LAND AT DEAL GROUND AND MAY GURNEY

Environmental Statement Addendum – Chapter 12: Hydrology, Hydrogeology, Flood Risk and Surface Water Drainage

Serruys Property Company Limited

Version No: Final
June 2023

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12 HYDROLOGY, HYDROGEOLOGY, FLOOD RISK AND SURFACE WATER DRAINAGE

12.1 INTRODUCTION

In the time that has elapsed since preparation of Chapter 7 of the original (2010) Environmental Statement, new legislation, policy and guidance has been published. In addition, revised and updated data describing baseline conditions is now available.

12.1.1 Purpose and Structure of the Chapter

Within the context of the changes highlighted above, the purpose of this chapter is to revisit Chapter 7 and summarise changes in baseline conditions, identify any additional likely significant effects and consider the mitigation required.

This chapter summarises the policy, legislation and guidance that post-dates the 2010 Environmental Statement, the assessment methodology, changes in baseline conditions, likely effects associated with construction and whether there may be any additional operational phase or cumulative effects. It also considers the mitigation measures required to prevent, reduce or offset effects and the nature of any residual effects.

12.2 METHODOLOGY

12.2.1 Changes in Legislation, Guidance and Planning Policy

The planning policy context is summarised in Chapter 7 of the ES addendum. The policy, legislation and guidance that post-dates the 2010 ES and that is relevant to the assessment of the potential effects of the Proposed Development on hydrology, hydrogeology, flood risk and surface water drainage is summarised below.

12.2.1.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF), as revised 20th July 2021, sets out national planning policy with regards to development and flood risk. The accompanying Planning Practice Guidance (PPG) 'Flood Risk and Coastal Change' (discussed below) provides local planning authorities with guidance on implementation of the planning policy as set out in the NPPF.

The NPPF (Paragraphs 161-163) advocates use of the risk-based, sequential approach (which recognises that risk is a function of probability and consequence), in which new development is preferentially steered towards areas at the lowest probability of flooding. It also requires that new development should be planned to avoid increased vulnerability to the range of impacts arising from climate change.

In respect of flood risk, paragraph 159 states that: "*Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere*".

Paragraph 162 requires that the "*sequential approach is applied to steer new development to areas with the lowest risk of flooding.*" However, Paragraph 166 confirms that the "*sequential test does not need to be undertaken for planning applications that come forward on sites allocated in the development plan through the sequential test*."

12.2.1.2 National Planning Practice Guidance

The PPG (Ministry of Housing, Communities and Local Government, 25th August 2022) defines the Flood Zones that provide the basis for application of the Sequential Test. The Flood Zones are defined as follows (PPG Table 1 Paragraph: 078 Reference ID: 7-078-20220825):

- Flood Zone 1: Low probability of flooding - less than 0.1% (1 in 1,000) annual probability of river or sea flooding in any year;
- Flood Zone 2: Medium probability of flooding - between 1% and 0.1% (1 in 100 and 1 in 1000) annual probability of river flooding and between 0.5% and 0.1% (1 in 200 and 1 in 1000) annual probability of sea flooding in any year;
- Flood Zone 3a: High probability of flooding - 1% (1 in 100) or greater annual probability of river flooding or 0.5% (1 in 200) or greater annual probability of sea flooding in any year; and
- Flood Zone 3b: The functional floodplain - where water from rivers or the sea has to flow or be stored in times of flood. The functional floodplain will normally comprise land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

It should be noted that Flood Zones 1, 2 and 3a definitions ignore the presence of flood defences.

The 'Flood Risk and Coastal Change' PPG advocates the use of sustainable drainage systems (SuDS) to reduce the overall level of flood risk. SuDS can reduce the causes and impacts of flooding, remove pollutants from urban run-off at source and combine water management with green space providing benefits for amenity, recreation and wildlife.

The NPPF (Paragraphs 153 and 154) and the 'Flood Risk and Coastal Change' PPG require that the spatial planning process should consider the possible impacts of climate change and contingency allowances are provided to enable impacts to be considered over the lifetime of the development.

12.2.1.3 Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 ('WFD Regulations 2017') consolidate, revoke and replace the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, which transpose the European Union (EU) Water Framework Directive (WFD) into national law. The WFD is a wide-ranging piece of European legislation that establishes a new legal framework for the protection, improvement and sustainable use of surface waters, coastal waters and groundwater across Europe in order to:

- Promote sustainable water use;
- Contribute to the mitigation of floods and droughts;
- Prevent deterioration and enhance status of aquatic ecosystems, including groundwater; and
- Reduce pollution.

Water management has historically been co-ordinated according to administrative or political boundaries. The WFD promotes a new approach based upon management by river basin - the natural geographical and hydrological unit. River basin management plans, published by the Environment Agency (EA) and the Department for Environment Food & Rural Affairs (Defra), include clear objectives in respect of water quality and pollution control and a detailed account of how objectives are to be met within a prescribed timeframe.

12.2.1.4 Environmental Permitting (England and Wales) Regulations 2016

The Environmental Permitting Regulations 2016 consolidate and replace the 2010 Regulations and the 15 associated amendments. The permitting regime covers a range of activities that release emissions to land, air or water or that involve waste. The regime covers facilities previously regulated under the Pollution Prevention and Control Regulations 2000 and Waste Management Licensing and exemptions schemes, some parts of the WRA 1991 and the Groundwater Regulations 2009. Schedule 21 relates to water discharge activities and Schedule 25 relates to flood risk activities. Schedule 22 to the Regulations relates to Groundwater activities and the regulations place a duty on regulating authorities to implement the Water Framework Directive and the Groundwater Daughter Drainage Directive and exercise their relevant function to ensure all necessary measures are taken to:
(a) prevent the input of any hazardous substance to groundwater; and
(b) limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater" (Paragraph 6, Schedule 22).

12.2.1.5 Flood and Water Management Act 2010 & Sustainable Drainage Systems: Ministerial Written Statement – HCWS161

The Flood and Water Management Act (FWMA) 2010 takes forward some of the proposals set out in three previous strategy documents published by the UK Government: Future Water, Making Space for Water and the UK Government's response to the Sir Michael Pitt Review of the summer 2007 floods. In doing so, it gives the EA a strategic overview of flood risk and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

The FWMA 2010 (Schedule 3) proposed the establishment of Sustainable drainage systems (SuDS) Approval Bodies (the SAB) at county or unitary local authority levels. The role of the SAB was envisaged as implementing the recommendations of the Pitt Review (2008) in promoting the use of SuDS within future development.

Following a period of consultation, the proposed role of the SAB has been amended, with the promotion of SuDS being incorporated into the planning process. This has been achieved by designating LLFA's as statutory consultees with regards to 'local' sources of flood risk and surface water management. The Ministerial Written Statement HCWS161 details this change in policy, which came into effect in April 2015.

