

7.0 WATER RESOURCES AND FLOODING

Introduction

- 7.1 This chapter assesses the likely significant effects of the Developments as described in Chapter 3, on water resources and flooding. In particular, the likely significant effects on flood risk and drainage during the construction and within the operational phase of the Developments.
- 7.2 This chapter has been prepared by Stantec (see Appendix 1.4: Statement of Expertise). It is supported by a Flood Risk Assessment (FRA) contained within ES Appendix 7.1 and an outline surface water drainage strategy. Stantec is consultant to the Applicant.
- 7.3 Stantec has many years of experience in, amongst other areas, the assessment of flood risk, hydrology, flood defence and river engineering. The reviewers who assisted in the preparation of this chapter are all experienced engineers and members of chartered institutions such as the Chartered Institution of Water and Environmental Management (CIWEM) or the Institution of Civil Engineers (ICE).
- 7.4 This chapter first presents a summary of the relevant legislation and policy (Section 7.2), followed by an overview of its assessment methodology (Section 7.3), which has informed the assessment. The methods that have been employed to obtain the baseline information, subsequent assessment of their sensitivity/value and impacts on these are presented. The chapter then presents a summary of the baseline conditions at the Site and surrounding areas outside the Site (Section 7.4), as appropriate. The chapter then identifies the likely significant environmental effects (Section 7.5) arising from the Developments on water resources and flooding, and the likely significant effects (Section 7.5) from demolition & construction and operational activities, taking into account the mitigation already designed into the Development. Appropriate additional avoidance, mitigation or compensation measures (Section 7.6) necessary to reduce these effects to an acceptable level are identified, and the significance of any residual effects are finally assessed. The residual effects are further considered cumulatively with those of other identified schemes (as set out in Section 7.7). The chapter concludes with consideration of the cumulative effects of the Developments (Section 7.8). It is considered that the Developments will be categorised as 'nil detriment' in terms of water resources and flooding related impacts and the cumulative effects of development in the local area (including potential interactive effects from the Consented Development) are negligible.

Policy Context

National Planning Policy

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

- 7.5 The Flood and Water Management Act 2010ⁱ (the 'FWMA') implements several key recommendations of Sir Michael Pitt's Reviewⁱⁱ (2008) of the summer 2007 floods, to protect water supplies to consumers and protect community groups from excessive charges for surface water drainage. It gives the Environment Agency (EA) a strategic overview role for flood risk, and gives local authorities (known as Lead Local Flood Authorities (LLFAs)) responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas. Reading Borough Council (RBC) is the LLFA in this area.
- 7.6 The FWMA's Schedule 3 proposed the establishment of Sustainable urban 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.
- 7.7 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 LLFAs as statutory consultees with regards to 'local' sources of flood risk and surface water management. Ministerial Written Statement HCWS161ⁱⁱⁱ details this change in policy, which came into effect in April 2015.

- 7.8 The FWMA also amends Section 106 of the Water Industry Act 1991^{iv} (the WIA) in respect of the right of connection to a public sewer. In the future, the automatic right of connection will be revoked, and all new connections must be made via a Section 104 Agreement for foul sewers and following the consent of the SAB for surface water connections. As the role of the SAB has been removed following HCWS161, this amendment to Section 106 of the WIA is now subsumed into the planning process under the purview of the Lead Local Flood Authority. DEFRA is currently intending to implement Schedule 3 of the FWMA in England and planning a public consultation on the implementation of Schedule 3 later in 2024.

Water Environment (Water Framework Directive) (England and Wales) Regulations (DEFRA, 2003)

- 7.9 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003^v transpose the European Union Water Framework Directive^{vi} (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;
- Reduce pollution.

- 7.10 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 (RBMP) 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. The site lies within the Thames River Basin District.

- 7.11 WFD classifications are expressed in terms of five classes (High, Good, Moderate, Poor or Bad). The classifications are established on the basis of specific criteria and boundaries defined against the following elements: biological (e.g. numeric measures of communities of plants and animals); physico-chemical (e.g. temperature and level of nutrients); and hydro morphological (e.g. water flow and structure of physical habitats). The overall status of a water body is determined by whichever of these assessments is the poorest.

- 7.12 The WFD's ultimate aim is to ensure all inland and near shore watercourses and water bodies (including groundwater) are of 'Good' status or better, in terms of ecology, and also chemical, biological and physical parameters, with the first management cycle ending in 2015, the second cycle due to end by 2021 and the third cycle due to end in 2027. Therefore, any activities or developments that could cause detriment to a nearby water resource, or prevent the future ability of a water resource to reach its potential status, must be mitigated so as to reduce the potential for harm and allow the aims of the Directive to be realised.

The Water Resources Act 1991

- 7.13 The Water Resources Act 1991^{vii} (the WRA) in particular Section 92(1)(a) stipulates that the Secretary of State may make provisions "*for prohibiting a person from having custody or control of poisonous, noxious or polluting matter unless prescribed works and precautions and other steps have been carried out or taken for the purpose of preventing or controlling the entry of the matter into any controlled waters*". This has implications for the Developments in that all potential pollution sources of controlled waters must be mitigated.
- 7.14 The WRA sets out the responsibilities of the EA in relation to water pollution, resource management, flood defence, fisheries, and in some areas, navigation. The WRA regulates discharges to controlled waters, namely rivers, estuaries, coastal waters, lakes and groundwater. Discharge to controlled waters is only permitted with the consent of the EA. Similarly, a licence is required to abstract from controlled waters.
- 7.15 The Water Act 2003 (the WA) amends the WRA and the WIA. The four broad aims of the WA are the sustainable use of water resources; strengthening the voice of consumers; a measured increase in competition; and the promotion of water conservation. The WA amends the WRA to improve long-term

water resource management and amends the WIA so that water companies are given a duty to prepare and publicise drought plans; are placed under a duty to agree and publicise water resource management plans; and are placed under an enforceable duty to further water conservation through these measures.

