

Growing Baldock

Environmental Statement Volume 1: Text
Chapter 10: Hydrology and Flooding



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Urban&Civic

Hertfordshire

CONTENTS

10.1	INTRODUCTION	1
10.2	RELEVANT POLICY	3
	National Policy	3
	Local Policy.....	4
10.3	ASSESSMENT METHODOLOGY	6
	Scope	6
	Data Sources	6
	Assessment Approach	7
	Significance Criteria	7
	Receptor Sensitivity	8
	Receptor Type.....	8
	Uncertainties and Limitations	10
10.4	BASELINE CONDITIONS.....	11
	The Current Baseline.....	11
	The Projected Future Baseline	16
10.5	POTENTIAL EFFECTS	19
	Construction Stage	19
	Post-Completion Stage	21
10.6	MITIGATION MEASURES	23
	Construction Stage	23
	Post-Completion Stage	24
10.7	RESIDUAL EFFECTS	26
	Construction Stage	26
	Post-Completion Stage	26
	Summary of Effects	26
	CUMULATIVE EFFECTS.....	28
10.8	REFERENCE LIST	29

APPENDICES

Appendix 10.1	Flood Risk Assessment
Appendix 10.2	Drainage Strategy Report

10.1 INTRODUCTION

- 10.1.1 This chapter has been prepared by Michael Duff [BEng (Hons), CEng, MICE], a Project Director at AKT II Limited. He has 28 years of experience in civil engineering of which 18 have been with AKT II and has been a Chartered Engineer since 2008.
- 10.1.2 This chapter has been reviewed by David Anthony Purcell IEng AMIStructE MCIHT a Project Director at AKT II Limited and an incorporated engineer, an Associate Member of the Institute of Structural Engineers and a member of the Chartered Institute of Highways and Transportation with 28 years' experience, 9 of these years being in the Civil and Infrastructure team at AKTII.
- 10.1.3 This chapter assesses the potential effects of the Proposed Development upon surface water, flood risk and hydrology arising from the project construction and operation.
- 10.1.4 This chapter addresses the Scoping Opinion with regards to the assessment of the depth, quantity and duration of surface water run-off as a result of the Proposed Development.
- 10.1.5 This chapter addresses direct and indirect effects relating to surface water drainage both as a result of the scheme proposals and during the construction and occupation of the Proposed Development and the resulting potential impacts which include:
- Any increase in impermeable surfaces as a result of the Proposed Development and the required attenuation rate and volume of surface water runoff required to mimic the existing arrangement or provide betterment; and
 - Any impact during the construction works such as accidental fuel spills, leaching of contamination, vehicle washing or the movement of suspended solids in the surface water runoff.

10.1.6 The description of development for which planning permission is sought is:

Outline planning application with all matters reserved except for means of highway access into the development from the A505/Royston Road, North Road and Clothall Road for: up to 3,200 homes, up to 16ha of employment, waste and leisure infrastructure, a mixed use local centre, up to 1 secondary school, up to 2 x primary schools, up to 1 SEND school, health hub, green infrastructure (including parks, formal sports provision, play, habitat areas, informal open space and structural planting), internal street network, access junctions and railway crossing, public transport infrastructure, pedestrian/cycle network (including PRow diversions, active travel routes, mobility hubs and crossing of the railway), utilities and drainage infrastructure (including diversions of existing and provision of new infrastructure, pumping stations, sustainable drainage, primary substations, rising main/strategic sewer and renewable energy infrastructure), ground remodelling/earthworks and any necessary demolitions.

10.2 RELEVANT POLICY

10.2.1 This chapter refers to the following documents and guidance.

National Policy**National Planning Policy Framework**

10.2.2 Chapter 14 "Meeting the challenge of climate change, flooding and coastal change" paragraphs 170 to 182 cover planning and flood risk. The key recommendations from these paragraphs are:

- All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – to avoid, where possible, flood risk to people and property.
- When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment.
- Applications which could affect drainage on or around the Site should incorporate sustainable drainage systems to control flow rates and reduce volumes of runoff, and which are proportionate to the nature and scale of the proposal. These should provide multifunctional benefits wherever possible, through facilitating improvements in water quality and biodiversity, as well as benefits for amenity.

Planning Practice Guidance

10.2.3 The following Planning Practice Guidance notes are relevant to Hydrology and Flooding:

- Climate change - Advises how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change.
- Flood risk and coastal change - Advises how to take account of and address the risks associated with flooding and coastal change in the planning process.
- Water supply, wastewater and water quality - Advises on how planning can ensure water quality and the delivery of adequate water and wastewater infrastructure.

10.2.4 The following national policies are also referred to in this Chapter:

- The Water Resources Act 1991;
- The National Planning Policy Framework (December 2024);
- The Environment Agency guidance on groundwater protection (Document GP3);
- The Environment Agency guidance on sustainable drainage systems (GP13) Planning; and
- Policy Statement 25 Development and Flood Risk (PPS25).

Local Policy

North Hertfordshire Local Plan (2022)

10.2.5 Policy BA3: Land south of Clothall Common

- Incorporate ordinary watercourses (and any appropriate measures) within comprehensive green infrastructure and / or SUDs approach;
- Address existing surface water flood risk issues, including any run-off through SUDs or other appropriate solution;

10.2.6 Policy BA10: Royston Road

- Address existing surface water flood risk issues, including any run-off through SUDs or other appropriate solution;
- Use of green roofs on buildings in order to create a less harsh urban-rural transition to the Green Belt on the eastern side of this allocation.