The FWMA 2010 also amends Section 106 of the Water Industry Act 1991 (WIA) in respect of the right of connection to a public sewer. As the role of the SAB has been removed following HCWS161, this process is now subsumed into the planning process under the purview of the LLFA.

12.2.1.6 Flood Risk Assessments: climate change allowances

This guidance was published by the EA in February 2016 (last updated in May 2022) and should be used as the basis for preparing FRAs. The guidance sets out the climate change allowances for peak river flow, peak rainfall intensity, sea level rise, offshore wind speeds and extreme wave height.

Allowances in respect of peak river flow vary according to River Basin District, flood zone and proposed land-use (and therefore the lifetime of the development). The Proposed Development lies within the Anglian River Basin District.

12.2.1.7 Non-statutory Technical Standards for Sustainable Drainage Systems

This document contains non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems serving housing, non-residential or mixed-use developments and was published by Defra in March 2015.

12.2.1.8 The SuDS Manual (C753)

The SuDS Manual (2015) expands upon the framework set out by the Government's Non-Statutory Technical Standards for SuDS and sets out the latest industry practice and guidance regarding the planning, design, construction, management and maintenance of SuDS.

12.2.1.9 Rainfall Runoff Management for Developments (Report SC030219/R, October 2013)

This document advises regulators, developers and local authorities on the requirements for storm water drainage design for new developments and sets out recommended methods for the sizing of storage measures for the control and treatment of storm water runoff.

12.2.1.10 Sewerage Sector Guidance

On the 1st April 2020, new sewerage adoption arrangements came into effect through the publication of the Sewerage Sector Guidance (SSG). The SSG is a suite of documents submitted by Water UK on behalf of the water industry for approval by Ofwat.

Sewers for Adoption, the old industry guidance on the design of sewers for adoption by the water industry, has been updated and replaced by the Design and Construction Guidance (DCG). The DCG contains updated information on pipes, manholes and pumping stations and, for the first time, includes information regarding sustainable drainage systems (SuDS). Those SuDS features included in the DCG can now be adopted by water companies under s104 of the Water Industry Act 1991, meaning they can be adopted through the same mechanism as pipes, manholes and pumping stations.

12.2.2 Scoping Opinion

In September 2022, the Applicant submitted an EIA Scoping Report to Norwich City Council, South Norfolk Council and the Broads Authority and requested a Scoping Opinion under Regulation 15 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

The Local Planning Authorities consulted various statutory and non-statutory bodies and published Scoping Opinions on 2 November 2022 (Broads Authority), 23 November 2022 (Norwich City Council) and 7 December 2022 (South Norfolk Council). Scoping Opinion responses are summarised in Table 12.1.

Table 12.1: Summary of Scoping Opinion Responses

Comment	Response
Broads Authority	
The Authority's comments related to landscape, heritage and ecology and biodiversity only. No comment was provided regarding hydrology, hydrogeology, flood risk and surface water drainage.	None required.
Norwich City Council	
The baseline environmental information relating to the site will have changed and legislation (including substantial revisions to the EIA Regulations), the policy framework and guidance has also been revised/updated since the initial Environmental Statement received 2012 and addendum reports received 2013 as part of outline application ref 12/00875/O. Therefore, "further information" is required to assess the significant effects of the development on the environment.	The updated baseline information is set out in the Flood Risk Assessment (Appendix 12.1) that supports this chapter.
Any more up to date flood modelling that is available should be used to gain an up-to-date account of the flood risk present at the site. In addition, there is understood to be updated flood incident data, hydrological and hydrometric data, Lidar data, an updated hydrological data set (including rainfall data), flood mapping from all source layers, an updated SFRA for the Greater Norwich Area, groundwater flood risk information, climate change evidence, publication of the SuDS Manual in 2015 and updates to the NPPF in relation to managing flood risk	The updated baseline information is set out in the Flood Risk Assessment (Appendix 12.1) that supports this chapter.
Account should be taken of the detailed Lead Local Flood Authority consultation response in full in relation to assessment of flood risk	The LLFA has been consulted and their requirements reflected in the Flood Risk Assessment (Appendix 12.1).
This proposal falls within the Impact Risk Zone of European Sites vulnerable to nutrient impacts. Please refer to Natural England's overarching advice sent to all relevant Local Planning Authorities dated 16th March 2022 which is relevant to decisions for reserved matters applications.	The current position regarding nutrient neutrality is set out in Section 12.7 of this chapter.
As the development will give rise to an increase in wastewater flows the need for a foul drainage strategy, including an up-to-date assessment of capacity within the local sewerage network is required. The announcement from Natural England regarding nutrient neutrality due to wastewater impacts on designated sites requires additional evidence needed to demonstrate that the	The current position regarding nutrient neutrality is set out in Section 12.7 of this chapter.

Comment	Response
development will be able to avoid adverse effects on the Wensum and Broads river catchments prior to any consent being granted. As previously mentioned a Habitats Regulations Assessment which has been informed by advice on nutrient neutrality should be included for proposals with the potential to affect water quality resulting in nutrient impacts on European Sites, to allow consultation with Natural England at the planning application stage	
Carrow Abbey Marsh CWS includes wetland and water dependant habitats which are potentially vulnerable to changes in local hydrology such as groundwater flow and mobilisation of site contaminants. Travel times through local aquifers should be considered and the potential for historical contaminants mobilised during construction, or operational phase wastewater or road run-off to reach and impact the nearby CWS should be considered as part of the ES. Therefore, the potential for impacts on the nearby CWS from changes in groundwater flows or from increased risks of groundwater contamination from the construction and operational phases of the development should be included in the ES.	The hydrogeology of the site is considered as part of this chapter.
The Council considers that a development of this size in combination with other existing and approved developments, has the potential to give rise to significant environmental impacts The Council therefore requires that the ESA considers cumulative impacts.	Cumulative effects are considered in Section 12.4.3 of this chapter.
Any off-site development that is required, such as the provision of new utilities or infrastructure, including bridge and underpass links should be taken into account in the ES.	The proposals are not reliant upon any off-site development.
South Norfolk Council	
Due to changes in the baseline information relating to this site and changes to the EIA Regulations and other relevant legislation since the initial ES, further information is required to the significant environmental effects of your proposal.	The updated baseline information is set out in the Flood Risk Assessment (Appendix 12.1) that supports this chapter.
Updated hydraulic modelling should be undertaken to understand current flood risk within the site and to inform an updated flood risk assessment and surface water drainage strategy to be included in this chapter. This should address all sources of flood risk including those from ordinary watercourses, surface water and	Updated hydraulic modelling has been undertaken and underpins the revised and updated Flood Risk Assessment enclosed in Appendix 12.1.

