Redrow Homes Plc

Land at Little Bushey Lane, Bushey

Flood Risk Proof of Evidence

680462 PoE

MARCH 2023

Town and Country Planning Act 1990 (as amended)

Section 78 (including an appeal under section 78 as applied by the regulations made under section 220

Appellant: Redrow Homes Plc

APPEAL REFERENCE: APP/N1920/W/23/3314268 - Land East Of Little Bushey Lane And North Of The Squirrels

LPA REFERENCE: 22/1071/OUT

Application for residential development (up to 310 units) with access from Little Bushey Lane, and land reserved for primary school, community facilities and mobility hub (Class E) along with car parking, drainage and earthworks to facilitate drainage, open space and all ancillary and enabling works. (Outline Application with Appearance, Landscaping, Layout and Scale Reserved).

1. Introduction

Personal details

1.1 My name is Colin Whittingham, I am a director with RSK and responsible for technical expertise in the impacts of development on the water environment, flood risk, drainage consultancy and design. I work within RSK's Land & Development Engineering (LDE) division, which specialises in sustainable engineering and environmental consultancy.

1.2 I am chartered through the Chartered Institute of Water and Environmental Management (CIWEM) and a Practitioner Member of the Institute of Environmental Management and Assessment (IEMA). I have significant experience in this field, gained through varied roles within a consultancy setting and through academic qualifications.

1.3 My experience covers a wide array of public and private sector projects. Public sector coverage includes flood mapping studies for the Environment Agency while private sector work covers flood and drainage studies for a range of residential, industrial and infrastructure projects. I am also experienced in the production of environmental impact assessment chapters on hydrology, flood risk and water resources. I am responsible for supervising and coordinating all aspects of RSK flood risk assessment production, reviewing and authoring, and for supervising and training staff on flood risk and sustainable drainage.

1.4 I have specialist skills in hydrological modelling: Flood Estimation Handbook (FEH), WINFAP-FEH, Revitalised Flood Hydrograph (ReFH), together with 1D and 2D hydraulic modelling: Flood Modeller Pro, ISIS, ISIS 2D, Hydrologic Engineering Centres River Analysis System (HEC RAS), WinDes.

1.5 Prior to joining RSK in 2010, I was employed as senior hydrologist by Atkins (2008-2010) and previously as hydrologist by Engiol (2006-2008) and Weetwood (2004-2006).

1.6 My evidence will show that flood risk has been a key consideration in determination of the location of the built development on the application site with the key polices relating to flood risk within the NPPF and associated PPG being addressed.

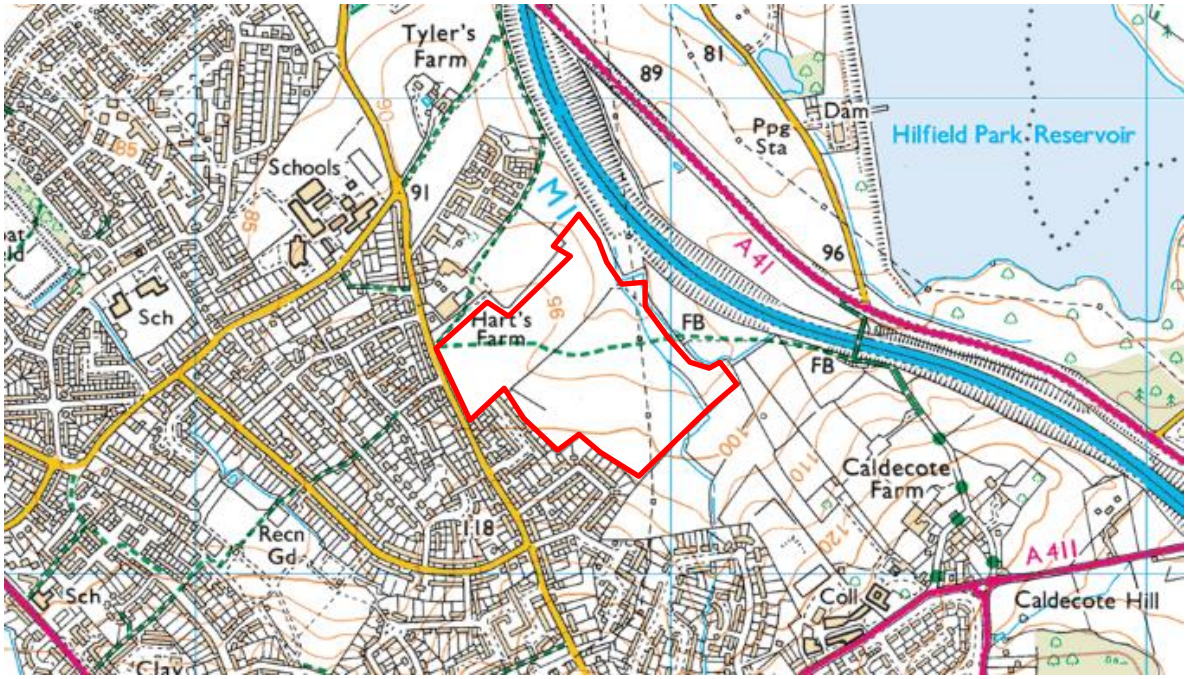
1.7 The evidence which I have prepared and provide for this appeal in this proof of evidence is true and has been prepared, and is given in accordance, with the guidance of my professional institution and I confirm that the opinions expressed are my true professional opinions.

2. Site Description and flood risk context

Site description

2.1 The site is located between Little Bushey Lane and the M1 in Hertsmere Borough in the county of Hertfordshire and can be located at National Grid Reference 514804E, 195513N.

2.2 The site covers an area of approximately 18.2ha and currently comprises an open expanse of agricultural land between Little Bushey Lane to the west and the M1 motorway to the north-east.



Site location plan

Topography

2.3 A site-specific topographic survey was carried out by AHP Surveys in June 2021. The survey shows the existing site levels vary from 105.5m above ordnance datum (mAOD) in the southmost corner to 87.68mAOD along the banks of the watercourse in the north-east corner (with the lowest invert level of 87.5mAOD).

2.4 The land generally slopes north-east along all fronts except in the north-east corner which folds into a bowl shape around the lowest point.

Existing drainage and utilities

2.5 Thames Water sewer plans have been obtained for the site and are included in the Flood Risk Assessment. These plans indicate the following network of sewers in the vicinity of the site:

2.6 A 175mm diameter foul sewer runs southeast to northwest through the south of the site, ultimately connecting into a 225/300mm foul sewer which runs in a northerly direction beneath Little Bushey Lane.

2.7 A 1200mm diameter foul sewer (possibly a typographic error as this seems unusually large) and a 375mm surface water sewer run along the northern edge of Little Bushey Lane and appear to encroach partially within the western site boundary.

2.8 Runoff from the site currently drains to the existing drainage ditches that cross the site, which discharge into Bushey Heath Drain in the north of the site.

2.9 The site also has an existing 18 inch gas main running south-east along its northern boundary before diverting east. This structure will require a 10m development easement to prevent disruption during construction.

