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TECHNICAL NOTE

FLOOD RISK & DRAINAGE

Land West of London Lane, Ascott-under-Wychwood, Oxfordshire, OX7 6AB

Prepared for: Obsidian Strategic Asset Management Limited

Ref: 020_8211067_JB_Flood_Risk_&_Drainage

Document History

Issue	Date	Description	Prepared By	Checked By
1	17 Jan 24	First Draft	J Birch	C Salt
2	22 Jan 24	Minor Amendments for Issue to LPA / LLFA	J Birch	C Salt

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1.0 Introduction

1.1 This Technical Note has been prepared by Glanville Consultants on behalf of Obsidian Strategic Asset Management to provide further information in relation to groundwater flood risk and surface water drainage in connection with a proposed residential development on land west of London Lane, Ascott-under-Wychwood, Oxfordshire. A location plan for the site is provided at **Appendix A**.

1.2 Outline planning permission was sought from West Oxfordshire District Council (WODC), as Local Planning Authority (LPA) by Obsidian Strategic Asset Management under application reference 23/01504/OUT. It follows that the final drainage details will be a reserved matter, should outline consent be granted. Further, the details of the final drainage scheme can be secured by a negatively worded Grampian condition. At no stage have the LPA required that the final drainage scheme should be determined at this stage. Accordingly, it is considered that it is only the principle of development (and access) which is the subject of determination. The Appellant need only demonstrate that the site can be appropriately drained in principle, with the details to be secured by condition.

1.3 The description of development is as follows and the concept masterplan as submitted for illustrative purposes is provided at **Appendix B**:

'Outline planning application with all matters reserved (except for access) for the development of up to 40 residential dwellings (C3 use), including 50% affordable housing, with vehicular access from London Lane. Provision of associated public open space, alongside landscaping, drainage infrastructure, and associated works.'

1.4 Glanville Consultants prepared a Flood Risk Assessment to accompany the planning application (report reference 010_8211067_BW_Flood_Risk_Assessment, Issue 2, dated 5 May 2023). It concluded that the proposed development would not be at an unacceptable risk from any potential source of flooding and would not increase flood risk elsewhere. It also demonstrated that suitable strategies for the disposal of foul and surface water from the proposed development could be provided.

1.5 In its consultation response as Lead Local Flood Authority (LLFA) and statutory consultee on the planning application dated 28 June 2023, Oxfordshire County Council (OCC) raised no objection, subject to standard conditions relating to the detailed design of the drainage system, the provision of as-built information (plans and photographs) and confirmation of contact details for any appointed management company being attached to any permission granted. A copy of the LLFA's consultation response is provided at **Appendix C**.

1.6 WODC Officers recommended the application be refused for four reasons, none of which related to flood risk or drainage. Accordingly, at the time of the determination, there were no outstanding requests for further information regarding flooding and/or no extant criticisms of the scope, method, assessment, or conclusions of the Flood Risk Assessment. Rather, this issue was agreed between the technical experts and the LPA's Case Officer.

1.7 Further, at no stage has the LPA exercised its statutory powers to require that any of the reserved matters, such as the drainage solution, require determination at the outline stage. This remains the case in the light of the Council's Statement of Case.

1.8 Nonetheless, during the Planning Committee Meeting an additional reason for refusal relating to flooding and drainage was raised by a Member of the Planning Committee (without supporting technical justification) and the application was refused. Reason for refusal 3 (RfR 3) relates to flooding and drainage, and is worded as follows:

'*The proposed development would fail to adequately manage flood risk resulting from the many springs surrounding the village and existing poor surface water drainage resulting in an increased risk of flooding in conflict with Policies OS2, OS3, H2, EH7, EH8 and BC1 of the adopted West Oxfordshire Local Plan 2031 and the relevant paragraphs of the NPPF*.'

1.9 Obsidian Strategic Asset Management has appealed against the decision by WODC to refuse planning permission and a public inquiry is scheduled for late February / early March 2024 (appeal reference APP/D3125/W/23/333208).

1.10 This Technical Note has been prepared following discussions with WODC, as LPA, and OCC, as LLFA, to provide further information in respect of flood risk and drainage with a view to addressing RfR 3 ahead of the inquiry. This is a matter which can and should be addressed at the reserved matters approval (RMA) stage and secured by condition. The purpose of this Technical Note is to seek to reach agreement with the Council on this point and to avoid a partial application for costs (as I am instructed that it is unreasonable to refuse a scheme where the issue could be addressed by condition).

1.11 The note focuses on providing a detailed assessment of flood risk resulting from the springs surrounding the village and demonstrating robust strategies for the disposal of surface water run-off from the development that would not increase flood risk. Rather, there would be betterment and a benefit to weigh in the planning balance. There would also be compliance with national and local policy.

2.0 Site Location and Context

2.1 The site is located at Crown Farm in Ascott-under-Wychwood and consists of a stable yard and adjoining paddocks. A topographical survey is provided at **Appendix D**. Levels on-site generally fall from higher ground in the south to lower ground in the north.

Ground Conditions

2.2 Geological maps published by the British Geological Survey (BGS) shows the site is underlain by a range of soil types. The south-eastern half of the site is underlain by mudstone bedrock, with no superficial deposits recorded. A large part of the north-western half of the site is underlain by siltstone and mudstone bedrock, again with no superficial deposits recorded. Land along the north-western boundary of the site and further to the north-west is underlain by mudstone bedrock with superficial River Terrace Deposits of sand and gravel recorded. The higher ground immediately to the south-east of the site is underlain by limestone bedrock. A plan showing the geological mapping is provided at **Appendix E**.

2.3 The BGS publishes Infiltration SuDS GeoReports which provide detailed information relating to infiltration based sustainable drainage systems (SuDS). An Infiltration SuDS GeoReport was obtained for the site to provide an initial assessment of the suitability of the site for infiltration SuDS and is provided at Appendix C of the Flood Risk Assessment and provided at **Appendix F** of this report for ease of reference.

