Flood Risk Assessment Including Preliminary Surface Water Drainage Strategy

Land North of Raleigh Drive, Claygate, Surrey

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Charles & Associates

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1 Introduction

1.1 Introduction

1.1.1 Charles & Associates Consulting Engineers Ltd (C&A) have been commissioned by Claygate House Investments Ltd and MJS Investments Ltd, hereafter called 'The Client', to prepare a Flood Risk Assessment (FRA) incorporating a preliminary Surface Water Management scheme for the proposed redevelopment of the former recreational land associated with the commercial use of the adjoining redevelopment known as Esher Park Gardens.

1.1.2 The former recreational use comprised of a bowling green, tennis courts, a pitch & putt golf course and ancillary buildings/hardstanding associated with their use.

1.1.3 The Client proposes to redevelop this sustainable part greenfield and brownfield site for residential use. As such, an outline planning application for the erection of up to 60 homes and associated public open space, with all matters reserved except access has been prepared, which this report supports. The proposed illustrative masterplan is included in **Appendix A** and location plan within **Figure 1** at section 2 below.

1.2 Purpose

1.2.1 The purpose of this report is to support an outline planning application in terms of flood risk and sustainable urban drainage. As such, this report has been prepared as a means of demonstrating that potential flooding and surface water drainage issues would not constrain the redevelopment of the Site or have any adverse effects on existing public surface water drainage networks, watercourses, or groundwater source protection zones should they exist within the area.

1.2.2 The provisions of the National Planning Policy Framework (NPPF)[1] have been considered in preparing this Flood Risk Assessment, together with the Planning Practice Guidance (PPG)[2]. In addition, due consideration has given paid to the local policies and guidance, such as: the Surrey County Council's (SCC) Flood Risk Management Strategy[3]; Elmbridge Borough Council's (EBC) adopted Core Strategy[4]; EBC's Development Management Plan[5]; EBC's Flood Risk SPD[6]; EBC's Level 1 Strategic Flood Risk Assessment[7]; and the SCC site specific 'Detailed Flood Risk Report[8] dated 26th September 2022.

1.2.3 In terms of surface water drainage and potential for flooding, this report examines the Site's suitability, not only with respect to planning policy and guidance, but also its physical characteristics to allow suggested solutions to control surface water drainage following the redevelopment. This ensures the Site is drained in a sustainable manner whilst not negatively impacting the surrounding area. The preliminary surface water drainage strategy (SuDS scheme) will be designed to conform to the DEFRA non-statutory Technical Guidance[9]. together with the CIRIA technical guidance provided in 'The SuDS Manual' (C753)[10] and 'Designing for exceedance in urban drainage-good practice' (C635)[11].

1.3 Consultation

1.3.1 The following stakeholders have been consulted as part of the pre-application process and preparation of this report:

- Surrey County Council (SCC) as the Lead Local Flood Authority (LLFA); and
- Thames Water Utilities as the local sewerage undertaker.

1.3.2 As part of the preapplication consultation the LLFA was commissioned to undertake a site-specific Flood Risk Report (FRR). This report sets out the parameters to underpin this assessment, both in terms of flood risk and sustainable urban drainage.

[1] National Planning Policy Framework, Ministry of Housing, Communities and Local Government, July 2021
[2] Planning Practice Guidance, Ministry of Housing, Communities and Local Government, June 2021
[3] Surrey Local Flood Risk Management Strategy, 2017
[4] Elmbridge Borough Council Core Strategy, July 2011
[5] Elmbridge Local Plan Development Management Plan, October 2014
[6] Elmbridge Borough Council Flood Risk Supplementary Planning Document, May 2016
[7] Elmbridge Borough Council Level 1 Strategic Flood Risk Assessment, February 2019
[8] Surrey Detailed Flood Risk Report, September 2022
[9] Department for Environment, Food & Rural Affairs, Sustainable drainage systems: non-statutory technical standards, March 2015
[10] CIRIA, The SuDS Manual (C753F), December 2015
[11] CIRIA, Designing for exceedance in urban drainage (C635), May 2006

1.3.3 Copies of the correspondence and the LLFA FRR are enclosed in **Appendices B and F** respectively.

1.4 Report Limitations

1.4.1 The findings, recommendations and conclusions of this report are based on information obtained from a variety of external sources which are understood to be reputable. However, C&A cannot guarantee the authenticity or reliability of any data and/or records provided by third parties.

2 Existing Site

2.1 Site Location

2.1.1 The Site is located to the east of Littleworth Road, separated by Claygate House/Esher Park Gardens, and the apartments currently under construction. It is enclosed by existing dwellings to the east and south and to the north by open fields. The Site is currently an open field. However, it originally functioned as the recreational part of the historical commercial use of Claygate House, comprising of a bowling green, tennis courts, a pitch & putt golf course and ancillary buildings/hardstanding associated with these uses. As such, it can be considered part greenfield and part brownfield in nature.

Figure 1: Site Location

2.1.2 Access is to be taken from an existing gated access from Raleigh Drive to the south.

2.2 Topography

2.2.1 A topographic survey confirms the Site falls gently from 19.06 to 17.50 m AOD south to north and 17.50 to 17.35 m AOD west to east to the northeast corner of the Site. There is a localised low area created by the former bowling green, surrounded by a relatively flat area. Remnants of the former pitch & putt golf course remain as hollows and rises across the Site. Refer to Appendix C for the topographic survey.

2.2.2 Existing hardstanding areas on the Site include tennis courts at the southwest corner of the Site and partially at the bowling green to the northwest. There appear to be no records of the existing drainage networks for these areas or elsewhere on the Site.

2.2.3 When reviewing the topographic information available it can be assumed that the tennis courts,' runoff simply flowed into the adjoining open space. However, the bowling green has been artificially lowered in level to that of the surrounding ground, which suggests that it would have had a positive drainage network, potentially toward the Claygate House carpark, which in turn drains to the watercourse to the west known as 'The Rythe'. A full topographic survey is provided within Appendix C.

2.3 Hydrological Features

2.3.1 The nearest watercourse is a riparian ditch that is located onsite, within the eastern boundary. It flows in a northerly direction, eventually joining The Rythe via culverts to the north of the Site.

2.3.2 A secondary ditch is located on the northern boundary and flows west to east. The topographic survey suggests that this is culverted approximately 20 metres from the eastern boundary into the riparian ditch.

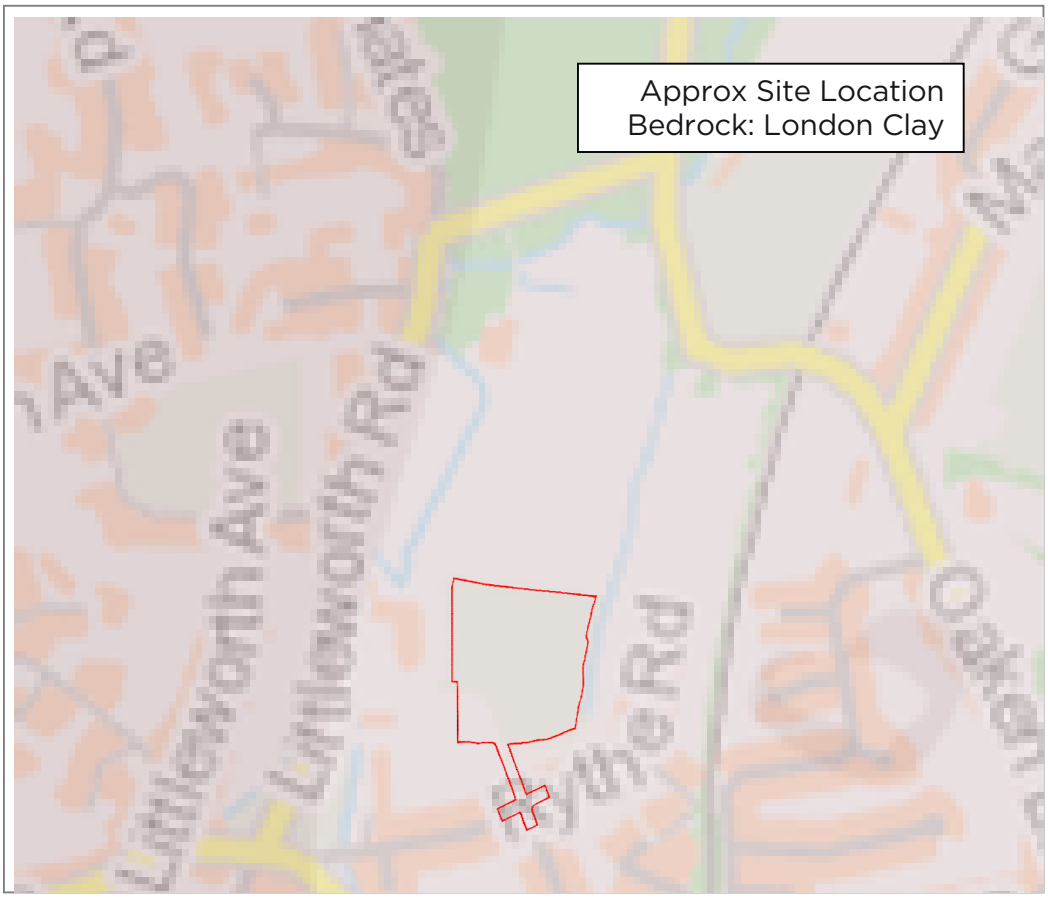
2.3.3 The Rythe, which is a main river, is offsite approximately 50 metres to the west and flows south to north. It is culverted beneath Claygate House emerging just past its carpark to the north as an open water course.

2.3.4 The riparian and secondary ditch to the east and north respectively falls under the jurisdiction of the Lead Local Flood Authority, Surrey County Council, while the River Rythe falls under that of the Environment Agency due to its classification as a main river.