National Planning Policy Framework and Planning Practice Guidance

- 7.16 The National Planning Policy Framework^{viii} (NPPF, December 2023) and the accompanying Planning Practice Guidance^{ix} (PPG, November 2023) sets out the Government's national policy on development and flood risk. The NPPF aims are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk. In exceptional circumstances where new development is necessary in flood risk areas the policy also aims to ensure it is safe, without increasing flood risk elsewhere, and, where possible, reducing flood risk overall.
- 7.17 The NPPF requires the use of a risk based sequential test, in which new development is directed towards the areas of lowest risk of flooding. The different areas of flooding are defined by the following Flood Zones:
- 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;
 - Flood Zone 3b: The functional floodplain (where water is stored in times of flood, including water conveyance routes, annual probability of 1 in 30 or greater in any given year).
- 7.18 The August 2022 update to the PPG 'Flood Risk and Coastal Change' section includes an amended definition for Flood Zone 3b as the 1 in 30 (3.3%) annual probability flood, instead of the 1 in 20 (5%) annual probability flood. However, it also states that "*Local planning authorities should identify in their Strategic Flood Risk Assessments (SFRAs) areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency*", so it is assumed for the purposes of this study that the definitions within the RBC SFRA continues to apply until the local policy is amended.
- 7.19 It should be noted that Flood Zones 1, 2 and 3a definitions ignore the presence of flood defences.
- 7.20 In addition, the PPG specifies the type of land use, defined by its flood risk vulnerability that is appropriate in each Flood Zone. For example, more sensitive developments that would be most severely affected in the event of flooding, such as hospitals, should not be permitted in areas at high probability of flooding, although leisure and tourism developments may be allowed in Flood Zone 3a.
- 7.21 EA supporting guidance to the NPPF 'Flood Risk Assessments: Climate Change Allowances' (February, 2016^x) states how new development must include appropriate consideration of the potential effects of climate change on flooding and the hydrological regime. These have been taken into consideration in both the FRA (Appendix 7.1) and surface water drainage strategy.
- 7.22 Updated climate projections were presented as part of UKCP18 published on 26th November 2018^{xi}. The NPPF 'Flood Risk Assessments: Climate Change Allowances' guidance has since been updated based on management catchments in place of river basin districts, on which the February 2016 guidance was based. The latest updates to 'Flood Risk Assessments: Climate Change Allowances' guidance are dated May 2022.

Local Planning Policy

- 7.23 Local planning policy contained within the Reading Borough Local Plan^{xii}, adopted November 2019, with specific reference to Policy EN18 'Flooding and Sustainable Drainage Systems', which states:

“Development will be directed to areas at lowest risk of flooding in the first instance, following the Sequential and Exceptions Test set out in the NPPF, and taking into account the effects of climate change. It will consider flooding from all sources, including fluvial, surface water, groundwater, and sewer flooding. Where development in areas at risk of flooding is necessary, it will not reduce the capacity of the flood plain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding. Wherever possible, development should be designed to reduce flood risk, both on- and off-site.

All major developments must incorporate sustainable drainage systems (SuDS) as appropriate and in line with the Government’s Technical Standards. Smaller schemes are encouraged to incorporate SuDS, where possible. Runoff rates should aim to reflect greenfield conditions and, in any case, must be no greater than the existing conditions of the site. Schemes should ensure that the movement of water through vertical infiltration as well as horizontal run-off does not worsen contamination effects. Wherever possible, SuDS provision should maximise ecological benefits, link into the existing Green Network, incorporate tree planting and landscaping and avoid damage to existing significant trees, including through changes to the site hydrology. All new developments in areas of flood risk should give priority to SuDS.

All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development...

...All development shall minimise the impact of surface water runoff from the development in the design of the drainage system, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels as a result of climate change.”

Other relevant policy, standards and guidance

7.24 Additional relevant international/national policy include:

- The Flood Risk Regulations^{xiii}
- Land Drainage Act 1991^{xiv}
- The Environmental Permitting (England and Wales) Regulations 2010^{xv}

7.25 The ‘Non-statutory technical standards for sustainable drainage systems’^{xvi} (DEFRA, April 2015) should be used in conjunction with the NPPF and PPG. It provides planning guidance for the implementation of SuDS.

7.26 SuDS techniques are described in CIRIA C753 The SuDS Manual^{xvii} (CIRIA, 2015) guidance which outlines approaches to deal with surface water as close to the source as possible and reproduce natural drainage patterns to prevent an increase in the volume and peak discharge from development sites.

7.27 At the more detailed stage in the design and planning process of the Developments, further guidance will be referenced and the conceptual strategies outlined here have been considered in this context. These design guides or regulations include:

- Designing for exceedance in urban drainage^{xviii} (CIRIA C635);
- Sewerage Sector Guidance^{xix} (Water UK, 2020);
- Building Regulations Part H^{xx} ; and
- BS EN 752:2017 – Drain and Sewer Systems Outside Buildings.

