WATER RESOURCES & FLOOD RISK

14.1 INTRODUCTION

Company

This chapter of the ES has been prepared by Hydrock, an engineering design consultancy.

Author

The chapter has been authored by Jon Cracknell (BSc, MSc), a Senior Consultant with Hydrock, and reviewed by Dr. David Lloyd (BSc, PhD), a Technical Director with Hydrock. Both individuals are considered suitably qualified and experienced to prepare this chapter in the role of 'competent experts' in relation to water resources and flood risk.

Chapter Purpose

This chapter of the ES assesses the likely significant effects of the proposed development on the environment in terms of water resources and flood risk. The chapter and its supporting appendices describe the planning policy context; the assessment methodology; the baseline conditions at the application site and surroundings; the likely significant effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after these measures have been employed; and, the cumulative effects. In summary, the objectives of the chapter are to:

- Assess the likely significant effects of the proposed development on water resources and flood risk;
- Confirm any mitigation measures required to prevent, reduce or offset any significant adverse effects identified; and
- Evaluate likely residual effects of the proposed development on water resources and flood risk after any such mitigation measures have been employed.

Appendices

The following appendices should be consulted in relation to this chapter:

- Appendix 14.1: Flood Risk Assessment & Drainage Strategy report
- Appendix 14.2: Utilities Assessment report

14.2 METHODOLOGY

Guidance

Industry guidance and standards which have been consulted in the undertaking of this assessment and associated Appendices, are as follows:

- Guidelines for Environmental Impact Assessment, 2004 [1]
- Guidelines for Environmental Impact Assessment, 2006 [2]
- Strategic Flood Risk Assessment, 2008 [3]
- North Kent Rivers Catchment Flood Management Plan, 2009 [4]
- National Standards for Sustainable Drainage Systems, 2011 [5]
- Preliminary Flood Risk Assessment, 2011 [6]
- Surface Water Management Plan, 2013 [7]
- National Planning Policy Framework Flood Risk and Coastal Change Planning Practice Guidance, 2014 [8]
- Water Resources Management Plan 2015 – 2040, 2014 [9]
- Non-Statutory Technical Standards for Sustainable Drainage Systems, 2015 [10]
- The Building Regulations, Approved Document H: Drainage and Waste Disposal, 2015 [11]
- The SUDS Manual, 2015 [12]
- Drainage and Planning Policy Statement, 2017 [13]
- Strategic Flood Risk Assessment, 2017 [14]
- Water Resources Management Plan 2020 – 2100 [draft], 2018 [15]
- Flood Risk Assessments: Climate Change Allowances, 2019 [16]
- Sewers for Adoption 8th Edition, 2019 [17]

Legislation and Policy

The following summarises planning and environmental legislation and policies which are considered relevant to water resources and flood risk in relation to the proposed development, and accordingly have been consulted in the undertaking of the ES process:

- European
  - Water Framework Directive, 2000 [18]
  - Flood Directive, 2007 [19]
  - Whilst the implications on European environmental legislation is currently unclear post-Brexit, the above legislation is still currently in-force at the time of preparing this chapter, and as such is referenced accordingly.
- National
  - Environmental Protection Act, 1990 [20]
  - Water Industry Act, 1991 [21]
  - Land Drainage Act, 1994 [22]
  - Environment Act, 1995 [23]
  - Water Act, 2003 [24]
  - Flood Risk Regulations, 2009 [25]
  - Water Resources Act, 2009 [26]
  - Flood and Water Management Act, 2010 [27]
  - Water Environment (Water Framework Directive) (England and Wales) Regulations, 2017 [28]
  - National Planning Policy Framework, 2019 [29]
- Local
  - Local Development Framework: Core Strategy, 2011 [30]
  - Allocations and Development Management Plan, 2015 [31]
  - Kent and Medway Growth and Infrastructure Framework, 2018 [32]
  - Infrastructure Delivery Plan, 2019 [33]

Consultees

The following statutory bodies have been consulted in the undertaking of this assessment and associated Appendices. Consultations were undertaken November – December 2018 as part of the Scoping Opinion exercise:

- Environment Agency
- Kent County Council (in their role as Lead Local Flood Authority (LLFA))
- Thames Water

Scoping

Table 14.1 summarises the comments received as part of the Scoping Opinion from those consultation bodies concerned with the assessment of the likely significant effects of the proposed development on water resources and flood risk, along with commentary of how the comments have been addressed.

