North Uttlesford Garden Village

Flood Risk and Surface Water Management Due Diligence Report

On behalf of Bidwells
Document Control Sheet

Project Name: North Uttlesford Garden Village
Project Ref: 36997
Report Title: Flood Risk and Surface Water Management Due Diligence Report
Doc Ref: 36997/4001
Date: May 2016

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepared by:</td>
<td>Robert Pike</td>
<td>Graduate Engineer</td>
<td>RP</td>
</tr>
<tr>
<td>Reviewed by:</td>
<td>Åsa Söderberg</td>
<td>Associate</td>
<td>ACS</td>
</tr>
<tr>
<td>Approved by:</td>
<td>Simon Darch</td>
<td>Equity Director</td>
<td></td>
</tr>
</tbody>
</table>

For and on behalf of Peter Brett Associates LLP

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
<th>Prepared</th>
<th>Reviewed</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Peter Brett Associates LLP disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report. This report has been prepared with reasonable skill, care and diligence within the terms of the Contract with the Client and generally in accordance with the appropriate ACE Agreement and taking account of the manpower, resources, investigations and testing devoted to it by agreement with the Client. This report is confidential to the Client and Peter Brett Associates LLP accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

© Peter Brett Associates LLP 2016
Contents

1 Introduction .......................................................................................................................... 1

2 Site Location and Description .......................................................................................... 2
   2.1 Site Location and Local Context .................................................................................. 2
   2.2 Site Topography ........................................................................................................... 3
   2.3 Hydrological Context .................................................................................................... 3
   2.4 Geological Context ...................................................................................................... 3
   2.5 Existing Site Drainage .................................................................................................. 4

3 Assessment of Flooding .................................................................................................... 5
   3.1 Fluvial Flooding .......................................................................................................... 5
   3.2 Reservoir Flooding ....................................................................................................... 5
   3.3 Surface Water Flooding ............................................................................................... 5
   3.4 Groundwater Flooding ................................................................................................. 6
   3.5 Sewer Flooding ........................................................................................................... 6

4 Flood Mitigation ................................................................................................................ 7
   4.1 Principles for Flood Mitigation .................................................................................... 7

5 Surface Water Management ............................................................................................. 8
   5.1 Existing Surface Water Regime .................................................................................. 8
   5.2 Potential Impact of Proposed Development ................................................................. 10
   5.3 Principles for Surface Water Management Strategy ................................................... 10
   5.4 Proposed Strategy ...................................................................................................... 11

6 Summary and Further Work ............................................................................................. 14
   6.2 Further Work ................................................................................................................ 14

Figures

Figure 2.1. Site Location Plan .................................................................................................... 2
Figure 3.1. Extract of EA Online Flood Map for Planning (Rivers and Sea). 09/05/2016 ............... 5
Figure 3.2. Extract of online EA Flood Map for Risk of Flooding from Surface Water. 09/05/2016 ...... 6
Figure 5.1. Drainage catchments and overland flow routes within the site .................................. 9
Figure 5.2. SuDS Options .................................................................................................... 13

Tables

Table 5.1. Surface Water Storage Requirements ..................................................................... 12

Appendices

Appendix A Site Location Plan
Appendix B Surface Water Calculations
Flood Risk and Surface Water Management Due Diligence Report
North Uttlesford Garden Village
1 Introduction

1.1.1 This report has been prepared by Peter Brett Associates LLP, on behalf of our client, Bidwells to provide a preliminary review of potential constraints and opportunities relating to flood risk and surface water management at a site at North Uttlesford, Essex. The findings of this report will help to identify any issues that may prove to have a significant impact on the cost or ability to develop the site.

1.1.2 Flood risk at the site has been assessed through a desk based review of flood mapping and local evidence based documents.

1.1.3 Options for surface water management and their potential impacts on the development site have been reviewed through a preliminary review of topography, existing runoff rates, and likely outfall locations.

1.1.4 The report also sets out the scope of further work required in order to fully define flood risk related constraints and ultimately enable preparation of a Flood Risk Assessment (FRA) that is compliant with the National Planning Policy Framework (NPPF), to support a planning application.