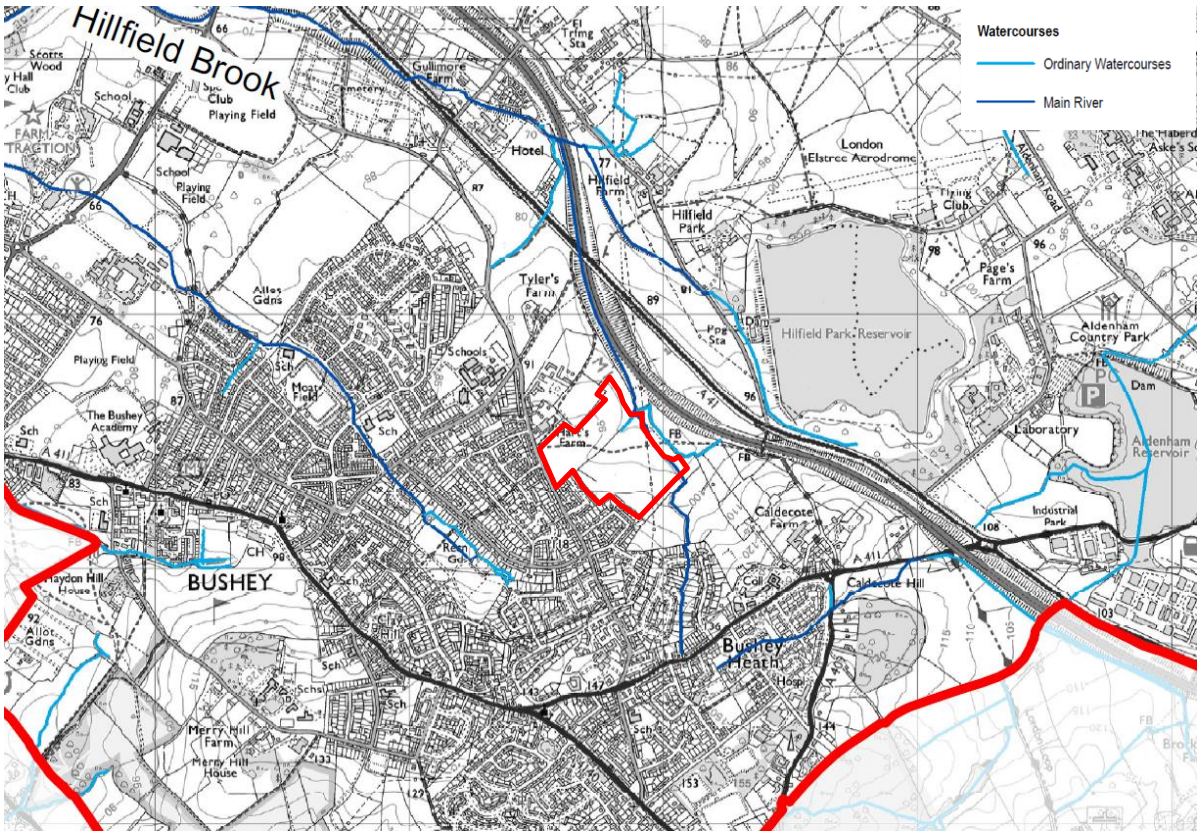
Hydrology

2.10 Reference to Ordnance Survey (OS) mapping and the EA's web-based mapping indicates that the nearest EA Main River is Bushey Heath Drain, which runs southeast to northwest through the north-eastern part of the site. The stream passes through a number of culverted sections comprised of short sections of 300mm pipes. The watercourse eventually merges with the Hilfield Brook approximately 500m to the north.

2.11 A number of surface water drainage ditches are present on site, the most notable of which runs southwest to northeast along a field boundary across the centre of the site. Another small ditch runs southwest to northeast through the southern part of the site.

2.12 The Hilfield Park Reservoir is located approximately 350m to the northeast of the site and Aldenham Reservoir is located 1.5km to the east of the site.

2.13 The Figure overleaf is extracted from the Hertsmere Borough Council Strategic Flood Risk Assessment (SFRA) and shows the local Main Rivers and Ordinary Watercourses. The eastern end of the drainage ditch crossing the centre of the site is considered by Hertsmere Borough Council to be an Ordinary Watercourse. Hertfordshire County Council (LLFA) also confirmed that the remainder of the site drainage ditches are not considered as Ordinary Watercourses in correspondence dated 1st September 2022.



Flood Risk

Fluvial

2.14 The latest EA published flood zone map shows that the majority of the site lies within Flood Zone 1, representing a less than 1 in 1000 year probability of flooding from fluvial sources.

2.15 However the course of the Bushey Heath Drain watercourse along the north-east boundary is classed as Flood Zones 2 and 3 although these flood zones are mostly indicated on the downhill side from the watercourse, on the eastern side of the channel. It should be noted however that no built development is proposed within Flood Zones 2 or 3.

2.16 Flood extents and levels have been supplied by the EA for a number of nodes within the vicinity of the site, taken from their model Upper Colne Flood Risk Mapping Study (Halcrow, 2010).

2.17 Consideration has been given to increased river levels due to climate change, as per guidance issued by the EA in February 2016 and most recently updated in May 2022. For developments within Flood Zones 2 and 3, or within Flood Zone 1 but that may be in Flood Zone 2 or 3 in the future, the 'central' peak river flow climate change allowance should be used. In this location, the central allowance is 21%. However, as a conservative approach, the Flood Zone 2 (1 in 1000 year) extent has been used when determining the location of development within the application boundary.

2.18 In accordance with paragraph 159 of the NPPF, development areas have been guided away from the areas shown to be at risk from this source with all development located within Flood Zone 1 and on ground higher than the modelled flood levels. As well as being located outside the 1 in 1000 year flood extent, finished floor levels of the properties will be set at least 300mm above the in-channel 1 in 100 year plus 20% climate change flood level.

Tidal

2.19 The site is not considered to be at risk from tidal flooding due to its inland location.

Surface water (pluvial) flood risk

2.20 The EA's surface water flood map shows that a surface water flow path exists through the east of the site, flowing in a southeast to northwest direction and correlating with the course of the Bushey Heath Drain. Additional surface water flow paths are shown along the course of the field drain running west-east through the centre of the site and within the southwest and northwest parts of the site, with flows generally conveyed in a southwest to northeast direction.

2.21 The built development has been directed to the lowest risk parts of the site in terms of the surface water flood risk, by avoiding the placement of development areas or surface water drainage features within the main overland flow paths associated with Bushey Heath Drain and the drainage ditch running east-west through the centre of the site. The impact of the development on other overland flow paths has been taken full account of, with mitigation measures incorporated into the scheme as discussed below.

2.22 In order to further quantify the surface water flood risk at the site and to establish any impacts resulting from the proposed development, a surface water flood risk modelling exercise has been undertaken. A Pluvial flood modelling analysis has been undertaken at the site to establish the impact of the proposed development on surface water flooding helping to quantify the flood risk to the site for the existing and post development scenarios. The model results (existing scenario) are a comparable representation of the EA's Extent of Flooding from Surface Water mapping. During the 1 in 100 year 40% plus climate change scenario, flows outside the on-site watercourses / ditches were generally shown to be shallow, in the region of 10mm to 140mm.

2.23 The assessment produced existing surface water flood maps for the site and the applicable catchment both up- and downstream of the site. Using the pre-development (existing) scenario as the benchmark, an assessment was made of the impact of the proposed development by raising proposed development areas above the predicted surface water flood level. Proposed areas for storage of runoff derived from the development were also excluded from the post-development model to ensure there is no interaction between the overland flow paths from off-site and the proposed site drainage system. The assessment of the post-development scenario included the incorporation of mitigation measures (swales and realigned drainage ditch in the eastern part of the site) that have been included to direct surface water flows away from the proposed development areas whilst ensuring existing flow paths can be maintained without increasing flood risk off-site in accordance with the requirements of NPPF paragraph 167.

2.24 The scenarios have been simulated for the 30 year, 100 year and 100 year plus 40% climate change events.

2.25 From the modelled outputs an extent and a depth comparison exercise were then undertaken to understand the impacts of the development and the mitigation proposals on the flood risk at the site and in the local area.

2.26 The mapped outputs contained within Section 4.6 of the updated FRA and its corresponding Appendix H (Core Document D7) show;

(i) Surface water flow paths from offsite can be managed within the mitigation features on site (swales and realigned ditch);

(ii) Post mitigation surface water flow paths do not impact upon the development proposals including the surface water attenuation features;

(iii) The development results in a reduction in flood depths in the downstream areas by a variable amount, but typically within a range of 10mm – 40mm with further localised improvements.

2.27 In accordance with the modelled outputs, the development would conform to NPPF paragraph 167 with no offsite detrimental impacts as a result of the development.

Groundwater

2.28 The Hertsmere Borough Council Strategic Flood Risk Assessment (SFRA) (CD G16) states that the borough as a whole has a low susceptibility to groundwater flooding, and mapping within the SFRA indicates that the site itself is classified as 'not considered to be prone to groundwater flooding'.