Table 0.1
Scoping Opinion responses

COMMENT	WHERE ADDRESSED
Need to prepare Flood Risk Assessment	Undertaken and included as Appendix 14.1.
Requirement to undertake a Surface Water Management Strategy, with reference to relevant guidance	The proposed means of surface water drainage is presented in the Flood Risk Assessment & Drainage Strategy report, included as Appendix 14.1. This has been prepared in accordance with all relevant guidance and legislation.
Potable water and waste water issues to be assessed, with specific consideration of: ■ Effect on sewage treatment and network infrastructure.	This has been assessed within this chapter and chapter 13.

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- Surface water drainage requirements and potential for on- and off-site flood risk.
- Anticipated demand for water supply and effect on network infrastructure.
- Phasing details to ensure infrastructure can be delivered ahead of occupation.
- Piling methodology, in respect potential effect on existing utility services.

Consideration of Climate Change

Climate change is integral to the assessment of potential effects and mitigation design in relation to water resources and flood risk. The assessment of flood risk across the study area takes into account the anticipated increase in river flows and rainfall intensity that would result from climate change, whereas the proposed surface water drainage system allows for the potentially larger, more intense and more frequent storms that are predicted.

This chapter adopts the latest Environment Agency climate change guidance which requires the adoption of climate change allowances on a catchment basis, and subject to the 'flood risk vulnerability' and design life of a proposed development.

The following climate change allowances have been adopted for the purposes of this chapter, in accordance with the Environment Agency's guidance:

- Assessment of fluvial flood risk: + 25% ('Central' climate change allowance), + 35% ('Higher Central' climate change allowance) and + 70% ('Upper End' climate change allowance), applied to the 1 in 100 year flood event.
- Assessment of surface water flood risk: + 20% ('Central' climate change allowance) and + 40% ('Upper End' climate change allowance), applied to the 1 in 100 year storm event.
- Design of surface water drainage system: + 40% ('Upper End climate change allowance), applied to the 1 in 100 year storm event.

Wider consideration of climate change in the context of the proposed development is addressed at Appendix 2.4, Vol III of this ES.

Consideration of Human Health

Human health is an indirect consideration within this chapter, specifically in relation to foul water drainage. This is on the basis that any increase in the rate and volume of foul water discharge from a site, if unmanaged, could result in a decrease in water quality in any receiving waterbodies, which if used for consumptive purposes, could have an adverse effect on human health.

Wider consideration of human health in the context of the proposed development is addressed at Appendix 2.5, Vol III of this ES.

Consideration of Risk of Major Accidents and/or Disasters

Depending on their scale, flood risk events can be considered as major accidents / disasters, and as such the consideration of such scenarios is relevant to this chapter.

Furthermore, 'design exceedance events' (i.e. a scenario of a greater magnitude and/or intensity than the design capacity of infrastructure, such as a prolonged and/or intense rainfall event overwhelming drainage infrastructure) which can likewise be considered as major accidents / disasters, are also considered in relation to the application of design interventions / mitigation measures.

Wider consideration of the risks of major accidents and disasters in the context of the proposed development is addressed at Appendix 2.6, Vol III of this ES.

Alternatives

Chapter 4 outlines the alternatives considered in relation to the proposed development.

With specific reference to this chapter, alternative design interventions / mitigation measures have been considered in relation to the potential technical solutions for surface and foul water management and disposal. The Flood Risk Assessment & Drainage Strategy report, included as Appendix 14.1, outlines the alternative drainage strategy management and disposal options explored; the opportunities and constraints posed by each option; and, details the reasoning behind the selected proposed approaches.

Assessment of Baseline Conditions & Receptor Sensitivity

The Flood Risk Assessment & Drainage Strategy and Utilities Assessment reports (included as Appendices 14.1 and 14.2 respectively), undertaken in accordance with the guidance described above and in consultation with statutory consultees, were used to inform the baseline conditions and assessment of likely significant effects in this chapter.

The baseline conditions at the application site were also established through:

- A Topographical Survey of application site to establish details including local topography and existing water infrastructure.
- Review of secondary data and mapping sources, provided by the Environment Agency, Severnoaks District Council, Kent County Council, and Thames Water.
- Consultation with the Environment Agency, Severnoaks District Council, Kent County Council, and Thames Water.
- Ground investigations to establish geological and hydrogeological conditions, to inform surface water management and disposal options.

The study area for this chapter principally comprises the application site, but extends to the relevant natural and man-made water resource catchments where necessary, i.e. the Upper Cray and Upper Darent catchments downstream of the application site with respect to flood risk and surface/foul water discharges; the Thames Water sewer network area which serves the application site; and, the 'London Water Resource Zone' with regard to potable water.

In addition, all other areas within a 250m radius of the application site are included within the study area in order to assess the potential effects on relevant identified receptors in upstream areas.

This chapter considers the existing baseline situation, as of 2019; the demolition / enabling works stage from 2020 – 2021; the construction stage from 2021 – 2030; and, the operational stage from 2023.

