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PROPOSED RESIDENTIAL DEVELOPMENT, LAND OFF HARBURY STREET, BURTON-UPON-TRENT, STAFFORDSHIRE

FLOOD RISK ASSESSMENT

MAY 2016

REPORT REF: 21420/05-16/4225 Rev A

Consulting Development Engineers

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REGISTRATION OF AMENDMENTS

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EXECUTIVE SUMMARY

Flood Risk

1. This Flood Risk Assessment has been carried out in accordance with the requirements of the National Planning Policy Framework (Ref. 4) and the Planning Practice Guidance (Ref. 18).

2. The Environment Agency flood zone maps show that the site lies within Flood Zone 1 and is not at risk of fluvial flooding in storm events up to 1 in 1000 years.

3. The vulnerability of the development to flooding from all other sources, such as pluvial, sewerage, groundwater and artificial water bodies, has been assessed. It is considered all these sources pose a low risk to the development subject to the recommended mitigation measures being implemented.

Drainage Strategy

4. Infiltration drainage has not been considered as a primary means of surface water disposal due to the local underlying geology and the results of soakage testing.

5. The strategy proposes that surface water from the development will be collected via a network of surface water sewers before outfalling into the existing public surface water sewers to the south of the site on Harbury Street.

6. A combination of permeable paving areas and geo-cellular storage units will accommodate storage up to a 1 in 100yr +40% climate change storm event. The proposed surface water strategy will not increase flood risk at the site or elsewhere.

7. The strategy proposes that foul water from the development will be collected via a network of sewers and discharge into the existing public foul water sewers to the south of the site on Harbury Street.

1.0 INTRODUCTION

1.1 Mewies Engineering Consultants Ltd (M-EC) has been commissioned by Andrew Granger to undertake a Flood Risk Assessment (FRA) for a proposed residential development at Harbury Street, Burton-upon-Trent, Staffordshire. A site location plan is included in Appendix A and a site layout is included in Appendix B.

1.2 This Flood Risk Assessment has been carried out in accordance with the requirements of the National Planning Policy Framework (Ref. 4) and the Planning Practice Guidance (Ref. 18).

1.3 Reference has been made to the basic flood maps contained within the Environment Agency websites and the Environment Agency Standing Advice for Local Planning Authorities (Development and Flood Risk – England) (Ref. 5).

1.4 The assessment has been prepared using our best engineering judgement but there are levels of uncertainty implicit in the historical data and methods of analysis. The report is based on the following information:

- British Geological Survey Mapping
- Flood Zone Maps from the Environment Agency website
- Site Walkover survey
- Topographical Survey undertaken by Midlands Surveys Ltd
- Soakage Testing undertaken by M-EC

1.5 All comments and opinions contained in this report, including any conclusions are based on the information available to M-EC at the time of writing the report. The conclusions drawn by M-EC could therefore differ if the information is found to be inaccurate, incomplete or misleading. M-EC accepts no liability should this prove to be the case, or, if additional information exists or becomes available with respect to this site.

1.6 M-EC has completed this report for the benefit of the organisations/individuals referred to in paragraph 1.1; and any relevant Statutory Authority which may require reference in relation to approvals for the proposed redevelopment of the site. Other third parties should not use or rely upon the contents of the report unless written approval has been gained from M-EC.

1.7 M-EC accepts no responsibility or liability for:

a. the consequences of this documentation being used for any purpose or project other than that for which it was commissioned, and
b. this document to any third party with whom approval for use has not been agreed.

2.0 SITE DESCRIPTION

Site Location and Surroundings

2.1 The site is located in the centre of the Horninglow district of Burton-upon-Trent. The National Grid Reference (NGR) for the approximate centre of the site is 423514, 324855 and covers an area of approximately 0.37ha.

Site Description

2.2 The site is situated at the centre of a square of terraced houses, located between the branches of Harbury Street to the south, Fostern Avenue to the north, Norton Road to the west, and Swannington Street. The site is currently a series of garages and access roads with the gardens and allotments of the surrounding houses backing onto the site area. The ground is comprised of many trees and rough ground that have since been felled and the ground dug up.

2.3 The site lies within the administrative areas of the East Staffordshire Borough Council and Staffordshire County Council.

