PRELIMINARY FLOOD RISK APPRAISAL

Land at Long Lane, Newbury

Prepared for: Donnington New Homes
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Contents

Appendices

1.0 Introduction

1.1 This preliminary Flood Risk Appraisal has been prepared by Glanville Consultants on behalf of Donnington New Homes in order to support representations to be submitted to West Berkshire Council in relation to the promotion of land at Long Lane, Newbury for residential development.

1.2 The purpose of this document is to provide a high-level review of the existing level of flood risk to the site and its surroundings to further inform the ongoing promotion of the site. It also provides a live document that will highlight how the site will incorporate and enhance flood defence works undertaken by West Berkshire Council, and further explore how sustainable drainage techniques can be incorporated to deliver a comprehensive residential development with SuDS measures at the core of the design.

1.3 This assessment has been prepared in accordance with the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG) to the NPPF. It has also been prepared with reference to West Berkshire Council's Level 1 Strategic Flood Risk Assessment, published in June 2019, and Level 2 Strategic Flood Risk Assessment, published in February 2009, as well as West Berkshire Council's Sustainable Drainage Systems Supplementary Planning Document, published in December 2018.

1.4 This report concludes that the site can be developed safely without increasing flood risk on-site or elsewhere, and therefore the development proposals comply with relevant planning policy concerning flood risk. The report demonstrates that suitable provision for the disposal of surface water from the proposed development and substantial opportunities to increase the flood storage offered by the Cromwell Road FAS can be provided.

1.5 The report also demonstrates that the application of wetlands, along with other appropriate SuDS features, would provide effective nitrogen mitigation measures for the surface water run-off from the proposed development.

1.6 More extensive technical work in relation to flood risk and drainage would be required in due course to support the promotion of development proposals through the Local Plan process and to accompany any subsequent planning application.

2.0 Site Description

Site Location

2.1 The site is located to the north of Newbury town and is bordered by Shaw Cemetery and existing residential development to the south, woodlands to the east and west of the site and agricultural land to the north. Long Lane divides the development site into two parcels which cover a total area of approximately 17ha and comprise undeveloped agricultural land. The approximate centre of the site is located at Ordnance Survey National Grid reference SU 48244 68800. A plan showing the extent of the site is included in Appendix A.

Topography

2.2 The Ordnance Survey (OS) mapping indicates that the site falls from two high points of approximately 90m AOD on the western side of the site and 87m AOD at the opposite extreme to the north-eastern side of the site, to a low point of approximately 77.5m AOD to the southern side of the site, adjacent to the existing Shaw Cemetery.

2.3 The LiDAR DTM map of the site verifies that the west, east and north boundaries of the site fall southwards. This topography forms a gully landform (valley line) bisecting the site. The LiDAR DTM map of the site is included in Appendix B.

Watercourses

2.4 The closest watercourse designated by the Environment Agency as a main river is the River Lambourn located approximately 0.5km to the south of the site. The site is bounded to the south by a raised embankment which directs surface water to a sewer that heads south towards the River Lambourn.

Geological Mapping

2.5 Geological records published by the British Geological Survey (BGS) indicate the entire site is largely underlain by bedrock geology comprising chalk from the Seaford Chalk Formation, as well as head deposits of clay, silt, sand and gravel along the valley line that crosses the site from north to south. Extracts from BGS mapping are included in Appendix C.

2.6 Soilscapes mapping provided by Cranfield University on behalf of DEFRA shows that the entire site falls on HOST soil class 7, which is described as "freely draining slightly acid but base-rich soils" but adjacent to the east and west on HOST soil class 18 which is described as "slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils". An extract from Cranfield University Soilscapes website is included in Appendix C.

2.7 Borehole SU46NE46 – Shaw Cottages Cold Ash Berks, from BGS borehole records, located adjacent to the south-west of Shaw Cemetery, indicates the presence of superficial drifts comprising brown clay up to 12m below ground level. In addition, borehole SU46NE173 – Highwood Farm Shaw, located in Highwood Farm to the north-west, shows groundwater at approximately 14m below ground level.

Groundwater Vulnerability

2.8 The Environment Agency (EA) defines Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The SPZs mapping indicates that the entire site is located within a SPZ III (Total Catchment).

2.9 A Nitrate Vulnerable Zone (NVZ) is a conservative designation for areas of land that drain to nitrate polluted waters or waters which could become polluted by nitrates. The NVZs mapping indicates that the site is located within a Surface Water NVZ.

2.10 The EA defines Drinking Water Safeguard Zones (SgZs) for water sources used for public drinking water supply. SgZs are catchment areas that influence the water quality for their respective Drinking Water Protected Area (Surface Water), which are at risk of failing the drinking water protection objectives. The site is not located within a SgZ.

2.11 The bedrock Aquifer Designation Map published by the EA indicates that the bedrock underlying the site is classed as a Principal Aquifer. Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability, which provide a high level or water storage. They may support water supply and/or river base flow on a strategic scale.

2.12 The superficial Aquifer Designation Map published by the EA indicates that the superficial head deposits along the valley line that crosses the site from north to south are classed as a Secondary Undifferentiated Aquifer. Secondary Undifferentiated Aquifers have been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Proposed Development

2.13 The current outline proposals for the site are for a residential development of circa 210 – 260 dwellings within the site that comprises approximately 17ha of undeveloped land to the north of Newbury town, along with supporting facilities and infrastructure. Vehicular access is proposed from Long Lane along both boundaries of the parcels, while pedestrian accesses are proposed from Highwood Close to the south-west, Pear Tree Lane to the south-east and an unnamed path to the north-west.

2.14 An illustrative masterplan for the proposed development is provided in Appendix D.

3.0 Planning Policy and Guidance

3.1 Set out below is a summary of the national and local planning policy and guidance relating to flood risk and surface water management that are relevant to the development proposals.

National

3.2 At a national level, the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG) to the NPPF ensure flood risk is taken into account at all stages of the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development towards areas at lowest flood risk. The NPPF retains a risk based approach to the planning process and defines four Flood Zones to be used as the basis for applying the sequential test to consider a development in terms of Flood Risk Vulnerability Classifications, which define the type of development that is considered appropriate within each zone.

3.3 The NPPF establishes the Flood Zones as the starting point for assessment with the overarching aim to steer new development to areas with the lowest probability of flooding. The Flood Zones are defined as follows:

- Flood Zone 1 (Low Probability) comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
- Flood Zone 2 (Medium Probability) comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
- Flood Zone 3a (High Probability) comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- Flood Zone 3b (The Functional Floodplain) comprises land where water has to flow or be stored in times of flood.

Local Policy and Guidance

West Berkshire Council Level 1 Strategic Flood Risk Assessment (SFRA) – June 2019

3.4 This Level 1 SFRA was produced by JBA and replaced the Level 1 SFRA produced in 2008 and the SFRA update published in October 2015. The SFRA provides the flood risk evidence and long-term strategy to support the management and planning of development, protect the environment, deliver infrastructure and promote sustainable communities within in the Local Plan area. It also supports the selection of site allocations in the Local Plan Review and provides information and guidance to be used in the preparation of Flood Risk Assessments (FRAs) in support of site-specific planning applications. The SFRA includes flood maps covering the entire district of West Berkshire, as well as strategic sites and key settlements.

