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MB608-67/ACJ/HB

For the attention of:
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FLOOD RISK ASSESSMENT
For
LAND OFF BARFORD ROAD,
BLOXHAM

This report was carried out in accordance with JPB Quality Management procedures.

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Practical Solutions to Technical Problems

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1.0 INTRODUCTION

1.1 Further to instructions received on 31 January 2012 from Gladman Developments Limited (GDL), Johnson Poole & Bloomer Limited (JPB) is pleased to present a Flood Risk Assessment (FRA) for the proposed residential development site located on land off Barford Road, Bloxham. The study location, boundaries and existing site layout are shown on JPB Drawings MB608/01 and MB608/02.

1.2 This report has been written for GDL, for submission as part of an Outline Planning Application to Cherwell District Council (CDC). The planning application is for a residential development on a 'greenfield' site, occupying an approximate area of 2.65ha. It is currently proposed that up to 75 dwellings will be constructed at the site.

1.3 The site has been considered under Planning Policy Statement 25: Development and Flood Risk (PPS 25) and the Technical Guidance to the National Planning Policy Framework, which sets out the Government's national policy on Development and Flood Risk. The flood risk policies are applied by regional planning bodies in the preparation of Regional Spatial Strategies; by local planning authorities in the preparation of local development documents and in making decisions on individual planning applications. As the proposed development area is greater than 1 hectare (ha) in size and has the potential to increase flood risk elsewhere through the addition of hard surfaces, a Flood Risk Assessment (FRA) for the site is required. This need only be brief unless local considerations require particular attention.

1.4 JPB has also previously prepared a Phase 1 Desk Study for the site referenced MB608-10/ACJ/HB and dated 16 February 2012. Information from this report (including a GroundSure EnviroInsight and GeoInsight Report) has been used in the preparation of the FRA and a list of information consulted is provided in Appendix A. An Envirocheck Flood Screening Report has been purchased as part of the FRA (dated 1 February 2012 and referenced 37446371_1_1) and a full copy is presented in Appendix B.

1.5 This report and related documents have been prepared for the sole use of the specified client in response to an agreed brief, for a stated purpose and at a particular time and its application must be made accordingly. No duty of care extends to any other party who may make use of the information contained therein. The information discussed in Section 10.0 – General of this report should be consulted and noted.

2.0 SITE SETTING

2.1 Site Description

2.1.1 The 'greenfield' site occupies 2.65ha and is located in the outskirts of the village of Bloxham, approximately 6km southwest of the town of Banbury, Oxfordshire, at approximate National Grid Reference SP 431 350, as shown on JPB Drawing MB608/01. The area being considered for redevelopment comprises a generally triangular shaped plot of land in plan view, which is bound by established hedgerows and trees, with long grasses, sedges, brambles etc at their base. Barford Road trends along the curved south-western site boundary.

2.1.2 The site generally slopes down to the north-eastern site corner towards two existing ponds, one of which is located on site, whilst the other is sited immediately beyond the field boundary line, as shown on JPB Drawing MB608/02. The site slopes down from 125.5m Above Ordnance Datum (AOD) along the south-western site boundary to 117.8m AOD in the northeast of the site. The contours of the site, and the 'greenfield' runoff routes, are shown on JPB Drawings MB608/02 and MB608/03.

2.1.3 At the time of the first site visit in February 2012, the ponds were frozen and the water level was noted to be low. However, rushes were identified around the on site pond, indicating that it is likely to be wet all year round. Frozen ponded water was noted to be present across the surface of the grass, within a hollow in the north of the site. Two routes of water appeared to drain down towards the on site pond across the grasses. The off site pond also appeared to accept 'greenfield' runoff from the adjacent field, to the east of the site, as shown on JPB Drawing MB608/02. Subsequent site visits made in March and May indicated some areas of the hollow, in the north of the site, to be slightly waterlogged, following prolonged periods of heavy rainfall.

2.1.4 A third pond was noted to be located immediately southeast of the site. The south-eastern corner of the site appeared to promote 'greenfield' runoff from a localised area towards this pond. A ditch also trended along the far side of the curved south-western site boundary, which appeared to accept runoff from Barford Road. The ditch appeared to discharge storm water runoff to the pond immediately southeast of the site. This pond and the ditch were noted to be dry at the time of the time of the February 2012 site visit. However, the pond was noted to contain water during the May 2012 site visit.

2.1.5 The land to the north of the site had recently been developed for residential housing and was noted to be approximately 0.5m to 1m higher than the site, with the difference in height accounted for by a graded vegetated soil embankment. The open land to the immediate east of the site was at a similar height to the subject site although a soil bund (approximately 1m) was noted along the southern half of the eastern site boundary. Established residential housing was located on the far side Barford Road, which marked the summit of the hill. A residential garden, associated with the off site property, 'St Christopher's Lodge', was located immediately beyond the north-western corner of the site, with the lawn sloping down gently towards the site.

2.2 Site History

2.2.1 The first available CS plan for the site is dated 1881 at 1:2,500 scale. The site is shown to have been part of a wider area of farmland, with an unnamed road trending northwest to southeast along the curved south-western site boundary. This is located along the route of the existing Barford Road. The northern, eastern and southern site boundaries are shown to have been tree lined and a field boundary is shown to have trended diagonally, from northeast to southwest, through the centre of the site. The field boundary is shown to have been linked to a pond located on site in the northeast corner and a ditch or land drain may have been present along its length to drain the field to the pond. The pond is shown to be in the same location as the present day pond. The ponds immediately northeast and southeast of the site are also mapped from the late 1800s onwards.

2.2.2 The road located immediately beyond the curved south-western site boundary is annotated as 'Barford Road' for the first time, on the 1971 OS plan at 1:2,500 scale, and the field boundaries in the north-western corner are also shown as present day, separating the site from the existing off site dwelling 'St Christopher's Lodge'. The diagonal field boundary and possible land drain / ditch are no longer shown from this time onwards. No further significant changes are noted on site.

2.3 Geology

2.3.1 Made Ground (artificial) deposits are not mapped across the site by the British Geological Survey (BGS). However, a limited thickness of Made Ground, most likely comprising reworked natural materials, is anticipated across the site as a result of agricultural activities on site. There is also potential for relatively inert construction materials, i.e. brick and concrete, to be present along the site's boundaries as a result of the development of the roads and adjacent, largely residential, developments. The on site pond and potential land drain / ditch, trending diagonally through the site, during the late 1800s and early 1900s, may be associated with localised peat deposits. Waterlogged areas were also noted within a central hollow draining down towards the on site pond to the northeast and may also be associated with organic peat-like deposits.

2.3.2 Information published by the BGS on Sheet 218 (solid and drift) indicates natural superficial deposits to be absent across the site and the wider surrounding area. The solid geology present at the surface, beneath any limited Made Ground deposits, is indicated as Jurassic aged Whitby Mudstone Formation, which is between 10m to 50m thick and comprises medium and dark grey fossiliferous mudstone and siltstone, with thin siltstone or silty mudstone beds. The Whitby Mudstone Formation is underlain by the Marlstone Rock Formation, also Jurassic in age, which comprises ferruginous limestone and ironstone. The Marlstone Rock Formation is also shown by the BGS to marginally extend within the site boundaries in the northeast corner of the site. However, recent ground investigations have confirmed this to not be the case. The Marlstone Rock Formation is indicated to be near horizontal.

2.3.3 The permeability of the on site Whitby Mudstone Formation is indicated to be low, by the BGS, in the GroundSure Report, with groundwater movement likely to be through fracture flow. However, the Marlstone Rock Formation has a moderate to high permeability with groundwater movement likely to be through a combination of intergranular and fracture flow.

2.3.4 The site was noted to predominantly drain down towards the northeast corner of the site, where the Marlstone Rock Formation outcrops at the surface (beneath any limited Made Ground deposits) either partially on site or immediately beyond the site boundary.

2.3.5 Intrusive investigations have been undertaken on site by JPB, in March and May 2012, in order to determine the geology and confirm the permeability of both the Whitby Mudstone Formation and underlying Marlstone Rock Formation. These works are described in detail in the JPB letter report dated 6 June 2012 and referenced MB608-58/ACJ/HB/JC, which is presented in Appendix J.

2.3.6 In summary, the ground investigation works proved the Whitby Mudstone Formation to be approximately 6.3m thick in the northeast of the site and 9.3m thick in the southwest of the site, with a very low permeability. The limestone's of the underlying Marlstone Rock Formation were found to be a confined aquifer with sub-artesian groundwater in the, lower topographical, northeast corner of the site. Therefore, neither the mudstone or limestone formations were deemed to be suitable for traditional or deep bore soakaways, for the disposal of storm waters from the proposed development.

2.4 Hydrogeology

2.4.1 The Environment Agency's (EA) groundwater vulnerability map, Sheet 30, and their web site, indicate that the classification of the aquifers at the site and its environs are as follows:

Table 2.1 Aquifer and Leachability Classification

Inferred Strata	Aquifer	Overlying Soil Leachability
Whitby Mudstone Formation	Unproductive [(1)]	Not Classified
Marlstone Rock Formation	Secondary A [(2)]	-

[(1)] **Unproductive Strata** - rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.
[(2)] **Secondary A Aquifer** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

2.4.2 The site is not located within or in the vicinity of a groundwater Source Protection Zone (SPZ) and there are no potable or non-potable groundwater abstractions within a 1km radius of the site. Groundwaters are considered to be of **low to moderate sensitivity**.

2.5 Hydrology

2.5.1 The nearest surface water features, identified during the Phase 1 researches are summarised in Table 2.2, together with their distance and bearing from the study area and their flow direction.

Table 2.2: Location of Surface Water Features

Surface Water Feature	Distance and Bearing from Site	Flow Direction
Ponds	On site, 1m and 3m east	n/a
Bloxham Brook	590m north	west to east
Culverted watercourses discharging to the Bloxham Brook	720m & 785 north	northwest to southeast
Tributary of the Bloxham Brook and land drains	878m northwest	west to east southwest to northeast
Tributary of the Bloxham Brook	910m east	south to north

2.5.2 The Bloxham Brook is classified by the EA as a 'main river' and is a tributary of the Sor Brook, which ultimately discharges to the River Ray. A review of the Thames Catchment Flood Management Plan indicates Bloxham to be located in the 'Upper Thames' catchment, which is classified as being in an area of low to moderate flood risk, where the EA take action, with others, to store water or manage run off in locations that provide overall flood risk reduction to rivers or environmental benefits.

2.5.3 Under the Water Framework Directive (WFD), the Bloxham Brook is classified as having a moderate ecological quality and does not require assessment, under the WFD, for its chemical quality. Surface waters in the proximity of the site are considered to be of **moderate to high sensitivity**.

2.6 Contamination

2.6.1 A historic review of the study area and the development of a Conceptual Site Model during the previous Phase 1 researches has not highlighted any significant potentially contaminative land uses to have occurred within the site's boundaries.

2.7 Existing Site Drainage

2.7.1 The Commercial Drainage and Water Enquiry with Thames Water Utilities Limited (TWUL) has confirmed that the site does not currently connect to the TWUL public sewers for either surface waters or foul waters. Consultation of the TWUL plans, presented in Appendix C, indicates that there are no TWUL public sewers within the boundaries of the site. However, both TWUL foul and surface water public sewers are present in Barford Road.

2.7.2 The greenfield runoff from the site has been calculated in order to determine the existing discharges to the ponds identified on and adjacent to the site. JPB Drawing MB608/03 indicates the existing surface water flow pathways across the site.

2.7.3 The existing greenfield runoff rates have been calculated using QBAR(rural) as detailed in R&D Technical Report W5-074/A Preliminary Rainfall Runoff Management for Developments (Revision D).

$$QBAR_{rural} = 0.00108\ AREA^{0.89}\ SAAR^{1.17}\ SPR^{2.17}$$

2.7.4 The runoff for different return periods has been calculated by applying the appropriate regional growth factor. For the southeast region (Region 6) these factors are as shown in Table 2.3.

Table 2.3: Growth Curve Factors for Region 6 (FSSR 14)

Return Period (years)	1	2	5	30	100
Growth Factor	0.85	1.00	1.28	2.23	3.15

2.7.5 Table 2.4 below indicates the runoff rates for the above return periods, using the given soil class (SOIL), SAAR and AREA input values. The soil class has been selected to reflect the presence of the low permeability strata at the surface of the site. The calculation sheets are provided in Appendix D.

Table 2.4: Estimated Greenfield Runoff from Fields

INPUT PARAMETERS					
SOIL CLASS	**SAAR (mm/year)**			**AREA (ha)**	
0.4 (Class 3)	710			2.65	
GREENFIELD RUNOFF	**RETURN PERIODS (YEARS)**				
Units	**1**	**2**	**5**	**30**	**100**
l/s	7.79	9.17	11.73	20.44	28.88
l/s/ha	2.94	3.46	4.43	7.71	10.90

2.7.6 This method was designed to calculate runoff rates for ‘small’ catchments, which were still greater than 50ha. Therefore, for development sites that are smaller than 50ha, it is necessary to carry out the calculations using an area of 50ha and then scale the results down by linear interpolation, to provide the reported runoff values.

3.0 SITE DEVELOPMENT PROPOSALS & THE SEQUENTIAL / EXCEPTION TESTS

Site Development Proposals

3.1 The study area comprises undeveloped agricultural land, occupying an area of 2.65ha, as shown on JPB Drawing MB608/02. The proposed residential development will occupy this entire area, with up to 75 residential dwellings and 0.22ha proposed for public open space in the northeast of the site. The properties will comprise a combination of detached and linked dwellings fronting onto Barford Road together with internal courtyards and areas of public open space. No basement structures are proposed as part of the development and front and rear gardens will be provided, together with driveways and garages for vehicle parking.

3.2 The hedgerows and trees along the site boundaries will be retained, together with the existing on site pond. Further ponds will be created within the area of public open space, in the northeast of the site, which will provide additional biodiversity and habitat creation.

3.3 The proposed development layout is shown on the FPCR Illustrative Masterplan and JPB Drawing MB608/08.

Sequential Test

3.4 PPS 25 and the Technical Guidance to the National Planning Policy Framework steers new development to areas of the lowest probability of flooding i.e. Flood Zone 1. However, development is permitted in Flood Zones 2 and 3 where the Sequential Test and Exception Tests are passed and there are no reasonably available sites in Flood Zone 1 that are more suitable. The EA flood map indicates the proposed development to lie completely within Flood Zone 1 and the proposed residential development is considered to be compliant with the principles of PPS25. It is not necessary to apply the Exception Test for this site. A copy of the EA Flood Map is included as part of the Flood Screening Report in Appendix B.

3.5 For Flood Zone 1, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems. Sustainable drainage systems cover the whole range of sustainable approaches to surface drainage management, designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible.

4.0 OPERATING AUTHORITIES

4.1 Environment Agency

4.1.1 The EA has wide ranging responsibilities which include the management of water courses, control of pollution and flood defence. The Environment Agency has general flood defence and land drainage powers, including a supervisory duty over all flooding. They are responsible for advising the local authorities on planning conditions relating to volumes and rates of runoff. It is therefore essential that the EA is consulted throughout the design process.

4.1.2 A pre planning enquiry has been made with the EA during the preparation of this Flood Risk Assessment (FRA). A copy of the correspondence received from the EA is provided in Appendix E. In summary, the EA have confirmed the following points and require the issues raised to be addressed by the FRA:

- The EA Flood Zone Maps indicate the site to lie outside of Flood Zones 2 and 3 and a FRA, in terms of fluvial flood risk, is not considered necessary. However, a site of this site will generate significant volumes of surface water and an FRA is therefore necessary.
- The FRA should consider all forms of flood risk, including existing overland flooding issues;
- The applicant must demonstrate through their surface water drainage scheme that the proposed development will not create an increased risk of flooding from surface water. The scheme should be carried out in accordance with PPS25 and its associated practice guidance, giving preference to infiltration over discharge to a watercourse, which is in turn preferable to discharge to a surface water sewer;
- Infiltration rates should be worked out in accordance with BRE365:Soakaway Design. If it is not feasible to access the site to carry out soakage tests before planning approval is granted, a desktop study may be undertaken looking at the underlying geology of the area and assuming a worst-case infiltration rate for that site. If infiltration methods are likely to be ineffective then discharge may be appropriate. In any case, the surface water scheme should clearly show that:
  - *peak discharge rates from the site will not increase as a result of the proposed development, across a range of storm events, up to and including the 1 in 100 year storm with a suitable allowance for climate change (the deign storm event);*
  - *discharge volumes from the site will not increase as a result of the proposed development, across a range of storm events, up to and including the design storm event;*
  - *the site will not flood from surface water ,up to and including the design storm event, or any surface water flooding beyond the 1 in 30 year storm event, up to and including the design storm event can be safely contained on site;*
  - *the likely flood flow routes and impact of a storm that exceeds the capacity of the system has been considered;*
  - *the future management and/or adoption of the system has been fully explored;*
- The Institute of Hydrology Report 124 ‘Flood estimation for small catchments’ should be used to determine peak greenfield runoff rates, in accordance with the CIRIA ‘Interim Code of Practice for Sustainable Drainage Systems’.

- Any surface water drainage scheme should utilise sustainable drainage technique, offering ecological, water quality and amenity benefits, wherever possible, in accordance with the SuDS Management Train (CIRIA C609) and the SuDS Manual (CIRIA C697);
- Above ground storage devices, such as ponds, should be favoured over underground storage in tanks. Open swales or ditches should used instead of pipes, wherever possible.

4.2 Cherwell District Council

4.2.1 Cherwell District Council (CDC) is the local planning authority for the area and is responsible for the preparation and development of local plans and controlling development within the area. CDC will be consulted throughout the design process for the proposed development to ensure that the proposals do not conflict with any existing or proposed developments in terms of flooding and drainage.

4.2.2 It is understood from correspondence with Oxfordshire County Council (OCC) that CDC had previously been the Land Drainage Authority for the area, although these responsibilities have now been taken over by OCC, as discussed in more detail below. However, informal enquiries have been made with the previous Drainage Engineer at CDC as to whether any records of surface water flooding were known in the vicinity of the site. A copy of this correspondence is provided in Appendix F.

4.3 Oxfordshire County Council

4.3.1 Oxfordshire County Council (OCC) has become the lead Flood Authority for the area as a result of the implementation of the Flood and Water Management Act 2010 in April 2011. As such, their responsibilities and duties are to promote 'Sustainable Drainage Systems' (SuDS) on all developments, adopt all SUDs which drain two properties and above from October 2012, investigate significant flooding in Oxfordshire, designate flooding structures in Oxfordshire, maintain a public register of adopted SUDs, maintain a public register of designated flood structures noticed by the County Council, as well as the District Council and Environment Agency, consent to the piping of watercourses from April 2012, and carry out enforcement concerning watercourses from April 2012.

4.3.2 A Preliminary Flood Risk Assessment (PFRA) has been carried out by others on behalf of Oxfordshire County Council, dated June 2011. The information contained in the PFRA report has been consulted and noted, with particular reference to surface water flooding issues from the 2007 floods.

4.3.3 JPB has corresponded with OCC's Senior Engineer (Drainage) as part of this assessment to determine any specific flooding issues at or immediately surrounding the site. A copy of this correspondence is provided in Appendix F.

4.4 Thames Water Utilities Limited

4.4.1 Thames Water Utilities Limited (TWUL) is the local sewerage undertaker responsible for all the public foul and surface water infrastructure in the area. TWUL has been consulted by the Client and will continue to be informed throughout the design process regarding existing capacities, as well as any proposed connections to them. A copy of the correspondence with TWUL is provided in Appendix G. In summary, TWUL has made the following comments:

- Foul flows emanating from the site would be allowed to discharge into the 150mm foul public sewer located in Barford Road, with a connection made at manhole MH003.
- A connection consent application should be sent in due course.
- Surface waters from the site could be discharged to the surface water public sewer located in Barford Road at 'greenfield' runoff rates.
- A combined pumping station would be required for both the foul and surface waters sewers on site due to the topography of the site and this would be adoptable by TWUL.

5.0 FLOOD RISKS

5.1 Identified Potential Flood Risks

5.1.1 The following table summarises a number of key factors that should be considered for all new developments. Where a risk of flooding is identified further assessment of the hazard and risk is required and this is provided in Sections 5.2 to 5.7 of this report.

Table 5.1: Potential Flood Risk Summary

Question ✓ = Yes ✗ = No ? = Possible	Flood Hazard						
	Fluvial	Sea	Estuaries	Groundwater	Overland Flow	Artificial Drainage Systems	Infrastructure Failure
Is the development next to the sea or any watercourse shown on Ordnance Survey maps?	✗	✗	✗				
Is the development site, or part of the development site, identified as being at risk of flooding within available documentation?	✗	✗	✗	?	?	✗	✗
If a strategic flood risk assessment is available, is the development site, or part of the development site, identified as being at risk of flooding?	✗	✗	✗	✗	✓	✗	✗
If a flood zone map is available, is the development, or part of the development site, within a High Risk zone?	✗	✗	✗				
If a flood zone map is available, is the development, or part of the development site, within a Medium Risk zone?	✗	✗	✗				
If a flood zone map is not available, is the development site, or part of the development site, situated on alluvium based on consideration of geological maps of the area?	✗	✗	✗				
If there is an existing property on, or next to the site at the same level, is the property within a flood warning area?	✗	✗	✗	✗			
Are LPA/FDA aware of any existing, historical or potential flooding problems that may affect the site?	✗	✗	✗	✗	✓	✗	✗
Do the physical characteristics of the site suggest that it may be prone to flooding?	✗	✗	✗	?	✓	✗	✗
If a flood zone map is not available, is the development site below 10mAOD and does the FDA consider the development to be at risk from tidal flooding?		✗	✗				
Is the development located within a natural or artificial hollow, or at the base of a valley or at the bottom of a hillslope?				✓	✓		
Does examination of historical maps indicate any likelihood of flood risk at the site?	✗	✗	✗	✗	✗		
Do the names of surrounding roads, areas or houses suggest the possibility of seasonal or historical flooding?	✗	✗	✗	✗	✗		
Is the site likely to involve excavation / construction below existing ground levels (excluding foundations)?				✗			
Is the land use upslope of the site such that the generation of overland flow may be encouraged, and can water from this area flow onto the site?					✓		
Are there any artificial drainage systems on or next to the site, at the same level, or upslope of, the site?						✓	✗
Is the development site protected by an existing flood defence?	✗	✗	✗			✗	✗
Is the development site protected by a control structure (e.g. flap valve, sluice gate, tidal barrier etc)?	✗	✗	✗			✗	✗
Is the development site located upstream of a culvert which may be prone to blockage?	✗		✗	✗	✗	✗	✗
Are water levels in a watercourse located in or next to a development site controlled by a pumping station?	✗	✗	✗	✗	✗	✗	✗
Is the development site next to or downstream/down slope of a canal?						✗	✗
Is the development site downstream/down slope of a reservoir or other significant water body?						✗	✗

(CIRIA C624 – Table A2.1 Level 1 FRA Summary)

5.1.2 The potential flood hazards identified in Table 5.1 are summarised in Table 5.2 below, together with whether the potential risk will affect the development site itself and/or potentially increase the flood risk upstream or downstream of the study area.

Table 5.2: Flood Risk to the Development and its Surroundings

Flood Hazard	Flood Risk to the Development?	Increased Flood Risk Upstream?	Increased Flood Risk Downstream?
Groundwater flooding	✓	✗	✗
Overland flooding (pluvial)	✓ (without surface water runoff management)	✗	✓ (without surface water runoff management)
Artificial Drainage Systems	✓	✗	✓

5.2 Fluvial Flooding

5.2.1 The EA's flood map (Appendix B) indicates the site to be located entirely within Flood Zone 1 and is therefore considered to be at **low risk** from fluvial flooding. There are no surface watercourses within a 500m radius of the site. The EA do not hold any historic flood records for the site or its immediate surroundings and a search of the Chronology of British Hydrological Events has found no results relating to the site.

5.3 Overland Flooding (pluvial)

5.3.1 Overland flooding (pluvial) generally refers to flood events caused by surface water runoff from short, very intense rainfall events, where the rainfall intensity exceeds the infiltration capacity of the ground, when the soil is so saturated that it cannot accept any more water or when the sewer network is surcharged.

5.3.2 The study area occupies 2.65ha of undeveloped greenfield land, which upon development will comprise up to 75 residential dwellings, with associated courtyards, roads, driveways and public open space. The 2.65ha will be apportioned as follows: 21% roofs (houses and garages), 31% roadways, courtyards, pavements and driveways and 48% private residential gardens and public open space. The increase in area occupied by hard surfaces will significantly increase the volume of surface water runoff generated within the study area, particularly given the topography of the site.

5.3.3 The existing surface water runoff routes are shown on JPB Drawing MB608/03. The existing topography of the site currently promotes the majority of the site's surface water runoff towards the northeast corner of the site. However, a small section of the site, in the southeast corner, currently promotes surface waters to the southeast, towards an off site pond.

5.3.4 The pluvial flood maps provided in the Flood Screening Report (Appendix B) indicate the site to lie outside of the 1 in 75 year, 1 in 100 year and 1 in 1000 year return periods. However, for the 1 in 1000 year return period, pluvial flooding is shown to extend within approximately 50m of the site's north-eastern corner. The site's topography currently promotes surface water runoff in this direction and the proposed development will also continue to channel surface waters towards the northeast.

5.3.5 Past surface water flooding maps, for the July 2007 floods, included within OCC's PFRA report, indicate the site and it's surrounding to be in an area where "6 to 10 properties were flooded internally by drainage or watercourses". There are no other surface water flooding events recorded for Bloxham in the PFRA other than those in 2007. In addition to this information, enquiries with both CDC and OCC have confirmed that there are no records specifically relating to the site with regard to overland flows and surface water runoff. Copies of the Local Authority responses are provided in Appendix F.

5.3.6 With regard to future surface water flooding events, the plans contained within OCC's PFRA report indicate that the site is not located in an area where surface water flooding is perceived to be a significant issue, in the future, for the modelled 1 in 200 year storm events.

5.3.7 Adequate surface water runoff control measures will need to be implemented for the proposed residential development area. The proposals will need to mitigate the potential increased flood risks to the off site agricultural land to the northeast and potentially the southeast, dependant upon final development levels. Sufficient attenuation storage volumes will be required on site to contain storm waters from the design storm, whilst also taking account of climate change. It will also be necessary to undertake some limited re-profiling of the site's surface to form a suitable development platform, which will enable the surface waters being generated from within the development boundary, to be managed and controlled by the new infrastructure and prevent overland flows off site, and within the site, to prevent localised flooding issues to the proposed residential dwellings.

5.3.8 The proposed surface water drainage system should be designed to manage storm events for a 1 in 100 year event with a factor of 30% allowed for climate change. Consideration should also be given to the design and layout of the development to ensure that the on site properties are sufficiently elevated from surface water flows during rare storm events that may exceed the design storm event. This further assessment should be carried out during the detailed drainage design.

5.4 Groundwater Flooding

5.4.1 Groundwater flooding may be a problem where developments are underlain by permeable rocks; for example chalk, limestone and sandstone. Whilst rocks such as these generally have an extensive capacity to receive and store water from rainfall, during heavy rainfall or prolonged periods of rainfall groundwater levels may rise to or near ground level. Groundwater flooding will be more of an issue where groundwater is naturally present at shallow depths.

5.4.2 Elevated/shallow groundwater levels will pose a significant risk to basements; will reduce/prevent infiltration to the ground causing waters to pond at the surface or flow overland; and may result in infiltration to sewers and other buried services, reducing their capacity to remove surface water runoff. Once groundwater flooding has occurred, it may take a long time for groundwater levels to fall. This can increase the damage from groundwater flooding.

5.4.3 The BGS does not map the site as being in an area that is susceptible to groundwater flooding, this being based on the underlying geological conditions i.e. the Whitby Mudstone Formation and site topography.

5.4.4 The on site soils i.e. the Whitby Mudstone Formation, are described as 'slowly permeable, seasonally wet, slightly acid but base-rich loamy and clayey soils with impeded drainage' (Soilscapes).

5.4.5 Groundwater flooding, in and around Bloxham, is not recorded within the available Preliminary FRA, prepared for OCC.

5.4.6 Recent ground investigation works, undertaken by JPB and described in Appendix J, have confirmed the groundwaters beneath the site to be resting between 6m to 7m below ground level (bgl) within the more permeable underlying Marlstone Rock Formation. The presence of the Whitby Mudstone Formation will prevent groundwaters from rising upwards, with the Marlstone Rock Formation being a confined aquifer. No groundwater was encountered within the Whitby Mudstone Formation.

5.4.7 On consideration of the above information, groundwater flooding is considered **not significant** to the site. There will be a freeboard of >1m between the resting groundwater level and the base of any foundations across the development site or any below ground storage.

5.5 Flooding from Artificial Drainage Systems

5.5.1 Many artificial drainage systems, such as pipes, land drains, sewers and drainage channels exist to manage runoff and effluent from developments and roads. During heavy rainfall, flooding from artificial drainage systems may occur, where the rainfall event exceeds the capacity of the drainage system, or if the system becomes blocked by debris or sediment. This will also occur if the system surcharges due to a high water level in the receiving watercourse. Flooding results, if water overflows from the drainage system, if water is unable to enter a drainage system that is blocked, or if it has inadequate capacity.

5.5.2 TWUL has not indicated that there are any issues regarding sewer flooding in the vicinity of the site and they have no objections to a new connection for either the foul or surface waters for the proposed development. The surface water public sewer in Barford Road is noted to discharge to a land drain located approximately 150m southeast of the site, which feeds into the catchment of the Bloxham Brook. The discharge of storm waters from the site at 'greenfield' runoff rates should not increase flood risk to the Bloxham Brook.

5.5.3 A land drain / ditch is located immediately beyond the site's curved south-western boundary, which would appear to accept runoff from the highway i.e. Barford Road. The proposed development will need to either maintain this ditch or provide a suitable alternative, dependant upon the propose access and egress routes to the site. There are no available records indicating that the ditch has been subject to flooding in the past, although further assessment should be carried out during the detailed drainage design to ensure that the proposed dwellings fronting on to Barford Road will not be subject to any localised flooding originating from this feature. At present, the base of the ditch is approximately 0.5m lower than the land immediately on site.

5.5.4 Enquiries with OCC indicated that there are issues with standing water on Barford Road, which is thought to be associated with either a blocked surface water gully or the road profile. OCC confirmed that this issue is currently being investigated and they do not anticipate that it will cause any problems with the regard to the site's development.

5.5.5 Flooding from artificial drainage systems is considered **not significant** to the proposed development.

5.6 Flooding due to Infrastructure Failure

5.6.1 Flooding from infrastructure failure can be as a result of structural, hydraulic or geotechnical failure of features (canals, dams, pipes etc) that retain, transmit or control the flow of water. The risk of such infrastructure failures increase during flood events, as the conditions put physical pressure on the operation of the system.

5.6.2 A 100mm diameter water main currently trends along Barford Road, which serves the existing housing estate on the southern side of Barford Road. Any ruptures of the mains water pipe in Barford Road would be channelled along the road in a south-easterly direction, with some of the waters potentially flowing into the land drain / ditch located immediately beyond the site's curved south-western site boundary, as this section of the highway is not kerbed. Access and egress to the proposed development site is considered to still be possible should a water main burst, due to the steepness of Barford Road promoting the majority of flood waters away from the site. Spot levels along Barford Road are provided on the plans provided within the Flood Screening Report (Appendix B). A new connection to the water main will be required to serve the new development. This is not considered to increase the risk posed to off site properties.

5.6.3 A pond is present on site in the northeast corner and it is likely that this will be maintained as part of the development. Additional ponds are also likely to be included into the site's drainage scheme in the northeast of the site and these should be designed to ensure that waters do not overtop the banks during the design storm event. There are no significant water bodies located up gradient of the site which pose a significant flood risk.

5.6.4 Flooding from infrastructure failure is considered **not significant** to the proposed development.

5.7 Climate Change

5.7.1 Global climate is reputed to be changing as a result of human activity. The nature of climate change experienced will vary with location. In the UK, projections for future climate change indicate more frequent short duration, high intensity rainfall together with more frequent periods of long duration rainfall (PPS 25).

5.7.2 Observations of climate change to date suggest that the annual mean precipitation for England and Wales has not changed significantly since records began in 1966. However, patterns are emerging that would indicate that seasonal rainfall has varied, decreasing in the summer and increasing in the winter. In addition to changes in the seasonality of precipitation, there are also changes in its characteristics, with a greater number of heavy rainfall events recorded (UKCIP 2008).

5.7.3 The type of rainfall events experience will have implications on flooding, with the potential for more frequent river flooding events and local flash flooding from surface waters. It is important that new developments assess the potential influence climate change may have upon them in the future. It is currently projected that peak rainfall intensity could have increased by 20% by 2085, with up to as much as a 30% increase by 2115 (PPS 25). In the following assessments a climate change value of 30% has been adopted in line with EA requirements for a proposed residential development.

6.0 SURFACE WATER DRAINAGE

6.1 Proposed Development Surface Water Discharge Rates

6.1.1 The volume of surface waters requiring disposal from the development site has been calculated using the Modified Rationale Method (Table 6.1). Various storm durations ranging from 1 minute to 7 hours for both summer and winter rainfall conditions have been used for the 1 in 1 year, 1 in 30 and 1 in 100 year events. A factor of 10% for climate change has been added to the rainfall intensities used within the calculations as discussed in CIRIA C697.

6.1.2 The average discharge from the proposed impermeable areas of the development site (approximately 1.36ha) for the range of storm durations calculated for the 1 in 1 year event is 94l/s, whilst for the 1 in 30 year and 1 in 100 year events the average discharges are 219l/s and 280l/s, respectively. The calculation sheets are presented in Appendix H.

Table 6.1: Runoff from the Proposed Development Area

Duration (mins)		Discharge Rate (l/s)		
		1 in 1 year event	1 in 30 year event	1 in 100 year event
1	SUMMER	330	745	922
5		208	495	626
10		151	363	468
15		119	291	377
30		79	189	248
60		49	118	155
120		30	71	94
180		23	53	69
240		19	42	55
300		16	35	46
360		14	31	40
420		13	27	35
1	WINTER	376	848	1049
5		236	563	713
10		172	413	532
15		136	331	429
30		90	216	282
60		56	134	177
120		35	81	107
180		27	60	78
240		21	48	63
300		19	40	53
360		16	35	45
420		14	31	40

6.1.3 It is clear from the discharge rates presented in Table 6.1 above that attenuation and storage of peak flows will be required to address the additional runoff caused by the development of the site, when compared with the estimated 'greenfield' runoff for the study area, for each of the storm events (Section 2.7).

6.2 Attenuation Storage Volumes

6.2.1 The EA and TWUL will require that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (1 in 100 year event), the developed rate of runoff should be no greater than the undeveloped rate of runoff for the same event. Given that the site is located in an area where the soil type is classified as 'intermediate soils' i.e. SOIL 3, the run off rates from the site are moderate, with a maximum 'greenfield' run off rate of approximately 28.88l/s calculated for the study area (Section 2.7). TWUL has confirmed that a discharge at 'greenfield' runoff rates to the public sewer in Barford Road is acceptable and the maximum discharge from the site has been restricted to the 1 in 30 year event to ensure that there is sufficient capacity in receiving pipework.

6.2.2 Outline estimates of the required storage volumes for the proposed development have been calculated using the EA methodology provided in R&D Technical Report W5-074/A/TR/1 Revision D – Preliminary Rainfall Runoff Management for Developments, assuming a fixed outflow of 20.44l/s (7.71l/s/ha) for the 1 in 30 year event. The 1.36ha impermeable area of the proposed development occupies 52% of the developed site area and has a permeable area of 1.29ha i.e. 48% of the study area.

6.2.3 The estimated required total storage volumes for the development are shown in Table 6.2 below for the 1 year, 30 year and 100 year return periods, together with those adjusted for plus 30% climate change. The calculation sheets are presented in Appendix I.