10.2.7 Policy NE7: Reducing flood risk

Planning permission for development proposals will be granted provided that:

- a) *Development is located outside of medium and high-risk flood areas (flood zone 2 and 3) and other areas affected by other sources of flooding where possible;*
- b) *Where (a) is not possible, application of the sequential and exception tests is demonstrated where development is proposed in areas of flood risk using the Strategic Flood Risk Assessment (SFRA) and Environment Agency flood maps;*
- c) *An FRA has been prepared in accordance with national guidance that considers the lifetime of the development, climate change impacts and safe access and egress;*
- d) *It will be located, designed and laid out to ensure the risk of flooding is reduced whilst not increasing flood risk elsewhere;*
- e) *The impact of any residual flood risk will be minimised through flood resilient design and construction;*
- f) *Any flood protection and mitigation measure necessary will not cause harm to nature conservation, heritage assets, and/ or landscape and recreation and, where possible, will have a positive impact in these respects; and*
- g) *Overland flow routes and functional floodplain areas are protected from all development other than that which is "water compatible" and this must be designed and constructed to remain operational and safe for users during flood events, resulting in no net loss of flood plain storage and no impedance of water flows or increased flood risk elsewhere.*

10.2.8 Policy NE8: Sustainable drainage systems

Planning permission for development will be granted provided that:

- a) The most appropriate sustainable drainage solution is used taking into account technical, viability and design issues to reduce the risk of surface water flooding, and enhance biodiversity, water quality and provide amenity benefits;*
- b) It aims to mimic the natural drainage patterns and processes as far as possible; and*
- c) Drainage solutions follow the SuDS hierarchy.*

10.2.9 Policy SP14: Site BA1 – North of Baldock

- j) Address existing surface water flood risk issues, particularly to the south of Ashwell Road, through SUDs or other appropriate solution; and*
- k) Appropriate mitigation, compensation and / or enhancement of key features of biodiversity as informed by detailed assessments including: i. Ivel Springs Local Nature Reserve; ii. Bygrave Road local wildlife site; and iii. identified protected species and priority habitats.*

Hertfordshire County Council's Local Flood Risk Management Strategy (LFRMS) (2019)**10.2.10 The following policies from the Strategy are referred to in this Chapter:**

- Policy 13: Discharge hierarchy for SuDS
- Policy 14: Runoff rates for greenfield sites
- Policy 16: Flooding on and from development sites
- Policy 17: Development sites along natural flow routes and in existing flood risk areas
- Policy 18: SuDS to be designed at or near the surface
- Policy 19: During construction arrangements
- Policy 20: SuDS to have a design life compatible with the development and to include a management and maintenance plan
- Policy 21: SuDS to have wider benefits

10.2.11 The following local policies are also referred to in this Chapter:

- North Hertfordshire Strategic Flood Risk Assessment (July 2008);
- North Hertfordshire Strategic Flood Risk Assessment Update (2016);
- Hertfordshire County Council Level 1 Strategic Flood Risk Assessment (2022); and
- Hertfordshire County Council's LLFA Summary Guidance for Developers updated in August 2021.

10.3 ASSESSMENT METHODOLOGY**Scope*****Flood Risk Assessment***

- 10.3.1 This chapter assesses the geology based on the site-specific site investigations and provides a review of flood risk from all potential sources, including groundwater. Although Flood Risk has been scoped into the EIA via a detailed site-specific Flood Risk Assessment (Appendix 10.1), this chapter gives consideration to the flood risk posed to and from the Proposed Development with respect to the surface water drainage design.

Surface Water Drainage Strategy

- 10.3.2 A detailed Drainage Strategy (Appendix 10.2) has been prepared to demonstrate that the Proposed Development can be satisfactorily drained and will not cause any flood risk to other receptors.

BA3 – School Options (Parcel FLE01)

- 10.3.3 In flood risk terms, both residential and educational uses are classified as “more vulnerable” and so there is no difference in the consideration of this parcel within the Flood Risk Assessment regardless of which use is taken forward. The surface water drainage strategy has considered the parcel as being educational use to calculate the worst-case size of the infiltration basin. If the parcel is taken forward as residential use, the volume of the basin will reduce.

Data Sources

- 10.3.4 Consultation has been undertaken with Hertfordshire County Council Lead Local flood authority (HCC LLFA) via three formal pre-planning application meetings.
- 10.3.5 The site-specific Flood Risk Assessment for the development (contained in Appendix 10.1) and the site-specific foul and surface water drainage assessment (contained in Appendix 10.2) were submitted to HCC LLFA and their consultant, WSP, to invite comments prior to the formal planning application. Useful comments were received on expected methodology and parameters, and these have been incorporated into the submission documents.
- 10.3.6 Consultation has been undertaken with Anglian Water (AW) via a formal Pre-Planning Enquiry.
- 10.3.7 The Proposed Development, types of use and project phasing were explained in the application and a local point of foul water connection was identified in Laxton Gardens to which the first parcel might be connected.

- 10.3.8 No further foul water capacity was noted as being available locally and so AW have identified a route for a pumped rising main from the Site to the treatment works in Letchworth. AW have confirmed that these works have sufficient capacity for the proposed development.
- 10.3.9 The Environment Agency were consulted regarding the proposed surface water drainage strategy and have confirmed that a Preliminary Groundwater Risk Assessment should be carried out, given the proposed infiltration solution. This assessment has been carried out by Shadbolt (refer to the Preliminary Risk Assessment appended to Chapter 12).

Assessment Approach

- 10.3.10 In this chapter, both the magnitude of the impact and the sensitivity of the receptor are considered in order to assess the significance of impacts. Magnitude is described as the level of change against baseline conditions. Included within the assessment of magnitude is the likelihood of whether an impact will occur and the rate of spread of the impact.
- 10.3.11 For an impact to occur, a pathway must be established between the source pollutant / activity to the receptor in the water environment.
- 10.3.12 All assessments state the level of effect that is considered to be significant in terms of the EIA, so that the assessment can state whether each effect considered is either significant, or not significant. As a guide, effects that are assessed as Moderate or greater are generally assessed as significant.
- 10.3.13 All effects identified are either classified as beneficial or adverse, with the EIA giving appropriate weight to both types of effects.