West Berkshire Council Level 2 Strategic Flood Risk Assessment (SFRA) – North Newbury Development Area – February 2009

3.5 This Level 2 SFRA was produced by Jacobs in order to assist West Berkshire Council in its planning decisions for the North Newbury Development Area. It supplements information and recommendations contained within the West Berkshire Level 1 SFRA.

West Berkshire Council Sustainable Drainage Systems Supplementary Planning Document, published – December 2018

3.6 This Supplementary Planning Document (SPD) is intended to introduce the concept of SuDS, and outline the design principles required to deliver SuDS in West Berkshire. It provides advice on integrating SuDS within any development and delivering the multiple benefit drainage systems expected within West Berkshire.

4.0 Sources of Potential Flooding

4.1 Flood risk to the site has been considered from all likely sources of flooding, as defined in the NPPF and the Planning Practice Guidance to the NPPF. These include tidal, artificial sources (reservoir), fluvial, surface water, sewer and groundwater. The following paragraphs consider flood risk to the site from all of these sources.

Tidal

4.2 Given that there is no tidally influenced watercourse on or within the vicinity of the site, tidal flooding is not an issue that would prevent the development of the site.

Fluvial

4.3 The EA publishes its Flood Map for Planning on the GOV.UK website which shows the maximum extent of fluvial flooding. The mapping indicates that the entire site is located within Flood Zone 1, beyond the limits of the 1 in 1,000 year fluvial flood event (<0.1%). It is therefore considered that the risk of fluvial flooding to the development is very low. An extract from the GOV.UK mapping is included in Appendix E.

Surface Water

4.4 The EA publishes a Flood Risk from Surface Water map on the GOV.UK website which indicates the predicted risk of surface water flooding in the event that rainwater does not drain away through normal drainage systems or soak into the ground. The mapping indicates that both the eastern and western sides of the site are at 'very low' risk of surface water flooding, with an annual probability of flooding of less than 1:1,000. However, areas of low to high risk are closely associated with the valley line (gully landform), described in paragraph 2.3, which provides an overland flow path running from north to south across the centre of the site, as well as local ground depressions within the site boundary as would be expected. An extract from the GOV.UK surface water flood map is included in Appendix F.

4.5 The West Berkshire Council Level 2 SFRA (2009) states that the topography of the proposed North Newbury Development Area is characterised by hilly and undulating land, whereby large areas of sloping land are typically associated with the generation of surface water run-off which can result in localised flooding during heavy rainfall events. On this basis, the SFRA states that the level and severity of surface water run-off risk will need to be clarified on a site by site basis through a Flood Risk Assessment. Vulnerable developments should be avoided in high risk areas.

4.6 The Newbury Flood Investigation Report for the flooding in winter 2013-2014 indicates that groundwater may have emerged in the field to the east of Red Farm House off of the B4009 Long Lane. This water combined with overland flow from the heavy rainfall event flowed south towards Long Lane. The road initially held the water back, causing a large pool of water to form in the field adjacent to the road. The increase in flood water eventually caused water to cross the road into the field to the east of Long Lane. The water flowed in a southerly direction through Newbury Cemetery towards properties on Cromwell Road and Wellington Road.

4.7 The West Berkshire Council Level 1 SFRA (2019) indicates that areas at risk from surface water or locations at risk of groundwater emergence should be protected from development to ensure flow routes are not blocked, preventing water from building up to potentially dangerous depths. The RoFSW maps, groundwater monitoring and detailed surface water or groundwater modelling should be used to inform the site design at masterplanning stage. The Council promotes innovative and flexible design.

4.8 West Berkshire Council have implemented the Cromwell Road Flood Alleviation Scheme (FAS) that introduces a raised embankment above the southern boundary of the site in order to retain the overland flow from the emerging groundwater by impounding them within the land immediately adjoining Shaw Cemetery, to the southern side of the proposed development site. According to the Newbury Flood Investigation Report, a new drainage pipe will also be constructed through the cemetery, which will connect into the existing drainage network in Cromwell Road, which will help reduce the risk from the overland flow route to the properties in Cromwell Road and Wellington Close. It is recognised by West Berkshire Council that due to budget constraints these remedial measures will not fully safeguard existing residential properties to the south and on this basis, future redevelopment provides an opportunity to improve the level of flood protection both in terms of frequency and severity.

4.9 A two-dimensional surface water hydrodynamic modelling has been performed using Tuflow software for 1:30 year (High risk), 1:100 year (Medium risk) and 1:1,000 year (Low risk) rainfall events, in order to assess the nature of potential surface water flood risk noted on Environment Agency mapping and provide a better understanding and detailed analysis on the potential depths and levels of flooding that might affect the site during extreme rainfall events, and thereby inform the site design at masterplanning stage. The hydrodynamic modelling has also considered the raised embankment related to the Cromwell Road FAS located to the southern margin of the development site, along the northern boundary of the Shaw Cemetery. A plan showing the surface water hydraulic modelling outputs is included in Appendix G.

4.10 The West Berkshire Council Level 1 SFRA (2019) indicates that climate change is predicted to increase rainfall intensity in the future by a range of between 20% and 40% (the recommended national precautionary sensitive range for 2085 to 2115). This will increase the likelihood and frequency of surface water flooding across the entire district, however it is likely to particularly affect impermeable urban areas that are already susceptible such as Thatcham, Newbury, Hungerford and Pangbourne.

4.11 On this basis, an additional simulation of the surface water hydraulic modelling has been carried out using the 1:100 year+40%CC rainfall event, in order to assess the impact of climate change and determine flood extent within the development site. According to hydraulic modelling outputs from Tuflow, flood extent associated with the 1:100 year+40%CC rainfall event would cover a less area than the worst case 1:1,000 year rainfall event (i.e. Low surface water flood risk).

4.12 However, it is considered that the risk of surface water flooding to the development is very low, provided that any residential development proposed is situated around the areas of at significant risk of surface water flooding, associated with the worst case 1:1,000 year rainfall event (i.e. Low surface water flood risk). In addition, the introduction of a positive drainage system which employs potential SuDS features to accommodate run-off from the development would mitigate against any residual risk and meanwhile reduce the existing risk of surface water flooding on-site and elsewhere, provides betterment to the Cromwell Road FAS and in turn provide potential open space, ecological and biodiversity opportunities and benefits. As such, surface water flooding is not an issue that would prevent or constrain the development of the site to any significant extent.

Reservoir

4.13 The EA publishes indicative mapping on the GOV.UK website which shows the maximum extent of reservoir flooding in the unlikely event that a reservoir should fail. The mapping indicates that the entire the site is located outside of a reservoir flood risk area. Therefore, reservoir flooding is not considered to be an issue that would prevent the development of the site for its intended end use.

Sewer

4.14 The West Berkshire Council Level 1 SFRA (2019) includes data provided by Thames Water sewer flooding register. This register provides information on the number of recorded sewer flooding incidents by postcode area. No recorded incidents of sewer flooding have occurred on or in the vicinity of the site. Therefore, the risk posed by this source of flooding to the site is considered to be very low. As such, sewer flooding is not an issue that would prevent or constrain the development of the site.

Groundwater

4.15 The West Berkshire Council SFRA (2019) indicates that two groundwater mapping datasets, the Jacobs 2014 groundwater emergence modelling and JBA groundwater map, have been used to assess groundwater flood risk within the district.