Table 6.2: Estimate of Required Attenuation Storage Volumes with a Maximum Outflow of 20.44l/s (7.71l/s/ha) Assuming Storm Waters are Discharged to the Public Sewer in Barford Road

Storm Return Period	Storage Volume (m^3)
1 in 1	132.5
1 in 1 + 30%	160.0
1 in 30	318.0
1 in 30 + 30%	462.0
1 in 100	397.5
1 in 100 + 30%	678.1

6.2.4 A maximum storage volume of approximately 680m^3 will be required on site to limit the storm water runoff for the 1 in 100 year storm event plus 30% for climate change, with a discharge of 7.71l/s/ha to the public storm water sewer. The potential types of attenuation storage which could be used are discussed in Section 6.3.

6.3 Use of Sustainable Drainage Systems (SuDS)

6.3.1 The sustainable management of surface water is paramount in reducing the future risk of flooding on and surrounding the site. PPS 25 states that, as far as is practicable, surface water arising from the developed site should be managed in a suitable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account. The EA and Local Water Authorities support this method of dealing with surface waters and Part H of the Building Regulations indicates that the first choice of surface water disposal should be to discharge to infiltration systems, where practicable.

6.3.2 The general principles of Sustainable Drainage Systems (SuDS) are to:

- reduce the volume of storm water runoff;
- reduce the rate of storm water runoff;
- ensure that storm water is treated appropriately, prior to discharge to the receiving watercourse;
- ensure that groundwater is protected.

6.3.3 SuDS techniques can be used to control storm water at the source, through permeable pavements, rainwater harvesting and green roofs; once collected, through storage and attenuation of waters with swales, wetlands, basins, ponds, bio-retention, pipes and subsurface storage; or at the point of discharge through the use of infiltration systems, such as soakaways and infiltration trenches.

6.3.4 Ground investigation works have been undertaken on site by JPB to determine if traditional, or deep bore, soakaways would be a feasible solution for the disposal of storm waters from the proposed development. However, as discussed previously, and in detail Appendix J, the site is not considered suitable for infiltration style drainage due to the low permeability Whitby Mudstone Formation and the presence of a confined aquifer, under sub-artesian pressure, within the underlying Marlstone Rock Formation. Therefore, an alternative solution for the disposal of surface waters is required.

6.3.5 Using the hierarchy provided in Part H of the Building Regulations, a discharge to a watercourse should be considered as the next most preferable option. However, as the site is not located within a 500m radius of a watercourse, the only alternative available to the proposed development is to use the public surface water sewer located in Barford Road. As the site slopes down to the northeast corner of the site from Barford Road, a pumped system will be required and TWUL has confirmed that this would be adoptable. The following paragraphs discuss the potential SuDS components that could be used on site to reduce the rate of flow down to the northeast corner of the site.

6.3.6 Green roofs are vegetated roofs or roofs that include vegetated spaces that contribute to local biodiversity. The vegetated surface provides a degree of retention, attenuation and treatment of rainwater, and promotes evapotranspiration. Given the gradient of the roofs and their long term management issues for private residential properties, they are not considered a feasible option for this development.

6.3.7 Rainwater harvesting is not currently proposed as part of the development scheme. However, as a minimum requirement it is recommended that individual houses are fitted with a water butt to capture rainfall from the roofs during normal storm events, which over flows to the main drainage network. This volume should not be used to reduce the overall attenuation storage required on site.

6.3.8 The use of permeable paving would help control storm water runoff at the source, with a significant proportion of the site, approximately 0.8ha, being formed by paved areas i.e. roadways, pavements, and driveways, occupying 30% of the site area. Permeable paving promotes filtration, adsorption, biodegradation and sedimentation, which all help to improve water quality. The void space in the sub-base material of a permeable paving system, or within geo-cellular modular units, can also be used to provide rainwater storage. Given the low permeability of the mudstones beneath the site, any permeable paving systems included on the site, would need to be sealed; passing water forward to other SuDS components rather than allowing infiltration to occur.

6.3.9 Consideration would also need to be given to the final gradients of the site, as, if too steep, rainwater will flow overland at a rate, faster than it can infiltrate, which could increase the risk of pluvial flooding down gradient of the site. Permeable paving is generally not considered suitable where the on site gradients are greater than 5% (1 in 20). At present, the site slopes moderately down to the northeast corner with gradients generally shallower than 1 in 20 in the west of the site, although in the east of the site the gradient are slightly steeper at approximately 1 in 18 and upon development these gradients could be lessened by the use of terracing. Alternatively, where the development layout permits, permeable paved areas could be incorporated along the contour lines.

6.3.10 Above ground storm water storage solutions for attenuated increased flows are preferred over sub surface solutions, as they increase biodiversity as well as providing improved water quality benefits. It is currently estimated that approximately 200m^3 of storage could be provided using granular storage beneath permeable paved areas, with the remaining storage requirements provided above ground.

6.3.11 Two attenuation storage ponds have been included in the northeast corner of the site, within the Illustrative Masterplan, which incorporate the existing pond. The ponds are positioned at the lowest point on site to allow them to be gravity fed, with a pumping station situated in the northeast corner of the site to then pump the storm waters back up to the public sewer in Barford Road. The ponds would provide the further 480m^3 attenuation storage required on site, with a permanent treatment volume of 145m^3 required, based on the current areas of hardstanding.

6.3.12 It will be necessary to ensure that the ponds are designed to prevent waters from overtopping the sides of the ponds, due to the topography of the site, as waters could then continue to run over land to the off site field to the northeast. The housing to the north of the site is topographically higher than the subject site and should not be affected.

6.3.13 Swales provide relatively low maintenance options that provide moderate to high water quality improvements to storm waters, as well as conveying and storing storm waters. There is limited space within the development, along the roadside, to incorporate swales on site. However, a swale could be used to connect the two attenuation storage ponds. Where swales are used on site, the gradients along their length should be less than 5% (1 in 20) or, if greater, (up to 1 in 10) check dams should be used to slow down the water flows along their length.

6.3.14 An alternative solution to provide the required attenuation storage volumes could be to utilise the natural hollow in the north of the site as a detention basin. Detention basins are surface storage basins or facilities that provide flow control through attenuation of storm water runoff. They are normally dry, and in certain situations, the land may also function as a recreational facility. During extreme storms, they can facilitate the settling out of particulate pollutants and provide low to moderate water quality benefits. Where incorporated into the drainage design the base of the detention basin should be fairly flat, with the slope near to the outlet, no greater than 1 in 100.

Summary

6.3.15 The combined used of permeable paving with granular storage, ponds/detention basins, and potentially swales will provide water quality benefits for the storm waters discharging off site to the public sewer, which ultimately discharges to the catchment of the Bloxham Brook. Conventional pipework would connect the main site areas to the SuDS components. A pumping station would then enable the storm waters to be pumped up to the public sewer in Barford Road for discharge at 'greenfield' runoff rates.

6.3.16 Clean surface waters from roofs, paths or roadways can be discharged to watercourses without requiring a discharge consent from the EA. The roof water downspouts should be sealed to prevent rogue discharges to the conventional drainage system and the various SuDS components.

6.3.17 The potential locations for the SuDS Components discussed above are shown on JPB Drawing MB608/08. CIRIA C697 SuDS Manual should be consulted with regard to the design criteria required for the possible SuDS components discussed above. With the introduction of the SuDS Approving Bodies it will also be necessary to ensure that they are constructed to National Standards that will allow them to be adopted in the future.

6.3.18 During construction, once a topsoil strip has been completed on site, it will be essential that the developer ensures that any surface water runoff from the site is contained within the site boundaries. The topography of the site will cause surface waters to flow down to the northeast of the site and it may be necessary to construct temporary ditches to prevent overland flows off site and/or to the existing ponds.

7.0 FOUL DRAINAGE

7.1 Foul flows from the proposed development will be discharged directly to the existing TWUL public foul sewer in Barford Road at manhole MH003. Based on the assumptions in Table 7.1, the total foul flows from the development will be 3.47l/s.

Table 7.1: Proposed Foul Flows

Development Use	Criteria for Calculating Foul Flows	Foul Flows (l/s)
75 Residential Houses	4000litres/dwelling/day	3.47

* Foul flow rates taken from British Water Code of Practice (2005) Flows and Loads – 2, Sizing criteria, Treatment Capacity for Small Wastewater Treatment Systems.

7.2 Correspondence with TWUL to date indicates that they have no objection to the proposed connection and a full application for a connection to the public sewer will be made to TWUL at the appropriate time.

7.3 All sewers will be constructed to an adoptable standard, and given the site topography; a pumped system will be required.

8.0 MAINTENANCE AND ACCESS REQUIREMENTS

8.1 SuDS require specialist maintenance schemes and it is recommended that a manual is set up, as per the requirements of CIRIA C697, 2007. The manual should include the following:

- location of all SUDS techniques on site;
- brief summary of how the techniques work, their purpose and how they can be damaged;
- maintenance requirements and a maintenance record;
- explanation of the consequences of not carrying out the maintenance that is specified;
- identification of areas where certain activities are prohibited;
- an action plan for dealing with accidental spillages;
- advice on what to do if alterations are to be made to a development, if service companies undertake excavations or other similar works are carried out that could affect the SUDS.

8.2 The maintenance of the on site SuDS will depend on the final methods included in the detailed design and reference to CIRIA C697 should be made for further details. By the time the site is developed, local SuDS Approval Bodies (SAB) will have come into effect, through the implementation of the Flood and Water Management Act 2010, and the SuDS used on site will need to be adopted by the SAB, who will also be responsible for their maintenance. Therefore, it will be necessary to ensure that the site's drainage is constructed to National Standards that will allow it to be adopted and additional requirements, in term of the SuDS Manual may be required in the future.

8.3 With regard to the maintenance of ponds included within the SuDS treatment train, they should be regularly cleared of leaf litter, aquatic plants should be regularly pruned, pond sediment should be monitored and removed as and when required and the outlets of the pond should remain clear of sediment/litter to enable them to overflow as and when required. Vegetation management to any areas of wetland will also be required.

8.4 Swales and detention basins will require regular litter removal, inlets and outlets cleared, vegetation management including any areas of wetland incorporated into the design, grass cutting and sediment monitoring and removal. A suitable easement (approximately 5m) should be provided along the swales to enable access for maintenance.

8.5 Maintenance of permeable pavements will include regular cleaning of silt and other sediments to preserve their infiltration capability. Manufacturers' recommendations as to the frequency of cleaning should be followed.

8.6 The combined foul and storm water pumping station will be adoptable by TWUL. It should be fully automatic with provision for remote monitoring by telemetry, in accordance with the guidance provided in Sewers for Adoption. The plant and equipment should be reliable, efficient and capable of operating between the manufacturer's recommended service intervals without attention or inspection. A maintenance schedule should be put in place and access to the pumping station from the public highway should be provided.

8.7 With regard to site access and egress in the event of emergencies, the site itself is sufficiently elevated above any fluvial floodplain and any low points where flood waters from burst water mains etc may collect. During the detailed drainage design, for the surface water pumping station, a check should be made against the 1 in 30 year storm frequency to ensure no flooding occurs to properties due to pump or plant failure (Sewers for Adoption). To ensure that sewage flooding does not occur at, or upstream of, the pumping station during plant or power failure, additional storage should be provided.

9.0 CONCLUSIONS & RECOMMENDATIONS

Flooding & Surface Water Drainage

9.1 The flood risk assessment demonstrates that the proposed development is **not at risk** from fluvial flooding and is located in the **low probability** EA Flood Zone 1, which according to PPS25 is where all new developments should be directed.

9.2 The proposed development will increase the area of hard cover across the site, which has the **potential to increase flood risk** from pluvial flooding (overland). Adequate surface water runoff control measures will need to be implemented for the proposed development site to prevent overland flows within the site boundaries causing flood events to the future residential properties. The implemented control measures, through the form and layout of the proposed development site, should also prevent overland flows from the site, to the land to the northeast. Surface waters will be controlled at the source by channelling storm waters from roofs, pavements, roads and driveways to above ground and below ground attenuation storage areas.

9.3 Attenuation storage could be provided by granular storage beneath permeable paving, where the topography allows, with conventional pipework to convey the storm waters to attenuation storage ponds, which could be connected by a swale. There is also potential to include a detention basin. The drainage system will be designed to store and dispose of storm waters arising from a 1 in 100 year event plus 30% for climate change. Sufficient area is available on site to provide the required storage volume of up to 680m^3 for the maximum design storm event.

9.4 Infiltration drainage techniques are not considered to be feasible on site given the low permeability of the Whitby Mudstone Formation and the presence of a confined aquifer in the underlying Marlstone Rock Formation.

9.5 It is currently proposed that all surface waters will be discharged to the TWUL public storm water sewer in Barford Road at a maximum rate of 20.44l/s (7.71l/s/ha), which equates to the greenfield runoff rate for the 1 in 30 year event. The public sewer discharges to a land drain within the catchment of the Bloxham Brook at a point 150m southeast of the site. Given the topography of the site, all surface waters will drain under gravity to the northeast corner of the site, where a combined foul and storm water pumping station will pump them back up to the public sewer in Barford Road. Enquiries with TWUL have confirmed that they would accept the storm water discharge from the proposed development and that the combined pumping station would be adoptable.

9.6 Water quality improvements to storm discharges would be provided by the proposed SuDS components, with filtration occurring through the granular storage and settlement within the pond. Pollution control measures such as areas of wetland within the pond and/or swale/detention basin can be provided to further improve water quality. The downspouts from the roofs of residential housing should be sealed to prevent rogue discharges.

9.7 The BGS does not map the site as being in an area that is susceptible to groundwater flooding, which is based on the underlying geological conditions i.e. the Whitby Mudstone Formation and site topography. Ground investigation works on site have confirmed that there is a freeboard of >1m between the resting groundwater level and the base of any foundations across the development site or any below ground storage. Therefore, groundwater flooding is considered **not significant** to the proposed development site.

9.8 Flooding from infrastructure failure and artificial drainage systems is **not considered to pose a significant risk** to the proposed development and the development of the site is **not considered to pose an increased risk** to the off site properties / land. The on site drainage infrastructure should be maintained to ensure that it continues to function as designed and that pipe work remains free of blockages. The combined pumping station will be adoptable by TWUL and will be part of a long term maintenance scheme.

9.9 In summary, the collection and active management of surface waters discharging from the proposed development will negate the risk of flooding both on and off site. The surface water drainage proposals will control runoff from extreme storm events without putting the public or properties at risk and reduce the risk of overland flooding both on and off site through source control and improved storm water quality before its discharge to controlled waters.

Foul Drainage

9.10 The foul drainage from the development will be discharged to the existing TWUL foul sewer in Barford Road, through the use of a pumping station, with an estimated discharge of approximately 3.5l/s. Connection points and flow rates will need to be discussed with TWUL during the detailed drainage design. A full application for a connection to the public sewer will be made to TWUL at the appropriate time. All sewers and the pumping station should be constructed to an adoptable standard.

Maintenance and Access

9.11 A SuDS manual should be compiled for the site. By the time the site is developed, local SuDS Approval Bodies (SAB) will have come into effect and the SuDS used on site will need to be adopted by the SAB, who should then become responsible for their maintenance. Therefore, it will be necessary to ensure that the site's drainage is designed and constructed to National Standards that will allow it to be adopted.

9.12 All SuDS features for the storage of storm waters should be sited to allow ease of access for maintenance. Appropriate easements should be maintained along any swales incorporated into the detailed drainage design. The maintenance of the on site SuDS will depend on the final methods included in the detailed drainage design and reference to CIRIA C697 should be made for further details.

9.13 It is anticipated that the foul sewers outside of the curtilage of the private properties will be adopted by TWUL upon development of the site. Enquiries with TWUL have also confirmed that the combined pumping station will be adoptable and the advice and guidelines in Sewers for Adoption should be followed.

9.14 The site itself is sufficiently elevated above any fluvial floodplain and pedestrian and vehicular access to the site will not be prevented during flood events from fluvial, pluvial or infrastructure failure i.e. burst water mains. In order to prevent pluvial flooding on site, the site's drainage should be constructed to attenuate the 1 in 100 year event plus 30% for climate change.

10.0 GENERAL

10.1 Whilst confident in the findings of our report we are unable to give an assurance that they will be accepted by the authorities without question. We therefore advise that where appropriate our report and associated matters are submitted to approving bodies and approval obtained or sought before detailed design, site works or other irrevocable action is embarked upon.

10.2 The recommendations contained in this report do not constitute any form of specification for the undertaking of the works required.

10.3 The conclusions reached in this report are necessarily restricted to those that can be determined from the information consulted and may be subject to amendment in the light of additional information becoming available.

10.4 It should be noted that soil and rock conditions are highly variable and may differ between sampling points and this may affect interpolation. Additionally, features may exist buried at depth and undetected by investigation. Other information may become available on the conditions of the site not available at the date of this report and thus site assessment may be subject to amendment in the light of such additional information becoming available.

10.5 This report has been prepared for the sole use of the specified client in the intended context stated above. It should not be relied upon or used for any other project or by any other party without written authority from Johnson Poole and Bloomer Limited.

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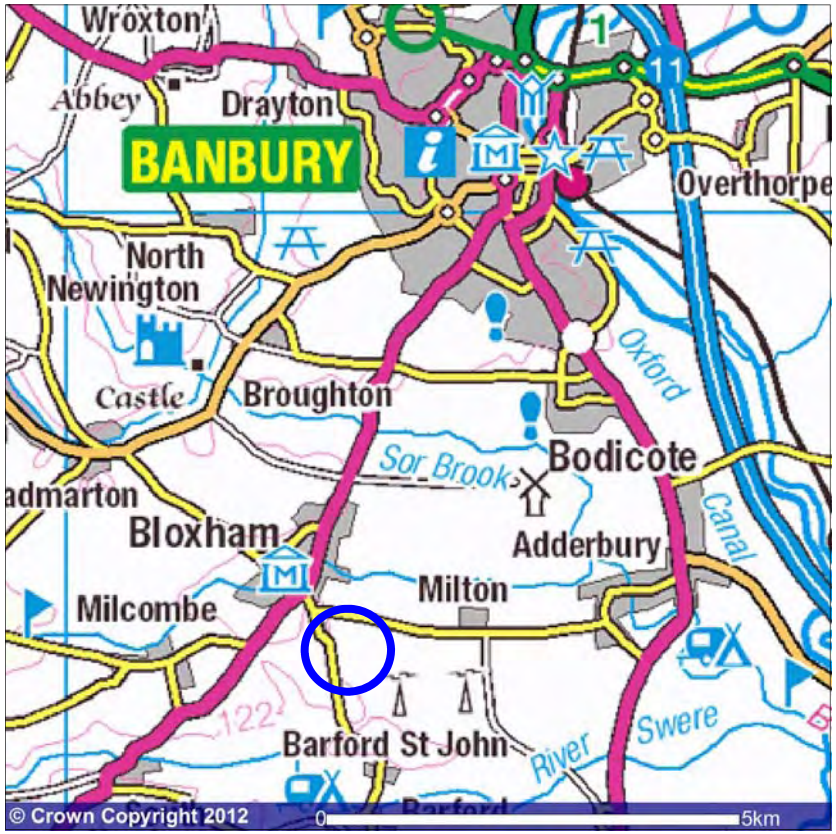
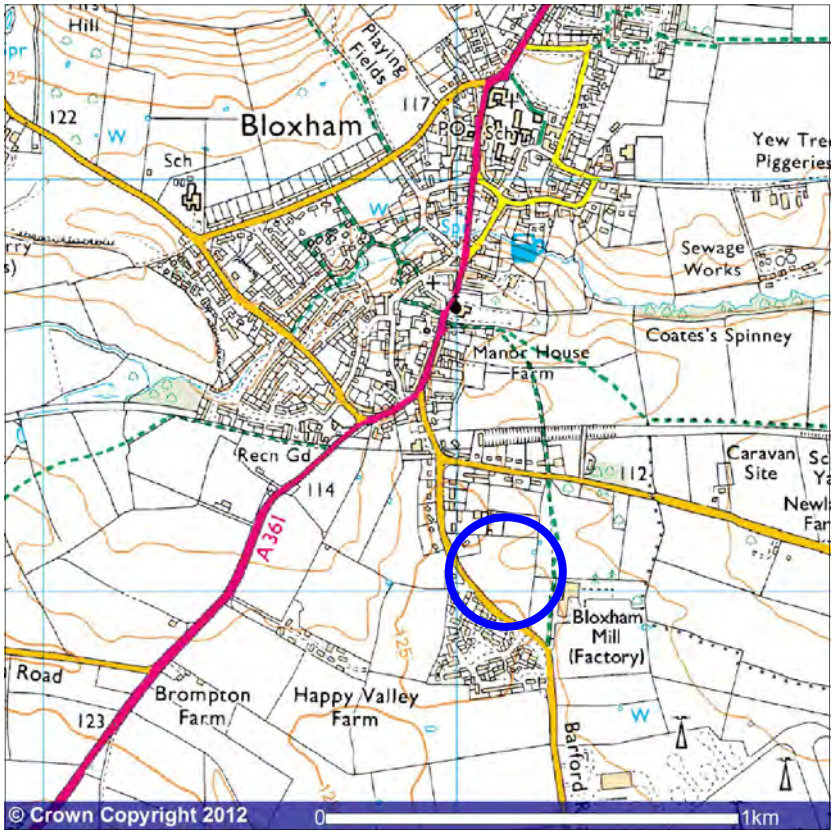
Drawings

(These drawings are reproduced in colour)



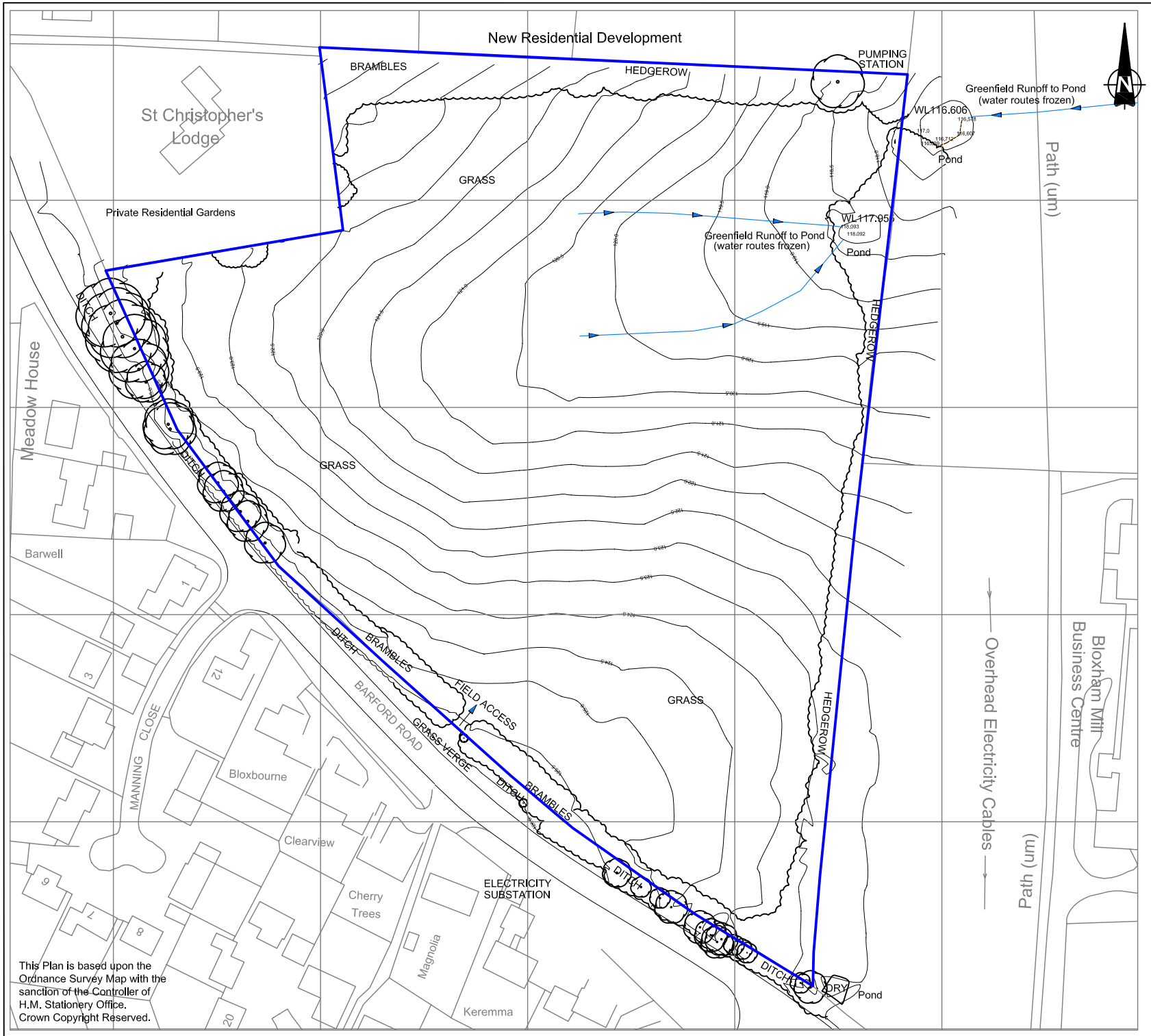


Key -

Approximate Study Location

JOHNSON POOLE & BLOOMER CONSULTANTS

Engineer HB	Client GLADMAN DEVELOPMENTS LTD		Title STUDY LOCATION PLAN
Checked HB	Project LAND OFF BARFORD ROAD, BLOXHAM		
Approved ACJ	Date 13/02/2012	Scale SEE SCALE BAR	Drawing MB608/01



Key –

- Study Boundary
- Greenfield Runoff Routes
- WL116.606 — Pond & Water Level

Client
GLADMAN DEVELOPMENTS LTD

Project
LAND OFF BARFORD ROAD, BLOXHAM

Title
EXISTING SITE LAYOUT

JOHNSON POOLE & BLOOMER CONSULTANTS
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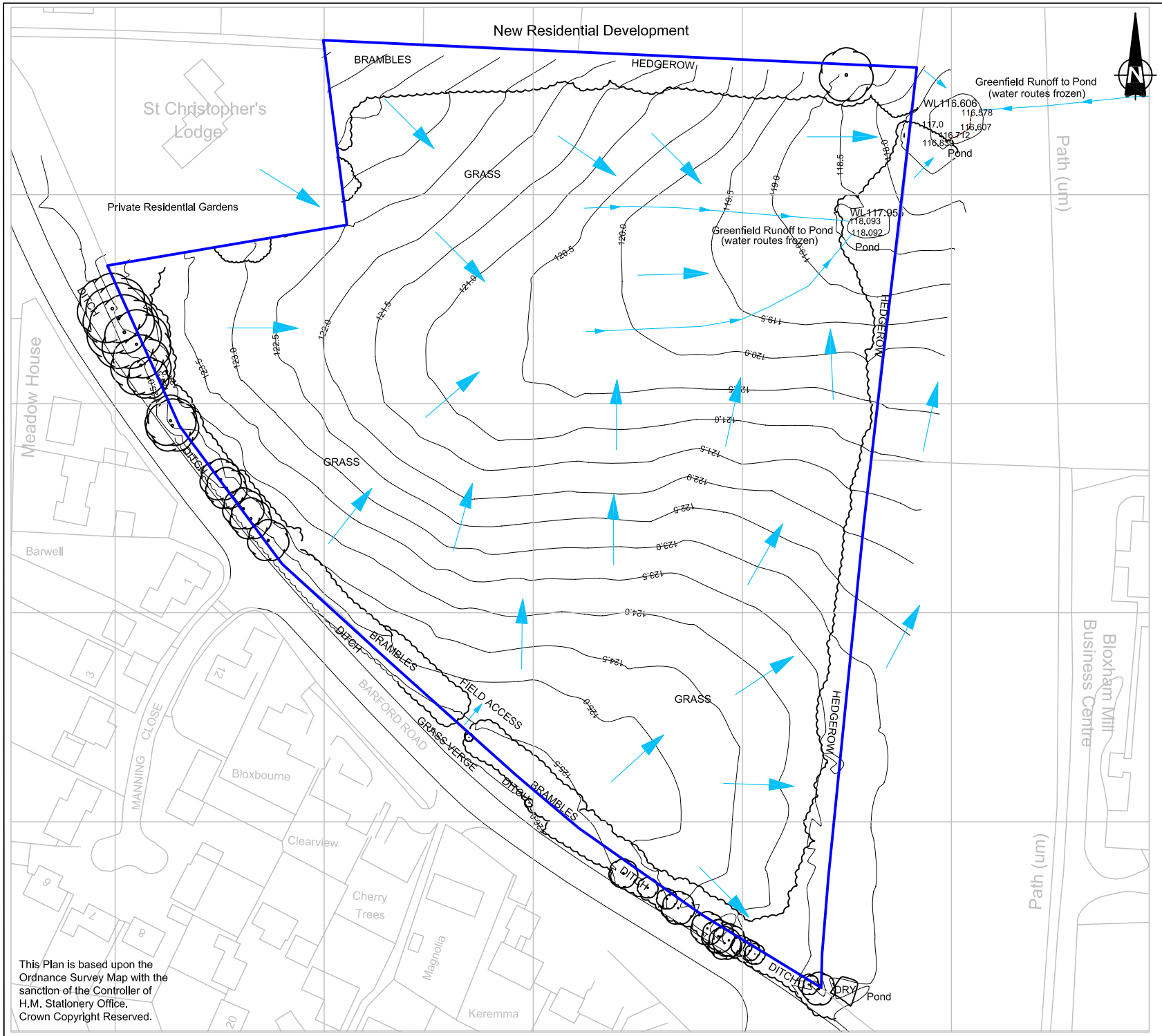
Engineer	Checked	Approved
HB	HB	ACJ

Date	Scale
13/02/2012	1:1,250 @ A4

Drawing	Drawn
LB102/02	HB

Plan Laid Out by	Office
JLP Surveys Ltd S12/027 Jan'12	Brierley Hill



Key –

- Study Boundary
- Greenfield Runoff Routes (January 2012)
- WL116.606 — Pond & Water Level (January 2012)

Client	GLADMAN DEVELOPMENTS LTD
Project	LAND OFF BARFORD ROAD, BLOXHAM
Title	SURFACE WATER FLOW PATHWAYS

JOHNSON POOLE & BLOOMER CONSULTANTS
Tel 01384 262000 www.jpb.co.uk

Engineer	Checked	Approved
HB	HB	ACJ

Date: 13/02/2012	Scale: 1:1,250 @ A4
Drawing: MB608/03	Drawn: HB
Plan Laid Out by: JLP Surveys Ltd S12/027 Jan'12	Office: Brierley Hill

Combined Pumping Station
(Foul and Storm Waters)

Attenuation Storage Ponds
Storage Volume up to 480cu m
Treatment Volume - 145cu m

Potential to use natural hollow as detention basin
Consideration of safety and children's play area required

Potential areas of permeable paving
with granular storage in sub base
Approximately 200cu m across the site.

St Christopher's Lodge
Meadow House
Barwell
MANNING CLOSE
BARFORD ROAD
Bloxbourne
Clearview
Cherry Trees
Magnolia
Keremma
Path (um)
Bloxham Mill Business Centre

This Plan is based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office. Crown Copyright Reserved.