Assessment Methodology

Study Area

- 7.28 The Study Area for this chapter is the Site and the land immediately surrounding it (outside the red line Site Boundary). A plan of the Site is included in the Flood Risk Assessment (Appendix 7.1) that supports this chapter. The Developments must not increase flood risk to the surrounding land, in particular areas which are not currently at risk of flooding or increasing the risk (e.g., increasing frequency or depth of flooding) for areas which are already at risk.
- 7.29 The Site is split into two parcels:
- Yield Hall Place 1 Development (YHP1) – former Debenhams site comprising 0.75 hectares (ha); and
 - Yield Hall Place 2 Development (YHP2) – Vue Cinema complex comprising 1.03 ha.
- 7.30 Flood risk to both internal (within red line Site Boundary) and external (outside red line Site Boundary) receptors is assessed.
- 7.31 For internal but not external receptors, this chapter provides information on the degree of flood hazard and hence the degree of flood risk. In the case of external receptors, flood hazard and hence flood risk during the design events is not evaluated. Instead, the potential for the Developments to qualitatively increase or decrease flood risk at external receptors is assessed so that targeted measures to ensure a qualitative reduction can subsequently be taken, if necessary.

Data sources

- 7.32 This chapter has been prepared with reference to the following sources of flood risk information:
- EA online flood maps^{xxi} (<https://flood-map-for-planning.service.gov.uk>);
 - The Standards for Highways Design Manual for Roads and Bridges^{xxii} (DMRB);
 - Topographic survey of the site (Drawing reference RS2200121/01) undertaken by Ruxton Surveys in July 2022 (see FRA Appendix B);
 - Outputs from the EA Kennet (Tyle Mill to Thames Confluence) 2018 hydraulic model, provided as a Product 4 ref. THM315890 in July 2023 (see FRA Appendix C);
 - Proposals by CallisonRTKL Ltd. (see FRA Appendix E);
 - The Reading Borough Council (RBC) Preliminary Flood Risk Assessment (PFRA), June 2011^{xxiii} and Addendum 2017^{xxiv};
 - RBC Level 1 Strategic Flood Risk Assessment^{xxv} (SFRA), June 2017; and
 - RBC Level 2 Strategic Flood Risk Assessment^{xxvi} (SFRA), December 2017.

Stakeholder Engagement

- 7.33 The Applicant has also consulted local stakeholders to acquire local/site-specific information on flood risk, to confirm design criteria/principles and agree the methodology for the technical assessments/analysis required to inform the FRA and drainage strategy that support this chapter (Appendix 7.1).
- 7.34 Stakeholders consulted by the Applicant include:
- Environment Agency (EA);
 - RBC; and

- Thames Water (TW).

7.35 Copies of the correspondence and meeting notes of the Applicant's consultation with local stakeholders are included in the FRA (Appendix 7.1) and further details regarding the matters identified, discussed and agreed with certain stakeholders are summarised in Table 7.1 below.

Table 7.1: Applicant Correspondence with consultees

Consultee	Date	Comments
Environment Agency (EA)	June 2023	The Environment Agency (EA) provided a consultation response to the FRA in June 2023 with the following objections, however the red line boundary has subsequently been revised with all Developments now located within Flood Zone 1: Former Debenhams Department Store (YHP1) <i>"1) Proposed development incompatible with Flood Zone</i> <i>We object to the proposed development as it falls within a flood risk vulnerability category that is inappropriate to the Flood Zone in which the application site is located....According to our flood modelling (Kennet-Tyle Mill to Thames Confluence 2018), part of the development lies within Flood Zone 3b 'Functional Floodplain'.....The development is classed as more vulnerable in accordance with Annex 3 of the NPPF. Table 2 of PPG makes it clear that this type of development is no compatible with this Flood Zone and should therefore not be permitted.</i> <i>The FRA does not currently contain a detailed enough review of the computer flood modelling to demonstrate that any development would lie outside of the 5% annual exceedance probability (AEP) flood extent (Flood Zone 3b). Comparing modelled flood levels with a site topographical survey will indicate which areas of the site fall within Flood Zone 3b. More Vulnerable development is not permitted in Flood Zone 3b so the FRA will need to demonstrate that any proposed development is outside of Flood Zone 3b for the objection to be removed.</i> Both Former Debenhams Department Store (YHP1) and Vue Cinema Complex (YHP2) <i>2) Inadequate FRA</i> <i>The FRA does not adequately assess the flood risks posed by the development. In particular, the FRA fails to:</i> <i>Include computer flood modelled data to demonstrate flood extents and levels for a range of flooding events.</i> <i>Demonstrate that finished floor levels are set above the 1% annual exceedance probability plus an appropriate allowance for climate change (1% AEP CC) flood level. Therefore, the development may not be safe for its lifetime.</i> <i>Assess the impacts of the development on floodplain storage.</i> <i>Demonstrate that any loss of floodplain storage within the 1% annual exceedance probability (AEP) plus an appropriate allowance for climate change flood extent caused by the proposed development can be mitigated for.</i> <i>To overcome our objection, the applicant should submit a revised FRA which addresses the points highlighted above.</i> <i>3) Building Next to a Main River – Unlikely to Grant Permit</i> <i>The submitted applications and associated documents indicate that the River Kennet will be adversely affected, and a flood risk activity permit will be required. We do not have enough information to know if the proposed development can meet our requirements for mitigation of adverse</i>

Consultee	Date	Comments
		<i>environmental effects because inadequate details of the mitigation measures has been provided."</i>
Reading Borough Council (RBC)	June 2023	Request for EIA Screening Opinion (ref. 221918/SCR) " - <i>Impact on Natural Resources (Water – River Kennet) - Due to scale of proposed buildings located in close proximity to either side of the River. There is currently an Environment Agency objection to the proposed planning applications (221916FUL and 221917FUL) citing concerns about overshadowing/shading and impact on the water body and its biodiversity.</i> - <i>Population and Human Health - The Environment Agency have identified that part of the site of the application to the north of the river (ref. 221916) is located within flood zone 3B (functional flood plan) where the proposed residential and commercial development is, in accordance with Annex 3 of the NPPF, considered incompatible with this flood zone and should not be permitted due to the high probability of flooding. The EA have also identified that the Flood Risk Assessments submitted in support of the applications on both sides of the river are inadequate and fail to demonstrate that the proposals would be safe for their lifetime from flooding."</i>
Thames Water (TW) Source: <i>Flood Risk Assessment and Drainage Strategy, ref. L1451-CIV-R001, Byrne Looby</i>	29 th September 2022 (DS6099032)	Initial capacity concerns. TW advised that only enough capacity for first 50 residential units and that a formal assessment and application for modelling is to be made. Agreed that application for formal assessment would be made following planning approval.
	18 th October 2022 (DS6099031)	TW advised in their response that they are unable to facilitate the proposed foul and surface water discharge rates without further modelling and possible upgrades to the network.