4.16 Emergence zones from the Jacobs groundwater modelling have been mapped in order to identify areas where groundwater could be at or near the ground surface. The extents and depths of the resulting flooding on the ground surface have been simulated for the Winter 2014 event and predicted for the 3.3% and 1% annual probability events. The groundwater emergence modelling indicates that the site is not located within a groundwater emergence zone.

4.17 The JBA groundwater flood map provides a detailed assessment of the risk of groundwater emergence in a 1 in 100 year event at a 5m resolution. The risk is scaled between 0 and 4, with 0 indicating no risk and 4 identifying groundwater levels either at or very near (within 0.025m) to the ground surface. The groundwater levels are compared against ground surface levels to determine the head difference in metres; with 0m suggesting artesian discharge of groundwater at the ground surface.

4.18 West Berkshire Council's "Risk of Groundwater Flooding" map indicates that groundwater levels at most of the development site are either at or very near (within 0.025m) to the ground surface. Furthermore, the West Berkshire Council Level 2 SFRA (2009) verifies the development site largely located within a Groundwater Emergence Zone.

4.19 However, given the topography of the site it is likely that the hydraulic gradient associated with elemental groundwater would lead to emergence only in lower lying areas. It has been demonstrated through the Winter 2013-14 Newbury Flood Investigation Report, as shown in paragraphs 4.6, that such areas are heavily linked with overland surface water flooding and it is therefore likely surface water flood risk identified by Environment Agency mapping would represent a robust assessment of groundwater emergence zones. Therefore, given that development would be planned around the areas at significant risk of surface water flooding it is considered that the development would also be located outside of any area at risk of groundwater flooding.

Historic Flooding

4.20 The West Berkshire Council Level 1 SFRA (2019) indicates that Newbury has been affected by several surface water flood events, including July 2007, January/February 2014 and September 2016. In the winter of 2013-2014 properties south of Newbury Cemetery at Cromwell Road and Wellington Close experienced flooding as a result of overland flow from a groundwater source north of the Cemetery.

Summary

4.21 The development site is considered to be at low risk from all sources of flooding, with the exception of the area associated with the valley line which provides an overland flow path running from north to south across the centre of the site, which is also at low to high risk of surface water flooding as well as groundwater flooding. The development will be planned around the areas of identified flood risk to mitigate the risk such that flooding will not prevent or constrain the development of the site to any significant extent.

4.22 In addition, the introduction of a positive drainage system which employs SuDS features to accommodate run-off from the development would mitigate against any residual risk and meanwhile reduce the existing risk of surface water flooding on-site and elsewhere, and in turn provide potential open space, ecological and biodiversity opportunities and benefits.

5.0 Flood Risk Assessment

Fluvial

5.1 The NPPF encourages a sequential, risk-based approach to determine the suitability of land for development. This document advises that the development of sites within Flood Zone 1 should be given preference where available.

5.2 Table 2 of the Planning Practice Guidance to the NPPF categorises different types of development into five flood risk vulnerability classifications:

- Essential Infrastructure;
- Highly Vulnerable;
- More Vulnerable;
- Less Vulnerable; and
- Water Compatible Development.

5.3 The NPPF classifies residential use as being 'More Vulnerable'. Table 3 of the PPG states that 'More Vulnerable' development is compatible with Flood Zones 1 and 2, without the need to apply the Exception Test.

5.4 As shown in Section 4 of this report, the site is entirely located within Flood Zone 1, beyond the limits of the 1 in 1,000 year fluvial flood event (<0.1%). Table 3 of the PPG states that all uses are appropriate for Flood Zone 1. Therefore, the proposed development use is compatible with the flood zone it is in and developing the site for its intended purpose is considered appropriate in terms of fluvial flood risk. As such, the Sequential and Exception Tests should not need to be applied to this development.

Surface Water

5.5 The risk of surface water flooding along the eastern and western side of the site is very low, with an annual probability of flooding of less than 1:1,000. However, areas of low to high risk are closely associated with the valley line (gully landform), which provides an overland flow path running from north to south across the centre of the site, as well as local ground depressions within the site boundary as would be expected.

5.6 As shown in Section 4, the development will be planned around the areas of at significant risk of surface water flooding, associated with the worst case 1:1,000 year rainfall event (i.e. Low surface water flood risk). As such, the proposed residential development will be situated entirely at very low risk of surface water flooding, thereby taking a sequential approach to developing the site.

5.7 The proposed drainage strategy will offer protection against surface water flooding by providing a positive drainage system, which will intercept overland flows generated within the site.

5.8 The drainage system will be designed to ensure that no flooding takes place up to and including the design rainfall event (1 in 100 year return period), with additional capacity within the system to allow for the potential future effects of climate change. In addition, flow routes through the site will be preserved accordingly.

5.9 As shown in the proposed masterplan and further detailed in Section 6, significant storage basins will be provided along the valley line that crosses the site from north to south in order to reduce the severity and frequency of downstream flood risk. On this basis, the proposed development presents betterment and potential opportunities to increase the flood storage offered by the Cromwell Road FAS, thereby increasing the level of flood protection offered to Shaw cemetery and residential properties to the south.

5.10 Therefore, the introduction of a positive drainage system which employs SuDS features to accommodate run-off from the development will provide betterment to the Cromwell Road FAS and potential opportunities in terms of reducing the existing flood risk on-site and elsewhere and in turn ecological and biodiversity benefits.

Flood Compensation

5.11 There should be no interruption to flood flows or loss of flood storage as a result of any proposed development. Compensatory flood storage should be provided on land that does not currently flood but is adjacent to the floodplain. It should be in the vicinity of the site and within the red line of the planning application boundary. On this basis, any proposal for modification of ground levels will be assessed as part of a detailed flood risk assessment in order to demonstrate that there is no adverse impact on the hydrological and hydrogeological setting.

Flood Resilience / Resistance

5.12 Given that the new dwellings will be located within Flood Zone 1, additional flood resilience in the form of raised floor level or other specific measures will not be required in respect of fluvial flood risk. However, given the potential risk of surface water and groundwater locally raising threshold levels is appropriate as identified by the West Berkshire Council SFRA, and residential properties will be designed to be flood resistant in this regard.

Other Sources

5.13 A review of sources of potential flooding in Section 4 of this assessment has concluded that there is a low risk to the proposed development from all other sources of flooding examined. As such, no additional mitigation measures are necessary.

Conclusions

5.14 The proposed initial masterplan demonstrates how a high quality residential development to the north of Newbury can be delivered in conjunction with enhancements to the Cromwell Road FAS.

5.15 The masterplan is sympathetic to worst case flood events and maintains identified overland flow routes such that the existing drainage regime of the site is unaffected. Accordingly, it can be demonstrated that the proposed development does not increase flood risk in this regard.

5.16 Significant areas of land along the valley line across the site would be safeguarded in order to provide surface water flood storage, thereby reducing flood risk to the development site and existing residential properties to the south.

5.17 It should be noted that the present masterplan recognises the potential for overland flooding to occur and does not seek to locate residential development within significant areas of surface water flood risk. The proposals have therefore applied a sequential approach within the site boundary to ensure that due consideration is given to all forms of flood risk.

6.0 Surface Water Drainage

6.1 This section of the report presents an outline surface water drainage strategy for the proposed development of land at Long Lane, Newbury.

6.2 At this stage detailed proposals for the various phases of the development are not defined. This outline strategy therefore provides a framework for more refined information to be provided when detailed proposals are developed in due course.