1.1.5 This report provides a summary of the key flood risk and surface water issues that may affect the development of the site based on a preliminary desk based review. Further assessment is required to validate and develop this work further, inform the masterplanning process and to support any planning application.
2 Site Location and Description

2.1 Site Location and Local Context

2.1.1 The site comprises a 466 hectare (ha) area of primarily agricultural land to the north of Great Chesterford, Uttlesford, Essex. The site is centred on OS grid reference 552454mE 245271mN. A site location plan is included in Figure 2.1 and Appendix A.

![Site Location Plan](image)

Contains Ordnance Survey Data © Crown Copyright and Database Right 2016

Figure 2.1. Site Location Plan

2.1.2 The site lies within the administrative boundary of Uttlesford District Council (UDC). The district boundary forms the northern and western boundaries of the site.

2.1.3 The site is bound by the A11 to the west and the B184 to the south-west. Park Road branches from the B184 and bisects the centre of the site. Cow Lane borders a small section of the south-east site boundary.

2.1.4 The site is predominantly surrounded by agricultural land to the west, north and east. The village of Great Chesterford is situated just south of the site.
2.2 Site Topography

2.2.1 LiDAR data has been obtained to provide an assessment of the topography.

2.2.2 The LiDAR data indicates a significant variation in ground levels across the site. Northern, eastern and southern areas of the site fall in a southerly and easterly direction towards the watercourse at the south-eastern site boundary.

2.2.3 The high point of the site lies at the north-eastern corner of the site at approximately 105m AOD. From this point the land falls generally in a south westerly direction through the site. The lowest area at the south-east corner of the site is approximately 40m AOD.

2.2.4 There is a ridge that protrudes southwards centrally through the site from the northern boundary. The high point of this ridge is approximately 98m AOD. To the east of the ridge land falls in a south-easterly and southerly direction towards the watercourse at the south-east site boundary. To the west of the ridge, land falls in a westerly and north-westerly direction towards the A11.

2.2.5 An assessment of the catchment boundaries within the site and likely overland flow routes is provided in Section 5.1.

2.3 Hydrological Context

2.3.1 There are no main rivers located within the site extents. The nearest Environment Agency (EA) designated main river is the River Cam which flows in a north-easterly direction approximately 1km south-west of the site.

2.3.2 A tributary of the River Cam bisects the south-east corner of the site and flows in a south westerly direction along the south-eastern site boundary. This watercourse ultimately confluences with the River Cam to the west of Great Chesterford. This tributary is designated as an ordinary watercourse and is fed by numerous field drains located within the site.

2.3.3 The western part of the site falls in a westerly direction towards the A11. OS mapping suggests there is a drainage connection beneath the A11 and that this would continue to drain in a westerly direction beyond the A11 towards the River Cam.

2.3.4 It is understood that there a number of springs located within the site.

2.4 Geological Context

2.4.1 The British Geological Survey (BGS) online geology viewer provides the following information on the geology of the site:

- The bedrock underlying the site is chalk, comprising the ‘Lewes Nodular Chalk Formation and Seaford Chalk Formation (undifferentiated) in the centre and north-east, and the New Pit Chalk Formation across the south and west.’

- Across western and southern parts of the site there are no superficial deposits and the chalk bedrock is present at ground level.

- Central and northern parts of the site are underlain by superficial deposits of the ‘Lowestoft Formation – Diamicton’ comprising chalky till with sands, gravel, silts and clay characterised by its flint and chalk content.

2.4.2 The Cranfield University online ‘Soilscape’ website provides an overview of the drainage potential of land across Britain. This indicates a number of different soils underlay the site:
Central and northern areas of the site are underlain by ‘Loamy and clayey soils with impeded drainage’

Western and southern areas of the site are underlain by ‘Freely draining lime-rich loamy soils’ and ‘Freely draining slightly acid but base-rich soils’

2.4.3 Online EA groundwater maps indicate the chalk bedrock is designated a principal aquifer across the whole site. The superficial deposits are indicated as a Secondary (undifferentiated) aquifer.

2.4.4 The online EA maps also confirm that central, northern and western areas of the site are located in a Groundwater Source Protection Zone (SPZ) Outer Zone (Zone 2). The remainder of the site is located within the total catchment of the SPZ (Zone 3). Zone 1 of the SPZ is recorded approximately 200m north-west of the site. Groundwater vulnerability is classed as intermediate to high.