Comment	Response
groundwater to the development, how surface water drainage from the development will be managed on-site. Phasing of the development should also be addressed and indicate what arrangements, temporary or otherwise, would be in place at each stage of the development in order to ensure the satisfactory performance of the overall surface water drainage system for the entirety of the development.	
An updated FRA should also address wastewater flows from the proposed development which should include an assessment of capacity within the network. As previously mentioned, this site falls within the catchments impacted by nutrient neutrality and so your submission should demonstrate adequate mitigation to ensure that this development would not adversely affect these protected catchments.	The current position regarding nutrient neutrality is set out in Section 12.7 of this chapter.
An assessment should be made of the extant consents, current applications and proposed allocations. The majority of this site is within the administrative area of Norwich City Council and their EIA scoping opinion dated 23 November 2022 already identifies sites within their area which have the potential to generate cumulative impacts	Cumulative effects are considered in Section 12.4.3 of this chapter.

12.2.3 Additional Consultation

The Applicant consulted Norfolk County Council (as Lead Local Flood Authority) to discuss the emerging surface water drainage strategy 'concept' and agree the design principles and parameters to be adopted for the purposes of developing the strategy in further detail (i.e. as required to support reserved matters applications). Full details of the matters discussed and agreed and the nature/configuration of the proposed surface water drainage strategy are presented in the Flood Risk Assessment prepared by JBA Consulting and included as Appendix 12.1.

12.2.4 Assessment Methodology

The assessment in relation to the water environment is predominantly desk-based but also included a site walkover. The most up-to-date information available on publicly accessible websites and mapping has been used to determine the existing baseline conditions at the site and in the immediate vicinity. This has facilitated identification of the receptors which will need consideration when assessing the potential effects of the Proposed Development upon hydrology, hydrogeology, food risk and surface water drainage.

A walkover survey has been undertaken to facilitate an understanding of the baseline water environment and the general landform of the Proposed Development and surrounding area and to define the scope/specifications of technical assessments and surveys.

Table 12.2: Sources of Information

Source	Data
Ordnance Survey mapping at 1:50,000 and 1:25,000 scales:www.multimap.com	Topography: elevation, relief.
Cranfield University's National Soils Resources Institute Soilscapes website: http://www.landis.org.uk/soilscapes/	Soil type and land use.
Magic Map: https://magic.defra.gov.uk/magicmap.aspx Natural England website: https://designatedsites.naturalengland.org.uk/	Nature Conservation Sites: Special Areas of Conservation (SACs). Special Protection Areas (SPAs). Sites of Special Scientific Interest (SSSI).
The National River Flow Archive: www.nwl.ac.uk/ih/nrfa/index.htm	Climate: rainfall.
https://flood-map-for-planning.service.gov.uk/ https://flood-warning-information.service.gov.uk/long-term-flood-risk/ EA: http://environment.data.gov.uk/catchment-planning/ EA Norwich Hydraulic Model (CH2M, 2017) and the Broadland Environmental Services Limited model (BESL) (Jacobs, 2019) The National River Flow Archive: www.nwl.ac.uk/ih/nrfa/index.htm	Surface Water. Surface watercourses and flood risk. Water quality. River flows.
British Geological Survey GeoIndex: http://www.bgs.ac.uk/geoindex/	Solid and drift geology.
Data requested from the EA. https://data.gov.uk/dataset/f3684ee9-4c81-4ccd-a658-7f8d9dc70706/environment-agency-register-licence-abstracts https://data.gov.uk/dataset/55b8eaa8-60df-48a8-929a-060891b7a109/consented-discharges-to-controlled-waters-with-conditions http://www.environment-agency.gov.uk/maps/ EA Source Protection Zones and 2022 River Basin Management Plans (Groundwater): River basin management plans: updated 2022 - GOV.UK (www.gov.uk)	Groundwater levels. Groundwater vulnerability. Groundwater quality. Abstractions and discharges.
Norfolk Partnership laboratory – Desk Study and Risk Assessment, Deal Ground and Former May Gurney Site, Trowse, Norwich, Norfolk (April 2023) Norfolk Partnership laboratory – Site Investigation Including Quantitative Risk Assessment, The Deal Ground, Trowse, Norwich (August 2021) Plandescil Consulting Engineers – Contamination Report Desk Study (August 2010)	Ground conditions. Contamination/chemical analysis.

12.2.4.1 Assessment of Significance

The methodology for the assessment of potential impacts follows the generic EIA methodology guided by IEMA (2016) and current government guidance, and is based on the following principles:

- The type of effect (long-term, short-term, or intermittent; positive, negative or neutral);
- The probability of the effect occurring:
- Receptor sensitivity (see Table 12.3); and
- The magnitude (severity) of the effect (see Table 12.4).

The assessment methodology identifies the significance of an effect by firstly considering the sensitivity of the receptor (i.e. its importance and ability to tolerate and recover from change) and, secondly, by considering the likely magnitude of the impact (i.e. its spatial extent and duration). By combining sensitivity and magnitude, the significance of the effect is established. Where significant negative effects are identified, mitigation measures are proposed to reduce the significance.

The sensitivity of receptors has been assessed using the criteria set out in Table 12.3.

Table 12.3: Receptor Sensitivity

Sensitivity	Criteria	Examples
High	Feature with a high yield and / or quality and rarity at a national or international scale, with a limited potential for substitution. Attribute highly sensitive to change.	Conditions supporting sites with international conservation designations (SAC, SPA, Ramsar sites), where the designation is based specifically on aquatic features. Highly productive aquifers and surface water resources typically used for public water supplies. Public water supplies. Conditions supporting a SSSI. Sites with freshwater fish protected areas. Water quality of receptor water body: Supporting WFD element type (e.g. Priority Substances) classified as 'High', ''Good' or Pass'. NPPF PPG Flood Risk Vulnerability Classification "Essential Infrastructure" or "Highly Vulnerable".
Medium	Feature with a medium yield and/or quality at a regional scale, or good quality at a local scale, with some limited potential for substitution. Attribute tolerant of some degree of change.	Medium productivity aquifer and surface water resources typically used for smaller public water supplies or industrial water supplies. Industrial water supplies. Conditions supporting local nature conservation interest (e.g. National Nature Reserve [NNR]), where the interest features are water-dependent.

Sensitivity	Criteria	Examples
		Water quality of receptor water body: Supporting WFD element classified as at least 'Good' in all cases. NPPF PPG Flood Risk Vulnerability Classification "More Vulnerable".
Low	Feature with variable yield and/or quality at a local scale, with potential for substitution. Attribute tolerant of modest change.	Low productivity aquifer and surface water resources typically used for private water supplies or not utilised. Private water supplies; livestock supplies; springs; ponds/lagoons; non-statutory groundwater-dependent conservation sites. Water quality of receptor water body: Supporting WFD element type classified as less than 'Good' in any situation (any supporting element). NPPF PPG Flood Risk Vulnerability Classification "Less Vulnerable".
Negligible	Feature with poor yield and / or quality at a local scale, with good potential for substitution. Attribute tolerant of substantial change.	Unproductive strata. Water quality of receptor water body: Supporting WFD element type classified as 'Poor' or 'Bad', with severely restricted ecosystems and pollution. Small surface water bodies such as drainage ditches and ephemeral ponds that are too small to be classified under WFD and have limited ecological potential due to being artificial or heavily-modified. NPPF PPG Flood Risk Vulnerability Classification "Water Compatible".