2.4 Mapping provided within Part 1 of the GeoReport confirms the following:

- The ground underlying the site provides opportunities for bespoke infiltration SuDS. The subsurface is potentially suitable although the design will be influenced by the ground conditions.
- Ground instability problems may be present or anticipated, but increased infiltration is unlikely to result in ground instability.
- The groundwater is not expected to be especially vulnerable to contamination.

2.5 Part 2 of the GeoReport provides more detailed data that confirms the following:

- Groundwater is likely to be less than 3m below the ground surface for at least part of the year.
- Superficial deposits in the north-western part of the site are likely to be free draining, with permeability assessed as being in the high to very high range.
- Bedrock deposits through the central part of the site and in the far northern corner are likely to be free draining, with permeability assessed as being in the low to moderate range.
- Increased infiltration is unlikely to result in subsidence.
- Increased infiltration is unlikely to lead to slope instability.

Existing Drainage Regime

2.6 A sizeable part of the site is previously developed and comprises large agricultural barns with access roads and external hardstanding areas. Most of the downpipes and guttering on the existing barns discharge run-off from the large roof areas onto the ground surface and drain overland from south to north following the prevailing topography. Some of this run-off discharges overland and off-site via the farm's main access road towards Heritage Lane / Church View / The Green to the north where there is little evidence of a positive surface water or highway drainage system to dispose of this run-off effectively.

2.7 Several inspection chambers exist in the northern part of the stable yard that provide evidence of a below ground drainage system that discharges to ground via a French drain / linear soakaway located in the adjacent paddock at the northern end of the site. Run-off from the stable yard can also enter this drainage system overland and is then routed via a drainage channel and cut-out in the masonry wall that separates the yard from the adjoining paddock to the north-east. The French drain / linear soakaway can be observed on site and is identified on the topographical survey and shown on the plan provided at **Appendix G**.

2.8 It is evident that the existing drainage system has not been well maintained and is in a poor state of repair. This will inevitably affect the performance of the drainage system and could lead to more regular exceedance of the system. There is no reason to assume that this will change in the absence of planning permission being granted.

2.9 A plan showing the existing drainage catchment areas on the site is provided at **Appendix G**. This shows that the existing impermeable area extends to around 0.52Ha. Also shown on this plan are existing flow paths for overland flow and exceedance events. The brownfield run-off rates for the existing impermeable areas within the appeal site boundary have been calculated as follows, increasing for various return period rainfall events (refer to **Appendix G** for calculations):

1 in 1 year	= 18.2 l/s
1 in 2 year (QBAR)	= 23.0 l/s
1 in 30 year	= 43.8 l/s
1 in 100 year	= 57.7 l/s

2.10 Third party correspondence received by the Planning Inspectorate in respect of the appeal include representations via Ascott-under-Wychwood Parish Council and Mr Chris Badger, former tenant farmer at Crown Farm. Mr Badger's statement, provided at **Appendix H**, confirms that there are no springs in the field and suggests that the pond (described further below in paragraph 2.18), just above the top farm building is full of water during the winter months with the overflow going into a stone drain and then into the main drain taking water from the indoor school, around the building and into the village by the main entrance to the farm. He refers to surface water coming down the unnamed road from Leafield, crossing the B3347 and then heading down the track in the direction of Crown Farm (called New Road), through to the farm buildings and finishing up by the Crown Barn boundary. He also refers to problems due to a lack of maintenance of this existing drainage system. Mr Badger confirms that he dug a trench across the field that he filled with shingle (i.e. the French drain / linear soakaway referenced above) and this works in normal conditions but overflows in extreme conditions.

2.11 Mr Badger's comments do not raise any new issues and support the view that the lack of effective drainage on the appeal site currently leads to overland surface water flows entering the village via the main access to the farm and that, where one exists, the drainage system on site is poorly maintained and ineffective.

2.12 The run-off rates for the overland flow that originates from within the appeal site and discharges off-site via the access to the farm and towards Heritage Lane / Church View / The Green to the north has been calculated as follows for various return period rainfall events based on the contributing area of 0.11Ha shown on the drawing and calculations at **Appendix G**:

1 in 1 year	= 3.9 l/s
1 in 2 year (QBAR)	= 4.9 l/s
1 in 30 year	= 9.3 l/s
1 in 100 year	= 12.2 l/s

2.13 The run-off rates from the existing roof and hardstanding areas that discharges on-site via the French drain / linear soakaway located in the paddock at the northern end of the site have been calculated as follows for various return period rainfall events based on the contributing area of 0.41Ha shown on the drawing and calculations at **Appendix G**:

1 in 1 year	= 14.3 l/s
1 in 2 year (QBAR)	= 18.1 l/s
1 in 30 year	= 34.5 l/s
1 in 100 year	= 45.5 l/s

2.14 Flows into the French drain / linear soakaway are unrestricted and no storage is provided other than a nominal volume in the voids of the shingle that was used to backfill the trench. Mr Badger notes that the French drain / linear soakaway overflows in extreme conditions. Any exceedance flows from the linear soakaway located in the paddock at the northern end of the appeal site are directed off-site towards the lower-lying properties on the south side of The Green, as indicated by the blue arrows on the drawing at **Appendix G**. The path of groundwater movement, which tends to travel from high to low ground, would also be directed towards these properties and ultimately the River Evenlode further to the north.

2.15 There is also an area of gravel surfacing located between the main part of the site and London Lane that has been used for the storage of construction materials during the construction of the adjacent Foresters Court development. Any run-off from this area would discharge off-site to London Lane.

Watercourses, Springs & Ponds

2.16 A plan showing relevant watercourses, springs and ponds in the vicinity of the site is provided at **Appendix I**, as described below.

2.17 The closest watercourse designated as a main river by the Environment Agency is the River Evenlode, located some 370m west of the site. The closest ordinary watercourse is Colwell Brook which can be found approximately 200m south-west of the site. The Colwell Brook flows south-westwards and then turns north-westwards before joining the River Evenlode just to the north of Shipton Road. The Colwell Brook is culverted under Shipton Road.

2.18 A small pond exists on the site, immediately to the south of the existing stable yard which may be fed by groundwater but is dry for part of the year. This pond is to be retained with the proposals and is shown to be located within an open space area at the south-western end of the development.