Sustainable Drainage Systems

6.3 The PPG and West Berkshire Council Sustainable Drainage Systems Supplementary Planning Document (December 2018) recommend that priority should be given to the use of Sustainable Drainage Systems (SuDS) as they are designed to control surface water run-off where it falls and mimic natural drainage characteristics as closely as possible. Sustainable drainage systems (SuDS) also provide opportunities for the following:

- Reducing the causes and impacts of flooding;
- Removing pollutants from urban run-off at source; and
- Combining water management and green space with benefits for amenity, recreation and wildlife.

6.4 SuDS encompass a wide range of drainage techniques intended to minimise the rate of discharge, volume and environmental impact of run-off and include:

- pervious pavements;
- swales and basins;
- green roofs and rainwater reuse;
- infiltration trenches and filter drains; and
- ponds and wetlands.

6.5 When used across a site these techniques control the rate of discharge, attenuate flow, provide storage and improve water quality. The combination of techniques that are appropriate will be dependent upon ground conditions, topography and other site-specific characteristics.

6.6 The Building Regulations part H3 stipulates that rainwater from roofs and paved areas is carried away from surface to discharge to one of the following, listed in order of priority:

a) An adequate soakaway or some other adequate infiltration system; where that is not practical;
b) A watercourse; or, where that is not practical
c) A sewer.

Potential Surface Water Drainage Strategy

6.7 The proposed strategy will strive to utilise sustainable drainage techniques in accordance with the guidance described in CIRIA document C753 'The SuDs Manual' (2015) to accommodate run-off from all rainfall events up to and including the 1 in 100 year event, with a 40% allowance for climate change. A positive drainage system along with suitable SuDS features will be properly designed at the appropriate stage in the design and planning process.

6.8 British Geological Survey and Soilscapes mapping indicates that ground conditions are likely to be variable and as such the preliminary strategy presented at this early consultation stage will assume that infiltration drainage into the underlying strata may not be feasible.

6.9 At the appropriate stage in the design and planning process an intrusive site investigation will be undertaken to confirm the groundwater level and soil conditions to assess whether there is any potential for infiltration drainage techniques to be used at locations across the site.

6.10 Discharge rates from the proposed development would be restricted to the natural undeveloped 'greenfield' run-off rate. SuDS features will be incorporated within the design proposals to restrict and attenuate surface water flow, in order to ensure that the natural drainage regime of the undeveloped site is maintained and that flood risk downstream is not increased.

Cromwell Road Flood Alleviation Scheme

6.11 Given the nature of the Cromwell Road FAS, and the fact that the impounded volume is created by the construction of a raised embankment, the natural overland flow regime of the site has been revised.

6.12 The greenfield run-off generated by the undeveloped site itself would naturally discharge as overland flow with the lower lying valley running north to south through the site. However, the creation of a raised embankment severs the natural connectivity of the undeveloped site with land to the south and diverts surface water towards a surface water sewer.

6.13 However, on the basis that any future development would seek to restrict surface water discharge to a greenfield rate or better, discharging via the 'basin' created by the FAS in the above manner would not increase flood risk and the FAS would not remove the ability or rights of any future development in this regard.

6.14 Similarly, the hydraulic assessment of surface water flows from the catchment draining via the FAS would have, by definition, needed to include the Long Lane development site and therefore any restricted flows from future development discharging in this manner would not increase flood risk as they are naturally included within the contributing flows associated with the FAS.

Surface Water Management Train

6.15 CIRIA C753 defines a hierarchical 'SuDS Management Train' approach to reduce the impact of surface water runoff from new / existing developments. Key elements of the hierarchical approach, in order of preference, are summarised below:

- Prevention – the use of good site design and housekeeping measures to prevent runoff (e.g. water butts, strategic planting such as tree pits and rain gardens).
- Source Control – control of runoff at or very near its source (e.g. house soakaways or other infiltration drainage, pervious paving).
- Site Control – management of water in a local area (e.g. large soakaways, infiltration or detention basin, swale).
- Regional Control – management of runoff from a number of sites, typically in a retention basin or wetland, or improvements to overland flow routes (such as baffles).

Prevention (Water Butts)

6.16 Water butts are the most common method of harvesting rainwater for garden watering. Water butts will be provided to houses as a first stage method of preventing runoff from entering downstream SuDS components.

Green Roofs

6.17 A green roof or living roof is a roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane, which can help contribute to local biodiversity. The vegetated surface provides a degree of retention, attenuation and treatment of rainwater, and promotes evapotranspiration.

6.18 Green roofs can be used on a variety of roof types and on any property size, although large areas of roof are generally more cost-effective. They are particularly suitable for use on flat or gently sloping roofs on commercial buildings, sports centres, schools, and other similar buildings. Their use can be limited when accounting for vernacular and maintenance issues.

Swales

6.19 The SuDS Manual (C753) describes swales as linear vegetated drainage features in which water can be stored or conveyed. Swale channels are broad and shallow features considered effective at removing urban pollutants.

6.20 The SuDS Manual identifies different types of swales each with different surface water management capabilities. A dry swale is considered to be the most appropriate given site constraints and comprises a vegetated channel designed to include a filter bed of prepared soil that overlays the underdrain system. As they remain dry most of the time this affects the types of planting that can be incorporated.

6.21 It is expected that the network of dry swales provided within each sub-catchment will generally act as offline attenuation when additional storage is needed in extreme events.

6.22 Consideration could also be given to the inclusion of urban swales. These features are provided alongside roads in denser development and can be used to provide additional attenuation adjoining pervious pavements. Their appearance is a little more structured than dry swales, including features such as stepped paving slabs rather than shallow green banks.

Bio-retention Areas, Rain Gardens and Tree Planting

6.23 Bio-retention areas, including rain gardens and tree planting, are shallow landscaped depressions which are typically underdrained and rely on engineered soils and enhanced vegetation and filtration to remove pollution and reduce runoff downstream. They are aimed at managing and treating runoff from frequent rainfall events.

6.24 These features rely on over the edge 'sheet' flow from adjacent areas of hard-standing which may present difficulties for use in this development given the anticipated extensive use of pervious paving which has no sheet flow off the surface.

6.25 Should suitable opportunities present themselves it may be possible to integrate small bioretention areas into the layout. These features would be best suited to locations where pervious construction may not be practical.

Ponds and Wetlands

6.26 Ponds and wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. They can support emergent and submerged aquatic vegetation along their shoreline and in shallow, marshy (wetland) zones, which helps enhance treatment processes and has amenity and biodiversity benefits.

6.27 Attenuation storage is provided above the permanent pool and wetland areas. A flow control system at the outfall controls the rates of discharge for a range of water levels, causing the pond volume to fill during storm events.

Detention Basins

6.28 Detention basins are landscaped depressions that are normally dry except during and immediately following storm events. They can be on-line components where surface runoff from regular events is routed through the basin and when the flows rise, because the outlet is restricted, the basin fills and provides storage of runoff and flow attenuation. They can also be off-line components into which runoff is diverted once flows reach a specified threshold.

6.29 Detention basins can be vegetated depressions (that can provide treatment when designed to manage regular flows) or hard landscaped storage areas (that will tend not to provide any treatment and are normally designed as off-line components). Where the basin is vegetated, the soil surface can absorb some runoff, so can be used to support the prevention of runoff from the site for small rainfall events.