The magnitude of change arising as a result of the Proposed Development has been assessed using the criteria set out in **Table 12.4**

Table 12.4: Magnitude of Change

Magnitude of Change	Criteria	Examples
Large	Results in a loss of feature/attribute and/or quality and integrity of the attribute.	Major reduction in groundwater levels, flow or quality, reducing use and water body status. Major reduction in groundwater levels or water quality leading to a marked deterioration in conditions that support Groundwater Dependent Terrestrial Ecosystems (GWDTE) features.

Magnitude of Change	Criteria	Examples
	Following development, the baseline situation is fundamentally changed.	Deterioration in river flow regime, morphology or water quality, leading to sustained, permanent or long-term breach of relevant SSSI conservation objectives (Cos), or downgrading of WFD status (deterioration in current thresholds as defined by current WFD status, including supporting WFD elements). Complete loss of resource or severely reduced resource availability to other water users. Change in flood risk resulting in potential loss of life or damage to nationally critical infrastructure.
Moderate	Results in impact on integrity of feature/attribute, or loss of part of feature/attribute. Following development, the baseline situation is noticeably changed.	Moderate reduction in groundwater levels, flow or quality, reducing use and water body status in some circumstances. Moderate reduction in groundwater levels or water quality leading to some deterioration in conditions that support GWDTE features. Deterioration in river flow regime, morphology or water quality, leading to periodic, short-term and reversible breaches of relevant SSSI conservation objectives, or downgrading of WFD status (deterioration in current thresholds as defined by current WFD status, including supporting WFD elements). Water quality status may impact upon potential future thresholds in relation to objective WFD status – potential for prevention of waterbody reaching its future WFD objectives. Minor reduction in resource availability for other water users. Change in flood risk resulting in potential for major damage to property and infrastructure.
Small	Results in minor impact on feature, of insufficient magnitude to affect its use/integrity in most circumstances. Following development, the baseline situation is largely unchanged with barely discernible differences.	Measurable reduction in groundwater levels, flow or quality, but with limited consequences in terms of use and water body status. Measurable reduction in groundwater levels or water quality, leading to a minimal change in conditions that support GWDTE features. Measurable deterioration in river flow regime, morphology or water quality, but remaining generally within SSSI Cos, and with no change of WFD status (of overall status or supporting element status) or compromise of Environmental Quality Standards (EQSs). No change in resource availability for other water users. Increase in flood hazard in areas with no flood risk receptors e.g. increased flooding of agricultural land.

Magnitude of Change	Criteria	Examples
		Change in flood risk resulting in potential for minor damage to property and infrastructure.
Negligible	Results in little or no impact on feature, with insufficient magnitude to affect its use / integrity. The impacts are unlikely to be detectable or outside the norms of natural variation.	No measurable reduction in groundwater levels or flow. Any change to water quality will be quickly reversed once activity ceases with no consequence in terms of use, water body status (of overall status or supporting element status) or compromise of Environmental Quality Standards (EQSs). No measurable reduction in groundwater levels or water quality, leading to no change in conditions that support GWDTE features. No measurable deterioration in river flow regime, morphology or water quality, and no consequences in terms of SSSI conservation objectives, WFD designations, water resources or flood risk. Change in flood risk causes more frequent inconvenience and triggering of emergency response measures, but does not result in increased risk of damage to property and infrastructure.

The significance of a potential effect is determined using the matrix presented at Table 12.5. The significance of an effect can be beneficial, neutral or adverse. For the purpose of undertaking the assessment in accordance with the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, effects determined to be moderate or greater are considered significant in EIA terms.

Those levels of effect which are shaded in **Table 12.5** equate to those considered significant under the EIA Regulations with the others constituting no effect or an insignificant effect.

Table 12.5: Determining Significance of Effect

Magnitude of change	Receptor sensitivity			
	High	Medium	Low	Negligible
Large	Substantial	Major	Moderate	Minor
Moderate	Major	Moderate	Minor	Negligible
Small	Moderate	Minor	Minor	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

12.2.5 Effects Not Requiring Further Assessment

There are no new or materially different effects to those previously assessed as part of the original Environmental Statement.

12.3 Changes In Baseline Conditions

12.3.1 ES Baseline

The ES prepared in 2010 in support of Outline applications 12/00875/O (Norwich City Council) and 2011/0152/O (South Norfolk Council) set out the flood risk baseline in terms of the floodplain extents associated with the River Yare and River Wensum, based upon hydraulic modelling analysis. This indicated that:

- A small area to the west of the Deal Ground lies within Flood Zone 1: Low probability of flooding (Land having a less than 0.1% (1 in 1000) annual probability of river flooding);
- the majority of the site was categorised as Flood Zone 2: Medium probability of flooding - between 1% and 0.1% (1 in 100 and 1 in 1000) annual probability of river flooding;
- approximately 60% of the Deal Ground area was categorised as Flood Zone 3a: High probability of flooding - 1% (1 in 100) or greater annual probability of river flooding;
- approximately 30% of the Deal Ground area was categorised as Flood Zone 3b: the functional floodplain - where water from rivers or the sea has to flow or be stored in times of flood;
- none of the May Gurney site was categorized as Flood Zone 3a: High probability of flooding.

Flood depths associated with the 1 in 100 year (1% annual probability) flood event were reported to be 0.5m-1.0m on Carrow Abbey Marshes, although generally c.0.2m in those areas proposed for development. The Flood Hazard (a function of the depth and velocity of flood water) was reported to be 'low'.

12.3.2 ES Future Baseline

The ES prepared in 2010 assessed the future flood risk baseline within the context of 20% higher flood flows arising as a result of climate change. Modelling of this scenario resulted in a design flood level of 2.04mAOD.

12.3.3 Current Baseline

The site of the Proposed Development comprises 19ha and is situated approximately 2km to the south-east of Norwich City Centre. The site consists of two parcels separated by the River Yare: Deal Ground to the north of the river and the former May Gurney site to the south.

Deal Ground is bound to the north by the River Wensum and to the east by the River Yare, with the confluence between the two watercourses located at the north-eastern corner of the site. The northern part of the site is characterised by areas of hardstanding, whilst the central, southern and eastern areas (forming Carrow Abbey Marsh County Wildlife Site (CWS)) comprise marshland. Ground levels are generally in the range of 0.5mAOD to 6.8mAOD.

The former May Gurney site is bound by the River Yare to the west and north and a secondary channel of the River Yare to the east. The site comprises permanent and temporary office buildings, an area of car-parking and scrubland in the eastern area where buildings have been demolished. Ground levels are generally in the range of 0.8mAOD to 3.4mAOD.