Assessment approach

- 7.36 For the FRA (Appendix 7.1), three principal activities have been undertaken as part of the assessment process:
- Desk-study review;
 - Stakeholder consultation; and
 - Assessment of surface water drainage regime.
- 7.37 Existing studies/documents have been reviewed to assist with characterising the baseline water environment and to identify the best available data to be taken forward to inform the assessment.
- 7.38 Consultation with statutory consultees (listed above) has been undertaken to identify and collate data in respect of the baseline water environment, define the scope of investigation/technical work required to inform the FRA and this ES chapter, agree assessment methodologies and the design principles to be applied to ensure compliance with the policy, legislation and guidance summarised in Section 7.2.

Significance criteria

- 7.39 For the purposes of this chapter, an assessment of the likely significance of an effect has been made firstly by considering the sensitivity of receptors (i.e. a receptor's importance and ability to tolerate and recover from change) and, secondly, by considering the likely magnitude of the effect (i.e. the effect's spatial extent and duration). By combining sensitivity and magnitude, the likely significance of the effect can be established. Where likely significant negative effects are identified, mitigation measures can be proposed to reduce the significance.

Defining Sensitivity of Receptors

- 7.40 The sensitivity of a receptor is characterised by its ability to tolerate and recover from changes in the environment as well as its importance to society (i.e. protection under a statutory designation or economic value). Table 7.2 below shows the criteria used to determine receptor sensitivity.
- 7.41 DMRB guidance note LA 104 'Environmental assessment and monitoring' sets out generic criteria for determining receptor sensitivity and the magnitude of the impact; these are replicated in Table 7.2 and 7.3 below.

Table 7.2: Sensitivity / Value of Receptors

Sensitivity / Value	Description Criteria	Examples of receptors
Very High	• Very high importance and rarity, international scale and very limited potential for substitution. • Attribute with a very high quality and rarity with national or international importance or recognition and limited potential for substitution. • Attribute highly sensitive to change.	• Examples include: • Receiving watercourse classified as High or High Ecological status/potential under WFD • World Heritage Sites • Site protected under EU or UK wildlife legislation (SAC, SPA, SSSI). Species protected under EU or UK wildlife legislation • NPPF Flood Risk Vulnerability Classification "Essential Infrastructure" or "Highly Vulnerable" • Site located within a Groundwater Source Protection Zone (SPZ) inner or outer protection zone (Zone 1) • EA current groundwater quantitative and chemical qualities defined as 'High' • Human receptors (construction workers and future residents).
High	• High importance and rarity, national scale, and limited potential for substitution. • Attribute with a high quality and rarity, national scale and limited potential for substitution. • Attribute sensitive to change.	• Examples include: • Receiving watercourse classified as Good or Good Ecological status/potential under WFD • Site protected under EU or UK wildlife legislation (SAC, SPA, SSSI). Species protected under EU or UK wildlife legislation • NPPF Flood Risk Vulnerability Classification "Essential Infrastructure" or "Highly Vulnerable" • Site located within a Groundwater Source Protection Zone (SPZ) inner or outer protection zone (Zone 1) • EA current groundwater quantitative and chemical qualities defined as 'Good' • Human receptors (construction workers and future residents).
Medium	• Medium or high importance and rarity, regional scale, limited potential for substitution. • Attribute with a medium quality and rarity, local scale and limited potential for substitution. • Attribute reasonably tolerant of change.	• Examples include: • Floodplain providing a moderate volume of storage • Receiving watercourse classified as Moderate or Moderate Ecological status/potential under WFD • NPPF Flood Risk Vulnerability Classification "More Vulnerable".
Low	• Low or medium importance and rarity, local scale. • Attribute with a low quality and rarity, local scale and limited potential for substitution.	• Examples include: • EA current river ecological quality defined as Poor and chemical quality defined as Fail • Floodplain essentially rural, characterised by agricultural land use, with limited existing development.

Sensitivity Value /	Description Criteria	Examples of receptors
	Attribute tolerant of modest to substantial change.	- Receiving watercourse classified as Poor Ecological status/potential under WFD - NPPF Flood Risk Vulnerability Classification "Less Vulnerable".
Negligible	- Very low importance and rarity, local scale. - Minimal evidence of attribute present with any sensitivity to change.	- Examples include: - No watercourses or existing features present which may cause flooding. - NPPF Flood Risk Vulnerability Classification "Water Compatible".

Defining Magnitude of Impact

7.42 Determination of the magnitude of change to the receptors as a result of the Developments has been undertaken based on the criteria set out in Table 7.3 below.