2.19 The Ordnance Survey map of the local area shows two springs located relatively close to the site, one some 200m to the south-west, close to the south-eastern end of Dawls Close, and the other a similar distance to the east, on the opposite side of London Lane. All these springs feed watercourses that discharge into the River Evenlode located in the valley on the north side of the village of Ascott-under-Wychwood.

2.20 The topographical survey (provided at **Appendix D**) confirms ground levels in the vicinity of the nearest spring located 200m to the south-west of the site are around 99m AOD, with the watercourse that flows downstream from this point located in a pronounced ditch at a lower level, and ground levels fall away from this point in a westerly direction towards Shipton Road and the River Evenlode beyond.

2.21 Ground levels in the vicinity of the spring just to the east of London Road appear to be between 100m AOD and 105m AOD according to contours on Ordnance Survey mapping and a watercourse is shown to flow downstream from this point as the ground falls away north-westwards towards High Street and the railway line beyond providing a direct route from the spring to the lower lying ground to the north.

2.22 There is a pond indicated to the front of existing properties on the west side of London Road (18, 20 and 20a) immediately to the south of and at a higher elevation than the newly constructed development of five dwellings at Foresters Court (application reference 17/01067/FUL). It is understood that this pond may also be spring-fed and the proposed drainage design for the development at Foresters Court includes a swale across the site's frontage with London Lane that is stated as being designed to convey flows from the spring in a safe manner northwards towards lower lying ground. A drawing showing the drainage design for this development that was approved by the LPA via the discharge of Condition 10 (drainage) is provided at **Appendix J**.

2.23 The springs and ponds described above are located close to the change in geology between the more freely draining limestone bedrock underlying the higher ground to the south of the appeal site and the less permeable mudstone bedrock that underlies most of the site, or where the more permeable superficial deposits of River Terrace Deposits are located. These conditions are where groundwater is more likely to emerge as it rises to the surface through the permeable subsoil following prolonged periods of wet weather.

3.0 Flood Risk from Springs (Groundwater)

Overview

3.1 The entire site is located within Flood Zone 1, and so is not at risk of fluvial flooding. It is also not at risk of surface water flooding, sewer flooding, or flooding for artificial sources. This is not in dispute.

3.2 Flood risk resulting from springs surrounding the village (i.e. groundwater flood risk) is the only source of flooding referenced in RfR 3. Flood risk from this source has been assessed in detail, as described in this section.

Groundwater Flood Risk

3.3 The West Oxfordshire District Council (WODC) Level 1 Strategic Flood Risk Assessment (SFRA) states at paragraph 4.3.1 that in broad terms there is limited potential for groundwater flooding in the central and northern part of the district where Ascott-under-Wychwood lies. The potential for groundwater flooding is greater in Carterton, Witney, Eynsham and Woodstock where the underlying geological conditions are more permeable.

3.4 At paragraph 4.3.2, the SFRA states that groundwater flooding usually occurs in low lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and groundwater paths tend to travel from high to low ground.

3.5 The Areas Susceptible to Groundwater Flooding (ASTGWF) map for the West Oxfordshire area is included as Figure 6 at Appendix B of the SFRA and is provided at **Appendix K** of this report. This map divides the district into 1km squares and indicates the proportion of each square that is susceptible to groundwater flood emergence. The mapping indicates the site is within an area where less than 25% of the area is susceptible to groundwater flooding and is therefore at low risk.

3.6 The 1km squares immediately to the west and north are indicated to be in the medium risk category where between 25% and 50% of the area of each 1km square is susceptible to groundwater flooding. These areas correspond more closely with lower lying areas of the village that are at risk of fluvial flooding from the River Evenlode and where some of the springs surrounding the village are located, as described in Section 2.

3.7 The locations of the springs and ponds shown on the plan at **Appendix I** coincide with the change in geology between the more freely draining limestone bedrock underlying the higher ground to the south of the site and the less permeable mudstone bedrock that underlies most of the site where groundwater is more likely to emerge.

3.8 No springs are identified as located within the boundary of the site but as noted in Section 2, three springs are located close to the site, one around 200m to the south-west, and the other two a similar distance to the east, on opposite sides of London Lane. These springs either feed watercourses that discharge into the River Evenlode on the north side of the village of Ascott-under-Wychwood or result in overland flow on London Lane such that any exceedance flows from these sources would be directed away from the site. Therefore, the development is not at risk of flooding from these springs.

3.9 Although not indicated as a spring on the published mapping, the small pond within the site, which is dry for part of the year, may be fed by groundwater. There is potential for this pond to overtop after a prolonged period of rainfall, which would result in overland flow off-site via the farm's main access road towards Heritage Lane / Church View / The Green to the north.

3.10 The pond is located at a higher elevation than the proposed built development, suggesting that should any groundwater emergence from the pond occur it could affect the development.

3.11 The pond is to be retained with the proposals, but no additional inflows will be introduced, so any flood risk from the pond that exists will not be exacerbated by the development. Rather, any groundwater emergence will be actively managed such that there will be betterment. Should groundwater emerge above the development, from the pond or from the higher ground more generally, any exceedance flows would be collected by the development's surface water drainage system and flow routes would be maintained through the development. Therefore, exceedance flows from the pond which flow towards Heritage Lane / Church View / The Green to the north (as discussed in paragraph 2.6) would no longer exist post-development, thereby providing betterment to the existing situation.

3.12 In accordance with standard construction practice, finished floor levels of the new dwellings will be typically elevated around 300mm above natural ground level and external hardstanding areas will be designed to fall away from building entrances so any exceedance flows will be directed away from the dwellings. No basements are proposed, which are particularly susceptible to high groundwater levels as they are situated below ground level.

3.13 As such, it can be demonstrated that the development is not at risk of groundwater flooding and any residual risk can be mitigated by the development's detailed design.