12.3.3.1 Tidal/Fluvial Flood Risk

The EA publishes online floodplain maps (https://flood-map-for-planning.service.gov.uk). These maps show the possible extent of fluvial flooding for a 1 in 100 year flood (1% probability of occurrence) and the possible extent of tidal flooding associated with a 1 in 200 year event (0.5% probability of occurrence), ignoring the presence of flood defences. Also shown is the possible extent of flooding arising from a 1 in 1,000 year event (0.1% probability).

The flood map indicates that the County Wildlife Site is located almost entirely within Flood Zone 3 (High Probability – land having a 1 in 100 or greater annual probability of fluvial flooding). However, that part of Deal Ground identified for development (i.e. outside the CWS) falls largely within Flood Zone 1 (Low Probability – land having a less than 1 in 1,000 annual probability of flooding) and Flood Zone 2 (Medium Probability – land having between a 1 in 100 and 1 in 1,000 annual probability of flooding). Limited areas within the northern area of Deal Ground adjacent to the River Wensum are located in Flood Zone 3.

The former May Gurney site is shown to be unaffected by Flood Zone 3 and comprises areas within Flood Zones 1 and 2.

Flood Zones defined based upon revised and updated hydraulic modelling analysis (Appendix 12.1) are generally comparable to those shown on the Flood Map for Planning.

12.3.3.2 Surface Water Flood Risk

The EA 'Flood Risk from Surface Water Map' (https://flood-warning-information.service.gov.uk/long-term-flood-risk) shows areas that may be susceptible to surface water flooding following an extreme rainfall event. The mapping shows that the vast majority of Deal Ground and the former May Gurney sites are at 'Very Low' risk of surface water flooding. The map identifies a very limited number of isolated and very localised areas at medium and low risk of surface water flooding.

12.3.3.3 Reservoir Flood Risk

The EA 'Flood Risk from Reservoirs Map' shows the area that may be affected by flooding as a result of a breach of a large, raised reservoir i.e. capable of storing over 25,000 cubic metres of water above the natural level of any part of the surrounding land.

According to EA records the nearest reservoir is located approximately 16km to the north-west of Deal Ground. The EA's map shows that, when river levels are normal, neither Deal Ground nor the former May Gurney site are affected by reservoir flooding. The mapping shows that under conditions when there is also flooding from rivers, the entirety of the former May Gurney site may be affected by reservoir flooding. Whilst much of the Deal Ground site is also affected by reservoir flooding when there is also flooding from rivers, a corridor along the western edge adjacent to the railway is shown to be unaffected.

12.3.3.4 Geology and Hydrogeology

BGS mapping indicates that both Deal Ground and the former May Gurney sites are characterised by superficial deposits comprising alluvium (unconsolidated clay, silt, sand and gravel) underlain by bedrock comprising chalk formations.

A ground investigation across the northern part of the site (in the vicinity of the River Wensum), undertaken by Norfolk Partnership Laboratory in August 2021, and comprising 19 window sample locations, confirmed the sequence of strata to comprise Made Ground, underlain by Alluvium and First River Terrace Gravels to depths exceeding 5m. Groundwater strikes were recorded at all locations and groundwater monitoring over a period of approximately one month recorded groundwater at depths of generally around 1m below ground level.

Previous site investigations, summarised in the Contamination Report Desk Study undertaken by Plandescil Consulting Engineers (August 2010) recorded chalk at depths of 7.25m-9.2m below ground level.

EA aquifer designation maps at https://magic.defra.gov.uk categorise the superficial deposits as a 'Secondary A' aquifer (i.e. permeable layers that may support local water supplies and may form an important source of base flow to rivers) and the bedrock deposits as a 'Principal' aquifer (i.e. areas comprised of rocks that may support water supply and/or river base flow on a strategic scale).

The site is located in groundwater Source Protection Zone 1 (Inner Protection Zone).

12.3.3.5 Land Quality - Soils

Several site investigations have been undertaken across the area during the period 1990 to 2009 and are described in the Contamination Report Desk Study undertaken by Plandescil Consulting Engineers (August 2010). These investigations recorded historical and potentially contaminative land uses comprising: timber yard/timber treatment, sawmill, printworks, bottle works, mineral extraction and infilling, railway sidings, transport depot and haulage, petrol filling station and below ground fuel tanks. The investigations identified soil contaminated with heavy metals, hydrocarbons, Volatile Organic Compounds, asbestos and Polychlorinated Biphenyls (PCBs). Groundwater monitoring/testing indicated no significant contamination.

The site investigation across the northern part of the site (undertaken by Norfolk Partnership Laboratory in August 2021) concluded that:

- *'A low to medium risk to controlled waters has been deemed appropriate for this site. This is due to the relatively low level of contamination found and the apparent zero impact on the quality of the adjacent River Wensum'*
- *'The testing undertaken during this investigation has indicated that the strata within the site poses a low risk to the human health issues of the end user' and*
- *'The site poses a low risk to buildings and services'*

12.3.3.6 Groundwater Flood Risk

Geological data suggests that groundwater emergence is possible within the lower areas of the site due to the high porosity deposits that underlie the Deal Ground and former May Gurney sites.

The Greater Norwich Level 2 Strategic Flood Risk Assessment (February 2021) refers to the Areas Susceptible to Groundwater Flooding dataset and notes that (i) the majority of the site has a >75% susceptibility to groundwater flood emergence from superficial deposits and (ii) the southern part of the site has a >50%-<75% susceptibility to groundwater flood emergence from superficial deposits.

12.3.3.7 Water Framework Directive

The Proposed Development falls within the area administered by the Anglian River Basin Management Plan. The relevant Management Catchment is the Broadland Rivers and the Operational Catchment is the Yare. According to the EA's Catchment Data Explorer (https://environment.data.gov.uk/catchment-planning), the Proposed Development lies within the Yare (Tiffey to Wensum) and the Wensum DS Norwich water bodies. Both water bodies are designated as 'heavily modified', which denotes that they have been substantially changed in character as a result of physical alterations by human activity. The water bodies cannot therefore achieve 'good ecological status' and the environmental (Water Framework Directive) objective for the water bodies is to achieve 'good ecological potential'. The overall water body classifications are currently 'Moderate' potential (Cycle 2, 2019).

12.3.4 Changes in Baseline

The ES prepared in 2010 in support of Outline applications 12/00875/O (Norwich City Council) and 2011/0152/O (South Norfolk Council) set out the flood risk baseline in terms of the floodplain extents associated with the River Yare and River Wensum, based upon hydraulic modelling analysis. The modelling analysis has since been updated and full details are set out in the FRA (Appendix 12.1) prepared in accordance with Condition 10 of the Outline planning permission.

The principal changes in respect of baseline conditions relating to tidal/fluvial flood risk may be summarised as follows:

- A greater proportion of the site is shown to be classified as Flood Zone 1 (low probability)
- A greater proportion of the site is shown to be classified as Flood Zone 3b (functional floodplain). This has arisen because Flood Zone 3b is now defined by the 30 year (3.3% annual probability) flood event as opposed to the 20 year (5% annual probability) flood event that applied at the time of the original planning application.