Key –

- Study Boundary
- Attenuation Storage Ponds
- Permeable Paving & Granular Storage
- Roofs to houses & garages

Client
GLADMAN DEVELOPMENTS LTD

Project
LAND OFF BARFORD ROAD, BLOXHAM

Title
SuDS COMPONENTS

JOHNSON POOLE & BLOOMER CONSULTANTS
Tel 01384 262000 www.jpb.co.uk

Engineer	Checked	Approved
HB	HB	ACJ

Date	Scale
18/06/2012	1:1,000 @ A3

Drawing	Drawn
MB608/08	HB

Plan Laid Out by	Office
HB	Brierley Hill

Appendix A

Information Consulted

INFORMATION CONSULTED:

In preparation of this report, the following information has been consulted:

General

- JPB archives
- Environment Agency Website: http://www.environment-agency.gov.uk/
- Envirocheck Flood Screening Report dated 1 February 2012 and referenced 37446371_1_1
- Oxfordshire County Council (June 2011) Preliminary Flood Risk Assessment, Preliminary Assessment Report, prepared by JBA Consulting

Flood and Drainage Assessments

- Planning Policy Statement 25: Development and Flood Risk (December 2006)
- Planning Policy Statement 25: Development and Flood Risk – Practice Guide (December 2009)
- British Water Code of Practice (2005) Flows and Loads – 2, Sizing criteria, Treatment Capacity for Small Wastewater Treatment Systems.
- Chronology of British Hydrological Events website http://www.dundee.ac.uk/geography/cbhe/
- CIRIA R156 (1996) Infiltration drainage – Manual of good practice
- CIRIA X108 and Wallingford, H.R. (2004) Drainage of development sites – a guide
- CIRIA C609 (2004) Sustainable drainage systems – Hydraulic, structural and water quality advice
- CIRIA C624 (2004) Development and flood risk – guidance for the construction industry
- CIRIA C635 (2006) Designing for exceedance in urban drainage – good practice
- CIRIA C697 (2007) The SUDS manual
- CIRIA SUDS website http://www.ciria.org/suds/
- CIRIA C687 (2010) Planning for SuDS – Making it happen
- DEFRA / EA (June 2007) Preliminary rainfall runoff management for developments, R&D Technical Report W5-074/A/TR/1 Revision D
- Environment Agency (December 2009) Thames Catchment Flood Management Plan – Summary Report
- Flood Estimation Handbook (1999)
- Sewers for Adoption (6th Edition) A design and construction guide for developers
- Soilscapes website http://www.landis.org.uk/soilscapes/
- UK Climate Impacts Programme (2008) website http://www.ukcip.org.uk
- Wallingford, H.R. (1983) The Wallingford Procedure, Design and analysis of urban storm drainage, Volume 1 Principles, methods and practice

Appendix B

Flood Screening Report

Envirocheck® Report:

Flood Screening Report Datasheet

Order Details:

Order Number:
37446371_1_1

Customer Reference:
MB608

National Grid Reference:
443120, 235040

Slice:
A

Site Area (Ha):
2.65

Search Buffer (m):
1000

Site Details:

Barford Road
Bloxham
BANBURY
Oxfordshire

Client Details:

Ms F Townley
Johnson Poole & Bloomer Ltd
Harris & Pearson Building
56 Brettell Lane
Brierley Hill
West Midlands
DY5 3LH

JOHNSON POOLE & BLOOMER LAND CONSULTANTS

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Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m
EA / CEH Flood Data					
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
RMS Flood Data					
RMS 75 year Flood Return				n/a	n/a
RMS 100 year Flood Return				n/a	n/a
RMS 1000 year Flood Return	pg 1		1	n/a	n/a
BGS Flood Data					
BGS Geological Indicators of Flooding	pg 2				1
BGS Groundwater Flooding Susceptibility	pg 2		9	18	46
EA Detailed River Network Data					
Detailed River Network Lines	pg 6				17
Detailed River Network Nodes	pg 8				13
Detailed River Network Offline Drainage	pg 9			2	
EA Historic Flood Events Data					
Historic Flood Events					
Historical Flood Liabilities					
EA National Flood Risk Assessment Data					
National Flood Risk Assessment	pg 10				61
Flood Insurance Risk Data					
Property-based Flood Risk			n/a	n/a	n/a
Postcode Sector Flood Insurance Claim Ratings	pg 15	1	n/a	n/a	n/a

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JOHNSON POOLE & BLOOMER LAND CONSULTANTS

RMS Flood Data

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	RMS 75 year Flood Return None				
	RMS 100 year Flood Return None				
	RMS 1000 year Flood Return Flood Type/Depth: 1000 year pluvial flood, depth is not applicable Flood Hazard: Pluvial & Minor River Flood Risk	A13NE (E)	42	2	443234 235082

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Geological Indicators of Flooding Flooding Type: Inland Flooding Flood Potential Code: Higher flood potential from rivers: the first areas to experience the effects of inland flooding in a river catchment.	A18SE (NE)	586	3	443392 235681
	BGS Groundwater Flooding Susceptibility Flooding Type: Negligible Susceptibility to Groundwater Flooding	A13NE (NE)	9	3	443200 235101
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A13NW (W)	99	3	442900 235040
	BGS Groundwater Flooding Susceptibility Flooding Type: Negligible Susceptibility to Groundwater Flooding	A13SE (E)	123	3	443300 235001
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A13NW (W)	149	3	442850 235040
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A13SW (W)	169	3	442850 235001
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A13SW (W)	191	3	442850 234951
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A13NW (W)	199	3	442800 235040
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A13SW (W)	215	3	442800 235001
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A13SW (W)	235	3	442800 234951
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A14NW (E)	259	3	443450 235101
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A13NW (NW)	260	3	442800 235251
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A14SW (SE)	282	3	443450 234901
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A13NW (NW)	293	3	442850 235351
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A13NW (NW)	329	3	442800 235351
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A12SE (SW)	329	3	442750 234851
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A12NE (NW)	330	3	442750 235301
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A13SW (SW)	355	3	442800 234751
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A12NE (W)	400	3	442600 235040
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A17SE (NW)	400	3	442750 235401
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A12NE (NW)	401	3	442700 235351
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A12SE (W)	420	3	442600 234951

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A17SE (NW)	436	3	442700 235401
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A12SE (W)	456	3	442550 235001
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A17SE (NW)	470	3	442700 235451
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A17SE (NW)	472	3	442650 235401
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A18SE (NE)	497	3	443350 235601
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A12NE (W)	500	3	442500 235040
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A17SE (NW)	507	3	442650 235451
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A18SE (N)	524	3	443250 235651
	BGS Groundwater Flooding Susceptibility Flooding Type: Negligible Susceptibility to Groundwater Flooding	A14SW (E)	526	3	443700 234951
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A18SE (NE)	561	3	443400 235651
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A18NE (N)	570	3	443200 235701
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A19SW (NE)	581	3	443450 235651
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A17SE (NW)	581	3	442700 235601
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A18NE (N)	592	3	443350 235701
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A17SE (NW)	595	3	442750 235651
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A12NW (W)	610	3	442400 235201
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A18NW (NW)	617	3	442800 235701
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A18NE (N)	618	3	443150 235751
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A12NW (W)	622	3	442400 235251
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A18NE (N)	623	3	443250 235751
	BGS Groundwater Flooding Susceptibility Flooding Type: Negligible Susceptibility to Groundwater Flooding	A14SE (E)	631	3	443800 234901
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A19SW (NE)	632	3	443550 235651

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A18NW (N)	632	3	442900 235751
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A18NW (N)	646	3	442850 235751
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A18NE (N)	655	3	443400 235751
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A18NE (N)	664	3	443100 235801
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A18NE (N)	666	3	443115 235801
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A18NE (N)	670	3	443200 235801
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A19NW (NE)	672	3	443450 235751
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A17SW (NW)	678	3	442400 235401
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A17SE (NW)	683	3	442600 235651
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A18NE (N)	689	3	443350 235801
	BGS Groundwater Flooding Susceptibility Flooding Type: Negligible Susceptibility to Groundwater Flooding	A19NW (NE)	693	3	443500 235751
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A7NE (SW)	697	3	442750 234351
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A17NE (NW)	707	3	442700 235751
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A8SW (SW)	713	3	442800 234301
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A17NE (NW)	729	3	442750 235801
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A8SW (S)	733	3	442850 234251
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A12SW (W)	753	3	442250 235001
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A19NW (NE)	765	3	443700 235701
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A18NE (N)	768	3	443150 235901
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A18NW (N)	771	3	442950 235901
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A17SW (NW)	791	3	442400 235601
	BGS Groundwater Flooding Susceptibility Flooding Type: High Susceptibility to Groundwater Flooding	A17SW (NW)	814	3	442300 235501

BGS Flood Data

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A18NW (N)	816	3	443000 235951
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A18NE (N)	816	3	443115 235951
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderately High Susceptibility to Groundwater Flooding	A17NE (NW)	823	3	442450 235701
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A17SW (NW)	830	3	442350 235601
	BGS Groundwater Flooding Susceptibility Flooding Type: Negligible Susceptibility to Groundwater Flooding	A14SE (E)	839	3	444000 234801
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A17NE (NW)	933	3	442450 235851
	BGS Groundwater Flooding Susceptibility Flooding Type: Low Susceptibility to Groundwater Flooding	A8SW (S)	936	3	442800 234050
	BGS Groundwater Flooding Susceptibility Flooding Type: Moderate Susceptibility to Groundwater Flooding	A23SE (N)	968	3	443150 236101

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	**Detailed River Network Lines** River Type: Primary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: Bloxham Brook Water Course Reference: 14BL	A18NE (N)	597	1	443350 235705
2	**Detailed River Network Lines** River Type: Primary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: Bloxham Brook Water Course Reference: 14BL	A17SE (NW)	658	1	442579 235596
3	**Detailed River Network Lines** River Type: Secondary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A17SE (NW)	674	1	442452 235477
4	**Detailed River Network Lines** River Type: Primary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: Bloxham Brook Water Course Reference: 14BL	A17NE (NW)	686	1	442750 235754
5	**Detailed River Network Lines** River Type: Extended Culvert (greater than 50m) River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Below Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A17NE (NW)	696	1	442646 235704
6	**Detailed River Network Lines** River Type: Primary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Flood Risk Management Indicative/Statutory Main River Water Course Name: Bloxham Brook Water Course Reference: 14BL	A18NW (N)	703	1	442835 235806

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
7	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18NW (NW)	704	1	442779 235786
8	**Detailed River Network Lines** River Type: Extended Culvert (greater than 50m) River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Below Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18NW (N)	732	1	443050 235869
9	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A7SE (SW)	782	1	442739 234257
10	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A14SE (E)	800	1	443955 234764
11	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A14SE (E)	832	1	443986 234755
12	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A14SE (E)	836	1	443991 234760

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
13	**Detailed River Network Lines** River Type: Secondary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A17SW (NW)	853	1	442253 235498
14	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A17SW (NW)	853	1	442253 235496
15	**Detailed River Network Lines** River Type: Secondary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A17SW (NW)	856	1	442253 235502
16	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A17SW (NW)	856	1	442253 235502
17	**Detailed River Network Lines** River Type: Extended Culvert (greater than 50m) River Name: Not Supplied Hydrographic Area: D006 River Flow Type: Primary Flow Path River Surface Level: Below Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A14NE (E)	914	1	444100 235031
18	**Detailed River Network Nodes** River Node Type: Pseudo (general) Hydrographic Area: D006	A17SE (NW)	674	1	442452 235477
19	**Detailed River Network Nodes** River Node Type: Junction Hydrographic Area: D006	A17NE (NW)	696	1	442646 235704
20	**Detailed River Network Nodes** River Node Type: Junction Hydrographic Area: D006	A18NW (NW)	704	1	442779 235786

EA Detailed River Network Data

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
21	**Detailed River Network Nodes** River Node Type: Junction Hydrographic Area: D006	A18NW (N)	732	1	443050 235869
22	**Detailed River Network Nodes** River Node Type: Source Hydrographic Area: D006	A18NW (N)	748	1	442788 235837
23	**Detailed River Network Nodes** River Node Type: Source Hydrographic Area: D006	A7SE (SW)	798	1	442646 234300
24	**Detailed River Network Nodes** River Node Type: Source Hydrographic Area: D006	A14SE (E)	802	1	443954 234748
25	**Detailed River Network Nodes** River Node Type: Source Hydrographic Area: D006	A14SE (E)	832	1	443986 234755
26	**Detailed River Network Nodes** River Node Type: Junction Hydrographic Area: D006	A14SE (E)	836	1	443991 234760
27	**Detailed River Network Nodes** River Node Type: Junction Hydrographic Area: D006	A17SW (NW)	853	1	442253 235498
28	**Detailed River Network Nodes** River Node Type: Junction Hydrographic Area: D006	A17SW (NW)	856	1	442253 235502
29	**Detailed River Network Nodes** River Node Type: Source Hydrographic Area: D006	A17SW (NW)	881	1	442201 235457
30	**Detailed River Network Nodes** River Node Type: Pseudo (general) Hydrographic Area: D006	A14NE (E)	914	1	444100 235031
31	**Detailed River Network Offline Drainage** River Type: Tertiary River Hydrographic Area: D006	A14SW (E)	285	1	443454 234912
32	**Detailed River Network Offline Drainage** River Type: Tertiary River Hydrographic Area: D006	A12NE (NW)	310	1	442756 235275

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Low Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A12NE (NW)	525	4	442530 235321
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18SE (N)	576	4	443375 235676
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	591	4	443345 235701
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Low Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18SE (NE)	599	4	443404 235691
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Low Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18SE (NE)	604	4	443401 235696
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18SE (NE)	605	4	443400 235697
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19SW (NE)	616	4	443435 235696
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Low Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19SW (NE)	618	4	443435 235698
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	619	4	442590 235551
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	619	4	442585 235546
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	622	4	442605 235571
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19SW (NE)	624	4	443450 235698
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	624	4	443295 235746
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19SW (NE)	628	4	443463 235696

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19SW (NE)	629	4	443485 235686
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	630	4	443300 235751
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	632	4	443309 235751
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	633	4	442655 235631
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	639	4	442670 235651
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Low Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	641	4	443350 235751
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19SW (NE)	642	4	443530 235676
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Low Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	651	4	442650 235651
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	653	4	442705 235691
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	653	4	443245 235781
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17NE (NW)	655	4	442725 235706
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NW (NW)	663	4	442765 235736
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17NE (NW)	664	4	442700 235701
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Low Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	672	4	442467 235494

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	673	4	443250 235801
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	674	4	443261 235801
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Low Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19NW (NE)	674	4	443550 235701
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	676	4	443275 235801
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	677	4	443285 235801
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	678	4	443289 235801
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	681	4	442504 235551
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	682	4	442550 235601
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17NE (NW)	685	4	442754 235754
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	689	4	442450 235501
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	690	4	443190 235821
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NW (N)	702	4	442855 235811
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NW (N)	706	4	442810 235801
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NE (N)	706	4	443200 235837

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NW (N)	707	4	442870 235821
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: No Result Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NW (N)	724	4	442905 235846
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: No Result Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SE (NW)	726	4	442500 235611
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19SW (NE)	739	4	443675 235689
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19SW (NE)	740	4	443680 235686
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: No Result Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A18NW (N)	741	4	442950 235871
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Low Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SW (NW)	750	4	442375 235500
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SW (NW)	763	4	442360 235501
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SW (NW)	775	4	442350 235506
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SW (NW)	803	4	442323 235516
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Low Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SW (NW)	807	4	442320 235521
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19NW (NE)	842	4	443760 235751
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SW (NW)	860	4	442250 235506
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SW (NW)	870	4	442265 235551

EA NaFRA Data

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19NE (NE)	923	4	443900 235722
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19NE (NE)	941	4	443924 235721
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19NE (NE)	946	4	443930 235721
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Significant Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A19NE (NE)	959	4	443950 235716
	National Flood Risk Assessment (NaFRA) Flood Risk Assessment Code: Moderate Source: Environment Agency, Head Office Catchment Area: Cherwell & Windrush	A17SW (NW)	990	4	442155 235601

Flood Insurance Risk Data

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Postcode Sector Flood Insurance Claim Ratings Insurance Rating: Medium Flood Insurance Claim Rating Postcode Sector: OX15 4	A13NE (SW)	0	4	443115 235040

Data Currency

EA / CEH Flood Data	Version	Update Cycle
Extreme Flooding from Rivers or Sea without Defences Environment Agency - Head Office	November 2011	Quarterly
Flooding from Rivers or Sea without Defences Environment Agency - Head Office	November 2011	Quarterly
Areas Benefiting from Flood Defences Environment Agency - Head Office	November 2011	Quarterly
Flood Water Storage Areas Environment Agency - Head Office	November 2011	Quarterly
Flood Defences Environment Agency - Head Office	November 2011	Quarterly
RMS Flood Data	**Version**	**Update Cycle**
RMS 75 year Flood Return Risk Management Solutions - Thames Catchment	December 2008	As notified
RMS 100 year Flood Return Risk Management Solutions - Thames Catchment	December 2008	As notified
RMS 1000 year Flood Return Risk Management Solutions - Thames Catchment	December 2008	As notified
BGS Flood Data	**Version**	**Update Cycle**
BGS Geological Indicators of Flooding British Geological Survey - National Geoscience Information Service	February 2011	Annually
BGS Groundwater Flooding Susceptibility British Geological Survey - National Geoscience Information Service	February 2011	Annually
EA Detailed River Network Data	**Version**	**Update Cycle**
Detailed River Network Lines Environment Agency - Head Office	April 2010	As notified
Detailed River Network Nodes Environment Agency - Head Office	April 2010	As notified
Detailed River Network Offline Drainage Environment Agency - Head Office	April 2010	As notified
EA Historic Flood Events Data	**Version**	**Update Cycle**
Historic Flood Events Environment Agency - Head Office	July 2011	Quarterly
Historical Flood Liabilities Landmark Information Group Limited	December 1999	Not Applicable
EA National Flood Risk Assessment Data (NaFRA)	**Version**	**Update Cycle**
National Flood Risk Assessment Environment Agency - Head Office	October 2011	Annually
Flood Insurance Risk Data	**Version**	**Update Cycle**
Property-based Flood Risk Aviva - Dataservice	January 2010	Not Applicable
Postcode Sector Flood Insurance Claim Ratings Crawford and Company	November 2011	Quarterly

Data Suppliers

A selection of organisations who provide data within this report

Data Supplier	Data Supplier Logo
Ordnance Survey	
Environment Agency	
Centre for Ecology and Hydrology	
British Geological Survey	
Aviva	
Risk Management Solutions	

Useful Contacts

Contact	Name and Address	Contact Details
1	**Environment Agency - National Customer Contact Centre (NCCC)** PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 08708 506 506 Email: enquiries@environment-agency.gov.uk
2	**Landmark Information Group Limited** Legal and Financial, The Smith Centre, Fairmile, Henley-on-Thames, Oxon, RG9 6AB	Telephone: 0844 844 9966 Fax: 0844 844 9980 Email: info@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk
3	**British Geological Survey - Enquiry Service** British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
4	**Landmark Information Group Limited** 5 - 7 Abbey Court, Eagle Way, Sowton, Exeter, Devon, EX2 7HY	Telephone: 01392 441761 Fax: 01392 441709 Email: cssupport@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk
-	**Landmark Information Group Limited** The Smith Centre, Henley On Thames, Oxfordshire, RG9 6AB	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

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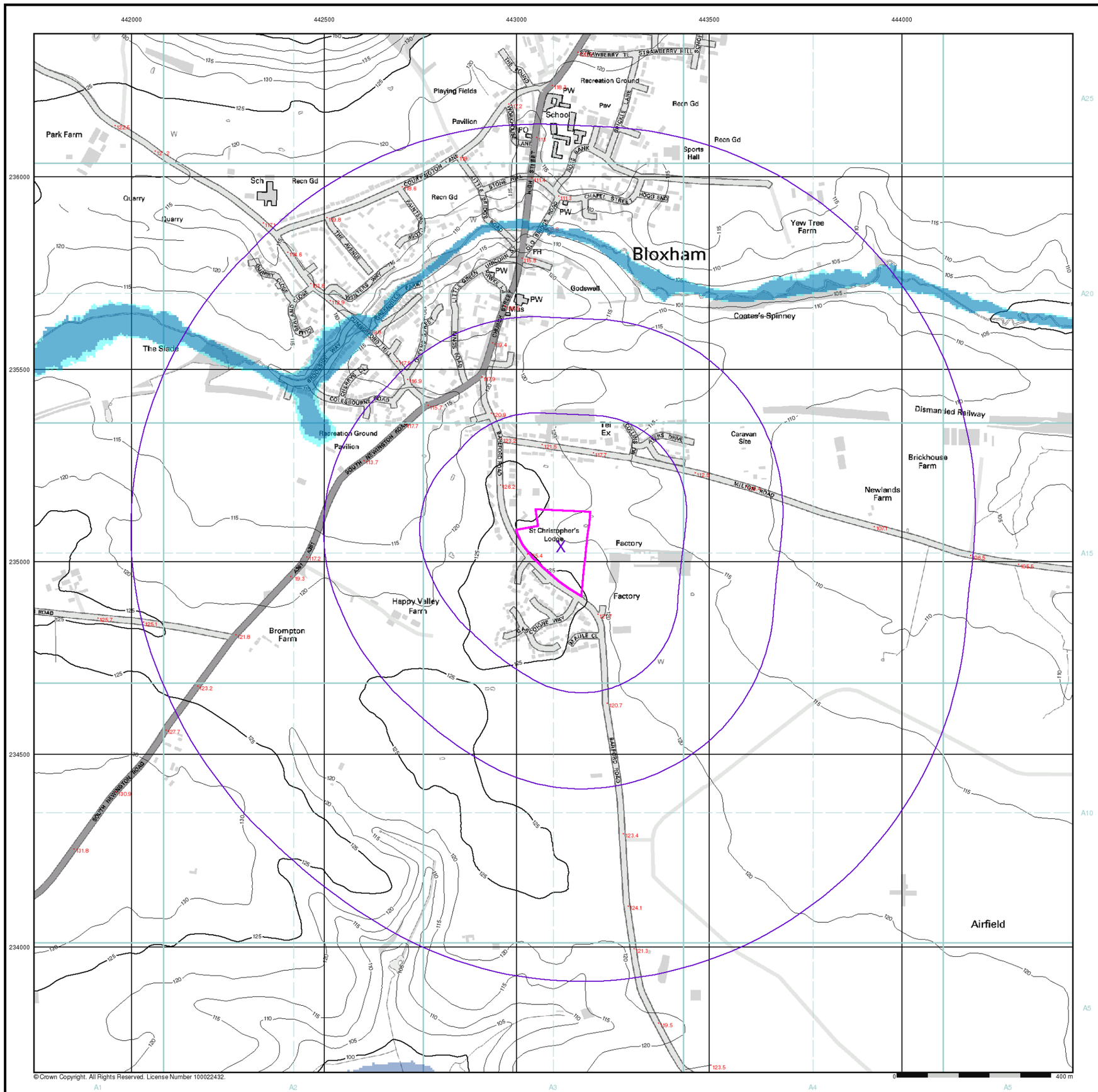

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LAND CONSULTANTS

EA Flood Data Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Environment Agency Flood Data

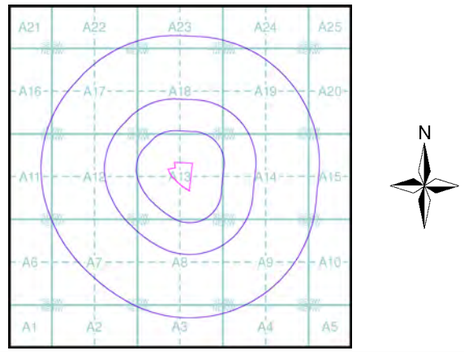
- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Contours (height in metres)

Standard Contour — 105 — 100 — 95 — *167.8 Spot Height

Index Contour — *45.8 Air Height

EA Flood Data Map - Slice A



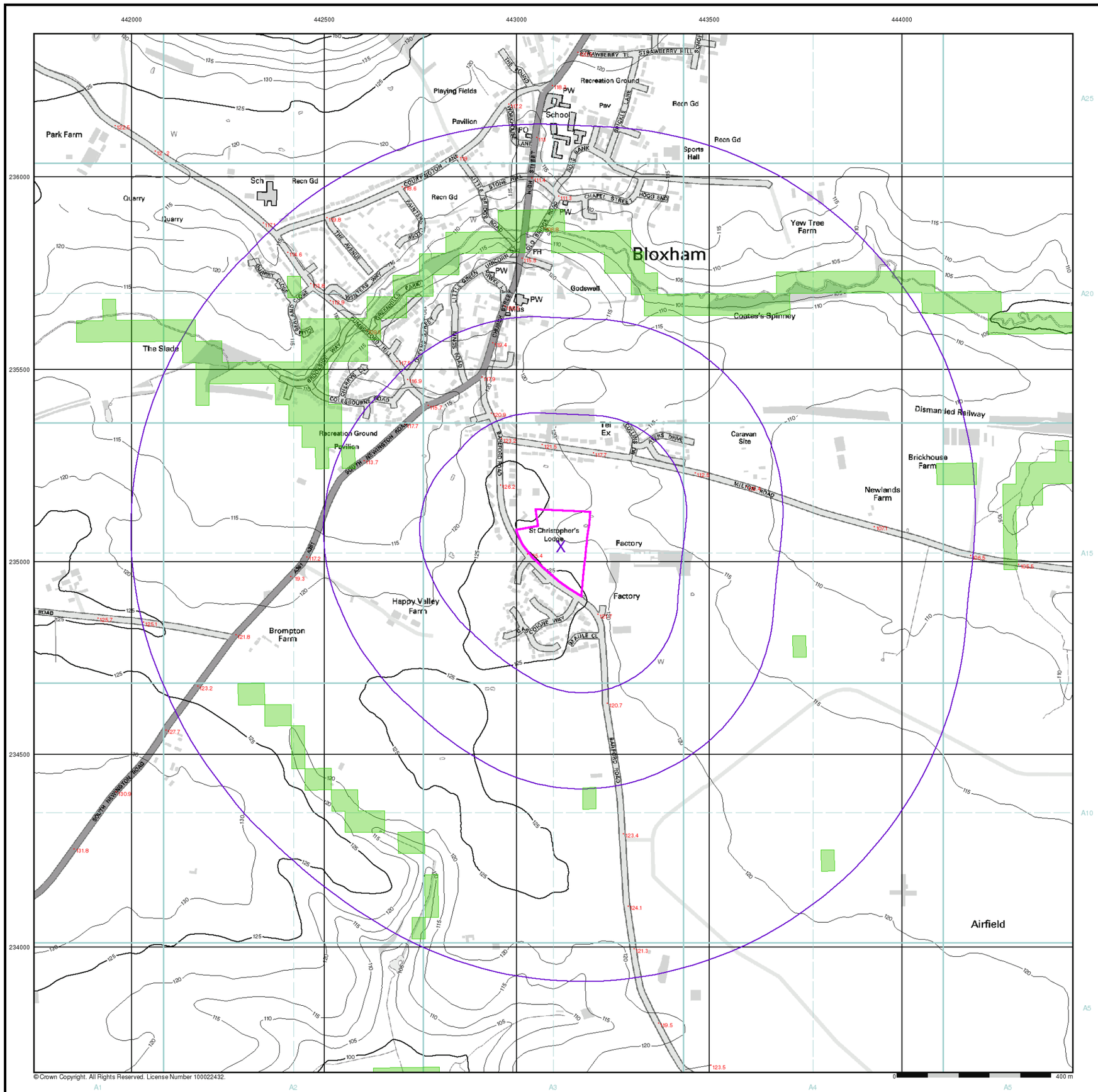
Order Details

Order Number:	37446371_1_1
Customer Ref:	MB608
National Grid Reference:	443120, 235040
Slice:	A
Site Area (Ha):	2.65
Search Buffer (m):	1000

Site Details

Barford Road, Bloxham, BANBURY, Oxfordshire

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



JOHNSON POOLE & BLOOMER
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RMS 75 year Return Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

RMS 75 year Return Flood Data

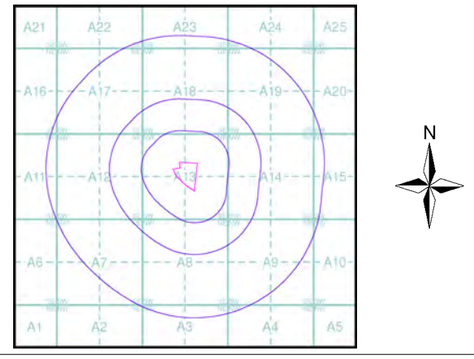
Flood Depth (mm)	Flood Type: Defended Flood	Flood Type: Undefended Flood	Pluvial & Minor River Flood (flood depth n/a)
0 - 200			
201 - 500			
501 - 2000			
2001 +			

Contours (height in metres)

Standard Contour 105 100 95 — *167.3 Spot Height

Index Contour — *45.8 Air Height

RMS 75 year Return Flood Map - Slice A



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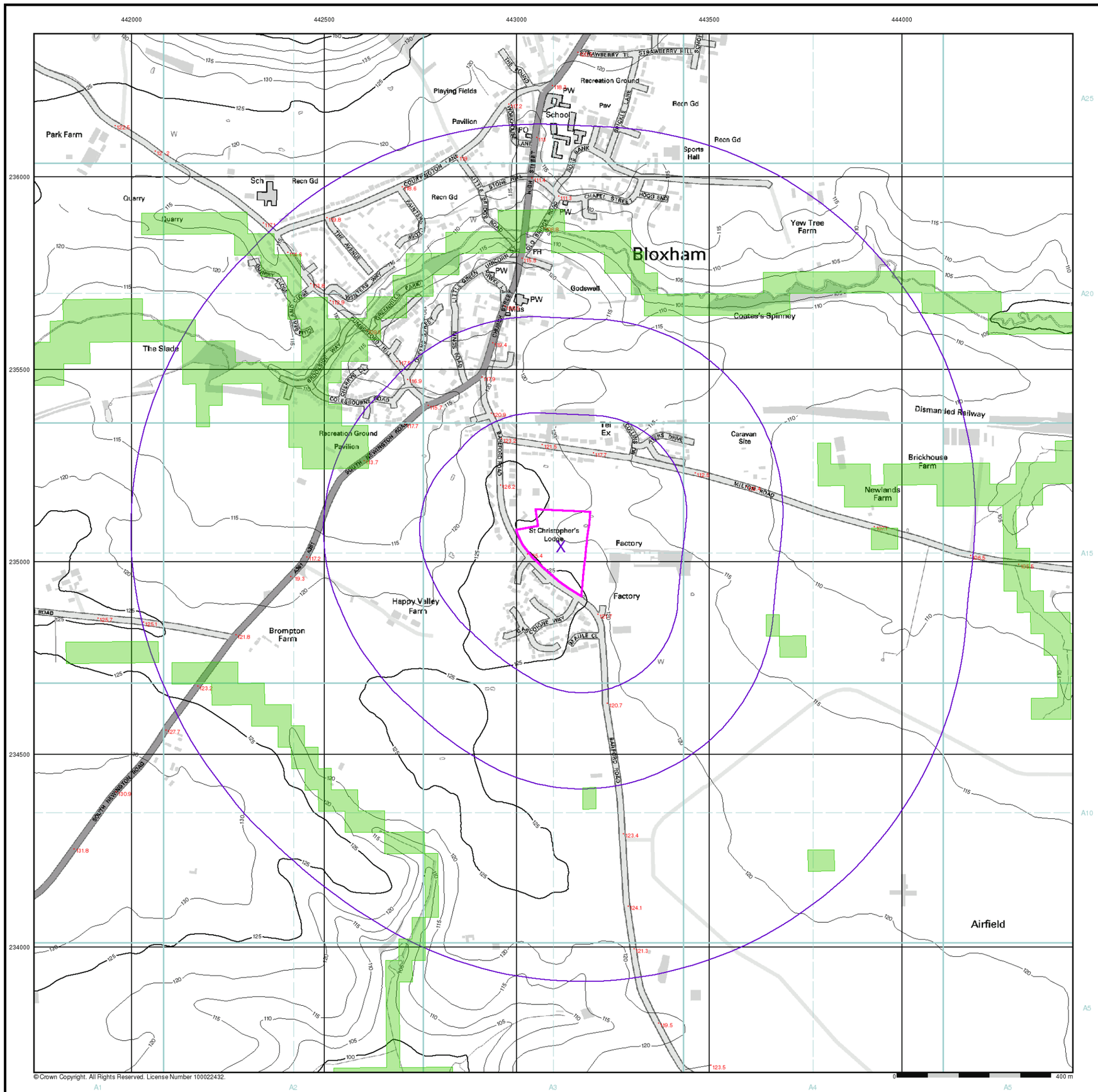

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RMS 100 year Return Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

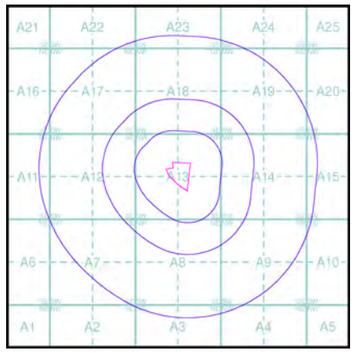
RMS 100 year Return Flood Data

Flood Depth (mm)	Flood Type: Defended Flood	Flood Type: Undefended Flood	Pluvial & Minor River Flood (flood depth n/a)
0 - 200			
201 - 500			
501 - 2000			
2001 +			

Contours (height in metres)

Standard Contour — 105 100 95
Index Contour
*167.3 Spot Height
*45.8 Air Height

RMS 100 year Return Flood Map - Slice A



Order Details

Order Number: 37446371_1_1
Customer Ref: MB608
National Grid Reference: 443120, 235040
Slice: A
Site Area (Ha): 2.65
Search Buffer (m): 1000

Site Details

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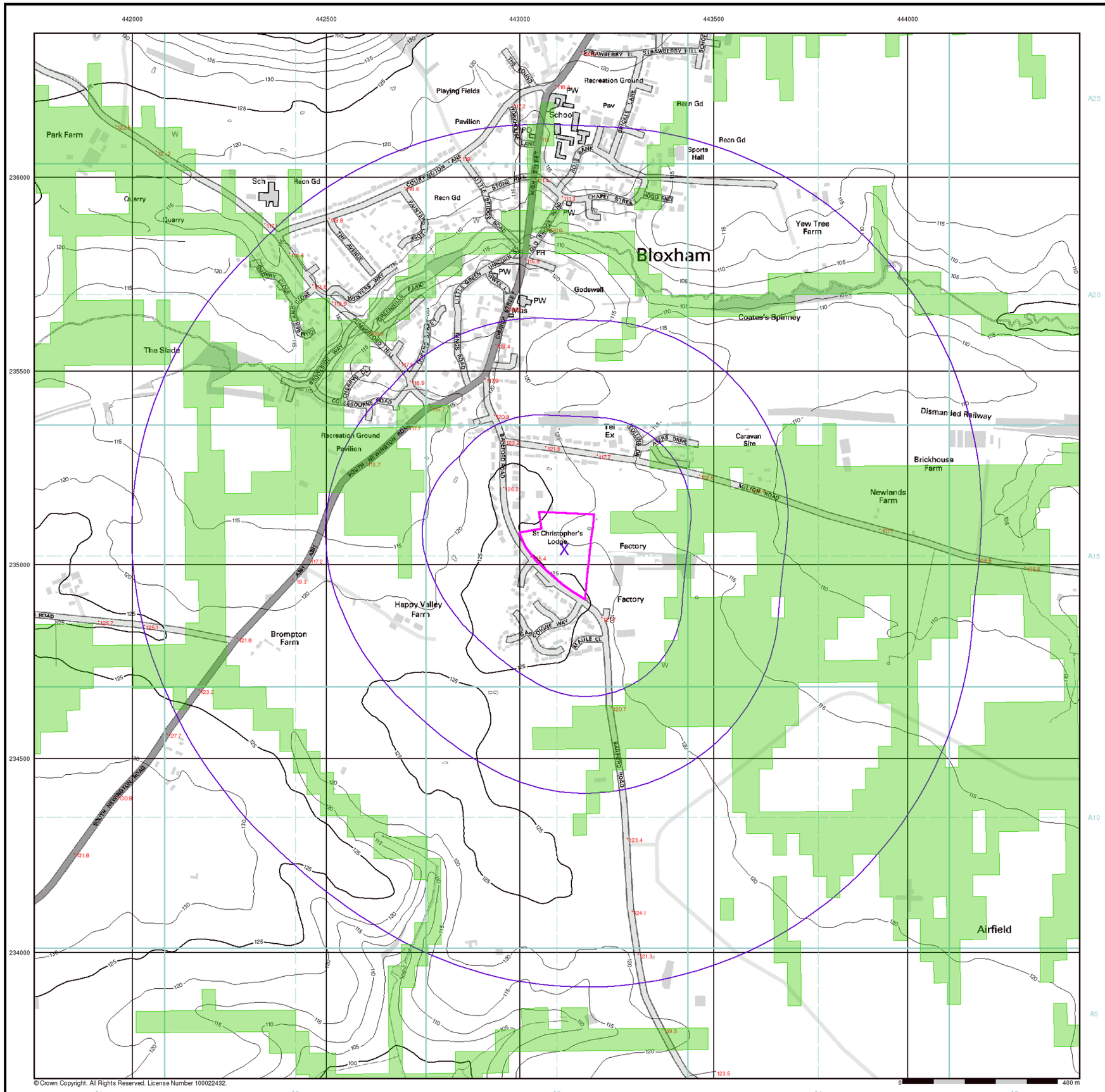

JOHNSON POOLE & BLOOMER
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RMS 1000 year Return Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

RMS 1000 year Return Flood Data

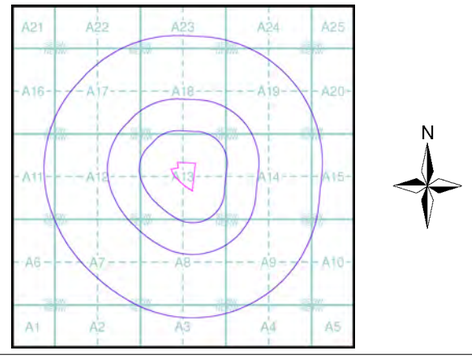
Flood Depth (mm)	Flood Type: Defended Flood	Flood Type: Undefended Flood	Pluvial & Minor River Flood (flood depth n/a)
0 - 200			
201 - 500			
501 - 2000			
2001 +			

Contours (height in metres)

Standard Contour 105 100 95 — *167.3 Spot Height

Index Contour — *45.8 Air Height

RMS 1000 year Return Flood Map - Slice A



Order Details

Order Number:	37446371_1_1
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National Grid Reference:	443120, 235040
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Site Area (Ha):	2.65
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EA Detailed River Network Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

EA Detailed River Network Data

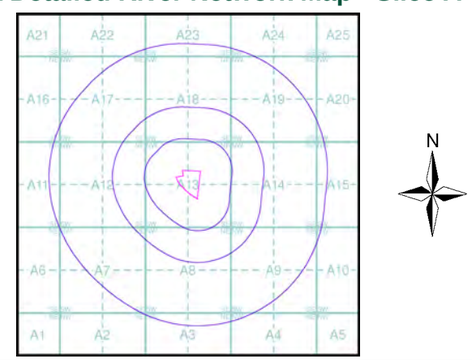
- Primary River
- Secondary River
- Tertiary River
- Canal
- Canal Tunnel
- Undefined River
- Lake/Reservoir
- Extended Culvert (greater than 50m)
- Underground River (inferred)
- Underground River (local knowledge)
- Downstream of High Water Mark
- Downstream of Seaward Extension
- Not assigned River feature
- Source
- Junction
- Sink
- Non-interactive Node
- Offline Drainage Feature
- Not assigned River feature
- Pseudo Node (general)
- Pseudo Node (High Water Mark)
- Pseudo Node (OS MasterMap polygon boundary)

Contours (height in metres)