3.14 As described in Section 2, surface water run-off from the existing buildings and hardstanding areas on site is not well managed currently. There is limited chance of this changing in the future, without this development. Most of the gutters and downpipes on the existing buildings discharge run-off from the large roof areas onto the ground surface and drain overland from south to north following the prevailing topography. Some of this run-off discharges overland and off-site via the farm's main access road towards Heritage Lane / Church View / The Green to the north, where there is little evidence of a positive surface water or highway drainage system to dispose of this run-off effectively.

3.15 Other areas on the site currently drain overland or via a rudimentary system that intercepts flows along the site's northern boundary and discharges via a French drain / linear soakaway in the paddock to the north-east corner of the site. This system falls well below modern design standards and is poorly maintained. Mr Badger, former tenant farmer at Crown Farm has stated that this soakaway works in normal conditions but overflows in extreme conditions. Any exceedance flows from this linear soakaway are directed off-site towards the lower-lying properties on the south side of The Green. The path of groundwater movement, which tends to travel from high to low ground, would also be directed towards these properties.

3.16 An effective surface water drainage system will be introduced as part of the development. As described in Section 4, run-off can be managed effectively by infiltration or by a combination of infiltration and the highly restricted discharge of surface water to a watercourse or sewer. The system will prevent the run-off that currently discharges overland and off-site via the farm's main access road towards Heritage Lane / Church View / The Green to the north, thereby reducing flood risk off-site.

3.17 In contrast to the existing drainage regime on the site, the surface water drainage system for the development will be designed and constructed to modern standards and be able to accommodate run-off from all rainfall events up to and including the 1 in 100 year storm (the design rainfall event), with an additional 40% allowance for the future effects of climate change.

3.18 Storage to cater for excess rainfall will ensure the proposed drainage system does not exceed capacity, after detailed assessment at the RMA stage. For example, the provision of storage within the basin proposed at the northern end of the site will reduce the risk of an exceedance event occurring that currently results in flows off-site towards the lower-lying properties on the south side of The Green, thereby reducing flood risk off-site and providing betterment to the existing situation.

3.19 Therefore, the development proposals will manage the disposal of surface water much more effectively than the current situation and reduce the risk of flooding both on- and off-site, providing betterment to the existing situation, so there will be a positive impact as a result of the proposals.

3.20 On this basis, it can be concluded that the proposed development would not fail to adequately manage flood risk resulting from the springs surrounding the village and existing poor surface water drainage resulting in an increased risk of flooding as suggested by RfR 3.

4.0 Surface Water Drainage

4.1 As described in Section 2, the appeal site is partially previously developed and includes several large agricultural buildings and associated external hardstanding areas. The existing impermeable area within the site extends to around 0.52Ha as shown on the drawing at **Appendix G**. The brownfield run-off rates for the existing impermeable areas have been calculated for various return period rainfall events and are summarised in paragraph 2.9.

4.2 The proposed development will increase the impermeable area on site to 0.73Ha, an increase of 0.21Ha or 40% compared with the existing situation.

4.3 The proposed developable area within the red line boundary of the site, excluding the large open spaces, extends to 1.34Ha in total. The equivalent greenfield run-off rates for the developable area have been calculated as follows for various return period rainfall events:

1 in 1 year	= 5.4 l/s
1 in 2 year (QBAR)	= 6.4 l/s
1 in 30 year	= 14.5 l/s
1 in 100 year	= 20.3 l/s

4.4 In contrast to the existing situation, an effective drainage system designed to modern standards will be designed and constructed to manage the disposal of surface water from the development effectively by catering for all flows up to the 1 in 100 year +40% climate change storm (the design rainfall event). Appropriate pollution control and maintenance measures will also be incorporated.

4.5 The surface water drainage strategy presented in the Flood Risk Assessment submitted with the planning application proposed disposal via infiltration with all surface water to be discharged to the underlying soils. A plan illustrating this outline strategy is provided at Appendix H of the Flood Risk Assessment and is also provided at **Appendix L** of this document for ease of reference. The strategy proposed employs an infiltration and storage basin in the northern corner of the development, with additional storage provided through permeable paving with deepened sub-base beneath access roads and hardstanding areas upstream of the basin.

4.6 In its consultation response as LLFA dated 28 June 2023 (see **Appendix C**), OCC raised no objection to the proposed development, subject to standard conditions relating to the detailed design of the surface water drainage system, the provision of as-built information (plans and photographs) and confirmation of contact details for any appointed management company being attached to any permission granted. As such, approval of the detailed design and construction of the proposed surface water drainage system can be secured and controlled through submission of information to discharge planning conditions in line with the two draft conditions suggested by OCC.

4.7 Nevertheless, the infiltration-based strategy proposed previously has been reviewed and updated, and alternative strategies have been considered to demonstrate that there are other effective means of draining surface water from the development.

4.8 The options demonstrate that, regardless of the results of further infiltration testing and modelling that will take place at the approval of reserved matters stage to inform the final drainage design, there is an acceptable drainage solution, in principle, which complies with national and local planning policy.

4.9 Part H of the Buildings Regulations: Drainage and Waste Disposal establishes a hierarchy for surface water disposal, which encourages a SuDS based approach. The hierarchy is that surface run-off must be discharged to one or more of the following in order of priority:

- an adequate soakaway or some other adequate infiltration system; or, where not reasonably practicable,
- a watercourse; or, where not reasonably practicable,
- a sewer.

4.10 It is important to note that this is just a hierarchy. It does not mean or imply that any option is unacceptable per se. Rather, it needs to be demonstrated that a higher priority is not feasible/deliverable before relying on a lower priority.

4.11 On this basis, the following options have been considered in order of preference/hierarchy for the disposal of surface water run-off from the proposed development, as described in detail further below:

- Option 1 - 100% disposal via infiltration;
- Option 2 - Hybrid solution with part infiltration and part discharge to a watercourse;
- Option 3 - 100% discharge to a watercourse; and
- Option 4 - 100% discharge to a sewer.

Option 1 - 100% Disposal via Infiltration

4.12 Based on published information regarding the geological context of the site and surrounding area, infiltration drainage techniques are considered a suitable and effective method for disposing of surface water run-off generated by the development and will be confirmed in due course by the results of soakage testing to BRE Digest 365 'Soakaway Design' and groundwater monitoring, the scope of which can be controlled by condition. Disposal of surface water in this way is the preferred means, if conditions allow, in accordance with the drainage hierarchy stipulated by Building Regulations and other relevant guidance.