National Planning Policy Framework Flood Risk and Coastal Change Planning Practice Guidance (2014) requires consideration of a 100 year 'design life' for new development in relation to climate change allowance. As such, the operational stage is assessed from 2023 – 2130 (100 years from the final completion year of 2030).

Acknowledging comments received as part of the Scoping Opinion response, and in accordance with the guidance noted above, the water resource and flood risk receptors to be assessed include:

- Flood risk (specifically in relation to flood risk within the application site and downstream catchments).
- Surface water drainage (specifically in relation to capacity / flood risk within the application site and downstream catchments).
- Foul water drainage (specifically in relation to drainage capacity within receiving sewer system / Sewage Treatment Works (STW); and, human health, including construction workers, future application site occupants, and the general population within the study area).
- Potable water demand (specifically in relation to water resource availability within 'Water Resource Zone').

Table 0.2 sets out the scale of sensitivity that has been applied to receptors identified and considered within this assessment.

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Table 0.2

Scale of water resource and flood risk sensitivity used in the assessment

SENSITIVITY	DESCRIPTION
Very High	No ability to absorb effect without fundamentally altering baseline condition, and/or is of international importance, such as: ■ Within Flood Zone 3b / very high risk of flooding identified. ■ No capacity within discharge receiving environment, i.e. drainage system and/or waterbody. ■ Water resources classified as under very 'serious' water stress.
High	Little ability to absorb effect without fundamentally altering baseline condition, and/or is of national importance, such as: ■ Within Flood Zone 3a / high risk of flooding identified. ■ Restricted capacity within discharge receiving environment, i.e. drainage system and/or waterbody. ■ Water resources classified as under 'serious' water stress.
Medium	Moderate capacity to absorb effect without significantly altering baseline condition, and/or is of regional importance, such as: ■ Within Flood Zone 2 / medium risk of flooding identified. ■ Limited capacity within discharge receiving environment, i.e. drainage system and/or waterbody. ■ Water resources classified as under 'moderate' water stress.
Low	Receptor tolerant of effect without detriment to baseline condition, and/or is of local importance, such as: ■ Within Flood Zone 1 / low risk of flooding identified. ■ Unrestricted capacity within discharge receiving environment, i.e. drainage system and/or waterbody. ■ Water resources classified as under 'low' water stress.
Negligible	Receptor tolerant of effect without any effect to baseline condition, and/or is of no importance, such as: ■ Within Flood Zone 1 / negligible risk of flooding identified. ■ Unlimited capacity within discharge receiving environment, i.e. drainage system and/or waterbody. ■ No water resource stress identified.

Assessment of Magnitude

The assessment was undertaken based on the description of the proposed development contained in chapter 3 of this ES. Table 0.3 indicates the scale of impact magnitude that has been used in undertaking the assessment.

Table 0.3

Scale of magnitude for water resource and flood risk effects used in the assessment

MAGNITUDE	DESCRIPTION
Very large	Total loss or major alteration to key elements / features of the baseline conditions such that the character / composition / attributes will be fundamentally changed, such as: ■ Flood risk posed to the application site and/or within study area. ■ Capacity within discharge receiving environment, i.e. drainage system and/or waterbody. ■ Water resources available within the 'Water Resource Zone'.
Large	Loss or substantial alteration to one or more key elements / features of the baseline conditions such that character / composition / attributes of the baseline will be materially changed, i.e. loss or alteration to those attributes noted above.
Medium	A shift away from baseline conditions. Change arising from the loss / alteration will be discernible / detectable, but not material. The underlying character / composition / attributes of the baseline condition will be similar to the baseline circumstances / situation, i.e. measurable change to those attributes noted above.
Small	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation, i.e. no measurable change to those attributes noted above.

Assessment of Significance

The assessment of significance within this chapter is based on the matrix presented in Table 14.4.

Table 0.4

Significance Matrix

MAGNITUDE OF EFFECT	SENSITIVITY OF RECEPTOR				
	Very High	**High**	**Medium**	**Low**	**Neg.**
Very Large	Major Sig.	Major Sig.	[3]	Mod. Sig.	[1]
Large	Major Sig.	[3]	Mod. Sig.	Minor Sig.	[2]
Medium	[3]	Mod. Sig.	Minor Sig.	[2]	Neg. Sig.
Small	Mod. Sig.	Minor Sig.	[2]	Neg. Sig.	Neg. Sig.
Negligible	[1]	[2]	Neg. Sig.	Neg. Sig.	Neg. Sig.

[1] The choice between 'Moderate Significance', 'Minor Significance' and 'Negligible Significance' will depend on the specifics of the impact and will be down to professional judgement and reasoning.