Reservoir

2.29 The EA reservoir flood map shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. Since this is a prediction of a worst-case scenario, it is unlikely that any actual flood would be this large.

2.30 The map shows a small section of the site is in a location at risk of reservoir flooding both when river levels are normal and when there is also flooding from rivers. Approximately 10% of the site is affected, with the affected area generally correlating to the EA fluvial flood zones. The reservoir flood risk originates from the Hilfield Park Reservoir immediately north-east of the M1. The development areas of the site are not located within this area shown to be at potential risk.

Sewer

2.31 A number of historical foul / surface water sewer flooding incidents are noted along Little Bushey Lane to the west of the site. Any surcharged water on Little Bushey Lane is likely to be conveyed away from the site in a northerly direction between the roadside kerbs, following the local topography and therefore is unlikely to significantly impact the proposed development.

2.32 A development-free easement has been allowed for either side of the existing mains sewer beneath the subject site limiting the potential impact of any localised flooding in the event of surcharging of this sewer.

2.33 The proposed development would be located down-gradient of Little Bushey Lane and will therefore not exacerbate any existing flooding issues on this road. However, to mitigate against any impacts downstream of the site, surface water has been considered within the design of the site, ensuring that any additional surface water and overland flows are managed correctly, to minimise flood risk to the site and the surrounding area.

Other

2.34 No other artificial features with the potential to result in a flood risk to the site have been identified.

Surface water drainage

2.35 The proposed development is for a residential end use. This will result in an increase in impermeable area and without mitigation would increase surface water runoff across the site. It will therefore be necessary to manage surface water on-site through conveyance

towards the proposed point of discharge, whilst providing sufficient attenuation for all events up to the 1 in 100 year event inclusive of 40% climate change (based on latest climate change guidance). The proposed drainage strategy incorporates a 10% allowance for urban creep to the estimated impermeable area in order to proof the attenuation systems components against unforeseen future expansions or individual building changes.

2.36 Discharge options from the site have been considered in line with the SuDS hierarchy. Infiltration is deemed not to be a viable solution due to the underlying geology and therefore discharge to the onsite watercourse has been considered. Discharging surface water directly to a local watercourse is considered feasible as there is an existing network of land drainage ditches and the Bushey Heath Drain running through the site. The site drains naturally in this way, and therefore utilising/enhancing the existing connection(s) will act to mimic the natural scenario.

2.37 Due to topographical constraints and the existing land drainage system the site's drainage system will need to be separated into five distinct catchments each with their own attenuation systems. Within each of the five catchments, runoff has been attenuated to the QBar greenfield rate for that particular catchment.

2.38 The proposed SuDS for the post development site include a combination of permeable paving, conveyance swales and attenuation basins. The basins are located depending on the positions of proposed buildings and taking account of the site's topography. Within the proposed school area, an indicative location has been shown for surface water attenuation, although the layout of the school site is yet to be determined.

2.39 The proposed attenuation basins are designed to provide the required storage volume to retain the 1 in 100 plus 40% climate change event. At this stage of the design, no account for plot drainage and network attenuation has been taken into account, therefore the storage estimates for the basins is conservative and will be refined at detailed design stage. The SuDS measures are outlined in the Indicative Surface Water Strategy as attached in Appendix K of the submitted updated FRA, March 2023 (Core Document D7). The drainage proposals meet the requirements of NPPF paragraph 169 by:

(i) Following advice from the LLFA - Advice from the LLFA has been followed. Initial Pre-app advice wasn't available prior to the planning submission due to LLFA staffing issues, however online advice was followed. Since the submission, further comments and consultation with the LLFA has been followed.

(ii) Minimum (national and local) operational standards are applied.

(iii) A draft SuDS Management Strategy has been prepared and submitted as Appendix L of the updated Flood Risk Assessment (Reference 680462-R1(2)-FRA Final, March 2023 – Core Document D7). This will be finalised at the detailed design stage.

(iv) The proposed attenuation basins will provide water quality, ecological and amenity benefits in addition managing surface water runoff generated on the application site, further deign refinement will be carried out at detailed design stage in liaison with the relevant ecology team. This can be secured through a Planning Condition.

2.40 The dimensions, volumes and location of the SuDS features will need to be revised as the masterplan develops and during the detailed planning stage. Detailed design of individual features is not part of the scope of this report. Preliminary design criteria have been based upon guidance given in the CIRIA publication 'The SUDS Manual'.

2.41 A draft SuDS Management Strategy has been submitted as Appendix L of the submitted updated FRA, March 2023 (Core Document D7) and would be finalised following detailed design of the site drainage system.

2.42 Temporary drainage should be established for the construction phase of development to prevent silt mobilisation, potentially impacting on flow regimes and silt pollution downstream. The construction of SuDS should be considered in the early stages of site design.

3. Development Plan context

Development Plan Requirements

3.1 Whilst not part of the Development Plan, I highlight that the relationship of the scheme to the NPPF is covered in the evidence of Mrs Ventham. The below summarises Hertsmere Borough Council local planning policies[1] (CD F2) and describes how the scheme meets each of the policy requirements.

3.2 **Policy SADM13** states that the natural environment of watercourses and areas of water will be improved wherever possible though Policy SADM16. Watercourses, including culverts, land adjacent to rivers, functional flood plains and flood storage areas should be restored to their natural state. New built development will normally be directed to Flood Zone 1. Reservoirs and water attenuation areas which help reduce flood risk downstream will be retained.

3.3 Built development has been directed to Flood Zone 1, avoiding developing in floodplains or flood storage areas. Where sections of the site are located in areas of other flood risk (pluvial), mitigation has been applied to ensure the new development remains flood free with no offsite detriment to flood risk, therefore policy SADM13 has been met within the submitted FRA (Reference 680462-R1(2)-FRA Final, March 2023 – Core Document D7).

3.4 **Policy SADM14** states that the risk of flooding will be avoided and reduced, and sets out a list of principles that new development must satisfy in relation to flood risk. The most relevant for the proposed development are:

(i) It must not increase the risk of flooding elsewhere.

(ii) Within sites at risk of flooding, the most vulnerable parts of the proposed development should be located in areas of lowest flood risk, unless there are overriding reasons to prefer different locations.

(iii) Floor levels of development in Flood Zones 2 and 3 should be situated above the 1% (1 in 100 years) plus climate change predicted maximum water level, plus a minimum watertight depth of 300mm above the normal water level.

(iv) Development at risk from any form of flooding should be flood resilient and resistant, with safe access and escape routes: it should also be demonstrated that residual risks can be safely managed.

(v) Development should incorporate appropriate flood resilient features and flood mitigation measures.

(vi) Where possible the footprint of existing buildings should be reduced.

(vii) Any necessary flood protection or mitigation measure should not have an undue impact on nature conservation, landscape character, recreation or other important matter.

(viii) There should be no net loss in flood storage on site.

(ix) Flood flow routes should be preserved.

(x) Where possible, flood storage should be maximised through the use of green infrastructure and sustainable drainage systems.

[1] Hertsmere Local Plan Site Allocations and Development Management Policies Plan, Adopted November 2016.

(xi) The risk from all types of flooding should be reduced as a consequence of development, wherever possible.

3.5 The submitted FRA (Reference 680462-R1(2)-FRA Final, March 2023 – CD D7) demonstrates that the most vulnerable parts of the development have been directed to the lowest risk parts of the site and that the development will be safe (including resilience/mitigation measures within the properties where required and providing safe access routes) without increasing flood risk elsewhere. Flow routes through the site are managed and overall reduction in flood risk is demonstrated through the surface water flood risk modelling and through the reduction of surface water runoff rates from the development area through the use of SuDS.

