

12 Hydrology (including Flood Risk and Drainage)

12.1 Introduction

- 12.1.1 This chapter of the Environmental Statement (ES) has been produced by JPP Consulting Ltd to set out the methodology for the assessment of the Proposed Development on Hydrology, Flood Risk and Drainage.
- 12.1.2 The assessment will appraise the potential effects, in regard to the above issues, of the Proposed Development upon the Site, and include any potential impacts the Proposed Development will have on the surrounding areas.
- 12.1.3 The analysis synthesises information from multiple authoritative sources, including the Environment Agency's Catchment Data Explorer.
- 12.1.4 The assessment also draws on updated national planning policy, including the National Planning Policy Framework (NPPF, August 2026), which reaffirms the need for development to avoid increased flood risk, incorporate sustainable drainage systems (SuDS), and adapt appropriately to climate change impacts on rainfall and runoff patterns.
- 12.1.5 Climate resilience considerations incorporate the Environment Agency's updated climate change allowances (2025), which outline revised expectations for applying UKCP18 projection data to assess future flood risk, including peak rainfall intensity increases for 2050s scenarios (Central estimates). These climate projections inform both the future baseline and the scale of SuDS required.
- 12.1.6 The flood risk associated with the Proposed Development has been assessed in accordance with the NPPF and the standalone Flood Risk Assessment and Drainage Strategy (Appendix 12.1). The Surface Water Drainage Strategy considers the existing regime, discharge points and rates, expected flows and attenuation volumes, SuDS feasibility and the proposed foul and surface water drainage strategy.

Legislative / Policy Background

- 12.1.7 Summary of relevant legislation and planning policies are as follows;
- Water Framework Directive (2000/60/EC) as transposed by the Water Environment (Water Framework Directive) Regulations 2003 – holistic management of the water environment and prevention of deterioration.
 - Flood and Water Management Act 2010 – comprehensive management of flood risk and encouragement of Sustainable Drainage Systems (SuDS).
 - Land Drainage Act 1991 and Water Resources Act 1991 (as amended) – responsibilities and consenting regimes for works in and near watercourses and discharges to controlled waters.
 - National Planning Policy Framework (NPPF) and National Planning Practice Guidance (Flood Risk and Coastal Change; Water Supply, Wastewater and Water Quality) – sequential approach to flood risk, accounting for all sources of flooding and climate change.

- Building Regulations Part H – surface water discharge hierarchy (infiltration; watercourse; public sewer).
- Local policy: Wokingham Borough Core Strategy and Managing Development Delivery Local Plan – CC09 Development and Flood Risk; CC10 Sustainable Drainage; CC04 Sustainable Design and Construction.

Planning Practice Guidance – Sequential Test

12.1.8 The Planning Practice Guidance (PPG) September 2025 update confirms that the Sequential Test must now consider all sources of flooding—including surface water, sewer, groundwater and reservoir risks—rather than only fluvial/tidal flood zone designations.

12.1.9 This change has implications for the methodology, requiring:

- Identification of all local flood pathways
- Assessment of both existing and future (climate-adjusted) flood risk
- Evidence that development is placed in the lowest-risk area possible

National SuDS Standards

12.1.10 The drainage strategy evaluation is guided by the National SuDS Standards (DEFRA, 30 July 2025), which introduces strengthened requirements for:

- Runoff destination hierarchy (reuse → infiltration → watercourse → sewer)
- Mandatory first 5 mm interception for most events
- Multi-stage treatment for water quality protection
- Amenity and biodiversity contributions
- Climate change integration across drainage design

12.1.11 These standards inform the scale and type of SuDS selected for the operational development

Background to the Site

Adjacent Development

12.1.12 Contextually, the Proposed Development Site, in which this ES is reporting upon, is part of a wider mixed-use development at the Former Arborfield Studios (Parcels W, Y and Z), Arborfield Green. The planning history associated with the wider Site dates back to October 2014, consisting of an outline planning application. Outline planning permission was granted in April 2015 by Wokingham Borough Council.

12.1.13 At the time of writing, it is noted that a separate outline planning application for a proposed residential development (Land south of Langley Common Road Arborfield Green Wokingham), located adjacent to the Proposed Development has been submitted. This development is to comprise of up to 660 residential dwellings and is located beyond the Proposed Developments northern boundary.

12.2 Assessment Methodology

- 12.2.1 The proposed drainage strategy is to present a sustainable surface water drainage strategy addressing the potential impact of the Proposed Development on the existing Site.
- 12.2.2 As per the outline planning permission granted in April 2015 by Wokingham Borough Council (0/2014/2280), the proposed Surface Water Drainage Strategy for the wider Arborfield Green Site centres upon a catchment strategy, comprising of 25 drainage catchments.
- 12.2.3 The Proposed Development is located within four of these catchments. These being catchments 16, 18, 19 and 21.
- 12.2.4 Surface water flows from drainage catchment 18, located to the western extent of the Site, will discharge into an existing ditch network located along Langley Common Road. Surface water flows from drainage catchment 21, located to the eastern extent of the Site, will discharge into the existing watercourse (Barkham Brooke) located adjacent to the site's eastern boundary.
- 12.2.5 Surface water discharge rates for drainage catchments 18 and 21 will be restricted to greenfield equivalent run-off rates, as approved as part of the prior outline planning approval. In relation to the former Arborfield Studios Site, restricting flows to greenfield equivalent run-off rates will provide a betterment on the existing scenario; based upon the brownfield nature of the Site.
- 12.2.6 Surface water flows from both drainage catchments 16 and 19 will discharge into an existing watercourse south of the Site via as-built drainage infrastructure and SuDS networks outlined within the proposed surface water drainage strategy associated with the prior outline planning approval.
- 12.2.7 Drainage catchments 16 and 19 have been confirmed to have free discharge into as-built infrastructure and SuDS networks as per AECOM's drainage attenuation assessment (6312043/CIV/298 P13) dated September 2014.