Online / Offline Storage (Geocellular Storage)

6.30 The SuDS manual identifies Geocellular storage tanks as being able to provide online / offline storage.

6.31 These systems need to be provided with minimum cover below finished ground levels for protection which means that they are unlikely to be feasible in the lower lying sections of the site.

6.32 These systems provide very high storage volume capacity capable of managing high flow events. They can be installed beneath landscaping or trafficked areas providing that structural performance is proven to be sufficient (this is of particular importance in heavy clay soils where excessive depths need to be avoided).

6.33 The main disadvantage of these features is that they provide very limited water quality treatment and should therefore only be used in conjunction with other SuDS features, such as downstream of a pervious pavement.

Online / Offline Storage (Oversized pipes and box culverts)

6.34 Oversized pipes and box culverts may need to be considered in some areas.

6.35 These pipes and culverts will provide online storage that will help reduce overall storage requirement on the site.

Source Control (Pervious Pavements)

6.36 Pervious pavements are structures that allow water to filtrate through the surface to the underlying sub-base layers where water is temporarily stored and treated before being discharged to downstream SuDS or local watercourse. Pervious pavements are very effective in removing general urban runoff pollutants.

6.37 Pervious paving will be used wherever practical within the development as a pollution control measure prior to discharge to downstream SuDS features. If soakage testing undertaken at a later stage of the planning process indicates that infiltration techniques are feasible, pervious pavements would be utilised as appropriate to facilitate the discharge of surface water by infiltration to ground wherever practical.

Sustainable Drainage

6.38 As shown in the proposed masterplan, significant space has been afforded within the masterplan to include conveyance and attenuation features, provided along the valley line that crosses the site from north to south in order to reduce the severity and frequency of downstream flood risk, thereby increasing the level of protection offered by the Cromwell Road FAS.

6.39 The potential attenuation areas along the valley line will also provide a substantial opportunity to improve Long Lane's highway drainage and reduce the current level of flood risk to the existing road network. As part of the proposals, attenuation features on the north and south of Long Lane could be linked via a short section of culvert thereby removing overland flows from the carriageway and reducing the frequency of surface water ponding on the public road network. This approach was discussed and supported by WBC Drainage Officers.

6.40 The FAS constructed by West Berkshire Council controls the release of surface water so as to manage excess run-off and reduce the likelihood of flooding.

6.41 It has been discussed with WBC Drainage Officers that this surface water storage area could potentially be enlarged in order to increase the level of flood protection offered by the FAS and utilised as a contribution towards the attenuation storage required by the proposed development, subject to further design at the appropriate stage. However, in order to provide a robust strategy, consideration will also be given to the inclusion of separate SuDS features within the development areas with restricted discharges as appropriate.

6.42 As currently proposed, the Cromwell Road FAS does not include any headroom capacity that would contribute toward the attenuation required by the proposed development, and as such the proposed SuDS strategy will not be reliant upon the FAS for provision of surface water storage.

6.43 The final selection and location of SuDS features to be employed will be explored further as the promotion of the site progresses, in conjunction with the technical design of the scheme. However, a concept masterplan has been developed such that broad development catchments can be established. The masterplan is presented in Appendix D.

6.44 The choice of SuDS attenuation features has been assessed against site / development constraints. Table 1 details each of the SuDS features as set out in The SuDS Manual, outlines which features are most suitable for the development site and how these would be incorporated.

Table 1: SuDS Features

SuDS Feature	Description	Water Quality	Amenity	Biodiversity	*Site-Specific Suitability*
Rain water harvesting	Systems that collect runoff from roofs / surfaces for re-use		Y		*Use of these features will be considered however their use is likely to be restricted by wider planning constraints.*
Green roofs	Planted soil layers on roofs that slow and store runoff	Y	Y	Y	
Filter strips	Grass strips that promote sedimentation and filtration as water flows over the surface	Y	Y	Y	*Filter strips and drains will be provided adjacent to main roads to replace conventional piped systems within the development wherever appropriate, conveying water to downstream SuDS features.*
Filter drains	Shallow stone-filled trenches that provide attenuation, conveyance and treatment	Y	Y	Y	
Swales	Vegetated channels used to convey and treat runoff	Y	Y	Y	*Swales will be provided within green corridors to replace conventional piped systems wherever appropriate, conveying flows from adjacent development areas towards downstream SuDS features.*
Bioretention systems	Shallow landscaped depressions allowing runoff to pond on the surface, before filtering through vegetation and underlying soils	Y	Y	Y	*Bioretention and tree pit systems work best when used on small drainage areas. They could be used to enhance other features, such as swales and filter strips. The use of these features will therefore be considered on a plot-by-plot basis at detailed design stage.*
Trees	Trees within soil-filled tree pits, tree planters or structural soils used to collect, store and treat runoff	Y	Y	Y	
Infiltration systems	Systems that collect and store runoff, allowing it to infiltrate into the ground	Y	Y	Y	*Infiltration techniques subject to intrusive site investigations during appropriate design stage (refer para 6.2), however the use of pervious pavements for water treatment and attenuation will be considered on a plot-by-plot basis at detailed design stage.*
Pervious pavements	Paving through which runoff soaks and is stored in the sub-base beneath, and/ or allowed to infiltrate into the ground	Y	Y	Y	
Attenuation Storage	Below-ground voided spaces used to temporarily store runoff before infiltration, controlled release or use				*Below-ground features do not provide quality, amenity or biodiversity benefits and so are low down in the hierarchy of SuDS choices. However, they may need to be considered in due course in order to provide attenuation in areas with restricted space.*
Detention basins	Vegetated depressions that store and treat runoff	Y	Y	Y	*Wetlands and basins will be used to provide attenuation and treatment of run-off prior to discharge off-site. Consideration will be given to basins to work together with the wetlands at detailed design.*
Ponds and wetlands	Permanent pools of water used to treat runoff with storage above the pool	Y	Y	Y	

6.45 The development site lies within a Groundwater Source Protection Zone, therefore development proposals should assess the pollution risk to receiving waterbodies and include appropriate treatment steps ahead of any discharge to surface water or groundwater. In addition, as with Groundwater SPZs, Nitrate Vulnerable Zones could affect the suitability of surface water drainage features and the level of treatment required.

6.46 Wetlands could be utilised within the proposed strategy in order to provide sufficient storage volumes to restrict to the pre-development greenfield run-off rates. Sufficient space will be allocated within the masterplan to accommodate these SuDS features.

6.47 Wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water run-off. They can support emergent and submerged aquatic vegetation along their shoreline and in shallow, marshy zones, which helps enhance treatment processes, such as nitrogen removal, and has amenity and biodiversity benefits. Attenuation (temporary) storage could be provided above the permanent pool of the wetlands.

6.48 WBC Drainage Officers have confirmed that they would support a series of cascading ponds/basins or landscaped baffles incorporated within areas of existing surface water flood risk. These ponds could therefore enlarge the area liable to flooding and contribute towards the attenuation required by the development. Sensitive landscaping of flow routes could also provide significant amenity gains by creating wildlife corridors and green routes.

6.49 When more detailed proposals for the development are available, consideration will be given to the use of swales and/or filter strips or filter drains for conveyance as well as source control techniques, within each of the development parcels. These SuDS features can reduce flood risk, as well as providing water quality treatment and enhancement, and landscape and ecology benefits. Furthermore, consideration will be given to the use of bioretention systems, tree pits and permeable pavements for water quality purposes, especially as nitrogen mitigation measures, as shown in paragraphs 6.34 to 6.43.