2.4.5 It is anticipated that a ground condition assessment including some ground investigation would be available to inform future technical studies, subject to the onward planning and development strategy for the site. These will inform the proposed surface water drainage strategy (i.e. suitability of infiltration drainage), discussed further in Section 5.

2.5 Existing Site Drainage

2.5.1 The site is predominantly greenfield and it is therefore understood that surface water run-off drains to the field drains and watercourses within and adjacent to the site and infiltrates into the ground where conditions allow.
3 Assesment of Flooding

3.1 Fluvial Flooding

3.1.1 The online EA Flood Map for Planning (Rivers and Sea) indicates the site is located almost entirely within Flood Zone 1. This is land assessed as having a lower than 1 in 1,000 (0.1%) annual probability of river flooding.

3.1.2 A small area associated with the watercourse corridor of the channel at the south-east of the site is shown to be located in Flood Zones 2 and 3. Flood Zone 2 is land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding and Flood Zone 3 is land assessed as having a 1 in 100 or greater annual probability of river flooding.

3.1.3 An extract of the EA online flood map is provided in Figure 3.1.

Figure 3.1. Extract of EA Online Flood Map for Planning (Rivers and Sea). 09/05/2016.

3.2 Reservoir Flooding

3.2.1 The online EA Flood Map for Risk of Flooding from Reservoirs indicates that the site is not at risk from a reservoir breach.

3.3 Surface Water Flooding

3.3.1 The online EA Flood Map for Risk of Flooding from Surface Water (Figure 3.2) indicates that the site predominantly lies in an area at 'Very Low' risk of flooding from surface water. The map does show that several areas across the site are classified as 'High Risk.'
3.3.2 ‘High Risk’ areas generally coincide with existing field drains and watercourses across the site and are associated with the natural overland flow routes and drainage channels.

3.3.3 The Uttlesford Strategic Flood Risk Assessment (SFRA) (JBA Consulting, January 2016) identifies potential new settlement areas in the Uttlesford District, which includes this potential development site. The summary sheet states that surface water flood risk at the site follows ‘flow paths defined by topography and existing watercourses’ with ‘no areas of ponding.’

3.4 Groundwater Flooding

3.4.1 The Uttlesford SFRA states that ‘the north of Uttlesford is underlain by a chalk aquifer; however, due to the actual depth (20 to 50m) of the water table compared to the ground surface and the clay till that overlays the underlying chalk, the risk from groundwater flooding is low.’

3.4.2 The baseline ground conditions assessment (PBA, May 2016), confirms that BGS borehole records at the site indicate resting groundwater levels at 31.7-41.5m AOD.

3.4.3 Map 9 of the SFRA indicates the western area of site has lower than 25% susceptibility to groundwater flooding. The remainder of the site remains unaffected.

3.5 Sewer Flooding

3.5.1 Map 10 of the SFRA confirms there have been no recorded incidents of flooding attributable to surcharging sewers within the vicinity of the site.
4 Flood Mitigation

4.1 Principles for Flood Mitigation

4.1.1 Local policy documents set out ways for new developments to reduce flood risk both within the development site and across the district.

4.1.2 The Uttlesford SFRA states ‘Where developers are riparian owners, they should also assess existing assets (e.g. bridges, culverts, river walls, embankments) and renew them to last the lifetime of the development. Enhancement opportunities should be sought when renewing assets. Any works should be designed to be maintenance free, but there is an obligation to the riparian owner to undertake maintenance when required.’

4.1.3 ‘Major development offers a unique opportunity to reduce the level of flood risk, both to the development area, and also to existing communities downstream. Changes to legislation mean that it is now much easier for developers to contribute towards the cost of flood risk management infrastructure.

Developers can be asked to make direct contributions to fund improvements to flood risk infrastructure for communities flood to developments, for example:

- If a Section 19 Flood Investigation Report which recommends the improvement or installation of flood defence infrastructure has been completed in the community.

- If it has been shown that the proposed development would increase flood risk form the affected sewers, ordinary watercourse and surface water drainage on the site and/or place undue strains on the existing flood risk management infrastructure on site.

- If the site is in an area at risk from surface water flooding identifies on the Environment Agency’s uFMSW (Surface Water Flood Map).