12.3.5 Receptors

Based upon review and characterisation of baseline conditions, the principal receptors that may be affected by the Proposed Development have been identified. Their sensitivity (defined based upon a combination of the methodology outlined in Section 12.2.4 above and professional judgement) is summarised in Table 12.6 below:

Table 12.6: Receptor Sensitivity

Receptor	Rationale	Sensitivity
Surface Water		
River Yare and River Wensum	The watercourses are both categorised as Main River under the jurisdiction of the EA. The River Wensum is a chalk-fed river and is designated as a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC). In its lower reaches, the River Yare forms part of the Broads National Park. Based upon the criteria set out in Table 12.3, the watercourses are categorised as high sensitivity.	High
Carrow Abbey Marsh County Wildlife Site	Fen habitat comprising swamp communities and nationally scarce Green Figwort species. Based upon the criteria set out in Table 12.3, the CWS is categorised as high sensitivity.	High
Whitlingham and Whitlingham Marsh Local Nature Reserves	Reserves comprising a diverse mosaic of habitats providing connectivity with other designated sites along the River Yare. Based upon the criteria set out in Table 12.3, the LNRs are categorised as medium sensitivity.	Medium
River Wensum Special Area of Conservation	Designation relates to abundance of water crowfoot species, white-clawed crayfish, Desmoulin's whorl snail, brook lamprey and bullhead fish. Based upon the criteria set out in Table 12.3, the SAC is categorised as high sensitivity.	High
Broads Special Area of Conservation and Ramsar site	The Broads contain several examples of naturally nutrient-rich lakes and the lakes and the ditches in areas of fen and drained marshlands support	High

	relict vegetation of the original Fenland flora, and collectively this site contains one of the richest assemblages of rare and local aquatic species in the UK, including Stoneworts. Based upon the criteria set out in Table 12.3, the SAC is categorised as high sensitivity.	
The 'Yare (Tiffey to Wensum) Water Body'	The Water Body is designated as a 'heavily modified' water body and the classification is currently 'Moderate'. Based upon the criteria set out in Table 12.3, the water body is categorised as medium sensitivity.	Medium
The 'Wensum DS Norwich Water Body'	The Water Body is designated as a 'heavily modified' water body and the classification is currently 'Moderate'. Based upon the criteria set out in Table 12.3, the water body is categorised as medium sensitivity.	Medium
Existing development/ infrastructure/ third party assets/land in the vicinity and downstream of the proposed development	Land use in the vicinity of the site is generally categorised as 'Less Vulnerable' and 'More Vulnerable' (in accordance with the NPPF PPG Flood Risk Vulnerability Classification). Based upon the criteria set out in Table 12.3, 'Less Vulnerable' uses are considered to be of low sensitivity and 'More Vulnerable' uses are considered to be of medium sensitivity.	Medium
Groundwater		
Superficial deposits	'Secondary A' aquifer. Based upon the criteria set out in Table 12.3, the aquifer is categorised as medium sensitivity.	Medium
Bedrock deposits	'Principal' aquifer. Based upon the criteria set out in Table	High

	12.3, the aquifer is categorised as high sensitivity.	

12.3.6 Embedded Mitigation

The design philosophy that underpins the Proposed Development includes measures to prevent, reduce and offset significant adverse effects upon hydrology, hydrogeology, flood risk and drainage. Being 'built-in' to the proposals from the outset, the assessment of the significance of effects includes consideration of these embedded mitigation measures.

Condition 43 of Outline planning permission 12/00875/O (Norwich City Council) and Condition 35 of Outline planning permission 2011/0152/O (South Norfolk Council) require that a Construction and Environmental Management Plan (CEMP) is submitted to and approved by the Local Planning Authority prior to any development works commencing. Mitigation measures in respect of impacts on hydrology, hydrogeology, flood risk and drainage during the construction phase will be secured through implementation of the measures set out in this document. Details of the mitigation are outlined below:

Construction Phase (CEMP)

- A management system would be in place to adequately manage works within the floodplain;
- Best practice working methods to prevent both water pollution and adverse impacts upon the surface water drainage regime;
- Appropriate storage of hydrocarbons and petrochemicals in accordance with Control of Substances Hazardous to Health (COSHH) Regulations 2002 and Control of Pollution (Oil Storage) (England) Regulations 2001;
- Any surface water potentially contaminated by hydrocarbons would be passed through oil interceptors prior to discharge;
- Precautions would be in place to prevent silt laden run-off, arisings or chemicals entering watercourses.

Operational Phase

- Surface Water Management infrastructure would be designed in accordance with CIRIA C753 and guidance set out by the LLFA, such that the surface water run-off regime replicates that existing prior to development;
- Implementation of SuDS (i.e. swales and permeable paving);
- Ground raised above the design flood level and the provision of floodplain storage compensation, so that the storage available within the floodplain is unchanged post-development;
- Elevated floor levels and flood resilient construction measures. Building floor levels will be set at an appropriate freeboard above the design flood level (as per parameters set out in the FRA supporting the ESA).

12.4 Assessment of Effects

The ES prepared in 2010 in support of Outline applications 12/00875/O (Norwich City Council) and 2011/0152/O (South Norfolk Council) considered effects relating to fluvial flooding/the extent of the floodplain associated with the River Yare and River Wensum and surface water run-off. This section expands upon the 2010 assessment and considers the following potential effects:

- Potential effects upon flood storage and flood flows/flood routing processes;
- Potential effects upon drainage patterns and surface water flows;
- Potential effects upon aquifer recharge;
- Potential pollution of watercourses and underlying aquifers;

This section describes the findings of the assessment of likely significant effects associated with the Proposed Development, prior to the implementation of any mitigation measures additional to those incorporated into the design (Paragraph 12.3.6). As set out in paragraph 12.3.6, the assessment of the significance of effects includes consideration of 'mitigation by design'/embedded mitigation measures. Effects for the construction and operational phases are considered separately.

12.4.1 Construction Phase Effects

Flood Storage, Flood Flows and Flood Routing Processes

Construction works have the potential to affect flood storage and flood flows/flood routing processes as a result of construction activities and earthworks operations within the floodplain. Construction works therefore have the potential to increase flood risk locally and downstream.

The implementation of measures set out in the CEMP and as required by conditions imposed via Permits/Consents for works within watercourse corridors will facilitate control of the potential impacts of construction works upon flood storage and flood flows/flood routing processes such that flood risk locally and downstream is not increased. The receptors are considered to be of Medium/Low sensitivity and, as a result of the implementation of measures in the CEMP and the requirements of conditions imposed upon Permits/Consents, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be Negligible and therefore Not Significant.

Surface Water Drainage – Flows

Development works, including earthworks operations, have the potential to impact upon the surface water drainage regime which, in turn, may impact upon sensitive receptors in the vicinity of the site.

