

Redwings Baldock

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY REPORT

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Redwings Lodge

Redwings Baldock

Flood Risk Assessment & Drainage Strategy Report

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1 Introduction

1.1 Background

- 1.1.1 Link was commissioned by Redwings Lodge to prepare a Flood Risk Assessment and associated Drainage Strategy in respect to a proposed development at Redwings Lodge hotel off the A1, Baldock, south of Hinxworth.
- 1.1.2 As required by North Hertfordshire District Council, the Local Planning Authority, and the North Herts Local Plan 2011-2031, this report has been prepared to provide a Flood Risk Assessment, Sustainable Drainage Strategy, and Drainage Management Plan in support of a full planning application.
- 1.1.3 Hertfordshire County Council are the LLFA responsible for undertaking the Strategic Flood Risk Assessment for the region which the site is located in.
- 1.1.4 The proposed scheme shall comprise an extension to the existing hotel with car parking, landscaping and associated works. The extension shall increase the hotel capacity from 40 to 91 rooms.
- 1.1.5 The proposed site plan and site location plan are included within **Appendix A**.

1.2 Site Location

- 1.2.1 The site is located off the A1, north of Baldock and south of Hinxworth. The site address is A1 Southbound, Hinxworth and will be accessed via the existing entrance to the car park at the southwest corner of the site. Within the site boundary is the existing Cotey's Restaurant to the west of the existing hotel, with Brookside Lodge being located to the south of the site. The site location is outlined in Figure 1. The Nearest Post Code is SG7 5EX.

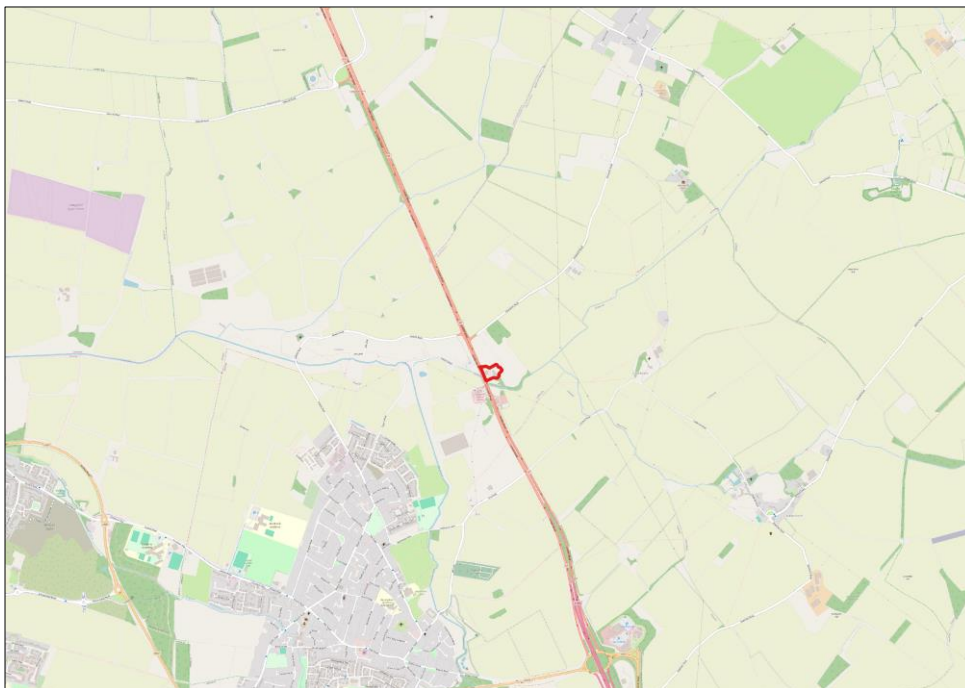


Figure 1. Site Location

1.3 Topography

- 1.3.1 A detailed topographical survey of the site has been completed by Oakley Building Surveyors in May 2025. The survey shows the existing site level range to be between circa 44.3m AOD and 45.1m AOD. The site is generally flat, with some local high points of elevation to the northeast and northwest of the site.