Predicting Effects

- 12.2.8 The following assessment is undertaken through a desk study and Site investigation of existing geological, hydrological, flood risk and drainage conditions. The existing conditions, which takes into account the consented enabling works, are described and potential risks that may be associated with the Proposed Development are identified and assessed.
- 12.2.9 A Flood Risk Assessment and Drainage Strategy has been prepared (Appendix 12.1) to establish flood risk in regards to the Proposed Development. The report considers the following:
- The risk of flooding at the Proposed Development from all potential sources.
 - Storage requirement calculations to accommodate the 1 in 100 year event plus 40% allowance for climate change and a 10% allowance for urban creep. Based on Greenfield run-off rates.
 - Calculating the sizing of attenuation features along with informing other Sustainable Urban Drainage Systems to provide interception and treatment of surface water flows.
- 12.2.10 Flood risk has been determined by analysis of government flood data taken from the GOV.UK website, defining Flood Zones (Flood Map for Planning), other technical mapping and the local Wokingham Borough Council Level 1 Strategic Flood Risk Assessment (SFRA). Using these existing categories, the proposed surface water design for the Proposed Development will be modelled using an industry standard specialist computer programme (Flow) to determine potential on-site flooding. The timeframe is an industry standard periods, namely 1 in 2 year, 1

in 30 year and 1 in 100 year plus and allowance for climate change. Based on these scenarios and using the computer programme, the potential risk of flooding accruing can be determined.

12.2.11 The significance of potential effects has been classified considering three principal factors:

- the sensitivity of the receiving environment;
- the potential magnitude of the effect; and
- the potential risk of that effect occurring.

Receptor Sensitivity

12.2.12 The sensitivity of a receptor represents its ability to absorb the anticipated effect without resulting perceptible change. Four levels of sensitivity have been used as follows:

Table 12.1 Value/sensitivity assessment

Receptor value / sensitivity	Receptor type	Typical Criteria
High	The receptor has very limited ability to absorb change without fundamentally altering its present character, is of very high environmental value and/or is of international importance.	• High likelihood of fluvial/ tidal and/or surface water flooding – 1 in 30 annual likelihood of flooding. • Active floodplain.
Medium	The receptor has limited ability to absorb change without significantly altering its present character, is of high environmental value and/or is of national importance.	• Medium likelihood of fluvial/ tidal and/or surface water flooding – 1 in 100 annual likelihood of flooding. • Aquifer providing water for agricultural or industrial use.
Low	The receptor has moderate capacity to absorb change without significantly altering its present character, has moderate environmental value and/or is of regional importance.	• Sewer • Undesignated watercourse of regional importance • Unproductive strata/no abstractions for water supply.
Negligible	The receptor is tolerant of change without detriment to its present character, is of low environmental value and/or of local importance.	• Undesignated watercourse of low importance

12.2.13 Receptor Sensitivity is determined with reference to:

- Water Framework Directive (WFD) classification (e.g., Barkham Brook = Poor Ecological Status, multiple failing elements)
- Ecological importance of receiving waters
- Hydrological role in regional drainage (e.g., contribution to the Loddon catchment)
- Susceptibility to pollution, morphological alteration, and flow regime change

Magnitude of Impact

12.2.14 Magnitude considers:

- Scale of hydrological alteration
- Duration (short-term construction vs. long-term operational conditions)
- Reversibility
- Pathway strength (e.g., direct drainage discharges)
- Climate change effect on rainfall and runoff

12.2.15 Magnitude thresholds are guided by EA's national climate change datasets (2025 update), which incorporate UKCP18 projections for peak rainfall and flood risk, illustrating expected increases in rainfall intensity for both 2050s and 2070s epochs

Table 12.2 Magnitude of impact

Magnitude	Description
High	Loss of attribute and/or integrity OR Major improvement of attribute quality
Medium	Effect on integrity or loss of part of attribute OR Moderate improvement of attribute quality
Low	Measurable change in attribute quality/vulnerability OR Some beneficial effect or reduced risk
Negligible	Effect insufficient to affect integrity or use

Level of Effect

12.2.16 The predicted level of effect is based upon the consideration of magnitude of impact and sensitivity of the resource/receptor to come to a professional judgement of how important this effect is.

Table 12.3 Level of effect

Receptor Sensitivity	Magnitude of Impact			
	High	Medium	Low	Negligible
High	Substantial	Major	Moderate	Negligible
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

12.2.17 Level of Effect is derived from combining receptor sensitivity and magnitude. The level of effect which is considered significant is outlined below:

- Substantial, major or moderate level of effect = **Significant**
- Minor or negligible = **Not Significant**

12.2.18 For ease of interpretation, emphasis has been added to Table 12.3.

12.2.19 In addition to the sensitivity and magnitude of an effect, effects can be adverse or beneficial, temporary or long-term, direct or indirect, single or cumulative.

12.2.20 This assessment applies the precautionary principle required under the NPPF, which emphasises risk avoidance and climate adaptability for all new development.

Geographic Scope

12.2.21 A 1 km study area from the Arborfield Studios Site boundary has been adopted to identify surface water features that may be directly or indirectly affected, including consideration of pollution propagation pathways during construction and operation.

Consultation

12.2.22 The following consultation has been undertaken.

- Thames Water asset plans and consultation regarding foul/surface water networks and Arborfield STW capacity.
- A scoping exercise has been undertaken as part of main pre-application process.