Significance Criteria

- 10.3.14 Magnitude of impact, based on the change that the Proposed Development would have upon the resource/receptor, is considered within the range of Large, Moderate, Small and Negligible. Consideration is given to scale, duration of impact/effect (e.g. for construction, short-term for 1-2 years, medium-term for 3-5 years, long-term for 5 years and greater, and permanent, dependent upon project timeframes) and the extent of the Proposed Development. These magnitudes are defined as:

Table 10.1 - Magnitude of Impact Criteria

Magnitude	Description
Large	The proposed development would result in the complete loss of a receptor and cause an acute and severe short-term impact and the potential for long term secondary impacts or a chronic long term permanent change to the baseline condition. A direct pathway is identified with no barriers or factors impeding a pollutant from reaching the receptor.

Magnitude	Description
	Impacts are detectable over a large area and would cause a breach or failure of statutory policy / legislation
Moderate	The proposed development would result in the partial loss of a resource or degrade a receptor environment and cause a change to the baseline condition but not of major magnitude. A pathway can be clearly identified but with limits or barriers that would impede the interaction between the source and the receptor. The impacts may be contrary to relevant policy and guidance.
Small	The proposed development would increase the rate of current degradation or introduce some minor detractors to the environment with a small-scale impact to the water environment with no long-term effects. A pathway can be clearly identified but there are limits or barriers that would impede the source from reaching the receptor. Any impacts are confined to the immediate surroundings of the proposed development. Although a change is proposed, it is in line with the relevant policy and guidance.
Negligible	No measurable change against the baseline. No feasible pathway can be identified.

Table 10.2 – Receptor Sensitivity Assessment

Receptor Sensitivity	Receptor Type
High	High sensitivity land use (e.g. schools and residential) is protected by regional or local legislation: - Can be substituted in the long term. - Is used as a local potable water supply.
Medium	Medium sensitivity land use (e.g. public open spaces) with a local amenity value: - May be afforded protection by regional or local legislation or is of value to stakeholders. - Can be substituted in the long-term. - It is used as water supply for industrial, commercial or agricultural purposes.
Low	Low sensitivity land use (e.g. commercial or industrial) with low amenity value: - It is not used as water supply. - Can be substituted in the short-term. - Has non-statutory designation.
Negligible	Very low sensitivity land use (e.g. unoccupied or vacant land) that is not used for water supply. - Has a non-statutory designation. - Can be substituted in the short term.

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

Table 10.3 - Magnitude of Impacts

Impact	Large	Moderate	Small	Negligible
Impact from earthworks or construction activities during the construction phase		✓		
Impact from typical pollutants from the construction Site		✓		
Impact from runoff over the lifetime of the Proposed Development / failure of the SuDS attenuation protective measures.		✓		
Impact from flooding within the Proposed Development / failure of the attenuation protective measures.		✓		
Impact from groundwater flooding over the lifetime of the Proposed Development				✓
Impact from hydrocarbons derived from roads and car parks entering surface water watercourses / surface water drainage			✓	
Impact from hydrocarbons derived from roads and car parks entering the underlying aquifer.		✓		

Table 10.4 – Sensitivity of Receptors

Receptor	High	Medium	Low	Negligible
Fluvial flood risk to downstream receptors	✓			
Surface water (pluvial) flooding of adjacent areas		✓		
Surface water (pluvial) flooding of construction site			✓	
Groundwater flooding		✓		
Water quality (surface watercourses)		✓		
Water quality (groundwater)	✓			

Table 10.5 - Significance of Effects

Magnitude	Sensitivity			
	High	Medium	Low	Negligible
Large	Major	Major	Moderate	Minor
Moderate	Major	Moderate	Minor	Negligible
Small	Moderate	Minor	Minor	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Uncertainties and Limitations

- 10.3.16 The surface water drainage strategy is based upon the Parameter Plan and a series of assumptions regarding the amount of hardstanding to be provided in each parcel. These assumptions are believed to be representative but as each parcel comes forward as a detailed masterplan, more detailed calculations will need to be undertaken.
- 10.3.17 The site investigations undertaken to date give sufficient information to determine the infiltration solution is viable across the Site. However, as parcels come forward, developers may wish to undertake additional, more focused investigation to suit specifics of the detailed masterplan.

10.4 BASELINE CONDITIONS

- 10.4.1 This section describes the current conditions within the Study Area and the likely evolution of these conditions if the Proposed Development were not to be implemented.

The Current Baseline***Topography***

- 10.4.2 The southern area generally falls from south to north from a high point of approximately 90.00 m AOD at the south-western corner to 72.00 m AOD at Clothall Road and approximately 68.00 m AOD at Royston Road.
- 10.4.3 The central area between Royston Road and the railway line generally falls from east to west from a high point of 77.00 m AOD at the eastern boundary down to 66.00 m AOD next to the commercial premises.
- 10.4.4 The northern area also falls east to west from a high point of 80.00 m AOD at the eastern boundary to 57.00 m AOD at North Road.

Surface Hydrology

- 10.4.5 There is a single existing mapped water course to the north-west of the Site – Ivel Springs and the River Ivel, which emanates from the Springs and flows north to join the Great Ouse just west of Tempsford.
- 10.4.6 There is also an existing ditch which runs north along the western boundary of Plot BA3, adjacent to Aleyn Way and then east along the southern side of Royston Road.