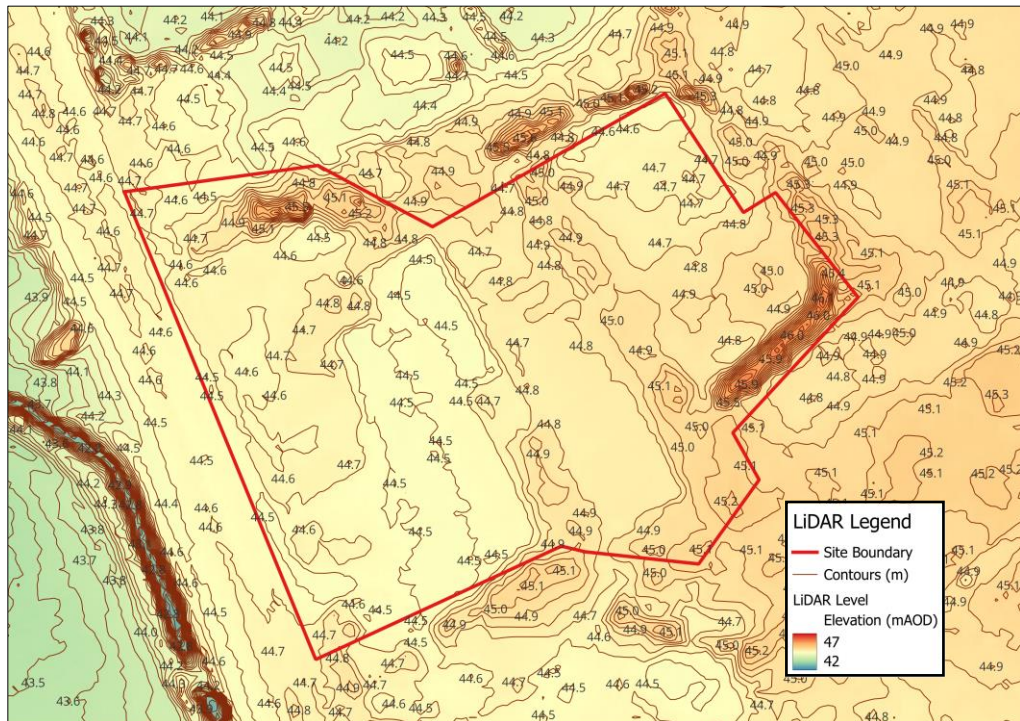


Figure 2. LiDAR Level

- 1.3.2 The main features within the site are the existing hotel with a Finished Floor Level (FFL) of 44.94m AOD, the existing Cotey's Restaurant, the accompanying car park, access, footways and landscaping. The northeast of the site (proposed for the hotel extension) is existing landscaping.
- 1.3.3 The topographical survey is provided in **Appendix B**.

1.4 Former Land Uses

- 1.4.1 Historical free-to-view mapping ([found here](#)) has been reviewed as part of this flood risk assessment. A map published in 1882 shows some small buildings around the site. It appears since 1882 there has been a building where the current restaurant is, however, the location of the hotel itself has remained greenfield until its construction. Given the current land use, existing drainage was anticipated and has been confirmed via a drainage survey (further details in section 1.7) which can be retained as part of the drainage strategy for the development.

1.5 Ground conditions

- 1.5.1 At the time of this report being written there was no site investigation available. Therefore, to get an understanding of the ground geology British Geological Survey (BGS) records were consulted.
- 1.5.2 There is a borehole record within the site boundary, BGS ID: TL23NW119. The borehole record presents the site to be underlain by the following:
- Topsoil – Ground level to 0.25m
 - Medium dense brown silty sand with gravel and flint traces – 0.25m to 0.5m
 - Medium dense light brown sandy gravel with flint and chalk traces – 0.5m to 1.0m
 - Firm grey clayey silt – 1.0m to 2.5m

To gain an approximate understanding of the ground geology deeper than 2.5m, a borehole of sufficient depth was located, BGS ID: TL23NW6, located 1.21km to the east of the site. The borehole record presents the site to be underlain by the following:

- Topsoil – Chalky silty clay from ground level to a depth of 0.30m
- Fairly weak yellowish white chalk between 0.30m and 2.44m
- Medium hard white chalk with occasional soft patches between 2.44m and 6.71m

The borehole logs state that the borehole remained dry throughout boring, therefore the water table is over 6.71m below ground level.

1.6 Watercourses

- 1.6.1 As part of this report, a review of the existing watercourses in close proximity has been completed. The nearest river is the River Ivel, approximately 480m to the west of the site. A small brook splinters off the main River Ivel, along Taylor's Road which at its closest is approximately 30m to the west of the site, moving around to the south of Brookside Lodge approximately 50m south of the site. Figure 3 presents the brook to the south of Brookside Lodge which the existing network on site currently discharges to, and therefore where any additional surface water from the new development will eventually discharge to after it joins the existing network on site.
- 1.6.2 The Internal Drainage Boards (IDB) online map identified that the development is within the Bedfordshire and River Ivel IDB.



Figure 3. Location of Watercourse to Discharge to

1.7 Existing Drainage

- 1.7.1 There is currently storm and foul drainage infrastructure for the existing hotel. The storm water drainage consists of pipes and gullies, with all the storm water having one shared outfall to the south of the site, discharging into the brook to the south of Brookside Lodge. The foul drainage pipes service the main hotel and restaurant, draining to a pumping station at the northwest of the site. This pumping station then discharges the foul water to a package treatment works to the south of the site prior to discharge into the southern brook.
- 1.7.2 A CCTV survey was conducted by Interlock Surveys on the 18th of December 2025 on site to survey the existing drainage and assess its capability and capacity to intake the additional discharge that will arise due to the construction of the proposed development. The CCTV survey drawing can be found in **Appendix C** and the full CCTV report can be found in **Appendix E**.

1.8 Flood Zones and Vulnerability Classification

- 1.8.1 The formal flood zone mapping (<https://flood-map-for-planning.service.gov.uk/>), approved by the government and prepared for use in the planning process, identifies areas potentially at risk of flooding from fluvial or tidal sources without taking into account the presence of flood defences or structures such as culverts or minor watercourses. An extract from the mapping is included in Figure 4; the red line denotes the site boundary.