Assumption and Limitations

12.2.23 This desk-based assessment has been prepared using information obtained from publicly available sources and project information provided by the client. Accordingly, the findings are subject to the accuracy and completeness of the available data, and environmental features or constraints not identified within the reviewed sources may exist on Site. Further site-specific surveys and investigations may be required to validate the findings and inform detailed design and planning decisions.

12.3 Baseline Conditions

Current Baseline

Water Framework Directive (WFD)

- 12.3.1 Barkham Brook is classified as Poor Ecological Status under WFD Cycle 3, with persistent phosphate and dissolved oxygen failures. Arborfield WWTW discharged 53 times (522 hours) in 2024. The Site lies in Flood Zone 1 with limited surface water hotspots. Groundwater risk is low due to London Clay. Nearby ecological receptors include Longmoor Bog.
- 12.3.2 The Arborfield Studios Site lies within the Barkham Brook catchment (a tributary of the River Loddon). The Blackwater River catchment lies approximately 200 m to the south and the Loddon main catchment approximately 500 m to the west. Several unnamed drainage ditches converge locally and ultimately discharge towards Barkham Brook. A man-made attenuation feature (Garrison Lake) exists in the wider area and drains north-west towards Barkham Brook.

Tidal Flood Risk

- 12.3.3 The Site is at no risk of tidal flooding. The tidal limit of the River Thames is at Teddington, >30 km downstream of the Loddon confluence, and the Site is inland of this limit.

Fluvial Flood Risk

- 12.3.4 Environment Agency Flood Maps indicate that the majority of the Site lies in Flood Zone 1 (annual probability <0.1%). A band of Flood Zone 2 exists, outside of, but to the southeast of the Site boundary associated with local watercourse low points and the vicinity of Garrison Lake.
- 12.3.5 Historic flooding has been recorded in the wider Arborfield area (1993, 2000, 2003, 2007 and 2013/14). Hydrological and hydraulic modelling has been undertaken to quantify risk and illustrates existing flood extents in the vicinity of on-site culverts and pinch points.

Surface Water (Pluvial) Flood Risk

- 12.3.6 Risk of surface water flooding is present in local low-lying areas and adjacent to watercourses, compounded by low-capacity culverts and structures. For the majority of the Site the risk is low; locally moderate risk can occur near watercourses and structures during intense rainfall.

Groundwater Flood Risk

- 12.3.7 Predominantly London Clay underlies the area with local drift deposits and Bagshot Beds. Environment Agency records do not indicate historic groundwater flooding; risk is considered low.

Flooding from Drains and Sewers

- 12.3.8 Thames Water foul sewers route towards Arborfield STW (~2.8 km downstream). Sewer flooding risk is low; historic records indicate one flooding location near Park Lane. There are limited public surface water sewers; many systems are private.

Flooding from Artificial Sources

- 12.3.9 Longmoor Lake lies to the east and is an impounded waterbody. Environment Agency reservoir breach mapping indicates a very unlikely probability of failure; modelled flood depths are

generally <0.3 m with isolated pockets up to 2.0 m. Consequences would be significant though probability is very low.

Nature Conservation and Fisheries

12.3.10 No European or national designations are within the Site boundary. Longmoor Bog SSSI and LNR lie c. 1.2km southeast. EA fish records indicate cyprinid species such as chub and dace in Barkham Brook downstream; Blackwater River supports roach, perch, pike and eel.

Water Resources

12.3.11 The Site does not lie within a groundwater Source Protection Zone 1. No surface or groundwater abstractions are within 1 km. Twenty-eight active environmental permits (discharges) lie within 1 km; Arborfield STW discharges to Barkham Brook downstream.

Future Baseline

12.3.12 Without the Proposed Development, baseline pressures on Barkham Brook are expected to continue. The WFD dataset shows no improving trajectory, with persistent failures across ecological and chemical indicators, making future improvement unlikely without targeted intervention by water companies or catchment partners. Concurrently, storm overflow behaviour at the Arborfield WWTW suggests ongoing episodic pollution tied to wet-weather events, meaning discharge frequency is unlikely to decline without infrastructure upgrades.

12.3.13 Climate science confirms that future rainfall patterns will intensify. The Environment Agency's climate change allowance summary notes rising rainfall intensities across the 2050s epoch (2040–2069), particularly for surface water flooding, reflecting UKCP18 projections used in national flood assessment methodologies. This implies an increasing likelihood of excessive runoff volumes, elevated overland flow, and exacerbated pressures on watercourses, particularly those with existing poor water quality.

12.3.14 Looking ahead, national SuDS requirements in the **2025 National Standards** mandate increasingly stringent runoff control and on-site interception to counter these trends. They require capturing the **first 5 mm** of rainfall for most events, enhanced pollution mitigation, and the prioritisation of source-control features aligned with multifunctional green infrastructure principles.

12.3.15 These policy shifts indicate that, without development, such upstream interventions would not automatically be introduced to the Site.

Receptors Scoped in/out of the Assessment

12.3.16 Receptors are identified and assessed according to their sensitivity, value, and vulnerability to project-related impacts. Through the EIA scoping process, receptors that are not expected to experience significant effects, due to the absence of impact pathways, limited spatial influence, low sensitivity, or effective embedded mitigation, may be scoped out of further assessment. This enables the assessment to focus on receptors that have the greatest potential to experience significant environmental effects.