4.13 The surface water drainage strategy presented in the Flood Risk Assessment that accompanied the planning application was developed following an assessment of the suitability of ground conditions on site for disposal via infiltration based on the available evidence (as described in Section 2) but in the absence at that time of an intrusive site investigation because it was not considered to be proportionate or necessary at outline application stage by either the Appellant, Glanville, the LLFA or LPA Officers. Indeed, it was not requested by Members of the Planning Committee (who could have deferred the decision for such an assessment to be submitted if this was the concern).

4.14 An infiltration rate of 1 x 10^{-5}m/s was assumed at that time, based on test results from an adjacent development, as described in paragraphs 6.7 and 6.8 of the Flood Risk Assessment.

4.15 For robustness, the proposed infiltration-based surface water drainage strategy has been reviewed and updated assuming a much lower infiltration rate of 5 x 10^{-6}m/s should, in the event, soakage testing confirm infiltration is a feasible means of disposal but infiltration rates, in practice, are lower than expected.

4.16 A drawing illustrating the revised surface water drainage strategy for Option 1 and the supporting calculations are provided at **Appendix M**. Each infiltration component (basin and geocellular soakaways) would be able to discharge from full to half-full in a reasonable time, as advised by guidance in the SuDS Manual, so the risk of them not being able to manage a subsequent rainfall event would be minimised. A freeboard of 300mm would be achieved for the basin during the design rainfall event, again in accordance with relevant guidance, which will provide resilience in terms of additional storage capacity to accommodate subsequent rainfall events or greater rainfall volumes from more onerous events than the design rainfall event.

4.17 This strategy option would prevent the uncontrolled run-off that currently discharges overland and off-site via the farm's main access road towards Heritage Lane / Church View / The Green to the north (refer to paragraph 2.12 for run-off rates). It would also reduce significantly the risk of an exceedance event occurring that results in flows off-site towards the lower-lying properties on the south side of The Green. Therefore, the proposals will not exacerbate any pre-existing problems in the village related to poor surface water drainage and will provide betterment in this respect due to the reduction in likelihood of overland flows occurring off-site through improvements to the management of surface water on-site.

4.18 Whilst an infiltration-based solution is considered viable and hierarchically preferable, given the lay concerns that have been raised leading to RfR 3, and the need for this to be confirmed through comprehensive intrusive ground investigations at the appropriate time, consideration has been given to alternative means of disposal of surface water to demonstrate that there are other effective means of draining the development in the event that ground conditions are not as expected, based on the available evidence, and a different drainage solution is required.

Option 2 - Hybrid Solution with Part Infiltration and Part Discharge to a Watercourse

4.19 As the most suitable alternative to 100% disposal via infiltration, a hybrid solution has been developed that would discharge some surface water run-off to ground via infiltration and the remainder at a highly restricted rate to a watercourse (the Colwell Brook) around 200m to the south-west. This watercourse is within land controlled by the appellant, as shown by the red line on the plan provided at **Appendix N**, and therefore it would be possible to provide a drainage outfall in this direction and secure the provision of associated infrastructure via condition or an obligation in the Section 106 agreement.

4.20 Ground levels within the developable area relative to the outfall point are such that a gravity discharge would be feasible from a large proportion of the development, with only the lowest lying parts of the development discharging via infiltration, as shown on the plan provided at **Appendix O**. Of the total impermeable area of area 0.73Ha, 0.43Ha would discharge via infiltration and the remaining 0.30Ha would discharge via the watercourse. However, the proportions could be varied to respond to changes in infiltration rates and/or groundwater levels, if necessary. The equivalent greenfield run-off rates these two catchments have been calculated as set out below for various return period rainfall events based on the contributing developable areas of 0.83Ha and 0.51Ha, respectively.

Via infiltration (0.83Ha):		Via watercourse (0.51Ha):	
1 in 1 year	= 3.3 l/s	1 in 1 year	= 2.1 l/s
1 in 2 year (QBAR)	= 4.0 l/s	1 in 2 year (QBAR)	= 2.4 l/s
1 in 30 year	= 9.0 l/s	1 in 30 year	= 5.5 l/s
1 in 100 year	= 12.6 l/s	1 in 100 year	= 7.7 l/s

4.21 Option 2 has been assessed on the basis that the infiltration basin would remain the same size and shape as in Option 1 and therefore provide the same storage volume. An infiltration rate of 5 x 10^{-6}m/s has also been assumed, the same as for Option 1. However, as much less of the development's impermeable area would drain in this direction with Option 2 (0.43Ha compared with 0.73Ha) there would be flexibility to alter the design of the basin, in terms of its area and/or depth, if required, to respond to changes in infiltration rates and/or groundwater levels should they prove to be different to those based on the available evidence. Any such changes could be dealt with through the approval of reserved matters, when layout is considered in detail, and through the discharge of planning conditions.

4.22 With Option 2, it is proposed that discharge to the watercourse would be restricted to a rate of 1.0l/s for all return periods, which would be lower than the equivalent greenfield run-off rates for the catchment as presented in paragraph 4.20. This restriction would be achieved through a flow control device (e.g. Hydro International's Hydro-Brake vortex flow control, or similar) with attenuation storage provided upstream of the flow control chamber within an open basin, below ground storage, or a combination of the two (the strategy presents two sub-options), to accommodate all flows up to the 1 in 100 year +40% climate change design rainfall event in accordance with current guidance.

4.23 A drawing illustrating this alternative strategy (Option 2) and the supporting calculations are provided at **Appendix O**. Again, the calculations demonstrate that each storage component would be able to discharge from full to half-full in a reasonable time, so they would be able to accommodate a subsequent rainfall event. A freeboard of 300mm could be achieved for both basins during the design rainfall event that would provide additional storage capacity to accommodate subsequent rainfall events or greater rainfall volumes from more onerous events than the design rainfall event.