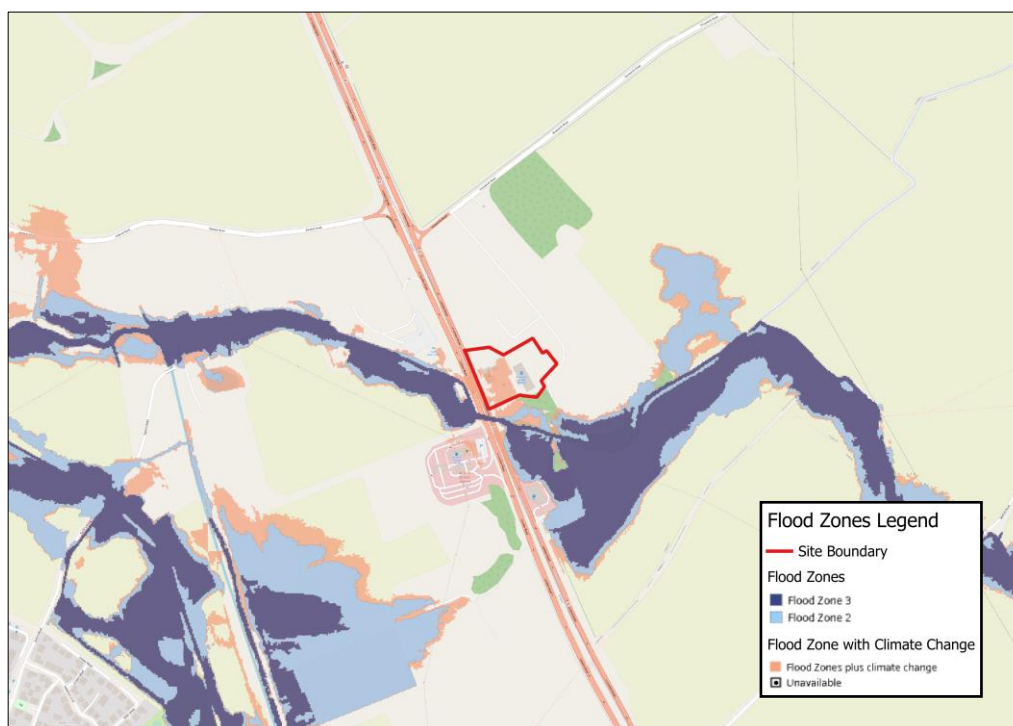


Figure 4. Flood Zones

1.8.2 The formal flood zone mapping shows the site to be located entirely within Flood Zone 1, with the car park being encompassed by the 'Flood Zones plus Climate Change' classification. Table 1 indicates what uses of land are appropriate for each flood zone, as set out within Annex 3 – Flood risk vulnerability and flood zone 'compatibility' in the NPPF. The proposed use would be defined as 'More Vulnerable'; hence the proposed use is deemed acceptable.

Table 1. Flood risk vulnerability and flood zone 'incompatibility'

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓
Zone 2	✓	Exception Test	✓	✓
Zone 3a	Exception Test	✗	Exception Test	✓
Zone 3b	Exception Test	✗	✗	✗

1.9 National Planning Flood Risk Policies Relevant to this Development

1.9.1 The National Planning Policy Framework (NPPF), last revised by the Department of Communities and Local Government (DCLG) on 12th December 2024, took immediate effect on that date. The document Technical Guidance on the National Policy Framework (TGNPPF) also published by the Department of Communities and Local Government, has now been withdrawn and superseded by the Planning Practice Guidance (PPG), published on 29 November 2016. Within the PPG Documentation, there is a guidance document: Flood risk and coastal change which was published 6 March 2014 (last updated 25 August 2022), which '*advises how to take account of and address the risks associated with flooding and coastal change in the planning process*' for new developments.

1.9.2 The requirement for conducting an FRA as part of a planning application is set out in Footnote 63 on page 51 of the NPPF, which states:

"A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use."

1.9.3 Essential content of a site-specific FRA is explained in the PPG, paragraph 20 as follows:

"A site-specific flood risk assessment is carried out by (or on behalf of) a developer to assess the flood risk to and from a development site. Where necessary (see footnote 5 in the National Planning Policy Framework), the assessment should accompany a planning application submitted to the local planning authority. The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users (see Table 1 – Flood Risk Vulnerability).

The objectives of a site-specific flood risk assessment are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- The evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- Whether the development will be safe and pass the Exception Test, if applicable."

1.9.4 For certain types of flood sensitive development, NPPF describes how the Local Planning Authority (LPA) should check that the site proposed has the lowest frequency of flooding of those available for the development. This check is called the "Sequential Test". All development that is identified in the LPA's Local Development Framework Development Plan (LDFDP) has been Sequentially Tested using the LPA's Strategic Flood Risk Assessment (SFRA). When a test is required, and the development is not identified in the Development Plan, NPPF advises that the site-specific FRA includes the Test. NPPF also requires that the FRA includes an

“Exception Test” for flood sensitive development proposed in areas with high frequency of flooding. The reason is to demonstrate that flood risk will be safely managed for the lifetime of the development.

- 1.9.5 According to the latest relevant Planning Practice Guidance, updated on 14th of February 2024, present day rainfall rates should be confirmed from the [Climate Change Allowances](#) map demonstrating climate change allowances for peak rainfall in England. Climate change allowances are further discussed in section 4.3 of this report.
- 1.9.6 "Non-Statutory Technical Standards for Sustainable Drainage Systems" published by Department for Environment, Food and Rural Affairs in March 2015 sets out Government expectations for surface water drainage systems serving major developments to restrict discharges to greenfield rates. The standards do not address the quality of surface water discharges and state circumstances when the discharge rate can be higher than green field, up to the existing flow in the case of redevelopment of brown field sites.

1.10 Local Policy Guidance

- 1.10.1 The North Herts Local Plan 2011-2031 outlines the requirements and considerations developers should follow as part of their proposals. As part of this report, the adopted policies have been reviewed, and the proposal has been developed to comply with their requirements.

- 1.10.2 Policy NE7: Reducing flood risk

Planning permission for development proposals will be granted provided that (as applicable): 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) A 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 resistant, resilient design and construction; f) Any flood protection and mitigation measures 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 not impeding water flows or increasing flood risk elsewhere

- 1.10.3 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, 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.