3.6 **Policy SADM15** relates to Sustainable Drainage Systems. In particular, the Council will require the introduction of sustainable drainage (SuDS) on all major developments (as defined in the Town and Country Planning (Development Management Procedure) (England) Order 2015 and any subsequent order). The drainage scheme should provide the most sustainable option from the SuDS hierarchy. Measures should attenuate water runoff at source (e.g. through attenuation ponds, filter strips, swales) and achieve multiple benefits (including management of flood risk and surface water pollution, amenity and biodiversity). The drainage scheme will:

(i) achieve the green field runoff rate, or as close to it as practicable;

(ii) provide a 1 in 100 year attenuation taking into account climate change;

(iii) provide arrangements for future maintenance and management.

3.7 A drainage strategy based on the use of SuDS is proposed. The drainage hierarchy has been followed. Greenfield runoff rates have been achieved and attenuation is provided for the 1 in 100 year plus climate change event. A draft SuDS Management Plan is provided with the drainage strategy drawing and calculations within the submitted FRA (Reference 680462-R1(2)-FRA Final, March 2023 – Core Document D7).

3.8 **Policy SADM16 -** Development on sites that contain a watercourse or are situated next to a watercourse will comply with the following principles:

(i) Development will not culvert a watercourse nor build over a culverted watercourse.

(ii) The natural environment of the watercourse and areas of water will be conserved or improved.

(iii) A minimum 9m wide undeveloped buffer zone will be provided from the top of the bank of any watercourse.

(iv) Opportunities should be provided to support river restoration and enhancement within the catchment of the watercourse.

(v) The opportunity to refurbish and/or renew existing assets (e.g. bridges, culverts and river walls) should be provided to ensure their lifetime is commensurate with the lifetime of the development (an assessment of the condition of the assets will be required).

(vi) A Water Framework Directive (WFD) assessment will be required for proposals involving works which would have a direct impact on a river (e.g. re-alignment of a river or work to bridges).

3.9 The submitted Flood Risk Assessment (Reference 680462-R1(2)-FRA Final, March 2023 – Core Document D7) demonstrates the above points can be met. The proposed diversion of on site overland flow routes into formal swales will allow additional on site attenuation and

management of the flow routes. This provides a further opportunity to provide ecological benefits whilst ensuring flood risk is managed on site for the proposed development and off site areas.

3.10 **Policy CS16** addresses the environmental impact of development and is relevant to matters of drainage and flood risk. It states that proposals will be required to incorporate sustainability principles, minimising their impact on the environment and ensuring prudent use of natural resources by measures including, inter alia: iii) incorporating the use of Sustainable Urban Drainage Systems (SUDS) where appropriate and where required by the Flood and Water Management Act 2010 to help reduce the risk of flooding; and ix) demonstrating that development accords with Policy CS12 and that any adverse effects can be overcome by appropriate alleviation and mitigation, which are capable of being secured through planning conditions or an obligation in accordance with Policy CS21. The CCS IPPS clarifies that development should make a positive contribution towards the area, its biodiversity alongside climate change adaptation and mitigation. It should also take full account of and positively design for sustainability, net zero carbon emissions, mitigation of climate change and building climate change resilience.

3.11 A drainage strategy based on the use of SuDS is proposed. SuDS features will offer multi-functional benefits (attenuation, water quality improvements, biodiversity and amenity benefits), a drainage strategy drawing and calculations within the submitted FRA (Reference 680462-R1(2)-FRA Final, March 2023 – Core Document D7).

4. Consultation responses

Environment Agency (EA)

4.1 The EA, as statutory consultee on flood risk matters were consulted as part of the application. A response dated 14th July 2022 (EA Ref: NE/2022/134645/01-L0) states that 'based on a review of the submitted information we have no objections to the application on flood risk grounds subject to the inclusion of the following informative on any decision notice.

4.2 The Environmental Permitting (England and Wales) Regulations 2016 require a permit to be obtained for any activities which will take place:

- on or within 8 metres of a main river
- on or within 8 metres of a flood defence structure or culvert
- involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert
- in a floodplain more than 8 metres from the river bank, culvert or flood defence structure and you don't already have planning permission.

LLFA

4.3 A Flood Risk Assessment (FRA) Reference 680462-R1(1)-FRA Final, June 2022 (Core Document A11) was submitted in support of outline planning application reference 22/1071/OUT. Hertfordshire County Council as Lead Local Flood Authority (LLFA) have subsequently issued two letters requesting additional information and clarification on the information presented within the original FRA. These letters were dated 9th November 2022 and 1st February 2023 and are included in **Appendix A**. An updated FRA (Reference 680462-R1(2)-FRA Final, March 2023 – CD D7) addresses the comments within these two letters from the LLFA. A meeting was also held with the LLFA on 22nd February 2023 to discuss their requirements. A summary of the objection and amendments made since the original planning submission is provided below:

4.4 LLFA objection letter dated 9th November 2022

Item number	LLFA Comment	Applicants response	FRA Section*
4.4.1	Drainage strategy to account for existing flow routes within school catchment. Drainage strategy to provide improvement to flood risk where possible.	Existing overland flow routes managed by appropriately sized swales. Drainage strategy reduces runoff rates to Qbar greenfield rates for all return periods, providing a reduction in discharge rate for all rainfall events in excess of the QBAR event. This will provide offsite flood risk benefits by reducing the flow leaving the site from the pre-development scenario.	Section 4.5, 4.6 Section 7 Appendix J
4.4.2	Drainage calculations to use FEH2013 rather than FSR. Clarification to be provided on storage volumes to ensure they can	Calculations amended to use FEH2013 dataset. Clarification of storage volumes provided.	Section 7 Appendix I Appendix J

Item number	LLFA Comment	Applicants response	FRA Section*
	contain 1 in 100 year plus climate change event.		
4.4.3	Outfall point for north catchment basin not shown. Attenuation basins not to be located in flood risk areas.	Outfall point shown more clearly. Attenuation basins situated outside flood risk areas.	Appendix J Figure 4.22
4.4.4	Discharge rate to be based on proposed development areas. Clarification to be provided of area of school catchment.	Amendments made as requested.	Section 7 Appendix I Appendix J
4.4.5	Surface water drainage calculations to be provided for 1 in 1 year and 1 in 30 year events	Provided as requested	Appendix I
4.4.6	Any culverting / de-culverting of ordinary watercourses to include assessment of associated impacts on flood risk	One ordinary watercourse to be diverted in east of site. Surface water modelling undertaken to assess impact of proposed diversion and it can be confirmed that there is no offsite increase in flood risk. Culverts will be required for access, these will be sized in liaison with the relevant authorities to ensure design standards are met and there is no increase in flood risk.	Section 4.5, 4.6

***** Flood Risk Assessment (FRA) Reference 680462-R1(1)-FRA Final, June 2022 (CD A11)

4.5 LLFA objection letter dated 1st February 2023

	LLFA Comment	Applicants response	FRA Section*
4.5.1	Information required to show that the risks of flooding from surface water and ordinary watercourses can be managed appropriately	Updated drainage strategy and surface water modelling exercise taking account of proposed swales to carry overland flows and proposed diversion of ordinary watercourse in east of site	Section 4.5, 4.6 Section 7 Appendix J
4.5.2	Updated modelling to show how flow paths entering the site from the south and southwest will be managed within open spaces without adversely affecting flood risk elsewhere	The pre and post development modelling takes into account rain falling on the site and any inflows to the site from offsite. The modelling shows there is no offsite increase in flood risk as a result of the propose on site works	Section 4.5, 4.6 Section 7 Appendix J

4.5.3	Diversions of ordinary watercourses / ditches to be modelled to confirm flood risk not adversely affected and development kept outside 1 in 100 year plus climate change flood extent	The post development modelling demonstrates that the development parcels can be kept outside of the 1 in 100 year plus climate change allowance extent. There is no offsite increase in flood risk as a result of the propose on site works.	Section 4.5, 4.6 Section 7 Appendix J
4.5.4	Storage and conveyance infrastructure to be identified and quantified to convey surface water flows originating off-site. Upstream catchment to be identified.	The model and masterplan have been updated in line with LLFA consultation responses. The proposals allow for flows entering the site from offsite with the upstream catchment forming the basis for the model catchment.	Section 4.5, 4.6 Section 7 Appendix I Appendix J
4.5.5	Appropriate developable areas to be identified	Updated parameter plan provided based on the updated modelling exercise.	Appendix D
4.5.6	SuDS to be multifunctional features. Underground attenuation tanks not acceptable.	Drainage strategy updated to exclude attenuation tanks. Proposed attenuation basins to provide multifunctional benefits in water quality, amenity and biodiversity.	Section 7 Appendix J
4.5.7	1 in 1 year drainage calculations to be provided. Clarification of whether 10% urban creep included.	An allowance of 10% urban creep has been included in the calculations	Section 7 Appendix I

***** Reference 680462-R1(2)-FRA Final, March 2023 – Core Document D7

4.6 LLFA objection letter dated 22nd March 2023

4.7 A response to the FRA update was issued by the LLFA dated 22nd March 2023 maintaining the objection on flood risk grounds. This is included in **Appendix A.**

4.8 The below considers the points of objection in the letter in turn:

4.9 LLFA comment - Review of information to show that the risks of flooding from surface water and from the ordinary watercourses can be managed appropriately within the outline proposals. The current parameter plan would need to be updated to reflect the constraints and potential mitigation for future development.