[2] The choice between 'Minor Significance' and 'Negligible Significance' will depend on the specifics of the impact and will be down to professional judgement and reasoning.

[3] The choice between 'Major Significance' and 'Moderate Significance' will depend on the specifics of the impact and will be down to professional judgement and reasoning.

n.b. 'Negligible Significance' includes 'Neutral' and 'No Impact' assessments.

Sig.	Significance
Mod.	Moderate
Neg.	Negligible

Relevant Associated Development

The need for off-site utility infrastructure upgrading works, such as surface water network infrastructure, foul water sewage treatment and network infrastructure, and potable water infrastructure is currently unknown, and as such will be assessed at Reserved Matters stage as part of a 'multi-stage' assessment approach.

Assumptions/Limitations

In undertaking the water resource and flood risk assessment of the application site and wider surrounding area, there are a number of limitations and constraints affecting the outputs from this work. These include:

- The water resource and flood risk receptors have been defined using a combination of published data sources, and project-specific assessments. The availability of published data with which to inform this assessment is considered robust and therefore this approach is considered acceptable.
- The assessment process is designed to enable good decision-making based on the best possible information about the environmental implications of a proposed development. However, there will always be some uncertainty as to the exact scale and nature of the environmental effects identified. Where this is the case, this has been highlighted in the assessment of effects. This arises through the detail of information available at the time of the assessment and the limitations of the prediction process itself.

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14.3 BASELINE CONDITIONS

KEY RECEPTORS	DESCRIPTION	SENSITIVITY	FURTHER INFORMATION
Flood risk at the application site	The entirety of the application site is shown to be within Flood Zone 1, i.e. land having a less than 1 in 1,000 annual probability of fluvial or tidal flooding. The nearest watercourses to the application site are the River Darent and the Twitton Brook which are approximately 1.5km and 1.1km due east of the application site respectively. The floodplains of both these watercourses are at a level of around 57mAOD, some 120m lower than the lowest point of the application site. At this location these watercourses are not tidal. The application site is therefore concluded to be at negligible risk of fluvial and tidal flooding. The Environment Agency's Flood Risk from Surface Water mapping shows the majority of the application site to be at 'very low' risk of surface water flooding. The topographically elevated position of the application site means that there is no catchment draining in to the application site from higher ground. Couple this with the relatively permeable bedrock and expected low groundwater table, any overland flows are likely to be negligible and associated only with the developed areas of the application site where existing drainage is absent. There are a number of localised areas within the application site that are shown to be at potentially increased risk of surface water flooding. However, these areas are considered to be associated with existing impermeable areas which are likely to be positively drained. Sevenoaks District Council's Strategic Flood Risk Assessment (SFRA) does not record any previous surface water flooding incidents within the vicinity of the application site. The application site is therefore concluded to be at low risk of surface water 'ponding' / flooding. The application site is underlain by a layer of clay estimated to be between circa 0m and 12m in thickness. Upper, middle and lower chalk formations, classified as Principal Aquifers, are located beneath the clay. Due to the impermeable nature of clay, it is likely to act as an aquiclude and prevent groundwater from the aquifer from rising to the surface. Kent County Council's Preliminary Flood Risk Assessment (PFRA) indicates that the application site is located in a 'negligible' groundwater flood risk area. Furthermore, groundwater has not been encountered at the application site during previous Site Investigations. Mapping contained within Kent County Council's Surface Water Management Plan (SWMP) shows that no groundwater flooding has occurred at or in the vicinity of the application site, with the closest recorded incident being approximately 4.6km to the southeast of the application site where ground levels are much lower. The risk of groundwater flooding to the application site is therefore concluded to be low. According to Thames Water and Kent County Council's SWMP, the majority of the application site falls within a postcode area that has been subject to between one and three occurrences of sewer flooding. The southeastern area of the application site is shown to be in a postcode that has had seven to eight recorded incidents of sewer flooding. However, previous consultation with Thames Water has confirmed that there is no public sewerage infrastructure present within the application site and therefore these recorded flood events are assumed to have occurred at locations outside the application site boundary. The risk of flooding to the application site from surcharged sewers is therefore considered to be low. Reference to the Environment Agency's Flood Risk from Reservoirs mapping indicates that the application site will not be subject to flooding as a result of reservoir failure in the area. There are no other significant artificial bodies of water within close proximity to the application site and the risk of flooding from infrastructure failure is therefore considered low. Based on the 'low' risk of flooding identified at the application site, this receptor is concluded to be of 'low' sensitivity. The above baseline conditions are considered to remain the same in the future baseline scenario, i.e. with the consented scheme in place.	Low	Section 3, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1
Surface water drainage at the application site	The application site is currently largely developed (there are approximately 300 buildings present on the application site along with associated infrastructure) and therefore there is an existing drainage system in place. Existing records show surface water run-off from the application site either infiltrates into the subsoil via shallow soakaways or is discharged into the surrounding woodland via private drainage systems. Whilst this method of surface water management offers sustainable benefits in terms of its ability to recharge the natural ground water system, support biodiversity and facilitate improvements to water quality through filtration, it is not considered a robust solution to serve the proposed development and would be expected to be unacceptable by the Lead Local Flood Authority. On the basis that the receiving environment, i.e. the ground, has 'limited' capacity based on the maximum infiltration capacity of the ground, this receptor is concluded to be of 'medium' sensitivity. The above baseline conditions are considered to remain the same in the future baseline scenario, i.e. with the consented scheme in place, assuming no mitigation.	Medium	Section 5, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1
Foul water drainage at the application site	The application site is served by a private foul water sewer network, which drains by gravity (and a portion of the application site by a pumping station) into an existing Thames Water sewer along Polhill Road. Based on the existing building footprints, it has been estimated that the existing peak foul discharge from the application site is 95.42l/s, based on the existing employment space gross internal floor area of 91,749m². Previous consultation with Thames Water has indicated through a Pre-Development Enquiry that the existing sewer network does not have sufficient capacity to accommodate all the predicted foul water flows from the proposed development. Based on the 'restricted' capacity within the sewer system, this receptor is concluded to be of 'high' sensitivity. The above baseline conditions are considered to remain the same in the future baseline scenario, i.e. with the consented scheme in place, assuming no mitigation.	High	Section 5, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1