1.11 National Standards for Sustainable Drainage Systems (SuDS)

1.11.1 This application has been prepared following the National Standards for Sustainable Drainage Systems (SuDS). The 'SuDS Approach' as defined in Principle 3 has been used considered throughout the scheme development.

- ⬢ *Mimicking natural drainage systems and delivering surface water management that recognises the value of rainfall and runoff as a resource;*
- ⬢ *managing surface water flooding and the rates and volumes of runoff from developments now and in the future;*
- ⬢ *contributing to cleansing diffuse particulate and chemical substances that may be found in surface water runoff;*
- ⬢ *using drainage features in combination as a management train, which integrates these throughout the development and its landscape to help create healthy and resilient spaces for people and habitats for wildlife;*
- ⬢ *managing runoff close to its source, prioritising features that lie on the surface and incorporate vegetation;*
- ⬢ *meeting the requirements for delivering multiple benefit SuDS over the lifetime of the development by planning for a changing climate and ensuring long-term maintenance;*
- ⬢ *being sustainable, considering both construction and long-term maintenance and the additional environmental and social benefits afforded by the system;*

1.12 Sequential Test

- 1.12.1 On the 17th of September 2025, the Flood risk and coastal change guidance was updated. Under the revised guidance, the Sequential Test need not be applied provided a development clearly demonstrates that its proposed layout, design, and mitigation measures will ensure occupiers and users remain safe from current and future surface water flood risk for the lifetime of the development, without increasing flood risk elsewhere.
- 1.12.2 As defined within NPPF paragraph 172 the sequential test is not applied again as part of this planning application as the proposed development is consistent with the information considered at this time.

2 FLOOD RISK

2.1 Flood Risk from Sea

- 2.1.1 The proposed development is approximately 85km away from the sea at an average elevation of over 40mAOD. Therefore, it can be concluded that the site is not at risk of flooding from the sea and as such, this source of flooding is not discussed further within this report.

2.2 Flood Risk from Rivers and Watercourses

- 2.2.1 The site is shown on the available flood maps, see Figure 5, to be entirely outside any area of defined risk from river and sea flooding.
- 2.2.2 The EA online maps place the proposed site in an area of 'Very Low' risk of flooding from rivers without climate change, and 'Low' with climate change allowances, see Figure 4 and Figure 5 respectively. The area of 'Low' risk when accounting for climate change is at the existing car park, with the proposed building extension not being within this area. Additionally, as outlined in Section 3, the building extension shall be set above the surrounding external levels at the existing hotel FFL and such shall be protected from flooding. Therefore it is concluded that the proposed development is not at flood risk from this source.



Figure 5. Risk of flooding from Rivers & Sea EA Map



Figure 6. Risk of flooding from Rivers & Sea EA with Climate Change Map

2.3 Flood Risk from Surface Water

- 2.3.1 A source of flood risk to the site is from surface water flooding created by the site itself or adjacent areas. Figure 7 presents the majority of the site to be at very low risk of surface water flooding, with a small section in the middle of the site defined as 'Low' risk (between 1 in 1000 and 1 in 100 probability each year) and a smaller section within this area to be at 'Medium' risk (between 1 in 100 and 1 in 30 probability each year).