2.4 Ground Conditions

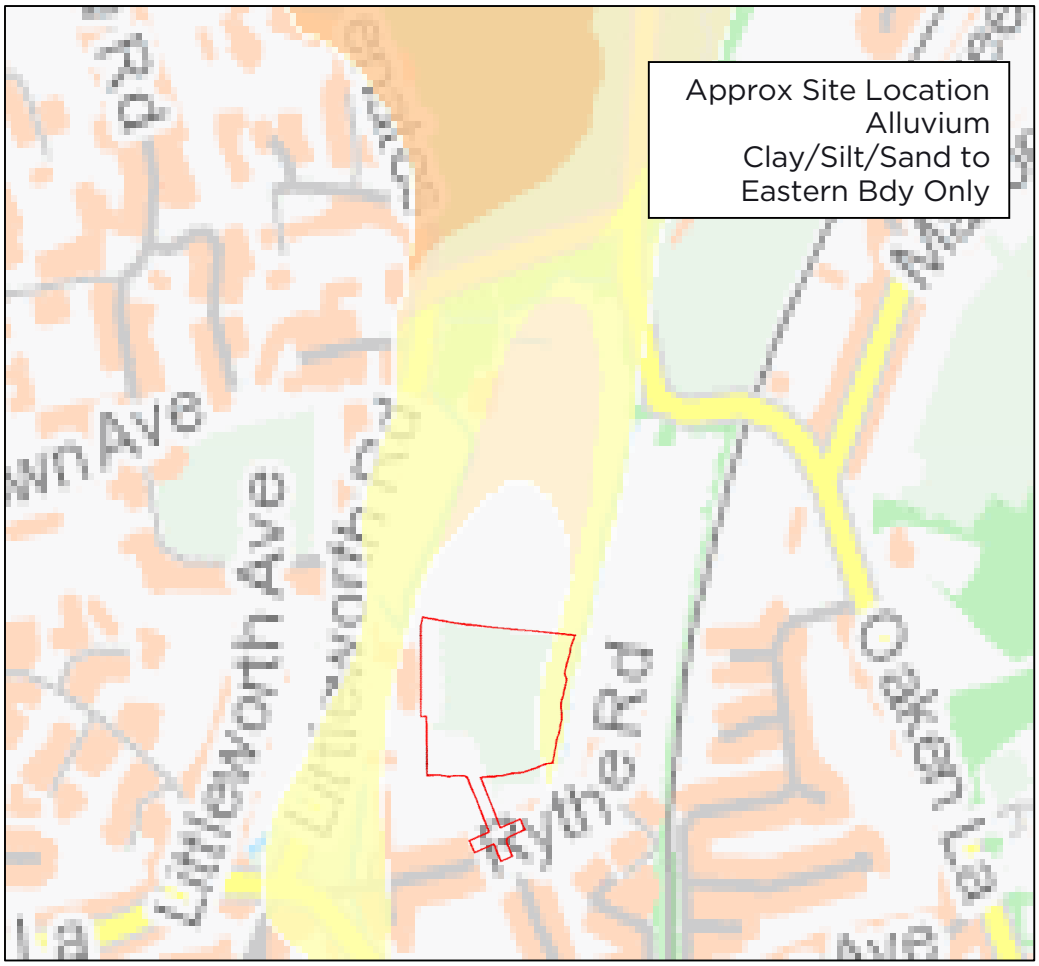
2.4.1 A desktop geotechnical study has been undertaken by consultants 'Ground & Water Ltd'. This study accompanies the application. It reviewed the British Geological Society's[12] records which indicate the underlying bedrock is London Clay Formation with Superficial deposits of Alluvium (clayey sands and silty clays) along the eastern boundary. A copy of the BGS records can be found within Figures 2.2 and 2.3 below.

Figure 2.2: BGS – Bedrock Geology



[12] BGS Geology of Britain Viewer, https://www.bgs.ac.uk/map-viewers/geology-of-britain-viewer/

Figure 2.3: BGS – Superficial Deposits



2.4.2 A further review of the British Geological Society borehole records, at a nearby site located approximately 43m away, indicates the ground conditions consist of 0.45m capping of Topsoil over a brown silty clay with occasional gravel to 2.45m bgl followed by a stiff fissured brown and grey silty clay to 3.60m bgl. A stiff dark grey clayey silt was then noted for the remainder of the borehole, a depth of 4.50m bgl. Groundwater was noted at 1.95m bgl. Copies of the borehole records are located within **Appendix D**.

2.4.3 It is accepted that this may in due course need to be confirmed through onsite geotechnical investigations and infiltration testing, but such confirmation is not needed at outline stage. A suitably worded condition would allow for this to come forward later at reserved matters stage. That said, the presence of London Clay over most of the Site confirms that infiltration techniques will not be suitable when considering SuDs techniques for surface water management on the Site. This is confirmed within the Surrey County Council detailed flood risk report for the Site provided within **Appendix B.**

2.5 Groundwater

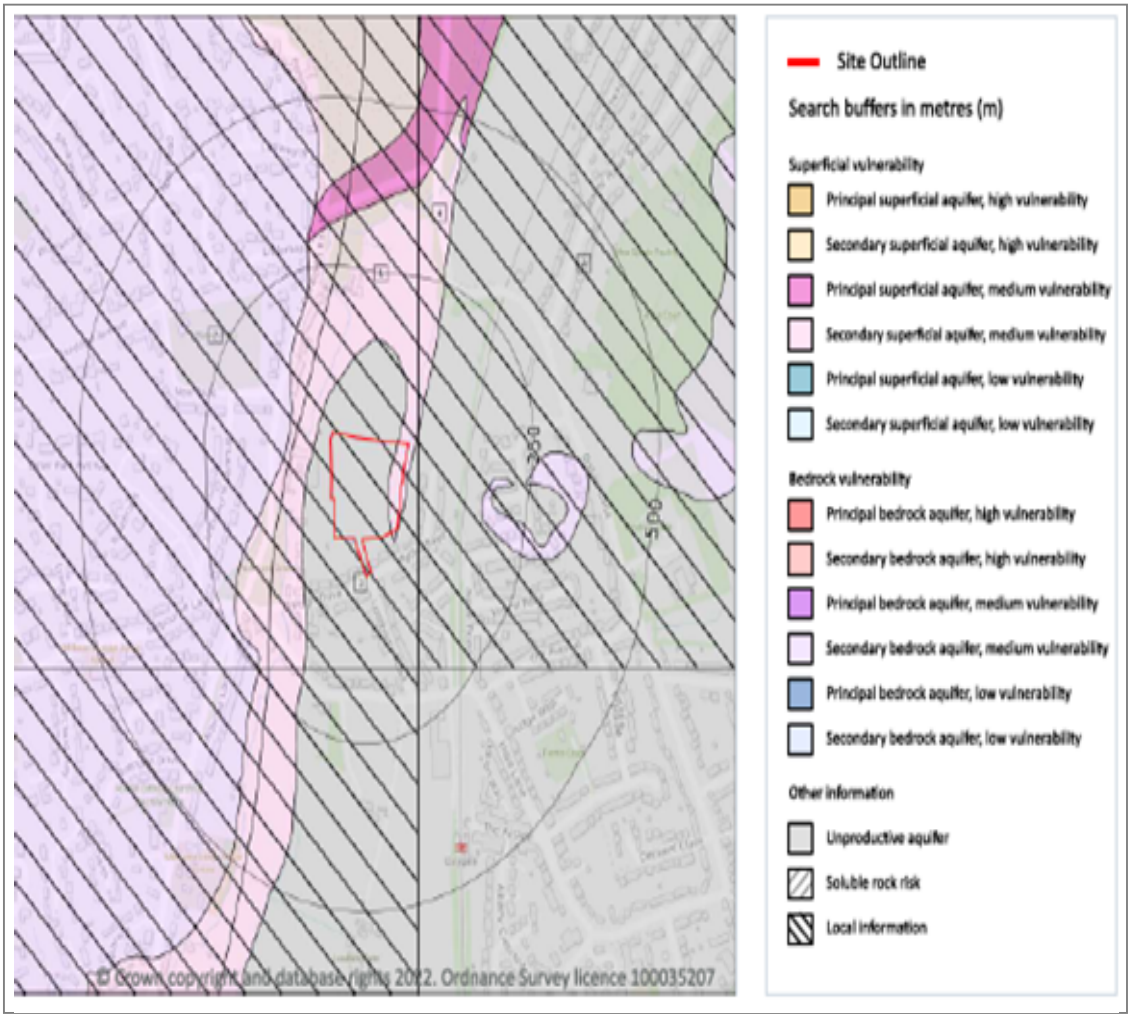
2.5.1 Ground & Water Ltd confirmed that the eastern boundary is underlain by a Secondary Aquifer comprising the superficial Alluvium.

2.5.2 The remainder of the Site was underlain by Unproductive Strata comprising bedrock deposits of the London Clay Formation.

2.5.3 Environment Agency records indicate that the Site does not fall within a Groundwater Source Protection Zone (SPZ) as classified in the Policy and Practice for the Protection of Groundwater.

2.5.4 The Groundwater Vulnerability Map can be found within Figure 2.4 below.

Figure 2.4: Groundwater Vulnerability Map



2.6 Existing Sewers

2.6.1 Review of the topographic survey of the Site confirms that there are no existing sewers within the Site. Surface water run-off from the existing site topography currently flows freely out of the Site in the easterly direction in the majority and partially to the north, with the water being intercepted by the onsite riparian ditches.

2.6.2 In addition, the Thames Water Utilities asset plans show no surface water sewers on the Site, the closest being to the south within Rythe Road, which discharges to the riparian watercourse that runs along the eastern boundary of the Site. Thames Water Utilities Plans are attached in **Appendix E.**

3 Redevelopment Proposal

3.1.1 It is proposed to redevelop this sustainable part greenfield, part brownfield site for residential use. This will entail the erection of up to 60 dwellings and associated public open space.

3.1.2 Refer to **Appendix A** for Illustrative Masterplan.

4 National Policy, Local Planning Policy & SuDS Guidance

4.1 National Planning Policy

National Planning Policy Framework

4.1.2 The National Planning Policy Framework (NPPF) provides national policy to planning authorities, developers, the public, and the Environment Agency (EA), to ensure that flood risk is considered at all stages of the planning process.