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KEY RECEPTORS	DESCRIPTION	SENSITIVITY	FURTHER INFORMATION
Potable water demand at the application site	Potable water is currently supplied to the application site by Thames Water. Between 2001 and 2011, water consumption at the application site has fluctuated between approximately 254,815m^3/day and 144,295m^3/day. The Environment Agency classify the Thames Water region as being under 'serious' water stress, the highest classification [34]. Thames Water's existing Water Resources Management Plan 2015 – 2040 indicates that over a forecast period to 2040 there is likely to be a significant demand on water supply in the 'London Water Resource Zone' (within which the application site is located). To address this, the Water Resources Management Plan 2015 – 2040 details a variety of measures to ensure that sufficient supply is available to meet demand during the plan period. Thames Water's draft Water Resources Management Plan 2020 – 2100 (which will supersede the previous Plan) also states that "The baseline forecasts … show that there is a significant supply-demand deficit against the dry year annual average … demand … in London throughout the planning period … The deficit is largely driven by the combination of population growth and reductions in raw water availability due to the impacts of climate change. By the implementation of our preferred plan (combining demand management and resource development), the supply/demand deficit will be removed … and the supply and demand for water will remain in balance throughout the remainder of the planning period". Based on the 'serious' water stress identified, this receptor is concluded to be of 'high' sensitivity. The above baseline conditions are considered to remain the same in the future baseline scenario, i.e. with the consented scheme in place, assuming no mitigation.	High	Utilities Assessment report, Appendix 14.2