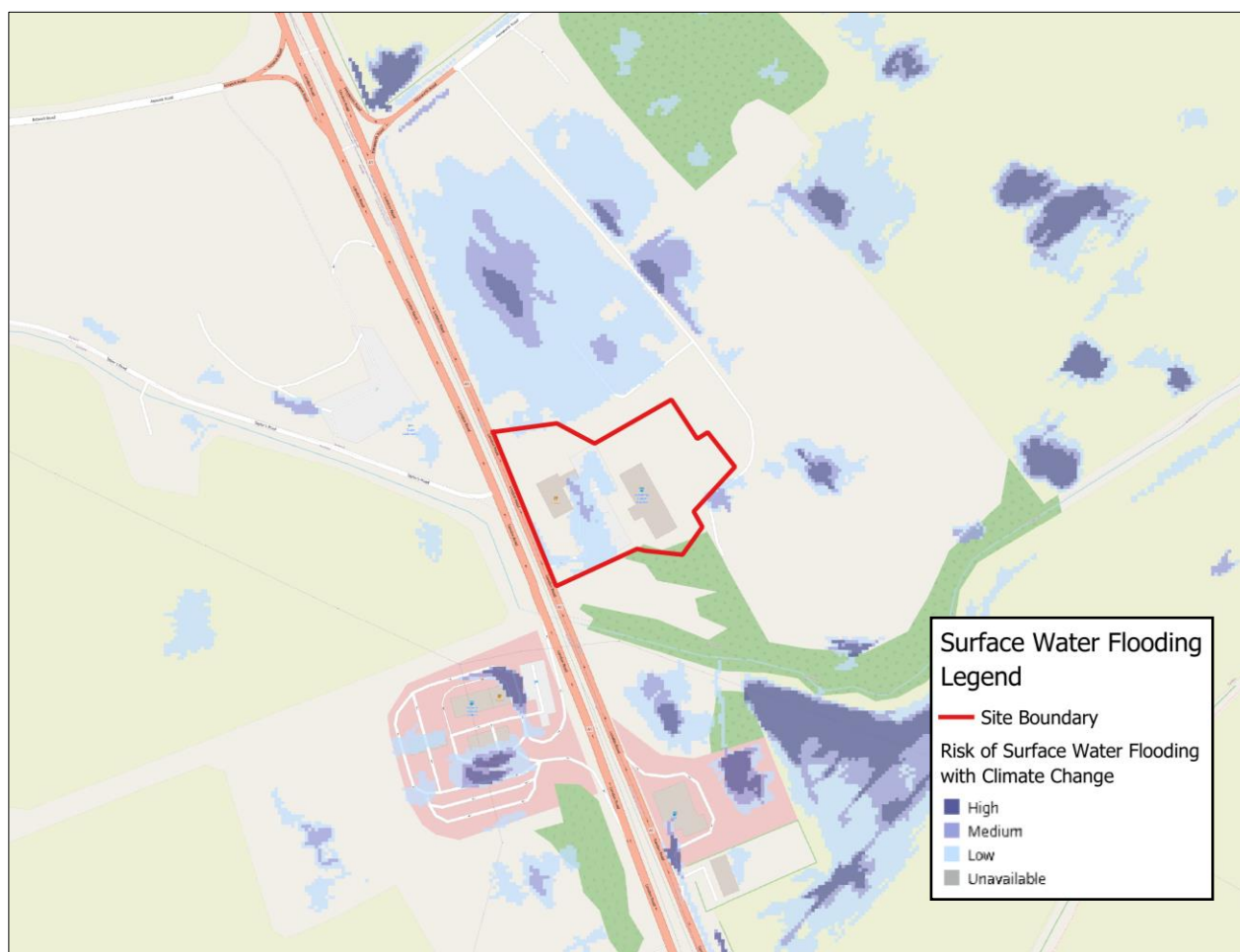


Figure 7. Risk of Flooding from Surface Water: 0.1% AEP (1in1000Y)

- 2.3.2 The new extension will be entirely located within the areas of 'Very Low' risk of surface water flooding, with only a small section of the new car park and access roads being located within the areas of 'Low' or 'Medium' risk. This surface water flood risk is due to the existing topography of the site. It should be noted that the car park and hotel extension shall increase the total impermeable catchment and theoretically increase the surface water flood risk. However, the proposed levels design and a suitably maintained drainage strategy (discussed further in Section 3-5) shall ensure this additional flood risk is mitigated against.
- 2.3.3 Therefore, with the proposed mitigation measures the proposed development will not be affected by surface water flooding and will not impact the potential overland flood flows.

2.4 Flood Risk from Groundwater

- 2.4.1 Hertfordshire County Council's LFRMS plan 2019-2029 includes a groundwater flood risk map. According to this map, the site (located on the County boundary), is located within an area of medium-to-high groundwater flood risk (susceptibility over 50%). However, the borehole record for TL23NW119 located within the site boundary did not strike water within its entire depth of 2.5m and the borehole record for TL23NW6 presents the water table to be at least 6.7m below ground level. In addition to this, the historic flood risk mapping presented in Figure 9

presents there to have been no historic flooding on site. Therefore, it can be said the risk of groundwater flooding local to this site is low, however a site investigation should be conducted to confirm the local groundwater flood risk.

2.5 Flood Risk from Reservoirs, Canals and Other Artificial Sources

- 2.5.1 The reservoir flood map shown in Figure 8 shows the extent of flooding should a canal, reservoir, or other artificial source breach upstream of the development. This shows that the site would not be at risk of flooding from this source and as such this source of flooding is not considered a risk.



Figure 8. Flooding from Reservoirs - EA Map

2.6 Flood Risk from Sewers

- 2.6.1 There are no public sewers located within the site boundary. The existing private drainage sewers are intact as shown in the CCTV survey. Furthermore, Figure 8 highlights there to have been no historic flooding on site. Subject to the maintenance plan outlined in Section 5, the onsite private drainage network shall be frequently maintained thus reducing the risk of flooding. Therefore, flooding from sewers is not considered a risk on this site.

2.7 Historic Flooding

2.7.1 The EA online map does not show the site to have been subject to any historic flooding (see Figure 9).



Figure 9. EA Historic Flooding Map

3 MITIGATION

3.1 Flood Risk Management

3.1.1 It is suggested that the following flood risk management measures are considered to mitigate the risks identified above:

- ✧ It is recommended that the development finished floor level is set above the existing levels and at least 150mm above the proposed surrounding external levels.
- ✧ Wherever possible, the external ground profile in the development will ensure that surface water is directed away from the buildings.
- ✧ The development drainage is subject to a managed maintenance regime to ensure performance as per the design.
- ✧ The proposed development will incorporate a positive surface water drainage system, described further in Section 4, which will intercept runoff from roofs and paved areas before discharging into the existing drainage at a rate no higher than 2.0 l/s (the minimum required to ensure silt does not accumulate in the network which would otherwise increase flood risk).

3.2 Residual Risks

3.2.1 Residual risks are the risks that remain once the flood risk management measures described above have been implemented. These are typically associated with extreme events that overwhelm drainage systems exceeding the flood levels used to design any mitigation measures. The primary residual risks that will affect this development are:

- ✧ An extreme rainfall event which exceeds the capacity of the proposed surface water drainage system to both intercept and convey the flows. During such an event, water that is unable to enter the formal drainage system will flow over the ground through the development. The risk can be reduced by designing site levels to direct any runoff towards the car park, adjacent watercourses, or other corridors running through the site.
- ✧ A lack of, or insufficient, maintenance of the installed drainage system which may cause flow restriction

4 PROPOSED DRAINAGE STRATEGY

4.1 Outfall Assessment

- 4.1.1 As required by Part H of Building Regulations, and Flood risk and coastal change - paragraph 056 in the Planning Practice Guidance of the NPPF and the National SuDS Guidance (Standard 1) the required Drainage Hierarchy has been considered in the development of this strategy as summarised in Table 2.