Construction activities will include the clearance of vegetation, topsoil stripping and stockpiling, establishment of compound areas, excavation and site re-profiling to create construction platforms, preparation of site access tracks and construction of foundations. Compaction of the ground caused by construction plant and an increase in the extent of impermeable surfaces associated with access roads and compound areas has the potential to impact upon the surface water drainage regime and increase surface water run-off from the Site. However, such effects would be localised and temporary and controlled using measures set out within the CEMP. The watercourses are considered to be of High sensitivity and, following implementation of the CEMP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be Minor and therefore Not Significant.

Surface Water Drainage – Water Quality

Construction activities also have the potential to give rise to the contamination of surface water resulting from spilled hydrocarbons/petrochemicals from construction plant and the mobilisation of silts and contaminants during soil stripping and earthworks operations, potentially leading to increased silt loading in watercourses.

However, such effects would be localised and temporary and controlled using measures set out within the CEMP. The watercourses and the WFD Water Bodies are considered to be of High/Medium sensitivity and, following implementation of the CEMP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be Minor and therefore Not Significant.

Groundwater Aquifers – flows

For the anticipated construction activities, the ground surface would largely be expected to remain above the local groundwater table, particularly since ground raising is required to address flood risk. It is therefore unlikely that groundwater would be encountered for the majority of the works.

The bedrock aquifer comprises a resource for water abstraction and piling works may penetrate the Chalk bedrock, which may affect local groundwater flow pathways in the upper part of this aquifer. However, given the known thickness of the Chalk bedrock (which extends well below the likely depth of penetration by piling) any disruption to critical flow pathways within the bedrock and to abstractions is highly unlikely. As such, the magnitude of the effect of excavation on groundwater flow is deemed to be negligible.

Reduced infiltration may be expected where areas of hardstanding across the site are increased, resulting in potentially adverse effects upon aquifer recharge. However, the site has previously been developed, and it is therefore anticipated that any further impacts upon infiltration properties would be negligible.

The aquifers are considered to be of High sensitivity and the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be Minor and therefore Not Significant

Groundwater Aquifers – water quality

Effects on groundwater quality could result from excavations and earthworks as well as spillages and leaks of fuels, oils and chemicals. This could result in potential pollution to underlying aquifers with potential pathways through the superficial deposits to the surrounding watercourses, potentially affecting sensitive habitats downstream. This may arise from runoff associated with construction activities (e.g. through generation of silt borne run-off during groundworks, accidental spills and leaks from construction plant as well as accidental spillage from construction activities).

During future piling activities associated with future site redevelopment, groundwater quality of the aquifer units may be affected where there is potential to generate viable pollutant linkage between the superficial deposits and bedrock groundwater. This may impact on the high sensitivity bedrock aquifer below and any surface waters to which they are hydraulically connected.

However, such effects would be controlled using measures set out within the CEMP and a piling risk assessment would be undertaken to identify an appropriate piling methodology and associated

groundwater pollution prevention/mitigation measures. The aquifers are considered to be of High sensitivity and, following implementation of the CEMP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be Minor and therefore Not Significant.

12.4.2 Additional Operational Phase Effects

The ES prepared in 2010 in support of Outline applications 12/00875/O (Norwich City Council) and 2011/0152/O (South Norfolk Council) considered operational effects relating to fluvial flooding/the extent of the floodplain associated with the River Yare and River Wensum and surface water run-off. For completeness and clarity, the full range of potential effects is summarised below.

Flood Storage, Flood Flows and Flood Routing Processes

To safeguard buildings and highway infrastructure from flooding, ground levels in some areas will be raised above the design flood level. This has the potential to reduce the volume of storage available within the floodplain, thereby increasing flood risk locally and downstream. However, in accordance with the principles set out in the FRA that supported the Outline application, the proposals include embedded mitigation in the form of floodplain storage compensation, so that the storage available within the floodplain is unchanged post-development. The current proposals do not therefore result in any new or materially different effects upon flood storage to those assessed previously, such that further assessment is not required.

Surface Water Drainage - Flows

The Proposed Development will give rise to an increase in the impermeable area within the catchment, thereby increasing surface water run-off. This has the potential to increase flood risk to existing development/infrastructure/third party assets/land downstream. However, in accordance with the principles set out in the FRA that supported the Outline application, the proposals include embedded mitigation in the form of a drainage strategy that controls surface water flows such that the surface water run-off regime replicates that existing prior to development. The current proposals do not therefore result in any new or materially different effects upon surface water drainage to those assessed previously, such that further assessment is not required.

Surface Water Drainage - Water Quality

There is the potential for the contamination of surface water entering the watercourses, resulting from the flushing of silts and hydrocarbons from areas of hardstanding. However, the implementation of pollution control measures as part of the drainage strategy will facilitate the control of diffuse pollution. The current proposals do not therefore result in any new or materially different effects upon surface water quality to those assessed previously, such that further assessment is not required.

Groundwater Aquifer – flows

The collection of surface water run-off from the Proposed Development using the new drainage system (comprising SuDS) that is proposed potentially limits the volume of direct recharge to the aquifers. However, the site has previously been developed, and it is therefore anticipated that any further impacts upon infiltration properties would be negligible.

Similarly, groundwater flow paths within the chalk bedrock are unlikely to be affected by piling due to the known thickness of the Chalk bedrock (which extends well below the likely depth of penetration by piling). It is also noted that the cross-sectional area of the piles relative to the size of the development will be extremely small, such that any effects upon groundwater flow would be highly localised and of negligible magnitude.

The aquifers are considered to be of High sensitivity and the magnitude of the effect of activities during operation on groundwater flows is deemed to be negligible. The significance of effect is therefore Minor and Not Significant.

Groundwater Aquifer – water quality

The collection of surface water run-off from the Proposed Development using the proposed drainage system minimises the potential for any contaminated surface water run-off to reach the superficial or bedrock aquifers during the operational stage. In addition, control of replacement material in the construction phase means that rainfall infiltration through the new fill material is unlikely to introduce potential contaminants to the groundwater. Similarly, implementation of site remediation works to remove contaminated soils (as recommended following ground investigation works) means that infiltration of rainwater is unlikely to transfer contaminants from the Made Ground to the groundwater below.

The aquifers are considered to be of High sensitivity and the magnitude of the effect of activities during operation on groundwater quality is deemed to be negligible. The significance of effect is therefore Minor and Not Significant.

12.4.3 Additional Cumulative Effects

Construction and operation of the Proposed Development could occur simultaneously with 'Other Developments' located in the vicinity of the Proposed Development.

Other proposed development will be subject to compliance with local and national planning policy and the Water Environment (WFD) regulations. Other proposals will therefore be required to demonstrate (amongst other matters) that flood risk is not increased, that the surface water drainage regime and water quality are not adversely affected and that groundwater aquifers are not affected. Without demonstrating compliance, planning permission would not be granted and construction could not commence for those projects.