4.1.3 Paragraph 159 of the NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

4.1.4 Paragraph 160 of the NPPF states that Local Plans should be supported by Strategic Flood Risk Assessments (SFRA) and policies developed in order to manage flood risk from all sources, considering advice from the EA and other relevant flood risk management bodies, such as Lead Local Flood Authorities and Internal Drainage Boards. Paragraph 161 advises that Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by:

- Applying the Sequential Test and then, if necessary, the Exception Test;
- Safeguarding land from development that is required for current and future flood management;
- Using opportunities offered by new development to reduce the causes and impacts of flooding;
- Where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to facilitate the relocation of the development, including housing, to more sustainable locations.

4.1.5 Paragraph 162 states that the aim of the Sequential Test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the Proposed Development in areas with a lower risk of flooding.

4.1.6 Paragraph 163 states that if it is not possible for development to be located in zones with a lower risk of flooding (considering wider sustainable development objectives), the Exception Test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3. That Annex sets out five flood risk vulnerability classifications. These, together with some examples, are as follows (for a full list, see Annex 3):

- *Essential Infrastructure, e.g., essential transport and utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood;*
- *Highly Vulnerable, e.g., emergency services (those required to be operational during flooding), basement dwellings; caravans, mobile homes and park homes intended for permanent residential use;*
- *More Vulnerable, e.g., residential dwellings, hospitals, schools, hotels, drinking establishments; Non–residential uses for health services, nurseries, and educational establishments; sites used for holiday or short let caravans and camping, subject to a specific warning and evacuation plan;*
- *Less Vulnerable, e.g., buildings used for shops; financial, professional, and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure; land and buildings used for agriculture and forestry; minerals working and processing; and*
- *Water-Compatible Development, e.g., amenity open space, nature conservation and biodiversity, outdoor sports and recreation; flood control infrastructure; docks, marinas, wharves.*

4.1.7 Paragraph 164 states that for the Exception Test to be passed it should be demonstrated that:

- The development would provide wider sustainability benefits to the community that outweigh the flood risk; and
- The development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

4.1.8 This report confirms, within **section 5,** that the Application Site is located within Flood Zone 1, 2 and small amount within Flood Zone 3. As such a Sequential Test has been undertaken by the planning consultant. Refer to the Woolf Bond report *'Flooding Sequential Statement March 2023'* accompanying the application.

4.1.9 The sequential test has confirmed that the Site is required within the Borough to meet current housing needs. As the redevelopment-built form is within Flood Zones 1 & 2 only the Exception Test is not required. That said, if in the unlikely event that the Local Planning Authority perceive that the Exception Test is required. Paragraph 164 sets out the requirements for the exception test to be passed as follows:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

4.1.10 The planning application's accompanying Planning Statement provides a positive response to item 'a' above. While this Flood Risk Assessment confirms that this redevelopment will be safe for its lifetime for the classification of 'more vulnerable' uses within Flood Zones 1 & 2. Refer to section 4.1.18 below.

4.1.11 Paragraph 167 of the NPPF states that when determining planning applications, Local Planning Authorities (LPA) should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific Flood Risk Assessment. Development should only be allowed in areas at risk of flooding where it can be demonstrated that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- The development is appropriately flood resistant and resilient;
- It incorporates Sustainable Drainage Systems (SuDS), unless there is clear evidence that this would be inappropriate;
- Any residual risk can be safely managed; and
- Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

4.1.12 Footnote 55 sets out when a site-specific flood risk assessment is required, which includes for all development in Flood Zones 2 and 3 and certain development in Flood Zone 1.

4.1.13 Paragraph 169 states that major developments should incorporate SuDS unless there is clear evidence that this would be inappropriate. The systems used should:

- Take account of advice from the Lead Local Flood Authority;
- Have appropriate proposed minimum operational standards;

- Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- Where possible, provide multifunctional benefits.

Planning Practice Guidance

4.1.14 The Planning Practice Guidance (PPG) was updated on the 25th of August 2022 provides additional guidance to LPAs and Developers to ensure effective implementation of the planning policies set out within the NPPF regarding development in areas at risk of flooding.

4.1.15 Paragraph 3 of the PPG sets out the main steps for LPAs and Developers to follow in assessing flood risk as follows:

'The National Planning Policy Framework sets out strict tests to protect people and property from flooding which all local planning authorities are expected to follow. Where these tests are not met, new development should not be allowed. The main steps to be followed in addressing flood risk are set out below, starting with assessing and then avoiding flood risk. The steps are designed to ensure that if there are lower risk sites available, or a proposed development cannot be made safe throughout its lifetime without increasing flood risk elsewhere, it should not be permitted. Measures to avoid, control, manage and mitigate flood risk should also not increase flood risk elsewhere.

Assess flood risk

- *Strategic policy-making authorities should undertake a Strategic Flood Risk Assessment;*
- *Where appropriate, in areas at risk of flooding, developers undertake a site-specific flood risk assessment to accompany applications for planning permission (or prior approval for certain permitted development rights, or Technical Details Consent);*
- *Assessments of flood risk identify sources of uncertainty and how these are accounted for in a mitigation strategy. Further information on how to do this can be found in Flood risk assessment for planning applications.'*

4.1.16 This site specific Flood Risk Assessment identifies flood risk, any mitigation required and follows the Planning Practise Guidance. Therefore, complying with the NPPF

4.1.17 PPG '*Flood risk assessments: climate change allowances'* provides advice on climate change, setting out recommended contingency allowance for peak rainfall intensities and peak river flow, which should be increased by between 20% to 40% and 12% to 40% respectively. From present day until the year 2123 (the lifetime of the development).

4.1.18 Paragraph 068 of the PPG also advises on flood resilience and resistance measures when dealing with the residual risks remaining after applying the sequential approach and mitigating actions. As it has been able to build within Flood Zone 1 and lift built form levels out of Flood Zone 2 These measures are not required.

4.1.19 Flood zones are classified as per below (see Table 1 in the PPG 'Flood Zone and flood risk tables'):

- *Zone 1 - low probability: less than 1 in 1000 annual probability of river or sea flooding (<0.1%) in any year; (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)*
- *Zone 2 - medium probability: between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% to 0.1%) or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% to 0.1%) in any year; (Land shown in light blue on the Flood Map)*
- *Zone 3a - high probability: 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability flooding from the sea (>0.5%) in any year (Land shown in dark blue on the Flood Map); and*
- *Zone 3b - the functional floodplain: where water has to flow or be stored in times of flood; identification should take account of local circumstances but would typically flood with an annual probability of (3.3%) or greater in any year or is designed to flood, even if it would only flood in more extreme events (such as 1 in 1,000 annual probability of flooding).*

4.1.20 Table 2 of the PPG 'Flood Zone and flood risk tables' then considers development within each of the NPPF, Annex 3 classifications for each of these flood zones:

Table 4.1 Extract from Table 2 of PPG Flood Risk Vulnerability and Flood Zone 'Incompatibility'

Flood Zones	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	√	√	√	√	√
Zone 2	√	Exception Test Required	√	√	√
Zone 3a	Exception Test Required	X	Exception Test Required	√	√
Zone 3b	Exception Test Required	X	X	X	√

√ - Exception test Is not required.

X - Development should not be permitted

4.1.21 As can be seen from the above table, an exception test is not required for more vulnerable development (such as dwelling houses) in flood zones 1 and 2 or water-compatible development (such as amenity open space) in any of the flood zones. As a result, an exception test is not required for the proposal.

Climate Change

4.1.22 Based on the most recent advice on climate change reported in the PPG, peak rainfall intensity, sea level, peak river flow, offshore wind speed and extreme wave heights are all expected to increase in the future. It is recommended that considerations for future climate change are included in Flood Risk Assessments for proposed developments.

4.1.23 In February 2022, the Environment Agency published revised guidance on how to use climate change allowances in Flood Risk Assessments and Drainage Strategies. It is recommended that designs accommodate the upper and central climate change allowances to understand the range of impact. Tables of the guidance (reproduced below) show anticipated changes in peak rainfall intensity in small catchments and peak river flow. As a minimum, there should be no significant flood hazard to people from on-site flooding for the central allowance.

Table 4.2: Peak rainfall intensity allowance in small catchments (less than 5km2) or urban drainage catchments

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2050 to 2060)	Total potential change anticipated for the '2080s' (2061 to 2125)
Upper end	10%	40%	40%
Central	5%	20%	25%

4.1.24 The Site is likely to be subject to increases in rainfall intensity of 25% to 40% for the central and upper allowances. Therefore, the sustainable drainage system that will serve the proposed development will be designed to cater for the 1 in 100- year plus 40% rainfall event.

4.1.25 The design of the drainage system will ensure that there is no increase in the rate of runoff discharged from the Site for the upper end allowance.

Table 4.3: Peak River Flow Allowances

Applies Mole Catchment	Total potential change anticipated for the '2020s'	Total potential change anticipated for the '2050s'	Total potential change anticipated for the '2080s'
Upper	27%	26%	40%
Higher	16%	12%	20%
Central	11%	6%	12%

4.1.26 In terms of the peak river flow allowance the central and higher allowance is 12% and 20% respectively. The Environment Agency have provided modelling for the River Rythe and the riparian water course has been provided for the 1 in 100 year plus 20% climate change. The output of which is provided within their product four data, refer to Appendix G.

4.1.27 Environment Agency guidance states that, for more vulnerable development within Flood Zones 2 or 3a the central allowance should be utilised. In addition, should a Strategic Flood Risk Assessment identify changes to the flood zones due to climate change in the future, the upper peak allowance should be used. In this case the EBC Strategic Flood Risk Assessment does not alter the current on-site flood zones due to climate change.

4.1.28 As such the central allowance may be utilised. For the redevelopment Site this is 12%. For robustness and as the lifetime of the development will be 100 years, a peak river flow higher central allowance of 20% has been reviewed as part of the FRA, the use of 20% instead of 12% is a conservative approach, however when examining the EA data provided, that contains the 20% allowance the redevelopment remains policy compliant.

