul sewage arising on site during construction will be tankered off site until the operational arrangements are in place.

- Implementation of working methods during construction to ensure there would be no surface water run-off from the works, or any stockpiles, into adjacent surface watercourses/leaching into underlying groundwater in accordance with best practice.

- Implementation of appropriate pollution incident control, such as the use of 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 construction. 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 should 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 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.

12.5.12 Any control measures used to protect groundwater and surface water during the construction phase would also be applied during the removal and reinstatement phase.

12.5.13 Additional tertiary mitigation that would be anticipated and referenced in the **CoCP** (Doc Ref. 8.11) includes:

- Excavation and handling of materials and stockpiling, and construction waste, would be managed by good working practice in accordance with the materials management measures, soil management measures and waste management measures set out in the **CoCP** (Doc Ref. 8.11).

12.6 Assessment

a) Introduction

12.6.1 This section presents the findings of the groundwater and surface water assessment for the construction, operation and removal and reinstatement stages of the proposed development.

12.6.2 This section identifies any likely significant effects that are predicted to occur and **section 12.7** of this chapter then highlights any secondary mitigation and monitoring measures that are proposed to minimise any adverse significant effects (if required).

b) Construction

i. Groundwater level and flow regime

12.6.3 The removal of on-site vegetation and the compaction of soils due to construction vehicles and materials storage 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 very low and low value superficial aquifers and a minor adverse effect for the medium value Crag aquifer. These effects would be **not significant**.

12.6.4 Current groundwater levels at the site have not been established, however, available BGS hydrogeological mapping suggest that Crag groundwater levels at the site is around 20m bgl. Given the nature of the proposed works, excavation is anticipated to be shallow, and therefore it has been assumed that groundwater in the underlying aquifers would not be encountered during construction. It is, therefore, anticipated that groundwater control measures would not be required, and that there would be no effect on the underlying aquifers with respect to dewatering activities.

12.6.5 Whilst no groundwater level control measures are anticipated, there is the potential that the localised changes to groundwater recharge from the removal of on-site vegetation and compaction of soils could impact on the abstraction borehole at Hacheston (60m east of the site) due to its close proximity to the site. With the implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter, the impact on the medium value abstraction with respect to groundwater level, and flow would be very low, and the effect therefore classified as minor adverse. The effect would be **not significant**.

12.6.6 The other groundwater abstractions identified within the study area are located over 500m from the site. Due to their distance from the site and with

the implementation of the primary and tertiary mitigation measures identified, it is unlikely they would be affected by any local changes to the hydrogeological environment. It is concluded that there would be no effect on the abstractions with respect to water level and flow.

12.6.7 There are no known PWS in the study area, as no groundwater control measures are anticipated, it is concluded that there would be no effect on PWS in the study area with respect to groundwater level and flow.

12.6.8 As no groundwater control measures are anticipated at the site during construction, it is concluded that there would be no effect on the medium value existing buildings in terms of subsidence risk.

ii. Contamination of groundwater

12.6.9 As presented in **Chapter 11** of this volume and its appendices, the construction phase 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 11** 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; and
- 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.

12.6.10 As presented in **Chapter 11** of this volume and its appendices, there is the potential for existing contamination at the site, as well as the introduction of new contaminants and preferential pathways through construction activities. The implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter and in **Chapter 11** of this volume, including

implementation of pollution incident control and safe storage of fuel, oils and equipment, would reduce this risk.

12.6.11 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 Crag is overlain by sand and gravel of the Lowestoft Formation there is a potential pathway for contamination to reach the Crag groundwater.

12.6.12 If a spill or leak does occur, given the relatively low volumes of potentially contaminative material and the primary and tertiary mitigation measures employed, the scale of any spill or leak is likely to be small.

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

12.6.14 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers from the migration of contaminants through preferential pathways created by the construction activities is increased during the construction phase, and the effect is classified as moderate adverse. The effects would be **significant**.

12.6.15 The seasonal groundwater abstraction borehole at Hacheston is located within 60m of the site boundary, and assumed to abstract from either the Crag aquifer, or the sand and gravel of the Lowestoft Formation. Due to its close proximity to the site, it is considered that there is the potential for contamination from the site activities to migrate to the abstraction, through leaching through the soil or via the creation of preferential pathways. With the implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter, it is anticipated that the risk to the abstraction is the same as for the aquifer from which it abstracts groundwater. This is an increase from the existing baseline during the construction activities and the effect is classified as moderate adverse. The effect would be **significant**.

12.6.16 There are no known PWS in the study area, however there is the potential for as yet unidentified PWS to be within the study area. With the implementation of the primary and tertiary mitigation measures identified, the impact to potential PWS with respect to water quality beyond the site itself would be the same as for the groundwater from which they would abstract, and therefore classified as moderate adverse. The effect would be **significant**.