Geology

- 10.4.7 Superficial geology across the area of the Site to the north of the railway line consists mainly of alluvial deposits of Sand and Silt with veins of Clay with Flints Formation and Lowestoft Formation. In addition, there is a small area of Glaciofluvial Deposits (Mid Pleistocene - Sand and Gravel) in the south-western corner. The area is underlain by bedrock comprising mainly of West Melbury Marly Chalk Formation. In addition, there are small areas of the Chalk Formations, Totternhoe Stone Member and Zig Zag Formation.
- 10.4.8 Superficial geology across the area of the Site to the south of the railway line comprises alluvial deposits of Sand and Silt with veins of head deposits of Clay, Silt, Sand and Gravel. The area is underlain by bedrock comprising Holywell Nodular Chalk Formation and New Pit Chalk Formation. A proportion of the southern area to the immediate south of the B656 comprises made ground as a result of the spoil which was generated during the construction of the A505.

Groundwater

- 10.4.9 An initial, limited site investigation was carried out on the northern part of the Site in November 2017 in which groundwater was not encountered.
- 10.4.10 Further, more detailed site investigation works were undertaken on the northern part of the Site in November 2023 and, as with the previous investigation, no groundwater was encountered.
- 10.4.11 In May 2024, more detailed site investigation works were undertaken in BA2 and the plots south of the railway line which did not encounter groundwater in any of the 36 exploratory holes nor in any of the subsequent monitoring visits to date.
- 10.4.12 The groundwater monitoring results are contained in Appendix 4 of the Flood Risk Assessment in Appendix 10.1 of this document.

Aquifers

- 10.4.13 The superficial drift expected beneath the Site is classified as a Secondary A or Secondary (undifferentiated) Aquifer.
- 10.4.14 The bedrock beneath the Site is classified as a Principal Aquifer.

Figure 10.1 - Combined Geology Map

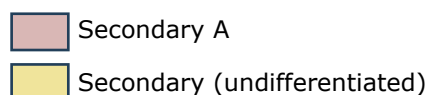
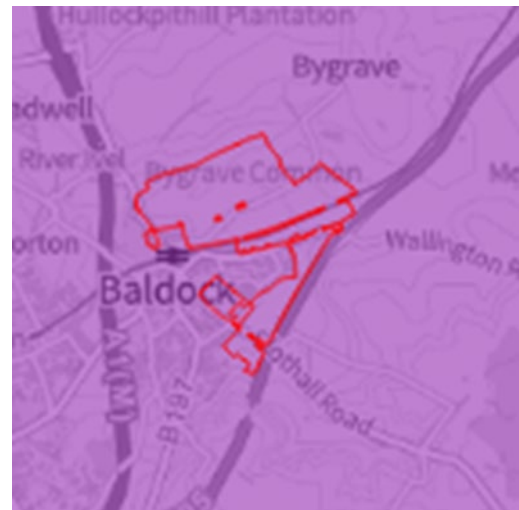


Figure 10.2 - Bedrock Aquifer Map



- 10.4.15 Principal and secondary aquifers provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands.

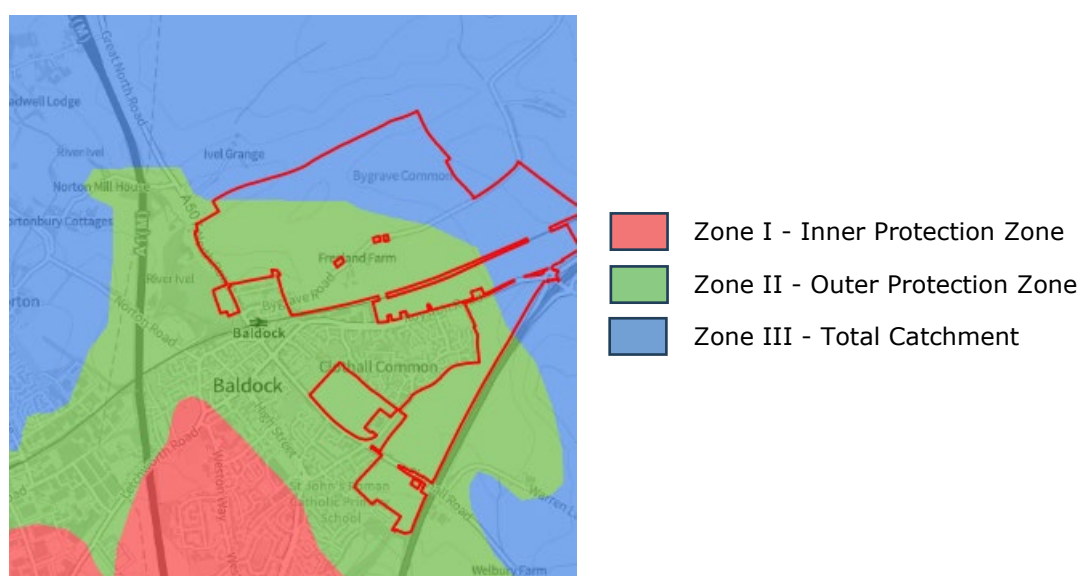
Water Framework Directive classification

- 10.4.16 There are no specific water bodies (rivers, canals or lakes) within the development land.

Source Protection Zone classification

- 10.4.17 The EA designates Source Protection Zones (SPZs) in areas of groundwater sources used to supply drinking water. These are non-statutory designations identifying the risk level in terms of susceptibility to contamination.
- 10.4.18 The Site is located partially within a Zone II - Outer Protection Zone (SPZ2) and partially in Zone III - Total Catchment (SPZ3).