4.1.4 Policy GEN3 of the Uttlesford Local Plan – 2005 states ‘Within areas of flood risk, within the development limit, development will normally be permitted where the conclusions of a flood risk assessment demonstrate an adequate standard of flood protection and there is no increased risk of flooding elsewhere. Outside flood risk areas development must not increase the risk of flooding through surface water run-off. A flood risk assessment will be required to demonstrate this. Sustainable Drainage Systems should also be considered as an appropriate flood mitigation measure in the first instance.’
5 Surface Water Management

5.1 Existing Surface Water Regime

Drainage Regime

5.1.1 The site is predominantly greenfield but also comprises the buildings and structures associated with Park Farm, Dell’s Farm and Field Farm Cottages.

5.1.2 At this stage it is unknown if the site is served by any formal drainage infrastructure, and given the greenfield nature of the site it is anticipated that the site currently drains by overland flow to the field drains and watercourses within the site, or by infiltration to the ground where conditions allow.

5.1.3 An assessment of the likely overland flow routes and outfall locations has been completed. This assessment has been undertaken based on freely available LiDAR data made available by the EA. The data has a 2m resolution. Figure 5.1 summarises the overland flow routes within the site and confirms the following:

- The site is split into three broad catchments.
- The majority of the site drains to the watercourse at the south-eastern site boundary which flows under the B184 towards Great Chesterford.
- An area to the north west of the site drains towards the A11. It is believed there is a culvert beneath the A11 that takes flows in a westerly direction towards the River Cam. This assumption needs to be confirmed through site observations.
- A small area at the north-western corner drains in a north-westerly direction towards the A11. At this stage it is currently unknown whether there is a formal outfall at this location and further site investigation is required to determine the ultimate point of outfall.
Infiltration Potential

5.1.4 BGS mapping and Soilscape mapping indicates that the northern and central parts of the site are underlain by loamy, clayey soils with impeded drainage. Western and southern areas of the site are underlain by freely draining soils.

5.1.5 The PBA Baseline Ground Conditions Assessment (May 2016) confirms:

- There is potential for shallow infiltration drainage across parts of the Site directly underlain by the Chalk bedrock. However, New Pit Chalk Formation is recorded as containing numerous seams of marl, which may be unsuitable for infiltration drainage. Further assessment would be required to verify the Site’s suitability, both in respect of infiltration rates and risk posed by potential dissolution feature occurrence.

- The feasibility of soakage infiltration (notwithstanding ground stability considerations/controls) should be investigated through both BRE 365 tests in trial pits and through deeper borehole tests.

5.1.6 The lack of drainage features in the north western part of the site suggest this small catchment may be drainage directly into the ground, however the surface water flood map in Figure 3.2 suggests medium risk of flooding in this area hence infiltration potential may be limited.

5.1.7 Should infiltration prove to be feasible, the EA may have additional requirements for the surface water management strategy to incorporate additional water quality measures due to
the site’s location on a principal aquifer. As a precaution at this stage, we have taken a conservative approach for the surface water management strategy and assumed there is no infiltration at the site.

Existing Surface Water Runoff Rates

5.1.8 For the purposes of this assessment the site has been considered as 100% greenfield. Greenfield runoff rates were estimated for the site using the WinDes Rural Runoff Calculator (a copy of the calculations is provided in Appendix B) as follows:

- QBAR = 2.6 l/s/ha
- Q100 = 9.3 l/s/ha

5.2 Potential Impact of Proposed Development

5.2.1 The proposed development will increase the impermeable surfacing within the site which unmitigated could affect flows in the receiving systems and therefore increase flood risk elsewhere.

5.3 Principles for Surface Water Management Strategy

5.3.1 The Uttlesford SFRA considers the development site as a potential new settlement and appraises the suitability of SuDS at the site. The SFRA states ‘Most SuDS techniques should be suitable here as an integrated part of a large new settlement. Slope and soil permeability will vary locally across the area, with more freely draining soils located in the west of the area.’

5.3.2 The Uttlesford District Water Cycle Study – Stage 2: Detailed Strategy (Hyder Consulting, November 2012) states ‘developers should consult the EA to ensure that any SuDS design takes account of any Source Protection Zone and other areas where aquifers may be vulnerable, and ensure that the risk of pollution is adequately controlled.’