14.4 POTENTIAL SIGNIFICANT IMPACTS

PHASE	DESCRIPTION	ADVERSE/BENEFICIAL
Construction	The proposed development has the potential to result in changes in flood risk at the application site and in the surrounding area during the construction phase as a result of the mounding of materials and placement of other structures within areas identified as being at risk of flooding which could result in a loss of floodplain storage and/or the alteration of overland flow characteristics / routes. Such changes could increase the flood risk posed to the application site and in the surrounding area.	Adverse
Construction	The proposed development has the potential to result in changes to surface water drainage at the application site during the construction phase as a result of: ■ The movement of plant and enabling ground works within existing permeable areas could alter the infiltration characteristics of the ground and thereby increase the rate and volume of surface water run-off from such areas. ■ The construction of buildings, highways and other hard surfaces within existing permeable areas could increase the rate and volume of surface water run-off from such areas. ■ The breaking-up and removal of existing hard standing areas could reduce the rate and volume of surface water run-off from such areas. An increase or decrease in the surface water run-off rate and volume from the application site could have an adverse or beneficial impact upon the capacity of the receiving environment (i.e. drainage system and/or waterbody) respectively.	Adverse or beneficial
Construction	The proposed development has the potential to result in changes to foul water drainage at the application site during the construction phase as a result of changes to the rate and volume of foul water discharged from the application site, through construction and related welfare activities. An increase or decrease in the foul water discharge rate and volume from the application site could have an adverse or beneficial impact upon the capacity of the receiving environment (i.e. drainage system) respectively.	Adverse or beneficial
Construction	The proposed development has the potential to result in changes to potable water demand at the application site during the construction phase as a result of changes to potable water use, through construction and related welfare activities. An increase or decrease in potable water demand at the application site could have an adverse or beneficial impact upon water resources available within the 'Water Resource Zone' respectively.	Adverse or beneficial
Operation	The proposed development has the potential to result in changes in flood risk at the application site and in the surrounding area during the operational phase as a result of the placement of proposed structures and buildings within areas identified as being at risk of flooding which could result in a loss of floodplain storage and/or the alteration of overland flow characteristics / routes. Such changes could increase the flood risk posed to the application site and in the surrounding area.	Adverse
Operation	The proposed development has the potential to result in changes to surface water drainage at the application site during the operational phase as a result of changes to the portion of impermeable surfacing across the application site as a result of the proposed layout, i.e. an increase in the presence of buildings, highways and other hard surfaces could increase the rate and volume of surface water run-off from the application site, whereas an increase in permeable areas, such as landscaping, could decrease the rate and volume of surface water run-off from the application site. An increase or decrease in the surface water run-off rate and volume from the application site could have an adverse or beneficial impact upon the capacity of the receiving environment (i.e. drainage system and/or waterbody) respectively.	Adverse or beneficial
Operation	The proposed development has the potential to result in changes to foul water drainage at the application site during the operational phase as a result of changes to the rate and volume of foul water discharged from the application site, through the occupation and use of the proposed development. An increase or decrease in the foul water discharge rate and volume from the application site could have an adverse or beneficial impact upon the capacity of the receiving environment (i.e. drainage system) respectively.	Adverse or beneficial
Operation	The proposed development has the potential to result in changes to potable water demand at the application site during the operational phase as a result of changes to potable water use, through the occupation and use of the proposed development. An increase or decrease in potable water demand at the application site could have an adverse or beneficial impact upon water resources available within the 'Water Resource Zone' respectively.	Adverse or beneficial

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14.5 DESIGN INTERVENTIONS

DESIGN INTERVENTION	DESCRIPTION	REASON FOR INTERVENTION	FURTHER INFORMATION
New surface water drainage system	The proposed SUDS based system entails the management of rainfall within the application site by routing surface water to attenuation ponds and tanks which discharge to deep borehole soakaways. The overall system has been designed to accommodate the 1 in 100 year + 40% storm event.	Ensure surface water is managed and discharged in accordance with current guidance, and offer a more formalised strategy compared to the existing baseline condition, with a greater design capacity, thereby reducing the risk of surface water flood risk within the application site and downstream catchments.	Section 5, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1
New foul water drainage system	The proposed system incorporates the management of foul water within the application site by routing foul water to pumping stations which discharge to the existing Thames Water sewer network. The system will incorporate storage in combination with any off-site utility infrastructure upgrading works (if necessary, in accordance with Thames Water's requirements).	Ensure foul water is managed and discharged in accordance with current guidance, thereby ensuring the capacity of the receiving sewer network and STW is not exceeded; demand on the network is reduced compared to the baseline condition; and, human health, including that of future application site occupants, and the general population within the study area, is not adversely impacted.	Section 5, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1