Figure 10.3 Source Protection Zone map

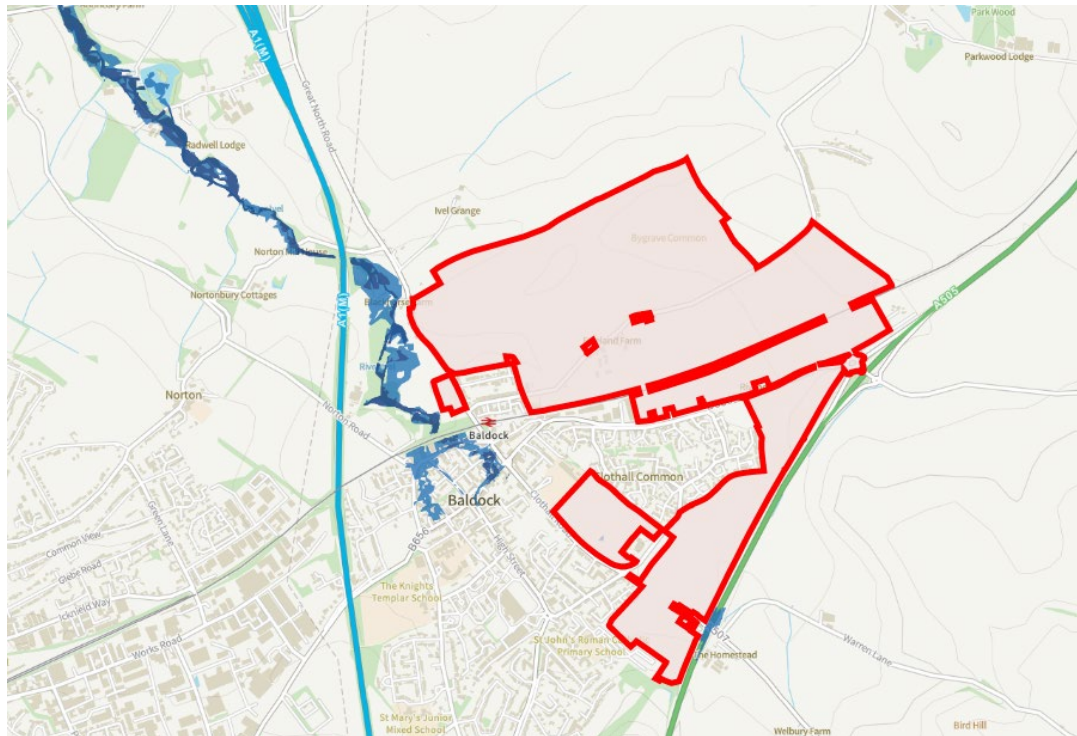


- 10.4.19 A groundwater SPZ2 is the area around an abstraction point for domestic supply or for food production purposes.
- 10.4.20 SPZ3 is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.

Fluvial Flood Risk

- 10.4.21 The EA floodplain maps identify areas in England at risk of flooding by allocating them into flood risk zones. The EA Flood Map for Planning, available via the EA's Flood Map for Planning service, indicates the Site is situated entirely within Zone 1. According to the Ministry of Housing, Communities and Local Government 'Flood Risk and Coastal Change' guidance, Flood Zone 1 is considered to have less than 1-in-1000 (<0.1%) annual probability of river or sea flooding in any year. Therefore, the baseline risk of flooding from rivers and the sea is considered low at the Site.

Figure 10.4 - Flood Risk Map for Planning



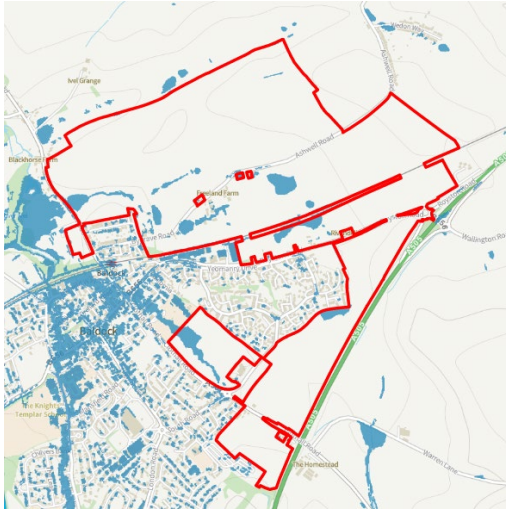
Flood Defences

- 10.4.22 According to the EA Flood Map for Planning, the Site is not in an area benefiting from flood defences. Flood defences are generally uncommon within Flood Zone 1 due to an absence of need.

Surface Water (Pluvial) Flood Risk

- 10.4.23 The Flood and Water Management Act 2010 defines surface water flooding as flooding that takes place when surface runoff generated by rainwater falls on the surface of the ground and has not yet entered a watercourse, drainage system or public sewer.
- 10.4.24 The EA's indicative surface water flood mapping, available via the online long-term Flood Warning Information Service, identifies areas in England at potential risk of surface water (pluvial) flooding. The EA published updated surface water mapping via the NaFRS in January 2025. The EA mapping indicates that the majority of the Site is located in an area identified as having a very low risk of surface water flooding.
- 10.4.25 On the southern half of the Site there are two localised areas of flooding indicated as having a medium to high risk of occurring - one to the south of the properties on Merchants Walk and one in the field between the property "Watts Roofing Supplies" and the railway line. There is also an overland flow path shown emanating from close to the junction of Clothall Road and Wallington Road and flowing north towards the centre of Baldock through the playing field of Hartsfield Primary School.

On the northern half of the Site there is flooding indicated to the south of Half Way Farm and Freeland Farm which then crosses Bygrave Road & flows around Laymoor Farm and the rear of the properties on Salisbury Road to a low point adjacent to North Road. This is generally consistent with the route of the historic Winterbourne which crosses the Site.