4.1.29 Compliance with national policy has been achieved, via the implementation of the sequential test confirming that, although some built form of the development will be within Flood Zone 2, there are no viable alternative sites completely within Flood Zone 1. Refer to Woolf Bond report '*Flooding Sequential Statement March 2023'* accompanying the application.

4.1.30 The majority of the Site's built form falls within Flood Zone 1 with the remainder of Flood Zone 2 and importantly Flood Zone 3 which remains as open space. As such, and as noted above, an exception test is not required. Moreover, as already noted, by virtue of the positioning of the built form within the current Flood Zones 1 & 2 a site-specific sequential test has been undertaken and passed.

4.1.31 As stated at section 4.1.09 and 10, should the Local Planning Authority Para 164 of the NPPF. The planning application's accompanying Planning Statement provides a positive response to item 'a' above. While this Flood Risk Assessment confirms that this redevelopment will be safe for its lifetime for the classification of 'more vulnerable' uses within Flood Zones 1 & 2. Refer to section 4.1.18 above.

4.1.32 The proposed surface water management scheme, provided within section 6 of this report also respects the need to address both extreme storm events and anticipated climate change requirements, both for river modelling and rainfall intensities.

4.2 Regional and Local Planning Guidance

Surrey County Council Flood Risk Management Strategy 2017-2032

4.2.2 As the Lead Local Flood Authority, SCC produced a local flood risk management strategy in 2014 which was updated in 2017. The primary objective is to make Surrey more resilient to flooding on a long-term basis through a co-ordinated approach with residents and partners.

4.2.3 Seven main principles have been enshrined within the strategy:

- ***A long-term vision:*** *we will reduce the impact of flooding in Surrey and future-proof project outcomes on a sustainable, long-term basis that considers the effect of climate change;*

- ***A catchment-based approach:*** *we will use a holistic catchment-based approach to assess and manage the integrated flood risk within Surrey and upstream/downstream river catchments;*

- ***Partnership working:*** *we will work in co-operation with partner risk management authorities to mitigate the risk of flooding in the County while achieving cross-cutting corporate goals;*

- ***Community resilience:*** *we will empower communities to be more resilient to flooding by supporting them to reduce risk, recover from incidents more quickly and lessen the disruptive impacts of flooding;*

- ***Enhancing growth and wellbeing:*** *we will ensure that efforts to reduce flood risk in Surrey enhance and protect the social, environmental and economic wellbeing of Surrey;*

- *Sustainable flood risk management through planning and development: we will use the opportunities presented by new development and regeneration to make communities more resilient to flooding;*

- *Capital investment: we will invest in flood alleviation schemes that reduce the risk of flooding to people, property and the natural environment where a robust business case indicates that this will provide value for money and that wider social, environmental and economic benefits will be achieved.*

4.2.4 In terms of planning this is built upon by Objective 6 with in the strategy which states:

'We will reduce the risk of flooding to and from development through local planning policy and processes. To achieve this we will:
a. Undertake a robust statutory consultee role on surface water drainage
b. Influence policy and advise Local Planning Authorities on managing flood risk
c. Take viable opportunities to utilise existing and new development to reduce flood risk
d. Educate planning officers, Members and developers on flood risk and drainage, particularly SuDS and environmentally beneficial measures'

4.2.5 Prior consultation with SCC, and the subsequent production of their Flood Risk Report (refer to Appendix E) has allowed a preliminary SuDS scheme to be produced that complies with the above objectives. The details of the SuDS scheme are presented in Section 8 of this report.

Elmbridge Borough Council Local Plan 2011

4.2.6 The Application Site is located within the administrative boundary of Elmbridge Borough Council (EBC). The EBC Local Plan was adopted in July 2011. The key policy with regards to flooding, drainage and surface water management is Policy CS26, which provides as follows (footnotes omitted):

CS26 – Flooding

In order to reduce the overall and local risk of flooding (68) in the Borough:

1. *Development must be located, designed and laid out to ensure that it is safe; the risk from flooding is minimised whilst not increasing the risk of flooding elsewhere; and that residual risks are safely managed. Planning permission therefore will only be granted, or land allocated for development where it can be demonstrated that:*

- *Through a sequential test it is located in the lowest appropriate flood risk zone in accordance with PPS25(69) and the Elmbridge Strategic Flood Risk Assessment.*
- *It would not constrain the natural function of the flood plain, either by impeding flood flow or reducing storage capacity.*
- *Where sequential and exceptions tests have been undertaken, any development that takes place where there is a risk of flooding will need to ensure that flood mitigation measures are integrated into the design to minimise the risk to property and life should flooding occur.*

2. *Permitted development rights for development which could result in a loss of flood storage capacity or impede flood flow will be removed from new developments in flood zone 3, in order to ensure the risk of flooding is not increased through unregulated development.*

3. *In the event that development takes place in flood zones 2 or 3, the Council will require flood resistance and resilience measures in line with current Environment Agency advice (70), and advice included within the Elmbridge SFRA. (71)*

4. *New developments will need to contain SuDS, in line with the Council's Climate Neutral Development Checklist. (72) All development within flood zones 2 and 3 will require surface water runoff to be controlled, as near to its source as possible, and at greenfield rates. Where SuDS have not been used in these areas the applicant should justify these reasons.*

5. *For the classification of flood zones, the Council will take account of the recommendations of the most recent Strategic Flood Risk Assessment and reclassify to take account of climate change and the protection of dry islands surrounded by high flood risk areas (seeCS14-Green Infrastructure and CS15-Biodiversity).*

6. *The Council will support recommendations contained within the Lower Thames Strategy, provided that these do not result in an unacceptable impact on the local environment.*

7. *The Council will protect all undeveloped flood plains such as Desborough Island and Hurst Park, East Molesey, from non-flood compatible uses, and promote flood-compatible ones in accordance with PPS25.*

4.2.7 Although Policy CS26 refers to PPS25 which is now superseded, all of its requirements that relate to the area of Claygate are addressed within this Flood Risk Assessment, including the Sequential Test as discussed above and a compliant Sustainable Urban Drainage Scheme.

Elmbridge Borough Council Flood Risk Supplementary Planning Document May 2016

4.2.8 This document sets out the planning process to avoid inappropriate development in areas at risk of flooding. It builds upon Policy CS26 within the EBC Local Plan.

4.2.9 As with Policy CS26 this FRA complies with these local policy requirements.

Elmbridge Borough Council Strategic Flood Risk Assessment

4.2.10 Strategic Flood Risk Assessments are required to inform the development of Local Plans, as stated within the NPPF. The primary objective of the SFRA is to identify the areas within a development plan area that are at risk from all forms of flooding. This enables the Local Planning Authority (LPA) to select and allocate sustainable development away from flood risk areas.

4.2.11 A Strategic Flood Risk Assessment (SFRA) for EBC was carried out in February 2019. The hydrological information pertaining to the locality in the SFRA have been used as one source of information in the preparation of this document. Refer to Chapter 5 below for a review of the risk of flooding to the Site.

4.3 Other Technical Guidance

British Standards

4.3.2 The British Standard BS 8582:2013[13] Code of Practice for Surface Water Management for development sites gives recommendations on the planning, design, construction, and maintenance of surface water management systems for new developments and redevelopment sites in minimizing and/or mitigating flooding and maximizing the social and environmental benefits.

4.3.3 The surface water sewer system for the proposed redevelopment would be designed to convey surface water only, with foul water being discharged separately. The design would be in accordance with BS EN 16933-2 – Drain and Sewer Systems Outside Buildings[14].

[13] British Standards, Code of practice for surface water management for development sites, Nov 2013
[14] British Standards, Drain and sewer systems outside buildings, July 2018

Building Regulations

4.3.4 Part H of the Building Regulations[15] was amended in 2015 to encourage and provide guidance on the incorporation of SUDS in drainage systems. This provides a hierarchical approach for the disposal of rainwater, with the preferred option being to drain it to an adequate soakaway or other infiltration system. If this is not possible, the next favoured option is to discharge to a watercourse. Only if neither of these options is possible should the Site discharge rainwater to a sewer.

CIRIA SuDS Manual (C753), 2015

4.3.5 An appropriate maintenance programme for the SuDS features will need to be established in accordance with standard industry guidance and best practice. Details of recommended activities and frequencies are set out in The SuDS Manual (CIRIA, C753), which has guided development of the Surface Water Strategy for this Site.

Elmbridge Borough Council - Flood Risk Pro-forma

4.3.6 EBC produced the 'Flood Risk Assessment Pro-forma[16]' in 2016 to assist developers to manage flood risk & surface water runoff from the new development sites in order to ensure all potential forms of flooding are addressed, and to confirm that new development does not increase the risk of flooding elsewhere. This flooding would be as a result of increased surface water runoff from new development, if not controlled to acceptable levels. The LPA requires housebuilders to complete this pro-forma for all developments that are classified as 'Major". The issue of flooding and the control of this redevelopment's surface water runoff is addressed throughout this document. The Pro-forma provided within Appendix J.

[15] HM Government, The Building Regulations, Drainage and waste disposal, December 2010
[16] Elmbridge Borough Council, Flood Risk Assessment Pro-forma, April 2016

5 Potential Sources of Flooding

5.1 Flood Zone Classification

5.1.1 Table 1 of the PPG sets the definition of flood zones. Flood zones refer to the probability of river and sea flooding. They are shown on the Environment Agency's (EA) Flood Maps for Planning purposes (Rivers and Sea).

5.1.2 The Environment Agency's product 4[17] data provided river modelling data and flood map for use within the planning process. This is provided within Appendix G and confirms that the majority of the Site is within Flood Zone 1, with little to no risk of flooding. However, there are two locations that are within the flood plain. The first along the eastern boundary that is within Flood Zones 2 and 3, the second to the northwest corner (bowling green) that is within Flood Zone 2.

5.2 Sources of Flooding

5.2.1 The NPPF identifies six potential sources of flooding that require investigation:

- Flooding from rivers or fluvial flooding;
- Flooding from the sea or tidal flooding;
- Flooding from land or pluvial flooding;
- Flooding from groundwater;
- Flooding from sewers; and
- Flooding from reservoirs, canals, and other artificial sources.