4.24 Such a hybrid strategy would provide flexibility and resilience should comprehensive intrusive site investigations demonstrate that ground conditions prevent a drainage solution that is entirely reliant on infiltration.

4.25 Like the preferred option, this alternative proposal would also remove the run-off that currently discharges overland and off-site via the farm's main access road towards Heritage Lane / Church View / The Green to the north and provide significant betterment in this respect. It would also reduce the risk of an exceedance event occurring that results in flows off-site towards the lower-lying properties on the south side of The Green.

4.26 The discharge rate of surface water flows diverted towards the watercourse with this alternative strategy (fixed at 1.0l/s for all return periods) would be significantly lower than the equivalent greenfield run-off rates, as presented in paragraph 4.20, and significantly lower than the uncontrolled overland flow rates that occur off-site via the farm's main access road, as presented in paragraph 2.12, which increase markedly during higher-order rainfall events.

4.27 Flows off-site in either direction – to the north via the farm's main access road or to the watercourse to the south-west – would ultimately discharge to the River Evenlode so this alternative strategy would decrease not increase flood risk overall when compared with the existing situation as flows off-site would be managed much more effectively and beneficially through the controlled, slow release of surface water and the temporary storage of surface water on-site to accommodate the design rainfall event.

Option 3 - 100% Discharge to a Watercourse

4.28 If, following the completion of comprehensive intrusive site investigations, ground conditions prove to be entirely unsuitable for any infiltration-based drainage strategy, there would be the option of discharging all surface water from the development to the watercourse following the route described above for Option 2. In this case the impermeable area discharging to the watercourse would be 0.73Ha and the equivalent greenfield run-off rates would be as presented in paragraph 4.3.

4.29 With some of the proposed development located at a lower elevation than the proposed discharge point, it would be necessary for surface water to be collected in the storage basin proposed at the northern end of the site and then pumped to a high point in the topography located at the north-western end of the open space area proposed west of the built development, within the red line boundary of the appeal site.

4.30 The plan provided at **Appendix P** shows the indicative location of the proposed pumping station, close to the northern storage basin, which would be largely located below ground with only a small control kiosk visible above ground. This could be appropriately screened by contextually appropriate planting (if necessary) and would not have any material visual impact.

4.31 Ultimately, discharge to the watercourse would be restricted to a low rate of 2.0l/s for all return periods with Option 3 and by the same control method with attenuation storage similarly provided upstream of the flow control chamber within an open basin, below ground storage, or a combination of the two (the strategy presents two sub-options), to accommodate all flows up to the 1 in 100 year +40% climate change design rainfall event in accordance with current guidance.

4.32 A drawing illustrating this alternative strategy (Option 3) and the supporting calculations are provided at **Appendix P**, which demonstrate that each storage component would be able to discharge from full to half-full in a reasonable time, so they would be able to accommodate a subsequent rainfall event, and a freeboard of 300mm can be achieved for the basins during the design rainfall event that will provide additional storage capacity. The storage basin proposed at the northern end of the site would provide both attenuation storage and the emergency storage required by current guidance to prevent flooding in the unlikely event of pump failure.

4.33 Like the previous options, Option 3 would also remove the run-off that currently discharges overland and off-site via the farm's main access road towards Heritage Lane / Church View / The Green to the north and provide significant betterment in this respect. It would also reduce the risk of an exceedance event occurring that results in flows off-site towards the lower-lying properties on the south side of The Green. This would improve the current situation.

4.34 The discharge rate of flows diverted towards the watercourse with this alternative strategy (fixed at 2.0l/s for all return periods) would be significantly lower than the equivalent greenfield run-off rates, as presented in paragraph 4.20, and significantly lower than the uncontrolled overland flow rates that occur off-site via the farm's main access road, as presented in paragraph 2.12, which increase markedly during higher-order rainfall events.

4.35 Flows off-site in either direction – to the north via the farm's main access road or to the watercourse to the south-west – would ultimately discharge to the River Evenlode so this alternative strategy would decrease not increase flood risk overall when compared with the existing situation as flows off-site would be managed much more effectively and beneficially through the controlled, slow release of surface water and the temporary storage of surface water on-site to accommodate the design rainfall event.

Option 4 – 100% Discharge to a Sewer

4.36 A fourth option involving the discharge to a sewer would be technically feasible but would be considered only as a fall-back in the unlikely event that the three hierarchically preferable options described above could not be delivered.

4.37 There are no surface water sewers nearby but there is a public foul water sewer in London Lane maintained by Thames Water as local sewerage authority, which would enable a connection to be provided from the development.

4.38 In this case the impermeable area discharging to the sewer would be 0.73Ha and the equivalent greenfield run-off rates would be as presented in paragraph 4.3.

4.39 This option would discharge surface water at a restricted rate of 3.5l/s for all return periods to the Thames Water foul sewer and attenuation storage would be provide through a basin located at the northern end of the site, with additional storage provided within permeable paving with deepened sub-base beneath access roads and hardstanding areas upstream of the basin, and a box culvert beneath the section of the access road immediately prior to London Lane. This discharge rate is the minimum that would enable the required storage volume to be accommodated within the illustrative masterplan.

4.40 A drawing illustrating this alternative strategy (Option 4) and the supporting calculations are provided at **Appendix Q**. Again, the calculations demonstrate that each storage component would be able to discharge from full to half-full in a reasonable time, so they would be able to accommodate a subsequent rainfall event. A freeboard of 300mm could be achieved for the storage basin during the design rainfall event that would provide additional storage capacity to accommodate subsequent rainfall events or greater rainfall volumes from more onerous events than the design rainfall event.

4.41 Again, like the previous options, Option 4 would also remove the run-off that currently discharges overland and off-site via the farm's main access road towards Heritage Lane / Church View / The Green to the north and provide significant betterment in this respect. It would also reduce the risk of an exceedance event occurring that results in flows off-site towards the lower-lying properties on the south side of The Green.

4.42 The discharge rate of flows diverted towards the sewer with this alternative strategy (fixed at 3.5l/s for all return periods) would be significantly lower than the equivalent greenfield run-off rates, as presented in paragraph 4.3, and significantly lower than the uncontrolled overland flow rates that occur off-site via the farm's main access road, as presented in paragraph 2.12, which increase markedly during higher-order rainfall events.