4.10 Appellant response - Updated Flood Risk Assessment (Reference 680462-R1(2)-FRA Final, March 2023 – CD D7) has demonstrated that the risks of flooding from surface water and from the ordinary watercourses can be managed appropriately within the outline proposals. The plans include the proposed mitigation for the development of the site, this meets the requirements of para 159 of the NPPF.

4.11 LLFA Comment - Updated modelling scenarios and parameter plans to show how all the surface water flow paths /fluvial flooding from watercourses entering the site from the south

and the south west (flowing to the north, north west and north east) will be managed within open spaces without adversely affecting flood risk elsewhere. Whilst the applicant has created a pluvial (surface water flooding) model it is not an integrated model to include the fluvial flooding as a downstream boundary.

4.12 Appellant response - The surface water hydraulic modelling undertaken in the updated Flood Risk Assessment (Reference 680462-R1(2)-FRA Final, March 2023 – CD D7) which is considered a standalone model, and not integrated with the fluvial flood risk model. The fluvial flood risk data has been provided by the Environment Agency. The rainfall incorporated into the surface water model has been considered in the fluvial model with the flows generated from the site contributing to river flow. The water levels in the river are below that of the developable area of the site and therefore has no impact on the surface water modelling results.

4.13 *LLFA Comment - The results from this current site-specific model, shows that there is up to 0.5m increase of flood levels outside of the site boundary to the south, south west and south east (existing dwellings and open space), see figures 4.24 to 4.27 of the FRA. This is not in line with NPPF and supporting PPG guidance to show how flood risk will not adversely affect areas outside the development boundary or to the development itself. The applicant suggests that the proposed development can be achieved through mitigation instead of avoidance of the areas at risk of flooding. That all development is built in Flood Zone one of the fluvial flood risk of the ordinary watercourse. However, much of the site is shown to be at risk of flooding from surface water flooding (confirmed by the high level modelling in the FRA).*

4.14 Appellant response - The model is so sensitive that it shows varied results in these areas with one grid square decreasing risk and the next increasing. This has been further investigated and it can be confirmed following consultation with the software developer that the results do not show that there is an increase in flood risk off site but shows the sensitivity of the model as the changes in the cells are in the order of millimetres. The software developer has received a copy of the model files and agreed that the parameters used are appropriate and there are no issues with the modelling carried out. This is further confirmed where similar results are seen in areas upstream of the site which cannot be impacted by the site due to their higher elevation. This is also further demonstrated in the fact there is a small section within the model which drains in the direction of another catchment which shows similar results. It is noted that in the 'pre-development' scenario some of the site is in areas shown to be at potential risk from surface water flooding, hence the post development (i.e. with mitigation) modelling exercise, this shows that the site can be protected for the lifetime of the development without adverse impacts off site. This meets the requirements of paragraph 159 of the NPPF.

4.15 Consultation on the modelling outputs has been undertaken with the software developer Jacobs to investigate the upstream variations in depth changes. The review of the model files by Jacobs (software developers for the Flood Modeller package) notes that from review of the check grids, the mitigation changes have all been correctly accounted for. On assessment of the max depth grid outputs (pre and post development) these are very similar apart from the differences occurring around the area where mitigation changes had been applied (as to be expected as the mitigation proposals alter the onsite surface water arrangement). Elsewhere (i.e. offsite) there were small differences with some extra cells showing wet in one model or the other, but the values in these cells were always very small in the examples assessed, i.e. close to the threshold value for a cell to be considered wet or dry. It was noted that these could be accounted for by small numeric discrepancies and the fact that the models were run in single precision. The variation in the results (upstream of

the site) is believed to be the result of the small numeric differences and the model being close to the cell threshold of being wet or dry in some sections of the upstream model.

4.16 LLFA Comment - To enable this masterplan, a development platform of up to 400mm is needed to raise manage the overland flow path, additional diversion swales for the overland flow route are needed, the proposed SuDS basins have to be bunded to keep surface water flooding out and a watercourse has to be diverted at 90-degree angles alongside a road and built development with no obvious buffers to manage flooding or maintenance of it. The full location of a watercourse on the north eastern boundary of the site is also unclear. It has not been confirmed if it flows away from the site boundary or culverted under the northern most proposed SuDS basin. All the development SuDS features should be modelled to include all water originating off site. It is unclear if the applicant could divert this watercourse if it is not within the red line boundary. Avoidance of flood risk is the most sustainable form of flood management. The areas currently marked for development may be required for flood management or mitigation and onsite SuDS. It is not appropriate to condition this element of the proposal to be investigated at a later planning stage.

4.17 Appellant response - The LLFA response has noted that mitigation is to be applied in the form of land modifications and creation of swales to manage the runoff and run on from off site. A development platform level of 400mm cannot be confirmed at this stage as this is an outline planning application and will be refined once a fixed detailed layout is developed. The model produced allows for rain falling on the site as well as flows originating from offsite, there is an allowance of discharge from the attenuation basis to fully illustrate the post development situation. It can be confirmed that there are no flows from the model entering the attenuation basins. The model produced is sufficient at outline planning stage to demonstrate that the strategy is deliverable, meeting local and national policy requirements, whilst being deliverable on site. It is considered likely that refinements to the model and detail of the swales and other features will develop as the scheme develops, with the requirement for a detailed drainage design being secured through a planning condition.

4.18 It should also be noted that the model represents a “worst case scenario.” It does not incorporate on-plot SuDS which would reduce the potential final storage volume required, which would be calculated at the detailed stage. In addition, the use of conditions is specifically allowed for in Local Plan Policy SADM14.

4.19 The ditch referred to, has been visually inspected and confirmed that it does sink along the site boundary with the onward route currently unknown. Whilst unlikely to be diverted in the location of the SuDS basin, if this were to be found to be the case, it could be diverted as part of the development without any impact to the capacity of the basin or compromise the surface water drainage proposals. If the ditch flows away from the site boundary, then this will be maintained with neither the ditch or the attenuation basins being impacted.

4.20 LLFA Comment - There is a proposal to potentially divert watercourses to assist with development. The flood risk from these watercourses need to be identified and mapped up to the 1 in 100 year plus climate change event. The inputs e.g. surface water outfalls to these watercourses must be identified and retained. Additional modelling scenarios should be undertaken to show pre and post development (including a potential diversion) to show how flood risk will not be adversely affected and development will be placed outside of the 1 in 100 plus climate change flood risk. Any diversions should promote naturalisation of channels to assist with biodiversity net gain and sustainable water management. Culverting of watercourses should be limited for watercourse crossings only. The LLFA does not support

culverting of watercourses for reasons other than securing access that cannot be achieved using a clear span bridge.