Tidal and Fluvial

5.2.2 The Site is located within the County of Surrey approximately 800 metres from Claygate railway station and village centre. Neither the River Rythe, to the west, nor the riparian water course to the east are tidal in nature.

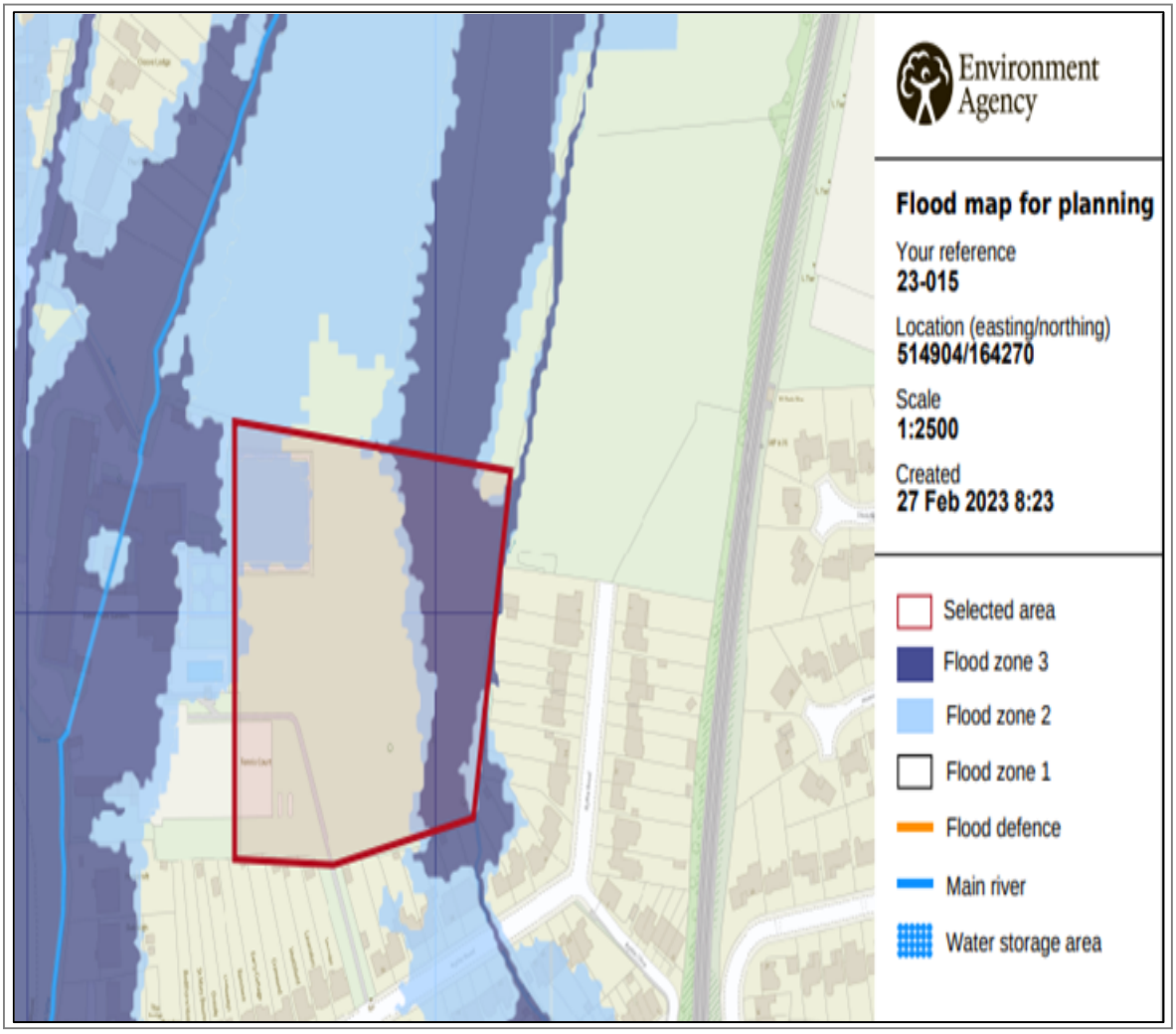
5.2.3 As such the risk of tidal flooding from the sea is negligible and not reviewed further within this report.

5.2.4 The nearest main river is the River Rythe to the west of the Site which flows south to north. This river falls under the authority of the Environment Agency. A second unnamed watercourse follows the eastern boundary, flowing in a northern direction ultimately joining the River Rythe to the north. This watercourse is classified as being in riparian ownership and as such is under the authority of Surrey County Council as the LLFA.

[17] Environment Agency, Product 4: Detailed Flood Risk Assessment Map & Modelling Output

5.2.5 As previously stated, the Site has a combination of Flood Zone 1, 2 and 3. Flood Zone 3 emanates from the riparian water course to the east. Flood Zone 2 comes from both the riparian water course and the River Rythe to the west. **Figure 5.1** below provides an extract from the EA Flood Mapping, which indicates the area at risk of fluvial flooding from these watercourses.

Figure 5.1: Fluvial Flood Map



5.2.6 It is possible to develop within Flood Zone 2 in this particular case as it has been proven via river modelling that the Flood Zone 2 areas are to convey water not to store water within the topography. In addition, due to the conveyance nature of the flows within Flood Zone 2 no flood compensation is required. This is confirmed within the modelling data available. This is within the public domain for a recent planning approval for residential redevelopment at Claygate House which is adjacent to the redevelopment to the west. Application Ref: 2020/2095.

5.2.7 A Flood Risk Assessment was prepared for this redevelopment which was approved by both the EA and LLFA and ultimately was part of the approval of the application. An extract of this report is set out below:

'The requirement for level for level flood compensation was assessed, however from inspection of the baseline model, it is apparent the flooding on site is associated with conveyance of flood water rather than flood plain storage. On this basis, the provision of level for level flood plain compensation is not deemed appropriate and a modelled approach has been undertaken which considers the effect the proposals would have on the flood routing rather than flood plain storage.'

5.2.8 This coupled with both the former bowling green, which artificially sits in Flood Zone 2, being lower than the surrounding ground that is within Flood Zone 1 and the ability via the NPPF to allow more vulnerable development within Flood Zone 2, following a sequential test confirms that redevelopment can take place.

5.2.9 The Environment Agency have provided modelling for the River Rythe which also encompasses the riparian watercourse to the east. Flood Levels are provided for a range of flood events up to and including the 1 In 1000 return period storm. In addition, the modelling also includes the 1 In 100 year plus 20 % climate change. A full set of maps and output data are provided within Appendix G.

5.2.10 The relevant storm events for this redevelopment are the 1 in 100 plus climate change and the 1 in 1000 which set the new Flood Zone 3 and Flood Zone 2 levels accordingly. It can be noted from the data that the 1 in 100 plus climate change storm event ranges from 18.41m OHD (node 7) to 18.20 m OHD (node 5) and the 1 in 1000 storm event ranges from 18.57m OHD (node 7) to 18.38m OHD (node 5) from east to west near the southern boundary. Levels of 17.94m OHD (node 10) are provided to the north for the 1 in 1000-year storm event. There are no results for the 1 in 100 year plus climate change to the north.

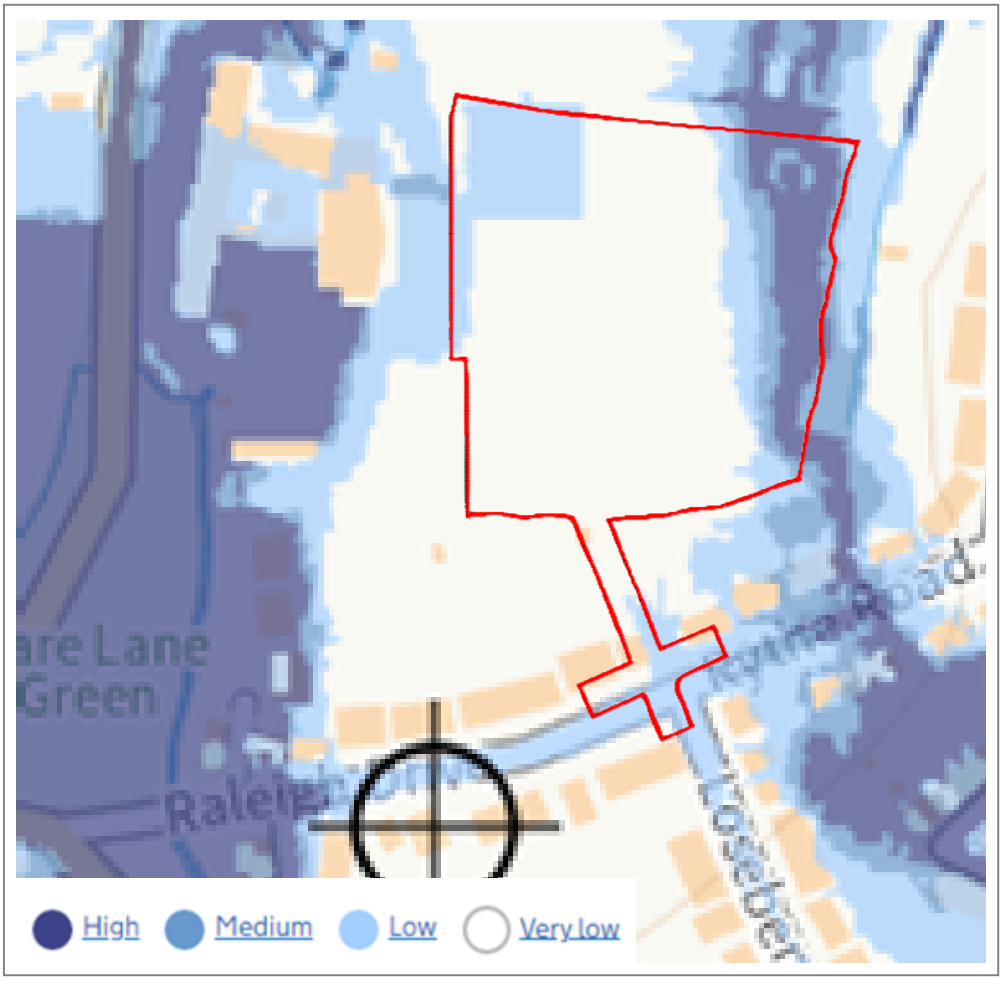
5.2.11 Although all the dwellings are to be either within Flood Zone 1 or 2 it is proposed to set the finished floor levels 150mm above the Flood Zone 2 level. While not a policy requirement it is considered good practice to do so.