12.3.17 Those elements scoped in and out of the assessment are detailed in the table below.

Table 12.4 Summary of Receptor Sensitivity

Receptor	Sensitivity	Justification
Water Framework Directive	Low	The Arborfield Studios development lies within the catchment of Barkham Brook, a waterbody that is already experiencing significant baseline ecological pressure, as evidenced by its Poor Ecological Status classification, driven by long term failures in phosphate and dissolved oxygen across multiple WFD monitoring cycles. These conditions indicate that the waterbody is sensitive to even modest incremental changes in pollutant loading or hydrological behaviour. The Proposed Development will incorporate a comprehensive SuDS strategy designed to control both runoff rates and water quality. The development does not materially add to these pre-existing pressures. Post-mitigation, no significant adverse effects are anticipated, as the key stressors affecting Barkham Brook originate from the regional wastewater network and catchment-wide water quality issues; rather than from controlled Site runoff.
Tidal/Fluvial Flood Risk	Negligible	The majority of the Proposed Development is located within Flood Zone 1 (Low Probability) and at a low risk of flooding from rivers or the sea. The eastern boundary is shown to be located in Flood Zone 3, associated with an existing watercourse. The extent of flood risk is shown outside of any built development. Therefore, it can be deduced that the Proposed Development is of negligible sensitivity and therefore, can be scoped out of the assessment.
Surface Water (Pluvial) Flood Risk	Low	The majority of the Site is shown to be located in an area of very low (less than 0.1%) chance of surface water flooding in a given year. Parts of the Site are shown to be located at a medium and high chance of surface water flooding in a given year, both without and with climate change allowances. These are assessed to be isolated areas of surface water flood risk, and are not considered to constitute a flow routes originating from offsite that need to be maintained. The development proposals will result in a reduction of impermeable surfaces, and new positive drainage infrastructure will be provided. Further, the levels of the Site will be designed such that the dwellings / buildings and drainage features are not at risk of surface water flooding.
Groundwater Flood Risk	Low	The Wokingham Borough Council Level 1 Strategic Flood Risk Assessment (SFRA) has been reviewed in regards to groundwater flooding. The Site is shown to be located a low groundwater vulnerability zone. The information

Receptor	Sensitivity	Justification
		available at the time of preparing this report, suggests that groundwater emergence at the surface is unlikely, such that groundwater flood risk does not constitute a constraint in this instance.
Flooding from Drains and Sewers	Low	We are not aware of any sewers located within the Site application boundary and are not in possession of any records of sewer flooding within the vicinity of the Proposed Development.
Flooding from artificial sources	Negligible	We are not aware of any canals or artificial water sources that may result in flooding of this site. Mapping depicts reservoir flooding to the eastern extent of the Site (when river levels are normal), which follows the alignment of Barkham Brook. This small area of reservoir flood risk is beyond the developable area of the Site. It can therefore be concluded that whilst there is a residual risk of flooding from reservoirs, the actual risk is very low which means the receptor is of negligible sensitivity and therefore, can be scoped out of the assessment.
Nature Conservation and Fisheries	Negligible	A Proposed Development that incorporates a SuDS-led surface water drainage strategy (in this case which discharges to Barkham Brook) is assessed as having a negligible effect on nature conservation and fisheries receptors, provided the scheme is designed in accordance with current drainage standards and regulatory requirements. Therefore, nature conservation and fisheries can be scoped out of the assessment.
Water Resources	Negligible	The Proposed Development incorporates a Sustainable Drainage System (SuDS) with controlled discharge to Barkham Brook. This would be expected to result in a negligible effect on water resources receptors. Barkham Brook forms part of the River Loddon catchment and has an established hydrological regime that would be protected through the implementation of attenuation and flow control measures. Therefore, water resources can be scoped out of the assessment.

12.4 Inherent design mitigation

Construction Phase

- 12.4.1 A Construction Environmental Management Plan (CEMP) will be prepared and implemented prior to the construction phase commencing. This document will set out how environmental impacts will be identified, controlled, monitored and managed during the construction phase. The CEMP will include controls, buffers, bunded storage, silt management and monitoring. Operational mitigation incorporates the full SuDS hierarchy, multi-stage treatment, first 5mm interception, attenuation basins, permeable paving, filter drains, and greenfield discharge rate controls, in line with 2025 SuDS Standards.

Operational Phase

- 12.4.2 The implementation of the proposed drainage strategy, designed to accommodate all storms up to and including the 1 in 100 year plus 40% climate change scenario (including a 10% allowance for urban creep) will result in surface water flows being positively managed on-site.
- 12.4.3 The layout has been designed to locate all residential buildings and pedestrian access routes outside areas at potential risk of flooding from surface water, groundwater and natural watercourses. Design iterations have responded to surface water flood risk, with attenuation and SuDS features incorporated to reduce surface water runoff rates.

12.5 Potential effects prior to additional mitigation

Construction Phase

- 12.5.1 Taking into account the construction phase inherent mitigation, the below table describes any potential significant effects following the implementation of this construction phase mitigation.

Table 12.5 Potential Construction Effects

Receptor/ Sensitivity	Assessment of Impact	Magnitude of Impact Prior to Additional Mitigation	Effect
Water Framework Directive/Low	Potential for adverse effects on the Barkham Brook WFD waterbody through accidental pollutant releases associated with earthworks and construction activities. Construction works will have a CEMP in place. Temporary SuDS drainage measures which will reduce the risk of potential deleterious material reaching sensitive receptors. Therefore, the magnitude of impact is negligible.	Negligible	Negligible adverse Not Significant