5.3.3 As Lead Local Flood Authority (LLFA), Essex County Council has developed their own Sustainable Drainage Systems Design Guide (December 2014) that sets out the design criteria for SuDS in new development sites within the county. The guide sets out 11 local principles for SuDS:

- Plan for SuDS
- Integrate with public spaces
- Manage rainfall at the source
- Manage rainfall at the surface
- Mimic natural drainage
- Design for water scarcity
- Enhance biodiversity
- Link to wider landscape
- Design to be maintainable
5.3.4 The Essex SuDS Design Guide also sets out stringent local design standards for water quantity and water quality that must be followed for all developments in Uttlesford District. The local standards are as follows:

- **SuDS should be designed so that runoff does not occur for the first 5mm of any rainfall event for 80% of summer events and 50% of winter events.**
- **In all cases, including on brownfield sites, runoff should where possible be restricted to the greenfield 1 in 1 year runoff rate during all events up to and including the 1 in 100 year rainfall event with climate change. If it is deemed that this is not achievable, evidence must be provided and developers should still seek to achieve no increase in runoff from greenfield sites and a 50% betterment of existing run off rates on brownfield sites (provided this does not result in a runoff rate less than greenfield).**
- **For rainfall events with a return period up to and including the 1 in 100 year rainfall event with an allowance for climate change SuDS should be sized to contain all surface water volumes.**
- **Safe conveyance routes and overflow flood storage areas must be established and agreed with the SuDS Team for the 1 in 100 year rainfall event with 30% allowance for climate change before adoption.**
- **An appropriate ‘train’ of SuDS components must be installed to reduce the risk of pollutants entering watercourses via runoff from developed sites. Following the SuDS Management Train hierarchy a series of drainage techniques should be designed into the development layout. The design should achieve a system where pollution is incrementally reduced at each stage.**

5.4 Proposed Strategy

### Storage Requirements

5.4.1 WinDes Quick Storage Estimates (QSE) have been produced to provide an indication of the volume of storage that would be required on site to provide the necessary attenuation for rainfall events up to the 1% annual probability (1 in 100 year) event plus an additional allowance of 40% on rainfall intensity to account for the potential impacts of climate change. The following parameters have been used:

- **Limiting discharging rates** – based on Q (1 year) discharge rates for the whole site
- **FEH rainfall data and Cv of 0.85 used**
- **Assumed 65% of the total developed area to comprise impermeable surfacing. (If a less dense development is taken forward or if there are significant areas that are not developed then both the impermeable area and storage requirement will reduce).**
- **Due to varying ground conditions across the site, and in the absence of further detailed information, for the purposes of this assessment it has been assumed that infiltration is negligible and all surface water runoff will discharge via a positive outfall. This represents a worst case scenario and if at a later stage following ground**
investigation infiltration drainage proves to be feasible, the storage requirements will likely be reduced.

5.4.2 The site has been divided into 3 sub-catchments (A-C) based on the general topographic data. Once an indicative masterplan is available the sub-catchments would be based around the proposed development layout.

5.4.3 An allowance for the potential climate change impacts has been made in this preliminary assessment. This uses the uplift of 40% peak increase in rainfall (2060-2115) which is based on the latest Environment Agency Flood Risk Assessments: Climate Change Allowances (February 2016).

5.4.4 The surface water storage requirements for each area of the site are detailed in Table 5.1.

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Area (ha)</th>
<th>Impermeable Area (ha) (Assuming 65% impermeable surfacing)</th>
<th>Allowable Discharge (l/s) based on Q(1yr) 2.3/l/ha</th>
<th>Storage Requirement 1 in 100yr + 40% CC (m³)</th>
<th>Required Pond Plan Area per Impermeable Area (ha/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>38.8</td>
<td>25.2</td>
<td>58</td>
<td>24,400</td>
<td>0.18</td>
</tr>
<tr>
<td>B</td>
<td>93.4</td>
<td>60.7</td>
<td>139.6</td>
<td>58,800</td>
<td>0.18</td>
</tr>
<tr>
<td>C</td>
<td>333.9</td>
<td>217</td>
<td>499.2</td>
<td>210,000</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Table 5.1. Surface Water Storage Requirements

**Location and Sizing of Attenuation Features**

5.4.5 At this stage it is anticipated that attenuation basins are likely to provide a suitable solution for managing surface water runoff as part of any development of the site.