Pluvial

5.2.12 Pluvial flooding occurs when natural and engineered drainage systems capacity is overwhelmed by the rainfall. Pluvial flooding can occur in urban areas during high intensity, extreme flooding rainfall events. This flood water would then be conveyed via overland flow routes dictated by the local topography.

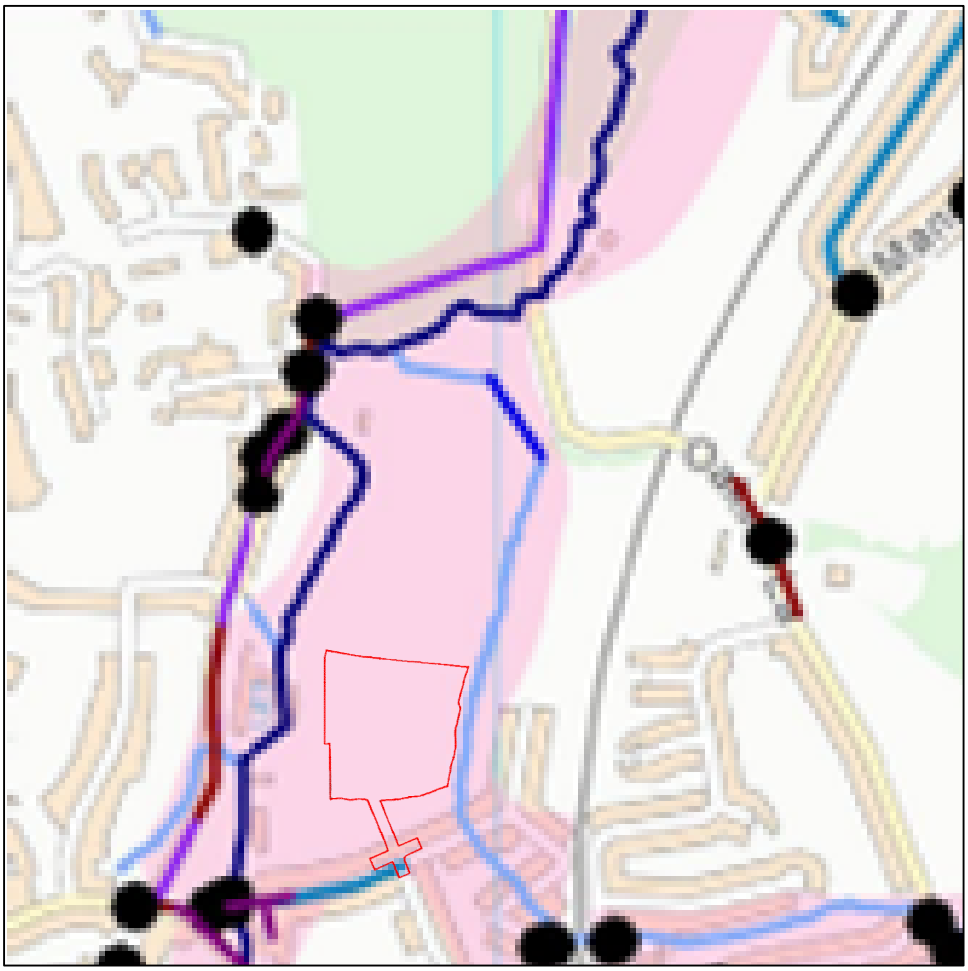
5.2.13 The EA's surface water flood map reproduced on **Figure 5.2** below displays different levels of surface water flood risk depending on the annual probability of flooding. EA mapping confirms that much of the Site is at very low risk from surface water flooding. The northwest area (former bowling green) and eastern boundaries have a low risk, with a small area of high risk at the eastern boundary of the Site, similar to that of the fluvial flooding. It is noted that the bowling green is artificially set below surrounding levels, by approximately 300mm. this would explain why the surface water flows into it and ponds there. This would not occur once the redevelopment proceeds.

Figure 5.2: Surface Water Flood Map



5.2.14 Historic flooding records are presented in the SFRA mapping and data tables indicate that the Site has not been affected by flooding incidents associated with surface water and pluvial sources. Refer to **Figure 5.3** below.

Figure 5.3: Extract from the EBC SFRA, Appendix E - Historic Flood Maps Extract



5.2.15 Historic flooding records presented in the SFRA mapping and data tables indicate that the Site has historically flooded in September 1968 and December 2002. Refer to Figure 5.3 above for an extract from the SFRA. Since the 1968 flooding occurred comprehensive flood defences and alleviation works have been carried out along the River Mole catchment to negate this form of flooding. Refer to Policy CS26 of the Local Plan. This is recognised within the EA's own modelling within the area, hence the current flood zone designations. It is noted from the EA data that the 2002 flooding occurred due to upstream sewers becoming overwhelmed and the Site was not affected by it. Refer to **Appendix G** page 7 & 8 of the Product 4 data.

5.2.16 As such flooding from these sources is extremely unlikely and therefore has not been considered further.

Sewers

5.2.17 Thames Water Utilities own the existing public sewers within the immediate vicinity of the Site. Thames Water Utilities records suggest there are no recorded incidents of sewer flooding on or immediately adjacent to the Site, refer to Appendix E.

5.2.18 As the Site's previous use was recreational, there are no existing sewers within the Site. The closest surface water drainage infrastructure is located within Raleigh Drive to the south of the Site, which consists of a public surface water sewer network.

5.2.19 A new sewer network serving the scheme will be sized adequately to serve the proposed redevelopment and separated into a surface water sewer system and a foul water sewer system.

5.2.20 As such flooding from these sources is extremely unlikely and therefore has not been considered further.

Groundwater

5.2.21 Groundwater flooding generally occurs when water levels in the ground rise above surface elevations. Severe storm events could cause groundwater levels to rise above ground level. Underlying geology is the principal factor that effects this. Groundwater flooding most commonly occurs in low lying areas which are underlain by impermeable rocks or aquifers.

5.2.22 As the Site is underlain by London Clay Formation in the majority the potential for groundwater flooding is negligible. This is supported by Figure B5, within Appendix B of the EBC SFRA which indicates that the area is less than 25% susceptible to ground water flooding. Refer to Appendix F for Figure B5.

5.2.23 Historic flooding records presented in the SFRA mapping indicate that the Site has not been affected by groundwater flooding incidents in the past. Refer to Figures 5.6 above.

Flooding from Reservoirs, Canals, and other Artificial Sources

5.2.24 Mapping provided by the EA indicates the area to the west of the Site may be affected by flooding if a reservoir were to fail. The EA's online Risk of Flooding from Reservoirs mapping indicates the Site may not affected by the failure of Barwell Court Lake which is approximately 2 km to the southeast of the Site. That said, it is noted that the Reservoirs Act requires a significant inspection and maintenance regime. The likelihood of a catastrophic failure of the lake is negligible.

5.2.25 No canals or other significant artificial water bodies are present up-gradient of the Site in its locality.

5.3 Flood Zone Classification

5.3.1 A summary of potential sources of flooding and the flood risk arising from them is presented in Table 5.1 below.

Table 5.1: Summary of potential sources of flooding

Potential Sources	Potential Flood Risk at the Site
Tidal /Sea flooding	N/A
Rivers /Fluvial flooding	High in non-built form areas
Surface Water /Pluvial flooding	Low
Groundwater	Low
Reservoirs, Canals, and other artificial sources	Low
Sewers and infrastructure failure	Very Low

5.3.2 The risk of flooding from the majority of sources to the Site is low, except for fluvial flooding. The introduction of an onsite sequential test has placed all built form either within Flood Zone 1 (1 in 100 years plus climate change) or lifted habitable rooms out of Flood Zone 2. This, coupled with the use of flood resistant building materials, will ensure that the risk of flooding would not present a constraint to the development within the Site.

5.3.3 Although not a policy requirement, as all dwelling finished floor levels will be constructed outside of the 1 in 100 year plus climate change flood plain, it is proposed to set dwelling finished floor levels 150mm above the current Flood Zone 2 level (1 in 1000 year).

5.3.4 Safe access and egress can be achieved via the proposed access via Raleigh Drive as it does not fall within the 1 in 100 years plus climate change area of flooding.

6 Surface Water Management Proposal

6.1 Design Approach

6.1.1 This section outlines a preliminary strategy for managing surface water runoff from the redevelopment in accordance with national and regional policy requirements and best practice guidance. It is based on the agreed parameters set out in preapplication discussions and subsequent Flood Risk Report (FRR) undertaken with Surrey County Council as the LLFA. The strategy intends to mitigate the risk of surface water flooding on the Site and avoid increasing flood risk downstream.

6.1.2 Drainage options are constrained by several elements on the Site, including the topography and underlying soils.

6.1.3 A surface water strategy is presented within **Appendix H.**

6.1.4 The illustrative masterplan of the proposed redevelopment, provided within **Appendix A,** has been utilised to calculate catchments for the Site**.** The remainder of the Site is to remain as open space and therefore the rate of runoff is not anticipated to change from existing conditions in those areas.

6.1.5 There is evidence of existing impermeable surfaces on the Site of marginally less than 0.26 ha, with the proposed Site to have an estimated gain of 0.53 ha of impermeable surfaces, which would have negative implications for on-site and downstream flood risk, if left unmanaged.

6.1.6 Current best practice SuDS guidance states:

- *The rate of discharge of the urban runoff to the receiving water should be limited to the equivalent greenfield runoff rate for the site via the provision of storage (Attenuation Storage) and flow constraints (Downstream Flow Controls).*

6.1.7 In line with the PPG, redevelopment proposals in all flood zones should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of SuDS.