14.6 ASSESSMENT PRE-MITIGATION (INCLUDING DESIGN INTERVENTION)

PHASE	RECEPTOR(S) AFFECTED	IMPACT	MAGNITUDE PRE-MITIGATION	SIGNIFICANCE PRE-MITIGATION	MITIGATION PROPOSED?	FURTHER INFORMATION
Construction	Flood risk at the application site and in the surrounding area	The application site is within Flood Zone 1, and at low risk of flooding from all other sources assessed. As such, construction activities, such as the mounding of materials and placement of other structures, are not anticipated to occur within areas identified as being at risk of flooding and therefore there will be no loss of floodplain storage and/or the alteration of overland flow characteristics / routes. On the basis that the flood risk posed to the application site and in the surrounding area is not expected to change as a result of the construction of the proposed development, no significant impacts are anticipated. The ES for the consented extant scheme did not assess flood risk, as a receptor, and therefore no comparison is possible between the two assessments.	Negligible	Negligible	No	Section 3, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1
Construction	Surface water drainage at the application site	Given the existing developed nature of the application site, construction activities are not expected to notably alter the amount of impermeable surfacing across the application site, and therefore no significant alteration in the rate and/or volume of surface water run-off is anticipated. Furthermore, existing utility (drainage) infrastructure is to be retained during the initial construction phase. Acknowledging that a notable change in the rate and/or volume of surface water run-off is not expected, and consequently there is no demonstrable change anticipated to the capacity of the receiving environment (i.e. drainage system / ground), no significant impacts are anticipated. The ES for the consented extant scheme did not assess surface water drainage as a receptor in the construction phase, and therefore no comparison is possible between the two assessments.	Negligible	Negligible	No	Section 5, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1
Construction	Foul water drainage at the application site	Significant volumes of foul water are not expected to be generated during the construction phase of the proposed development, particularly compared to the baseline condition, with foul discharges limited to 'standard' construction activities and associated welfare facilities. Furthermore, existing utility (drainage) infrastructure is to be retained during the initial construction phase. Acknowledging that an increase in the rate and/or volume of foul water discharge is not expected, and consequently there is no demonstrable adverse change anticipated to the capacity of the receiving environment (i.e. drainage system), no significant impacts are anticipated. The ES for the consented extant scheme did not assess foul water drainage as a receptor in the construction phase, and therefore no comparison is possible between the two assessments.	Negligible	Negligible	No	Section 5, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1
Construction	Potable water demand at the application site	Anticipated potable water uses during the construction phase will include welfare facilities, contamination remediation (if necessary), construction activities (e.g. mortar silos, concrete mixing and internal wet trades etc.) and cleaning operations (e.g. wheel wash and road sweepers etc.). However, the water demand of such activities is not anticipated to be greater than the current baseline condition. Acknowledging that an increase in potable water demand is not expected, and consequently there is no demonstrable adverse change anticipated to the water resources available within the 'Water Resource Zone', no significant impacts are anticipated. The ES for the consented extant scheme did not assess potable water demand as a receptor in the construction phase, and therefore no comparison is possible between the two assessments.	Negligible	Negligible	Yes	Utilities Assessment report, Appendix 14.2

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PHASE	RECEPTOR(S) AFFECTED	IMPACT	MAGNITUDE PRE-MITIGATION	SIGNIFICANCE PRE-MITIGATION	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Flood risk at the application site and in the surrounding area	The application site is within Flood Zone 1, and at low risk of flooding from all other sources assessed. As such, operational activities, such as the placement of proposed structures and buildings, are not anticipated to occur within areas identified as being at risk of flooding and therefore there will be no loss of floodplain storage and/or the alteration of overland flow characteristics / routes. On the basis that the flood risk posed to the application site and in the surrounding area is not expected to change as a result of the operation of the proposed development, no significant impacts are anticipated. The ES for the consented extant scheme did not assess flood risk, as a receptor, and therefore no comparison is possible between the two assessments.	Negligible	Negligible	No	Section 3, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1
Operation	Surface water drainage at the application site	Given the existing developed nature of the application site, the proposed development is not expected to notably alter the amount of impermeable surfacing across the application site, and therefore no significant alteration in the rate and/or volume of surface water run-off is anticipated. However, a new Sustainable Drainage System (SUDS) based surface water drainage system 'design intervention' (as noted in Table 14.7) will be installed during the construction phase of the proposed development to manage rainfall within the application site. The proposed strategy will ensure that surface water is managed and discharged in accordance with current guidance, and offer a more formalised strategy compared to the existing baseline condition, with a greater design capacity, thereby reducing the risk of surface water flood risk within the application site and downstream catchments. As such, whilst acknowledging that a notable change in the rate and/or volume of surface water run-off generated from the application site is not expected, a substantial beneficial alteration is anticipated to the capacity of the receiving environment (i.e. drainage system) as a result of the proposed 'design intervention'. The ES for the consented extant scheme assessed the potential effect of the operation of the proposed development on surface water drainage to be of minor beneficial significance. The slight difference in 'minor' and 'moderate' beneficial significance conclusions is considered to be based on the difference in design capacities of the proposed surface water drainage system for each application, based on climate change allowances (i.e. 20%/30% allowances for the consented extant scheme, compared to 40% for the proposed development).	Large	Moderate beneficial	No	Section 5, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1
Operation	Foul water drainage at the application site	Whilst the occupation and use of the proposed development could alter the rate and volume of foul water generated within the application site, a beneficial impact is anticipated based on the new foul water drainage system 'design intervention' which is designed to manage and discharge foul water in accordance with current guidance, thereby ensuring the capacity of the receiving sewer network and STW is not exceeded; demand on the network is reduced compared to the baseline condition; and, human health, including that of future application site occupants, and the general population within the study area, is not adversely impacted. As such, whilst acknowledging that the rate and volume of foul water generated within the application site could alter, a substantial beneficial alteration is anticipated to the capacity of the receiving environment (i.e. drainage system) as a result of the proposed 'design intervention'. The ES for the consented extant scheme assessed the potential effect of the operation of the proposed development on foul water drainage to be of minor beneficial significance. The slight difference in 'minor' and 'moderate' beneficial significance conclusions is considered to be based on the acknowledgement of any necessary off-site utility infrastructure upgrading works as a 'design intervention' at the pre-mitigation assessment stage in this ES, unlike the previous assessment which did not consider such interventions.	Large	Moderate beneficial	No	Section 5, Flood Risk Assessment & Drainage Strategy report, Appendix 14.1
Operation	Potable water demand at the application site	Based on the proposed uses compared to the existing application site use, the potable water demand of the proposed development during its operation is not anticipated to be substantially greater than the current baseline condition. Acknowledging that a notable increase in potable water demand is not expected, and consequently there is no demonstrable adverse change anticipated to the water resources available within the 'Water Resource Zone', no significant impacts are anticipated. The ES for the consented extant scheme assessed the potential effect of the operation of the proposed development on potable water demand to be of minor beneficial significance. The slight difference in 'minor' beneficial and 'negligible' significance conclusions is considered to be based on the greater number of residential dwellings as part of the proposed development compared to the consented extant scheme, which could therefore demonstrate a slight reduction, and hence minor beneficial effect, in potable water demand compared to the baseline situation.	Negligible	Negligible	Yes	Utilities Assessment report, Appendix 14.2