12.6.17 It is considered that there is no pathway for contaminative sources from the construction activities to impact groundwater receptors beyond the inner study area of 500m. Groundwater receptors identified in the baseline

environment **section 12.4** 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 phase.

iii. Alteration of surface water flow regime

12.6.18 Any changes to the flow regime have the potential to increase existing pressures and adversely affect the hydromorphology and biology of the Rivers Deben and Ore, which are medium sensitivity receptors.

12.6.19 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.

12.6.20 Construction phase water management is embedded in the design, with on-site surface water run-off being infiltrated or discharged at Greenfield run-off rates until the operational phase SuDS infrastructure is operational to avoid off-site contamination. This will result in a very low magnitude effect. This effect is classified as minor adverse and considered to be **not significant** for the Rivers Deben and Ore. Once the SuDS infrastructure is operational, there will be no effect.

iv. Contamination of surface waters

12.6.21 Contamination of surface waters arising from construction activities through the disturbance/mobilisation of existing sources of contamination or the introduction of new sources/contaminants have the potential to adversely affect the biology and water quality of the Rivers Deben and Ore (and associated floodplain drains) and the existing pond, increasing existing pressures on these watercourses. 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 the introduction of contaminants during the construction phase.

12.6.22 The site would be isolated from the wider environment until the operational phase SuDS is operational. Implementation of appropriate pollution incident control in accordance with the **CoCP** (Doc Ref. 8.11) would further minimise the impacts of site construction activities on the surface drainage network.

12.6.23 As detailed in **Appendices 11B** and **11C** of this volume, the risk to the existing pond, the Rivers Deben and Ore and the floodplain drainage network from both lateral migration of existing contamination and discharge of contaminants from construction activities is considered to increase compared to the baseline risk. The effects from both impacts on these surface water

receptors are classified as minor adverse and considered to be **not significant**.

12.6.24 Contamination of surface waters arising from construction activities also have the potential to affect the existing surface water abstraction (Bridge Farm, Hacheston) from floodplain drains on the River Deben floodplain. Based on the protection afforded by primary and tertiary mitigation measures, the effects from both impacts on the surface water abstraction is classified as minor adverse and considered to be **not significant**.

12.6.25 It is considered that there is no pathway for contaminative sources from the construction activities to impact surface water receptors beyond the inner study area of 500m. Surface water receptors identified in the baseline environment **section 12.4** 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 phase.

v. Flood risk

12.6.26 The proposed development would include sustainable drainage for the life time of the development to manage any additional surface water run-off from it. A combination of infiltration and controlled discharge methods are proposed for the discharge of surface water run-off. Controlled discharge would be at the greenfield run-off rate to the unnamed watercourse. As the site is located in Flood Zone 1, construction activities will not lead to a loss in functional floodplain storage or displacement of sea or river flood water. No significant increase in flood risk relating to surface water is anticipated and therefore no effect is predicted.

12.6.27 Further information on flood risk at the site is provided in the **Southern Park and Ride FRA** (Doc Ref. 5.4) which has been submitted as part of this application for development consent.

vi. WFD compliance

12.6.28 The site is located within the Deben (Brandeston Bridge - Melton) and Ore WFD water body catchments and on the Waveney and East Suffolk Chalk and Crag groundwater body.

12.6.29 The WFD assessment demonstrates that proposed construction activities would not have direct or indirect effects on the Deben (Brandeston Bridge - Melton), Ore and Waveney and East Suffolk Chalk and Crag water bodies that would be sufficient to cause deterioration in the status of the water body or protected areas located within the water bodies.

12.6.30 As the proposed construction activities will not lead to a change in the overall status of the water bodies; the proposed construction activities are deemed compliant with the WFD.

12.6.31 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.

vii. Inter-relationship effects

12.6.32 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.

12.6.33 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.

12.6.34 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.

12.6.35 The assessment of contamination of groundwater and surface water is considered inherently within the geology and land quality, provided in **Chapter 11** of this volume, assessment and no further combined effects are anticipated.

12.6.36 The assessment of terrestrial ecology is considered in **Chapter 7** of this volume.

c) Operation

i. Groundwater level and flow regime

12.6.37 It has been assumed that groundwater in the underlying aquifers would not be encountered during the operation phase and therefore groundwater dewatering control measures would not be required during the operation of the proposed development. Therefore, there is no potential impact to groundwater levels, and no effect on existing buildings, from the proposed development with respect to subsidence risk.