**Figure 10.5 - Environment Agency's
Extent of Flooding from Surface
Water (1 in 30)**



**Figure 10.6 - Environment Agency's
Extent of Flooding from Surface
Water (1 in 100)**



**Figure 10.7 - Environment Agency's
Extent of Flooding from Surface
Water (1 in 1,000)**

Flooding from Artificial Sources

- 10.4.26 According to the EA's online Flood Warning Information Service, the Site is not identified as being within an area at risk of flooding from reservoirs. Any flooding from a failure of the Hatch Lane Reservoir remains west of Clothall Road and south of the railway line.
- 10.4.27 There are no other known artificial sources of flooding in the area.

Historic Flood Risk

- 10.4.28 The Site is not situated within an area of historic flooding according to data from the EA's online spatial data map service.
- 10.4.29 There is no historic flooding recorded by the EA on the Site. Additionally, no historic flooding of any type is noted on the Site within the Hertfordshire County Council SFRA.

Groundwater Flood Risk

- 10.4.30 Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata and is often highly localised and complex. After a prolonged period of rainfall, a considerable rise in the water table can result in inundation for extended periods of time.
- 10.4.31 The North Hertfordshire SFRA indicates areas susceptible to groundwater flooding and shows that the majority of the Site has a flood risk of less than 25%, with a small area in the north-west of the Site having a 50-75% risk. However, the mapping is based on a 1km by 1km grid and this square is an isolated higher risk square which includes Ivel Springs and so the "groundwater flooding" is believed to relate to the origin of the River Ivel rather than actual flooding.
- 10.4.32 Neither the site investigation works undertaken by WYG in 2017 or Shadbolt in March 2024 encountered significant groundwater anywhere on Site.
- 10.4.33 Also, the available British Geological Society onshore borehole records in the area did not encounter groundwater to a depth of at least 10 m below ground level.

The Projected Future Baseline***Topography***

- 10.4.34 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of topography.

Surface Hydrology

- 10.4.35 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of surface hydrology.

Geology

- 10.4.36 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of geology.

Groundwater

- 10.4.37 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of groundwater.

Aquifers

- 10.4.38 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of aquifers.

Water Framework Directive classification

- 10.4.39 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of the Water Framework Directive classification.

Source Protection Zone classification

- 10.4.40 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of the Source Protection Zone classification.

Fluvial Flood Risk

- 10.4.41 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of fluvial flood risk. The EA mapping includes allowances for the impact of climate change on the flood extents.

Flood Defences

- 10.4.42 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of flood defences.

Surface Water (Pluvial) Flood Risk

- 10.4.43 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of surface water flood risk. The EA mapping includes allowances for the impact of climate change on the flood extents.

Flooding from Artificial Sources

- 10.4.44 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of the risk of flooding from artificial sources. The EA mapping includes allowances for the impact of climate change on the flood extents.

Historic Flood Risk

- 10.4.45 There would be no evolution of the current conditions without implementation of the Proposed Development in respect of historic flooding.

Groundwater Flood Risk

- 10.4.46 Without implementation of the Proposed Development, it is likely that groundwater levels would continue to drop due to abstraction in the area unless Affinity Water implement a scheme to reduce their abstraction rates. In this scenario, there would be an improvement on the current conditions in respect of groundwater flood risk.

10.5 POTENTIAL EFFECTS

- 10.5.1 This section identifies potentially significant effects of the Proposed Development before any mitigation measures are implemented.

Construction Stage

Fluvial Flood Risk to the Proposed Development

- 10.5.2 The Proposed Development is in Flood Zone 1 and at low risk of flooding both now and when the future impacts of climate change are considered. Further detail is given in the detailed site-specific Flood Risk Assessment in Appendix 10.1 of this document. The Significance of Effects is considered **Minor Adverse**.

Fluvial Flood Risk resulting from the Proposed Development

- 10.5.3 Earthworks during the construction phase may compact and disturb the ground reducing its ability to absorb rainfall. Prior to construction of the Sustainable Drainage Systems (SuDS) which will form part of the Proposed Development, there will be some potential for increased surface water runoff rates which, in turn, could exacerbate fluvial flood risk in downstream watercourses and rivers. The Significance of Effects is considered **Moderate adverse**.

Pluvial (Surface Water) Flooding

- 10.5.4 As with fluvial flood risk, earthworks during the construction phase may compact and disturb the ground reducing its ability to absorb rainfall. Localised low points may also exist temporarily during construction where surface water could accumulate. The impact would be limited to the effect on the progress of the construction itself and is likely to be short-lived and manageable. The Significance of Effects is considered **Minor Adverse**.
- 10.5.5 There may also be some potential for increased surface water runoff causing pluvial flooding beyond the Site. The Significance of Effects is considered **Moderate Adverse**.

Groundwater Flooding

- 10.5.6 Although unlikely, earthworks during the construction phase may involve excavation into ground water and require the provision of ground water management during the works. Prior to construction of the Sustainable Drainage Systems (SuDS) which will form part of the proposed development, there may be some potential for increased ground water runoff which, in turn, could exacerbate fluvial flood risk in downstream watercourses if not managed correctly. The Significance of Effects is considered **Minor Adverse**.

Water Quality Impacts on Surface Water Receptors

10.5.7 During the construction phase, there are a range of typical pollutants from construction sites which could impact the water quality of surface watercourses if this water were to enter the surface water drainage systems.