5.4.6 The maximum stored water depth to achieve a gravity outfall will need to be confirmed at a later stage once full survey data is available.

5.4.7 The Essex County Council SuDS guide and Anglian Water SuDS guidance states attenuation ponds should have a maximum water depth of 0.6m and side slopes of 1 in 3.

5.4.8 Due to the steeply sloping nature of the site, the land take of any strategic attenuation features is likely to be significant. The size of the proposed SuDS features will be affected by any groundworks that may take place as part of the development proposals.

5.4.9 Figure 5.2 indicates the possible land take for strategic SuDS features. This assessment has been completed on a catchment basis using the catchments indicated in Figure 5.1. It should be noted that this assessment provides an extremely conservative estimate of potential SuDS requirements and assumes the whole of the site would be developed. The parameters for this assessment are as follows;

- Assumed ground slopes across the width of the pond of 1 in 50. This assumes some ground works are undertaken as existing slopes in the proposed pond locations are approximately 1 in 20, and steeper in some locations.

- Assumed ground slope across the length of the pond as flat. This assumes the ponds are constructed along existing contours.
5.4.10 The SuDS corridors shown on Figure 5.2 could potentially offer further storage within the development areas and reduce the required size of the strategic SuDS features.

5.4.11 The land take may increase/decrease depending on side slopes, water depth, a review of detailed topography in the area and the final form/shape which may be more accommodating of existing topography. This initial assessment has not taken into account the existing vegetation in this area, any existing buried utilities or other constraints to excavation or any environmental constraints.

5.4.12 If large strategic SuDS features are proposed as part of the final development it should be noted that these features may become classed as reservoirs. The Reservoirs Act has onerous requirements to ensure features retaining large volumes of water are safe and well maintained.

5.4.13 We are aware of flooding downstream of the site, and therefore to provide wider betterment in the local area, SuDS features could be oversized to retain run-off in the upstream catchment during exceedance events.
6 Summary and Further Work

6.1.1 A preliminary assessment of the potential flood risk and surface water management constraints has been completed for the proposed residential development north of Great Chesterford.

6.1.2 The key issues / constraints identified in this preliminary review based on available information are presented in sections 5.2 and 5.3.

6.1.3 In summary, there is limited fluvial flooding within the site and any localised flooding is likely to be restricted to the watercourse corridors. Surface water flooding may also be an issue along the watercourse corridors. No flooding from any other sources is likely to affect the site. Appropriate surface water management measures within a SuDS based strategy will be required to support any development of the site and, given the sloping nature of the site, the land take for these features may be greater than other sites, depending on the location and form of the SuDS features employed.

6.2 Further Work

6.2.1 Further work likely to be required to support the masterplanning process and to support a planning application include:

- Ground Investigation to confirm ground conditions, geotechnical constraints and suitability for infiltration drainage.
- Topographical survey of the site and watercourses including key structures.
- Liaison with the Environment Agency, Lead Local Flood Authority (Essex CC) and Local Planning Authority to:
  - Identify all sources of flood risk at the site
  - Confirm hydraulic modelling methodology (if necessary)
  - Confirm the principles for the surface water management strategy
- Once a masterplan and proposed plot levels are confirmed, the proposed surface water drainage strategy can be developed to include 3D modelling of ponds.
- Preparation of appropriate technical reports to support the planning application.
Appendix A  Site Location Plan
Appendix B  Surface Water Calculations
ICP SUDS Mean Annual Flood

**Input**

<table>
<thead>
<tr>
<th>Return Period (years)</th>
<th>Soil</th>
<th>Area (ha)</th>
<th>Urban</th>
<th>SAAR (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>1.000</td>
<td>0.000</td>
<td>556</td>
</tr>
</tbody>
</table>

**Region Number** Region 5

**Results  l/s**

- QBAR Rural 2.6
- QBAR Urban 2.6

Q1 year 2.3
Q1 year 2.3
Q30 years 6.2
Q100 years 9.3
36997 North Uttlesford Garden Village

Appendix B – Surface Water Management Calculations

RP 13/05/16

Catchment A

Catchment B

Catchment C