12.6.38 The parking areas would predominantly be covered with permeable surfaces and any water falling onto impermeable surfaces would be channelled into the SuDS infrastructure. This would allow infiltration to ground, and would mean that although the spatial distribution of infiltration would be changed by the proposed development, the total volume of infiltration entering the ground would not be substantially changed. The proposed development would therefore not substantially alter recharge volumes to the superficial aquifer. The impact to the superficial aquifers would be of medium-term, low magnitude and the effect classified as negligible for the very low value diamicton deposits, and minor adverse for the low value sand and gravels of the Lowestoft Formation. The effects would be **not significant**.

12.6.39 Variable permeability of the superficial deposits overlaying the Crag Group and changes to the distribution of recharge over the site area may affect the flow regime of the Crag groundwater under the site. The impact on the medium value Crag aquifer would be low, and the effect on the flow regime of the Crag aquifer is classified as minor adverse. The effect would be **not significant**.

12.6.40 The localised changes to groundwater recharge could impact on the abstraction borehole at Hacheston (60m east of the site) due to its close proximity to the site. With the implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter, the impact on the medium value abstraction with respect to groundwater level and flow would be very low, and the effect therefore classified as minor adverse. The effect would be **not significant**.

12.6.41 The other groundwater abstractions identified within the study area are located over 500m from the site and are assumed to be either within the Crag aquifer, or the sand and gravel of the Lowestoft Formation. Due to their distance from the site, and with the implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter, it is unlikely they would be affected by any local changes to the hydrogeological environment. It is concluded that there would be no effect on the abstractions with respect to water level and flow.

12.6.42 Whilst there are no known PWS in the study area, the superficial and bedrock aquifers are anticipated to experience very little impact from the proposed development. The impact on any medium value PWS would be very low and the effect would be classified as minor adverse. The effect would be **not significant**.

ii. Contamination of groundwater

12.6.43 As presented in **Chapter 11** 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 12.5** of this chapter and in **Chapter 11** of this volume, would reduce this risk.

12.6.44 During operation the main risks from contamination are fuel spills or leaks within the car parks. It is not anticipated that substantial spills or leaks will occur from vehicles used for commuting purposes. The presence of bypass separators within the drainage design would prevent the supply of sediment and other contamination to the drainage network. The provision of swales and infiltration ponds for areas of impermeable surface cover would protect the underlying groundwater from hydrocarbon contamination.

12.6.45 As presented in **Chapter 11** of this volume and its appendices, there is the potential for contamination sources, and the existing contamination on the site, compared to the existing baseline, the level of risk to receptors remains the same or decreased.

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

12.6.47 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial, and bedrock aquifers from the migration of contaminants through preferential pathways created by the operational activities is slightly decreased during the operation phase, and the effect is classified as minor beneficial. The effects would be **not significant**.

12.6.48 The seasonal groundwater abstraction borehole at Hacheston is located 60m east of the site boundary, and assumed to abstract from either the Crag aquifer, or the sand and gravel of the Lowestoft Formation. Due to its close proximity to the site, it is considered that there is the potential for contamination from the site activities to migrate to the abstraction, through leaching through the soil or via the creation of preferential pathways. With the implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter, it is anticipated that the risk to the abstraction is the same as for the aquifer from which it abstracts groundwater. This is a decrease from the existing baseline during the operation activities, and the effect is classified as minor beneficial. The effect would be **not significant**.

12.6.49 There are no known PWS in the study area. With the implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter, the impact on any PWS with respect to water quality would be very low, and the effect would be the same as for the groundwater from which

they would abstract, and therefore classified as minor beneficial. The effect would be **not significant**.

12.6.50 It is considered that there is no pathway for contaminative sources from the operational activities to impact groundwater receptors beyond the inner study area of 500m. Groundwater receptors identified in the baseline environment **section 12.4** 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.

iii. Alteration of the surface water flow regime

12.6.51 Any changes to the flow regime have the potential to increase existing pressures and adversely affect the hydromorphology and biology of the Rivers Deben and Ore, which are medium sensitivity receptors.

12.6.52 An increase in the extent of hardened surfaces will lower the infiltration rate and could increase surface run-off in receiving watercourses. As detailed in **section 12.5** of this chapter the proposed development will have areas of impermeable surfaces, an operational drainage system is embedded in the design, with on-site surface water run-off being infiltrated or discharged at Greenfield run-off rates. No effect is predicted for the Rivers Deben and Ore.

iv. Contamination of surface waters

12.6.53 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 Rivers Deben and Ore (and associated floodplain drains), and the existing pond, increasing existing pressures on these watercourses.

12.6.54 Any change in water quality would have the potential to adversely affect the existing surface water abstraction from floodplain drains on the Deben floodplain.

12.6.55 Water draining from the car parking areas will pass through bypass separators before discharging to the swales. Implementation of appropriate pollution incident control will further reduce the risks of chemical spills or leaks run-off, and prevent water contamination of the surface drainage network and existing pond.