Standard Contour 105 100 95
Index Contour

*167.3 Spot Height
*45.8 Air Height

EA Detailed River Network Map - Slice A



Order Details

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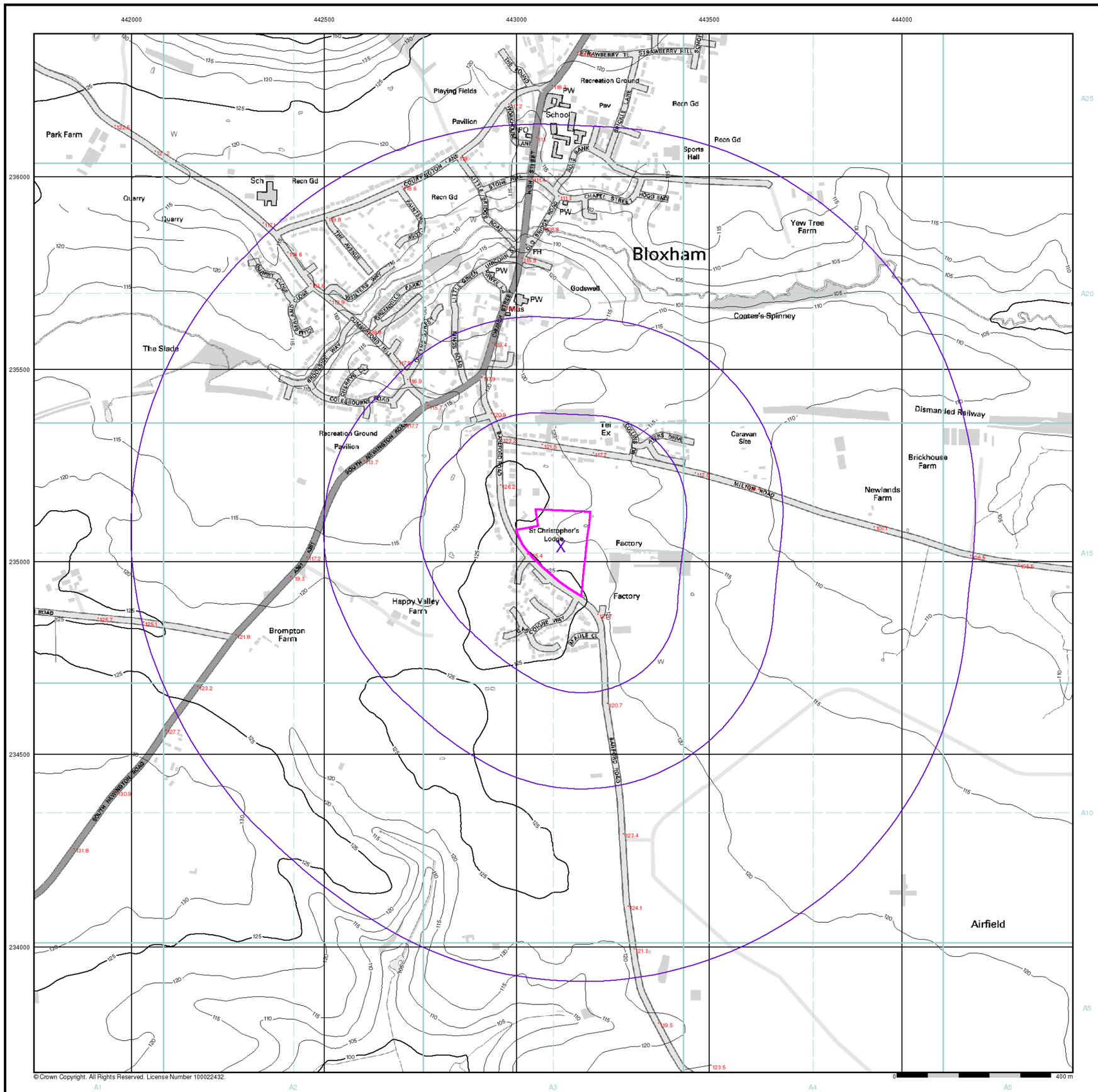

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EA Historic Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

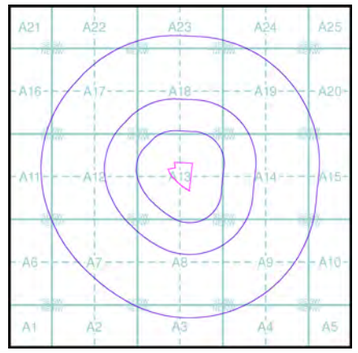
EA Historic Flood Events Data

- Channel Capacity Exceeded (no raised defences)
- Groundwater/High Water Table
- Local Drainage/Surface Water
- Mechanical Failure
- Obstruction/Blockage - Bridge
- Obstruction/Blockage - Channel
- Obstruction/Blockage - Culvert
- Obstruction/Blockage - Debris Screen
- Operational Failure/ Breach of Defence
- Other
- Overtopping of Defences
- Unknown
- Historical Flood Liabilities

Contours (height in metres)

Standard Contour 105 100 95
Index Contour
*167.3 Spot Height
*45.8 Air Height

EA Historic Flood Map - Slice A



Order Details

Order Number:	37446371_1_1
Customer Ref:	MB608
National Grid Reference:	443120, 235040
Slice:	A
Site Area (Ha):	2.65
Search Buffer (m):	1000

Site Details

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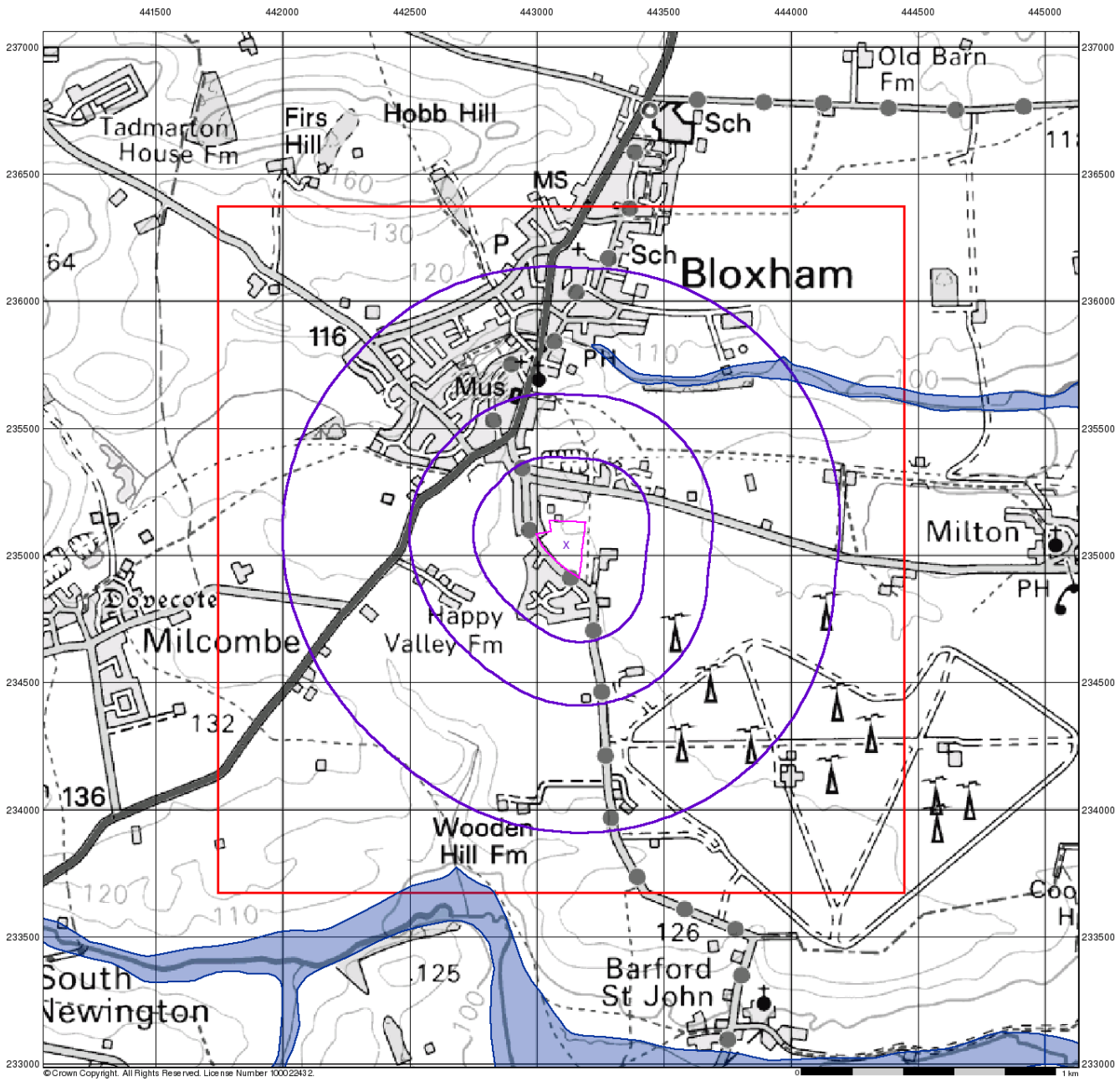

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LAND CONSULTANTS

BGS Flood Data (1:50,000)

General

Specified Site | Specified Buffer(s) | Bearing Reference Point
Slice | Map ID

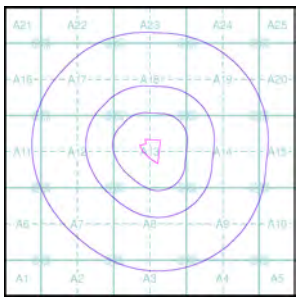
BGS Geological Indicators of Flooding

Coastal

Inland

Bodies of Water

BGS Flood Data Map - Slice A



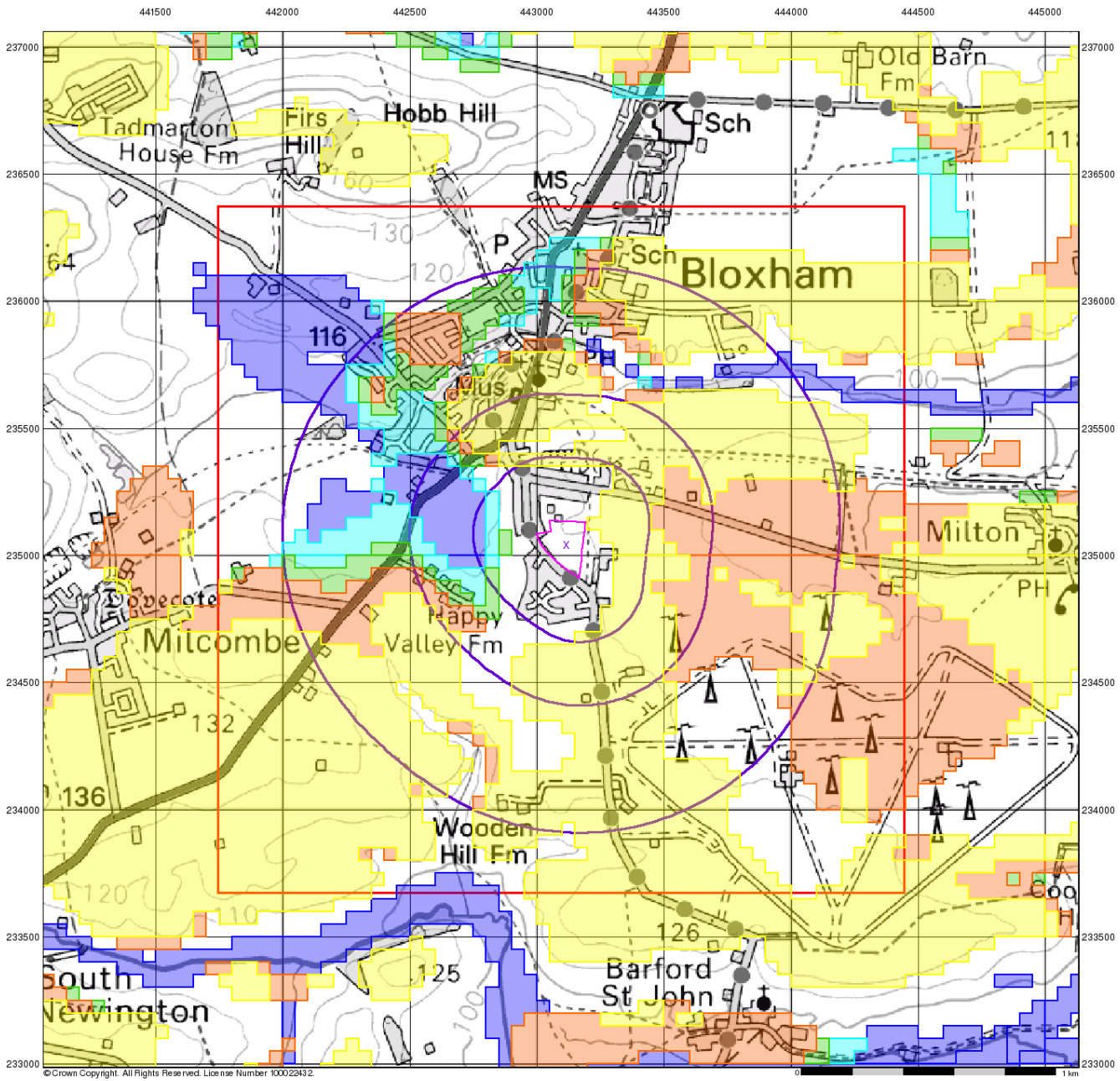
Order Details

Order Number:	37446371_1_1
Customer Ref:	MB608
National Grid Reference:	443120, 235040
Slice:	A
Site Area (Ha):	2.65
Search Buffer (m):	1000

Site Details

Barford Road, Bloxham, BANBURY, Oxfordshire

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



JOHNSON POOLE & BLOOMER
LAND CONSULTANTS

BGS Flood Data (1:50,000)

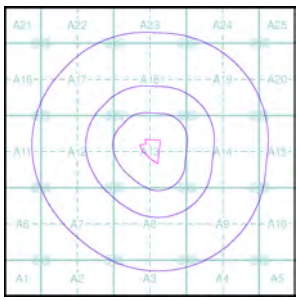
General

Specified Site | Specified Buffer(s) | Bearing Reference Point
Slice | Map ID

BGS Groundwater Flooding Susceptibility

- High Susceptibility
- Moderately High Susceptibility
- Moderate Susceptibility
- Low Susceptibility
- Negligible Susceptibility

BGS Flood Data Map - Slice A



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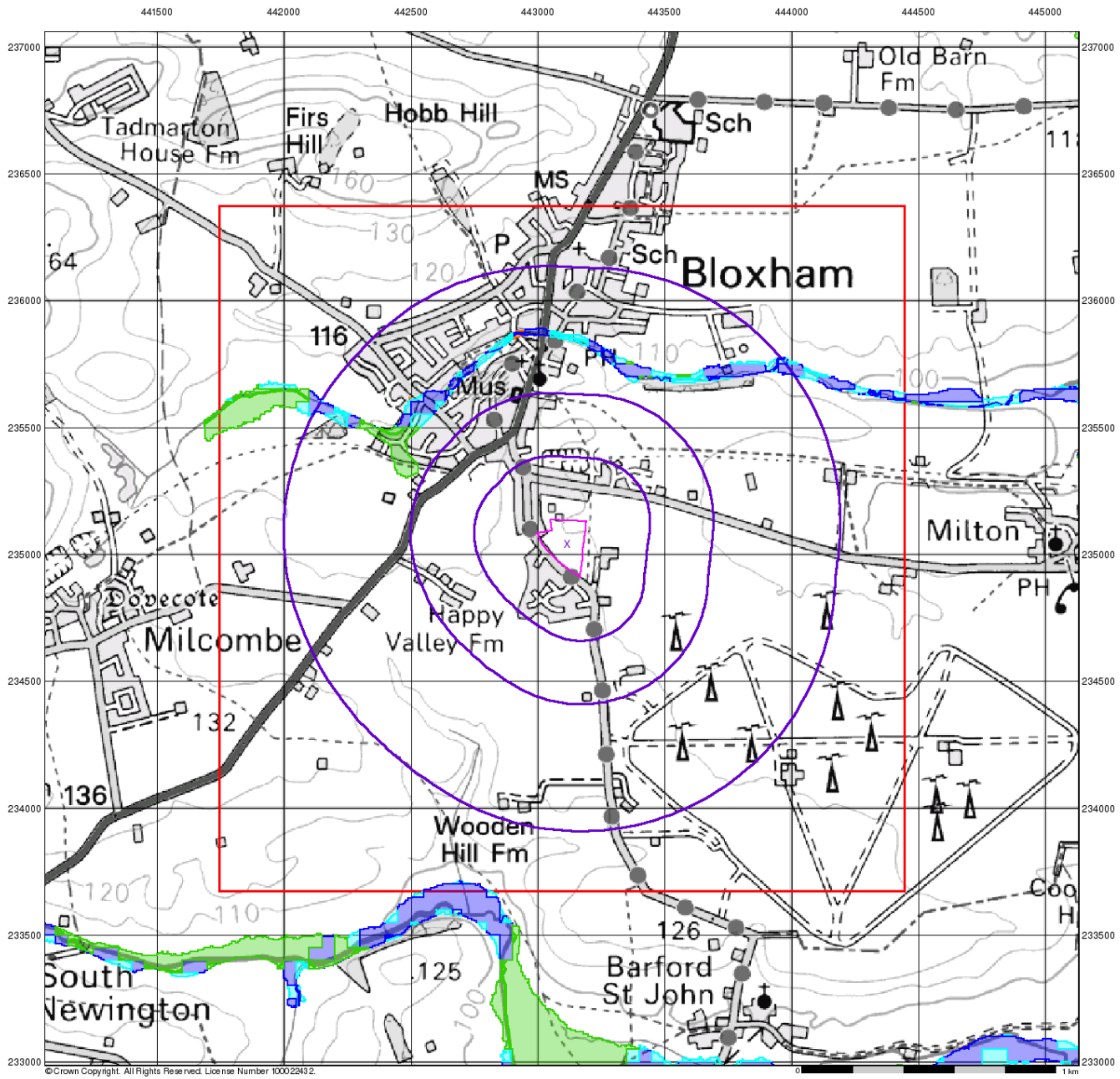


JOHNSON POOLE & BLOOMER LAND CONSULTANTS

EA NaFRA Data (1:50,000)

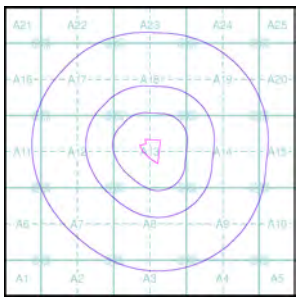
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

National Flood Risk Assessment (NaFRA)

- Significant Risk
- Moderate Risk
- Low Risk
- No Result

EA NaFRA Data Map - Slice A



Order Details

Order Number:	37446371_1_1
Customer Ref:	MB608
National Grid Reference:	443120, 235040
Slice:	A
Site Area (Ha):	2.65
Search Buffer (m):	1000

Site Details

Barford Road, Bloxham, BANBURY, Oxfordshire

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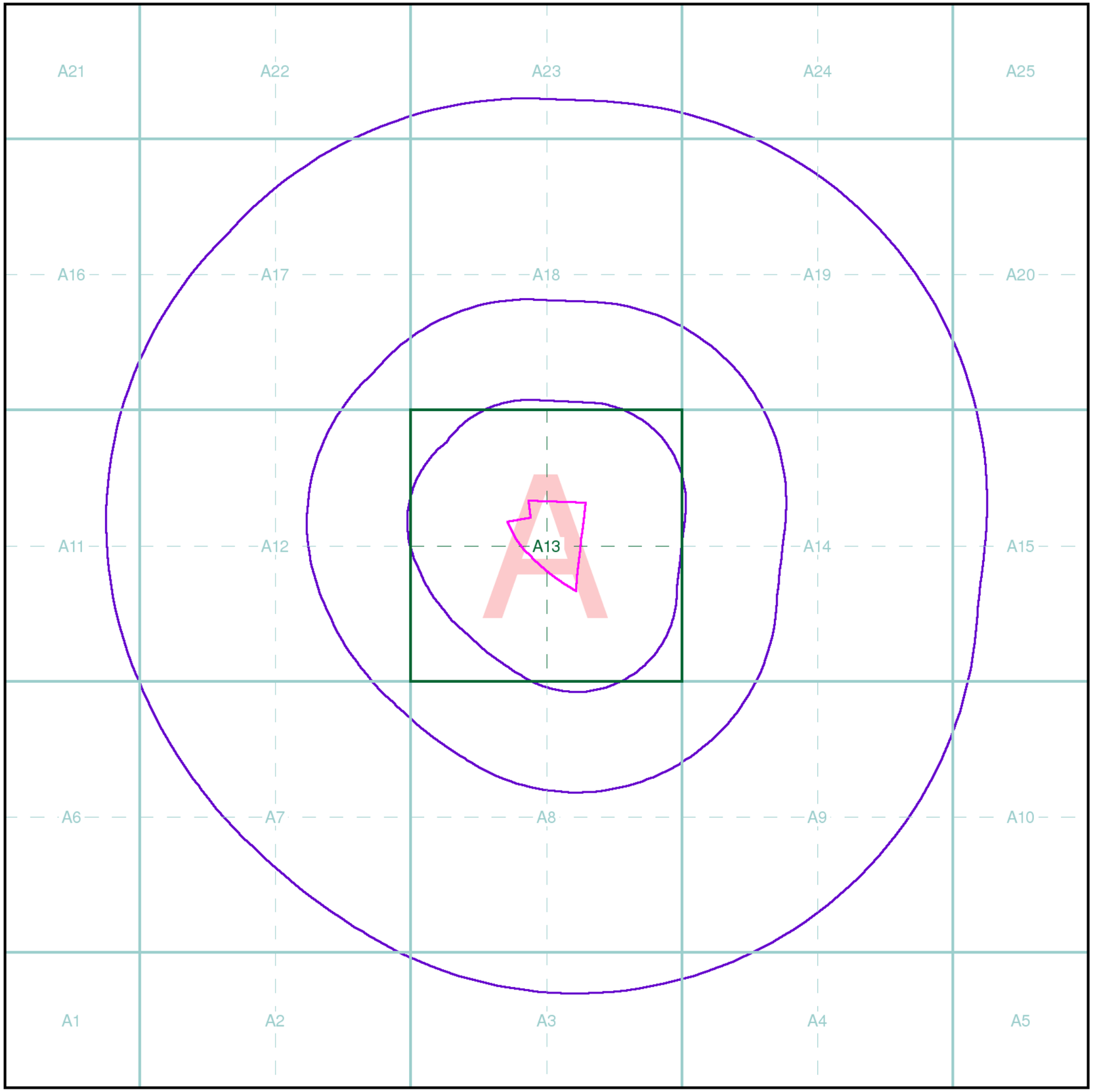

JOHNSON POOLE & BLOOMER LAND CONSULTANTS

Index Map

For ease of identification, your site and buffer have been split into Slices, Segments and Quadrants. These are illustrated on the Index Map opposite and explained further below.

Slice
Each slice represents a 1:10,000 plot area (2.7km x 2.7km) for your site and buffer. A large site and buffer may be made up of several slices (represented by a red outline), that are referenced by letters of the alphabet, starting from the bottom left corner of the slice "grid". This grid does not relate to National Grid lines but is designed to give best fit over the site and buffer.

Segment
A segment represents a 1:2,500 plot area. Segments that have plot files associated with them are shown in dark green, others in light blue. These are numbered from the bottom left hand corner within each slice.

Quadrant
A quadrant is a quarter of a segment. These are labelled as NW, NE, SW, SE and are referenced in the datasheet to allow features to be quickly located on plots. Therefore a feature that has a quadrant reference of A7NW will be in Slice A, Segment 7 and the NW Quadrant.

A selection of organisations who provide data within this report:

Ordnance Survey Licensed Partner

British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL

Environment Agency

NATURAL ENGLAND

Envirocheck reports are compiled from 136 different sources of data.

Client Details

Ms F Townley, Johnson Poole & Bloomer Ltd, Harris & Pearson Building, 56 Brettell Lane, Brierley Hill, West Midlands, DY5 3LH

Order Details

Order Number:	37446371_1_1
Customer Ref:	MB608
National Grid Reference:	443110, 235040
Site Area (Ha):	2.65
Search Buffer (m):	1000

Site Details

Barford Road, Bloxham, BANBURY, Oxfordshire

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

LANDMARK STANDARD TERMS AND CONDITIONS

DEFINITIONS

In these Terms, the following terms have the following meanings:
"Agreement" has the meaning set out in clause 1.d.
"Authorised Reseller" means an agent or reseller who We have duly appointed to resell Our Reports and Services.
"Consumer" means a natural person acting for purposes other than his trade, business or profession.
"Content" means any data, computing and information services and software, and other content and documentation or support materials and updates included in and/or supplied by or through the Websites, in Reports or Services or in any other way by Us and shall include both material developed by or on behalf of Us and Third Party Content.
"End User" means either: (i) a Consumer or a Consumer's friend or family member who uses the Services provided to the Consumer; or (ii) where You are not a Consumer, an employee of Yours who uses the Services provided to You; or (iii) a person identified in clause 2.b or their respective employees.
"Fees" means any charges levied by Us or an Authorised Reseller for Services provided to You.
"First Purchaser" means the first person, or legal entity to purchase the Property Site following provision of a Report.
"First Purchaser's Lender" means the funding provider for the First Purchaser.
"Information Pack" means a pack compiled by or on behalf of the owner or prospective buyer of the Property Site, designed to aid the marketing or purchase of the Property Site and containing information provided by or on behalf of the owner or prospective buyer of the Property Site.
"Intellectual Property Rights" means copyright, patent, design right (registered or unregistered), service or trade mark (registered or unregistered), database right or other data right, moral right or know how or any other intellectual property right.
References to "We", "Us" and "Our" are references to Landmark Information Group Limited, whose registered office is 7 Abbey Court, Eagle Way, Exeter, EX2 7HY.
"Order" means the request for Services from Us by You.
"Property Site" means a land site in relation to which We provide a Service.
"Report" includes any information that We supply to You including all reports, services, datasets, software or information contained in them.
"Services" means the provision of any service by Us pursuant to these Terms, including without limitation, any Report.
"Supplier" means any third party organisation that provides services, software, data, information and other content or functionality of any form to Us.
"Terms" means these terms and conditions.
"Third Party Content" means the services, software, data, information and other content or functionality provided by Suppliers and linked to or contained in the Services.
"Website" means any website hosted by Us and includes the Content and any report, service, document, data-set, software or information contained in such websites or derived from them.
References to "You", "Your" and "Yourself" refer to the contracting party who accesses the Website or places an Order with Us.

1. Basis of Contract

a. These Terms govern the relationship between Us and You where You purchase Services from Us. Where these Terms are not expressly accepted by You, they will be deemed to have been accepted by You, and You agree to be bound by these Terms, when You place any Order, or pay for any Services provided to You by Us.

b. You shall take all reasonable steps to check that the details that You provide in relation to Your Order are complete, accurate and correct and that the Report has been prepared for the correct location and property type. Neither We nor any Suppliers shall have any liability for errors or omissions in information provided by or on behalf of You or from Your failure to check that the Report relates to the correct location or property.

c. We may modify these Terms, and may discontinue or revise any or all other aspects of the Services at Our sole discretion, with immediate effect and without prior notice, including without limitation changing the Services available at any given time. Any amendment or variation to these Terms shall be posted on Our Websites. You acknowledge that it shall remain Your responsibility to check Our Website from time to time for any such amendments or variation to these Terms. Continued Orders of the Services by You shall be deemed an acceptance by You to be bound by any such amendments to the Terms.

d. These Terms together with Your Order, the Fees and delivery details in relation to Your Order and Our privacy policy, which is available on the Website, constitute the entire agreement between the parties relating to the supply of Services to You by Us ("Agreement"). You acknowledge that You have not relied on any statement, promise or representation made or given by or on behalf of Us which is not set out in the Agreement or delivery details. Nothing in this clause 1.d shall limit or exclude any liability for fraud.

e. These Terms shall prevail at all times to the exclusion of all other terms and conditions including any terms and conditions which You may purport to apply even if such other provisions are submitted in a later document or purport to exclude or override these Terms and neither the course of conduct between parties nor trade practice shall act to modify these Terms.

2. Services and Licensed Use

a. Subject to clauses 6.d, 6.k and 6.l, We shall use all reasonable skill, care and diligence in the performance of the Services.

b. Subject always to these Terms You may, without further charge, make the Services available to:
   i. the owner of the whole or part of the Property Site at the date of the Report;
   ii. any person who purchases the whole or part of the Property Site;
   iii. any person who provides funding secured on the whole or part of the Property Site;
   iv. any person for whom You act in a professional or commercial capacity in relation to the Property Site;
   v. any person who acts for You in a professional or commercial capacity in relation to the Property Site; and/or
   vi. prospective buyers of the whole or part of the Property Site as part of an Information Pack but for the avoidance of doubt, We shall have no liability to such prospective buyer unless the prospective buyer subsequently purchases the Property Site, and the prospective (or actual) buyer shall not be entitled to make the Service available to any other third party.

c. You shall not hold yourself out or describe yourself as Our agent or an agent of any of the Suppliers.

d. You shall ensure that acknowledgements of copyright and database right ownership are included in a conspicuous position in all copies of the Content. You may not delete any of Our or the Suppliers' intellectual property protection notices (including without limitation copyright notices or trade marks) from the Content.

e. You shall use Your best endeavours to use adequate technological and security measures, including measures We or Suppliers may reasonably recommend from time to time, to ensure that all Content which You hold or are responsible for is secure from unauthorised use or access.

f. The Content shall only be used strictly in accordance with these Terms and not for any other purpose; nor shall any use of the Content be made that would or might be deemed to be disparaging to Us, the Suppliers or any of them. You shall not be entitled to resell or rent any Content or otherwise any supply products incorporating such Content for commercial sale or rental.

g. You shall not reverse engineer, separate or otherwise tamper with the Content so that Content can be extracted and used for any purpose outside the scope of the Agreement.

h. If You are a Company or public body, You agree that the licensed use of Content pursuant to the Agreement always excludes its use by any of Your subsidiaries, holding companies or subsidiaries of such holding companies (as such terms are defined in section 1159 of the Companies Act 2006) or by any government entity associated with You (in each case as applicable). You agree, and shall procure, that any such company or entity shall enter into a separate agreement with Us.

i. All other uses of the Content are prohibited. If You wish to use the Content in a manner which is not authorised by the Terms, then You must contact Us to seek the necessary consents or licences (which may include further licences from the Suppliers), for which there may be additional Fees.

j. You agree to notify Us as soon as You suspect any infringement of Our or any of Our Supplier's intellectual property rights and You agree to give Us all reasonably required assistance in pursuing any potential infringement.

3. Intellectual Property and Confidentiality

a. You acknowledge and agree that all Intellectual Property Rights in Content are and shall continue to be owned by Us or Our Suppliers and nothing in the Agreement shall transfer, assign or grant any rights to You (save for the licence as set out above).

b. Subject to any use of the Content in accordance with these Terms, You acknowledge and agree that You shall, and shall procure that any person to whom You provide access to the Content shall, treat as strictly private and confidential the Services, the Content and all information which they obtain from the Services and Content. You agree to indemnify Us against all liabilities, damages, penalties, costs, expenses (including legal expenses on an indemnity basis) or other loss suffered or incurred by Us in relation to any breach or alleged breach of this clause 3.b.

4. Termination

a. At any time, We may terminate the Agreement with immediate effect by giving You written notice:
   i. if You are in breach of the Terms and, if such breach is capable of remedy, You fail to remedy the breach within 30 days of written notice from Us specifying the breach and requiring it to be remedied; and
   ii. if You have a receiver or administrative receiver or administrator appointed over You or any part of Your undertaking or assets or shall pass a resolution for winding up (otherwise than for the purpose of a bona fide scheme of solvent amalgamation or reconstruction) or if a court of competent jurisdiction shall make an order to that effect or if You become subject to an administration order or enter into a voluntary arrangement with Your creditors or shall cease or threaten to cease to carry on business or if You are presented with a bankruptcy petition.

b. In the event of the termination or expiry of the Agreement:
   i. You shall, subject to clause 4.b.iii, immediately cease to use the Report and any Content;
   ii. You shall, subject to clause 4.b.iii, within 30 days of such termination or expiry, destroy all Content in any media which You hold or for which You are responsible and provide, at Our request, a sworn statement by a duly authorised person that You no longer hold such Content;
   iii. except in the event of termination by Us under clause 4.a, You may retain Content in an archive following expiry of the Agreement for the sole purpose of addressing a complaint or challenge from a regulator or other third party regarding Your use of such Content during the term of the Agreement. Your rights are on condition that: (a) the archive rights do not apply to Content that include third party Intellectual Property Rights (other than Content provided by Ordnance Survey to the extent that the Intellectual Property Rights in such Content are owned by Ordnance Survey); (b) You shall not disclose Content retained under this clause 4.b.iii to any regulator or other third party except strictly to the extent necessary for the relevant purpose of addressing a complaint or challenge from a regulator or other third party and in paper or read-only electronic format only; (c) You must store such Content separately from any other data which You hold; and (d) subject to clause 6.a, We shall have no liability for Your use of it following termination or expiry of the Agreement; and
   iv. the parties shall have no further obligations or rights under the Agreement, without prejudice to those which have accrued to either party prior to termination or expiry save that the "Definitions", clauses 2.c to 2.j (inclusive), this clause 4.b, clauses 5.d, 6, 7, 9, 10 and 11 together with those other clauses the survival of which is necessary for the interpretation or enforcement of the Agreement or which by their nature can be reasonably interpreted as surviving the expiry or termination of the Agreement, shall continue to have effect after such expiry or termination.

5. Payments

a. An individual or a monthly invoice showing all Orders created by You will be generated subject to these Terms. You will pay the Fees at the rates set out in Our or Our Authorised Reseller's invoice within 30 days of the date of each invoice without deduction, counterclaim or set off. Where Your order comprises a number of Services or severable elements within any one or more Services, any failure by Us or its Authorised Reseller to provide an element or elements of the Services shall not prejudice Our or Our Authorised Reseller's ability to require payment in respect of the Services delivered to You. You acknowledge that time is of the essence with respect to the payment of such invoices.

b. VAT shall be due in addition to any Fees. You shall pay any other applicable indirect taxes related to Your use of the Services.

c. Neither We nor any Authorised Reseller shall be required to notify You in advance of any amendment to the Fees and the placing of any further Order for Services shall be deemed acceptance of any revisions to the Fees.

d. If You fail to pay by the due date any amount due and payable by You under the Agreement, We shall be entitled, but not obliged to, charge You interest on the overdue amount, payable by You immediately on demand, accruing from the due date up to the date of actual payment, after as well as before judgment, at the rate set out in the Late Payment of Commercial Debts (Interest) Act 1998 from time to time and fixed sum compensation under the Late Payment of Commercial Debts Regulations 2002. Such interest shall accrue on a daily basis.

6. Liability

a. Nothing in these Terms excludes or limits either party's liability for death or personal injury caused by that party's negligence or wilful default or for fraud, and the remainder of this clause 6 is subject to this provision. If You are a Consumer, Your statutory rights (which include, for example, that We will provide the Services to a reasonable standard and within a reasonable time) are not affected by anything in these Terms.

b. Save as set out in clause 6.a, We shall not be liable to You or to any End User in contract, tort (including negligence) or for breach of statutory duty or in any other way for:
   i. any indirect or consequential losses (which includes any loss that could not have been reasonably expected by You and Us at the time of entering into these Terms);
   ii. loss arising from or in connection with loss of revenues, profits, contracts or business or failure to realise anticipated savings; or
   iii. loss of goodwill or reputation.

c. Save as set out in clause 6.a, Our total liability to You and/or any End User in contract or tort (including negligence) or for breach of statutory duty shall not exceed an amount of ten million pounds (£10,000,000) per claim or series of connected claims.

d. The Content that Services are based on is derived from third party sources. Therefore, save as set out in clause 6.l in respect of risk assessments and professional opinions, We do not warrant the accuracy or completeness of any information or Content provided, unless We should reasonably have been alerted to any omission, error or inaccuracy in the Content. Such Content is provided specifically from the sources as described by Us and We do not claim that these represent an exhaustive or comprehensive list of all sources that might be consulted.

e. You acknowledge and agree that neither You nor any End User shall have any claim or recourse against any Supplier of Third Party Content.

f. You acknowledge and agree that We do not warrant that the online supply of Content or Services or any internet ordering service will be: uninterrupted or error free or provide any particular facilities or functions; free from defects; free from software viruses; free of error from computer malfunction, inaccurate processing; free from corruption of data whilst geo-coding, processing by computer or electronic means or in the course of transmission; or similar, although We will use reasonable endeavours to correct any such issues within a reasonable period of them becoming known (which may be limited to notifying the relevant Supplier). Time shall not be of the essence in providing the Content or Services.

g. You acknowledge and agree that no physical inspection of the Property Site

reported on is carried out as part of any Services offered by Us and We do not warrant that all land uses or features whether past or current will be identified in the Services. The Services do not include any information relating to the actual state or condition of any Property Site nor should they be used or taken to indicate or exclude actual fitness or unfitness of a Property Site for any particular purpose nor should it be relied upon for determining saleability or value or used as a substitute for any physical investigation or inspection.

h. You acknowledge and agree that We will not be held liable in any way if a Report is used otherwise than as provided for in these Terms and/or in the Report.

i. You acknowledge and agree that the Services have not been prepared to meet Your or anyone else's individual requirements and it is Your responsibility to ensure that the Services ordered are suitable for Your (or the End User's) intended purpose.

j. You acknowledge and agree that You shall, on receipt of a Report carry out a reasonable inspection to satisfy Yourself that there are no apparent defects or failures with respect to the description and location of the Property Site and shall promptly inform Us if there are any such defects or failures.

k. All liability for any insurance products purchased by You rests solely with the insurer. We do not endorse any particular product or insurer and no information contained within the Services should be deemed to imply otherwise. You acknowledge that if You Order any such insurance We will deem such as Your consent to forward a copy of the Report to the insurers. Where such policy is purchased, You acknowledge and agree that all liability shall remain with the insurers and that You are entirely responsible for ensuring that the insurance policy offered is suitable for Your needs and should seek independent advice. We do not guarantee that an insurance policy will be available on a Property Site. You acknowledge and agree that all decisions with regard to the offer of insurance policies for any premises will be made solely at the discretion of the insurers and We accept no liability in this regard. The provision of a Report does not constitute any indication by Us that insurance will be available on the Property Site.

l. We may provide You with professional opinions or a risk assessment in a Report. You acknowledge and agree that We shall carry out (or procure that third parties carry out) such assessment with reasonable skill and care and that We shall be liable where any such risk assessment is carried out negligently. Notwithstanding the foregoing We shall not be liable for any inaccurate statement, opinion or risk rating in a Report which resulted from a reasonable interpretation of the Content.

m. Neither You, nor any End User or any other person may rely on a Service more than 12 months after it was originally provided.

n. You shall use all reasonable endeavours to ensure that End Users acknowledge and agree to the limitations and exclusions of liability set out in this clause 6.