4.43 Although at the bottom of the drainage hierarchy, the newly constructed dwellings at Foresters Court on the west side of London Lane (application ref. 17/01067/FUL) discharge surface water to this foul sewer at a restricted rate, as agreed with Thames Water and approved by the Local Planning Authority through the discharge of the associated planning condition (Condition 10) so there is a precedent locally for this strategy option, which has been considered to be appropriate and acceptable by the LLFA, the LPA and Thames Water. A drawing showing the drainage design for this development that was approved by the LPA via the discharge of Condition 10 (drainage) is provided at **Appendix J**.

Pollution Control Measures

4.44 With all strategy options, pollution control measures as part of a robust treatment train would be provided to minimise the transmission of any pollutants collected by run-off flowing over hard paved areas to the receiving infiltration features and/or watercourse. Pollution control measures are described and assessed in paragraphs 6.12 to 6.15 and Tables 1 and 2 of the Flood Risk Assessment submitted with the planning application.

Future Management & Maintenance

4.45 With all options, any drainage infrastructure located within individual property boundaries would be owned by the property owner who would also have maintenance responsibility. It is envisaged that the surface water drainage system that serves more than one property would be maintained by a private management company. Details of the proposed maintenance arrangements and a schedule for the maintenance of the various drainage components proposed is provided in paragraphs 6.16 to 6.18 and Table 3 of the Flood Risk Assessment.

4.46 In contrast to the site's existing drainage system that is poorly maintained and ineffective, the system serving the new development will be properly and regularly maintained to ensure it will function as required and this could be controlled by condition.

Summary

4.47 In summary, it has been demonstrated that various options are available for the disposal of surface water run-off from the proposed development that are all technically feasible, deliverable within the land available, and able to be addressed via the approval of reserved matters and secured by condition. Flows off-site would be managed much more effectively and beneficially through the controlled, slow release of surface water and the temporary storage of surface water on-site to accommodate the design rainfall event.

4.48 All four options would remove the run-off that currently discharges overland and off-site via the farm's main access road towards Heritage Lane / Church View / The Green to the north and provide betterment in terms of the discharge rate off-site, either to a watercourse (Options 2 and 3) or sewer (Option 4) that would be fixed for all return periods, lower than that which occurs off-site currently and lower than the equivalent greenfield run-off rates, which increase markedly during higher-order rainfall events. All options would also reduce the risk of an exceedance event occurring that results in flows off-site towards the lower-lying properties on the south side of The Green. Therefore, all four strategies would reduce not increase flood risk overall and provide significant betterment. Table 1 on page 18 provides a summary of discharge rates to aid comparison.

4.49 The strategy option drawings presented at **Appendices M, O, P** and **Q** show that there would be very little difference between the options in terms of what would be visible above ground. Options 2 and 3 would require additional surface water storage to be provided prior to the proposed outfalls to the watercourse to enable the discharge off-site to be restricted to the very low rates proposed. This storage could be provided below ground in geocellular storage crates or above ground in a storage basin similar to that proposed with all options in the northern corner of the site (depending on the preference of the LPA and LLFA). Option 3 would require a pumping station located close to the northern storage basin, which would be largely below ground with only a small control kiosk visible above ground and could be screened by planting, if necessary. Option 4 would be very similar to Option 1 with the additional storage required provided below ground within a box culvert located beneath the section of the access road immediately prior to London Lane.

4.50 The land use planning implications of the changes and additions required to implement the different alternative drainage strategy options have been considered in terms of impacts on landscape, built heritage and archaeology and no adverse impacts have been identified.

4.51 With all options, at the detailed design stage, further SuDS features, such as permeable paving within driveways and/or raingardens, bio-retention areas and tree pits, could be incorporated into the design of the proposed drainage scheme to provide additional surface water storage and further treatment of surface water flows to prevent pollution.

Table 1: Comparison of Discharge Rates (l/s)

Option	Description / Discharge Method	Existing Discharge Rate Off-Site [1]				Existing Greenfield Run-off Rate				Proposed Discharge Rate Off-Site [2]		
		1 in 1 year	QBAR	1 in 30 year	1 in 100 year	1 in 1 year	QBAR	1 in 30 year	1 in 100 year	QBAR	1 in 30 year	1 in 100 year
1	100% infiltration	3.9	4.9	9.3	12.2	0.0	0.0	0.0	0.0	0.0		
2	Hybrid - infiltration & watercourse					2.1	2.4	5.5	7.7	1.0		
3	100% watercourse					5.4	6.4	14.5	20.3	2.0		
4	100% sewer									3.5		

[1] *via overland flow onto Heritage Lane / Church View / The Green*
[2] *for proposed catchment discharging off-site only*

Note:

1. The existing discharge rate off-site via Heritage Lane / Church View / The Green increases progressively with higher order rainfall events, from 3.9l/s during the 1 in 1 year rainfall event up to 12.2l/s for the 1 in 100 year rainfall event.

2. In future, with the development, no discharge of surface water would occur off-site with Option 1 (100% infiltration).

3. Discharge rates off-site for other options would be fixed for all return period rainfall events – i.e. fixed at 1.0l/s for Option 2 (hybrid infiltration/watercourse), 2.0l/s for Option 3 (100% watercourse) and 3.5l/s for Option 4 (100% sewer). All the proposed discharge rates for all rainfall events are lower than the existing discharge rate off-site via Heritage Lane / Church View / The Green for the 1 in 1 year rainfall event.

4. Discharge rates off-site for Options 2, 3 and 4 in all rainfall events are lower than the corresponding existing greenfield run-off rate for the contributing area for the 1 in 1 year rainfall event.

5.0 Summary & Conclusion

5.1 This Technical Note has been prepared by Glanville Consultants on behalf of Obsidian Strategic Asset Management to provide further information in relation to groundwater flood risk and surface water drainage in connection with a proposed residential development on land west of London Lane, Ascott-under-Wychwood, Oxfordshire.