12.6.56 As detailed in **Appendices 11B** and **11C** of this volume, on the basis implementation of the primary and tertiary mitigation measures detailed in **section 12.5** of this chapter, the risk on surface waters would decrease, compared to the baseline risk. The effects from lateral migration and

discharge of contaminants on these surface water receptors are classified as minor beneficial and considered to be **not significant**.

12.6.57 Contamination of surface waters arising from operational activities also have the potential to affect the existing surface water abstractions. On the basis of the implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter, the effects from both impacts on the surface water abstraction is classified as minor beneficial and considered to be **not significant**. 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 **section 12.4** 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.

v. Discharge of foul sewage

12.6.58 Foul sewage from the operation of the proposed development would be treated by a package plant. The treated effluent would drain to ground through infiltration devices.

12.6.59 It is assumed that the treated foul sewage would be discharged to ground so as to not cause a measurable change in the integrity of the underlying aquifers, and that the discharge would be localised and of medium-term duration.

12.6.60 It is therefore considered that there will be no effect to groundwater and surface water from the discharge of foul sewage during the operation of the proposed development.

vi. Flood risk

12.6.61 The majority of the site is located in Flood Zone 1, meaning that there will be no loss in functional floodplain storage, or displacement of sea or river flood water as a result of the proposed development. The proposed development will not, therefore, increase flood risk to surrounding areas.

12.6.62 With the exception of the section encompassing the A12 slip road, the existing site is currently greenfield, with no impermeable surfaces and small localised areas of surface water flood risk. Therefore, the proposed development would substantially increase the impermeable area on the site. Without infiltration, this increase in impermeable area would increase the surface water run-off and the associated flood risk both on- and off-site.

12.6.63 The increase in impermeable area associated with the proposed development would require sustainable management of surface water run-off through the infiltration, and controlled discharge of flows to the

surrounding environment, most likely infiltration to ground. These mitigation measures would be designed to ensure that there are no adverse effects from the existing surface water flood risk identified on part of the site. Following the implementation of this mitigation, the proposed development is considered to be appropriate in terms of flood risk vulnerability under the NPPF and passes the Sequential Test guidance. The high risk areas of the site have been avoided in terms of vulnerable uses or integrated into the drainage system. The surface water flood risk is managed as part of the **Outline Drainage Strategy** in **Appendix 2A** of **Volume 2** of the **ES**, and therefore no effect is predicted.

12.6.64 Further information on flood risk at the site is provided in the **Southern Park and Ride FRA** (Doc Ref. 5.4) which has been submitted as part of this application for development consent.

vii. WFD compliance

12.6.65 The site is located within the Deben (Brandeston Bridge - Melton) and Ore WFD water body catchments and on the Waveney and East Suffolk Chalk and Crag groundwater body.

12.6.66 The WFD assessment demonstrates that proposed operational activities would not have direct or indirect effects on the Deben (Brandeston Bridge - Melton), Ore and Waveney and East Suffolk Chalk and Crag water bodies that would be sufficient to cause deterioration in the status of the water body or protected areas located within the water bodies.

12.6.67 Furthermore, the proposed operational activities would not counteract or otherwise affect the delivery of the mitigation or improvement measures that have been identified in the RBMP for these water bodies.

12.6.68 As the proposed operational activities will not lead to a change in the overall status of the water bodies; the proposed operational activities are deemed compliant with the WFD.

12.6.69 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.

viii. Inter-relationship effects

12.6.70 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.

12.6.71 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.

12.6.72 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.

12.6.73 The assessment of contamination on groundwater and surface water is considered inherently within the geology and land quality, provided in **Chapter 11** of this volume, assessment and no further combined effects are anticipated.

12.6.74 The assessment of terrestrial ecology is considered in **Chapter 7** of this volume.

d) Removal and reinstatement

i. Groundwater level and flow regime

12.6.75 The proposed development would be removed and the site reinstated to existing conditions as far as reasonably practical. 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 very low, and low value superficial aquifers and a minor adverse effect for the medium value Crag aquifer. These effects would be **not significant**.

12.6.76 It has been assumed that groundwater in the underlying aquifers would not be encountered during the removal and reinstatement phase, and therefore groundwater dewatering control measures would not be required during the removal and reinstatement of the proposed development. Therefore, there is no potential impact to groundwater levels, and no effect on existing buildings, from the proposed development with respect to subsidence risk.

ii. Contamination of groundwater

12.6.77 As presented in **Chapter 11** of this volume and its appendices, the removal and reinstatement of the proposed development could introduce new sources of contamination to the site and create additional potential pathways for the migration of potential contamination. Intrusive activities and removal of

SuDS infrastructure and 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 implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter and in **Chapter 11** of this volume, would reduce this risk.

12.6.78 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 Crag is overlain by sand and gravel of the Lowestoft Formation there is a potential pathway for contamination to reach the Crag groundwater.