Table 7.3: Magnitude of Impacts and typical descriptions

Magnitude of Impact		Typical Description	Characteristics of Change
Major	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.	- Fundamental changes to the regional hydrological regime at catchment scale. - Increase in peak flood level (100mm) - Pollution of potable sources of water abstraction. - Fundamental changes in volume and/or peak discharge of surface water runoff from the Site. - Fundamental changes in surface water quality. - Fundamental changes to flow conveyance and floodplain storage.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.	
Moderate	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.	- Moderate changes to the local hydrological regime. - Increase in peak flood level (> 50mm). - Moderate changes in volume and/or peak discharge of surface water runoff from the Site. - Moderate changes in surface water quality. - Moderate changes to flow conveyance and floodplain storage.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.	
Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.	- Some noticeable changes to the local hydrological regime. - Increase in peak flood level (>10mm) - Some noticeable changes in volume and/or peak discharge of surface water runoff from the Site. - Some noticeable changes in surface water quality. - Some noticeable changes to flow conveyance and floodplain storage.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.	
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.	No noticeable changes to the local hydrological regime.

Magnitude of Impact		Typical Description	Characteristics of Change
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.	- Negligible change to peak flood level ($\leq \pm 10\text{mm}$). - No noticeable change in volume and/or peak discharge of surface water runoff from the Site. - No noticeable changes in surface water quality. - No noticeable changes to flow conveyance and floodplain storage.
No Change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.	

Determining the Significance of Effects

- 7.43 The likely significance of an effect is derived based upon the sensitivity of the receptor and the magnitude of the change. The significance of the effect is then determined using the matrix presented at Table 7.4 below. The DMRB standard states that where the significance table “*includes two significance categories, evidence should be provided to support the reporting of a single significance category.*”
- 7.44 The DMRB standard also noted that “the approach to assigning significance of effect relies on reasoned argument, the professional judgement of competent experts and using effective consultation to ensure the advice and views of relevant stakeholders are taken into account”.

Table 7.4: Significance of Effects Matrix

	Magnitude of impact (degree of change)					
		No Change	Negligible	Minor	Moderate	Major
Environmental Value	Very High	Neutral	Slight	Moderate or Large	Large or very large	Very Large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

- 7.45 The likely significance of an effect can be beneficial, neutral or adverse. The significance of an effect should also be assessed based on the likelihood of an impact occurring (using a scale of certain, likely or unlikely) and the confidence in the accuracy of the assessment.
- 7.46 Temporary impacts are considered to occur in the demolition & construction phase (2025-2029) and permanent (long term) impacts in the post-completion (2029) operational phase (albeit that the impact may first occur during demolition & construction e.g. change of surface material).
- 7.47 The likely significance of residual impacts (i.e. the environment impacts that remain after the incorporation of mitigation measures) has been assessed through consideration of their magnitude, duration and nature (i.e. reversible or irreversible) and also the geographic context (e.g. highly localised [local level] or widespread [national level]). Specific significance criteria have been prepared for each specialist topic, based on the generic criteria, for adverse and beneficial effects, set out in Table 7.5. For the purposes of the EIA residual effects that are within the moderate, large or very large categories are considered to be ‘significant’ and require mitigation.

Table 7.5: Significance categories and typical descriptions

	Significance category	Typical Description
Significant	Very Large	Effects at this level are material in the decision-making process. These effects are generally, but not exclusively, associated with sites and features of national or regional importance. A change at a borough scale site or feature may also enter this category.
	Large	These effects are likely to be important considerations at a local or borough scale and may become key factors in the decision-making process.
	Moderate	Effects at this level can be considered to be material decision-making factors. These effects, while important at a local scale, are not likely to be key decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.
Not Significant	Slight	These effects may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in enhancing the subsequent design of the project and consideration of mitigation or compensation measures.
	Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error. Such effects should not be considered by the decision-maker.

Limitations and Assumptions

- 7.48 Assessment of flood risk and drainage at the Site is based on the most current available data, which is included in the Flood Risk Assessment (Appendix 7.1) that supports this chapter. This data includes, but is not limited to, the latest flood data for the Site provided by the EA.
- 7.49 Some of the conclusions in the assessment are based on third-party data. No guarantee can be given for the accuracy or completeness of any of the third-party data used.

Baseline Conditions

Study Area

- 7.50 The Study Area for this chapter is the Site and the land immediately surrounding it (outside the red line Site Boundary). A plan of the Site is included in the Flood Risk Assessment (Appendix 7.1) that supports this chapter.

Current Baseline

Surface Water Bodies

- 7.51 The River Kennet flows north-east through the centre of Reading between the two parts of the Site to its confluence with the River Thames approximately 1,000 metres (m) east of the Site at Kennetmouth.
- 7.52 The Holy Brook is located 50-100m to the north of the Site and flows eastwards to join the River Kennet shortly downstream of the Site.
- 7.53 Both watercourses lie within the Environment Agency's Kennet Operational Catchment, with the Developments located in 'Lower Kennet (Sheffield Bottom to Reading) catchment and YHP1 also partially located within 'Holy Brook' surface water catchment.

Groundwater

- 7.54 The British Geological Survey (BGS) Geology of Britain Viewer suggests that the bedrock underlying the Site comprises the Seaford Chalk Formation and Newhaven Chalk Formation (White Chalk), which are both classified as a 'Principal' aquifer.

- 7.55 The BGS mapping indicates superficial deposits of Alluvium (Clay, Silt, Sand and Gravel) are located on Site, which are classified as a 'Secondary A' aquifer.
- 7.56 The Site is not located within a Nitrate Vulnerable Zone (NVZ) based on the BGS mapping.
- 7.57 The online Magic map shows that the Site is situated within a 'Medium - High' EA Groundwater Vulnerability zone.
- 7.58 The Site is not located within an EA Groundwater Source Protection Zone.