Table 2. Outfall Assessment

Outfall Options	Available	Comment
Collection for non-potable use	✓	Options for incorporating rainwater harvesting systems have been considered, and it has been deemed suitable for a rainwater harvesting tank to be included as part of the drainage strategy to collect runoff from the extension roof. However, this is not suitable as a way of managing surface water for the entire site.
Discharge into the Ground	✗	The borehole records discussed in Section 1.5 present the strata underneath the proposed development as likely to have an infiltration rate of less than 10 ⁻⁶ m/s. Therefore, infiltration is not deemed a suitable outfall technique. Ground investigation results will confirm viability of infiltration techniques, but the existing site outfall shall be used as a primary surface water outfall.
Watercourse	✓	It is proposed that the existing brook located adjacent to techniques and western site boundaries is to be utilised as a suitable storm drainage outfall. The proposed strategy will be indirectly outfalling to the brook by forming a new connection into the existing hotel drainage infrastructure that currently outfalls into the brook.
Surface Water Sewer, Highway Drain, or another Surface drainage system	N/A	Not considered
Combined Sewer	N/A	Not considered

- 4.1.2 While the current development already discharges into the brook, the additional discharge into the watercourse is subject to agreement with the Bedfordshire and River Ivel IDB who shall be consulted as part of the planning process.

4.2 Runoff Rate Assessment

- 4.2.1 Runoff rates have been calculated based on a catchment area of 0.34ha, which corresponds to the impermeable catchment of the proposed hotel and car park extensions.

Table 3. Runoff Rate Assessment

Return Period	Greenfield Runoff rate (l/s)	Proposed Runoff rate (l/s)
Q_{bar}	1.3	2.0
1 Year	1.1	2.0
30 Year	3.1	2.0
100 Year	4.5	2.0

- 4.2.2 A greenfield runoff calculation extract using the HR Wallingford online tool can be found in **Appendix D**, which found the greenfield flow rate (Q_{bar}) to be 1.3l/s. However, a design flow rate of 2l/s has been selected to ensure self-cleansing velocity downstream of the proposed flow control and prevent long term sedimentation in the pipe. A runoff rate of 2.0l/s is proposed to ensure the network is maintained and silt does not accumulate in the pipes.

4.3 Climate Change Allowance

- 4.3.1 The proposed drainage strategy has taken into account the latest climate change allowances guidance issued by the Environment Agency (Last updated 27th May 2022).
- 4.3.2 To assess the climate change allowance required for the development, the peak rainfall climate change allowance by management catchment has been considered. The development is located within the Upper and Bedford Ouse Management Catchment; the corresponding allowances are listed in Table 4.

Table 4. Peak Rainfall Climate Change Allowances

Epoch	Central allowance	Upper end allowance
3.3% Annual Exceedance Rainfall Event (1 in 30Y)		
2050s	20%	35%
2070s	25%	35%
1% Annual Exceedance Rainfall Event (1 in 100Y)		
2050s	20%	40%
2070s	25%	40%

- 4.3.3 The proposed development's lifetime will be beyond 2100, therefore the Upper End Allowances must be taken into account for both the 1% and 3.3% AEP events for the period of 2061 to 2125.

4.3.4 In accordance with the EA's Climate Change guidance, the development will need to ensure that that during the 1% AEP event including for the Upper end allowance for climate change:

- ☐ There is no increase in flood risk elsewhere;
- ☐ The development will be safe from surface water flooding;

4.4 Attenuation Storage Assessment

4.4.1 Attenuation has been designed to attenuate storms up to and including the 1 in 100-year storm event with an allowance for 40% Climate Change based on a discharge rate of 2.0 l/s for all return periods.

4.4.2 To achieve the proposed runoff rates described in Section 4.2, a volume of 355m³ of attenuation storage is required and has been proposed in the form of:

- ☐ Porous paving for car park extension with storage provided in subbase with 30% voids.

4.5 SuDS Assessment

4.5.1 As part of the surface water drainage strategy for the site a number of Sustainable Drainage Systems were considered. Table 5 provides a list of the options considered and a justification for their inclusion or omission.

Table 5. SuDS Features Assessment

SuDS Features	Proposed	Justification
Rainwater Harvesting System	Yes	The use of a rainwater harvesting tank has been deemed suitable for this site. A rainwater harvesting tank is proposed which will collect rainwater from the extension roof for reuse within the development.
Green Roofs	No	No green roofs are proposed for the main buildings due to the roof arrangement and need to provide space for rooflights and PV. In addition, green roofs would have a significant impact on the structural design, risk of leakage to building and ease of safe maintenance.
Infiltration Systems	No	The borehole records discussed in Section 1.5 present the strata underneath the proposed development as likely to have an infiltration rate of less than 10 ⁻⁶ m/s. Therefore, infiltration is not deemed a suitable outfall technique
Proprietary Treatment Systems	No	The use of proprietary treatment systems is not considered economically viable or required on this site considering installation and operational costs and pollution treatment requirements.
Filter Strips	No	Filter strips have not been considered the most effective proposal for this site due to the proposed site layout.