12.6.79 If a spill or leak does occur, given the relatively low volumes of potentially contaminative material and the primary and tertiary mitigation measures employed, the scale of any spill or leak is likely to be small.

12.6.80 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers from the leaching/migration of contaminants through the soil is slightly increased during the removal and reinstatement phase, and the effect is classified as minor adverse. The effects would be **not significant**.

12.6.81 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers from the migration of contaminants, through preferential pathways created by the removal and reinstatement activities is increased during the removal and reinstatement phase, and the effect is classified as moderate adverse. The effects would be **significant**.

12.6.82 The seasonal groundwater abstraction borehole at Hacheston is located within 60m of the site boundary and assumed to abstract from either the Crag aquifer, or the sand and gravel of the Lowestoft Formation. Due to its close proximity to the site, it is considered that there is the potential for contamination from the site activities to migrate to the abstraction, through leaching through the soil or via the creation of preferential pathways. With the implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter, it is anticipated that the risk to the abstraction is as for the aquifer from which it abstracts groundwater. This is an increase from the existing baseline during the removal and reinstatement activities and the effect is classified as moderate adverse. The effect would be **significant**.

12.6.83 There are no known PWS in the study area, however there is the potential for as yet unidentified PWS to be within the study area. With the implementation of the primary and tertiary mitigation measures identified, the impact to potential PWS with respect to water quality beyond the site itself

would be the same as for the aquifer from which they abstract water, and therefore classified as moderate adverse. The effect would be **significant**.

12.6.84 It is considered that there is no pathway for contaminative sources from the removal and reinstatement activities to impact groundwater receptors beyond the inner study area of 500m. Groundwater receptors identified in the baseline environment **section 12.4** of this chapter which are situated outside of the inner study area are therefore not assessed for the effects from contaminative sources during the removal and reinstatement phase.

iii. Alteration of the surface water flow regime

12.6.85 Any changes to the flow regime have the potential to increase existing pressures and adversely affect the hydromorphology and biology of the Rivers Deben and Ore, which are medium sensitivity receptors.

12.6.86 Where removal and reinstatement activities increase 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 removal and reinstatement phase.

12.6.87 Removal and reinstatement phase water management is embedded in the design, with on-site surface water run-off being infiltrated, or discharged at Greenfield run-off rates. This will result in a very low magnitude effect. This effect is classified as minor adverse and considered to be **not significant** for the Rivers Deben and Ore.

iv. Contamination of surface waters

12.6.88 Contamination of surface waters arising from removal and reinstatement activities through the introduction of new sources/contaminants or the disturbance/mobilisation of existing sources of contamination have the potential to adversely affect the biology, and water quality of the Rivers Deben and Ore (and associated floodplain drains) and the existing pond, increasing existing pressures on these watercourses.

12.6.89 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 the introduction of contaminants during the removal and reinstatement phase.

12.6.90 The site would be isolated from the wider environment until the demolition works have ceased. Implementation of appropriate pollution incident control in accordance with the **CoCP** (Doc Ref. 8.11) would further minimise the impacts of site construction activities on the surface drainage network.

12.6.91 As detailed in **Appendices 11B** and **11C** of this volume, the risk on the Rivers Deben and Ore (and associated floodplain drains), and the existing pond from both lateral migration of existing contamination and discharge of contaminates from removal and reinstatement activities is considered increase compared to the baseline risk. The effects from both impacts on these surface water receptors are classified as minor adverse and considered to be **not significant**.

12.6.92 Contamination of surface waters arising from removal and reinstatement activities also have the potential to affect the existing surface water abstraction (Bridge Farm, Hacheston) from floodplain drains on the River Deben floodplain. Based on the protection afforded by primary and tertiary mitigation measures, the effects from both impacts on the surface water abstraction is classified as minor adverse and considered to be **not significant**.

12.6.93 It is considered that there is no pathway for contaminative sources from the removal and reinstatement activities to impact surface water receptors beyond the inner study area of 500m. Surface water receptors identified in the baseline environment **section 12.4** of this chapter which are situated outside of the inner study area are, therefore, not assessed for the effects from contaminative sources during the removal and reinstatement phase.

v. Flood risk

12.6.94 As the site is located in Flood Zone 1, removal and reinstatement activities will not lead to a loss in functional floodplain storage or displacement of sea or river flood water.

12.6.95 Once the operation of the proposed development has ceased, the site would be returned to its original agricultural use. This would include the removal of any related drainage and SuDS measures, which would have no adverse impact on flood risk to the site or the surface water flood risk, as such **no effect** is predicted.