Fluvial Flood Risk

- 7.59 The EA publishes floodplain maps on the internet (<https://flood-map-for-planning.service.gov.uk>). These maps show the possible extent of fluvial flooding for the 1 in 100 year flood (that which would have a 1% probability of being exceeded each year) or the possible extent of tidal flooding to a 1 in 200 year event. Also shown is the possible extent of flooding arising from a 1 in 1,000 year event (0.1% probability). An extract from the current (2023) EA Flood Map for Planning is shown in Figure 4.1 of the FRA (Appendix 7.1).
- 7.60 The mapping indicates the Developments lie within Flood Zone 1 'Low Probability' (classified as land at less than 1 in 1000 (0.1%) probability of flooding) and all proposed residential development will be located within Flood Zone 1.
- 7.61 The EA has provided Product 4 information for the Site which include modelled flood levels and extents from the EA 2018 Kennet 'Tyle Mill to Thames Confluence' 1D-2D model (received from the EA in July 2022 ref. THM315890) and these are provided in the FRA in Appendix 7.1.
- 7.62 The modelled flood levels have been superimposed over the site topographic survey and this is shown on Stantec drawing 332110757/4000/001 in Appendix D of the FRA (Appendix 7.1). The drawing confirms that all modelled floodplains up to and including the 1 in 1000 (0.1%) annual probability flood event are contained within the banks of the River Kennet and confirms that the sites are located within Flood Zone 1 'Low Probability'.
- 7.63 As such, there will be no detrimental impact to flood risk for either of the two watercourses, as the conveyance of the channels will be unaffected.

Surface Water Flood Risk

- 7.64 The EA's 'updated Flood Map for Surface Water' uFMfSW indicates the following in relation to the Developments:
- The YHP1 site has a 'Very Low' risk of surface water flooding, with the exception of a narrow strip in the south-western corner of the site which has a 'Low' risk of surface water flooding;
 - The majority of the YHP2 site has a 'Very Low' risk of surface water flooding. Small areas of 'Low' to 'High' surface water flood risk are present around the building perimeter.

Surface Water Quality

- 7.65 The Site lies within the catchment of the 'Lower Kennet (Sheffield Bottom to Reading' water body (Water Body ID – GB106039023140), which for the 2019 cycle has an Ecological status of 'Moderate' and a chemical status of 'Fail', as defined by the EA.
- 7.66 YHP1 also lies partially within the 'Holy Brook' water body (Water Body ID GB106039023141), which for the 2019 cycle has an Ecological status of 'Moderate' and a chemical status of 'Fail', as defined by the EA.

Groundwater Quality

- 7.67 The Developments lie within the groundwater catchment of the 'Berkshire Downs Chalk' Operational Catchment (Water Body ID – GB40601G600900), which for the 2019 cycle has an Overall status of 'Poor' and a chemical status of 'Poor', as defined by the EA.

Future Baseline

- 7.68 In accordance with national policy, other committed development schemes within the area will be required to incorporate measures to ensure that additional development does not have an adverse impact on the water environment or flood risk, to both internal (on site) and external (off site) receptors. On this basis, these schemes will not affect the water environment or increase flood risk to external receptors and therefore other developments.
- 7.69 In terms of future baseline, in the event that the Development does not come forward on the Site (also known as the 'do minimum' scenario), runoff from the Site will continue to drain as per the existing piped drainage system into the receiving watercourses.
- 7.70 The hydrological regime may change as a result of the predicted impacts of climate change. The 'Flood Risk Assessments: climate change allowances' (February 2016, updated May 2022) document provides guidance on the allowances that should be made for the impacts of climate change on river flow, rainfall intensity and sea level rise. Peak fluvial flows, sea level (tidal) and rainfall leading to surface water runoff are predicted to increase as a result of climate change.

Likely Significant Effects

Demolition & Construction Phase

- 7.71 This phase is expected to commence from September 2025 and includes initial demolition/site clearance and preparation, groundworks and general construction activities associated with the Developments, up to 2029 (completion).

Flood Risk

- 7.72 Any temporary construction activities in or near the watercourses floodplain could cause an impact whereby the available preferential flood flow routes are reduced or removed, which could increase the risk of flooding upstream or downstream of the Developments (outside the red line planning application boundary).
- 7.73 Further to this, there could also be an impact on construction workers and site users and therefore the effect is considered to be temporary slight adverse and of Slight significance to existing properties upstream/downstream of the Developments during construction.

Surface Water Bodies and Drainage

- 7.74 During construction of the Developments, the impermeable area of the Site could increase without mitigation. This has the potential to increase the likelihood of surface water flooding within the Site or outside the red line planning application boundary until the permanent drainage system is operational. This is considered to be a temporary moderate adverse effect and of Moderate significance.

Surface Water Quality

- 7.75 Without mitigation the Developments construction phase is likely to affect the water quality of the watercourses near the Site and outside the red line planning application boundary, through mobilisation of silts, contaminants and creation of new pathways during the excavation and the earthworks, as well as through a pollution incident. This is considered to be a temporary moderate adverse effect and of Moderate significance.

Groundwater Quality

- 7.76 Without mitigation, the construction phase is likely to affect groundwater flows beneath the Site through mobilisation of contaminants and creation of new pathways during the excavation and the earthworks or through a pollution incident. The effect is considered to be temporary during the construction phase but will affect the groundwater regime permanently if mitigation measures are not put in place and therefore the effect is considered to be permanently minor adverse and of Slight significance.

Operational Phase

- 7.77 The post-completion (completed Developments) stage is based on the provided masterplans and includes initial occupation of the Developments dwellings from 2029.