Filter Drains	No	Filter drains have not been considered the most effective proposal for this site due to the proposed site layout.
Swales	No	Swales are not suitable for this scheme due to available space and proposed land use.
Bioretention Systems	No	Bioretention Systems have not been considered the most effective proposal for this site due to the lack of available landscape areas.
Porous Pavements	Yes	Porous paving has been assessed as the most effective method to treat the most likely source of site contaminates from the parking bays. All surface works from the parking areas shall drain via the voided sub-base offering the required treatment. The available storage within the voided sub-base shall provide the required interception and attenuation requirements.
Attenuation Storage Tanks (oversized pipes)	No	Due to levels constraints, it is proposed that an attenuation tank will not be used. Instead, the porous paving will be sufficiently designed to provide all required attenuation on site.
Detention Basins	No	There is insufficient space for a detention basin on this site.
Ponds and Wetlands	No	There is insufficient space for a pond on this site.

4.6 Proposed Surface Water Drainage Strategy

- 4.6.1 The proposed extension shall comprise pipes, chambers, downpipes, a rainwater harvesting tank, and permeable paving.
- 4.6.2 The existing hotel drainage infrastructure is to be retained wherever possible with diversions required to coordinate with the proposed extension. The new infrastructure will be for the new extension and shall connect into the existing network (hence indirectly outfalling into the brook south of the site). Any additional runoff as a result of the extension will either pass through the permeable paving in the car parks or be channelled through downpipes pipes and / or the rainwater harvesting tank for water which lands on the roof. After this, the water will flow to join the existing network to the south of the site, where it will outfall into the watercourse through the existing outfall pipe.
- 4.6.3 To avoid the need for an attenuation tank, attenuation shall instead be provided by the voided subbase of the porous paving. The porous paving has been designed to attenuate storms up to and including the 1 in 100-year storm event with a 40% allowance for climate change. The total attenuation volume provided is circa 355m³.

- 4.6.4 A flow control chamber is to be used to restrict flows to 2.0l/s for all storms up to and including the 1 in 100 year return period with a 40% allowance for climate change. This restriction shall be provided by a combination of flow control and attenuation.
- 4.6.5 To support this assessment, Drainage Strategy Drawing No. RWB-LINK-XX-XX-DR-C-0501 has been prepared and this is included in **Appendix D** along with the supporting calculations demonstrating the system's performance. The proposed system has been assessed for a number of return periods and a series of rainfall events (using FEH22 rainfall Dataset) and the discharge rates for the critical storms are provided in Table 4.
- 4.6.6 In addition to the surface water treatment provided by the SuDS features the following measures are to be included within the surface water drainage system to improve water quality prior to discharge offsite

- ◻ Sediment sump in flow control chamber

4.7 Management of everyday rainfall (interception)

- 4.7.1 In accordance with the National standards for SuDS guidance, the requirements for Standard 2: Management of everyday interception are:

"2.1 Apply a 'SuDS approach' so that at least the first 5mm of rainfall for the majority of rainfall events does not result in runoff from the site to surface waters or piped drainage systems.

2.2 Evidence shall be provided that the approach to managing runoff from 'everyday' rainfall has been developed alongside and in support of the management of runoff quality (standard 4) and the delivery of amenity and biodiversity benefits (standards 5 and 6)."

- 4.7.2 The assessment is therefore based on the following:

- Total impermeable area across site – 0.34 Ha or 3400m²

The National standards for SuDS guidance states for permeable surfaces:

"Where the infiltration capacity of the ground below the permeable surface is greater than 1x10⁻⁶ m/s and unlined, up to 5 times the permeable surface area may be added as additional contributing area. For example, to comply with standard 2 for an impermeable surface area of 100m², the area of the permeable surface shall be 20m²."

Therefore, in order to comply, the total area of permeable surface SuDS must be a fifth of the total impermeable area, provided permeable car parks are unlined. According to the Drainage and Waste Disposal: Approved Document H, infiltration is not permitted within 5m of a building. Therefore, any of the porous paving closer than 5m to an existing or proposed building must be lined. Table 6 outlines the area of unlined porous paving that will provide contributing area.

Table 6. Pollution Hazard Level and Indices.

SuDS Feature	SuDS Area	Treated Interception SuDS Area
Unlined Permeable Car Park	2196m ²	10,981m ²
TOTAL	2196m²	10,981m²

As shown in Table 6, the area treated by the permeable paving (10,981m²), is more than sufficient to cover the total impermeable area across the site (3400m²). Therefore, the everyday rainfall is managed sufficiently as defined by the National standards for SuDS guidance.

4.8 Water Quality

- 4.8.1 As shown on the drainage strategy drawings in **Appendix D**, water quality is provided for both the car park and roof areas as the water from both of these areas are routed through the porous paving. In addition, some of the water which lands on the roof of the proposed development will be retained by the rainwater harvesting tank.
- 4.8.2 As per Table 26.2 in CIRIA 753 The SuDS Manual, the residential roofs are classed as having a 'Very Low' Pollution Hazard Level, with the proposed car park and roads classed as having a 'Low' Pollution Hazard Level. The corresponding pollution indices for these hazard levels for the three main sources of pollution are provided below in Table 7.

Table 7. Pollution Hazard Level and Indices.

Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Very Low	0.2	0.2	0.05
Low	0.3	0.2	0.05

- 4.8.3 For both the car park areas and roof areas, pollution treatment is provided through permeable paving. Table 26.3 in CIRIA 753 provides mitigation indices for various SuDS features against the three main sources of pollution. The corresponding mitigation indices in CIRIA 753 for permeable paving for each of the sources of pollution are provided below in Table 8.

Table 8. SuDS Mitigation Indices.