12.6.96 Further information on flood risk at the site is provided in the **Southern Park and Ride FRA** (Doc Ref. 5.4) which has been submitted as part of this application for development consent.

vi. WFD compliance

12.6.97 The site is located in within the Deben (Brandeston Bridge - Melton) and Ore WFD water body catchments and on the Waveney and East Suffolk Chalk and Crag groundwater body.

12.6.98 The WFD assessment demonstrates that proposed removal and reinstatement activities would not have direct or indirect effects on the Deben

(Brandeston Bridge - Melton) and Ore, Waveney and East Suffolk Chalk and Crag water bodies that would be sufficient to cause deterioration in the status of the water body or protected areas located within the water bodies.

12.6.99 As the proposed removal and reinstatement activities will not lead to a change in the overall status of the water bodies; the proposed removal and reinstatement activities are deemed compliant with the WFD.

12.6.100 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.

vii. Inter-relationship effects

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

12.6.102 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 removal and reinstatement of the proposed development.

12.6.103 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.

12.6.104 The assessment of contamination of groundwater and surface water is considered inherently within the geology and land quality, provided in **Chapter 11** of this volume, assessment and no further combined effects are anticipated.

12.6.105 The assessment of terrestrial ecology is considered in **Chapter 7** of this volume.

12.7 Mitigation and monitoring

a) Introduction

12.7.1 Primary and tertiary mitigation measures which have already been accounted for as part of the assessment are summarised in **section 12.5** of this chapter. Where further mitigation is required to this is referred to as secondary

mitigation and where reasonably practicable, secondary mitigation measures have been proposed.

12.7.2 This section describes the proposed secondary mitigation measures for groundwater and surface water as well as describes any monitoring required of specific receptors/resources or for the effectiveness of a mitigation measure.

b) Mitigation

12.7.3 A ground investigation would be undertaken to inform the detailed design of the proposed development, and confirm ground conditions, contamination status and other ground related risks. This would be completed prior to detailed design and commencement of construction works. Where the ground investigation and subsequent generic risk assessments identify unacceptable levels of contamination and ground related risks, further detailed quantitative risk assessment followed by, where necessary, remediation of soil and groundwater contamination prior to construction may be required.

12.7.4 Intrusive ground investigation would also be undertaken post operation of the proposed development as part of the removal and reinstatement phase. This ground investigation would confirm the ground conditions, contamination status and other ground related risks at the site following the operational phase. Remediation of soil or ground contamination would be undertaken if deemed necessary to ensure that the site was suitable for use as agricultural land.

12.7.5 Active management and maintenance of the drainage infrastructure would be required to ensure the continued efficacy of the SuDS.

12.7.6 A flood risk emergency plan 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.

c) Monitoring

12.7.7 A programme of short-term gas, groundwater and surface water monitoring would be designed as part of the ground investigation which will take place prior to the detailed design, and would be required prior to construction works commencing. The results of this would determine the need for whether further long-term gas and groundwater monitoring is required.

12.8 Residual effects

12.8.1 **Tables 12.7**, **12.8**, and **12.9** 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 mitigation proposed and the resulting residual effect.