Flood Risk

- 7.78 The Site is located within Flood Zone 1 which is defined as land with less than 1 in 1,000 year annual probability of flooding.
- 7.79 The Developments will be located in Flood Zone 1 and therefore there will be negligible effect on floodplain storage or conveyance on Site or outside the red line Site Boundary, post-completion. The minimum ground level at the Site is 38.00m AOD and therefore the following minimum freeboards are provided above the modelled flood levels:
- 1 in 20 (5%) AP event: 960mm
 - Present-day 1 in 100 (1%) AP event: 730mm
 - 1 in 1000 (0.1%) AP event: 350mm

- 7.80 As such there is a likely negligible effect and of Neutral significance to receptors on Site and existing properties upstream/downstream of the Site (outside the red line planning application boundary).

Surface Water Bodies and Drainage

- 7.81 The Developments will result in a change in the amount of impermeable surfacing across the Site. This could, without mitigation, result in an increase in surface water runoff entering the receiving watercourses, and potentially adversely affect the surface water flood risk in the area or increasing flows in the receiving systems, and therefore affecting flood risk on the Site or outside the red line Site Boundary. This is considered to be a permanent moderate adverse effect and of Moderate significance.

Surface Water and Groundwater Quality

- 7.82 The drainage from the Site is likely to contain contaminants from vehicles such as hydro-carbons, rubber and paint. After heavy rainfall, these contaminants could likely have a permanent moderate adverse effect and of Moderate significance on water quality within the receiving watercourses, and a permanent moderate adverse effect and of Slight significance on groundwater, both on Site and outside the red line planning application boundary (without mitigation).

Mitigation Measures

- 7.83 The following embedded mitigation is planned, for the construction and operational development phases as outline below.

Demolition & Construction Phase*Flood Risk*

- 7.84 All Developments will be located in Flood Zone 1, which is defined as land with less than 1 in 1,000 year annual probability of flooding.

- 7.85 No significant residual effects upon surface water bodies or with respect to groundwater, flood risk or drainage are anticipated on Site or outside the red line planning application boundary due to the employment of the mitigation measures to be included in the Construction Environmental Management Plan (CEMP) which will be secured through conditions attached to the planning consent.
- 7.86 Temporary construction activities (including construction compounds) will be located in Flood Zone 1. Site management procedures in the CEMP (i.e. ensure no storing of plant or materials adjacent to the ordinary watercourses etc.) will be provided to construction workers, providing details of the appropriate measures being undertaken to mitigate the impacts of the Developments build out.
- 7.87 Once mitigation is taken into account, the effects to both off site and on site receptors is considered to be temporary negligible adverse magnitude and of Slight significance.

Surface Water Drainage

- 7.88 During construction of the Development, the impermeable area of the Site could increase without mitigation. This has the potential to increase the likelihood of surface water flooding within the Site or outside the red line planning application boundary until the permanent drainage system (SuDS) is operational. This is considered to be a temporary moderate adverse effect.
- 7.89 The CEMP will be implemented as embedded mitigation, which will include the management of drainage from any earthworks, stockpiles and construction compounds. This could include drainage channels, sediment traps and attenuation. Stockpiles will be designed and positioned in order to minimise erosion, pollution of watercourses or increase flooding. A Method Statement will be prepared to outline how surface water drainage will be managed during the construction phase. This will be prepared for approval through the appropriate permitting and consenting process (e.g. Flood Risk Activity Permit, Land Drainage Consent).
- 7.90 Once constructed, the SuDS attenuation features on Site will reduce the surface water runoff during the later phases of the Developments demolition & construction work.
- 7.91 Once embedded mitigation is taken into account, the effects to both off site and on site receptors is considered to be temporary negligible adverse magnitude and of Slight significance.

Surface Water and Groundwater Quality

- 7.92 The Developments have the potential to increase the amount of soil particulates that could be mobilised by surface water flows, which could decrease the water quality of receiving watercourses etc, both on Site and outside the red line Site Boundary.
- 7.93 The presence of plant and other construction material on Site, including fuels/ hydrocarbons, also represent a potential source of contamination.
- 7.94 The Developments construction work, including cleaning, would also increase the likelihood of surface water contaminants becoming mobilised and entering the watercourses or existing surface water drainage features on Site and outside the red line Site Boundary.
- 7.95 A CEMP will be created for the Developments, with instructions as to the management and mitigation of any on-site water quality impacts in the demolition & construction phase. This will include measures to mitigate against risk to ground and surface waters from contaminated surface water runoff arising from general construction activities and the operation of construction vehicles (including wheel-washing should it be required). In addition, measures will be put in place to manage the migration of contaminants present on Site during any earthworks. Such measures may include the appropriate use of temporary bunding and settlement ponds to allow for isolation and on-site treatment of any sediment laden or contaminated water prior to discharge to the receiving watercourses.
- 7.96 Details of any potential temporary works on Site to prevent surface water runoff entering the watercourses may also be included in the CEMP for the construction phase, if considered appropriate.

- 7.97 Once embedded mitigation within the CEMP is taken into account, the effect to offsite receptors is considered to be temporary negligible adverse magnitude and of Slight significance.

Operational Phase

- 7.98 The post-completion stage is based on the provided masterplans and includes occupation of the Developments from 2029.

Flood Risk

- 7.99 The Developments will be located in Flood Zone 1, which is defined as land with less than 1 in 1,000 year annual probability of flooding. As such, the conveyance of the nearby watercourses will not be detrimentally affected, and flood risk will not increase on-site or off-site (outside the red line planning application boundary) as a result of these proposals.
- 7.100 Based on the above (and the relevant guidance) the proposals conform to the NPPF requirements. The proposed scheme is therefore considered to have Negligible impacts with regards to flood risk.
- 7.101 Therefore, the effect is considered to be negligible magnitude and of Slight significance.