10.5.8 Potential significant impacts associated with the construction phase include:

- Leakage of fuel or chemicals from storage tanks causing pollution of the River Ivel;
- Spillage of fuels during delivery or fuelling operations causing pollution of the River Ivel;
- Spillage or leakage from drainage systems causing pollution of the River Ivel;
- Migration of contaminants associated with leakages or spillages causing pollution of the River Ivel; and
- Migration of contaminants associated with the leakages or spillages to surface water bodies and ditches causing pollution

10.5.9 The Significance of Effects is considered **Moderate Adverse**.

Water Quality Impacts on Groundwater Receptors

10.5.10 During the construction phase, there are a range of typical pollutants from construction sites which could impact the water quality of groundwater if this water were to enter the groundwater system.

10.5.11 Potential significant impacts associated with the construction phase include:

- Leakage of fuel or chemicals from storage tanks causing pollution of the groundwater and aquifer;
- Spillage of fuels during delivery or fuelling operations causing pollution of the groundwater and aquifer;
- Spillage or leakage from drainage systems causing pollution of the groundwater and aquifer;
- Migration of contaminants associated with leakages or spillages causing pollution of the groundwater and aquifer; and
- Migration of contaminants associated with the leakages or spillages to groundwater and the aquifer causing pollution

10.5.12 The Significance of Effects is considered **Major Adverse**.

Post-Completion Stage

Fluvial Flood Risk resulting from the Proposed Development

- 10.5.13 The proposed increase in the impermeable area would, in the absence of mitigation measures, result in a significant increase in the peak rate and volume of surface water runoff, which would exacerbate flood risk to receptors downstream. T
- 10.5.14 The Significance of Effects is considered **Moderate Adverse**.

Pluvial (Surface Water) Flooding

- 10.5.15 The risk of surface water flooding before development is currently relatively low, but the development will involve a significant increase in surface hardstanding. In the absence of mitigation measures, it would therefore be more likely for surface water to flow overland and accumulate at localised low points both on site and at adjacent sites, notably at and adjacent to the areas noted in Section 10.4.12.
- 10.5.16 The Significance of Effects is considered **Moderate Adverse**.

Groundwater Flooding

- 10.5.17 The proposed SuDS strategy relies heavily on infiltration for disposal of surface water and so the groundwater and aquifer will be recharged, potentially increasing the risk of elevated groundwater levels.
- 10.5.18 The Significance of Effects is considered **Minor Adverse**.

Water Quality Impacts on Surface Water Receptors

- 10.5.19 During the operational phase, much of the runoff will be clean in that it comes from roofs and hard-landscaping areas.
- 10.5.20 There is the potential for contaminants to arise from roads and parking areas and flow to downstream watercourses and sensitive water storage areas.
- 10.5.21 The Significance of Effects is considered **Moderate Adverse**.

Water Quality Impacts on Groundwater Receptors

- 10.5.22 The proposed SuDS strategy relies heavily on infiltration for disposal of surface water and so this introduces a pathway to a sensitive receptor.
- 10.5.23 The majority of the runoff will be "clean" as it comes directly from roof drainage and drainage from hard-landscaping areas.
- 10.5.24 Runoff from car parking areas and internal site roads has greater potential for containing pollutants such as fuels and oils from vehicles.

10.5.25 The Significance of Effects is considered **Moderate Adverse**.

10.6 MITIGATION MEASURES

- 10.6.1 This section discusses the mitigation measures proposed to avoid, prevent, reduce or offset the potential adverse effects identified above, together with an indication of their likely effectiveness.

Construction Stage***Flood Risk to and from the Proposed Development***

- 10.6.2 During the construction phase of the project, a temporary drainage strategy will need to be produced by the contractor undertaking the works, in order to manage surface water quality and runoff volumes within the Site.
- 10.6.3 This approach will ensure that flood risk does not increase during the construction phase both within the Site and to downstream receptors.
- 10.6.4 This surface water management strategy forms part of the outline Construction Environmental Management Plan (CEMP) submitted with the Outline Master Plan. The outline CEMP can be controlled by planning condition. Detailed CEMPs will be required to be prepared, submitted and approved at the Reserved Matters application stage.

Water Quality Impacts on Surface Water and Groundwater Receptors

- 10.6.5 To mitigate these impacts, CEMPs will be drawn up and implemented during the construction phase which will identify all associated risks and put in place a strategy to deal with and monitor these risks.
- 10.6.6 Specific mitigation measures identified in the CEMPs are likely to include silt traps, temporary drainage systems to manage overland flow, and the storage of fuels and chemical in impermeable and bunded enclosures.
- 10.6.7 The preparation, submission and approval of the detailed CEMPs can be controlled by planning condition.
- 10.6.8 During the construction phase, and as will be identified in the CEMPs, regular inspections of the Site will be made to identify potential issues such as silt runoff and to ensure, for example, good housekeeping regarding use and storage of fuels and chemicals.
- 10.6.9 Emergency action plans should be prepared and kept on site for implementation in the event of accidental spills.

Post-Completion Stage***Fluvial and Pluvial Flood Risk to and from the Proposed Development***

- 10.6.10 The increase in the impermeable area of the Site during the operational phase gives rise to the potential for increased rates and volumes of surface water runoff which could exacerbate both fluvial and pluvial flood risk downgradient / downstream of the Site.
- 10.6.11 Mitigation against this potential adverse impact is embedded in the design of the development through the AKT II Drainage Strategy contained in Appendix 10.2 of this document.
- 10.6.12 Earthworks will regrade areas of existing surface water flooding to direct them to and contain them within the new infiltration basins to be disposed of in a controlled manner.
- 10.6.13 The Drainage Strategy proposes the use of soakaways, swales, permeable paving, raingardens / bio-retention and infiltration basins to dispose of surface water and reduce the potential for surface water flowing off-site and into surface water receptors.
- 10.6.14 These SuDS features are designed to accommodate a 1 in 100-year rainfall event plus a 40% allowance for climate change.
- 10.6.15 An allowance has also been made in the design for urban creep to mitigate possible future increases in hardstanding areas.
- 10.6.16 Base infiltration rates have been reduced to mitigate potential silting up of the infiltration devices over their lifetime.
- 10.6.17 Where possible, surface water will be captured and disposed of at source by using individual soakaways for residential plots and permeable paving within car parking areas and some secondary or tertiary roads.
- 10.6.18 During the operational phase, the drainage system, including all SuDS devices will be inspected and maintained routinely to ensure they continue to function as intended.
- 10.6.19 The detailed design of the proposed drainage strategy would be included in future Reserved Matters applications.