7. Contribution

a. Save where expressly provided, this clause 7 shall apply solely to Envirosearch Residential Reports (regardless of the result of such Report). Nothing in this clause 7 shall operate to override or vary the provisions of clause 6.

b. We are prepared to offer, without any admission or inference of liability, a contribution towards the costs of any remediation works required under a Notice (as defined below) on the terms of this clause 7 ("the Contribution").

c. In the event that a Remediation Notice is served on the First Purchaser or First Purchaser's Lender of a Property Site under Part IIA of the Environmental Protection Act 1990 ("the Notice") We shall contribute to the cost of such works as either the First Purchaser or First Purchaser's Lender (but not both) are required to carry out under the Notice subject to the provisions of this clause 7 and on the following terms:

   i. the Contribution shall only apply to contamination or a pollution incident present or having occurred prior to the date of the Report;

   ii. the Contribution shall only apply where the Property Site is a single residential dwelling house or a single residential flat within a block of flats. For the avoidance of doubt, this obligation does not apply to any commercial property, nor to any Property Site being developed or redeveloped whether for residential purposes or otherwise;

   iii. the Contribution is strictly limited to the cost of works at the Property Site and at no other site; and

   iv. the Contribution will not be paid in respect of any of the following: (1) radioactive contamination of whatsoever nature, directly or indirectly caused by or contributed to or arising from ionising radiations or contamination by radioactivity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel or the radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof; (2) asbestos arising out of or related in any way to asbestos or asbestos-containing materials on or in structures or services serving the structures; (3) naturally occurring materials arising from the presence or required removal of naturally occurring materials except in circumstances where such materials are present in concentrations which are in excess of their natural concentration; (4) intentional non-compliance arising from the intentional disregard of or knowing wilful or deliberate non-compliance by any owner or occupier of the Property Site with any statute, regulation, administrative complaint, notice of violation, or notice letter of any Regulatory Authority; (5) any condition which is known or ought reasonably to have been known to the First Purchaser or the First Purchaser's Lender prior to the purchase of the Report; (6) any condition which is caused by acts of war or an act of terrorism; (7) any property belonging to or in the custody or control of the First Purchaser which does not form a fixed part of the Property Site or the structure; (8) any fines liquidated damages punitive or exemplary damages; (9) any bodily injury including without limitation, death, illness or disease, mental injury, anguish or nervous shock; (10) any financial loss in respect of any loss of any rental, profit, revenue, savings or business or any consequential indirect or economic loss damage or expense including the cost of rent of temporary premises or business interruption; and/or (11) any losses incurred following a material change in use of, alteration or development of the Property Site.

d. Without prejudice to Your other rights and remedies under the Agreement, the maximum sum that shall be contributed by Us in respect of any Contribution shall be limited to £60,000. In the event that more than one Report is purchased on the Property Site the Contribution will only be payable under the first Report purchased by or on behalf of any First Purchaser or First Purchaser's Lender and no Contribution will be made in respect of subsequent Reports purchased by or on behalf of such First Purchaser, First Purchaser's Lender or any person connected to them.

e. We shall only pay a Contribution where the Notice is served within 36 months of the issue date of the Report.

f. Any rights to a Contribution under this clause 7 are not assignable in the event of a sale of the Property Site and We shall not make any Contribution after the date of completion of such sale.

g. In the event the First Purchaser or First Purchaser's Lender wishes to claim any Contribution, it shall notify Us in writing within 3 months of the date of the Notice. The First Purchaser or First Purchaser's Lender (as applicable) shall comply with all Our reasonable requirements with regard to the commission and conduct of the remediation works to be carried out under the Notice, and in the event the First Purchaser or First Purchaser's Lender (as applicable) does not do so, including without limitation, obtaining Our prior written consent to any estimates for such works or complying with any other reasonable request by Us, We shall not be required to pay any Contribution. Notwithstanding the payment of the Contribution by Us the First Purchaser or First Purchaser's Lender as applicable shall take all reasonable steps to mitigate any costs incurred in connection with the conduct of works required under the terms of any Notice.

h. In the event that the First Purchaser or First Purchaser's Lender receives any communication from a statutory authority to the effect that there is an intent to serve a notice received under Part IIA of the Environmental Protection Act 1990 You shall ensure that they advise Us within a maximum period of two months from receipt of such communication. This clause 7.h and the service of any notice under it shall not affect the provisions of clauses 7.e and 7.g, and any such communications, even if advised to Us will not operate as notice under clause 7.e.

i. We reserve the right at any time prior to a claim for Contribution being made in accordance with clause 7.g above, to withdraw the offer of payment of Contributions without further notice.

8. Assignment and Sub-contracting

a. We shall be entitled to assign or transfer the Agreement as We reasonably see fit.

b. The Agreement is personal to You. You shall not assign, transfer, sub-licence or otherwise deal with any of Your rights and obligations under the Agreement without Our prior written consent.

c. We may authorise or allow Our contractors and other third parties to provide to Us and/or to You services necessary or related to the Services and to perform Our obligations and exercise Our rights under these Terms, which may include collecting payment on Our behalf.

9. Events Beyond Our Control

a. Neither party to the Agreement shall be liable for any delay or failure to perform their obligations caused by any circumstance beyond their control, and such party shall be entitled to a reasonable extension of time for the performance of such obligation.

10. Complaints and Dispute Resolution

a. Any complaints in relation to the Services should, in the first instance, be in writing addressed to the Customer Service Support Manager at Our registered office. We will (or Our agents will) respond to any such complaints in writing as soon as practicably possible.

b. If any dispute arises out of or in connection with the Terms of the Agreement or their validity ("Dispute") the parties undertake, subject to clause 10.c, that prior to commencement of court proceedings they will negotiate in good faith to settle such Dispute by mediation in accordance with the Centre for Effective Dispute Resolution Model Mediation Procedure as in force from time to time, which Procedure is deemed to be incorporated by reference into this clause. Unless otherwise agreed between the parties, the mediator will be nominated by the Centre for Effective Dispute Resolution. To initiate the mediation a party shall give notice in writing to the other party to the dispute requesting a mediation. The mediation will start not later than 21 days after the date of service of such notice. If the Dispute has not been resolved to the mutual satisfaction of the parties within 60 days (or such other period as they shall agree) after the date of service of such notice then either party may refer the Dispute to the courts in accordance with clause 11.f.

c. Clause 10.b shall be without prejudice to the rights of termination stated in clause 4.a and in addition shall not prevent Us from:

   i. applying for injunctive relief in the case of: (1) breach or threatened breach of confidentiality; or (2) infringement or threatened infringement of Our or Our Suppliers' intellectual property rights; or

   ii. pursuing a debt claim for the payment of the Fees.

11. General

a. If any provision of the Agreement is found by either a court or other competent authority to be void, invalid, illegal or unenforceable, that provision shall be deemed to be deleted from the Agreement and never to have formed part of the Agreement and the remaining provisions shall continue in full force and effect.

b. No delay, failure or omission on Our, or any Supplier's, part in enforcing, exercising or pursuing any right, power, privilege, claim or remedy conferred by or arising under the Agreement or by law shall be deemed to be or construed as a waiver of that or any other right, power, privilege, claim or remedy, nor shall any single or partial exercise of any such right, power, privilege, claim or remedy preclude the exercise of that or any other right, power, privilege, claim or remedy.

c. Our privacy policy as displayed on Our Website and updated from time to time governs the use that We shall make of any information provided by You or an End User.

d. A person who is not a party to any contract made pursuant to these Terms shall have no right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Agreement and We shall not be liable to any such third party in respect of the Products, save that any Supplier may enforce any of these terms and conditions against You in accordance with the Contracts (Rights of Third Parties) Act 1999. Notwithstanding any other provisions of the Agreement, We may rescind or vary the Agreement in accordance with its terms without the consent of the Suppliers and accordingly section 2(1) of the Contracts (Rights of Third Parties) Act 1999 shall not apply.

e. You shall ensure that each End User complies with and is bound by the Terms and shall procure that We may in Our own right enforce such terms and conditions against the End User pursuant to the Contracts (Rights of Third Parties) Act 1999. You shall be responsible for End User's compliance with the Terms and You shall be liable for all breaches of the Terms by the End Users as if they were breaches by You.

f. The Agreement and any non-contractual obligations arising out of or in connection with it shall be governed by and construed in accordance with the laws of England and, subject to clause 10.b, each party irrevocably submits to the exclusive jurisdiction of the courts of England and Wales.

Appendix C

Thames Water Utilities Limited
Commercial Drainage and Water Enquiry

CommercialDW
Drainage and Water Enquiry

Gladman Developments Ltd
Gladman House
Alexandria Way
CW12 1LB

Search address supplied Vacant land adjacent to
Barford Road
Bloxham
Banbury
OX15

Your reference SK/Bloxham

Our reference CDWS/CDWS Standard/2011_1980620

Received date **5 April 2011**

Search date **6 April 2011**

Please Note:

This report provides £2m of capped liability cover for the details contained within this enquiry. Our commercial customers have requested that we develop products with higher levels of indemnity cover, so in response Thames Water can now provide commercial drainage and water enquiries with £5m and £10m cover. For full details and costs, please contact customer service team on 0118 9251504 or visit www.twpropertyinsight.co.uk for full details.

COMMERCIALDW
DRAINAGE AND WATER ENQUIRY

Thames Water Utilities Ltd

Property Insight
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.twpropertyinsight.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

CommercialDW
Drainage and Water Enquiry

Order Summary

	Question	Answer
Maps		
1	Where relevant, please include a copy of an extract from the public sewer map.	Map Provided
2	Where relevant, please include a copy of an extract from the map of waterworks.	Map Provided
Drainage		
3	Does foul water from the property drain to a public sewer?	See Details
4	Does surface water from the property drain to a public sewer?	See Details
5	Is a surface water drainage charge payable?	See Details
6	Does the public sewer map indicate any public sewer, disposal main or lateral drain within the boundary of the property?	No
7	Does the public sewer map indicate any public sewer within 30.48 metres (100 feet) of any buildings within the property?	See Details
8	Are any sewers or lateral drains serving, or which are proposed to serve the property, the subject of an existing adoption agreement or an application for such an agreement?	No
9	Has a sewerage undertaker approved or been consulted about any plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain?	No
10	Is any building which is or forms part of the property, at risk of internal flooding due to overloaded public sewers?	See Details
11	Please state the distance from the property to the nearest boundary of the nearest sewage treatment works.	See Details
Water		
12	Is the property connected to mains water supply?	See Details
13	Are there any water mains, resource mains or discharge pipes within the boundary of the property?	No
14	Is there any water main or service pipe serving, or which is proposed to serve the property, the subject of an existing adoption agreement or an application for such an agreement?	No
15	Is the property at risk of receiving low water pressure or flow?	Not Connected
16	Please include details of a water quality analysis made by the water undertaker for the water supply zone in respect of the most recent calendar year.	See Details

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CommercialDW
Drainage and Water Enquiry

17	Please include details of any departures, authorised by the Secretary of State or by the National Assembly for Wales under Part 6 of the 2000 Regulations from the provisions of Part 3 of those Regulations.	Passed

Charging

18	Please include details of the location of any water meter serving the property.	See Details
19	Who is the sewerage and water undertakers for the area?	See Details
20	Who bills the property for sewerage services?	Not Billed
21	Who bills the property for water services?	Not Billed
22	What is the current basis for charging for sewerage and / or water services at the property?	No Charge

Optional Additional Information

23	Are there any trade effluent consents relating to this site/property for disposal of chemically enhanced waste?	No
24	Is there a wayleave agreement giving Thames Water the right of access to pass through private land in order to reach the Company's assets?	No
25	Is there an easement agreement giving the Company the right of access to Assets located in private land which prevent the landowner from restricting the Company's access?	No
26	Details of any manhole cover and invert levels applicable to this site are enclosed.	See Details

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CommercialDW
Drainage and Water Enquiry

Search address supplied: Vacant land adjacent to, Barford Road, Bloxham, Banbury, OX15

Any new owner or occupier will need to contact Thames Water on 0845 9200 888 or log onto our website www.thameswater.co.uk and complete our online form to change the water and drainage services bills to their name.

The following records were searched in compiling this report: - the map of public sewers, the map of waterworks, water and sewer billing records, adoption of public sewer records, building over public sewer records, the register of properties subject to internal foul flooding, the register of properties subject to poor water pressure and the drinking water register. Thames Water Utilities Ltd (TWUL) holds all of these.

TWUL, trading as Property Insight, are responsible in respect of the following: -

(i) any negligent or incorrect entry in the records searched

(ii) any negligent or incorrect interpretation of the records searched

(iii) any negligent or incorrect recording of that interpretation in the search report

(iv) and compensation payments

Please refer to the attached Terms & Conditions. Customers and clients are asked to note these terms, which govern the basis on which this Commercial Drainage and Water search is supplied.

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CommercialDW
Drainage and Water Enquiry

Maps

Q1 Where relevant, please include a copy of an extract from the public sewer map.

A copy of an extract of the public sewer map is included, showing the public sewers, disposal mains and lateral drains in the vicinity of the property.

Q2 Where relevant, please include a copy of an extract from the map of waterworks.

A copy of an extract of the map of waterworks is included, showing water mains, resource mains or discharge pipes in the vicinity of the property.

Drainage

Q3 Does foul water from the property drain to a public sewer?

This enquiry appears to relate to a plot of land or a recently built property. It is recommended that drainage proposals are checked with the developer.

Q4 Does surface water from the property drain to a public sewer?

This enquiry appears to relate to a plot of land or a recently built property. It is recommended that drainage proposals are checked with the developer.

Q5 Is a surface water drainage charge payable?

This enquiry appears to relate to a plot of land or a recently built property. It is recommended that drainage proposals are checked with the developer.

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Q6 Does the public sewer map indicate any public sewer, disposal main or lateral drain within the boundary of the property?

The public sewer map indicates that there are no public sewers, disposal mains or lateral drains within the boundaries of the property. However, it has not always been a requirement for such public sewers, disposal mains or lateral drains to be recorded on the public sewer map. It is therefore possible for unidentified sewers, disposal mains or lateral drains to exist within the boundaries of the property.

Q7 Does the public sewer map indicate any public sewer within 30.48 metres (100 feet) of any buildings within the property?

The public sewer map indicates that there are no public sewers within 30.48 metres (100 feet) of a building within the property. However, it has not always been a requirement for such public sewers to be recorded on the public sewer map. It is therefore possible for unidentified sewers or public sewers to exist within the boundaries of the property.

Q8 Are any sewers or lateral drains serving, or which are proposed to serve, the property the subject of an existing adoption agreement or an application for such an agreement?

Records confirm that sewers serving the development, of which the property forms part are not the subject of an existing adoption agreement or an application for such an agreement.

Q9 Has a sewerage undertaker approved or been consulted about any plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain?

There are no records in relation to any approval or consultation about plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain. However, the sewerage undertaker might not be aware of a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain.

Q10 Is any building which is or forms part of the property, at risk of internal flooding due to overloaded public sewers?

The property is not recorded as being at risk of internal flooding due to overloaded public sewers.

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Q11 Please state the distance from the property to the nearest boundary of the nearest sewage treatment works.

The nearest sewage treatment works is 0.981 kilometeres to the north east of the property. The name of the nearest sewage treatment works is BLOXHAM STW.

Water

Q12 Is the property connected to mains water supply?

This enquiry relates to a plot of land or a recently built property. It is recommended that the water supply proposals are checked with the developer.

Q13 Are there any water mains, resource mains or discharge pipes within the boundary of the property?

The map of waterworks does not indicate any water mains, resource mains or discharge pipes within the boundaries of the property.

Q14 Is any water main or service pipe serving, or which is proposed to serve, the property the subject of an existing adoption agreement or an application for such an agreement?

Records confirm that water mains or service pipes serving the property are not the subject of an existing adoption agreement or an application for such an agreement.

Q15 Is the property at risk of receiving low water pressure or flow?

Records confirm that the property is not recorded on a register kept by the water undertaker as being at risk of receiving low water pressure or flow.

Q16 Please include details of a water quality analysis made by the water undertaker for the water supply zone in respect of the most recent calendar year.

The analysis confirmed that all tests met the standards prescribed by the Water Supply (Water Quality) Regulations 2000, except on two occasions. 1 out of 169 tests failed to meet the standard for coliform bacteria. 1 out of 24 tests failed to meet the standard for metaldehyde.

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Q17 Please include details of any departures, authorised by the Secretary of State or by the National Assembly for Wales under Part 6 of the 2000 Regulations from the provisions of Part 3 of those Regulations.

There are no such authorised departures for the water supply zone.

Charging

Q18 Please include details of the location of any water meter serving the property.

This enquiry appears to relate to a plot of land or a recently built property. It is recommended that drainage proposals are checked with the developer.

Q19 Who is the sewerage and water undertakers for the area?

Thames Water Utilities Limited, Clearwater Court, Reading, RG1 8DB is the sewerage undertaker for the area and Thames Water Utilities Limited, Clearwater Court, Reading, RG1 8DB is the water undertaker for the area.

Q20 Who bills the property for sewerage services?

The property is not billed for sewerage services.

Q21 Who bills the property for water services?

The property is not billed for water services.

Q22 What is the current basis for charging for sewerage and / or water services at the property?

Records indicate that this enquiry relates to a plot of land or a recently built property.

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CommercialDW
Drainage and Water Enquiry

Optional Additional Information

Q23 Trade Effluent Consent

Are there any trade effluent consents relating to this site/property for disposal of chemically enhanced waste?

No.

Q24 Wayleaves

Is there a wayleave agreement giving Thames Water (from here on known as "the Company") the right of access to pass through private land in order to reach the Company's assets?

No.

Q25 Easement

Is there an easement agreement giving the Company the right of access to assets located in private land which prevent the landowner from restricting the Company's access?

No.

Q26 Manhole Cover and Invert Levels

Details of any manhole cover and invert levels applicable to this site are enclosed.

Payment for this Search

The charge will be added to the NLIS Account. This search was ordered through National Land Information Services, Russell Square House, 10-12 Russell Square, London WC1B 5LF.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information.

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CommercialDW Drainage and Water Enquiry Sewer Map- CDWS/CDWS Standard/2011_1980620

The width of the displayed area is 500m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no survey information is available.

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1701	125.42	123.59
1752	123.95	122.5
2791	n/a	n/a
1702	123.96	122.04
1851	123.49	122.01
1801	123.6	121.69
2851	121.15	120.01
1852	122.27	120.49
1802	122.25	120.15
2852	121.76	120.36
0854	127.33	125.61
281A	n/a	n/a
0804	127.24	125.27
1857	126	124.38
1859	n/a	n/a
1803	125.91	124.05
1853	122.24	120.54
1856	124.97	123.09
1804	124.45	122.19
0855	126.91	125.44
1805	124.04	122.02
1854	123.94	122.37
1855	124.45	122.77
0905	127.2	125.74
1951	125.44	123.66
0904	126.5	125.41
0954	126.43	124.08
9851	129.2	127.96
9853	128.89	127.06
0801	129.12	127.23
0901	128.32	126.44
0951	128.48	126.91
0851	129.08	127.52
0902	127.5	125.71
0952	127.55	126.1
0802	128.73	126.53
0903	126.8	125.1
0953	126.8	125.48
0852	128.66	126.83
0003	n/a	n/a
0001	n/a	n/a
0004	n/a	n/a
0853	127.98	126.51
0856	128.22	126.61
0751	127.41	126.04
0803	128.12	125.94
9201	n/a	n/a
9101	126.22	122.38
9852	128.72	127.52
9802	128.8	127.08
9102	125.36	122.73
9103	125.16	123.25
9801	129.27	127.6
9803	128.96	126.77

Sewer Key - Commercial Drainage and Water

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) ‘na’ or ‘0’ on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0118 925 1504.

CommercialDW Drainage and Water Enquiry Water Map-CDWS/CDWS Standard/2011_1980620

The width of the displayed area is 500m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Waterworks Key - Commercial Drainage and Water Enquiry

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

CommercialDW Drainage and Water Enquiry Guidance Notes

Enquiries and Response

The records relating to this search were checked by Renee Truter of Thames Water Utilities who has no, nor is likely to have, any personal or business relationship with any person involved in the sale of the property.

This search report was prepared by Renee Truter of Thames Water Utilities who has no, nor is likely to have, any personal or business relationship with any person involved in the sale of the property.

For your guidance:

- Thames Water Property Insight's Complaints Procedure:
  - Thames Water Property Insight offers a robust complaints procedure. Formal complaints can be made by telephone, in writing or by email at searches@thameswater.co.uk.
  - Whilst we will endeavour to resolve complaints by telephone, there may be the need to investigate the complaint further to identify the error and in some cases third party consultation will be required. For this reason, we will log all complaints on our system and a response will be provided to the customer within 24 hours. If no error has occurred a full explanation will be provided.
  - If the query cannot be resolved within 24 hours, the customer will be provided with an update within 48 hours. Where necessary the search will be recompiled free of charge and an amended copy will be dispatched to the customer as soon as possible.
  - For queries relating to an expedited search that has exceeded its Service Level Agreement (SLA), the fees will be adjusted accordingly. If a refund or compensation has been agreed, this will be sent to the customer within approximately 6 weeks.
  - If the customer is not satisfied with the resolution to their query, a Senior Manager will review the matter and respond within 5 working days.

Question 1

For your guidance:

- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- The company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Sewers indicated on the extract from the public sewer map as being subject to an agreement under section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended that these details are checked with the developer.
- Assets other than public sewers may be shown on the copy extract, for information.

Question 2

For your guidance:

- The “water mains” in this context are those, which are vested in and maintainable by the water company under statute.
- Assets other than public water mains may be shown on the plan, for information only.
- Water companies are not responsible for private supply pipes connecting the property to the public water main and do not hold details of these. These may pass through land outside of the control of the seller, or may be shared with adjacent properties. The buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Question 3

For your guidance:

- Water companies are not responsible for any private drains and sewers that connect the property to the public sewerage system, and do not hold details of these. The property owner will normally have sole responsibility for private drains serving the property and may have shared responsibility, with other users if the property is served by a private sewer that also serves other properties. These may pass through land outside the control of the seller and the buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal.
- If foul water does not drain to the public sewerage system, the property may have private facilities in the form of a cesspit, septic tank or other type of treatment plant.
- An extract from the public sewer map is enclosed. This will show known public sewers in the vicinity of the property and it should be possible to estimate the likely length and route of any private drains and/or sewers connecting the property to the public sewerage system.

Question 4

For your guidance:

- Sewerage Undertakers are not responsible for any private drains or sewers that connect the property to the public sewerage system, and do not hold details of these.
- The property owner will normally have sole responsibility for private drains serving the property, and may have shared responsibility with other users, if the property is served by a private sewer which also serves other properties. These private sewers and drains may pass through land outside of the control of the seller and the buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal.
- In some cases, 'Sewerage Undertakers' records do not distinguish between foul and surface water connections to the public sewerage system.
- At the time of privatisation in 1989, Sewerage Undertakers were sold with poorly-kept records of sewerage infrastructure. The records did not always show which properties were connected for surface water drainage purposes. Accordingly, billing records have been used to provide an answer for this element of the drainage and water search.
- Due to the potential inadequacy of 'Sewerage Undertakers' infrastructure records with respect to surface water drainage, it is the customer's responsibility to inform the Sewerage Undertaker that they do not receive the surface water drainage service. If on inspection, the buyer finds that surface water from the property does not drain to a public sewer, then the property may be eligible for a rebate of the surface water drainage charge. For further information, please contact Thames Water on Tel: 0845 9200 888, or refer to the website at www.thameswater.co.uk.
- If surface water from the property does not drain to the public sewerage system, the property may have private facilities in the form of a soakaway or private connection to a watercourse.
- An extract from the public sewer map is enclosed. This will show known public sewers in the vicinity of the property and it should be possible to estimate the likely length and route of any private drains and/or sewers connecting the property to the public sewerage system.

Question 5

For your guidance:

- If surface water from the property drains to a public sewer, then a surface water drainage charge is payable.
- Where a surface water drainage charge is currently included in the property's water and sewerage bill but, on inspection, the buyer finds that surface water from the property does not drain to a public sewer, then the property may be eligible for a rebate of the surface water drainage charge. For further information, please contact Thames Water on Tel: 0845 9200 888 or refer to the website www.thameswater.co.uk.

Question 6

For your guidance:

- The boundary of the property has been determined by reference to the plan supplied. Where a plan was not supplied the Ordnance Survey Record was used.
- The presence of a public sewer running within the boundary of the property may restrict further development. The Company has a statutory right of access to carry out work on its assets, subject to notice. This may result in employees of the Company, or its contractors, needing to enter the property to carry out work.
- Sewers indicated on the extract of the public sewer map as being subject to an agreement under section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended that these details be checked with the developer, if any.

Question 7

For your guidance:

- This is because there are no buildings from which to measure the distance to any public sewers.
- The presence of a public sewer within 30.48 metres (100 feet) of the building(s) within the property can result in the local authority requiring a property to be connected to the public sewer.
- The measurement is estimated from the Ordnance Survey record, between the building(s) within the boundary of the property and the nearest public sewer.
- Sewers indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended that these details are checked with the developer.

Question 8

For your guidance:

- This enquiry is of interest to purchasers who will want to know whether or not the property will be linked to a public sewer.
- Where the property is part of a very recent or ongoing development and the sewers are not the subject of an adoption application, buyers should consult with the developer to ascertain the extent of private drains and sewers for which they will hold maintenance and renewal liabilities.
- Final adoption is subject to the developer complying with the terms of the adoption agreement under Section 104 of the Water Industry Act 1991 and meeting the requirements of 'Sewers for Adoption' 6th Edition.

Question 9

For your guidance:

- Buildings or extensions erected over a sewer in contravention of building controls may have to be removed or altered.

Question 10

For your guidance:

- A sewer is “overloaded” when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- “Internal flooding” from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- “At Risk” properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company’s reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0845 9200 800 or website www.thameswater.co.uk

Question 11

For your guidance:

- The nearest sewage treatment works will not always be the sewage treatment works serving the catchment within which the property is situated.
- The sewerage undertaker's records were inspected to determine the nearest sewage treatment works.
- It should be noted that there may be a private sewage treatment works closer than the one detailed above that has not been identified.
- As a responsible utility operator, Thames Water Utilities seeks to manage the impact of odour from operational sewage works on the surrounding area. This is done in accordance with the Code of Practice on Odour Nuisance from Sewage Treatment Works issued via the Department of Environment, Food and Rural Affairs (DEFRA). This Code recognises that odour from sewage treatment works can have a detrimental impact on the quality of the local environment for those living close to works. However DEFRA also recognises that sewage treatment works provide important services to communities and are essential for maintaining standards in water quality and protecting aquatic based environments. For more information visit www.thameswater.co.uk

Question 13

For your guidance:

- The boundary of the property has been determined by reference to the plan supplied. Where a plan was not supplied, the Ordnance Survey Record was used.
- The presence of a public water main within the boundary of the property may restrict further development within it. Water companies have a statutory right of access to carry out work on their assets, subject to notice. This may result in employees of the Company, or its contractors, needing to enter the property to carry out work.

Question 14

For your guidance:

- This enquiry is of interest to purchasers who will want to know whether or not the property will be linked to the mains water supply.

Question 15

For your guidance:

- As this enquiry appears to relate to a plot of land or recently built property, this information is therefore not relevant to this propery.
- The boundary of the property has been determined by reference to the plan supplied. Where a plan was not supplied the Ordnance Survey Record was used.
- “Low water pressure” means water pressure below the regulatory reference level, which is the minimum pressure when demand on the system is not abnormal.
- Water companies are required to include in the Regulatory Register that is presented annually to the Director General of Water Services, properties receiving pressure below the reference level, provided that allowable exclusions do not apply (i.e. events which can cause pressure to temporarily fall below the reference level)
- The reference level of service is a flow of 9 litres/minute at a pressure of 10metres / head on the customer's side of the main stop tap (mst). The reference level of service must be applied on the customer's side of a meter or any other company fittings that are on the customer's side of the mst. The reference level applies to a single property. Where more than one property is served by a common service pipe, the flow assumed in the reference level must be appropriately increased to take account of the total number of properties served. For two properties, a flow of 18 litres/minute at a pressure of 10metres/head on the customers' side of the mst is appropriate. For three or more properties the appropriate flow should be calculated from the standard loadings provided in BS6700 or the Institute of Plumbing handbook.
- **Allowable exclusions** The Company is required to include in the Regulatory Register properties receiving pressure below the reference level, provided that the allowable exclusions listed below do not apply.
- **Abnormal demand:** This exclusion is intended to cover abnormal peaks in demand and not the daily, weekly or monthly peaks in demand, which are normally expected. Companies should exclude from the reported DG2 (Low Pressure Register) figures properties which are affected by low pressure only on those days with the highest peak demands. During the report year companies may exclude, for each property, up to five days of low pressure caused by peak demand.
- **Planned maintenance:** Companies should not report under DG2 (Low Pressure Register) low pressures caused by planned maintenance. It is not intended that companies identify the number of properties affected in each instance. However, companies must maintain sufficiently accurate records to verify that low-pressure incidents that are excluded from DG2 because of planned maintenance are actually caused by maintenance.
- **One-off incidents:** This exclusion covers a number of causes of low pressure; mains bursts; failures of company equipment (such as pressure reducing valves or booster pumps); firefighting; and action by a third party. However, if problems of this type affect a property frequently, they cannot be classed as one-off events and further investigation will be required before they can be excluded.
- **Low-pressure incidents of short duration:** Properties affected by low pressures, which only occur for a short period, and for which there is evidence that incidents of a longer duration would not occur during the course of the year, may be excluded from the reported DG2 figures.
- Please contact your water company mentioned in Question 19 if you require further information.

Question 16

For your guidance:

- Please note that this property is not currently connected to the public clean network - and that this information is therefore not relevant to this enquiry.
- The statement about the quality of drinking water (above) is based on samples taken, during 2009, across an area that may contain more than 50,000 properties (a Water Supply Zone). The information given only provides a general indication of water quality and should not be used to determine water quality at a particular property. Where the report shows a sample has failed to meet the required standards, this is normally due to isolated local circumstances.
- Thames Water investigates all infringements of drinking water quality standards and takes appropriate corrective actions to resolve any problems. If there were any risk to public health from the quality of drinking water supplied, the Company would have informed customers immediately and advised not to drink the water until the issue had been resolved.
- Water companies have a duty to provide wholesome water that meets the standards of the Water Supply (Water Quality) Regulations 2000. However, the property owner is responsible for any deterioration in water quality that is a result of the distribution system (the supply pipe and the plumbing within the property) that results in the standards not being met.
- In England and Wales these regulations implement the requirements of the European Drinking Directive 98/83/EC. The 2000 regulations impose standards for a range of parameters, which are either health based to ensure the water is safe to drink or to ensure the water is aesthetically acceptable. They also require that drinking water should not contain any element, organism or substance (whether or not a parameter) at a concentration or value, which would be detrimental to public health.
- Water quality is normally tested at the tap used for domestic consumption, normally the kitchen. However, the householder is responsible for any of deterioration in water quality that is a result of the domestic distribution system (the supply pipe and the plumbing within the property) that results in the standards not being met.
- If there are concerns that lead pipes within the property may be causing high levels of lead in your drinking water please contact your water company mentioned in Question 14 for further advice.
- The Water Company undertakes a monitoring programme to establish water quality that includes random sampling from properties. It will notify the consumers of any failures to meet the water quality standards that are due to the condition or maintenance of the distribution system.
- The data collected by the Company is subject to external review by the Drinking Water Inspectorate (DWI) and by local and health authorities. In addition to reviewing quality data the DWI also carry out audits during which any area of the company's operation can be examined. Further information may be found at www.dwi.gov.uk
- If you require further advice regarding these failures, please contact your Water Company mentioned in Question 19.

Question 17

For your guidance:

- Authorised departures are not permitted if the extent of the departure from the standard is likely to constitute a potential danger to human health.
- Please contact your water company mentioned in Question 19 if you require further information.

Question 22

For your guidance:

- Water and sewerage companies' full charges are set out in their charges schemes which are available from the company free of charge upon request.
- The Water Industry Act 1991 Section 150, The Water Resale Order 2001 provides protection for people who buy their water or sewerage services from a person or company instead of directly from a water or sewerage company. Details are available from the Office of Water Services (OFWAT) website is www.ofwat.gov.uk.
- Where charges are given, these are based on the data available at the time of the report.
- The Company may install a meter at the premises where a buyer makes a change of use of the property or where the buyer uses water for:
    - Watering the garden other than by hand (this includes the use of sprinklers).
    - Automatically replenishing a pond or swimming pool with a capacity greater than 10,000 litres.
    - A bath with a capacity in excess of 230 litres.
    - A reverse osmosis unit

CommercialDW Drainage and Water Enquiry Terms and Conditions

Customer and Clients are asked to note these terms, which govern the basis on which this Commercial DW Drainage & Water Enquiry is supplied

Definitions

'Client' means the person, company or body who is the intended recipient of the Report with an actual or potential interest in the Property.
'Company' means a water service company or their data service provider producing the Report.
'Customer' means the person, company, firm or other legal body placing the Order, either on their own behalf as Client, or, as an agent for a Client.
'Order' means any request completed by the Customer requesting the Report.
'Property' means the address or location supplied by the Customer in the Order.
'Report' means the drainage and/or water report prepared by The Company in respect of the Property.
'Thames Water" means Thames Water Utilities Limited registered in England and Wales under number 2366661 whose registered office is at Clearwater Court, Vastern Road, Reading, Berks, RG1 8DB;

Agreement

1 Thames Water agrees to supply the Report to the Customer and the Client subject to these terms. The scope and limitations of the Report are described in paragraph 2 of these terms. Where the Customer is acting as an agent for the Client then the Customer shall be responsible for bringing these terms to the attention of the Client. The Customer and Client agree that the placing of an Order for a Report indicates their acceptance of these terms.

The Report

2. Whilst Thames Water will use reasonable care and skill in producing the Report, it is provided to the Customer and the Client on the basis that they acknowledge and agree to the following:-

2.1 The information contained in the Report can change on a regular basis so Thames Water cannot be responsible to the Customer and the Client for any change in the information contained in the Report after the date on which the Report was produced and sent to the Client.

2.2 The Report does not give details about the actual state or condition of the Property nor should it be used or taken to indicate or exclude actual suitability or unsuitability of the Property for any particular purpose, or relied upon for determining saleability or value, or used as substitute for any physical investigation or inspection. Further advice and information from appropriate experts and professionals should always be obtained.

2.3 The information contained in the Report is based upon the accuracy, completeness and legibility of the address and other information supplied by the Customer or Client.

2.4 The Report provides information as to the location and connection of existing services and should not be relied on for any other purpose. The Report may contain opinions or general advice to the Customer and the Client and Thames Water cannot ensure that any such opinion or general advice is accurate, complete or valid and accepts no liability therefore.

2.5 The position and depth of apparatus shown on any maps attached to the Report are approximate, and are furnished as a general guide only, and no warranty as to its correctness is given or implied. The exact positions and depths should be obtained by excavation trial holes and the maps must not be relied on in the event of excavation or other works made in the vicinity of apparatus shown on any maps.