Receptor/ Sensitivity	Assessment of Impact	Magnitude of Impact Prior to Additional Mitigation	Effect
	Potential for adverse effects on the Barkham Brook WFD waterbody through the mobilisation of sediments. As construction works will have a CEMP in place, including silt management measures, the risk of potential blockage reaching receptor is reduced. Therefore, the magnitude of impact is negligible.	Negligible	Negligible adverse Not Significant
	Blockage of temporary/Site drainage and fluvial pinch points by mud/debris could cause localised above-ground flooding. As construction works will have a CEMP in place, including silt management measures, the risk of potential blockage reaching receptor is reduced. Therefore, the magnitude of impact is negligible.	Negligible	Negligible adverse Not Significant
Surface Water/Low	Temporary increases in impermeable area (e.g., hardstanding/compaction) could accelerate runoff. As the construction team will be implementing temporary drainage measures to block and intercept runoff during construction, the magnitude of impact on the receptor is negligible.	Negligible	Negligible adverse Not Significant
	Encountered mains/sewers during works could lead to localised flooding if damaged. Measures outlined in the CEMP will stop sewage-contaminated water from reaching rivers, streams, groundwater, or sensitive areas. The CEMP will provide a framework for assessing damage, prioritizing repairs, restoring service, and monitoring environmental impacts afterward. The risk of potential flows and contamination reaching receptor is reduced. Therefore, the magnitude of impact is low.	Low	Minor adverse Not Significant

Receptor/ Sensitivity	Assessment of Impact	Magnitude of Impact Prior to Additional Mitigation	Effect
	Working in/near channels could expose personnel to flood hazard during events. The CEMP defines approved working methods for activities in and around the channel. The construction team will set exclusion zones and safe access/egress routes, meaning the risk of potential hazard reaching receptor is reduced. Therefore, the magnitude of impact is low.	Low	Minor adverse Not Significant
	In-channel works (culvert removal, new ditches/SuDS, ~20 outfalls) risk bed/bank disturbance and increased turbidity. The construction team will have a CEMP in place using temporary SuDS drainage measures and temporary attenuation. Therefore, the risk of pollution / contamination reaching the receptor is reduced and the magnitude of impact is negligible.	Negligible	Negligible adverse Not Significant
	Earthworks, dewatering, concreting and plant use may generate silty / contaminated runoff with potential for pollution. As construction works will have a CEMP in place, including silt management measures, the risk of potential pollution reaching receptor is reduced. Therefore, the magnitude of impact is negligible.	Negligible	Negligible adverse Not Significant
Groundwater/ Low	Leaks/spills of fuels/oils, concrete and grouts could infiltrate watercourses and/or groundwater, impacting water quality. Construction works will have a CEMP in place. Temporary SuDS drainage measures which will reduce the risk of potential deleterious material reaching sensitive receptors. Therefore, the magnitude of impact is negligible.	Negligible	Negligible adverse Not Significant
	The installation of foundations, sourcing of construction materials, and the presence of plant tracks and cable trenches could lead to alteration in groundwater flows. The contractor will be implementing temporary measures to	Low	Minor adverse Not Significant

Receptor/ Sensitivity	Assessment of Impact	Magnitude of Impact Prior to Additional Mitigation	Effect
	block and intercept drainage runoff during construction, then the magnitude of impact to the receptor is low.		
	Temporary dewatering of foundation trenches could lead to disturbance of localised groundwater levels. Temporary drainage measures set out in the CEMP shall be in place to block and intercept run-off from foundation trenches, resulting in the magnitude of impact on the receptor being low.	Low	Minor adverse Not Significant
Sewers/Low	Foul water from welfare facilities will be contained/removed from Site. No discharge will occur to watercourses. The risk of potential flows and contamination reaching the receptors is reduced. Therefore, the magnitude of impact is negligible.	Negligible	Negligible adverse Not Significant
	There is the potential for increased rates of runoff, before any on-line control devices can be installed, leading to a temporary increase in flood risk with indirect effects on biodiversity. The construction team will have a CEMP in place using temporary SuDS drainage measures and temporary attenuation, reducing risk of increased runoff entering the existing sewers. Therefore, the magnitude of impact is low.	Low	Minor adverse Not Significant

Operational Phase

12.5.2 Taking into account the operational phase inherent mitigation, the below table describes any potential significant effects following the implementation of this operational phase mitigation.

Table 12.6 Potential Operational Effects

Receptor/ Sensitivity	Assessment of Impact	Magnitude of Impact Prior to Mitigation	Effect
Water Framework Directive/Low	During operation, the Proposed Development has the potential to generate surface water runoff containing typical urban pollutants, including	Negligible	

Receptor/ Sensitivity	Assessment of Impact	Magnitude of Impact Prior to Mitigation	Effect
	sediments, hydrocarbons, metals and nutrients. Filtration of these pollutants are able to be controlled and mitigated through the design of the Proposed Development in accordance with SuDS principles which would not impact water quality. The magnitude of impact is therefore negligible.		Negligible adverse Not Significant
Surface Water/Low	SuDS/drainage systems may block over time causing localised pluvial flooding if not maintained. Maintenance requirements of implemented SuDS features will be outlined to the Site operator prior to handover of the drainage system, which will reduce the risk of potential pluvial flooding affecting receptors. The magnitude of impact is therefore low.	Low	Minor adverse Not Significant
	Permanent impermeable areas increase runoff volumes which, without mitigation, could raise on/off-site flood risk. The Proposed Development is designed in accordance with SuDS principles and therefore, would not impact flow rate/volume, hence no indirect source of contamination. Sufficient attenuation is provided within the design which will mean the magnitude of impact is negligible.	Negligible	Negligible adverse Not Significant
	Diffuse urban pollutants (hydrocarbons, heavy metals, nutrients, debris/silt) in runoff could impact watercourses without treatment. Filtration of these pollutants are able to be controlled and mitigated through the design of the Proposed Development in accordance with SuDS principles which would not impact water quality. The magnitude of impact is therefore low.	Low	Minor adverse Not Significant
	Traffic-related routine highway runoff assessed via Highways Agency Water Risk Assessment Tool (HAWRAT) is expected to be compliant with Environmental Quality Standards (EQSs) at reviewed locations. However,	Medium/ Low	Minor adverse Not Significant