Table 12.7: Summary of effects for the construction phase.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of effects	Additional Mitigation	Residual Effects
Crag groundwater (principal aquifer).	Reduction in the rate/volume of water discharging to ground.	Temporary SuDS and WMZ. Ensuring all site activities are carried out in accordance with the **CoCP** (Doc Ref. 8.11).	Minor adverse.	Not required.	Minor adverse **(not significant)**.
	Lowering of groundwater levels.		No effect.	Not required.	No effect.
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary. Longer term gas and groundwater monitoring if necessary.	Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Moderate adverse.		Minor beneficial **(not significant)**.
Lowestoft Formation sands and gravels groundwater (secondary A aquifer).	Reduction in the rate/volume of water discharging to ground.		Negligible.	Not required.	Negligible **(not significant)**.
	Lowering of groundwater levels.		Minor adverse.	Not required.	Minor adverse **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of effects	Additional Mitigation	Residual Effects
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary. Longer term gas and groundwater monitoring if necessary.	Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Moderate adverse.		Minor beneficial **(not significant)**.
Lowestoft Formation (diamicton) groundwater (secondary aquifer (undifferentiated))	Reduction in the rate/volume of water discharging to ground.		Negligible.	Not required.	Negligible **(not significant)**.
	Lowering of groundwater levels.		Negligible.	Not required.	Negligible **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary. Longer term gas and groundwater	Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Major adverse.		Minor beneficial **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of effects	Additional Mitigation	Residual Effects
				monitoring if necessary.	
Groundwater abstraction within 100m of the site boundary.	Reduction in groundwater availability to the abstraction.		Minor adverse.	Not required.	Minor adverse **(not significant)**.
	Contamination mobilised during construction migrating to the abstraction.		Moderate adverse.	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary. Longer term gas and groundwater monitoring if necessary.	Minor beneficial **(not significant)**.
Groundwater abstraction between 100m to 1km of the site boundary.	Reduction in groundwater availability to the abstraction.		No effect.	Not required.	No effect **(not significant)**.
Potential PWS.	Reduction in groundwater availability to the PWS.		Minor adverse.	Not required.	Minor adverse **(not significant)**.
	Contamination mobilised during construction migrating to the PWS.		Moderate adverse.	Ground investigation and relevant risk assessments completed prior to detailed design and construction works.	Minor beneficial **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of effects	Additional Mitigation	Residual Effects
				Remediation of soil and groundwater if necessary. Longer term gas and groundwater monitoring if necessary.	
Existing buildings.	Groundwater control measures attributing to subsidence risk.		No effect.	Not required.	No effect **(not significant)**.
River Deben (Main River).	Contamination of the watercourse.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground. Adoption of pollution prevention measures.	Minor adverse.	Ground investigation and risk assessment. Remediation of soil and surface water receptor if necessary.	Minor adverse **(not significant)**.
	Alteration of the flow regime.	Construction phase water management is embedded in the design.	Minor adverse.	Not required.	Minor adverse **(not significant)**.
River Ore (Main River).	Contamination of the watercourse.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground. Adoption of pollution prevention measures.	Minor adverse.	Ground investigation and risk assessment. Remediation of soil and surface water receptor if necessary.	Minor adverse **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of effects	Additional Mitigation	Residual Effects
	Alteration of the flow regime.	Construction phase water management is embedded in the design.	Minor adverse.	Not required.	Minor adverse **(not significant)**.
Surface water abstraction.	Contamination of the source.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground. Adoption of pollution prevention measures.	Minor adverse.	Ground investigation and risk assessment. Remediation of soil and surface water receptor if necessary.	Minor adverse **(not significant)**.
Existing pond within the site.	Contamination of the pond.		Minor adverse.		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 12.8: Summary of effects for the operational phase.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of effects	Additional Mitigation	Residual Effects
Crag groundwater (principal aquifer).	Reduction in the rate/volume of water discharging to ground.	Water draining from the car parking areas will pass through appropriate drainage, including the incorporation of SuDS, and bypass separator where necessary. This will allow infiltration to the superficial	Minor adverse.	Management and maintenance of the SuDS. Management and maintenance of the septic tank or package plant. Longer term gas and groundwater monitoring if necessary.	Minor adverse **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of effects	Additional Mitigation	Residual Effects
	Contamination of the groundwater from foul sewage.	aquifer, whilst also protecting the underlying groundwater from hydrocarbon contamination. Septic tank or package plant to treat sewage prior to discharge into ground.	No effect.		No effect **(not significant)**.
Lowestoft Formation sands and gravels groundwater (secondary A aquifer).	Reduction in the rate/volume of water discharging to ground.		Minor adverse.		Minor adverse **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.
	Contamination of the groundwater from foul sewage.		No effect.		No effect **(not significant)**.
Lowestoft Formation (diamicton) groundwater (secondary aquifer (undifferentiated)).	Reduction in the rate/volume of water discharging to ground.		Negligible		Negligible **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.
	Contamination of the groundwater		No effect.		No effect **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of effects	Additional Mitigation	Residual Effects
	from foul sewage.				
Groundwater abstraction within 100m of the site boundary.	Reduction in groundwater availability to the abstraction.		Minor adverse.		Minor adverse **(not significant)**.
	Contamination mobilised during operation migrating to the abstraction.		Minor beneficial.		Minor beneficial **(not significant)**.
Groundwater abstraction between 100m to 1km of the site boundary.	Reduction in groundwater availability to the abstraction.		No effect.		No effect **(not significant)**.
Potential PWS.	Reduction in groundwater availability to the PWS.		Minor adverse.		Minor adverse **(not significant)**.
	Contamination mobilised during operation migrating to the PWS.		Minor beneficial.		Minor beneficial **(not significant)**.
River Deben (Main River).	Alteration of the flow regime.	Infiltration ponds and swales will be incorporated into the design.	No effect.	Management and maintenance of the SuDS.	No effect **(not significant)**.
	Chemical spills or leaks.	Water draining from the site will pass through bypass separator where necessary and will predominantly discharge to ground.	Minor beneficial.	Remediation of soil and surface water receptor if necessary.	Minor beneficial **(not significant)**.
River Ore (Main River).	Alteration of the flow regime.	Ponds and swales will be incorporated	No effect.	Management and	No effect **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of effects	Additional Mitigation	Residual Effects
		into the design.		maintenance of the SuDS.	
	Chemical spills or leaks.	Water draining from the site will pass through bypass separators where necessary and will predominantly discharge to ground.	Minor beneficial.	Remediation of soil and surface water receptor if necessary.	Minor beneficial **(not significant)**.
Surface water abstraction.	Contamination of the source.	Water draining from the site will pass through bypass separators where necessary and will predominantly discharge to ground.	Minor beneficial.		Minor beneficial **(not significant)**.
Existing pond within the site.	Chemical spills or leaks.	Water draining from the site will pass through bypass separator where necessary.	Minor beneficial.		Minor beneficial **(not significant)**.
Flood risk to surrounding areas.	Loss of functional floodplain storage or displacement of sea or river water.	Ponds and swales will be incorporated into the design.	No effect.	Not required.	No effect **(not significant)**.