Liability

3 Thames Water shall not be liable to the Client for any failure, defect or non-performance of its obligations arising from any failure of, or defect in any machine, processing system or transmission link or anything beyond Thames Water's reasonable control or the acts or omissions of any party for whom Thames Water are not responsible.

3.1 Where the Customer sells this report to a Client (other than in the case of a bona fide legal adviser recharging the cost of the Report as a disbursement) Thames Water shall not in any circumstances (whether for breach of contract, negligence or any other tort, under statute or statutory duty or otherwise at all) be liable for any loss or damage whatsoever and the Customer shall indemnify Thames Water in respect of any claim by the Client.

3.2 Where a report is requested for an address falling within a geographical area where Thames Water and another Company separately provide Water and Sewerage Services, then it shall be deemed that liability for the information given by Thames Water or the Company as the case may be will remain with Thames Water or the Company as the case may be in respect of the accuracy of the information supplied. Where Thames Water is supplying information which has been provided to it by another Company for the purposes outlined in this agreement Thames Water will therefore not be liable in any way for the accuracy of that information and will supply that information as agent for the Company from which the information was obtained.

3.3 Except in respect of death or personal injury caused by negligence, or as expressly provided in these Terms:

3.3.1 The entire liability of Thames Water or the Company as the case may be in respect of all causes of action arising under or in connection with the Report (whether for breach of contract, negligence or any other tort, under statute or statutory duty or otherwise at all) shall not exceed £2,000,000 (two million pounds); and

3.3.2 Thames Water shall not in any circumstances (whether for breach of contract, negligence or any other tort, under statute or statutory duty or otherwise at all) be liable for any loss of profit, loss of goodwill, loss of reputation, loss of business or any indirect, special or consequential loss, damage or other claims, costs or expenses;

Copyright and Confidentiality

4. The Customer and the Client acknowledge that the Report is confidential and is intended for the personal use of the Client. The copyright and any other intellectual property rights in the Report shall remain the property of Thames Water or the Company as the case may be. No intellectual or other property rights are transferred or licensed to the Customer or the Client except to the extent expressly provided

4.1 The Customer or Client is entitled to make copies of the Report but is not permitted to copy any maps contained in, or attached to the Report

4.2 The maps contained in the Report are protected by Crown Copyright and must not be used for any purpose outside the context of the Report.

4.3 The Customer and Client agree (in respect of both the original and any copies made) to respect and not to alter any trademark, copyright notice or other property marking which appears on the Report.

Payment

5. Unless otherwise stated all prices are inclusive of VAT. The Customer shall pay for the price of the Report specified by Thames Water, without any set off, deduction or counterclaim.

5.1 Unless payment has been received in advance, Customers shall be invoiced for the agreed fee once their request has been processed. Any such invoice must be paid within 14 days. Where the Customer has an account with Thames Water, payment terms will be as agreed with Thames Water.

5.2 No payment shall be deemed to have been received until Thames Water has received cleared funds.

5.3 If the Customer fails to pay Thames Water any sum due Thames Water shall be entitled but not obliged to charge the Customer interest on the sum from the due date for payment at the annual rate of 2% above the base lending rate from time to time of Natwest Bank, accruing on a daily basis until payment is made. Thames Water reserves the right to claim interest under the Late Payment of Commercial Debts (Interest) Act 1998.

5.4 Thames Water reserves the right to increase fees on reasonable prior written notice at any time.

Cancellations or Alterations

6. Once an Order is placed, Thames Water shall not be under any obligation to accept any request to cancel that Order and payment for the Order shall still be due upon completion of the Report. In cases where an error has been made in the original Order (e.g. the Customer has supplied an incorrect address), the Customer will need to place a second Order, detailing the correct information, and shall be liable to pay a second charge in accordance with clause 5 above.

Delivery

7. On receiving your order the reports will be posted to you within 10 working days from receipt.

7.1 Delivery is subject to local post conditions and regulations. All items should arrive within 12 working days, but Thames Water cannot be held responsible should delays be caused by local post conditions, postal strikes or other causes beyond the control of Thames Water.

General

8. If any provision of these terms is or becomes invalid or unenforceable, it will be taken to be removed from the rest of these terms to the extent that it is invalid or unenforceable. No other provision of these terms shall be affected.

8.1 These terms shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts.

8.2 Nothing in this notice shall in any way restrict the Customer or Clients statutory or any other rights of access to the information contained in the Report.

These Terms & Conditions are available in larger print for those with impaired vision.

Appendix D

Greenfield Runoff Rates

Johnson Poole Bloomer Limited
www.jpb.co.uk

Harris & Pearson Building,
Brettell Lane, Brierley Hill,
West Midlands, DY5 3LH
Tel: (01384) 262000 Fax: (01384) 262001
email: enquiries?@jpb.co.uk

Job No.	MB608
Sheet no.	1
Date	15/06/12

MasterDrain
HY 8.21

Project: Land off Barford Road

Title: FSR Rainfall intensities for BLOXHAM

By	Checked	Reviewed
HB		

Mins\Yrs	1	2	5	10	20	30	50	100	200	500
1	84.9	108.2	139.7	157.9	178.5	191.7	209.9	237.3	268.2	315.4
2	73.9	94.2	121.7	138.1	156.8	168.8	185.3	210.4	238.8	282.4
3	64.7	83.8	108.3	123.3	140.5	151.6	166.9	190.1	216.6	257.3
4	58.4	75.7	97.8	111.8	127.8	138.1	152.4	174.2	199.0	237.4
5	53.4	69.2	89.5	102.6	117.5	127.3	140.7	161.2	184.7	221.1
6	49.3	63.9	82.6	94.9	109.0	118.3	131.0	150.5	172.8	207.6
7	45.9	59.4	76.9	88.5	101.9	110.7	122.8	141.3	162.7	196.0
8	42.9	55.6	72.0	83.1	95.8	104.2	115.7	133.5	154.0	186.1
9	40.4	52.3	67.8	78.3	90.5	98.5	109.6	126.7	146.5	177.4
10	38.8	50.1	64.1	74.1	85.8	93.4	104.0	120.4	139.3	169.0
11	36.8	47.5	60.8	70.4	81.6	88.9	99.0	114.7	132.9	161.3
12	35.1	45.2	57.9	67.1	77.8	84.8	94.6	109.6	127.1	154.5
13	33.5	43.2	55.3	64.1	74.4	81.2	90.5	105.0	121.8	148.3
14	32.1	41.4	52.9	61.5	71.3	77.8	86.9	100.9	117.1	142.6
15	30.8	39.7	50.8	59.0	68.6	74.8	83.6	97.1	112.7	137.4
16	29.6	38.2	48.9	56.8	66.0	72.1	80.5	93.6	108.8	132.7
17	28.5	36.8	47.1	54.8	63.7	69.5	77.7	90.4	105.1	128.3
18	27.5	35.5	45.5	52.9	61.5	67.2	75.1	87.4	101.7	124.2
19	26.6	34.3	43.9	51.1	59.5	65.0	72.7	84.7	98.5	120.4
20	25.8	33.2	42.6	49.5	57.7	63.0	70.5	82.1	95.6	116.9
21	25.0	32.2	41.3	48.0	56.0	61.2	68.4	79.7	92.8	113.6
22	24.2	31.3	40.0	46.7	54.4	59.4	66.5	77.5	90.3	110.5
23	23.5	30.4	38.9	45.3	52.8	57.8	64.7	75.4	87.9	107.6
24	22.9	29.6	37.9	44.1	51.4	56.3	63.0	73.4	85.6	104.8
25	22.3	28.8	36.9	43.0	50.1	54.8	61.4	71.6	83.5	102.3
26	22.4	28.4	35.9	41.9	48.9	53.5	59.9	69.8	81.5	99.8
27	21.9	27.7	35.0	40.9	47.7	52.2	58.5	68.2	79.6	97.5
28	21.4	27.0	34.2	39.9	46.6	51.0	57.1	66.6	77.8	95.3
29	20.9	26.4	33.4	39.0	45.5	49.8	55.8	65.2	76.0	93.3
30	20.4	25.8	32.7	38.1	44.5	48.7	54.6	63.7	74.4	91.3
31	20.0	25.3	31.9	37.3	43.6	47.7	53.4	62.4	72.9	89.4
32	19.5	24.7	31.3	36.5	42.6	46.7	52.3	61.1	71.4	87.6
33	19.1	24.2	30.6	35.8	41.8	45.8	51.3	59.9	70.0	85.9
34	18.7	23.7	30.0	35.1	41.0	44.9	50.3	58.7	68.6	84.3
35	18.4	23.3	29.4	34.4	40.2	44.0	49.3	57.6	67.3	82.7
36	18.0	22.8	28.9	33.7	39.4	43.2	48.4	56.6	66.1	81.2
37	17.7	22.4	28.3	33.1	38.7	42.4	47.5	55.6	64.9	79.8
38	17.4	22.0	27.8	32.5	38.0	41.6	46.7	54.6	63.8	78.4
39	17.1	21.6	27.3	31.9	37.3	40.9	45.9	53.6	62.7	77.0
40	16.8	21.2	26.9	31.4	36.7	40.2	45.1	52.7	61.6	75.8
41	16.5	20.9	26.4	30.9	36.1	39.5	44.4	51.9	60.6	74.5
42	16.2	20.5	26.0	30.4	35.5	38.9	43.6	51.0	59.7	73.4
43	15.9	20.2	25.5	29.9	34.9	38.3	42.9	50.2	58.7	72.2
44	15.7	19.9	25.1	29.4	34.4	37.7	42.3	49.4	57.8	71.1
45	15.4	19.6	24.7	28.9	33.8	37.1	41.6	48.7	56.9	70.0
46	15.2	19.3	24.4	28.5	33.3	36.5	41.0	48.0	56.1	69.0
47	15.0	19.0	24.0	28.1	32.8	36.0	40.4	47.3	55.3	68.0
48	14.8	18.7	23.6	27.7	32.4	35.5	39.8	46.6	54.5	67.0
49	14.6	18.4	23.3	27.3	31.9	35.0	39.3	45.9	53.7	66.1
50	14.3	18.2	23.0	26.9	31.5	34.5	38.7	45.3	53.0	65.2
51	14.1	17.9	22.7	26.5	31.0	34.0	38.2	44.7	52.3	64.3
52	14.0	17.7	22.4	26.2	30.6	33.6	37.7	44.1	51.6	63.5
53	13.8	17.4	22.1	25.8	30.2	33.1	37.2	43.5	50.9	62.7
54	13.6	17.2	21.8	25.5	29.8	32.7	36.7	42.9	50.2	61.8
55	13.4	17.0	21.5	25.1	29.4	32.3	36.2	42.4	49.6	61.1
56	13.2	16.8	21.2	24.8	29.1	31.9	35.8	41.9	49.0	60.3
57	13.1	16.6	20.9	24.5	28.7	31.5	35.3	41.3	48.4	59.6
58	12.9	16.3	20.7	24.2	28.3	31.1	34.9	40.8	47.8	58.9
59	12.8	16.1	20.4	23.9	28.0	30.7	34.5	40.4	47.2	58.2
60	12.6	16.0	20.2	23.6	27.7	30.3	34.1	39.9	46.7	57.5
61	12.5	15.8	20.0	23.4	27.3	30.0	33.7	39.4	46.1	56.8
62	12.3	15.6	19.7	23.1	27.0	29.6	33.3	39.0	45.6	56.2
63	12.2	15.4	19.5	22.8	26.7	29.3	32.9	38.5	45.1	55.6
64	12.4	15.4	19.3	22.6	26.4	29.0	32.6	38.1	44.6	54.9
65	12.3	15.3	19.1	22.3	26.1	28.7	32.2	37.7	44.1	54.3
66	12.1	15.1	18.9	22.1	25.9	28.4	31.8	37.3	43.7	53.8
67	12.0	14.9	18.7	21.9	25.6	28.1	31.5	36.9	43.2	53.2

Johnson Poole Bloomer Limited
www.jpb.co.uk

Harris & Pearson Building,
Brettell Lane, Brierley Hill,
West Midlands, DY5 3LH
Tel: (01384) 262000 Fax: (01384) 262001
email: enquiries?@jpb.co.uk

MasterDrain
HY 8.21

Job No.	MB608
Sheet no.	2
Date	15/06/12
Project	Land off Barford Road
Title	FSR Rainfall intensities for BLOXHAM
By	HB
Checked	
Reviewed	

Mins\Yrs	1	2	5	10	20	30	50	100	200	500
68	11.9	14.8	18.5	21.6	25.3	27.8	31.2	36.5	42.7	52.6
69	11.8	14.6	18.3	21.4	25.0	27.5	30.9	36.1	42.3	52.1
70	11.6	14.5	18.1	21.2	24.8	27.2	30.5	35.8	41.9	51.6
71	11.5	14.3	17.9	21.0	24.5	26.9	30.2	35.4	41.4	51.0
72	11.4	14.2	17.7	20.7	24.3	26.6	29.9	35.0	41.0	50.5
73	11.3	14.0	17.5	20.5	24.1	26.4	29.6	34.7	40.6	50.0
74	11.2	13.9	17.4	20.3	23.8	26.1	29.3	34.4	40.2	49.6
75	11.1	13.8	17.2	20.1	23.6	25.9	29.1	34.0	39.8	49.1
76	11.0	13.6	17.0	20.0	23.4	25.6	28.8	33.7	39.5	48.6
77	10.9	13.5	16.9	19.8	23.1	25.4	28.5	33.4	39.1	48.2
78	10.8	13.4	16.7	19.6	22.9	25.2	28.3	33.1	38.7	47.7
79	10.7	13.3	16.6	19.4	22.7	24.9	28.0	32.8	38.4	47.3
80	10.6	13.1	16.4	19.2	22.5	24.7	27.7	32.5	38.0	46.9
81	10.5	13.0	16.3	19.1	22.3	24.5	27.5	32.2	37.7	46.4
82	10.4	12.9	16.1	18.9	22.1	24.3	27.3	31.9	37.4	46.0
83	10.3	12.8	16.0	18.7	21.9	24.0	27.0	31.6	37.0	45.6
84	10.2	12.7	15.9	18.6	21.7	23.8	26.8	31.4	36.7	45.2
85	10.1	12.6	15.7	18.4	21.5	23.6	26.5	31.1	36.4	44.8
86	10.0	12.5	15.6	18.2	21.4	23.4	26.3	30.8	36.1	44.5
87	9.9	12.4	15.5	18.1	21.2	23.2	26.1	30.6	35.8	44.1
88	9.9	12.3	15.3	17.9	21.0	23.0	25.9	30.3	35.5	43.7
89	9.8	12.2	15.2	17.8	20.8	22.9	25.7	30.1	35.2	43.4
90	9.7	12.1	15.1	17.7	20.7	22.7	25.5	29.8	34.9	43.0
91	9.6	12.0	15.0	17.5	20.5	22.5	25.3	29.6	34.6	42.7
92	9.6	11.9	14.8	17.4	20.3	22.3	25.1	29.3	34.4	42.3
93	9.5	11.8	14.7	17.2	20.2	22.1	24.9	29.1	34.1	42.0
94	9.4	11.7	14.6	17.1	20.0	22.0	24.7	28.9	33.8	41.7
95	9.3	11.6	14.5	17.0	19.9	21.8	24.5	28.7	33.6	41.3
96	9.3	11.5	14.4	16.8	19.7	21.6	24.3	28.4	33.3	41.0
97	9.2	11.4	14.3	16.7	19.6	21.5	24.1	28.2	33.1	40.7
98	9.1	11.3	14.2	16.6	19.4	21.3	23.9	28.0	32.8	40.4
99	9.1	11.2	14.1	16.5	19.3	21.1	23.7	27.8	32.6	40.1
100	9.0	11.2	14.0	16.3	19.1	21.0	23.6	27.6	32.3	39.8
110	8.4	10.4	13.0	15.2	17.8	19.6	22.0	25.7	30.1	37.1
120	7.9	9.8	12.2	14.3	16.7	18.3	20.6	24.1	28.2	34.7
130	7.4	9.2	11.5	13.5	15.8	17.3	19.4	22.7	26.6	32.7
140	7.0	8.7	10.9	12.7	14.9	16.3	18.4	21.5	25.1	30.9
160	6.5	8.0	9.9	11.5	13.5	14.8	16.6	19.4	22.7	27.9
180	6.0	7.3	9.0	10.6	12.3	13.5	15.2	17.7	20.7	25.4
210	5.3	6.5	8.1	9.4	11.0	12.0	13.5	15.7	18.4	22.5
240	4.8	5.9	7.3	8.5	9.9	10.8	12.1	14.2	16.5	20.2
270	4.4	5.4	6.7	7.8	9.1	9.9	11.1	12.9	15.0	18.4
300	4.2	5.1	6.2	7.2	8.3	9.1	10.2	11.9	13.8	16.9
330	3.9	4.7	5.7	6.7	7.8	8.5	9.5	11.0	12.8	15.6
360	3.7	4.4	5.4	6.2	7.3	7.9	8.9	10.3	11.9	14.6
390	3.5	4.2	5.1	5.9	6.8	7.4	8.3	9.7	11.2	13.7
420	3.3	3.9	4.8	5.6	6.4	7.0	7.8	9.1	10.6	12.9

Rainfall depths for BLOXHAM at standard return periods in mm

Time\Yrs	1	2	5	10	20	30	50	100	200	500
3 min	3.2	4.2	5.4	6.2	7.0	7.6	8.3	9.5	10.8	12.9
30 min	10.2	12.9	16.3	19.1	22.3	24.4	27.3	31.9	37.2	45.6
1 hr	12.6	16.0	20.2	23.6	27.7	30.3	34.1	39.9	46.7	57.5
2 hr	15.7	19.5	24.4	28.6	33.5	36.7	41.2	48.2	56.4	69.5
5 hr	21.1	25.3	30.8	35.9	41.7	45.6	51.0	59.3	69.0	84.3
10 hr	25.0	30.0	36.6	42.3	48.9	53.3	59.4	68.7	79.5	96.4
24 hr	31.8	37.6	45.2	51.8	59.5	64.5	71.4	81.9	94.1	112.9
48 hr	39.7	45.4	53.3	60.7	69.2	74.7	82.2	93.7	106.8	126.9
5 day	49.4	56.6	66.3	74.7	84.2	90.3	98.6	111.1	125.1	146.6

The above figures are calculated in accordance with the protocol set out in the 'Wallingford Procedure' from data derived from the Wallingford maps :-

M5-60min	= 19.70	r	= 0.40
WRAP	= 3	SAAR	= 710
NG ref	= SP4235	Soil index	= 0.40

Data printed on 15/06/12 from Masterdrain Hydrology program

Johnson Poole Bloomer Limited
www.jpb.co.uk

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email: enquiries?@jpb.co.uk

Job No.	Sheet no.	Date
MB608	1	15/06/12

MasterDrain
HY 8.21

Project	By	Checked	Reviewed
Land off Barford Road	HB		

Title: IoH 124 Runoff calcs for BLOXHAM

Hydrological Data:-

FSR Hydrology:-

Location = BLOXHAM	Grid reference = SP4235
M5-60 (mm) = 19.7	r = 0.40
Soil runoff = 0.40	SAAR (mm/yr) = 710
WRAP = 3	Area = England & Wales
Hydrological area = 6	Hydrological zone = 8

Soil classification for WRAP type 3
i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Design data:-

Area = 0.0265 Km^2 - 2.65 Ha - 26500 m^2

Calculation method:-

Runoff is calculated from:-

$$Q_{BAR(rural)} = 0.00108\ AREA^{0.89}\ .\ SAAR^{1.17}\ .\ SOIL^{2.17}$$

where

AREA = Site area in Km^2
SAAR = Standard Average Annual Rainfall (mm/yr)
SOIL = Soil value derived from Winter Rainfall Acceptance Potential
$Q_{BAR(rural)}$ = Runoff (cumecs)

$Q_{BAR(rural)}$ is then multiplied by a growth factor - GC(T) - for different storm return periods derived from EA publication W5-074/A.

Calculated data:-

For areas less than 50Ha, a modified calculation which multiplies the 50Ha runoff value by the ratio of the site area to 50Ha is used
Reducing factor used for these calculations is 0.053

Mean Annual Peak Flow $Q_{BAR(rural)}$ = 9.17 l/s

Values for $Q_{BAR(rural)}$

1 year	2 year	5 year	30 year	100 year	200 year	Units
0.008	0.009	0.012	0.020	0.029	0.034	cumecs
7.79	9.17	11.73	20.44	28.88	33.92	l/s
2.94	3.46	4.43	7.71	10.90	12.80	l/s/Ha
0.850	1.000	1.280	2.230	3.150	3.700	GC(T)

The above is based on the Institute of Hydrology Report 124
to which you are referred for further details (see Sect 7).
Note that the 200 year growth curve was taken from W5-074/A.

Appendix E

Environment Agency Correspondence

Ms Helen Bayliss - Senior Environmental Engineer
Johnson Poole & Bloomer Limited
Harris & Pearson Building Brettell Lane
BRIERLEY HILL
West Midlands
DY5 3LH

Our ref: WA/2012/111450/01-L01
Your ref: -
Date: 28 February 2012

Dear Ms Bayliss

PROPOSED RESIDENTIAL DEVELOPMENT FOR UP TO 85 DWELLINGS.

LAND OFF BARFORD ROAD, BLOXHAM, CHERWELL.

Thank you for referring the above application. You are asked to quote our reference in any correspondence. The Environment Agency has the following comments:

According to our Flood Zone Maps the site is outside of Flood Zones 2 and 3 and therefore we do not consider a Flood Risk Assessment (FRA) in terms of fluvial flood risk is necessary. However, a site of this size will generate significant volumes of surface water and an FRA is therefore necessary.

The FRA should consider all forms of flood risk, including existing overland flooding issues.

The applicant must demonstrate through their surface water drainage scheme that the proposed development will not create an increased risk of flooding from surface water. The scheme should be carried out in accordance with Planning Policy Statement 25 (PPS25) and its associated practice guidance, giving preference to infiltration over discharge to a watercourse, which in turn is preferable to discharge to surface water sewer.

Infiltration rates should be worked out in accordance with BRE 365. If it is not feasible to access the site to carry out soakage tests before planning approval is granted, a desktop study may be undertaken looking at the underlying geology of the area and assuming a worst-case infiltration rate for that site. If infiltration methods are likely to be ineffective then discharge may be appropriate. In any case the surface water scheme should clearly show that:

· peak discharge rates from the site will be not increase as a result of the proposed development, across a range of storm events, up to and including the 1 in 100 year storm with a suitable allowance for climate change (the design storm event);

· discharge volumes from the site will not increase as a result of the proposed

development, across a range of storm events, up to and including the design storm event;

· the site will not flood from surface water up to and including the design storm event or any surface water flooding beyond the 1 in 30 year storm event, up to and including the design storm event can be safely contained on site;

· the likely flood flow routes and the impact of a storm that exceeds the capacity of the system has been considered;

· the future management and/or adoption of the system has been fully explored.

The Institute of Hydrology Report 124 *Flood estimation for small catchments* should be used to determine peak greenfield runoff rates, in accordance with the CIRIA *Interim Code of Practice for Sustainable Drainage Systems.*

Any surface water drainage scheme should utilise sustainable drainage techniques, offering ecological, water quality and amenity benefits wherever possible, in accordance with the *SUDS Management Train* (Ciria C609) and the *SUDS Manual* (Ciria C697). Above ground storage devices such as ponds should be favoured over underground storage in tanks. Open swales or ditches should be used instead of pipes wherever possible.

Yours sincerely

Mr Andy Goymer
Planning Liaison Officer

Direct fax 01276 454339
Direct e-mail planning-wallingford@environment-agency.gov.uk

End

Appendix F

Local Authority Correspondence

Helen Bayliss

From: Tony Brummell [tony.brummell@cherwellandsouthnorthants.gov.uk]
Sent: 06 March 2012 09:40
To: Helen Bayliss
Subject: RE: Flood Enquiry

Helen

Your site is on relatively high ground. I have not witnessed flooding from any sources on it, neither am I aware of any having been reported. However, it is not a site that where we would necessarily notice any flooding if it did occur.

I note there appears to be a pond near the north-eastern corner of the site which may provide some protection to adjacent land. This will have to be accommodated in any design.

These comments are given on an informal basis. I hope you will find them helpful.

Tony Brummell
Building Control Manager
Cherwell and South Northamptonshire Building Control Service
Ext 1524/2244
Direct Dial 01295 221524/01327 322244
mailto:tony.brummell@cherwellandsouthnorthants.gov.uk
www.cherwell.gov.uk

From: Helen Bayliss [mailto:Helen.Bayliss@jpb.co.uk]
Sent: 05 March 2012 16:21
To: Tony Brummell
Subject: FW: Flood Enquiry
Importance: High

Dear Tony

I have been liaising with Oxfordshire CC regarding past recorded flood events in Bloxham and as you will see from the emails below I have been passed your name.

We are currently preparing a Flood Risk Assessment and I wondered if you may have any further information relating to surface water flooding issues at or around the site that we should be aware of, particularly those of 2007. I have attached a site location plan for your reference.

Any assistance you may be able to provide would be much appreciated.

Kind regards

Helen Bayliss

From: Kelman, Gordon - Environment & Economy - Highways & Transport [mailto:Gordon.Kelman@Oxfordshire.gov.uk]
Sent: 05 March 2012 16:04
To: Helen Bayliss
Subject: RE: Flood Enquiry

Dear Helen,

You could try Tony Brummell. I believe he has actually retired but is still helping out there part time.

Regards,

Gordon Kelman
Senior Engineer (Drainage)

Oxfordshire County Council
Highways and Transport
Speedwell House
Speedwell Street
Oxford
OX1 1NE

From: Helen Bayliss [mailto:Helen.Bayliss@jpb.co.uk]
Sent: 05 March 2012 15:37
To: Kelman, Gordon - Environment & Economy - Highways & Transport
Subject: RE: Flood Enquiry

Dear Gordon

Many thanks for your response. I wondered if you had a contact name within Cherwell District Council that may be able to help me?

Best wishes

Helen

From: Kelman, Gordon - Environment & Economy - Highways & Transport [mailto:Gordon.Kelman@Oxfordshire.gov.uk]
Sent: 02 March 2012 15:22
To: Helen Bayliss
Subject: RE: Flood Enquiry

Dear Helen,

In response to your enquiry regarding the land adjacent to Barford Road in Bloxham.

We are not aware of flooding incidents which affect this area of land. There are some standing water issues at one point of the carriageway on Barford Road which is either a blocked surface water gully or a road profile issue. We are currently looking into this issue, however we don't anticipate this causing any problems on the site.

Regarding July 2007, there were some excessive surface water issues in Bloxham, but as far as we know this area was not affected. The affected area was more to do with the stream which is further north. For any local issues of minor flooding the Parish Council may be able to help or Cherwell District Council who were the Land drainage authority at the time.

I hope this helps.

Kind Regards,

Gordon Kelman
Senior Engineer (Drainage)

Oxfordshire County Council
Highways and Transport
Speedwell House
Speedwell Street

Oxford
OX1 1NE

From: Helen Bayliss [mailto:Helen.Bayliss@jpb.co.uk]
Sent: 20 February 2012 11:14
To: Highway Enquiries - Environment & Economy
Subject: FW: Flood Enquiry

From: Helen Bayliss
Sent: 03 February 2012 12:43
To: 'highwayenquries@oxfordshire.gov.uk'
Subject: Flood Enquiry

Johnson Poole & Bloomer Limited

Harris & Pearson Building, Brettell Lane,

Brierley Hill, West Midlands, DY5 3LH

Our reference: MB608-06/HB

Dear Sirs

We are in the process of preparing as site specific Flood Risk Assessment for a site located offBarford Road, Bloxham at NGR SP431350. We are currently undertaking enquiries with Thames Water and the Environment Agency bit wondered if you had any records of flooding associated with the site or its immediate surroundings. We are of the understanding that there were some issues with overland surface water runoff in Bloxham during the 2007 floods and any information you may hold with regard to this would be beneficial to our assessments.

A site location plan is attached for your reference and should you require any further information please do not hesitate to contact us.

Kind regards

Helen Bayliss BSc CSci MIEnvSc

Senior Environmental Scientist

Tel: 01384 262 000

Fax: 01384 262 001

Mob: 07793 621 589

Email: helen.bayliss@jpb.co.uk

Appendix G

Thames Water Utilities Limited
Pre-Development Enquiry

Helen Bayliss

From: Geraldine Horner [G.Horner@gladman.co.uk]
Sent: 02 June 2012 12:30
To: Helen Bayliss
Subject: Fw: Land at Barford Road Bloxham Oxfrdshre CH 509230 PDE

Follow Up Flag: Follow Up
Flag Status: Red

----- Original Message -----
From: Geoff.Nokes@thameswater.co.uk [mailto:Geoff.Nokes@thameswater.co.uk]
Sent: Thursday, May 31, 2012 04:32 PM
To: Geraldine Horner
Subject: RE: Land at Barford Road Bloxham Oxfrdshre CH 509230 PDE

Geraldine

The surface water pumping station would be adoptable and could be together with the foul pumping station and the greenfield run off rate would be acceptable to us.

Regards
Geoff

|---------->
| From: |
|---------->
>----------|
|Geraldine Horner <G.Horner@gladman.co.uk> |
>----------|
|---------->
| To: |
|---------->
>----------|
|'"Geoff.Nokes@thameswater.co.uk"' <Geoff.Nokes@thameswater.co.uk>
|
>----------|
|---------->
| Cc: |
|---------->
>----------|
|Anusha Peries <A.Peries@gladman.co.uk>, 'Helen Bayliss' <Helen.Bayliss@jpb.co.uk>
|
>----------|
|---------->
| Date: |
|---------->
>----------|
|30/05/2012 13:07 |
>----------|
|---------->
| Subject: |
|---------->
>----------|
|RE: Land at Barford Road Bloxham Oxfrdshre CH 509230 PDE |
>----------|

Geoff

Thank you for your response to our enquiry regarding the foul water drainage for this proposed development site. We are now investigating options for draining surface water.

One of our proposals would be to pump the surface water up to Barford Road (as has been done with the Bloxham Mill Factory located to the east of the site). Would Thames Water agree to take surface water at greenfield runoff rates from a residential development such as this? In addition would Thames Water consider adopting a surface water pumping system? The foul water from the development would have to be pumped because of the topography of the site and so it would be relatively straight forward to incorporate a surface water pump into a larger pumping station.

If you have any questions regarding this matter please do call me.

Thanks and regards

Geraldine Horner BEng CEng MICE
Technical Manager

Gladman Developments
Gladman House
Alexandria Way
Congleton
Cheshire CW12 1LB

Tel: 01260 288800 (Main)
01260 288862 (Direct Dial)
Fax: 01260 288801

-----Original Message-----
From: Geoff.Nokes@thameswater.co.uk [mailto:Geoff.Nokes@thameswater.co.uk]
Sent: 22 March 2012 15:27
To: Geraldine Horner
Subject: Land at Barford Road Bloxham Oxfrdshre CH 509230 PDE

Geraldine

The proposed 85 units for this development should not be a problem for our foul system connected at MH0003 and a connection consent application should be sent in due course.