Climate impact on drainage

6.1.8 Climate change impacts over the anticipated lifetime of the development will be duly taken into consideration within the assessment of post-development surface water run-off.

6.1.9 Considering the type and lifetime of the redevelopment, a 40% uplift in peak rainfall intensity is deemed appropriate for the preliminary design purposes with further exceedance flow checks made to consider the consequences of possible flooding from the Site drainage system. Refer to Section 8 for more details.

6.2 Existing and Proposed Run-off Rates

6.2.1 Under current conditions, there is no formal drainage system in place for the Site. Precipitation falling on the existing ground currently disperses through a combination of evaporation, transpiration, run-off from largely impermeable soil and geology into onsite riparian ditches.

6.2.2 Current government guidance advises that the post-development rate of runoff should be no greater than the pre-developed rate with the same rainfall event.

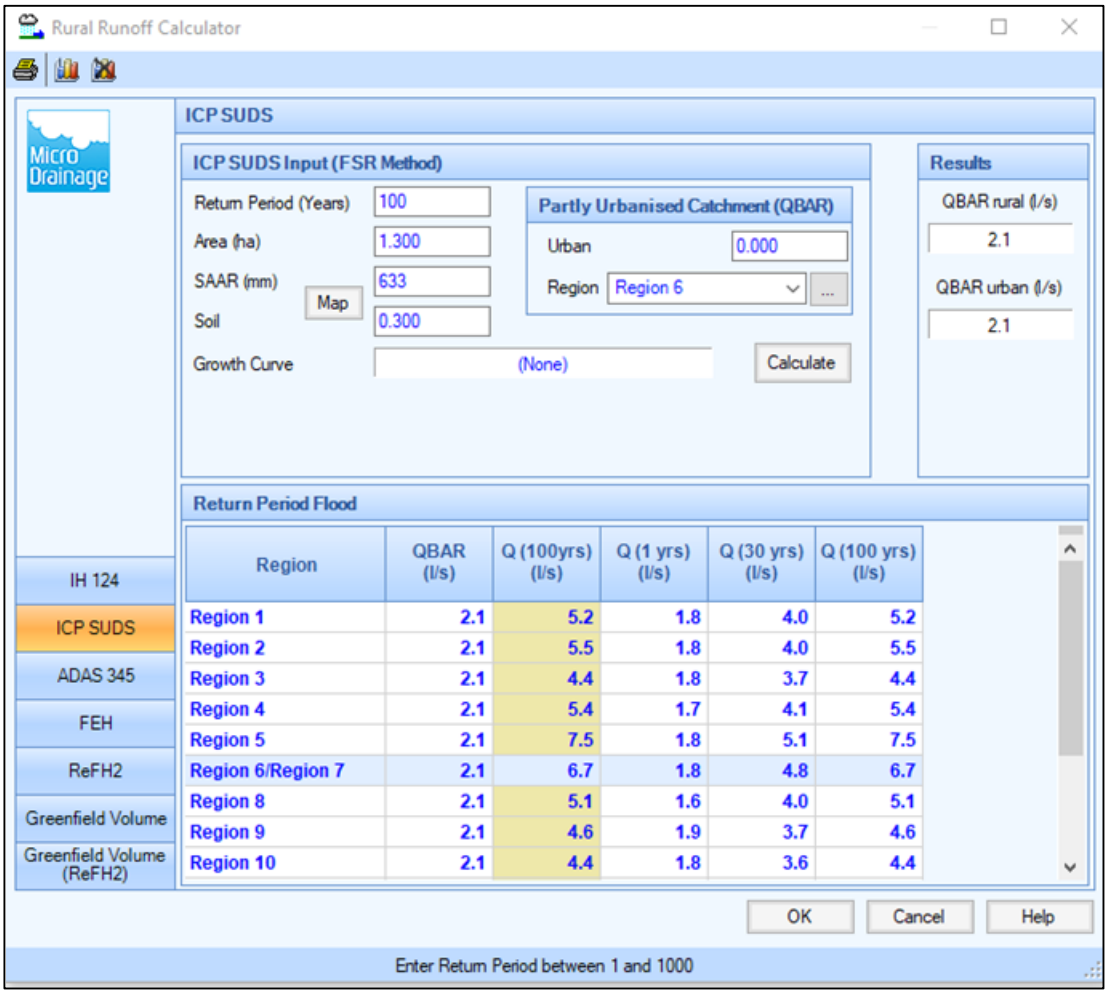
6.2.3 Greenfield runoff rates for the Site were calculated through application of the methodology outlined in ICP SuDS report for catchment areas of 50 hectares or less. ICP SuDS method is widely recognised as current best practice for estimation of existing catchment run-off rates for small rural catchments.

6.2.4 The ICP SuDS method can be used to estimate greenfield runoff rates for a range of annual probability events, or return periods, by applying regional growth curve factors to the mean annual peak runoff. The UK hydrological region for Mole Valley is Region 6, therefore appropriate growth curve factors for this region have been incorporated into the analysis undertaken in MicroDrainage.

6.2.5 The following parameters have been incorporated into the runoff modelling:

- Total redevelopable site area: 1.3 hectares paved or gardens (from development plans provided);
- Soil Index: 0.300 (as taken from Microdrainage software).

Figure 6.1 - Microdrainage Calculations[18]



Region	QBAR (l/s)	Q (100yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	2.1	5.2	1.8	4.0	5.2
Region 2	2.1	5.5	1.8	4.0	5.5
Region 3	2.1	4.4	1.8	3.7	4.4
Region 4	2.1	5.4	1.7	4.1	5.4
Region 5	2.1	7.5	1.8	5.1	7.5
Region 6/Region 7	2.1	6.7	1.8	4.8	6.7
Region 8	2.1	5.1	1.6	4.0	5.1
Region 9	2.1	4.6	1.9	3.7	4.6
Region 10	2.1	4.4	1.8	3.6	4.4

6.2.6 Within the Pre-Application correspondence received from Surrey County Council they have recommended that the design discharge be based on a 1-year storm, other than for a 100-year storm where the 100-year discharge rate could be used. Refer to **Appendices B & F**.

6.2.7 A complex outfall has been created, limited to 1.8l/s for storms up to and including 1 in 30 years, whilst any storms for 1 in 100 years will have a limit of 6.7l/s.

6.2.8 It should be noted that the POS to the east of the Site has been excluded from the above as this will continue to drain naturally to existing surface water bodies.

[18] MicroDrainage Design and Modelling Software (version 2019.1)

7 Hierarchy of Surface Water Disposal

7.1.1 In line with national and local policy guidance and Building Regulations (part H), the following hierarchy of surface water disposal should be adhered to, in decreasing order of preference:

- Discharge to ground;
- Discharge to a surface water body;
- Discharge to a surface water sewer; and
- Discharge to a combined sewer.

7.2 Discharge to the Ground

7.2.1 The most effective way to reduce surface water runoff is through infiltration into the subsoil, which reduces the total volume of runoff, rather than simply reducing peak flows. This can include features such as infiltration trenches, soakaways, infiltration basins, and permeable paving.

7.2.2 As discussed above, BGS records revealed that the Site is underlain by London Clay formation, with Superficial deposits of Alluvium (clayey sands and silty clays) along the eastern boundary. The London Clay is known for its poor infiltration characteristics. Therefore, there is no scope to discharge the generated surface water run-off to the ground.

7.3 Discharge to a Surface Water Body

7.3.1 In accordance with the requirements of the LLFA, the NPPF and SuDS best practice, the discharge location for surface water flows has been reviewed in line with the Site's specific watercourse characteristics.

7.3.2 Given the above hydrogeological conditions, it appears infiltration drainage techniques will be unfavourable. Therefore, the preliminary drainage strategy will likely be a combination of source control measures, and on-site attenuation drainage with restricted discharges into the local riparian watercourse to the east of the Site.

8 Sustainable Drainage Design

8.1.1 Current best practice guidance document: the SuDS Manual (CIRIA Report C753) promotes sustainable water management using Sustainable Drainage Systems (SuDS).

8.1.2 The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a 'management train'. The hierarchy of techniques is identified as:

- Prevention – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g., minimise areas of hard standing).
- Source Control – control of runoff at or very near its source (such as the use of rainwater harvesting).
- Site Control – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole Site).
- Regional Control – management of runoff from several sites, typically in a retention pond or wetland.

8.2 Site Constraints to the use of SuDS

8.2.1 There may be the opportunity for simple rainwater harvesting systems to be used and incorporated (subject to demand and developer preference); however, their use will largely be restricted to 'non-potable' external uses such as irrigation of soft landscaping / lawns etc. For the purposes of the surface water drainage strategy the precautionary principle has been adopted whereby no (beneficial) allowance for rainwater re-use has been factored into the calculations or design at this stage.

8.2.2 Based upon the largely impermeable local geology, traditional SuDS infiltration techniques (e.g., infiltration basins and soakaways, etc) are deemed to be unviable for wholesale disposal of surface water runoff via infiltration at this location.

8.2.3 The relatively small scale and nature of the proposed redevelopment preclude the allocation of land areas for 'open' attenuation features (incorporating permanent water) to accommodate source control surface water SuDS features. This is particularly due to the presence of Flood Zones 2 & 3 to the east of the Site taking the majority of the open space.

8.2.4 As such, the most appropriate and applicable SuDS system for the Site is permeable surfacing, as this not only provides storage and water quality treatment, but also allows the water to be transmitted to the outfall at gradients which would otherwise be unsuitable for a piped network.

8.3 Proposed Preliminary Surface Water Design

8.3.1 Underlying ground conditions are deemed unviable for the disposal of surface water runoff via infiltration. It is therefore proposed that the 'post redevelopment' discharge rate will be restricted. In accordance with the Pre-Application communications post-development run-off of 1.8 l/s for all return periods up to and including 3.33% (1 in 30-year return period) whilst the critical 1% AEP (1 in 100-year return period) storm event incorporating climate change allowances over the lifetime of the redevelopment (applied as a 40% uplift in peak rainfall intensity) would be limited to 6.7l/s.