4.21 Appellant response – Pre and post development modelling of the surface water system including the upstream catchment has been undertaken as part of the updated Flood Risk Assessment (Reference 680462-R1(2)-FRA Final, March 2023 – Core Document D7). This modelling shows that the proposed development can accommodate flows from off site as well as those generated on site with no adverse flood risk impacts to the development areas or off site. Construction details including features to further enhance the biodiversity of the diverted ditches can be carried out at detailed design/reserved matters stage. This can be secured through a planning condition, with the modelling carried out to date demonstrating a feasible and deliverable scheme. It should also be noted that the BNG assessment submitted with the application shows that the development will result in a net gain of 20.33% habitat units, 39.42% hedgerow units, and 12.41% river units (**CD B4**).

4.22 Culverts/watercourse crossing details will follow a detailed design procedure and will be co-ordinated with the requirements of the LLFA. This can be secured through a planning condition.

4.23 LLFA Comment - The applicant suggests that all details can be conditioned but the LLFA do not consider that it is appropriate to condition flood risk and mitigation at this time. Appropriate developable areas should be identified as part of the outline planning permission and an updated development strategy, parameter and phasing plan must be submitted.

4.24 Appellant response – It has not been suggested that flood risk and mitigation should be conditioned. The updated Flood Risk Assessment (Reference 680462-R1(2)-FRA Final, March 2023 – Core Document D7) has demonstrated a workable scheme within the confines of the site boundary with no adverse impacts off site and suitable and appropriate mitigation to ensure the development areas remain flood free for the lifetime of the development.

4.25 The development plans have been updated to account for the LLFA's previous comments. No further updates are required at this stage. A suitably worded planning condition is appropriate to secure the additional design details required by the LLFA and is both usual practice for outline applications and accepted in policy SADM14.

4.26 *LLFA Comment* - Whilst the drainage strategy is a high level assessment, it shows that half drain down times of the proposed storage features are greater than 24 hours. It may be required at a detailed design stage to add additional storage volume to account for a subsequent 1 in 30 year storm event. It should also be confirmed which version of FEH has been used in the calculations, if 1999 has been used and this is out of date, it is likely providing an underestimate of the likely storage volumes needed, which should be calculated using the up to date FEH 2013 or FEH2022. We can therefore not confirm if the areas for SuDS storage within the parameter plans is sufficient.

4.27 Appellant response – Further design of the drainage system will follow at detailed design stage, this will consider pipe sizes, gradients etc, this will further refine the basin sizes and details. A suitably worded planning condition is appropriate to secure the additional design details. The current strategy demonstrates sufficient space has been allocated for the basins, it can be confirmed (see below table) that all the basins have additional capacity for a subsequent 30 year rainfall event volume, 24 hours after a 1 in 100 year plus climate change event has occurred.

Table 4.1: Calculations showing the additional capacity of each basin following a 1 in 100 year plus climate change rainfall event and subsequent 30 year event 24 hours later

Basin North 1			Basin North 2		
Outfall Rate:	11.8	l/s	Outfall Rate:	2.12	l/s
Total Pond Volume:	2617.9	m3	Total Pond Volume:	523	m3
1 in 30yr Volume:	1207.6	m3	1 in 30yr Volume:	215.7	m3
1 in 100+CC Volume:	2466.1	m3	1 in 100+CC Volume:	445	m3
Capacity required for subsequent events (Q100+CC and Q30)	2378.9	m3	Capacity required for subsequent events (Q100+CC and Q30)	476.9	m3
Additional capacity in basin following Q30 event	239.0	m3	Additional capacity in basin following Q30 event	46.1	m3

Basin South 1			Basin South 2		
Outfall Rate:	2.22	l/s	Outfall Rate:	6.89	l/s
Total Pond Volume:	616.2	m3	Total Pond Volume:	1723.3	m3
1 in 30yr Volume:	228.1	m3	1 in 30yr Volume:	707.8	m3
1 in 100+CC Volume:	467	m3	1 in 100+CC Volume:	1442	m3
Capacity required for subsequent events (Q100+CC and Q30)	569.1	m3	Capacity required for subsequent events (Q100+CC and Q30)	1584.4	m3
Additional capacity in basin following Q30 event	47.1	m3	Additional capacity in basin following Q30 event	138.9	m3

School		
Outfall Rate:	3.6	l/s
Total Pond Volume:	884.4	m3
1 in 30yr Volume:	368.7	m3
1 in 100+CC Volume:	754	m3
Capacity required for subsequent events (Q100+CC and Q30)	810.1	m3
Additional capacity in basin following Q30 event	74.3	m3

4.28 It can be confirmed that the latest FEH2022 rainfall data has been utilised in the drainage calculations.

4.29 A suitably worded planning condition is appropriate to secure the additional surface water design details required by the LLFA, including use of the latest rainfall data and climate change allowances.

5. Current position on flood risk and drainage

5.1 The Environment Agency do not hold an objection on flood risk or drainage grounds to the application.

5.2 The LLFA issued a letter response to the updated Flood Risk Assessment (Reference 680462-R1(2)-FRA Final, March 2023 – CD D7) as detailed in section 4.9 of this Proof of Evidence. The issues raised in the latter remain unresolved with the LLFA, however the latest submission of data to the LLFA has addressed the issues raised in the objection with the development sited away from areas of flood risk (from all sources), no increase in offsite flood risk as a result of the development and the proposed surface water drainage strategy meeting the requirements in terms of discharge rates, on site attenuation and the appropriate use of SuDS. Further detail on the design aspects of the watercourse diversions and surface water drainage scheme can be secured through Planning Condition allowing the LLFA to review the detail prior to commencement on site.

5.3 The submitted flood risk assessment has demonstrated that the development of the site can be carried out in accordance with the requirements of the NPPF and in adopting the sequential approach all of the more vulnerable built development has been located in the areas of the site which lie area of low flood risk (from all sources) with no off site impacts as a result of the development.

APPENDIX A
LLFA CORRESPONDENCE

Department of Environment & Transport
and Sustainable Growth

Hertfordshire

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Contact Elaine Simpson
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Date 1 February 2023

Dear Georgia

RE: 22/1071/OUT - Land East of Little Bushey Lane and North of The Squirrels, Little Bushey Lane

Thank you for your consultation on the above site received on the 30 November 2022. We apologise for the delay in responding due to the current workload and the LLFA available resources. We have reviewed the application for up to 310 residential units, a primary school, community hub and associated infrastructure as submitted and wish to make the following comments.

The applicant has provided an addendum drainage strategy, parameter plans and additional information at this location.

We **object** to this planning application in the absence of an acceptable Flood Risk Assessment (FRA) and Drainage Strategy relating to:

- Local flood risk to the development from surface water flooding and ordinary water courses
- The development adversely effecting flood risk from SuDS features not being sized to accommodate additional water from surface water flow paths originating from off site.
- Not complying with NPPF, PPG and local policies (SADM13 – The Water Environment, SADM14 – Flood Risk, SADM15 – SuDS).

Reason

To prevent flooding in accordance with National Planning Policy Framework paragraph 167, 169 and 174 by ensuring the satisfactory management of local flood risk, surface water flow paths, storage and disposal of surface water from the site in a range of rainfall events and ensuring the SuDS proposed operates as designed for the lifetime of the development.

We will consider reviewing this objection if the following issues are adequately addressed.

1. Review of information to show that the risks of flooding from surface water and from the ordinary watercourses can be managed appropriately within the outline proposals. The current parameter plan would need to be updated to reflect the constraints and potential mitigation for future development.

2. Updated modelling scenarios and parameter plans to show how all the surface water flow paths /fluvial flooding from watercourses entering the site from the south and the south west (flowing to the north, north west and north east) will be managed within open spaces without adversely affecting flood risk elsewhere. Whilst the applicant suggests that these volumes of water can be managed in the future drainage schemes of the development, the current parameter plan shows that areas for residential development, school or infrastructure such as roads would be at risk of flooding. Avoidance of flood risk is the most sustainable form of flood management. The areas currently marked for development may be required for flood management or mitigation and onsite SuDS.