Regards
Geoff
Development Engineer - Waste
02035779228

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Appendix H

Surface Water Runoff Calculations –
Proposed Development

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www.jpb.co.uk

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West Midlands, DY5 3LH
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email: enquiries?@jpb.co.uk

Job No.	MB608
Sheet no.	1
Date	15/06/12

MasterDrain
HY 8.21

Project: Land off Barford Road

Title: FSR Rainfall intensities for BLOXHAM

By	Checked	Reviewed
HB		

Intensities increased by 10%

Mins\Yrs	1	2	5	10	20	30	50	100	200	500
1	93.4	119.0	153.6	173.7	196.3	210.9	230.9	261.0	295.0	346.9
2	81.3	103.6	133.8	151.9	172.4	185.7	203.9	231.4	262.7	310.6
3	71.2	92.2	119.1	135.7	154.5	166.8	183.6	209.1	238.2	283.0
4	64.3	83.3	107.6	123.0	140.5	151.9	167.6	191.6	218.9	261.1
5	58.8	76.1	98.5	112.8	129.3	140.0	154.8	177.3	203.2	243.3
6	54.3	70.3	90.9	104.4	120.0	130.1	144.1	165.5	190.1	228.3
7	50.5	65.3	84.6	97.4	112.1	121.7	135.1	155.5	179.0	215.6
8	47.2	61.2	79.2	91.4	105.4	114.6	127.3	146.9	169.4	204.7
9	44.4	57.5	74.5	86.1	99.6	108.4	120.6	139.4	161.1	195.1
10	42.7	55.1	70.5	81.5	94.4	102.8	114.4	132.4	153.2	185.9
11	40.5	52.3	66.9	77.5	89.7	97.8	108.9	126.2	146.2	177.5
12	38.6	49.8	63.7	73.8	85.6	93.3	104.0	120.6	139.8	169.9
13	36.8	47.5	60.8	70.5	81.8	89.3	99.6	115.5	134.0	163.1
14	35.3	45.5	58.2	67.6	78.5	85.6	95.6	110.9	128.8	156.9
15	33.8	43.7	55.9	64.9	75.4	82.3	91.9	106.8	124.0	151.2
16	32.5	42.0	53.8	62.5	72.6	79.3	88.6	102.9	119.6	145.9
17	31.4	40.5	51.8	60.2	70.0	76.5	85.5	99.4	115.6	141.1
18	30.3	39.1	50.0	58.2	67.7	73.9	82.6	96.1	111.8	136.6
19	29.3	37.8	48.3	56.3	65.5	71.6	80.0	93.1	108.4	132.4
20	28.3	36.6	46.8	54.5	63.4	69.3	77.6	90.3	105.1	128.6
21	27.5	35.4	45.4	52.8	61.6	67.3	75.3	87.7	102.1	124.9
22	26.7	34.4	44.0	51.3	59.8	65.4	73.2	85.2	99.3	121.5
23	25.9	33.4	42.8	49.9	58.1	63.6	71.2	82.9	96.7	118.3
24	25.2	32.5	41.6	48.5	56.6	61.9	69.3	80.8	94.2	115.3
25	24.5	31.7	40.5	47.3	55.1	60.3	67.5	78.7	91.8	112.5
26	24.7	31.2	39.5	46.1	53.7	58.8	65.9	76.8	89.6	109.8
27	24.1	30.5	38.5	45.0	52.5	57.4	64.3	75.0	87.5	107.3
28	23.5	29.7	37.6	43.9	51.2	56.1	62.8	73.3	85.5	104.9
29	23.0	29.1	36.8	42.9	50.1	54.8	61.4	71.7	83.6	102.6
30	22.4	28.4	35.9	41.9	49.0	53.6	60.1	70.1	81.9	100.4
31	21.9	27.8	35.1	41.0	47.9	52.5	58.8	68.6	80.1	98.4
32	21.5	27.2	34.4	40.2	46.9	51.4	57.6	67.2	78.5	96.4
33	21.0	26.6	33.7	39.3	46.0	50.3	56.4	65.9	77.0	94.5
34	20.6	26.1	33.0	38.6	45.1	49.3	55.3	64.6	75.5	92.7
35	20.2	25.6	32.4	37.8	44.2	48.4	54.3	63.4	74.1	91.0
36	19.8	25.1	31.8	37.1	43.4	47.5	53.3	62.2	72.7	89.3
37	19.5	24.6	31.2	36.4	42.6	46.6	52.3	61.1	71.4	87.7
38	19.1	24.2	30.6	35.8	41.8	45.8	51.4	60.0	70.2	86.2
39	18.8	23.8	30.1	35.1	41.1	45.0	50.5	59.0	69.0	84.8
40	18.4	23.3	29.5	34.5	40.4	44.2	49.6	58.0	67.8	83.3
41	18.1	22.9	29.0	33.9	39.7	43.5	48.8	57.0	66.7	82.0
42	17.8	22.6	28.6	33.4	39.0	42.8	48.0	56.1	65.6	80.7
43	17.5	22.2	28.1	32.8	38.4	42.1	47.2	55.2	64.6	79.4
44	17.3	21.8	27.6	32.3	37.8	41.4	46.5	54.4	63.6	78.2
45	17.0	21.5	27.2	31.8	37.2	40.8	45.8	53.6	62.6	77.0
46	16.7	21.2	26.8	31.3	36.7	40.2	45.1	52.8	61.7	75.9
47	16.5	20.9	26.4	30.9	36.1	39.6	44.4	52.0	60.8	74.8
48	16.2	20.6	26.0	30.4	35.6	39.0	43.8	51.2	59.9	73.7
49	16.0	20.3	25.6	30.0	35.1	38.5	43.2	50.5	59.1	72.7
50	15.8	20.0	25.3	29.6	34.6	37.9	42.6	49.8	58.3	71.7
51	15.6	19.7	24.9	29.2	34.1	37.4	42.0	49.1	57.5	70.8
52	15.4	19.4	24.6	28.8	33.7	36.9	41.4	48.5	56.7	69.8
53	15.1	19.2	24.3	28.4	33.2	36.4	40.9	47.8	56.0	68.9
54	14.9	18.9	23.9	28.0	32.8	35.9	40.4	47.2	55.3	68.0
55	14.8	18.7	23.6	27.7	32.4	35.5	39.8	46.6	54.6	67.2
56	14.6	18.4	23.3	27.3	32.0	35.0	39.3	46.0	53.9	66.3
57	14.4	18.2	23.0	27.0	31.6	34.6	38.9	45.5	53.2	65.5
58	14.2	18.0	22.8	26.6	31.2	34.2	38.4	44.9	52.6	64.7
59	14.0	17.8	22.5	26.3	30.8	33.8	37.9	44.4	52.0	64.0
60	13.9	17.6	22.2	26.0	30.4	33.4	37.5	43.9	51.4	63.2
61	13.7	17.3	22.0	25.7	30.1	33.0	37.0	43.4	50.8	62.5
62	13.5	17.1	21.7	25.4	29.7	32.6	36.6	42.9	50.2	61.8
63	13.4	17.0	21.5	25.1	29.4	32.2	36.2	42.4	49.6	61.1
64	13.7	17.0	21.2	24.8	29.1	31.9	35.8	41.9	49.1	60.4
65	13.5	16.8	21.0	24.6	28.8	31.5	35.4	41.5	48.5	59.8
66	13.4	16.6	20.8	24.3	28.4	31.2	35.0	41.0	48.0	59.1
67	13.2	16.4	20.5	24.0	28.1	30.9	34.7	40.6	47.5	58.5

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Job No.	Sheet no.	Date
MB608	2	15/06/12

Project	By	Checked	Reviewed
Land off Barford Road	HB		

Title: FSR Rainfall intensities for BLOXHAM

MasterDrain
HY 8.21

Intensities increased by 10%

Mins\Yrs	1	2	5	10	20	30	50	100	200	500
68	13.1	16.2	20.3	23.8	27.8	30.5	34.3	40.2	47.0	57.9
69	12.9	16.1	20.1	23.5	27.6	30.2	33.9	39.7	46.5	57.3
70	12.8	15.9	19.9	23.3	27.3	29.9	33.6	39.3	46.0	56.7
71	12.7	15.7	19.7	23.1	27.0	29.6	33.3	38.9	45.6	56.2
72	12.5	15.6	19.5	22.8	26.7	29.3	32.9	38.5	45.1	55.6
73	12.4	15.4	19.3	22.6	26.5	29.0	32.6	38.2	44.7	55.1
74	12.3	15.3	19.1	22.4	26.2	28.7	32.3	37.8	44.3	54.5
75	12.2	15.1	18.9	22.2	26.0	28.5	32.0	37.4	43.8	54.0
76	12.1	15.0	18.7	22.0	25.7	28.2	31.7	37.1	43.4	53.5
77	12.0	14.9	18.6	21.7	25.5	27.9	31.4	36.7	43.0	53.0
78	11.8	14.7	18.4	21.5	25.2	27.7	31.1	36.4	42.6	52.5
79	11.7	14.6	18.2	21.3	25.0	27.4	30.8	36.1	42.2	52.0
80	11.6	14.4	18.1	21.2	24.8	27.2	30.5	35.7	41.8	51.5
81	11.5	14.3	17.9	21.0	24.5	26.9	30.2	35.4	41.5	51.1
82	11.4	14.2	17.7	20.8	24.3	26.7	30.0	35.1	41.1	50.6
83	11.3	14.1	17.6	20.6	24.1	26.5	29.7	34.8	40.7	50.2
84	11.2	13.9	17.4	20.4	23.9	26.2	29.5	34.5	40.4	49.8
85	11.1	13.8	17.3	20.2	23.7	26.0	29.2	34.2	40.0	49.3
86	11.0	13.7	17.1	20.1	23.5	25.8	29.0	33.9	39.7	48.9
87	10.9	13.6	17.0	19.9	23.3	25.6	28.7	33.6	39.4	48.5
88	10.9	13.5	16.9	19.7	23.1	25.3	28.5	33.3	39.0	48.1
89	10.8	13.4	16.7	19.6	22.9	25.1	28.2	33.1	38.7	47.7
90	10.7	13.3	16.6	19.4	22.7	24.9	28.0	32.8	38.4	47.3
91	10.6	13.2	16.5	19.3	22.6	24.7	27.8	32.5	38.1	46.9
92	10.5	13.1	16.3	19.1	22.4	24.5	27.6	32.3	37.8	46.6
93	10.4	13.0	16.2	19.0	22.2	24.3	27.4	32.0	37.5	46.2
94	10.3	12.9	16.1	18.8	22.0	24.2	27.1	31.8	37.2	45.8
95	10.3	12.8	15.9	18.7	21.9	24.0	26.9	31.5	36.9	45.5
96	10.2	12.7	15.8	18.5	21.7	23.8	26.7	31.3	36.6	45.1
97	10.1	12.6	15.7	18.4	21.5	23.6	26.5	31.1	36.4	44.8
98	10.0	12.5	15.6	18.2	21.4	23.4	26.3	30.8	36.1	44.5
99	10.0	12.4	15.5	18.1	21.2	23.3	26.1	30.6	35.8	44.1
100	9.9	12.3	15.4	18.0	21.1	23.1	25.9	30.4	35.6	43.8
110	9.2	11.5	14.3	16.8	19.6	21.5	24.2	28.3	33.1	40.8
120	8.6	10.7	13.4	15.7	18.4	20.2	22.7	26.5	31.0	38.2
130	8.2	10.1	12.7	14.8	17.3	19.0	21.3	25.0	29.2	36.0
140	7.7	9.6	12.0	14.0	16.4	18.0	20.2	23.6	27.6	34.0
160	7.2	8.8	10.9	12.7	14.8	16.3	18.3	21.3	25.0	30.7
180	6.6	8.1	9.9	11.6	13.6	14.9	16.7	19.5	22.8	28.0
210	5.9	7.2	8.9	10.3	12.1	13.2	14.8	17.3	20.2	24.8
240	5.3	6.5	8.0	9.4	10.9	11.9	13.4	15.6	18.2	22.3
270	4.9	6.0	7.3	8.6	10.0	10.9	12.2	14.2	16.5	20.2
300	4.6	5.6	6.8	7.9	9.2	10.0	11.2	13.1	15.2	18.6
330	4.3	5.2	6.3	7.3	8.5	9.3	10.4	12.1	14.1	17.2
360	4.0	4.9	5.9	6.9	8.0	8.7	9.7	11.3	13.1	16.0
390	3.8	4.6	5.6	6.5	7.5	8.2	9.1	10.6	12.3	15.0
420	3.6	4.3	5.3	6.1	7.1	7.7	8.6	10.0	11.6	14.2

Rainfall depths for BLOXHAM at standard return periods in mm with global warming factor of 1.1

Time\Yrs	1	2	5	10	20	30	50	100	200	500
3 min	3.6	4.6	6.0	6.8	7.7	8.3	9.2	10.5	11.9	14.1
30 min	11.2	14.2	18.0	21.0	24.5	26.8	30.0	35.1	40.9	50.2
1 hr	13.9	17.6	22.2	26.0	30.4	33.4	37.5	43.9	51.4	63.2
2 hr	17.3	21.5	26.9	31.4	36.8	40.4	45.3	53.0	62.1	76.4
5 hr	23.2	27.8	33.9	39.5	45.9	50.2	56.1	65.3	75.9	92.8
10 hr	27.5	33.0	40.2	46.5	53.8	58.6	65.3	75.5	87.4	106.0
24 hr	35.0	41.3	49.7	57.0	65.4	70.9	78.5	90.1	103.5	124.1
48 hr	43.6	50.0	58.6	66.8	76.1	82.2	90.5	103.1	117.4	139.6
5 day	54.4	62.3	72.9	82.2	92.6	99.3	108.4	122.2	137.7	161.2

The above figures are calculated in accordance with the protocol set out in the 'Wallingford Procedure' from data derived from the Wallingford maps :-

M5-60min	= 19.70	r	= 0.40
WRAP	= 3	SAAR	= 710
NG ref	= SP4235	Soil index	= 0.40

Data printed on 15/06/12 from Masterdrain Hydrology program

PERCENTAGE RUNOFF

Site Name	Land off Barford Road, Bloxham
Reference	MB608

PR = (0.829 * PIMP) + (25 * SOIL) + (0.078 * UCWI) - 20.7

Where,

PR =	**Percentage Runoff (%)**		
PIMP =	**Percentage Impermeability (%)**	51.0	
	(Area of hard cover on site to be drained)		
	Development area 10.5ha - Area of hardcover 5.49ha		
SOIL =	**Index of the water holding capacity of the soil**	0.4	
	(Select from Table 1 below)		
UCWI =	**Urban Catchment Wetness Index**	65	(summer)
	(See graph in Ciria X108 pg.160)	130	(winter)

PR =	36.65	%	(summer)
	41.72	%	(winter)

Table 1 - Different classes of soil

Soil Class	WRAP	Runoff	SOIL	Soil Type
1	Very High	Very Low	0.15	Sandy, well drained
2	High	Low	0.30	Intermediate soils (sandy)
3	Moderate	Moderate	0.40	Intermediate soils (silty)
4	Low	High	0.45	Clayey, poorly drained
5	Very Low	Very High	0.50	Steep, rocky areas

Note

Reproduced from Ciria X108 Drainage of development sites pg. 159

DISCHARGE RATE (Proposed Development - 1 in 1 year)

Q = 2.78 * (Cv*Cr) * I * IMP

Where,

Q = Discharge Rate (l/s)

Cv = PR / PIMP — 0.72 (summer), 0.82 (winter)

Cr = Routeing Coefficient (factor) — 1.3

I = Rainfall Intensity (mm/hr)

Rainfall intensity for Abbeyfields calculated in Masterdrain (see enclosed sheets)

Includes factor of 10% for climate change

Duration (mins)	Rainfall Intensity (mm/hr)
1	93.4
5	58.8
10	42.7
15	33.8
30	22.4
60	13.9
120	8.6
180	6.6
240	5.3
300	4.6
360	4.0
420	3.6

IMP = Impermeable Area (ha) — 1.36

Duration (mins)		Discharge Rate (l/s)
1	Summer	329.89
5		207.68
10		150.82
15		119.38
30		79.12
60		49.09
120		30.38
180		23.31
240		18.72
300		16.25
360		14.13
420		12.72
1	Winter	375.52
5		236.41
10		171.68
15		135.90
30		90.06
60		55.89
120		34.58
180		26.54
240		21.31
300		18.49
360		16.08
420		14.47

Average Summer Discharge = 87.62 l/s

Average Winter Discharge = 99.74 l/s

Total Average Discharge = 93.68 l/s

DISCHARGE RATE (Proposed Development - 1 in 30 year)

Q = 2.78 * (Cv*Cr) * I * IMP

Where,

Q =	Discharge Rate (l/s)			
Cv =	PR / PIMP		0.72	(summer)
			0.82	(winter)
Cr =	Routeing Coefficient (factor)		1.3	
I =	Rainfall Intensity (mm/hr)	1	210.9	
Rainfall intensity for Abbeyfields calculated in		5	140.0	
Masterdrain (see enclosed sheets)		10	102.8	
Includes factor of 10% for climate change		15	82.3	
		30	53.6	
		60	33.4	
	Duration (mins)	120	20.2	
		180	14.9	
		240	11.9	
		300	10.0	
		360	8.7	
		420	7.7	
IMP =	Impermeable Area (ha)		1.36	

Duration (mins)		Discharge Rate (l/s)
1	Summer	744.90
5		494.48
10		363.09
15		290.68
30		189.31
60		117.97
120		71.35
180		52.63
240		42.03
300		35.32
360		30.73
420		27.20
1	Winter	847.94
5		562.88
10		413.32
15		330.90
30		215.50
60		134.29
120		81.22
180		59.91
240		47.85
300		40.21
360		34.98
420		30.96

Average Summer Discharge =	204.97	l/s
Average Winter Discharge =	233.33	l/s
Total Average Discharge =	219.15	l/s

DISCHARGE RATE (Proposed Development - 1 in 100 year)

Q = 2.78 * (Cv*Cr) * I * IMP

Where,

Q = Discharge Rate (l/s)

Cv = PR / PIMP — 0.72 (summer), 0.82 (winter)

Cr = Routeing Coefficient (factor) — 1.3

I = Rainfall Intensity (mm/hr)

Rainfall intensity for Abbeyfields calculated in Masterdrain (see enclosed sheets)

Includes factor of 10% for climate change

Duration (mins)	Rainfall Intensity (mm/hr)
1	261.0
5	177.3
10	132.4
15	106.8
30	70.1
60	43.9
120	26.5
180	19.50
240	15.60
300	13.10
360	11.30
420	10.00

IMP = Impermeable Area (ha) — 1.36

Duration (mins)		Discharge Rate (l/s)
1	Summer	921.85
5		626.22
10		467.63
15		377.22
30		247.59
60		155.05
120		93.60
180		68.87
240		55.10
300		46.27
360		39.91
420		35.32
1	Winter	1049.38
5		712.85
10		532.33
15		429.40
30		281.84
60		176.50
120		106.55
180		78.40
240		62.72
300		52.67
360		45.43
420		40.21

Average Summer Discharge = 261.22 l/s

Average Winter Discharge = 297.36 l/s

Total Average Discharge = 279.29 l/s

Appendix I

Attenuation Storage Calculations

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MasterDrain SW

Job No.	MB608
Sheet no.	1
Date	15/06/12
By	HB
Checked	
Reviewed	

Project: Land off Barford Road

Title: Attenuation storage volume for BLOXHAM

Hydrological region	(R)	6		Note 1
Hydrological rainfall zone	(Z)	8		Note 2
Development area - ha	(A)	2.650	ha	Note 3
Proport. of imp.area requiring storage	(a)	1.000		Note 4
Greenfield flow rate per unit area	(Q_{BAR}/A)	7.71	l/s/ha	Note 5
% impermeable area of catchment	(PIMP)	51.0	%	Note 6
Attenuation storage volumes per unit area:-				
	($Uvol_{1yr}$)	50.0	m^3/ha	Note 7
	($Uvol_{30yr}$)	120.0	m^3/ha	
	($Uvol_{100yr}$)	150.0	m^3/ha	
Basic storage volumes :- (Uvol x a x A)	(BSV_{1yr})	132.5	m^3	Note 8
	(BSV_{30yr})	318.0	m^3	
	(BSV_{100yr})	397.5	m^3	
Climate change factor	(CC)	1.3		Note 9
FEH factor		1.0		Note 10
Critical storm duration		2.0	hrs	Note 11
FEH Rainfall factor :-				
	(FF_{1yr})	1.10		Note 12
	(FF_{30yr})	1.00		
	(FF_{100yr})	0.90		
Storage volume ratio :- ƒ(CC/FF)	(SVR_{1yr})	1.258		Note 13
	(SVR_{30yr})	1.426		
	(SVR_{100yr})	1.631		
Adjusted storage volumes :- (SVR x BSV)	(ASV_{1yr})	166.7	m^3	Note 14
	(ASV_{30yr})	453.47	m^3	
	(ASV_{100yr})	648.4	m^3	

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Job No.	MB608
Sheet no.	2
Date	15/06/12

MasterDrain SW

Project	Land off Barford Road	By	HB
Title	Attenuation storage volume for BLOXHAM	Checked	
		Reviewed	

Growth curve factors :-

(GC_{1yr})	0.85	Note 15
(GC_{30yr})	1.07	
(GC_{100yr})	1.17	

Hydrological region volume storage ratio :-

(HR_{1yr})	0.96	Note 16
(HR_{30yr})	1.02	
(HR_{100yr})	1.05	

Final estimated attenuation storage volumes:-

(HR x ASV)

$(AtVol_{1yr})$	160.0	m^3	Note 17
$(AtVol_{30yr})$	462.0	m^3	
$(AtVol_{100yr})$	678.1	m^3	

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MasterDrain SW

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Job No. MB608			
Sheet no. 3			
Date 15/06/12			
Project Land off Barford Road	By HB	Checked	Reviewed
Title Attenuation storage volume for BLOXHAM			

Notes:-

References to Appendix 1 refer to 'R&D Technical Report W5-074/A – Preliminary rainfall runoff management for developments (Revision C) Defra/EA

Note 1 – UK is divided into 10 Hydrological regions reflecting the different flood frequency growth curves (Appendix 1, fig 1.1). This data is included in the database.

Note 2 – Zones 1 – 8 based on FSR rainfall characteristics. This data is included in the database.

Note 3 – Excluding public open spaces not modified 0r drained by the proposed development.

Note 4 – Impermeable area served by direct drainage / total area of impermeable surface.

Note 5 – From previous calculation.

Note 6 – For catchments where the PIMP value is less than 50%, a more detailed study should be made as the storage estimates may be undersized.

Note 7 – These values are generated by the program, based on the graphs in Appendix 1, figures 7.1 – 7.8.

Note 8 – Storage units may serve areas of different densities of development. If necessary, calculations should be based on each development zone, then cumulated.

Note 9 – The Defra guidance on the impact of climate change on river flows is to apply a factor of 1·2. As there is a non-linear relationship between rainfall and runoff, it is suggested that a factor of 1·1 should be applied to rainfall +depths in this procedure.

Note 10 – FEH factor is calculated by the program. It is used to derive the critical storm duration for the appropriate hydrological zone. (App. 1, fig. 11)

Note 11 – The critcal storm duration for the location. This should be used to select the FSR/FEH ratio map in Appendix 1, figures 6.1.1 to 6.3.4.

Note 12 – This is derived from the maps in Appendix 1, 6.1.1 to 6.3.4

Note 13 – This is a function of the Climate change factor and the FEH rainfall factor. See App 1, Figs 8.1 to 8.8

Note 14 – Storage volumes adjusted for climate change and FEH rainfall.

Note 15 – Growth curve factors for each hydrological region obtained from Appendix 1, figure 1.2 (table inset in figure).

Note 16 – These are a function of the Storage Volume Ratio and the growth curves.

Note 17 – Required attenuation storage.

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Job No.	MB608
Sheet no.	1
Date	15/06/12

MasterDrain SW

Project	Land off Barford Road	By	HB
Title	Treatment storage volume for BLOXHAM	Checked	
		Reviewed	

Site characteristics:-

Catchment area - ha	(A)	1.360	ha
Percentage impermeable area	(PIMP)	51	
Proportion of PIMP requiring storage	(β)	1.0	
Soil runoff coefficient	(SPR)	0.37	
M5 - 60	(M5-60)	19.70	mm

Results:-

Treatment storage volume	(T Vol)	145	m^3

Calculated using:-

$$T\ Vol = 9 \times A \times M5\text{-}60 \times (SPR/2 + (1 - SPR/2) \times (\beta * PIMP/100))$$

Note 1
The concept of treatment volume is to provide sufficient volume to provide partial treatment of the stormwater effluent. There is no specific water quality discharge criteria to comply with. Current best practice in the UK (CIRIA report C522, 2000) requires between 1 and 4 times the T Vol to be provided. A minimum of 1.0 T Vol would normally be required unless other appropriate forms of treatment are proposed.

Note 2
Hard surfaces being drained through infiltration units and pervious pavements can be deemed not to require treatment in terms of Vt for a pond. Vt only needs to be applied to impermeable surfaces with direct runoff.

Appendix J

Assessment of On Site Permeability

JOHNSON POOLE & BLOOMER CONSULTANTS
Harris & Pearson Building, Brettell Lane, Brierley Hill, West Midlands, DY5 3LH England
Tel: (01384) 262000 Fax: (01384) 262001

Our ref: MB608-58/ACJ/HB/JC

Geraldine Horner
Gladman Developments Limited
Gladman House
Alexandria Way
Congleton
Cheshire
CW12 1LB

6 June 2012

Dear Geraldine

LAND OFF BARFORD ROAD, BLOXHAM
ASSESSMENT OF ON SITE PERMEABILITY

1.0 BACKGROUND

1.1 Proposals for the site known as Land Off Barford Road, Bloxham are in the process of being prepared for a residential end use that will comprise up to 75 dwellings. JPB has previously carried out a Phase 1 Desk Study Report for the site dated 16 February 2012 and referenced MB608-10/ACJ/HB, and is now in the process of preparing a Flood Risk Assessment (FRA) for the site.

1.2 To aid with the development proposals and preliminary drainage design, required as part of the FRA, Johnson Poole and Bloomer Limited (JPB) was initially commissioned by Gladman Developments Limited (GDL) on 7 March 2012 to complete a preliminary assessment of the permeability of the shallow on site soils. Following the findings of these works, JPB was then commissioned on 9 May 2012 to carry out further on site tests to determine if deep bore soakaways may be a viable solution on site, for the disposal of surface waters, generated by the development of the site.

1.3 The Phase 1 Desk Study Report identified the near surface geology across the site to be the generally low permeability strata of the Whitby Mudstone Formation. However, the site slopes down to its northeast corner where the more permeable strata of the Marlstone Rock Formation is indicated, by the British Geological Survey (BGS), to outcrop at the surface, either just within the site's eastern boundary or immediately beyond.

1.4 It was anticipated that the Whitby Mudstone Formation may grade down into the Marlstone Rock Formation in the north-eastern corner of the site, with the Marlstone Rock Formation present at a shallow enough depth to be used for infiltration style drainage. The Marlstone Rock Formation comprises ferruginous limestone, ironstone and sandstone, with a moderate to high permeability.

1.5 The site is currently used as agricultural land and comprises a large single field, which is left fallow all year round. Further details on the site and its environs are provided in JPB's Phase 1 Desk Study Report.

2.0 ASSESSMENT OF SHALLOW SOILS (MARCH 2012)

2.1 Scope of Works

2.1.1 Intrusive ground investigation works to enable soakaway testing, in accordance with BRE365:Soakaway Design, were completed on the 29 March 2012, under the full time supervision and direction of a JPB Geotechnical Engineer. The ground investigation was undertaken in accordance with BS5930:1999+A2:2010, with each exploratory position logged in line with this British Standard by the supervising JPB Geotechnical Engineer. The positions of the trial pits for the soakaway tests are shown on JPB Drawing MB608/05 and were located in the topographically lower, north-eastern corner of the site, with the aim of determining the presence and depth of the more permeable strata of the Marlstone Rock Formation.

2.1.2 Four trial pits, designated TP101 to TP104, were excavated to a maximum depth of 2.9m below ground level (bgl) using a tracked DX55 excavator. The individual exploratory hole logs are presented in Appendix A.

2.1.3 Soakaway tests were completed by JPB in all four trial pits and were completed during and immediately following a period of prolonged dry weather. The ground across the majority of the site was noted to be dry during these site works. However, during the site walkover for the Phase 1 Desk Study, which was completed in January 2012, two routes of frozen ponded water were noted to drain through the hollow in the north of the site, to the on site pond. The ground around trial pit TP104 was noted to be slightly softer than elsewhere, during this trial pitting, with the excavator sinking approximately 150mm during the excavation of the trial pit.

2.2 Encountered Shallow Ground Conditions

2.2.1 The encountered ground conditions were generally consistent with the published BGS information, as reported in JPB's Phase 1 Desk Study Report. A brief description of the materials encountered on site is presented as a generalised geological sequence in Table 1. Full details of the encountered strata is provided on the exploratory hole logs presented in Appendix A.

Table 1: Generalised Geological Sequence

STRATA ENCOUNTERED AND DESCRIPTION	RANGE OF THICKNESS (m)	DEPTH TO BASE (m bgl)
A. MADE GROUND		
A1 Grass over firm brown clay with many roots and rootlets. *Top Soil.*	0.22 – 0.28	0.22 – 0.28
B. SOLID GEOLOGY		
B1 Firm to stiff brown mottled orange brown and orange grey clay with occasional rootlets. The clays in TP101 were noted to be slightly fissured. *Weathered Whitby Mudstone Formation*	0.97 – 1.88	1.22 – 2.10
B2 Firm to stiff blue pale grey mottled orange brown clay. Slightly fissured in TP103. *Weathered Whitby Mudstone Formation*	0.20 – 0.40	2.10 – 2.30
B3 Stiff blue grey slightly fissure clay. Some orange brown mottling. *Weathered Whitby Mudstone Formation*	0.47 – 1.17	2.20 – 2.90
B4 *Marlstone Rock Formation*	Not encountered	Not encountered

2.2.2 The very stiff nature of the encountered clays did not allow their full depth to be penetrated to enable the depth to the underlying limestone strata to be proven on site during this phase of site works. The excavator had a maximum reach of 6m depth but did not have sufficient strength to be able to excavate beyond a maximum depth of 2.90m bgl, due to the competency of the weathered mudstones.

2.2.3 The clays and weathered mudstones were deeper than anticipated in the northeastern corner of the site, which limited the ability to complete the soakaway tests in the Marlstone Rock Formation.

2.2.4 No seepages of groundwater were noted in the sides or bases of the trial pits during the course of the ground investigation and each of the trial pits remained stable.

2.3 Soakaway Tests

2.3.1 The permeability of the ground and the rate at which rainwater can infiltrate will vary with soil type and condition, antecedent conditions, and time. The tests were completed during a period of prolonged dry weather, as described above. Repeat tests should be completed to represent soil moisture conditions typical of the site when a soakaway is operative (BRE365).

2.3.2 Four soakaway tests were completed on site within the shallow encountered clay and weathered mudstone deposits of the Whitby Mudstone Formation. The trial pits were filled with water from a towed bowser to a level between 1m bgl and 1.5m bgl. Upon completion of the tests, the remaining water was extracted out of the pit back into the bowser for disposal.

2.3.3 The water did not soak away in any of the trial pits, with the clays being confirmed to have a very low permeability. The first test was abandoned after approximately 4 hours, in each test location, with very little change to the starting water level. It was clear from the observations made during the first four hours of the test, at each location, that the water would not have drained away within the six hour test period recommended in BRE 365 and that the shallow soils were unsuitable for infiltration. Therefore, repeat tests were not carried out in any of the trial pits. The BRE 365 permeability calculation sheets are presented in Appendix B, which show the recorded falls in water level. However, as there was insufficient change in water levels within the trial pits, the permeability of the soils has not been able to be calculated using this methodology.

2.3.4 In order to provide an estimation of the soil permeability, the data has been processed using the methodology for field drainage as discussed in BS6297 - Code of Practice for the design and installation of drainage fields for use in wastewater treatment. The field drainage methodology provides a percolation value (Vp) in seconds/millimetre, which is the time it will take for the water to drop by 1mm in seconds. Where the value of Vp is calculated to be greater than 100 the soils are considered unsuitable for infiltration.

Table 2: Percolation Value (Vp)

Trial Pit Location	Test Date	Depth water level reduced (mm)	Start Time	End Time	Elapsed Time		Vp * (s/mm)
					Minutes	Seconds	
TP101	29/03/2012	25	9:20:00	13:20:12	252	15120	604.8
TP102	29/03/2012	30	9:27:00	13:33:30	246.5	14790	493
TP103	29/03/2012	15	9:30:00	13:35:00	245	14700	980
TP104	29/03/2012	0	9:50:00	13:46:00	236	14160	14160

** Seconds for water to drop by 1mm.*

2.4 Conclusions

2.4.1 The near surface clays and weathered mudstones are not considered to be suitable for infiltration style drainage. The strength of the weathered mudstones, forming the Whitby Mudstone Formation, prevented the underlying limestone of the Marlstone Rock Formation from being encountered, and as such their permeability was not able to be determined by the first phase of investigation and assessment.

3.0 ASSESSMENT OF THE MARLSTONE ROCK FORMATION (MAY 2012)

3.1 Scope of Works

3.1.1 Further intrusive ground investigation works to determine the thickness of the overlying Whitby Mudstone Formation, and the depth to, and composition of, the Marlstone Rock Formation were completed on 29 May 2012 under the full time supervision and direction of a JPB Geotechnical Engineer. This second phase of site works also aimed to establish the thickness of the unsaturated zone within the underlying Marlstone Rock Formation and the depth to the main groundwater body across the site. Where the Marlstone Rock Formation was encountered at a reasonable depth beneath the site, with sufficient freeboard to the resting groundwater levels, it was proposed that permeability tests, by way of falling head tests, would be completed to determine the suitability of the Limestone strata for deep bore soakaways. This phase of ground investigation was again undertaken in accordance with BS5930:1999+A2:2010, with each exploratory position being logged in line with this British Standard by the supervising JPB Geotechnical Engineer.

3.1.2 The proposed borehole locations, to establish both the site's geology and depth to groundwater, are indicated on JPB Drawing MB608/06, and were placed in the north-eastern and south-western corners of the site, to account for the change in topography across the site. The proposed locations for the boreholes to be installed for falling head tests are also shown on this JPB drawing and were located to provide even coverage across the site, with the proposed site layout also considered in terms of the most likely locations for the deep bore soakaways upon development.

3.1.3 The two deeper boreholes, designated BH201 and BH202, were drilled using a combination of rotary open hole and cored drilling techniques, using a Klemm truck mounted rotary drilling rig, supplied by Geotechnics Limited. These boreholes were installed with groundwater monitoring equipment and the individual exploratory hole logs are presented in Appendix A.

3.1.4 Based on the findings at these two locations, the on site geology was deemed unsuitable for deep bore soakaways and the remaining works, i.e. the four boreholes for the completion of falling head tests, were abandoned. The findings of the ground investigations are discussed further in Section 3.2 and the actual locations of the completed boreholes are shown on JPB Drawing MB608/07.

3.2 Encountered Ground Conditions

3.2.1 The encountered ground conditions were generally consistent with the published BGS information, again as reported in JPB's Phase 1 Desk Study Report. However, the thickness of the Whitby Mudstone Formation in the northeast corner of the site, where this formation was considered to grade out, was found to be much thicker than anticipated, with a thickness of 6.34m encountered in borehole BH201.

3.2.2 In the southwest of the site, at the top of the hill, the mudstone deposit was found to be thicker still, which was as anticipated, with a thickness of 9.25m encountered in borehole BH202.

3.2.3 The Marlstone Rock Formation was encountered directly beneath the Whitby Mudstone Formation, as anticipated, and was proven to depths of 11.90m and 10.5m bgl in boreholes BH201 and BH202, respectively. The Marlstone Rock Formation comprised ferruginous limestone with ironstone and sandstone beds / bands.

3.2.4 Groundwater was encountered at the top of the Marlstone Rock Formation, at both investigation locations, with the limestone's considered to be a confined aquifer. The groundwater in borehole BH201 was considered to be under sub-artesian pressure, with the resting groundwater level rising above the top of the limestone strata and settling at a level of 6.61m bgl after 20mins monitoring during drilling. The groundwater in BH201 was struck at 7.50m bgl. The groundwater in BH202 was found to rest within the limestone strata, where it was initially struck at a depth of 10.4m bgl and rested at a depth of 10.3m bgl after 20mins monitoring during drilling.

3.2.5 The groundwater in borehole BH201 was purged following drilling and the rate of recharge to its resting level of approximately 6.6m bgl was monitored. The borehole was found to recharge within less than 1minute from the base of the borehole (11.9m bgl) to its resting level, which confirmed that the groundwater body encountered was the main aquifer and that the Limestone of the Marlstone Rock Formation does have a high permeability.

3.3 Conclusions

3.3.1 The Marlstone Rock Formation is not considered suitable for use with deep bore soakaways due to the lack of a sufficient unsaturated zone within the limestone's of the Marlstone Rock Formation. An unsaturated zone was not encountered in the northeast of the site, with the groundwaters found to be under sub-artesian pressure, whilst the unsaturated zone in the southwest of the site was only found to be approximately 1m thick, which would not allow the effective construction of a deep bore soakaway.

4.0 SUMMARY

4.1 The encountered on site ground conditions at the Land Off Barford Road, Bloxham are not considered suitable for the construction of either shallow soakaways or deep bore soakaways and alternative methods of surface water drainage using conventional sewers will need to be utilised on site. However, due to the topography of the site, and the location of the existing public sewers, it is likely that a pumped system would be required for both the surface water and foul sewerage systems.

4.2 Sustainable Drainage Systems (SuDS) such as permeable paving, swales and balancing ponds should still be incorporated within the proposed drainage design to assist in reducing the volume of storm water runoff from the proposed development; to reduce the rate of storm water runoff from the development; to ensure that storm water is treated appropriately, prior to its discharge; and to ensure that groundwater is protected.

4.3 The two installed boreholes; namely BH201 and BH202, should be decommissioned prior to the development of the site, in accordance with the Environment Agency guidance 'Good practice for decommissioning redundant boreholes and wells' (January 2012).

We hope the above and enclosed information meets with your present requirements. Should you have any queries or require any further information, please do not hesitate to contact us.

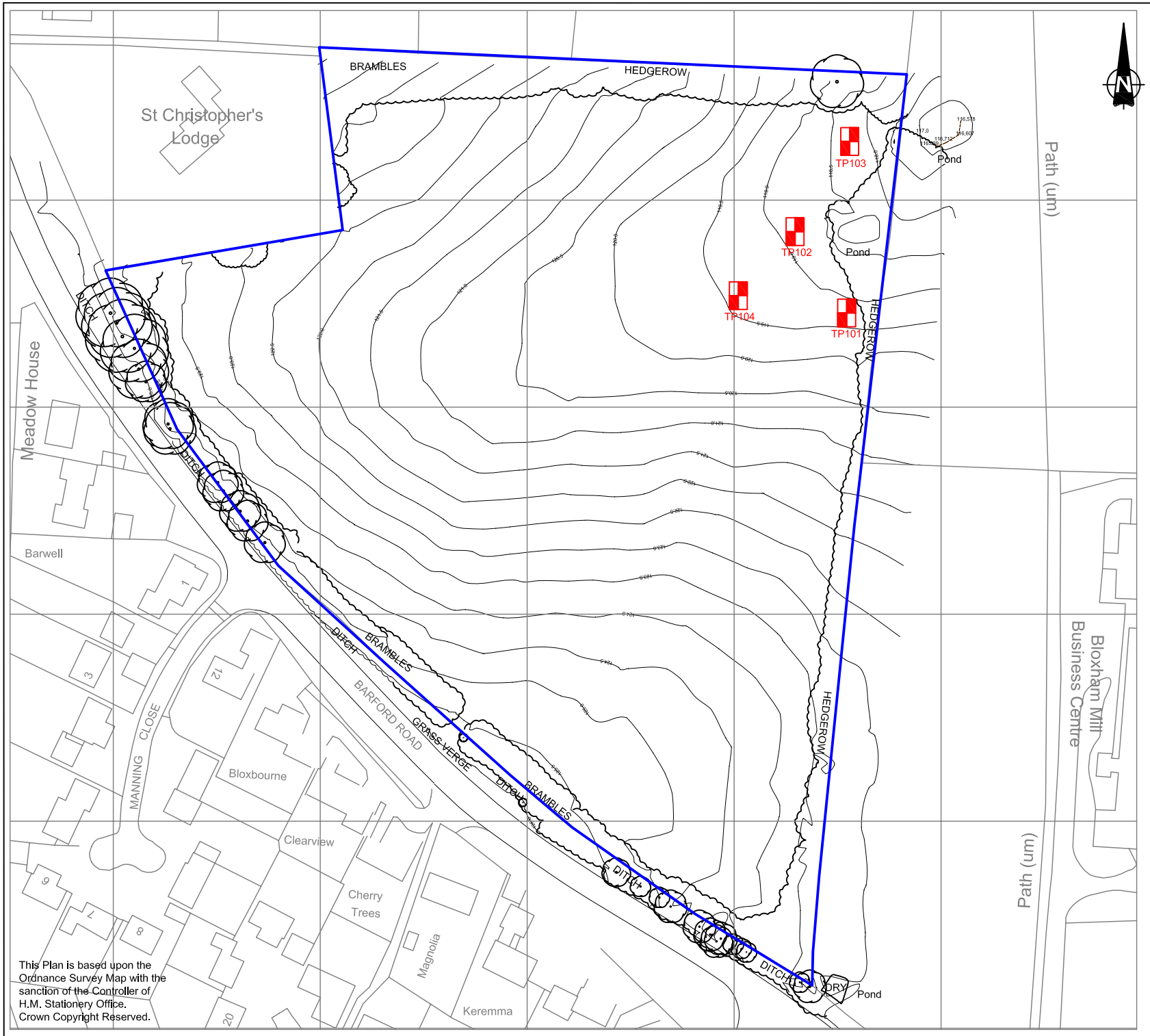
Yours sincerely

Helen Bayliss BSc CSci MIEnvSc
Senior Environmental Scientist

E-Mail: helen.bayliss@jpb.co.uk
Website: www.jpb.co.uk

Encl.