The 'Other Developments' are therefore likely to be subject to embedded mitigation and additional mitigation, where applicable, as required by the specifics of the proposed schemes. This would result in the residual effects of the construction and operational phases being classified as Not Significant or Beneficial. On this basis, there will not be any significant adverse cumulative effects.

12.5 Requirement for Additional Mitigation

12.5.1 Alternate or Additional Mitigation

Potential effects arising from construction of the Proposed Development are likely to be localised and temporary and controlled by embedded mitigation measures. The effects are therefore Not Significant and there is no requirement for additional mitigation measures.

With the implementation of embedded mitigation measures the effects associated with operation of the Proposed Development are Not Significant. On this basis, there is no requirement for additional mitigation measures over and above those identified.

12.6 Residual Effects

12.6.1 Construction Phase

The potential effects arising from construction of the Proposed Development are likely to be localised and temporary and controlled by embedded mitigation measures. The residual effects are therefore Negligible and Not Significant.

12.6.2 Operational Phase

With the implementation of embedded mitigation measures, the residual effects associated with operation of the Proposed Development are Negligible and Not Significant.

12.7 Nutrient neutrality

The Proposed Development lies within the River Yare catchment and is located upstream of The Broads Special Area of Conservation (SAC) and the Broadland Special Protection Area (SPA) and Ramsar designated habitat sites. Natural England has identified The Broads SAC as a water dependent habitat that is in unfavourable condition due to elevated nutrient levels. The Proposed Development, being located within the same hydrological catchment, has the potential to affect water quality of the designated sites.

In accordance with advice and guidance provided by Natural England, the nutrient loading (kg/year) arising from the Proposed Development has been calculated and a Habitats Regulations Assessment (HRA) has been completed (Appendix 12.2). The HRA concluded that the Proposed Development has the potential to result in deterioration of the designated habitats due to water pollution (increased levels of nitrogen and phosphorous). However, the HRA also concluded that the implementation of mitigation in the form of nutrient neutrality would avoid an adverse effect upon the integrity of The Broads SAC and Broadland SPA and Ramsar sites. It is currently envisaged that nutrient neutrality mitigation will be provided via the Norfolk Environmental Credits Joint Venture scheme.

12.8 Other Environmental Issues

This section seeks to detail any considerations and environmental effects that have been identified with regard to the range of topics which have been introduced into the EIA requirements through the EIA Regulations 2017. Where there are no such considerations or environmental effects relevant to hydrology, hydrogeology, flood risk and drainage, this is also specified for clarity.

12.8.1 Other Environmental Issues of Relevance

12.8.1.1 Infrastructure

The impacts of demolition and construction-related activities have been considered and mitigation will be secured through the implementation of measures set out in the Construction and Environmental

Management Plan (CEMP). It has therefore been concluded that the significance of the effects would be Negligible and therefore Not Significant.

12.8.1.2 Waste

The issue of waste is not directly relevant to the consideration of impacts upon hydrology, hydrogeology, flood risk and drainage.

12.8.1.3 Population and Human Health

The population/residents are a critical receptor when considering flood risk impacts. The Flood Risk Assessment (Appendix 12.1) demonstrates that the Proposed Development will be 'nil detriment' in terms of flood risk, such that (i) existing development/communities are not adversely affected and (ii) residents of the proposed scheme will be safe during periods of flooding. On this basis, there will be no significant effects upon the population.

12.8.1.4 Climate and Change

The baseline hydrological regime may change in the future as a result of the predicted impacts of climate change, irrespective of any development coming forward. River flows, tide levels and rainfall intensities are predicted to increase as a result of climate change. Should such changes materialise, rates of surface water run-off, flood flows within watercourses and flood levels associated with a breach of flood defences would increase. In addition, the seasonality of rainfall and river flows is likely to become more pronounced.

This chapter is supported by a Flood Risk Assessment (Appendix 12.1) that takes account of the potential future changes in the hydrological regime by incorporating appropriate allowances for climate change, as published by the EA (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances).

The impacts of climate change have therefore been assessed and reflected in the design of the Proposed Development. There will not therefore be any significant adverse effects upon the Proposed Development arising from climate change.

12.8.1.5 Risk of Major Accidents and/or Disasters

This has been scoped out of the ESA.

12.8.2 Summary

In respect of the EIA Regulations 2017, and in terms of hydrology, hydrogeology, flood risk and drainage, there are not considered to be any likely significant effects with regards to Other Environmental Issues.

12.9 SUMMARY OF EFFECTS

Effects, mitigation measures and residual effects are summarised in Table 12.7 below.

Table 12.7: Summary of Effects

Effect	Nature of Effect	Mitigation	Residual Effect
Construction			
Impact upon flood storage and flood flows/flood routing leading to increased flood risk	Temporary, Direct	Implementation of measures set out in the CEMP	Negligible and Not Significant
Impact upon surface water drainage regime and increased surface water run-off	Temporary, Direct	Implementation of measures set out in the CEMP	Negligible and Not Significant
Contamination of surface water and increased silt loading in watercourses	Temporary, Direct	Implementation of measures set out in the CEMP	Negligible and Not Significant
Impact upon groundwater flows and reduced aquifer recharge	Permanent, Direct	None required	Negligible and Not Significant
Contamination of groundwater aquifers	Temporary, Direct	Implementation of measures set out in the CEMP	Negligible and Not Significant
Operation			
Impact upon flood storage and flood flows/flood routing leading to increased flood risk	Permanent, Direct	Implementation of floodplain storage compensation as set out in the FRA	Negligible and Not Significant
Impact upon surface water drainage regime and increased surface water run-off	Permanent, Direct	Implementation of surface water drainage strategy as set out in the FRA	Negligible and Not Significant
Contamination of surface water	Permanent, Direct	Implementation of surface water drainage strategy and pollution control measures as set out in the FRA	Negligible and Not Significant
Impact upon groundwater flows and reduced aquifer recharge	Permanent, Direct	None required	Negligible and Not Significant
Contamination of groundwater aquifers	Permanent, Direct	None required	Negligible and Not Significant

12.10 CONCLUSIONS

The baseline conditions have been described and the principal receptors that may be affected by the Proposed Development identified.

Construction activities have the potential to impact upon flood flows and flood storage, the surface water drainage regime and both groundwater and surface water quality. However, the effects are likely to be localised, temporary and controlled by embedded mitigation measures, such that the residual effects would be Negligible and therefore Not Significant.

Similarly, the potential effects arising during the operational phase would be controlled by embedded mitigation measures, such that the residual effects are likely to be Negligible and therefore Not Significant.

Significant adverse cumulative effects are not anticipated on account of construction phase and operational phase mitigation measures being employed at the Proposed Development and 'Other Developments' being constructed/operational simultaneously.

With regard to the range of topics which have been introduced into the EIA process through the EIA Regulations 2017, there are not considered to be any likely significant effects associated with Other Environmental Issues.