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14.7 MITIGATION & ENHANCEMENT MEASURES

PHASE	POSSIBLE EFFECT BEING MITIGATED	MITIGATION MEASURE	HOW SECURED / TRIGGER	MAGNITUDE POST-MITIGATION	ADVERSE/BENEFICIAL	FURTHER INFORMATION
Construction	Increase in potable water demand	Given the essential use of water during the construction phase, it is not feasible to actively restrict water usage. Nevertheless, standard measures will be incorporated into the construction phase to limit potable water demand, use and wastage wherever practicable (i.e. ensure water supply connections are not leaking etc.). These measures will be formalised in a Construction Environmental Management Plan (CEMP) for the proposed development.	Planning condition	Negligible	No impact	Chapters 5 & 13
Operation	Increase in potable water demand	Standard measures will be incorporated through the detailed design of the proposed development to reduce water use. Such measures will likely include installation of water efficient welfare devices, and landscaping and open space areas designed to be of low water use. All residential buildings will be required to achieve Lifetime Homes standards and Code for Sustainable Homes (or equivalent scheme) Level 4 ($\leq$105 litres per person per day potable water demand) as a minimum. Confirmation will also be sought from Thames Water to ascertain whether their existing infrastructure is sufficient to supply the proposed development, with any necessary off-site reinforcement works being undertaken as part of the construction phase.	Planning condition	Negligible	No impact	Sustainability Statement report

14.8 ASSESSMENT POST-MITIGATION

PHASE	RECEPTOR	RESIDUAL IMPACT	RESIDUAL EFFECT SIGNIFICANCE	ADV/BEN	ST/MT/LT	D/IND	P/T	R/IRR
Construction	Flood risk at the application site and in the surrounding area	No mitigation proposed, and therefore no change from pre-mitigation assessment.	Negligible	No impact	-	-	-	-
Construction	Surface water drainage at the application site	No mitigation proposed, and therefore no change from pre-mitigation assessment.	Negligible	No impact	-	-	-	-
Construction	Foul water drainage at the application site	No mitigation proposed, and therefore no change from pre-mitigation assessment.	Negligible	No impact	-	-	-	-
Construction	Potable water demand at the application site	Despite mitigation measure proposed, this is not considered to have a demonstrable effect on water resource availability within the 'Water Resource Zone', and therefore no change from the pre-mitigation assessment is anticipated.	Negligible	No impact	-	-	-	-
Operation	Flood risk at the application site and in the surrounding area	No mitigation proposed, and therefore no change from pre-mitigation assessment.	Negligible	No impact	-	-	-	-
Operation	Surface water drainage at the application site	No mitigation proposed, and therefore no change from pre-mitigation assessment.	Moderate	Beneficial	Long-term	Direct	Permanent	Reversible
Operation	Foul water drainage at the application site	No mitigation proposed, and therefore no change from pre-mitigation assessment.	Moderate	Beneficial	Long-term	Direct	Permanent	Reversible
Operation	Potable water demand at the application site	Despite mitigation measure proposed, this is not considered to have a demonstrable effect on water resources available within the 'Water Resource Zone', and therefore no change from the pre-mitigation assessment is anticipated.	Negligible	No impact	-	-	-	-

Key: ADV/BEN= Adverse/Beneficial; ST/MT/LT = Short-term/Medium-term/Long-term; D/IND = Direct/Indirect; P/T = Permanent/Temporary; R/IRR = Reversible/Irreversible

14.9 WATER RESOURCES & FLOOD RISK: INTER-CUMULATIVE SCHEME IMPACTS

No cumulative schemes have been considered.

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