Table 12.9: Summary of effects for the removal and reinstatement phase.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Crag groundwater (principal aquifer).	Migration of existing contamination to groundwater.	Appropriate drainage design. Remediation of on-site contamination required. Ensuring all site activities are carried out in accordance with the **CoCP** (Doc Ref. 8.11).	Minor beneficial.	Not required.	Minor adverse **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.	Further ground investigation and risk assessment post operation to confirm the risks at the time of removal and reinstatement and identify areas requiring further remediation. Remediation of soil and groundwater due to incident occurring during the operational phase if necessary.	Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Moderate adverse.		Minor beneficial **(not significant)**.
Lowestoft Formation sands and gravels groundwater (secondary A aquifer).	Reduction in the rate/volume of water discharging to ground.		Negligible	Not required.	Negligible **(not significant)**.
	Lowering of groundwater levels.		Minor adverse.	Not required.	Minor adverse **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.	Further ground investigation and risk assessment	Minor beneficial **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
	Migration of contamination through preferential pathways to groundwater.		Moderate adverse.	post operation to confirm the risks at the time of removal and reinstatement and identify areas requiring further remediation. Remediation of soil and groundwater due to incident occurring during the operational phase if necessary.	Minor beneficial **(not significant)**.
Lowestoft Formation (diamicton) groundwater (secondary aquifer (undifferentiated)).	Reduction in the rate/volume of water discharging to ground.		Negligible	Not required.	Negligible **(not significant)**.
	Lowering of groundwater levels.		Negligible	Not required.	Negligible **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.	Further ground investigation and risk assessment post operation to confirm the risks at the time of removal and reinstatement and identify areas requiring further remediation.	Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Moderate adverse.		Minor beneficial **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
				Remediation of soil and groundwater due to incident occurring during the operational phase if necessary.	
Groundwater abstraction within 100m of the site boundary.	Reduction in groundwater availability to the abstraction.		Minor adverse.	Not required.	Minor adverse **(not significant)**.
	Contamination mobilised during construction migrating to the abstraction.		Moderate adverse.	Further ground investigation and risk assessment post operation to confirm the risks at the time of removal and reinstatement and identify areas requiring further remediation. Remediation of soil and groundwater due to incident occurring during the operational phase if necessary.	Minor beneficial **(not significant)**.
Groundwater abstraction between 100m to 1km of the site boundary.	Reduction in groundwater availability to the abstraction.		No effect.	Not required.	No effect **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
Potential PWS.	Reduction in groundwater availability to the PWS.		Minor adverse.	Not required.	Minor adverse **(not significant)**.
	Contamination mobilised during construction migrating to the PWS.		Moderate adverse.	Further ground investigation and risk assessment post operation to confirm the risks at the time of removal and reinstatement and identify areas requiring further remediation. Remediation of soil and groundwater due to incident occurring during the operational phase if necessary.	Minor beneficial. **(not significant)**.
River Deben (Main River).	Contamination of the watercourse.	Control measures adopted during the decommissioning phase of the site would be as described for the construction phase. Implementation of appropriate pollution incident control. Spill kits would be available on-site at all times. Sand	Minor adverse.	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Minor adverse **(not significant)**.
	Alteration of the flow regime.		Minor adverse.	Not required.	Minor adverse **(not significant)**.

Receptor	Impact	Primary Or Tertiary Mitigation	Assessment Of Effects	Additional Mitigation	Residual Effects
River Ore (Main River).	Contamination of the watercourse.	bags or stop logs would also be available for deployment on the outlets from the site drainage system in case of emergency spillages.	Minor adverse.	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Minor adverse **(not significant)**.
	Alteration of the flow regime.		Minor adverse.	Not required.	Minor adverse **(not significant)**.
Surface water abstraction.	Contamination of the source.		Minor adverse.	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Minor adverse **(not significant)**.
Existing pond within the site.	Contamination of the pond.		Minor adverse.		Minor adverse **(not significant)**.
Flood risk to surrounding areas.	Loss of functional floodplain storage or displacement of sea or river water.	Ponds and swales will be incorporated into the design.	No effect.	Not required.	No effect **(not significant)**.

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