5.2 The key points presented in this Technical Note can be summarised as follows:

a) The Lead Local Flood Authority, Oxfordshire County Council, raised no objection to the proposed development on flood risk or drainage grounds, subject to standard conditions relating to the detailed design and construction of the surface water drainage system.

b) West Oxfordshire District Council Officers recommended the application be refused for four reasons, none of which related to flood risk or drainage but during the Planning Committee Meeting an additional reason for refusal relating to flooding and drainage which states that the proposed development would fail to adequately manage flood risk resulting from the many springs surrounding the village and existing poor surface water drainage resulting in an increased risk of flooding (Reason for Refusal 3 – RfR 3).

c) A sizeable part of the appeal site is previously developed and comprises large agricultural barns with access roads and external hardstanding areas.

d) Some of the surface water run-off from the site currently discharges overland and off-site via the farm's main access road towards Heritage Lane / Church View / The Green to the north where there is little evidence of a drainage system that will dispose of this run-off effectively. Surface water run-off from other areas of the site is currently discharged to ground by infiltration via a rudimentary drainage system not constructed to modern standards that has not been well maintained. Any exceedance flows from this system are currently directed off-site towards the lower-lying properties on the south side of The Green. Therefore, it is evident that surface water disposal from the site is not currently controlled or managed effectively and there is a risk that flooding occurs off-site as a result.

e) Three springs are located close to the site, one around 200m to the south-west, and the other two a similar distance to the east, on opposite sides of London Lane. These springs either feed watercourses that discharge into the River Evenlode on the north side of the village or result in overland flow on London Lane such that any exceedance flows from these sources would be directed away from the site. Therefore, the development is not at risk of flooding from these springs.

f) There is a small pond within the appeal site, which is dry for part of the year and may be fed by groundwater. There is potential for this pond to overtop when groundwater levels rise after a prolonged period of rainfall, which would contribute to the overland flow that currently occurs off-site to the north via the farm's main access road.

g) The pond is to be retained with the proposals, but no additional inflows will be introduced, so any flood risk from the pond will not be exacerbated by the development. Should groundwater emerge above the development, from the existing pond or from the higher ground more generally, any exceedance flows would be collected by the proposed surface water drainage system and flow routes would be maintained through the development.

h) To mitigate the risk of flooding from groundwater, finished floor levels of the new dwellings would be typically elevated around 300mm above natural ground level and external hardstanding areas would fall away from building entrances so any exceedance flows would be directed away from the dwellings. No basements are proposed, which are particularly susceptible to high groundwater levels. As such, the development is not at risk of groundwater flooding and any residual risk can be adequately mitigated by the development's detailed design.

i) The introduction of a surface water drainage system for the development, which would be designed and constructed to modern standards and controlled by planning condition, would improve significantly upon the poor existing drainage arrangements for the site, manage the disposal of surface water much more effectively, and reduce the risk of flooding overall.

j) The entirely infiltration-based surface water drainage strategy presented in the Flood Risk Assessment that accompanied the planning application was developed following an assessment of the suitability of ground conditions on site for disposal via infiltration based on the available evidence but in the absence at that time of an intrusive site investigation because it was not considered to be proportionate or necessary at outline application stage.

k) The surface water drainage strategy previously proposed has been reviewed and updated using a much lower infiltration rate for robustness should, in the event, soakage testing confirm infiltration is a feasible means of disposal but infiltration rates, in practice, are lower than expected.

l) Whilst an entirely infiltration-based strategy is considered viable and is hierarchically preferable, alternative means of disposal have been considered to robustly demonstrate that that there would be other effective means of draining surface water from the development should ground conditions prevent a drainage solution that is entirely reliant on infiltration, thereby providing flexibility and resilience.

m) The following options have been considered in order of preference for the disposal of surface water run-off from the proposed development:

Option 1 - 100% disposal via infiltration;
Option 2 - Hybrid solution with part infiltration and part discharge to a watercourse;
Option 3 - 100% discharge to a watercourse; and
Option 4 - 100% discharge to a sewer.

n) It has been demonstrated that all these options are technically feasible, deliverable within the land available, and able to be addressed via the approval of reserved matters and secured by condition.

o) All four options would ensure that surface water would be managed much more effectively and beneficially than the situation currently through the controlled, slow release and temporary storage of surface water with the new drainage system designed to accommodate the design rainfall event (i.e. the 1 in 100 year +40% climate change event) without the risk of flooding.

p) Discharge off-site via the watercourse (Options 2 and 3) or sewer (Option 4) would be restricted to a very low rate that would be fixed for all rainfall events. This discharge rate would be lower than the equivalent greenfield run-off rates for the catchment and lower than that from the uncontrolled overland flows that currently occur off-site via the farm's main access road, which increase markedly during higher-order rainfall events.

q) All four strategy options would reduce the risk of an exceedance event occurring that results in flows off-site towards the lower-lying properties on the south side of The Green.

r) All four options would reduce, not increase flood risk overall, and provide betterment to the existing situation.

s) Control measures to prevent pollution of the receiving infiltration features, and underlying groundwater resource, and/or watercourses would be provided as part of a robust treatment train.

t) In contrast to the site's existing drainage system that is poorly maintained and ineffective, the system serving the new development will be properly and regularly maintained to ensure it will function as required and this could be controlled by condition.

u) At the detailed design stage, further SuDS features, such as permeable paving within driveways and/or raingardens, bio-retention areas and tree pits, could be incorporated into the proposed drainage scheme to allow for additional storage and treatment of surface water flows.

Conclusion

5.3 There is no evidence that the development would fail to adequately manage flood risk resulting from the springs surrounding the village and existing poor surface water drainage. On the contrary, the site would be properly drained and there would be a betterment for the local community.

5.4 There are four options available for the disposal of surface water run-off from the proposed development that are all technically feasible, deliverable within the land available, and would reduce not increase flood risk overall, thereby providing betterment to the existing situation. All options would be capable of being addressed via the approval of reserved matters and secured by planning condition.

5.5 Therefore, it is concluded that there are no flood risk or drainage related reasons why the appeal scheme should not be allowed.