6.50 As discussed in Section 5, the proposed drainage strategy will provide protection against any surface water flood risk by providing a positive drainage system, which will intercept overland flows generated within the site. Existing flow routes though the site will also be preserved. The development layout will incorporate road routes throughout the site, and any potential overland exceedance flows would be routed via the road network, away from buildings.

6.51 When detailed proposals for individual parcels and phases are available, more detailed surface water drainage strategies will be developed based on the SuDS framework established in a revised version of this report.

Flood Improvement Works

6.52 As noted above, the proposed residential development presents opportunities to increase the flood storage offered by the Cromwell Road FAS, thereby increasing the level of flood protection offered to Shaw cemetery and residential properties to the south.

6.53 Similarly, following discussions with WBC, it is noted that overland flows have caused localised flooding of Long Lane and can potentially lead to periods of temporary closure. By understanding and rationalising flow paths it is possible that flooding of the public carriageway could be alleviated by construction of a culvert crossing to remove flood water from the road surface. Surface water attenuation could also be incorporated within the scheme in this locality in order to provide compensatory storage.

6.54 Therefore, West Berkshire Council have been consulted and are supportive of the scheme, and the opportunities for potential betterment that the proposed development along with potential SuDS features will provide for the Cromwell Road FAS, as well as the existing flooding issues on Long Lane.

Pollution Control

6.55 The use of SuDS on the site would help to remove urban pollutants from run-off before discharge to the ground or watercourses.

6.56 Wetlands also provide a useful stage in pollution control; the slowing of flows allows the settlement of suspended solids and allows biological uptake of pollutants by plants, algae and bacteria. Wetlands can also deliver biodiversity, ecology and amenity benefits to a development.

6.57 The Pollution Prevention Guidance advises that oil interceptors may not be required if SuDS are used within a development. The need for petrol interceptors will be assessed when detailed proposals for the development are available.

Nitrogen Mitigation

6.58 The development site is located within a Nitrate Vulnerable Zone, as shown in paragraph 2.9, therefore, special emphasis should be placed on the correct application of nitrogen mitigation measures as an integral part of SuDS for the surface water run-off treatment from the proposed development.

6.59 The CIRIA C753 'The SuDS Manual' (2015) indicates that nutrient removal, normally represented by total nitrogen and phosphorous, can be important, particularly for nitrate – or phosphate – sensitive receiving water bodies and water bodies with high amenity value. Temporary saturated storage or slow conveyance zones, such as within bioretention systems or wetlands can reduce nutrient levels. Street sweeping has also been demonstrated to be an effective pollution prevention measure for nutrient control through removal of nutrient sources.

6.60 The SuDS Manual states that in ponds and wetlands, uptake by plants, especially via the biofilm growth around the plant structure, is an important removal mechanism for nutrients (phosphorous and nitrogen).

6.61 Shallow free water surface wetlands (similar in appearance and function to natural marshes with areas of open water, floating vegetation and emergent plants) are also beneficial in terms of nitrogen removal efficiency.

6.62 A variety of emergent wetland plants, not only reed, can be effective within wetlands, in terms of pollutant removal. Wetlands with a number of different plant species, rather than monocultures, are desirable both for biodiversity reasons and because they are more resilient against changes in environmental conditions; different species will have different tolerances.

6.63 Swales can help retain run-off from small events on site, helping reduce the contaminant load discharged to surface waters via volumetric control. Wet swales can also treat the residual runoff by removing nutrients and dissolved metals via biodegradation and plant uptake. The SuDS Manual indicates that median pollutant mass removal rates of swales from available performance studies have been reported as 76% for total suspended solids, 55% for total phosphorus and 50% for total nitrogen.

6.64 Bioretention systems, such as rain gardens, tree pits or trenches, can provide very effective treatment functionality through the removal of sediments and pollutants, such as nutrients, by filtration through surface vegetation and groundcover. The water storage within anaerobic bioretention systems, allows the vegetation to access it during dry periods and it assists the treatment of some pollutants, such as nitrogen. According to The SuDS Manual, bioretention systems, correctly designed and maintained, provide a typical removal efficiency of approximately 50% of nitrogen and more than 80% of total phosphorous.

6.65 Tree pits can also filter out pollutants from runoff and help to reduce pollutant loadings to receiving surface waters. The SuDS Manual states that excess nitrogen and phosphorus in soils are quickly taken up by tress with oxygen-rich rhizospheres, because osmosis can happen freely.

6.66 Furthermore, The SuDS Manual indicates that if increased confidence in the removal of nitrogen has to be achieved, water could be fed from sub-base material below the pervious pavements to the next stage of the management train, specifically designed to optimise nutrient removal. This could be achieved by linking up the pavements to a pond or series of ponds or bioretention system with anaerobic zone as these have better removal rates for phosphorous and nitrogen. Concrete grass grid pavers filled with sand have been found to be more effective at removing total nitrogen than other types of pervious surface.

6.67 Therefore, the correct application of wetlands as a fundamental SuDS proposal, along with other SuDS features, such as wet swales, bioretention systems, tree pits and pervious pavements, would provide an effective nitrogen mitigation measure of the surface water run-off from the proposed development site. These SuDS features will be considered accordingly when more detailed proposals for the development are available.

Maintenance and Adoption

6.68 SuDS serving single properties will be owned and maintained by the owner of that property.

6.69 SuDS serving more than one property would be the responsibility of the local authority or private management company as appropriate. The maintenance of above ground features within open space areas could be undertaken by the local authority or by a private management company as appropriate, with the outlets and underlying pipework maintained by a private management company.

6.70 Suitable adoption and maintenance regimes for SuDS will be developed when detailed proposals for the development are available.

7.0 Summary and Conclusions

Summary

7.1 This Flood Risk Assessment has been prepared by Glanville Consultants on behalf of Donnington New Homes in order to support representations to be submitted to West Berkshire Council in relation to the promotion of land at Long Lane, Newbury for residential development.

7.2 This assessment has been prepared in accordance with the requirement of National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG), flood risk and drainage guidance and with reference to the relevant Strategic Flood Risk Assessment.

7.3 The site is entirely located within Flood Zone 1, beyond the limits of the 1 in 1,000 year fluvial flood event (<0.1%).

7.4 The risk of surface water flooding to the majority of the site is very low, although the valley line across the site is at low to high risk of surface water flooding, as well as at risk of groundwater flooding. The development would be planned around such areas at significant risk of surface water flooding. The introduction of a suitable positive drainage system for the development will provide mitigation against these risks. In addition, flow routes through the site will be preserved accordingly.

7.5 West Berkshire Council have implemented the Cromwell Road Flood Alleviation Scheme (FAS) that introduces a raised embankment above the southern boundary of the site in order to retain the overland flow from the emerging groundwater by impounding them within the land immediately adjoining Shaw Cemetery, to the southern side of the proposed development site. It is recognised by West Berkshire Council that due to budget constraints these remedial measures will not fully safeguard existing residential properties to the south and on this basis, future redevelopment provides an opportunity to improve the level of flood protection both in terms of frequency and severity.

7.6 The site is considered to be at low risk from all other sources of flooding, including an allowance for the potential effects of climate change.

7.7 SuDS features will be incorporated within the design proposals in order to attenuate surface water flows for all events up to and including the 1 in 100 year event including an allowance for a 40% increase in rainfall intensities as a result of climate change.