Receptor/ Sensitivity	Assessment of Impact	Magnitude of Impact Prior to Mitigation	Effect
	as this is unknown at this stage, there may be an effect on integrity / measurable change in the quality of the attribute and therefore, the magnitude of impact is medium/low.		
	New outfalls and structures may cause local morphological changes. The Proposed Development is designed in accordance with SuDS principles and therefore would not impact flow rate/volume. Hence reducing the effect or morphological changes. As such, the magnitude of impact is negligible.	Negligible	Negligible adverse Not Significant
Groundwater/ Low	Only minor works would take place within the Proposed Development during the operational phase, to allow necessary maintenance activities to be undertaken. No additional effects on groundwater contamination are anticipated from the operational phase. As such, the magnitude of impact is negligible.	Negligible	Negligible adverse Not Significant
Sewers/Low	Increased foul flows directed to Arborfield STW (Sewage Treatment Works); with upgrades and liaison, CSO (Combined Sewer Overflows) risk to Barkham Brook managed. Increased demands may affect the capacity of sewers locally. Subject to a capacity check, the magnitude of potential adverse impacts reaching receptors is low.	Low	Minor adverse Not Significant
	Increased potable demand to be met by Thames Water; not a direct surface water quality impact. Increased demands may affect capacity of sewers locally. Subject to capacity check, risk of potential adverse impacts reaching receptors is low.	Low	Minor adverse Not Significant

12.6 Additional Mitigation

Construction Phase

12.6.1 Minor additional mitigation beyond the embedded design measures and CEMP commitments is required. This is outlined as follows.

- Preparation of a site-specific Flood Emergency Response Plan (FERP).
- Requirement for contractors to sign up to local flood alerts.
- Halt in channel works or works near the ditch network during heavy rainfall or flood conditions.

Operational Phase

12.6.2 Following on from previous correspondence, the operational assessment identifies some uncertainty regarding foul flows to Arborfield STW (Sewage Treatment Works). Written confirmation is required and the developer should enter into discussions with Thames Water as soon as reasonably practical.

12.6.3 This must confirm that sufficient sewer and wastewater treatment capacity is available prior to occupation of the Proposed Development. It should be noted that Thames Water have a statutory obligation to cater for all flows post development, regardless of the capacity of existing infrastructure.

12.6.4 All drainage has been designed in accordance with AECOM Foul Water Strategy “60312043 /CIV/003” subject to S106 approval.

12.7 Residual effects

Construction Phase

12.7.1 Following the implementation of the additional mitigation measures (identified in Section 12.6 above), residual effects of the Proposed Development have been reassessed. Construction phase effects relating to the WFD, surface water, groundwater and sewers remain between **Negligible Adverse** and **Minor Adverse** and **Not Significant** due to the effectiveness of the CEMP, temporary drainage controls, flood emergency planning and pollution prevention measures.

Operational Phase

12.7.2 Subject to confirmation from Thames Water, during operation, surface water and sewer receptors remain between **Negligible Adverse** and **Minor Adverse** and **Not Significant**. No significant residual hydrological, flood risk or drainage effects are predicted.

12.8 Implications of Climate Change

12.8.1 Climate change is projected to increase rainfall intensity globally. On a national scale, the Proposed Development has been specifically designed to account for this through the Environment Agency climate change allowances, with attenuation sized for the 1 in 100 year event plus 40% climate change and an allowance for 10% urban creep.

- 12.8.2 The SuDS strategy limits discharge rates to greenfield equivalents and provides exceedance routing and storage during extreme rainfall events. Consequently, while climate change will increase baseline flood risk over time, the Proposed Development has been designed to remain safe for its lifetime and is not expected to generate additional flood risk on-site or downstream. The residual effect is Negligible and Not Significant.

12.9 Cumulative effects

Barkham Square

- 12.9.1 Barkham Square is located adjacent to the Site and shares elements of the wider local drainage and watercourse network.
- 12.9.2 Due to its proximity, there is the potential for cumulative interaction during both construction and operation. However, both developments incorporate policy-compliant drainage strategies, attenuation storage and SuDS measures. No direct pathway has been identified that would result in a material increase in flood risk or deterioration in water quality when considering both developments. The cumulative magnitude of impact is Low and the cumulative level of effect is **Minor Adverse** and **Not Significant**.

Wider Committed Development

- 12.9.3 The wider Arborfield Green development includes a number of committed developments draining to the Barkham Brook and River Loddon catchments.
- 12.9.4 Existing cumulative pressures are principally associated with catchment conditions, wastewater infrastructure constraints and climate change. The Proposed Development will restrict surface water runoff to greenfield rates, aided by attenuation features and provides water quality treatment prior to discharge. As a result, the Proposed Development would not materially increase cumulative hydrological pressures. The cumulative magnitude of impact is Low and the level of effect is **Minor Adverse** and **Not Significant**.

12.10 Summary

- 12.10.1 This chapter explains how the proposed Arborfield Studios development may affect local watercourses, drainage, and flood risk. The following summary has been provided, commenting on the existing conditions, the likely impacts during construction and operation, and the measures in place to ensure the development remains safe and does not increase flood risk elsewhere.

Existing Environment

- 12.10.2 The Site is located within the catchment of Barkham Brook, a small watercourse that flows into the River Loddon. Most of the Site is currently at low risk of flooding from rivers, but some areas are prone to surface water pooling during heavy rainfall. The ground conditions (mainly London Clay) mean that water does not drain very easily into the soil.