SuDS	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Paving	0.7	0.6	0.7

- 4.8.4 By comparing the mitigation indices for the permeable paving against the pollution indices for the site it can be shown that sufficient treatment is provided through the permeable paving. This demonstrates that the SuDS

treatment train proposed for the development is more than sufficient to treat the anticipated pollution on site, hence water quality has been achieved through the drainage strategy.

4.9 Exceedance Flows

- 4.9.1 As per Section 3.2, an exceedance event is a storm event that exceeds the design parameters of the drainage system which will correspond to a storm event more severe than a 1 in 100 year storm. Any flooding resulting from such events shall be directed away from the existing and proposed buildings and contained within the car park areas. An exceedance drawing No. RWB-LINK-XX-XX-DR-C-0510 demonstrating this is included in **Appendix D**.

4.10 Foul Water Drainage Strategy

- 4.10.1 The proposed development will require supporting foul infrastructure to take the additional foul flows from the hotel extension. Similar to the surface water it is proposed to retain the existing infrastructure where possible and connect the additional foul pipework into the existing network. The foul drainage strategy is included on the Drainage Strategy Drawing No. RWB-LINK-XX-XX-DR-C-0501 included in **Appendix D**.
- 4.10.2 Due to level constraints, it is anticipated the foul will be pumped. By connecting the new foul infrastructure into the existing network, it is proposed to make use of the existing foul outfall arrangements for the hotel extension. These consist of an existing pumping station which pumps flows to a package treatment works to the south of the site, which drains into the existing brook. The existing pumping station will need to be reconstructed to accommodate the additional foul flows and any emergency storage upgraded or provided to achieve this. The treatment works will also need upgrading and / or replacing for the additional foul flows.
- 4.10.3 An EA permit will need to be obtained for the treated foul flows discharging from the upgraded and / or replaced treatment works and that the EA shall be consulted regarding this.

5 DRAINAGE MANAGEMENT PLAN

5.1 Responsibility

- 5.1.1 The occupier of the proposed development shall be responsible for the maintenance and operation of the drainage system, including any attenuation and flow control devices.

5.2 Maintenance of Pipe Networks

- 5.2.1 Maintenance and management of main storm sewers and chambers inclusive of pipework from paved areas and buildings (but excluding internal building drainage) should be visually inspected and jetted/cleaned as required. As a minimum, this should be carried out every 5 years. Methods of inspection to give indications of blockages etc. may include:

- Pulling a mandrel through the pipe to identify physical faults (e.g., disjointed pipes).
- Flushing/jetting.
- CCTV.
- Measurement of water depths in pipe entries, catchpits or interceptors along a drain run may identify potentially blocked pipes.

- 5.2.2 Gully gratings, manhole gratings and channel gratings shall be visually inspected at least once every year and replaced or re-set if damaged or dislodged. Gullies should be inspected at least once every year, ideally during springtime as the autumn and winter seasons produce the most detritus build up in the form of leaves, litter and silt. This material should be removed from the channels and disposed of at a licensed tip. This material should not be tipped in other areas of the development as it may pose a pollution threat to the surrounding drainage system.

- 5.2.3 Jetting should only be carried out after removal of the silt and debris, as jetting alone will simply wash the debris further downstream without removing the problem.

5.3 Maintenance of Pump systems

- 5.3.1 Pump systems should be strictly maintained as per the pumping manufacturers recommendations, with a minimum maintenance of once every 12 months.

5.4 Maintenance of SuDS Features

- 5.4.1 The regular and correct maintenance of the SuDS feature is essential to the continued performance. The SuDS Manual C753 provides advice on the management of the system. The recommended maintenance regimes for the permeable pavements and the rainwater harvesting system are given in Table 20.15 and Table 11.6, respectively, in the SuDS Manual C753, which will form the basis of the strategy for the provided development.

Table 9. Table 20.15 of CIRIA 753

TABLE 20.15 Operation and maintenance requirements for pervious pavements		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 10. Table 11.6 of CIRIA 753

TABLE 11.6 Operation and maintenance requirements for RWH systems		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of the tank for debris and sediment build-up, inlets/outlets/withdrawal devices, overflow areas, pumps, filters	Annually (and following poor performance)
	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris	Annually (and following poor performance)
Occasional maintenance	Cleaning and/or replacement of any filters	Three monthly (or as required)
Remedial actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs	As required

5.4.2 It should be noted that maintenance regimes detailed above are initial recommendations and the actual maintenance work undertaken should be adapted to suit the system performance by the maintenance provider.

6 CONCLUSION

- 6.1.1 This site-specific Flood Risk Assessment has been prepared in accordance with NPPF guidance and local policy on Flood Risk. The government approved flood mapping shows the site to be located within Flood Zone 1 with regard to flood risk from both fluvial and pluvial sources on the site. Further to this, the proposed levels on the site shall be set such that in the unlikely event of these systems failing the development on the site will remain protected.
- 6.1.2 The drainage strategy demonstrated that an appropriate drainage system for both foul and surface water can be provided on the site which discharge indirectly through the existing network to suitable outfalls. The surface water will join the existing storm water drainage network where it will then indirectly discharge into the brook to the south of the site. The foul water will join the existing network where it will be pumped to an onsite treatment works prior to discharge into the brook. Subject to the mitigation measures proposed, the development may proceed without being subject to significant flood risk. Moreover, the development will not significantly increase flood risk to the wider catchment area.

APPENDIX A

Proposed Site Plans

APPENDIX B

Topographical Survey

APPENDIX C

CCTV Survey

APPENDIX D

Drainage Strategy Drawings & Hydraulic Calculations

APPENDIX E

Supporting Documents



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