7.8 The proposed development presents opportunities to increase the flood storage offered by the Cromwell Road FAS, thereby increasing the level of flood protection offered to Shaw cemetery and residential properties to the south.

7.9 West Berkshire Council have been consulted and are supportive of the scheme, and the opportunities for potential betterment that the proposed development along with potential SuDS features will provide for the Cromwell Road FAS, as well as the existing flooding issues on Long Lane.

7.10 Flood risk will not increase either on-site or elsewhere as a result of the development and sufficient space for SuDS features will be provided within the masterplan.

7.11 The application of wetlands, along with other appropriate SuDS features, would provide an effective nitrogen mitigation measure of the surface water run-off from the proposed development site.

Conclusion

7.12 In conclusion, this report has demonstrated that the proposed development:

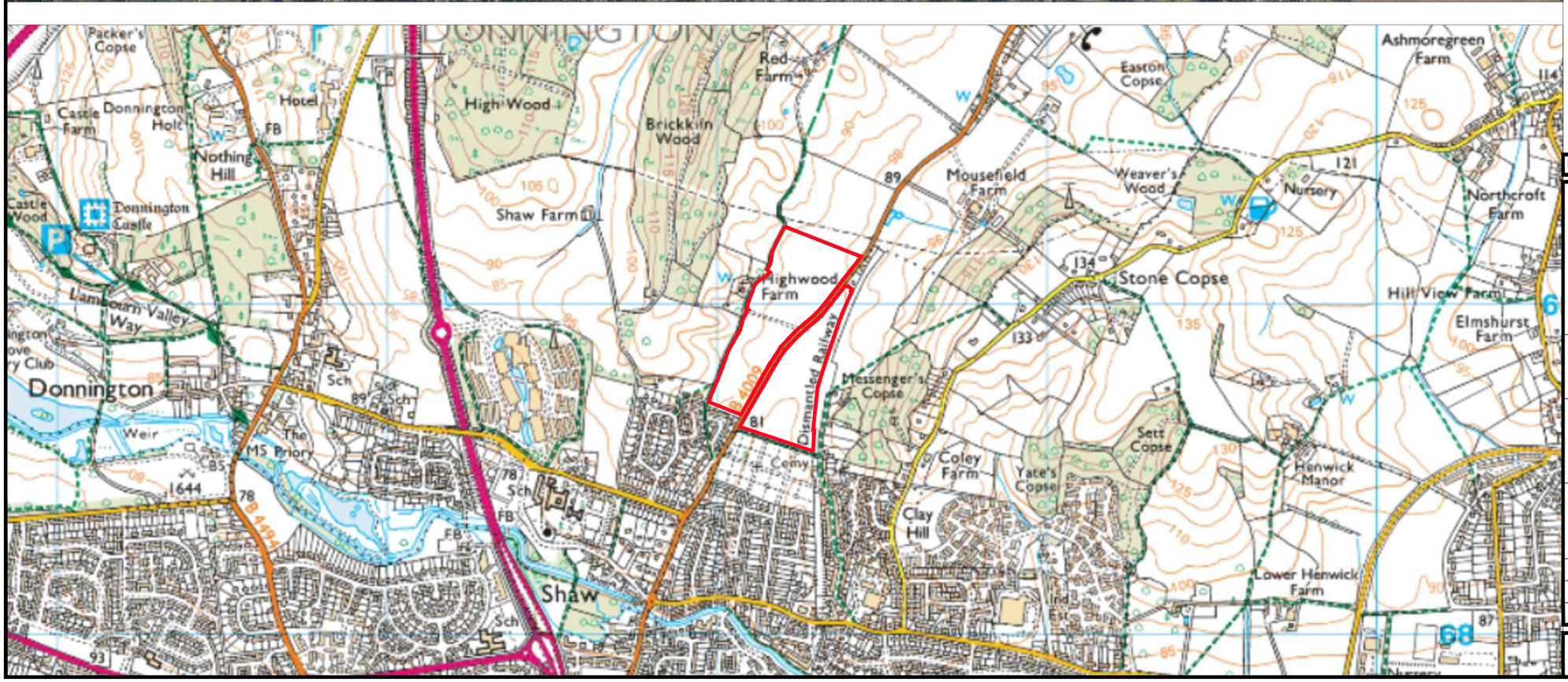
- is in accordance with the National Planning Policy Framework;
- will not be at an unacceptable risk from fluvial flooding or other sources;
- will not increase flood risk elsewhere;
- will employ a surface water drainage strategy based on the principles of sustainable drainage; and
- will explore opportunities to betterment for the Cromwell Road FAS, as well as the existing flooding issues on Long Lane.

7.13 Therefore, the proposals are considered to fully comply with National and Local planning policies in respect of flood risk and surface water drainage.

Appendices

Appendix A

Location Plan



NOTES

1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing

LOCATION

Nearby postcode: RG14 2ED
Grid reference: Easting: 448244
Northings: 168800

KEY

Approximate site boundary

N

Rev.	Description	Date	Chkd

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Client : Donnington New Homes

Project : Land at Long Lane
Newbury
RG14 2ED

Title : Site Location Plan

Project Engineer :	A.Quigley	Scale :	NTS
Project Director :	K. Rayner	Date :	January 2021
Status :	Preliminary		

Drawing No. CV8200923 - SK01 Rev P1

Appendix B

LiDAR DTM Map

447600 447800 448000 448200 448400 448600 448800

169400 169200 169000 168800 168600 168400

KEY

Site Boundary

OS Mastermap

Height (mAOD)

77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

0 100 200 300 400 m

447600 447800 448000 448200 448400 448600 448800

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Client:

Donnington New Homes

Project:

Land at Long Lane
newbury
RG14 2ED

Title:

LiDAR DTM Map

Project Engineer:	AQ	Scale:	1:4,000@A3
Project Director:	KR	Date:	19/01/2021

Drawing No:

LiDAR DTM

Appendix C

Geological Mapping and Soilscapes Mapping

KEY

Approximate site location

Bedrock Geology

Seaford Chalk Formation - Chalk

Superficial Geology

Head Deposits - Clay, Silt, Sand and Gravel

NOTES

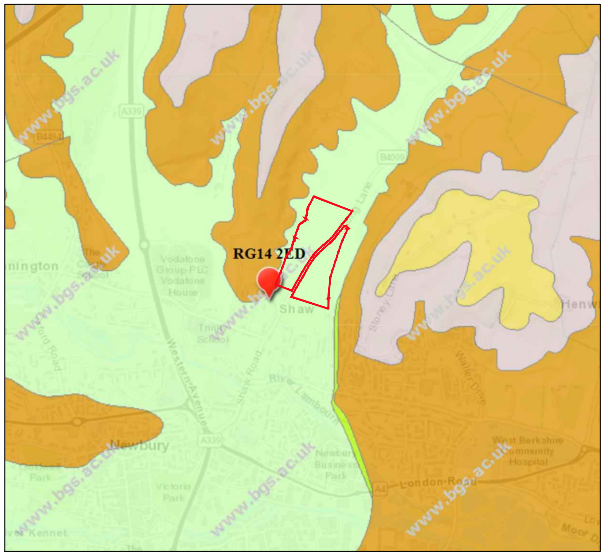
1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing

Soilscapes Map

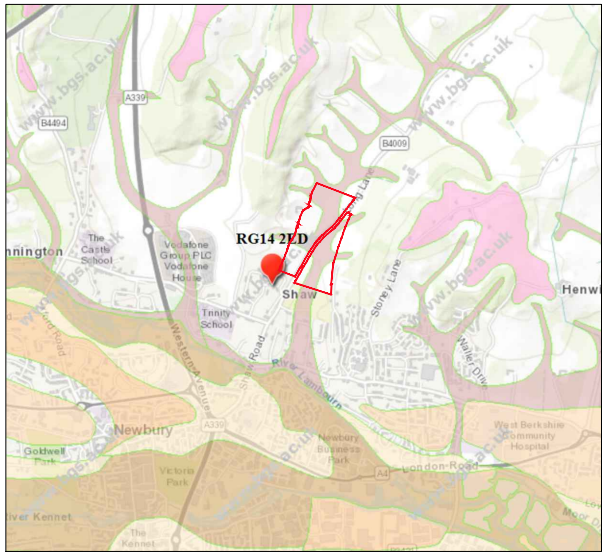
Freely draining slightly acid but base-rich soils

Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils

Bedrock Geology



Superficial Geology



Soilscapes Map_Cranfield University

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Project :	Land at Long Lane, Newbury, RG14 2ED				
Title :	British Geological Survey & Soilscapes Mapping Extract				
Project Engineer :	A. Quigley	Scale :	NTS	Drawing No.	CV8200923 - SK02
Project Director :	K. Rayner	Date :	January 2021		Rev -

Appendix D

Illustrative Masterplan

the environmental dimension partnership

Registered office: 01285 740427 - www.edp-uk.co.uk - info@edp-uk.co.uk

date	**27 JANUARY 2021**
drawing number	**edp6880_d003c**
scale	**Refer to scale bar @ A3**
drawn by	**PW**
checked	**JG**
QA	**JF**

client
Donnington New Homes

project title
Land at Long Lane, Newbury

drawing title
Concept Masterplan

Appendix E

Fluvial Flood Risk Mapping

KEY

Flood Zone 2

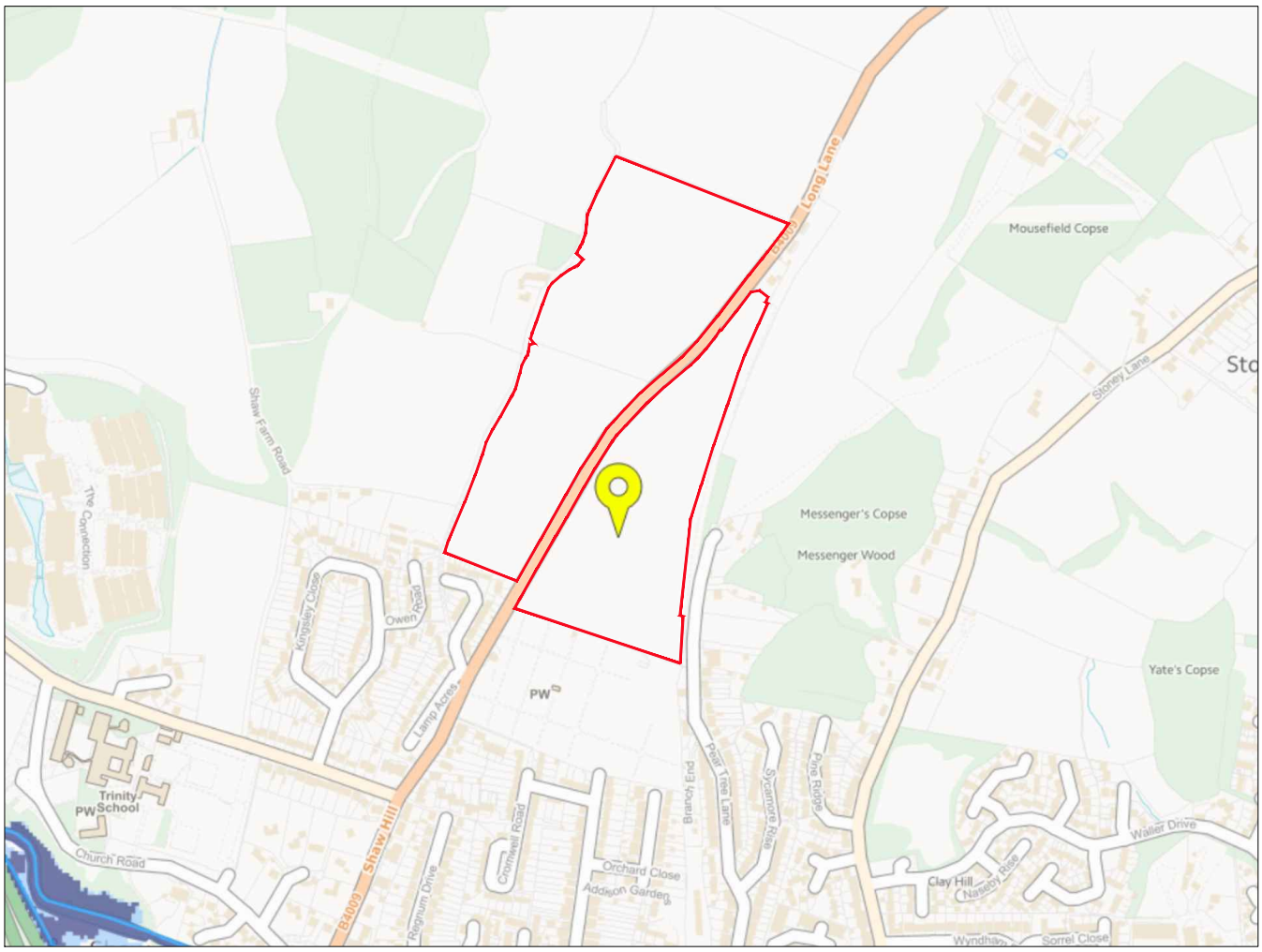
Flood Zone 3

Site boundary

N

NOTES

1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing



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Project :	Land at Long Lane, Newbury, RG14 2ED				
Title :	Environment Agency Flood Zone Map				
Project Engineer :	A. Quigley	Scale :	NTS	Drawing No. CV8200923 - SK03	Rev -
Project Director :	K. Rayner	Date :	January 2021		

Appendix F

Surface Water Flood Risk Mapping

448000

448500

169000

168500

N

KEY

- Proposed Development Site
- OS Mastermap
- High Surface Water Flood Risk
- Medium Surface Water Flood Risk
- Low Surface Water Flood Risk

0 50 100 150 200 m

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Project:

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Title:

EA Surface Water Flood Risk Map

Project Engineer:	AQ	Scale:	1:3,000@A3
Project Director:	KR	Date:	22/01/2021

Drawing No:

CV8200923 - EA SW Flood Risk

Appendix G

Modelled Surface Water Flood Map

448000

448500

169000

168500

N

KEY

- Proposed Development Site
- OS Mastermap
- Contours 50cm
- High Surface Water Flood Risk
- Medium Surface Water Flood Risk
- Low Surface Water Flood Risk
- 1:100 year+40%CC Surface Water Flood

0 50 100 150 200 m

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Project:

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RG14 2ED

Title:

Modelled Surface Water Flood Risk Extent

Project Engineer:	AQ	Scale:	1:3,000@A3
Project Director:	KR	Date:	22/01/2021

Drawing No:

CV8200923 - Tuflow 002

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- Transport & Highways
- Geomatics (Land Surveying)
- Building Surveying