3. There is a proposal to potentially divert watercourses / ditches to assist with development. The flood risk from these watercourses / ditches needs to be identified and mapped up to the 1 in 100 year plus climate change event. The inputs e.g. surface water outfalls to these watercourses must be identified and retained. Additional modelling scenarios should be undertaken to show pre and post development (including a potential diversion) to show how flood risk will not be adversely affected and development will be placed outside of the 1 in 100 plus climate change flood risk. Any diversions should promote naturalisation of channels to assist with biodiversity net gain and sustainable water management. Culverting of watercourse should be confirmed for watercourse crossings only. The LLFA does not support culverting of watercourses for land gain.

4. If the surface water flow paths originating off site are to be managed within the proposed drainage schemes for the development, then appropriate information to demonstrate how much additional storage and conveyance infrastructure would be required to accommodate this water (and an updated parameter plan and initial drainage strategy plan be submitted). This would include the identification of the upstream catchment of the flow paths, an assuming urban catchment with unknown drainage scheme design, and quantification of the additional storage volumes and associate green space to hold this water within the development boundary.

5. The applicant suggests that all details can be conditioned but the LLFA do not consider that it is appropriate to condition flood risk and mitigation at this time. Appropriate developable areas should be identified as part of the outline planning permission and an updated development strategy, parameter and phasing plan must be submitted. The LLFA originally requested updated documents to account for this dated 8 November 2022.

6. We note that the indicative surface water drainage storage features have been changed from attenuation basins to underground tanks. This is not acceptable, as this is a greenfield site, we require open surface SuDS to be provided and show how these can been incorporated into multifunctional structures (that provide amenity, biodiversity, water quality as well as water quantity benefits). It is accepted that the

updated modelling includes up to date FEH rainfall data, but the storage volumes should be able to be provided without the use of underground tanks. It may be that more source control such as permeable surfaces or bioretention structures could be incorporated within the detailed design of the development areas rather than regional sized attenuation basins.

7. New greenfield rates have been calculated based on proposed impermeable areas within each large parcel. Updated calculations in the drainage addendum have been provided, however the 1 in 1 year calculations appear to be missing. We request these be provided. We also request that it is clarified if urban creep has been included in the storage calculations provided. If not, we request updated supporting calculations for all storage features to include 10% urban creep.

For further advice on what we expect to be contained within the FRA to support a planning application, please refer to our Developers Guide and Checklist on our surface water drainage webpage https://www.hertfordshire.gov.uk/services/recycling-waste-and-environment/water/surface-water-drainage/surface-water-drainage.aspx this link also includes HCC's policies on SuDS in Hertfordshire.

Erection of flow control structures or any culverting of an ordinary watercourse requires consent from the appropriate authority, which in this instance is Hertfordshire Lead Local Flood Authority and the Local Council (if they have specific land drainage bylaws). It is advised to discuss proposals for any works at an early stage of proposals.

In December 2022 it was announced FEH rainfall data has been updated to account for additional long term rainfall statistics and new data. As a consequence, the rainfall statistics used for surface water modelling and drainage design has changed. In some areas there is a reduction in comparison to FEH2013 and some places an increase (see FEH22 - User Guide (hydrosolutions.co.uk)). Any new planning applications that have not already commissioned an FRA or drainage strategy to be completed, should use the most up to date FEH22 data. Other planning applications using FEH2013 rainfall, will be accepted in the transition period up to the 1st April 2023. This includes those applications that are currently at and advanced stage or have already been submitted to the Local Planning Authority. For the avoidance of doubt the use of FSR and FEH1999 data has been superseded by FEH 2013 and 2022 and therefore, use in rainfall simulations are not accepted.

Please note if, you the Local Planning Authority review the application and decide to grant planning permission, you should notify the us, the Lead Local Flood Authority, by email at FRMConsultations@hertfordshire.gov.uk.

Yours sincerely

Elaine

Elaine Simpson

SuDS and Watercourses Support Officer

Annex

The following documents have been reviewed, which have been submitted to support the application;

- Drawing: Bushy Masterplan by Stantec ref: BM-M-13 revision L dated 20 August 2022.
- Drawing: Parameter Plans: Land Use by Stantec ref: BM-M-20 revision B dated 17 October 2022.
- Document: Surface Water Drainage Strategy Addendum by LDE/RSK ref:680462-02L dated 16 November 2022.

Department of Environment & Transport
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Contact Nicole Boakye
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Date 9 November 2022

Dear Georgia

RE: 22/1071/OUT - Land East of Little Bushey Lane and North of The Squirrels, Little Bushey Lane

Thank you for consulting us on the above outline application for residential development (up to 310 units) with access from Little Bushey Lane, and land reserved for primary school, community facilities and mobility hub (Class E) along with car parking, drainage and earthworks to facilitate drainage, open space and all ancillary and enabling works. (Outline Application with Appearance, Landscaping, Layout and Scale Reserved). Land East Of Little Bushey Lane And North Of The Squirrels Little Bushey Lane Bushey Hertfordshire. Following our review of the information submitted including the Flood Risk Assessment prepared by RSK (June 2022), Ref. 680462-R1(1)-FRA, the details are not in accordance with NPPF, Hertsmere Core Strategy Policy SADM13 or SADM 14 and Hertfordshire County Council policy in terms of flood risk and drainage.

The drainage strategy proposes to manage surface water runoff through attenuation storage using 4 attenuation basins, a network of conveyance swales and permeable paving with different discharge rates and storage volumes calculated for each of the land parcels (northern catchment, school catchment, southern catchment 1 and southern catchment 2). We request further information be submitted as part of the application to address the following:

- The submitted Flood Risk Assessment shows that there are existing surface water flow paths crossing the site. As identified in the proposed drainage strategy layout (680462-RSK-A-ALL-17-05-22 - DRAINAGE STRATEGY), the drainage strategy will also need to account for these existing flow routes within the school catchment. We would expect to see the drainage strategy identify opportunities to improve flood risk directly by the development site where possible.
- The proposed drainage strategy layout (680462-RSK-A-ALL-17-05-22 - DRAINAGE STRATEGY) estimates the storage volume for each of the attenuation basins in the different land parcels. These volumes vary from the quick storage estimates provided for each of the land parcels in the Flood Risk Assessment. We would ask that the applicant carry out all these calculations using FEH 2013 rather than FSR, and

provide clarification on the storage volumes to ensure they can accommodate the 1 in 100 year plus climate change storm event.

- The proposed drainage strategy layout (680462-RSK-A-ALL-17-05-22 - DRAINAGE STRATEGY) shows the outfall points for each of the attenuation basins, however the outfall point for the north catchment is not shown. We would request that this is added to the drawing and that the attenuation basins are not located within flood risk areas, as they would not be able to store any additional water in a flood event.
- The calculated discharge rates are based on the entire site area, rather than just the impermeable areas proposed, resulting in a higher discharge rate being applied. We request that the discharge rate is just based on the impermeable area. We also request clarification for the area of the school catchment, as the developable area is 1.38ha however an impermeable area of 2.1ha has been included.
- The surface water drainage calculations in Appendix J are only included for the 1 in 100 year plus climate change storm event. The results show there is flood risk for some storm events. Although we would not object to small volumes of flooding for the 1 in 100 year plus climate change storm event, we would request to see the surface water drainage calculations for the 1 in 1 year and 1 in 30 year storm events to ensure there is no risk of flooding to the development in these lower return period events.
- All watercourses through the site are Ordinary Watercourses, which require suitable assessments if there is potential for the proposed development to impact them. Any culverting or de-culverting of these Ordinary Watercourses needs to be assessed in terms of the impacts to flood risk both upstream and downstream, and the proposed development needs to ensure that there would be no loss in flood storage from any source of flooding.

For further advice on what we expect to be contained within the FRA to support an outline planning application, please refer to our Developers Guide and Checklist on our surface water drainage webpage https://www.hertfordshire.gov.uk/services/recycling-waste-and-environment/water/surface-water-drainage/surface-water-drainage.aspx this link also includes HCC's policies on SuDS in Hertfordshire.

Please note if the LPA decide to grant planning permission, we wish to be notified for our records should there be any subsequent surface water flooding that we may be required to investigate as a result of the new development.