Groundwater Flooding

- 10.6.20 Groundwater was not recorded in any of the site investigation works carried out and there is a known issue of insufficient groundwater feeding the River Ivel, so groundwater flooding is highly unlikely even with the proposed infiltration strategy. However, groundwater levels will be monitored by the Developer to assess the impact of the drainage strategy on the aquifer / River Ivel, and this will also act as a method to assess any increasing flood risk from rising groundwater levels.

Water Quality Impacts on Surface Water Receptors

- 10.6.21 The proposed use of Sustainable Drainage Systems (SuDS), in this case a combination of soakaways, swales, permeable paving, raingardens / bio-retention and infiltration basins, will significantly limit the number of pollutants, debris and silts reaching any surface water receptors off-site.
- 10.6.22 A robust management and maintenance strategy will be produced to ensure that the SuDS drainage system remains fit for purpose throughout the lifetime of the development and particularly after extreme rainfall and storm events.

Water Quality Impacts on Groundwater Receptors

- 10.6.23 The discharge of clean roof water to the ground is acceptable provided that (a) all roof water downpipes are sealed against pollutants entering the system from polluted surface runoff, effluent disposal or other forms of discharge and (b) gross sediments and silts are removed upstream of the infiltration component.
- 10.6.24 To prevent hydrocarbons derived from roads and car parks entering the aquifer, a series of SuDS devices will provide treatment to the runoff before it is discharged by infiltration. Swales, permeable paving, filter trenches, raingardens / bio-retention and infiltration basins will be combined in a variety of permutations to provide sufficient levels of treatment to the runoff as necessary. In some cases, oil separators may need to be included within the drainage system which will require routine maintenance to remain effective.

10.7 RESIDUAL EFFECTS

- 10.7.1 Provided the mitigation measures detailed above are implemented, along with the recommendations of the site-specific Flood Risk Assessment and drainage assessments, negligible to minor beneficial, if any, residual effects on the water environment from the construction phase or operational phase are anticipated.

Construction Stage

- 10.7.2 The residual effect on hydrology and flooding at the construction stage is **Negligible**.

Post-Completion Stage

- 10.7.3 The residual effect on hydrology and flooding at the post-completion stage is **Negligible to Minor Beneficial**.

Summary of Effects

- 10.7.4 The effects identified are summarised in **Table 10.6** below.

Table 10.6 – Summary of Effects

Potential Effect	Significance (pre-mitigation)	Mitigation Measure	Significance of residual effect
Construction Stage			
Fluvial flood risk to downstream receptors	Minor adverse	Temporary drainage strategy to manage surface water runoff. Implementation of CEMP measures.	Negligible
Surface water (pluvial) flooding of adjacent areas	Moderate adverse	Temporary drainage strategy to manage surface water runoff. Implementation of CEMP measures.	Negligible
Surface water (pluvial) flooding of construction site	Minor adverse	Temporary drainage strategy to manage surface water runoff. Implementation of CEMP measures.	Negligible
Groundwater flooding	Minor adverse	Temporary drainage strategy to manage surface water runoff. Implementation of CEMP measures.	Negligible
Water quality (surface watercourse)	Moderate adverse	Implementation of CEMP measures.	Negligible
Water quality (groundwater)	Major adverse	Implementation of CEMP measures.	Negligible

Potential Effect	Significance (pre-mitigation)	Mitigation Measure	Significance of residual effect
Post-Completion Stage			
Fluvial flood risk to downstream receptors	Moderate adverse	Refer to site-specific Flood Risk Assessment (Appendix 10.1).	Minor Beneficial
Surface water (pluvial) flooding of adjacent areas	Moderate adverse	Refer to site-specific Flood Risk Assessment (Appendix 10.1).	Minor Beneficial
Surface water (pluvial) flooding of development site	Moderate adverse	Refer to Drainage Strategy (Appendix 10.2).	Minor Beneficial
Groundwater flooding	Minor adverse	Refer to site-specific Flood Risk Assessment (Appendix 10.1).	Negligible
Water quality (surface watercourse)	Moderate adverse	Refer to Drainage Strategy (Appendix 10.2).	Negligible
Water quality (groundwater)	Moderate adverse	Refer to Drainage Strategy (Appendix 10.2).	Negligible

CUMULATIVE EFFECTS

- 10.7.5 There are no other known Proposed Developments adjacent to the Site which may introduce impacts which are anticipated to produce cumulative effects.
- 10.7.6 As the Proposed Development has been designed to replicate and mimic the existing greenfield surface water run off rates and disposes of surface water by infiltration, there should be no impact on the surrounding land in the existing or proposed conditions.

10.8 REFERENCE LIST

Anglian Water Asset Maps.

BS 8533:2011 Assessing and managing flood risk in development: code of practice, October 2011.

CIRIA Report C624, Development and Flood Risk: guidance for construction industry, 2004.

DEFRA/Environment Agency FD 32 2321/TR2, Flood Risks to People methodology, March 2006.

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