Construction Effects

- 12.10.3 As inherent mitigation, a Construction Environmental Management Plan (CEMP) will be implemented. This will include measures such as silt fencing, sediment traps, controlled

refuelling areas, spill kits, and temporary drainage controls. These measures will ensure that any construction impacts are local, temporary, and well-managed.

12.10.4 Water quality in Barkham Brook is already under pressure from pollution entering the watercourse during storm events, and from wider catchment sources. This means the brook is sensitive to increases in polluted runoff or disturbance during construction. The impacts on the low sensitivity WFD receptors are considered to be negligible which results in a **negligible adverse** and **not significant** effect.

12.10.5 During construction, potential effects on water quality, surface water drainage, groundwater and sewers could arise from earthworks, temporary hardstanding, drainage installation, in-channel works, dewatering, plant use, accidental spills, sediment mobilisation, blockage of temporary drainage or damage to existing services. With the inherent mitigation measures, on the low sensitivity surface water receptor, impacts range from negligible to low and therefore, effects are assessed as **negligible adverse** to **minor adverse** and **not significant**.

12.10.6 Construction activities such as groundworks, excavation, new drainage installation and movement of materials could temporarily increase the risk of muddy water or pollutants being washed into nearby ditches or watercourses. As groundwater is considered to be a low sensitivity receptor, the impacts from these activities have been assessed to be between negligible and low. Therefore, effects range from **negligible adverse** to **minor adverse** which are **not significant**.

12.10.7 For the low sensitivity receptor of sewers, during construction, foul water from welfare facilities will be contained and removed from the Site, with no discharge to nearby watercourses. This will reduce the risk of flows or contamination reaching sensitive receptors, resulting in a negligible magnitude of impact and a **negligible adverse** and **not significant** effect.

12.10.8 Additionally, before permanent drainage controls are fully operational, construction activities could temporarily increase runoff rates and local flood risk, with potential indirect effects on biodiversity. However, temporary SuDS measures, attenuation and CEMP controls will be implemented to manage runoff and reduce the risk of flows entering existing sewers, resulting in a low magnitude of impact and a **minor adverse** and **not significant** effect.

12.10.9 Additional mitigation in the form of a Flood Emergency Response Plan, local flood alerts and halting in channel works near the ditch network during heavy rainfall or flood conditions will enhance operations during construction. As such, residual effects during construction remain as described above.

Operational Effects

12.10.10 During operation, the Proposed Development could generate surface water runoff containing typical urban pollutants. There is the potential for effects on the low sensitivity Water Framework Directive receptor.

12.10.11 However, the drainage strategy has been designed in accordance with SuDS principles, incorporating filtration and treatment measures to protect water quality. The magnitude of impact is therefore negligible, resulting in a **negligible adverse** and **not significant** effect.

12.10.12 During operation, potential effects may arise from increased impermeable areas, surface water runoff, diffuse urban pollutants, highway runoff, SuDS or drainage blockage, new outfalls, maintenance activities, increased foul flows and potable water demand. However, the Proposed Development will incorporate SuDS drainage, attenuation, filtration and treatment measures, together with appropriate maintenance requirements and further liaison with

Thames Water regarding sewer and wastewater treatment capacity. The magnitude of impact ranges from negligible to medium and operational effects are therefore assessed as ranging from **negligible adverse** to **minor adverse** and are **not significant**.

12.10.13 For the low sensitivity groundwater receptor, only minor operational works are expected, principally associated with maintenance activities. No additional groundwater contamination effects are anticipated during the operational phase. The magnitude of impact is negligible, resulting in a **negligible adverse** and **not significant** effect.

12.10.14 For the low sensitivity sewer receptor, increased foul flows will be directed to Arborfield Sewage Treatment Works, and increased demand could affect local sewer capacity. Additionally, increased potable water demand will be met by Thames Water, therefore, increased demands may affect capacity of sewers locally. Subject to liaison with Thames Water and confirmation of available capacity, the magnitude of impact is low, resulting in a **minor adverse** and **not significant** effect.

Cumulative Effects

12.10.15 As Barkham Square shares elements of the wider local drainage and watercourse network, there is the potential for cumulative interaction during construction and operation however, both developments incorporate policy-compliant drainage strategies and SuDS measures. As such, the cumulative magnitude of impact is low and the level of effect is therefore, **minor adverse** and **not significant**.

12.10.16 Existing cumulative pressures are principally associated with catchment conditions, wastewater infrastructure constraints and climate change. The Proposed Development will restrict surface water runoff to greenfield rates. As a result, the Proposed Development would not materially increase cumulative hydrological pressures. The cumulative magnitude of impact is Low and the level of effect is therefore, **minor adverse** and **not significant**.

Overall Conclusion

12.10.17 Overall, effects are not expected to be more than minor adverse which is not significant in EIA terms.

12.11 References

- Ordnance Survey mapping and Environment Agency interactive mapping (Flood Map for Planning; Risk of Flooding from Surface Water; Risk of Flooding from Reservoirs; Flood Warning Areas).
- Thames River Basin Management Plan and Loddon catchment information; Loddon Catchment Implementation Plan.
- Wokingham Borough Council Strategic Flood Risk Assessment (SFRA).

12.12 Assessor information

Table 12.7 Assessor Information

Chapter	Responsibility	Name	Qualifications	Assessor information
Hydrology (including Flood Risk and Drainage)	JPP Consulting	Jack Wsniewski	HNC	Associate with 12 years experience.
		Thomas Kirk	BSc (Hons)	Engineer with 3 years experience.