Surface Water Bodies and Drainage

- 7.102 An overall strategy for the surface water drainage on Site has been developed. The key principles of the strategy are in accordance with stakeholder and policy requirements. These are:
- Following the discharge hierarchy surface water from the Developments will be discharged to the adjacent River Kennet main river via the existing outfalls.
 - The network will be designed with no flood during a 1 in 100 year rainfall event + 40% allowance for climate change.
 - The Developments incorporate areas of green roof which capture and store surface water on the building roof. The areas of green roof will provide retention, attenuation, treatment of rainwater and promote evapotranspiration.
 - Surface water from the Developments will be attenuated within underground cellular storage tanks before being discharged to the River Kennet at a controlled rate, which is significantly reduced (rate) in comparison to the existing drainage network.
- 7.103 The drainage strategy is based on serving the Developments, which will outfall to the attenuation features before ultimately outfalling to the receiving watercourses, as per the existing Site drainage regime.
- 7.104 The proposed drainage strategy submitted with the planning application for the Developments will ensure that potentially adverse effects generated by the Developments will be effectively mitigated, as attenuation storage will ensure that flood risk will not be increased, and treatment storage will reduce the likelihood of contaminants being conveyed to receiving watercourses.
- 7.105 Therefore, the effect is considered to be negligible magnitude and of Slight significance.

Surface Water and Groundwater Quality

- 7.106 The drainage strategy has been developed to demonstrate that it will be practical to provide a new surface water drainage network that will incorporate SuDS to manage runoff from the Developments.
- 7.107 SuDS, which incorporate treatment storage, have been proposed to be provided in advance of all outfalls where reasonably practical, to enable contaminants to be removed before water is discharged to the receiving watercourses and the wider aquatic environment.
- 7.108 The proposed drainage strategy will ensure that potentially adverse effects generated by the Developments will be effectively mitigated, as attenuation storage will ensure that flood risk will not be

increased, and treatment storage will reduce the likelihood of contaminants being conveyed to receiving watercourses.

7.109 The drainage strategy will mitigate against pollutants entering the WFD designated surface water bodies or groundwater bodies and causing impacts such that it is considered that there will be no change to surface water quality or aquifers as a result of the scheme.

7.110 Therefore, the effect is considered to be negligible magnitude and of Slight significance.

Residual Effects

Demolition & Construction Phase

7.111 The demolition & construction phase is expected to commence from September 2025 and includes initial demolition/ site preparation, groundworks and general construction activities associated with the Developments, up to 2029 (Operational phase).

7.112 **No significant residual effects** upon surface water bodies or with respect to groundwater, flood risk or drainage are anticipated due to the employment of the mitigation measures to be included in the CEMP.

Operational Phase

7.113 The post-completion stage is based on the provided masterplans and includes occupation of the Developments from 2029.

7.114 The successful implementation of the embedded mitigation measures should result in **no significant residual effects** with respect to flood risk, surface water and ground water quality or drainage.

Cumulative Effects

7.115 The Yield Hall Place 1 Development has been assessed cumulatively with the Yield Hall Place 2 Development and the cumulative effects of both the Developments assessed with the remaining cumulative schemes within the surrounding area (Chapter 2, EIA Methodology).

7.116 The projects presented in Chapter 2, Table 2.6 have been considered in conjunction with the Developments to assess the cumulative effects of development in the local area.

7.117 In accordance with national policy, other committed development schemes within the area will be required to incorporate measures to ensure that additional development does not have an adverse impact on flood risk or drainage, to both internal (on site) and external (off site) receptors. On this basis, these schemes will not increase flood risk to external receptors and therefore other developments.

7.118 It is considered that due to the nature of the Developments considered and/or its distance from the Site, the likely cumulative effects resulting from these are negligible.

7.119 The Developments will be categorised as 'nil detriment' in terms of drainage and flood risk related impacts. On this basis, there will be no cumulative effects within the local area (outside the red line planning application boundary) and catchment of the Kennet Operational Catchment or its tributaries.

Summary

7.120 As the likely significant effects are the same for both Yield Hall Place 1 and Yield Hall Place 2, Table 7.6 contains a summary of the likely significant effects for both the Developments.

Table 7.6: Yield Hall Place 1 & 2 Development Table of Significance – Water Resources and Flooding

Potential Effect	Nature of Effect (Permanent/ Temporary)	Significance (Major/Moderate/Minor) (Beneficial/Adverse/ Negligible)	Mitigation / Enhancement Measures	Residual Effects	
				Magnitude (Major/Moderate/Minor) (Beneficial/Adverse/ Negligible)	Significance
Demolition & Construction					
Impact on fluvial flooding (River Kennet & Holy Brook)	Temporary	Slight Adverse	CEMP and temporary works to control construction impacts.	Negligible Adverse	Slight
Impact on surface water flooding	Temporary	Moderate Adverse	CEMP and temporary works to control construction impacts.	Negligible Adverse	Slight
Impact on surface water quality	Temporary	Moderate Adverse	Pollution and control measures in CEMP to control construction impacts.	Negligible Adverse	Slight
Impact on groundwater quality	Permanent	Minor Adverse	Pollution and control measures in CEMP to control construction impacts.	Negligible Adverse	Slight
Completed Development					
Impact on fluvial flooding (River Kennet & Holy Brook)	Permanent	Neutral	Development restricted to Flood Zone 1 and SuDS to mitigate rainfall runoff into receiving watercourses and reduce flood risk.	Negligible	Slight
Impact on surface water flooding	Permanent	Moderate Adverse	SuDS to reduce surface water discharge to greenfield or lower rates	Negligible	Slight
Impact on surface water and groundwater quality	Permanent	Moderate Adverse	SuDS & provision of sewer capacity as necessary for development	Negligible	Slight

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