8.3.2 A suite of 'on-site' SuDS measures will be integrated into the development layout and scheme design, where practical considerations allow, to manage runoff at source and to provide water quality improvements.

8.3.3 On-site SuDS measures to be integrated within the redevelopment layout include:

- Permeable paving or other permeable surfaces;
- Swales

8.3.4 No strategic (off-site) SuDS arrangements are required for control of surface water runoff from the Site.

8.3.5 Due to the gentle gradients of the Site a traditional piped network is inefficient. As such all the conveyance of water through the drainage system will be by utilising the sub-base and crates of the permeable paving beneath car parking and the road carriageways. Whilst this can cause complications from services and foul drainage, there has been a 2m wide service route allowed for within the Site (mostly utilising footways) which has been shown on the drainage strategy drawing, refer to **Appendix H.** In addition to this allowance for services, an allowance of 1.5m within the roads with paths alongside has been allowed for accommodating the foul sewer network.

8.4 Contributing Catchment Area Schedule

8.4.1 For the purposes of the drainage calculations, the proposed areas of impermeable surface or the 'contributing catchment' areas were assessed from the redevelopment proposals plan. A breakdown of the proposed surface types (and associated contributing catchment areas) is presented in Table 8.1 below.

Table 8.1 Proposed Site's areas

Proposed Site areas breakdown		
Sub catchment	**Surface Type**	**Area (ha)**
Building roof, external impermeable Surfaces, Access Road	Various permeable and impermeable surfaces	0.784 (0.823 with urban creep)
Gardens	Grass, Topo soil, trees, shrubs	0.516
Public open space	Grass, Topo soil, trees, shrubs	0.810
Total Site Area		**2.110**

8.4.2 For the purposes of the drainage calculations, the urban creep value of 10% has been applied to all roof areas to allow for things like extensions, conservatories and other built forms which may be added to the Site over time.

8.5 Allowable Off-site Discharge Rates

8.5.1 Attenuation storage calculations have been presented within Appendix I showing the quantum of attenuation storage required to control off-site discharge rates to rates agreed with the LLFA, refer to Appendix F for the LLFA Flood Risk Report.

Table 8.2 Proposed Catchment/ Discharge rates

Proposed Site Storage/Discharge Rates		
Catchment	**Storage**	**Discharge Rate (l/s)**
Catchment A - 0.823 ha	1,325m^3	1.8 (6.7 for 1 in 100)

8.6 Surface Water Treatment

8.6.1 The surface water run-off from the Site will be treated in accordance with the CIRIA SuDS Manual 2015 (Ref 12). As per Table 26.2 of the CIRIA SuDS Manual - Pollution hazard indices for different land use classifications. The Site has been classified as low Hazard Level.

8.6.2 Table 26.2 of the CIRIA SuDS Manual confirms that, where the pollution hazard level is classified as "low", this correlates to the following pollution indices:

- Total Suspended Solids (TSS) – 0.5
- Metals – 0.4
- Hydrocarbons – 0.4

8.6.3 Table 26.3 of the CIRIA SuDS Manual – Indicative SuDS mitigation indices for discharge to surface waters provides mitigation indices relating to SuDS features.

8.6.4 The proposed surface water strategy (**Appendix H**) shows that all surface run-off will flow through a Swale before being discharged into the riparian watercourse, at the eastern boundary of the Site.

8.6.5 According to Table 26.3 of the CIRIA SuDS Manual permeable paving has the following mitigation indices:

- Total Suspended Solids (TSS) – 0.7
- Metals – 0.6
- Hydrocarbons – 0.7

8.6.6 In accordance with the CIRIA SuDS Manual the total SuDS Mitigation Index for the Site is calculated using the following formula:

Total SuDS mitigation index = mitigation index$_1$ + 0.5(mitigation index$_2$)

8.6.7 Refer below for the Total SuDS mitigation index the Site (Low Hazard Level).

Table 8.3: Total SuDS Mitigation Index

Pollutant	Pollution Hazard Indices (low pollution hazard level)	Permeable Paving Mitigation Indices	Total SuDS Mitigation Indices
Total Suspended Solids (TSS)	0.5	0.7	**0.7**
Metals	0.4	0.6	**0.6**
Hydrocarbons	0.4	0.7	**0.7**

8.6.8 As can be seen from Table 8.3 above, the Total SuDS mitigation indices for the Site exceed the requirements of CIRIA SuDS Manual for the required pollutants (Total Suspended Solids (TSS), metals and hydrocarbons) for both classifications encountered on this Site.

8.6.9 Since the swale may be submerged at times the above assessment excludes the mitigation indices for the swale to ensure the water being discharged from the Site will be of adequate quality.

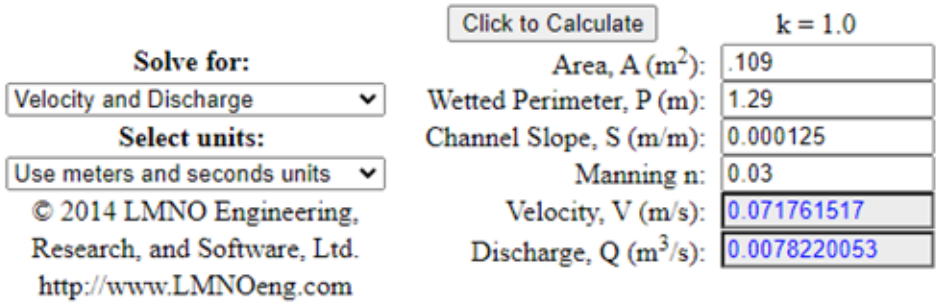
8.7 Surface Water Outfall

8.7.1 The surface water outfall Headwall is set below the 1 in 100 plus 20% level (circa 17.45 based on extent of flooding compared to the surveyed levels near the outfall location) provided by the Environment Agency, within their Product 4 Data.

8.7.2 As such the SuDs modelling has allowed for this outfall being submerged in the 1 in 100 design plus climate change storm events. For robustness the SuDs modelling undertaken utilised the peak flood level set at 17.65m from the onset as a permanent drowned outfall.

8.7.3 The control of surface water discharge to a 1-year storm event for storm events up to a 1 in 30-year storm will result in betterment related to downstream flows.

8.7.4 To ensure that the swale is of a suitable size the Manning Equation has been used to determine the available capacity of the ditch. For ease of presentation the following website was used https://www.lmnoeng.com/manning.php with the values for a 125mm deep swale with the Manning n value (0.030) for a weedy excavated earth channel, the results are presented below:



8.7.5 The discharge rate of 0.0078220053m³/s can be converted to 7.8l/s which exceeds the discharge rate of 6.7l/s within the 1 in 100-year events. As such, due to the ditch being designed to be between 200mm and 300mm deep, the swale is deep enough to accommodate the peak flow.

8.7.6 For completeness we have also undertaken the equation to determine water depth for the majority of storms where the water flow would be 1.8l/s. With a 60mm water depth the following results are obtained, which shows a 0.0019799198m3/s discharge rate (which equates to 1.98l/s), as such the water depth within the swale would normally be less than 60mm:

	Click to Calculate	k = 1.0
Solve for:	Area, A (m^2):	.041
Velocity and Discharge	Wetted Perimeter, P (m):	0.879
Select units:	Channel Slope, S (m/m):	0.000125
Use meters and seconds units	Manning n:	0.03
© 2014 LMNO Engineering, Research, and Software, Ltd. http://www.LMNOeng.com	Velocity, V (m/s):	0.048290727
	Discharge, Q (m^3/s):	0.0019799198

Units in Manning calculator: ft=foot, m=meter, s=second.

9 Conclusions and Recommendations

9.1 Background

9.1.1 This report has been prepared to assess the implications of Flood Risk for the proposed redevelopment of land known as 'Land North of Raleigh Drive, Claygate, Surrey'. It is proposed to provide up to 60 residential dwellings together with associated amenity and open space provision, landscaping, and vehicle access.

9.1.2 The majority of the built form of the Site lies within Flood Zone 1 with small elements within Flood Zone 2 to the northwest and east - 'Low & Medium Probability of flooding respectively. As defined within Table 1 of the PPG section on Flood Zone and flood risk tables. The proposed residential redevelopment is considered as 'More Vulnerable' when utilising Table 2 of the PPG section on Flood Zone and flood risk, while the open space is water-compatible development. The redevelopment being proposed is consistent with the appropriate uses for Flood Zone 1 & 2 and the open space is consistent with the appropriate use of Flood Zone 3, as outlined in Table 2 of the PPG.

9.1.3 The site has been the subject of a Sequential Test which confirms that it is acceptable for development. Under the NPPF and PPG an Exception Test is not required. That said should the LPA fell one is required this has been passed.

9.2 Probability of Flooding

9.2.1 All potential sources of flood risk to and from the Site, as listed in the NPPF, have been assessed and the risks of flooding occurring have all been assessed as low. In assessing the flood risk, the impacts of climate change have been considered for the lifetime of the proposed development and are also considered acceptable.

9.3 Flood Risk Management

9.3.1 As the proposed residential redevelopment will lie predominantly within Flood Zone 1 and with all built form set 150mm above the Flood Zone 2 levels the risk of flooding from all sources is assessed to be low and the safety of people is considered acceptable for all foreseeable flooding events. No specific flood management measures beyond that of regular maintenance are necessary.

9.4 Offsite Impacts

9.4.1 The Preliminary Surface Water Drainage Strategy set out in this assessment proposes management of surface water run-off from the redevelopment through the use of sustainable drainage techniques which will provide an improved surface water drainage regime and flood risk profile. Consequently, this will reduce surface water run-off flows from the Site, for storm return periods up to the 1 in 100 year event, plus an allowance for the detrimental effects of climate change. The proposed development will not increase the risk of flooding elsewhere. The implementation of the SuDs scheme as proposed, is likely to reduce any existing risk of downstream flooding.

9.5 Recommendations

9.5.1 Due to the positive outcome of this assessment, there is no reason why the Site should not continue through the planning process and be approved for residential redevelopment in respect of flood risk and surface water drainage.

Appendices

Appendix A Illustrative Masterplan