Table 12.8 Summary of effects

Receptor	Receptor sensitivity	Description of potential impact	Proposed mitigation	Residual effect	Significant / not significant
Construction Phase					
Water Framework Directive	Low	- Mobilisation of sediments - Accidental pollutant releases associated with earthworks and construction.	- Full CEMP; - Silt fencing, sediment traps, settlement areas; - Bunded fuel/chemical storage; - Controlled refuelling;	Negligible adverse	Not Significant
Surface Water	Low	- Temporary sediment mobilisation; - Risk of chemical polluted runoff; - Disturbance of flow paths; - Potential increased turbidity and water quality deterioration during rainfall; - Hazard to workers during heavy rainfall or channel works; and - Increased risk due to low-capacity culverts and localised ponding.	- Full CEMP; - Silt fencing, sediment traps, settlement areas; - Bunded fuel/chemical storage; - Controlled refuelling; - Temporary drainage and flow-path management; - Monitoring of culverts/pinch points; - Flood Emergency Response Plan (FERP); - Weather monitoring; - Exclusion zones near water edges; and - Temporary works sequencing to avoid in-channel work during rain events.	Negligible Adverse to Minor adverse	Not Significant
Groundwater	Low	- Release of chemical pollutants; and - Disturbance of flow sub-surface flow paths.	- Full CEMP; - Bunded fuel/chemical storage; - Controlled refuelling; and	Negligible Adverse to Minor adverse	Not Significant

Receptor	Receptor sensitivity	Description of potential impact	Proposed mitigation	Residual effect	Significant / not significant
			- Temporary drainage and flow-path management;		
Sewers	Low	- Release of chemical pollutants; - Temporary sediment mobilisation; and - Potential increased turbidity and water quality deterioration during rainfall.	- Full CEMP; - Silt fencing, sediment traps, settlement areas; and - Temporary drainage and flow-path management;	Negligible Adverse to Minor adverse	Not Significant
Operation Phase					
Water Framework Directive	Low	- Potential to generate urban surface water runoff containing low concentrations of pollutants.	- Implement a multi-stage SuDS “treatment train”.	Negligible adverse	Not Significant
Surface Water	Low	- Sediment mobilisation; - Risk of chemical polluted runoff; - Physical changes to overland drainage and surface water flows; and - Potential increased turbidity and water quality deterioration during rainfall.	- Limit discharge rates to greenfield equivalent values; - Provide positive drainage to manage both routine rainfall and extreme events; - Design the system to accommodate the 1 in 100 year storm plus climate change uplift consistent with national allowances; - Incorporate exceedance routes; and - Implement a multi-stage SuDS “treatment train”.	Negligible Adverse to Minor adverse	Not Significant

Receptor	Receptor sensitivity	Description of potential impact	Proposed mitigation	Residual effect	Significant / not significant
Groundwater	Low	- Minor works during the operational phase to allow for maintenance activities to be undertaken	N/A	Negligible adverse	Not Significant
Sewers	Low	- Release of chemical pollutants; and - Increased flood risk.	- Coordinate with Thames Water to ensure downstream treatment capacity, pumping regime, and sewer network conditions remain adequate post-development; and - Ensure no surface water connections are made to the foul network.	Minor adverse	Not Significant

12.13 Mitigation commitments Summary

Table 12.9 Summary for Securing Mitigation

Identified receptor	Type and purpose of additional mitigation measure (prevent, reduce, offset, enhance)	Means by which mitigation may be secured (e.g. planning condition / legal agreement)	Delivered by	Auditable by
Construction Phase				
Surface Water See details provided in Section 12.6.1	Storage, containment and operational best practice shall be implemented. Suitable emergency spill or leak response kits and procedures shall be in place.	Detailed through the final CEMP and associated Pollution Prevention Plan.	Principal contractor	Applicant
	Implementation of best practice with regards to construction methods in close proximity to watercourses.	Temporary drainage proposals to be submitted identifying measures to restrict/store runoff to watercourse.	Principal contractor	Applicant
	Detailed design of surface water drainage network to prevent increased runoff, to include on-site attenuation.	Detailed drainage calculations to quantify potential increases in surface runoff and define operational parameters for SuDS measures.	Designer	Applicant
Groundwater See details provided in Section 12.6.1	Storage, containment and operational best practice shall be implemented. Suitable emergency spill or leak response kits and procedures shall be in place.	Detailed through the final CEMP and associated Pollution Prevention Plan.	Principal contractor	Applicant
Sewer See details provided in Section 12.6.1	Storage, containment and operational best practice shall be implemented. Suitable emergency spill or leak response kits and procedures shall be in place.	Detailed through the final CEMP and associated Pollution Prevention Plan.	Principal contractor	Applicant

Identified receptor	Type and purpose of additional mitigation measure (prevent, reduce, offset, enhance)	Means by which mitigation may be secured (e.g. planning condition / legal agreement)	Delivered by	Auditable by
Operation Phase				
Surface Water See details provided in Section 12.6.2-12.6.4	Ongoing maintenance for all proposed drainage measures and sustainable drainage features designed to manage water quality and runoff rate. Maintenance schedule for Site operation to follow good practice for managing hazardous chemicals.	Relevant legislation and good practice measures for Site operation to be followed.	Designer & Contractor	Applicant
Sewers See details provided in Section 12.6.2-12.6.4	Ongoing maintenance for all proposed drainage measures and sustainable drainage features designed to manage water quality and runoff rate. Maintenance schedule for Site operation to follow good practice for managing hazardous chemicals	Relevant legislation and good practice measures for Site operation to be followed.	Designer & Contractor	Applicant