DRAWINGS



Key –

- Study Boundary
- Pond
- Potential Trial Pit Locations (Symbols not to scale)

Client
GLADMAN DEVELOPMENTS LTD

Project
LAND OFF BARFORD ROAD, BLOXHAM

Title
APPROXIMATE LOCATION OF TRIAL PITS AND SOAKAWAY TESTS

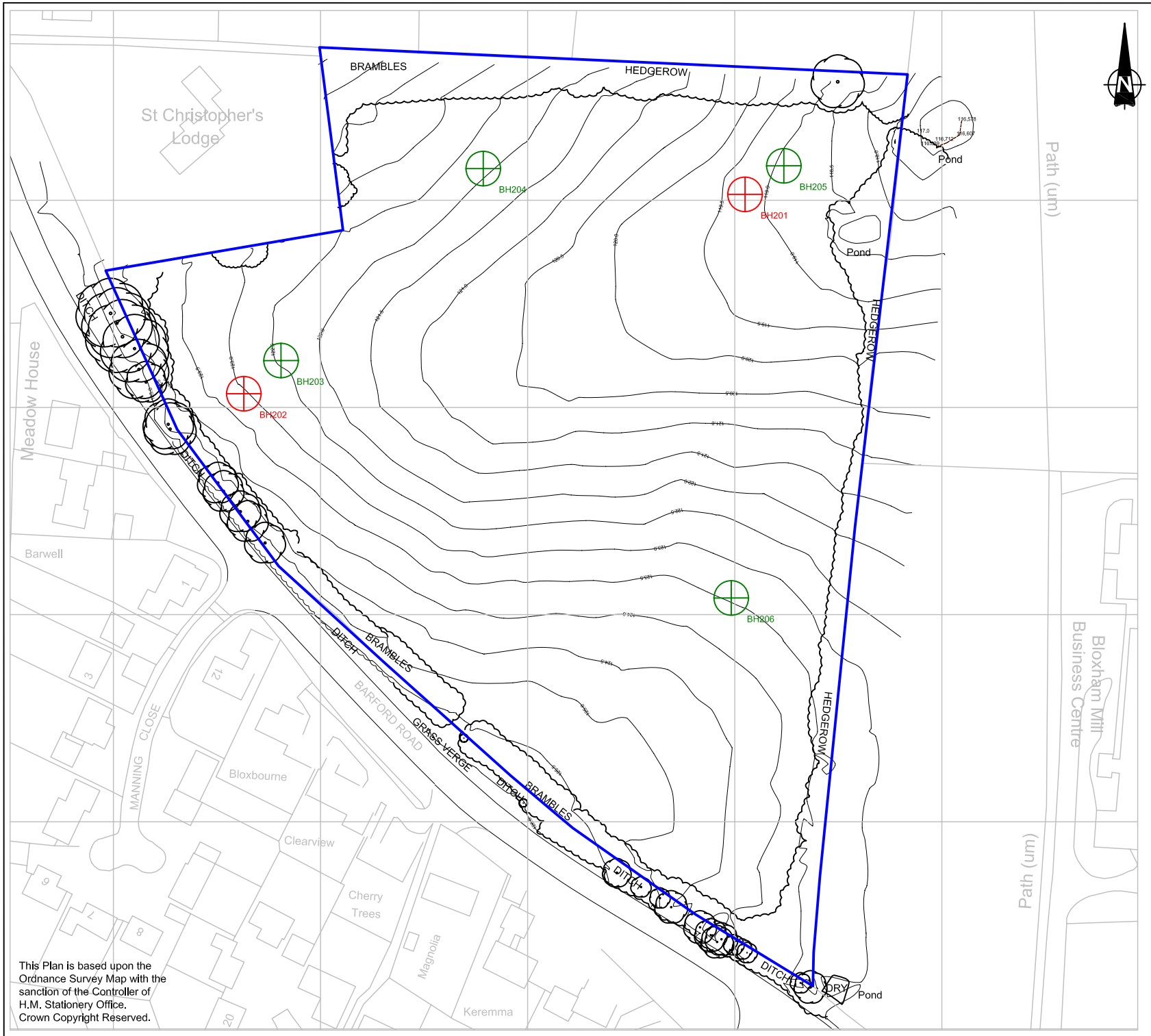
JOHNSON POOLE & BLOOMER CONSULTANTS
Tel 01384 262000 www.jpb.co.uk

Engineer	Checked	Approved
JC	HB	FT

Date	Scale
30/03/2012	1:1,250 @ A4

Drawing	Drawn
MB608/05	HB

Plan Laid Out by	Office
JLP Surveys Ltd S12/027 Jan'12	Brierley Hill



This Plan is based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office. Crown Copyright Reserved.

Key –

- Study Boundary
- BH201 — Borehole to determine geology and depth to groundwater
- BH203 — Borehole to be installed for Falling Head Tests within Marlstone Rock Formation

Client
GLADMAN DEVELOPMENTS LTD

Project
LAND OFF BARFORD ROAD, BLOXHAM

Title
PROPOSED BOREHOLE LOCATION PLAN

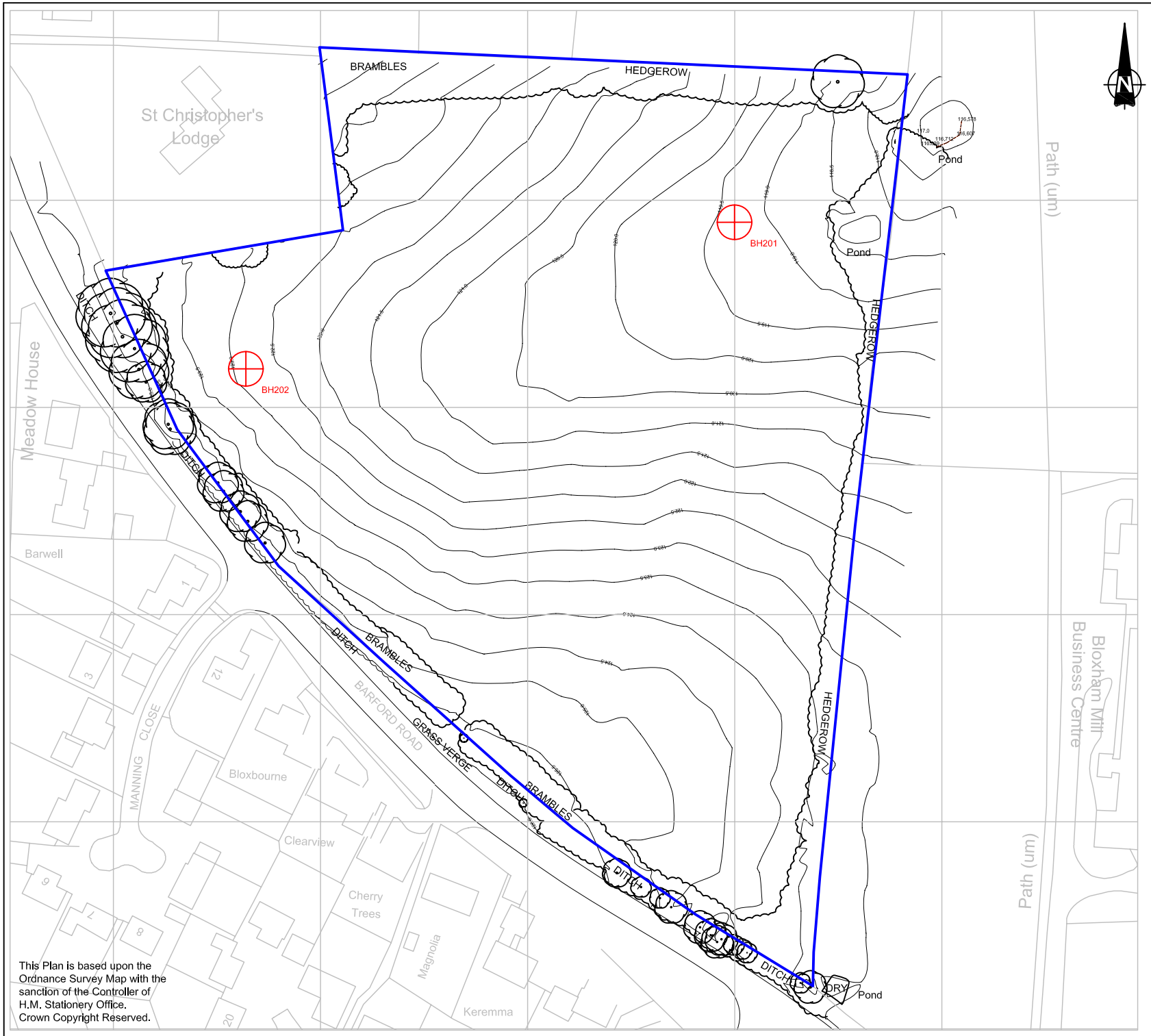
JOHNSON POOLE & BLOOMER
CONSULTANTS
Tel 01384 262000 www.jpb.co.uk

Engineer	Checked	Approved
JC	HB	ACJ

Date	Scale
28/05/2012	1:1,250 @ A4

Drawing	Drawn
MB608/06	HB

Plan Laid Out by	Office
JLP Surveys Ltd S12/027 Jan'12	Brierley Hill



This Plan is based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office. Crown Copyright Reserved.

Key –

Study Boundary

BH201 Borehole (Installed with ground water monitoring equipment)

Client
GLADMAN DEVELOPMENTS LTD

Project
LAND OFF BARFORD ROAD, BLOXHAM

Title
BOREHOLE LOCATION PLAN

JOHNSON POOLE & BLOOMER CONSULTANTS
Tel 01384 262000 www.jpb.co.uk

Engineer	Checked	Approved
JC	HB	ACJ

Date	Scale
30/05/2012	1:1,250 @ A4

Drawing	Drawn
MB608/07	HB

Plan Laid Out by	Office
JLP Surveys Ltd S12/027 Jan'12	Brierley Hill

APPENDICES

APPENDIX A

Exploratory Hole Logs

JOHNSON POOLE & BLOOMER AGS

Site	Trial Pit Number
Barford Road, Bloxham	TP101

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Doosan DX55	1.45m x 0.70m x 2.20m	119.20	Gladman Developments Ltd	MB608
	Location	**Dates**	**Engineer**	**Sheet**
	See JPB Drawing No. MB608/05	29/03/2012	Johnson, Poole & Bloomer Ltd	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25)	Grass over brown CLAY. Many roots and rootlets. (TOPSOIL)		
				118.95	0.25	Firm to stiff brown mottled orange brown slightly fissured CLAY. Occasional rootlets up to 20mm in length.		
					(0.97)			
				117.98	1.22	Stiff blue grey slightly fissured CLAY. Rare rootlets to 1.4mbgl.		
					(0.98)			
				117.00	2.20	Complete at 2.20m		

Plan

Remarks

Trial pit checked for services prior to excavation by JPB Engineer.
Trial pit stable throughout soakaway test
No groundwater encountered during excavation
Hard to extract below 2.1mbgl
Trial pit completed under supervision of JPB Engineer.
Ground levels estimated from topographical survey provided by client.

Scale (approx)	Logged By	Figure No.
1:25	JC	MB608.TP101

JOHNSON POOLE & BLOOMER AGS

Site	Trial Pit Number
Barford Road, Bloxham	TP102

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Doosan DX55	1.43m x 0.70m x 2.77m	118.80	Gladman Developments Ltd	MB608
	Location	**Dates**	**Engineer**	**Sheet**
	See JPB Drawing No. MB608/05	29/03/2012	Johnson, Poole & Bloomer Ltd	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.22)	Grass over firm brown CLAY. Many roots and rootlets. (TOPSOIL)		
				118.58	0.22	Firm brown mottled pale grey orange CLAY. Occasional rootlets up to 60mm in length to 0.45mbgl.		
					(1.88)			
				116.70	2.10	Firm to stiff blue pale grey mottled orange brown CLAY.		
					(0.20)			
				116.50	2.30	Stiff slightly blue grey mottled brown slightly fissured CLAY.		
					(0.47)			
				116.03	2.77	Complete at 2.77m		

Plan

Remarks

Trial pit checked for services prior to excavation by JPB Engineer.
Trial pit stable throughout soakaway test
No groundwater encountered during excavation
Hard to extract below 2.5mbgl
Limit of excavator reached at 2.77mbgl.
Trial pit completed under supervision of JPB Engineer.
Ground levels estimated from topographical survey provided by client.

Scale (approx)	Logged By	Figure No.
1:25	JC	MB608.TP101

JOHNSON POOLE & BLOOMER AGS

Site	Trial Pit Number
Barford Road, Bloxham	TP103

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Doosan DX55	1.95m x 0.72m x 2.90m	118.20	Gladman Developments Ltd	MB608
	Location	**Dates**	**Engineer**	**Sheet**
	See JPB Drawing No. MB608/05	29/03/2012	Johnson, Poole & Bloomer Ltd	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.23)	Grass over firm brown CLAY. Many roots and rootlets. (TOPSOIL)		
				117.97	0.23			
					(1.47)	Firm to stiff brown mottled pale grey orange CLAY. Many rootlets up to 0.35mbgl.		
				116.50	1.70			
					(0.40)	Stiff blue grey mottled brown slightly fissured CLAY. Rare rootlets.		
				116.10	2.10			
					(0.80)	Stiff blue grey mottled orange brown CLAY.		
				115.30	2.90			
						Complete at 2.90m		

Plan

Remarks

Trial pit checked for services prior to excavation by JPB Engineer.
Trial pit stable throughout soakaway test
No groundwater encountered during excavation
Hard to excavate below 2.5mbgl
Limit of excavator reached at 2.90mbgl.
Trial pit completed under supervision of JPB Engineer.
Ground levels estimated from topographical survey provided by client.

Scale (approx)	Logged By	Figure No.
1:25	JC	MB608.TP101

JOHNSON POOLE & BLOOMER AGS

Site	Trial Pit Number
Barford Road, Bloxham	TP104

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Doosan DX55	1.70m x 0.78m x 2.85m	119.40	Gladman Developments Ltd	MB608
	Location	**Dates**	**Engineer**	**Sheet**
	See JPB Drawing No. MB608/05	29/03/2012	Johnson, Poole & Bloomer Ltd	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.28)	Grass over firm brown slightly sandy CLAY. Many roots and rootlets. (TOPSOIL)		
				119.12	0.28	Firm becoming firm to stiff at 1.15mbgl brown mottled orange brown pale grey CLAY. Many rootlets up to 0.5mbgl.		
					(1.40)			
				117.72	1.68	Firm to stiff becoming stiff at 2.15mbgl pale blue grey mottled orange brown slightly fissured CLAY.		
					(1.17)			
				116.55	2.85	Complete at 2.85m		

Plan

Remarks

Trial pit checked for services prior to excavation by JPB Engineer.
Trial pit stable throughout soakaway test
No groundwater encountered during excavation
Hard to excavate below 2.65mbgl
Limit of excavator reached at 2.85mbgl.
Trial pit completed under supervision of JPB Engineer.
Ground levels estimated from topographical survey provided by client.

Scale (approx)	Logged By	Figure No.
1:25	JC	MB608.TP101

JOHNSON POOLE & BLOOMER

Site Barford Road, Bloxham			**Borehole Number** 201
Machine : Truck Mounted KLEMM **Flush :** MIST **Core Dia :** 92 **Method :**	**Casing Diameter** 144mm cased to 4.50m 92mm cased to 11.90m	**Ground Level (mOD)** 119.50	**Client** Gladman Developments Ltd	**Job Number** MB608
	Location See JPB Drawing MB608/07	**Dates** 29/05/2012	**Engineer** Johnson, Poole & Bloomer Ltd	**Sheet** 1/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(0.10)	Grass over firm dark brown CLAY. Many roots and rootlets. [TOPSOIL]			
						119.40	0.10				
							(0.20)	Firm dark brown to brown mottled yellow CLAY with many roots and rootlets. [SUB-SOIL]			
						119.20	0.30	Firm light brown mottled yellow brown and light grey CLAY. [Weathered WHITBY MUDSTONE FORMATION]			
							(2.40)				
	0	0	0								
						116.80	2.70	Firm grey mottled yellow brown and brown CLAY. [Weathered WHITBY MUDSTONE FORMATION]			
							(0.80)				
						116.00	3.50	Stiff blue grey mottled brown CLAY. [Weathered WHITBY MUDSTONE FORMATION]			
							(0.90)				

Remarks
Exploratory hole position checked for services prior to drilling by JPB Geotechnical Engineer and CAT scanned. No services identified.
Open hole drilling from ground level to 4.50m bgl using air flush.
Rotary cored drilling from 4.50m bgl to 11.90m bgl using mist flush.
Exploratory hole logged from cuttings between ground level and 4.50m bgl.
Groundwater encountered at approximately 7.50m bgl, rose to 6.61m bgl after 20 minutes.
Upon completion exploratory hole installed with groundwater monitoring pipework as follows: Ground level to 6.90m plain pipe with bentonite surround; 6.90m to 11.90m slotted pipe with geo-filter and gravel surround.

Scale (approx)	Logged By
1:20	JC

Figure No. MB608.201

JOHNSON POOLE & BLOOMER

Site Barford Road, Bloxham			**Borehole Number** 201
Machine : Truck Mounted KLEMM **Flush :** MIST **Core Dia :** 92 **Method :**	**Casing Diameter** 144mm cased to 4.50m 92mm cased to 11.90m **Location** See JPB Drawing MB608/07	**Ground Level (mOD)** 119.50 **Dates** 29/05/2012	**Client** Gladman Developments Ltd **Engineer** Johnson, Poole & Bloomer Ltd	**Job Number** MB608 **Sheet** 2/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(0.90)				
						115.10	4.40				
							(0.10)	Stiff to very stiff blue grey mottled light brown CLAY. [Weathered WHITBY MUDSTONE FORMATION]			
4.50						115.00	4.50				
							(0.51)	Stiff grey mottled light brown slightly gravelly CLAY. Gravel of subangular fine and medium dark grey mudstone lithorelicts. Thin 15mm band of red brown mudstone dipping 20 degrees from horizontal at 4.80m bgl. [Weathered WHITBY MUDSTONE FORMATION]			
						114.49	5.01				
						114.47	(0.02)	Very weak to weak brown mottled grey MUDSTONE. [Weathered WHITBY MUDSTONE FORMATION]			
	100	80	90				5.03				
							(1.31)	Stiff blue grey mottled brown CLAY. Occasional gravel of subangular medium blue grey mudstone lithorelicts. Occasional thin 20mm sub-horizontal band of grey brown mudstone. [Weathered WHITBY MUDSTONE FORMATION]			
6.00											
						113.16	6.34				
							(0.13)	Medium strong grey fine and medium grained calcareous SANDSTONE. [Probably MARLSTONE ROCK FORMATION]			
						113.03	6.47				
							(0.47)	Stiff blue grey mottled brown CLAY. Occasional thin limestone band up to 20mm thick. [Probably MARLSTONE ROCK FORMATION]		▼1	
	100	70	75								
						112.56	6.94				
							(0.12)	Medium strong light grey fine grained LIMESTONE. [MARLSTONE ROCK FORMATION]			
						112.44	7.06				
								Medium strong dark grey fine and medium grained nodular slightly ferruginous LIMESTONE. [MARLSTONE ROCK FORMATION]			
7.50					Fast(1) at 7.50m, rose to 6.61m in 20 mins.					▽1	
							(1.24)				

Remarks

Scale (approx)	Logged By
1:20	JC

Figure No. MB608.201

JOHNSON POOLE & BLOOMER

Site Barford Road, Bloxham			**Borehole Number** 201
Machine : Truck Mounted KLEMM **Flush :** MIST **Core Dia :** 92 **Method :**	**Casing Diameter** 144mm cased to 4.50m 92mm cased to 11.90m	**Ground Level (mOD)** 119.50	**Client** Gladman Developments Ltd	**Job Number** MB608
	Location See JPB Drawing MB608/07	**Dates** 29/05/2012	**Engineer** Johnson, Poole & Bloomer Ltd	**Sheet** 3/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	100	80	90				(1.24)				
						111.20	8.30				
							(0.10)	Weak brown mottled red brown IRONSTONE. [MARLSTONE ROCK FORMATION]			
						111.10	8.40				
							(0.20)	Medium strong dark grey fine and medium grained nodular slightly ferruginous LIMESTONE. [MARLSTONE ROCK FORMATION]			
						110.90	8.60				
							(0.15)	Medium strong light grey mottled dark grey modular fine grained LIMESTONE. [MARLSTONE ROCK FORMATION]			
						110.75	8.75				
9.00								Medium strong dark grey mottled white and red brown medium grained slightly ferruginous LIMESTONE. Joints medium spaced 30 degrees to horizontal smooth planar with no infill. [MARLSTONE ROCK FORMATION]			
							(0.95)				
	90	80	80			109.80	9.70	Medium strong dark grey fine medium grained LIMESTONE. [MARLSTONE ROCK FORMATION]			
							(0.70)				
10.40						109.10	10.40	Weak to medium strong dark grey mottled white and red brown fine and medium grained ferruginous LIMESTONE. [MARLSTONE ROCK FORMATION]			
	100	100	100				(1.50)				
11.90						107.60	11.90				

Remarks

Scale (approx)	Logged By
1:20	JC

Figure No. MB608.201

JOHNSON POOLE & BLOOMER

Site Barford Road, Bloxham			**Borehole Number** 202
Machine : Truck Mounted KLEMM **Flush :** MIST **Core Dia :** 92 **Method :**	**Casing Diameter** 144mm cased to 3.00m 92mm cased to 10.50m	**Ground Level (mOD)** 120.00	**Client** Gladman Developments Ltd	**Job Number** MB608
	Location See JPB DRawing MB608/07	**Dates** 29/05/2012	**Engineer** Johnson, Poole & Bloomer Ltd	**Sheet** 1/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						119.90	(0.10) 0.10	Grass over firm dark brown CLAY. Many roots and rootlets. [TOPSOIL]			
							(0.20)	Firm dark brown to brown mottled yellow CLAY with many roots and rootlets. [SUB-SOIL]			
						119.70	0.30	Firm light brown mottled yellow brown and light grey CLAY. [Weathered WHITBY MUDSTONE FORMATION]			
							(1.10)				
						118.60	1.40	Firm brown mottled grey CLAY. [Weathered WHITBY MUDSTONE FORMATION]			
							(1.60)				
						117.00	3.00	Stiff blue grey mottled brown CLAY. [Weathered WHITBY MUDSTONE FORMATION]			

Remarks

Exploratory hole position checked for services prior to drilling by JPB Geotechnical Engineer and CAT scanned. No services identified.
Open hole drilling from ground level to 9.00m bgl using air flush.
Rotary cored drilling from 9.00m bgl to 10.50m bgl using mist flush.
Exploratory hole logged from cuttings between ground level and 9.00m bgl.
Groundwater encountered at approximately 10.4m bgl, rose to 10.30m bgl after 20 minutes.
Upon completion exploratory hole installed with groundwater monitoring pipework as follows: Ground level to 9.50m plain pipe with bentonite surround; 9.50m to 10.50m slotted pipe with geo-filter and gravel surround.

Scale (approx)	Logged By
1:20	JC

Figure No. MB608.202

JOHNSON POOLE & BLOOMER

Site Barford Road, Bloxham			**Borehole Number** 202
Machine : Truck Mounted KLEMM **Flush :** MIST **Core Dia :** 92 **Method :**	**Casing Diameter** 144mm cased to 3.00m 92mm cased to 10.50m	**Ground Level (mOD)** 120.00	**Client** Gladman Developments Ltd	**Job Number** MB608
	Location See JPB DRawing MB608/07	**Dates** 29/05/2012	**Engineer** Johnson, Poole & Bloomer Ltd	**Sheet**

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(5.90)				

Remarks

Scale (approx)	Logged By
1:20	JC

Figure No. MB608.202

JOHNSON POOLE & BLOOMER

Site Barford Road, Bloxham			**Borehole Number** 202
Machine : Truck Mounted KLEMM **Flush :** MIST **Core Dia :** 92 **Method :**	**Casing Diameter** 144mm cased to 3.00m 92mm cased to 10.50m	**Ground Level (mOD)** 120.00	**Client** Gladman Developments Ltd	**Job Number** MB608
	Location See JPB DRawing MB608/07	**Dates** 29/05/2012	**Engineer** Johnson, Poole & Bloomer Ltd	**Sheet** 3/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(5.90)				
						111.10	8.90				
							(0.10)	Dark grey medium grained LIMESTONE. [Weathered WHITBY MUDSTONE FORMATION]			
9.00						111.00	9.00				
							(0.25)	Stiff blue grey CLAY with occasional gravel of subangular fine and medium grey mudstone lithorelicts. (Weathered WHITBY MUDSTONE FORMATION]			
						110.75	9.25				
							(0.10)				
						110.65	9.35	Stiff brown mottled red brown CLAY. [Probably weathered MARLSTONE ROCK FORMATION]			
							(0.30)	Weak brown mottled red brown ferruginous medium grained LIMESTONE. [MARLSTONE ROCK FORMATION]			
						110.35	9.65				
	100	100	75				(0.15)	Medium strong dark grey fine and medium grained SANDSTONE. [MARLSTONE ROCK FORMATION]			
						110.20	9.80				
							(0.25)	Medium strong dark grey and white fine grained nodular ferruginous LIMESTONE. [MARLSTONE ROCK FORMATION]			
						109.95	10.05				
						109.90	(0.05)				
						109.88	10.10	Medium strong dark grey fine grained SANDSTONE. [MARLSTONE ROCK FORMATION]			
							(0.02)				
							10.12				
							(0.23)	Weak red brown IRONSTONE.		1	
						109.65	10.35			1	
					Fast(1) at 10.40m, rose to 10.30m in 20 mins.	109.60	(0.05)	Strong dark grey mottled white fine grained LIMESTONE. [MARLSTONE ROCK FORMATION]			
10.50							10.40	Strong dark grey and brown mottled red brown fine grained ferruginous LIMESTONE. [MARLSTONE ROCK FORMATION]			
								Complete at 10.50m			

Remarks

Scale (approx)	Logged By
1:20	JC

Figure No. MB608.202

APPENDIX B

Soakaway Test Calculations

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365:1991

Client: Gladman Developments Limited
Site: Land off Barford Road, Bloxham
JPB Project Ref: MB608

Test Location: TP101
Test Date: 29/03/2012
Calculation Date: 30/03/2012

TO BE READ IN CONJUNCTION WITH MB608-58/FT/HB/JC

Size of Soakaway:

Length (m)	1.45
Width (m)	0.70
Depth (m)	2.20
Test depth above base (m)	1.09
Effective volume (m^3)	1.106

Test Depths of Soakaway:

Depth above base at start (m)	1.11
Depth above base at end (m)	1.085

Calculation of Soil Infiltration Rate

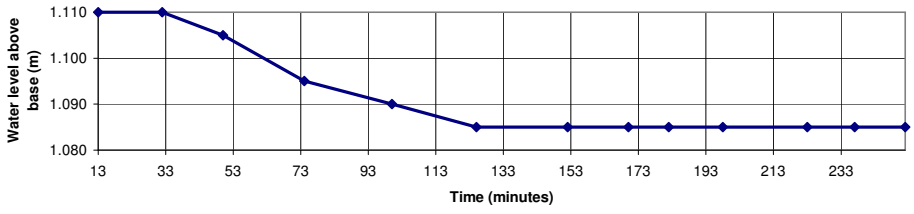
Time (minutes)	Depth of water below surface (m)	Water level above base (m)
13	1.09	1.110
32	1.09	1.110
50	1.095	1.105
74	1.105	1.095
100	1.11	1.090
125	1.115	1.085
152	1.115	1.085
170	1.115	1.085
182	1.115	1.085
198	1.115	1.085
223	1.115	1.085
237	1.115	1.085
252	1.115	1.085

%	Time * (minutes)	Water level above base (m)
75%	-	0.833
50%	-	0.555
25%	-	0.278

* Time estimated from graph

Volume outflow 75%-25% (m^3)	0.563	(V_{p75-25})
Area of pit (50% effective depth) m^2	3.36	(α_{p50})
Time outflow 25%-75% (minutes)	*	(t_{p75-25})

* Test abandoned after approximately 4 hours.
Strata considered to have a very low permeability.



$$f = \frac{V_{p75-25}}{\alpha_{p50} \times t_{p75-25}}$$

Soil Infiltration (f) = **#VALUE!** **m/s**

Completed by:	*H Bayliss*

Checked by:	*J Charlesworth*

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365:1991

Client: Gladman Developments Limited
Site: Land off Barford Road, Bloxham
JPB Project Ref: MB608

Test Location: TP102
Test Date: 29/03/2012
Calculation Date: 30/03/2012

TO BE READ IN CONJUNCTION WITH MB608-58/FT/HB/JC

Size of Soakaway:

Length (m)	1.43
Width (m)	0.70
Depth (m)	2.77
Test depth above base (m)	1.28
Effective volume (m^3)	1.281

Test Depths of Soakaway:

Depth above base at start (m)	1.49
Depth above base at end (m)	1.46

Calculation of Soil Infiltration Rate

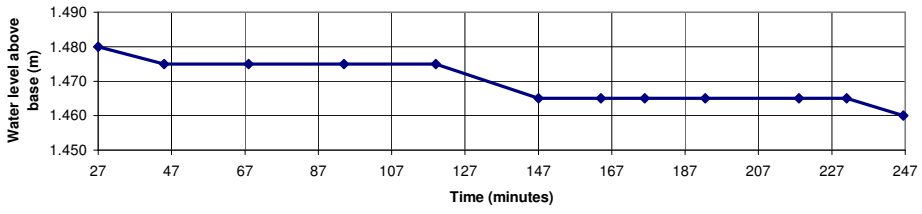
Time (minutes)	Depth of water below surface (m)	Water level above base (m)
27	1.29	1.480
45	1.295	1.475
68	1.295	1.475
94	1.295	1.475
119	1.295	1.475
147	1.305	1.465
164	1.305	1.465
176	1.305	1.465
192.5	1.305	1.465
218	1.305	1.465
231	1.305	1.465
246.5	1.31	1.460

%	Time * (minutes)	Water level above base (m)
75%	-	1.118
50%	-	0.745
25%	-	0.373

* Time estimated from graph

Volume outflow 75%-25% (m^3)	0.746	(V_{p75-25})
Area of pit (50% effective depth) m^2	3.73	(α_{p50})
Time outflow 25%-75% (minutes)	*	(t_{p75-25})

* Test abandoned after approximately 4 hours.
Strata considered to have a very low permeability.



$$f = \frac{V_{p75-25}}{\alpha_{p50} \times t_{p75-25}}$$

Soil Infiltration (f) = **#VALUE! m/s**

Completed by:	*H Bayliss*

Checked by:	*J Charlesworth*

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365:1991

Client: Gladman Developments Limited
Site: Land off Barford Road, Bloxham
JPB Project Ref: MB608

Test Location: TP103
Test Date: 29/03/2012
Calculation Date: 30/03/2012

TO BE READ IN CONJUNCTION WITH MB608-58/FT/HB/JC

Size of Soakaway:

Length (m)	1.95
Width (m)	0.72
Depth (m)	2.90
Test depth above base (m)	1.55
Effective volume (m^3)	2.176

Test Depths of Soakaway:

Depth above base at start (m)	1.350
Depth above base at end (m)	1.335

Calculation of Soil Infiltration Rate

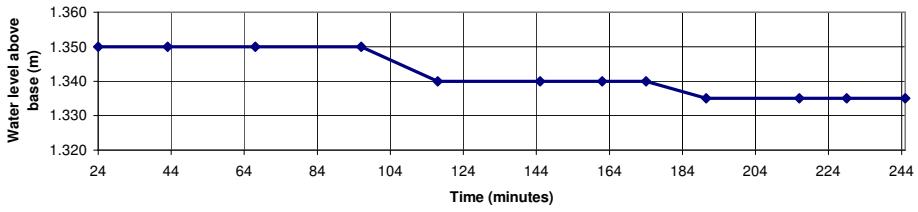
Time (minutes)	Depth of water below surface (m)	Water level above base (m)
24	1.55	1.350
43	1.55	1.350
67	1.55	1.350
96	1.55	1.350
117	1.56	1.340
145	1.56	1.340
162	1.56	1.340
174	1.56	1.340
190.5	1.565	1.335
216	1.565	1.335
229	1.565	1.335
245	1.565	1.335

%	Time * (minutes)	Water level above base (m)
75%	-	1.013
50%	-	0.675
25%	-	0.338

* Time estimated from graph

Volume outflow 75%-25% (m^3)	0.948	(V_{p75-25})
Area of pit (50% effective depth) m^2	5.54	(α_{p50})
Time outflow 25%-75% (minutes)	*	(t_{p75-25})

* Test abandoned after approximately 4 hours.
Strata considered to have a very low permeability.



$$f = \frac{V_{p75-25}}{\alpha_{p50} \times t_{p75-25}}$$

Soil Infiltration (f) = **#VALUE! m/s**

Completed by:	*H Bayliss*

Checked by:	*J Charlesworth*

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365:1991

Client: Gladman Developments Limited
Site: Land off Barford Road, Bloxham
JPB Project Ref: MB608

Test Location: TP104
Test Date: 29/03/2012
Calculation Date: 30/03/2012

TO BE READ IN CONJUNCTION WITH MB608-58/FT/HB/JC

Size of Soakaway:

Length (m)	1.70
Width (m)	0.78
Depth (m)	2.85
Test depth above base (m)	1.57
Effective volume (m^3)	2.082

Test Depths of Soakaway:

Depth above base at start (m)	1.28
Depth above base at end (m)	1.28

Calculation of Soil Infiltration Rate

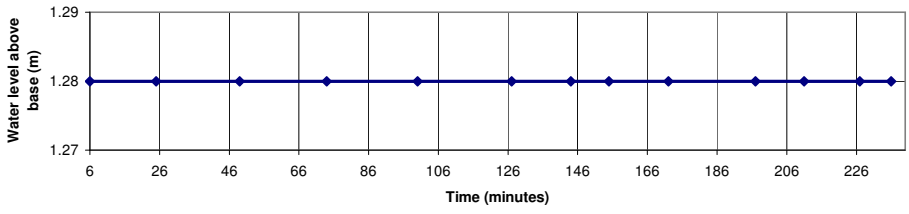
Time (minutes)	Depth of water below surface (m)	Water level above base (m)
6	1.57	1.28
25	1.57	1.28
49	1.57	1.28
74	1.57	1.28
100	1.57	1.28
127	1.57	1.28
144	1.57	1.28
155	1.57	1.28
172	1.57	1.28
197	1.57	1.28
211	1.57	1.28
227	1.57	1.28
236	1.57	1.28

%	Time * (minutes)	Water level above base (m)
75%	-	0.960
50%	-	0.640
25%	-	0.320

* Time estimated from graph

Volume outflow 75%-25% (m^3)	0.849	(V_{p75-25})
Area of pit (50% effective depth) m^2	5.22	(α_{p50})
Time outflow 25%-75% (minutes)	*	(t_{p75-25})

* Test abandoned after approximately 4 hours.
Strata considered to have a very low permeability.



$$f = \frac{V_{p75-25}}{\alpha_{p50} \times t_{p75-25}}$$

Soil Infiltration (f) = **#VALUE! m/s**

Completed by:	*H Bayliss*
Checked by:	*J Charlesworth*