Yours sincerely

Nicole Boakye
SuDS and Watercourses Support Officer
Environment & Transport and Sustainable Growth

Department of Environment & Transport
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Date 22 March 2023

Dear Georgia

RE: 22/1071/OUT - Land East of Little Bushey Lane and North of The Squirrels, Little Bushey Lane

Thank you for your consultation on the above site received on the 6 March 2023. We apologise for the delay in responding due to the current workload and the LLFA available resources. We have reviewed the application for up to 310 residential units, a primary school, community hub and associated infrastructure as submitted and wish to make the following comments.

The applicant has provided an addendum drainage strategy, parameter plans and additional information at this location.

We advise that the LPA should consider if this site has sufficiently investigated the sequential test for development at this location. NPPF states that all sources of flooding should be considered but the FRA indicates that it is in Flood Zone 1 and so development is appropriate. As the site is at medium to high risk of surface water flooding, we would expect that a site-specific sequential test to assess this. The sequential approach should also be applied within the site boundary, but this development is suggesting to alter the flow paths and watercourses to enable the current development masterplan. We wish to highlight that avoidance of flood risk is the most sustainable for of flood risk management.

We **maintain our objection** to this planning application in the absence of an acceptable Flood Risk Assessment (FRA) and Drainage Strategy relating to:

- Local flood risk to the development from surface water flooding and ordinary water courses
- The development adversely effecting flood risk from SuDS features not being sized to accommodate additional water from surface water flow paths originating from off site.

- Not complying with NPPF, PPG and local policies (SADM13 – The Water Environment, SADM14 – Flood Risk, SADM15 – SuDS).

Reason
To prevent flooding in accordance with National Planning Policy Framework paragraphs 167, 169 and 174 by ensuring the satisfactory management of local flood risk, surface water flow paths, storage and disposal of surface water from the site in a range of rainfall events and ensuring the SuDS proposed operates as designed for the lifetime of the development.

We will consider reviewing this objection if the following issues are adequately addressed.

1. Review of information to show that the risks of flooding from surface water and from the ordinary watercourses can be managed appropriately within the outline proposals. The current parameter plan would need to be updated to reflect the constraints and potential mitigation for future development.

2. Updated modelling scenarios and parameter plans to show how all the surface water flow paths /fluvial flooding from watercourses entering the site from the south and the south west (flowing to the north, north west and north east) will be managed within open spaces without adversely affecting flood risk elsewhere. Whilst the applicant has created a pluvial (surface water flooding) model it is not an integrated model to include the fluvial flooding as a downstream boundary. The results from this current site-specific model, shows that there is up to 0.5m increase of flood levels outside of the site boundary to the south, south west and south east (existing dwellings and open space), see figures 4.24 to 4.27 of the FRA. This is not in line with NPPF and supporting PPG guidance to show how flood risk will not adversely affect areas outside the development boundary or to the development itself. The applicant suggests that the proposed development can be achieved through mitigation instead of avoidance of the areas at risk of flooding. That all development is built in Flood Zone one of the fluvial flood risk of the ordinary watercourse. However, much of the site is shown to be at risk of flooding from surface water flooding (confirmed by the high level modelling in the FRA).

   To enable this masterplan, a development platform of up to 400mm is needed to raise manage the overland flow path, additional diversion swales for the overland flow route are needed, the proposed SuDS basins have to be bunded to keep surface water flooding out and a watercourse has to be diverted at 90-degree angles alongside a road and built development with no obvious buffers to manage flooding or maintenance of it. The full location of a watercourse on the north eastern boundary of the site is also unclear. It has not been confirmed if it flows away from the site boundary or culverted under the northern most proposed SuDS basin. All the development SuDS features should be modelled to include all water originating off site. It is unclear if the applicant could divert this watercourse if it is

not within the red line boundary. Avoidance of flood risk is the most sustainable form of flood management. The areas currently marked for development may be required for flood management or mitigation and onsite SuDS. It is not appropriate to condition this element of the proposal to be investigated at a later planning stage.

3. There is a proposal to potentially divert watercourses to assist with development. The flood risk from these watercourses need to be identified and mapped up to the 1 in 100 year plus climate change event. The inputs e.g. surface water outfalls to these watercourses must be identified and retained. Additional modelling scenarios should be undertaken to show pre and post development (including a potential diversion) to show how flood risk will not be adversely affected and development will be placed outside of the 1 in 100 plus climate change flood risk. Any diversions should promote naturalisation of channels to assist with biodiversity net gain and sustainable water management. Culverting of watercourses should be limited for watercourse crossings only. The LLFA does not support culverting of watercourses for reasons other than securing access that cannot be achieved using a clear span bridge..

4. The applicant suggests that all details can be conditioned but the LLFA do not consider that it is appropriate to condition flood risk and mitigation at this time. Appropriate developable areas should be identified as part of the outline planning permission and an updated development strategy, parameter and phasing plan must be submitted.

5. Whilst the drainage strategy is a high level assessment, it shows that half drain down times of the proposed storage features are greater than 24 hours. It may be required at a detailed design stage to add additional storage volume to account for for a subsequent 1 in 30 year storm event. It should also be confirmed which version of FEH has been used in the calculations, if 1999 has been used and this is out of date, it is likely providing an underestimate of the likely storage volumes needed, which should be calculated using the up to date FEH 2013 or FEH2022. We can therefore not confirm if the areas for SuDS storage within the parameter plans is sufficient.

We also have the following observations.

We note that the indicative surface water drainage storage features are shown as basins but the FRA indicates that source control will be implemented via the use of permeable paving. Conveyance swales are also included in the in principal drainage strategy. It may be that rainwater reuse and more source control such as bioretention structures could be incorporated within the detailed design of the development areas rather than regional sized attenuation basins.

New greenfield rates have been calculated based on proposed impermeable areas within each large parcel. Updated calculations in the updated FRA use these rates and have been provided, showing all rainfall events required and the inclusion of 10% urban creep.

For further advice on what we expect to be contained within the FRA to support a planning application, please refer to our Developers Guide and Checklist on our surface water drainage webpage https://www.hertfordshire.gov.uk/services/recycling-waste-and-environment/water/surface-water-drainage/surface-water-drainage.aspx this link also includes HCC's policies on SuDS in Hertfordshire.

Erection of flow control structures or any culverting of an ordinary watercourse requires consent from the appropriate authority, which in this instance is Hertfordshire Lead Local Flood Authority and the Local Council (if they have specific land drainage bylaws). It is advised to discuss proposals for any works at an early stage of proposals.

In December 2022 it was announced FEH rainfall data has been updated to account for additional long term rainfall statistics and new data. As a consequence, the rainfall statistics used for surface water modelling and drainage design has changed. In some areas there is a reduction in comparison to FEH2013 and some places an increase (see FEH22 - User Guide (hydrosolutions.co.uk)). Any new planning applications that have not already commissioned an FRA or drainage strategy to be completed, should use the most up to date FEH22 data. Other planning applications using FEH2013 rainfall, will be accepted in the transition period up to 1 April 2023. This includes those applications that are currently at and advanced stage or have already been submitted to the Local Planning Authority. For the avoidance of doubt the use of FSR and FEH1999 data has been superseded by FEH 2013 and 2022 and therefore, use in rainfall simulations are not accepted.

Please note if, you the Local Planning Authority review the application and decide to grant planning permission, you should notify the us, the Lead Local Flood Authority, by email at FRMConsultations@hertfordshire.gov.uk.

Yours sincerely

Elaine

Elaine Simpson

SuDS and Watercourses Support Officer
Environment & Transport and Sustainable Growth

Annex

The following documents have been reviewed, which have been submitted to support the application;

- Flood Risk Assessment: Little Bushey Lane Bushey Ref 680462-R1(2)-FRA revision R1(2) dated 3 March 2023 by RSK.
- Drawing: Bushy Masterplan by Stantec ref: BM-M-13 revision N dated 28 February 2023.
- Drawing: Parameter Plans: Land Use by Stantec ref: BM-M-20 revision C dated 21 February 2023