Topography

2.4 The site area is a rough bowl generally falling from west to south-east with the highest topographical point lying along the boundary and north-east corner. The southwest corner and entrance roadway are the lowest areas and form a natural drainage route. The topographical survey records a level difference of approximately 2.77 metres between the highest point on the north-west corner (55.65mAOD) and the lowest point in the south-west part of the site (52.58mAOD).

2.5 A copy of the topographical survey can be found in Appendix C.

Geology

2.6 The British Geological Survey (BGS) viewer shows the site is underlain by 'Mercia Mudstone Group - Mudstone', sedimentary bedrock approximately Triassic era (200 - 251 million years old) indicative of general hot desert environments. No superficial deposits are present within the sites boundaries but the area is in close proximity to "Etwall Sand and Gravel Member – Sand and Gravel".

Hydrology and Hydrogeology

2.7 According to a number of historic maps of the area (see Figure 1) the site may have once lain in proximity to the watercourse running east across the land from an Old Clay pit on the nearby hills towards the Trent and Mersey Canal. As Burton-upon-Trent expanded this watercourse was likely either culverted or the buried and removed. Site walkovers and ground investigations have not located any trace of this former watercourse and it is presumed to have been removed.

Figure 1: Historic Map of the site dated 1923

Existing Drainage

2.8 Severn Trent Water (STW) is responsible for the operation and maintenance of the public sewers within the Staffordshire area.

2.9 Severn Trent Water records show that the closest public sewer networks to the site is a set of 225mm (expanding to 300mm) surface sewer and foul sewers running to the south east along the length of Harbury Street.

2.10 A copy of the sewer record plans received from STW is included in Appendix D.

Artificial Water Bodies

2.11 There are no artificial waterbodies in sufficient proximity to affect the site. The Trent and Mersey Canal lies approximately 500 metres of the east.

3.0 POLICIES

National Planning Policy Framework

3.1 The National Planning Policy Framework (Ref. 4) sets out the Government's objectives for the planning system and how there should be a 'Presumption in Favour of Sustainable Development' and the planning system should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change.

3.2 The document seeks to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Reference should also be made to the National Planning Practice Guidance (Ref. 17) which provides additional guidance on flood risk.

3.3 For the purposes of applying the National Planning Policy Framework, areas at risk from all sources of flooding are included. For fluvial (river) and sea flooding, this is principally land within Flood Zones 2 and 3. It can also include an area within Flood Zone 1 which the Environment Agency has notified the local planning authority as having critical drainage problems.

3.4 Key elements from the document include: -

"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk..."

"Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding."

"When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding, where informed by a site-specific flood risk assessment."

Flood and Water Management Act 2010

3.5 The Flood and Water Management Act 2010 (Ref. 14) gained Royal Assent on the 8th April 2010. The Flood and Water Management Act is the government's newest legislation to help improve flood risk management and ensure the security of water supplies in England and Wales. The Act updates legislation to ensure better protection from flooding, manage water more sustainably, improve public services and secure water resources during periods of drought. The Flood and Water Management Act helps to reduce flood risk by:

- Clarifying who is responsible for managing all sources of flood risk.
- Encourage more sustainable forms of drainage in new developments.
- Makes it easier to resolve misconnections to sewers.

3.6 The Flood and Water Management Act imparts significant new roles and responsibilities on local authorities. County or unitary authorities are now classed as lead local flood authorities (LLFAs) who have responsibilities for managing local flood risk. The responsibilities of a LLFA include:

- Prepare and maintain a strategy for local flood risk management in their areas, co-ordinating views and activity with other local bodies and communities through public consultation and scrutiny, and delivery planning.
- Maintain a register of assets – these are physical features that have a significant effect on flooding in their area.
- Investigate significant local flooding incidents and publish the results of such investigations.
- Issue consents for altering, removing or replacing certain structures or features on ordinary watercourses.
- Play a lead role in emergency planning and recovery after a flood event.

Planning Practice Guidance on Flood Risk & Coastal Change - 2015

3.7 The Government's new planning policy on sustainable drainage systems came into effect on 6 April 2015. It expects local planning policies and decisions on planning applications relating to major development (those of 10 dwellings or more; or equivalent non-residential or mixed development) to ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate. Lead Local Flood Authorities (LLFAs) have also been made statutory consultees and new non-statutory guidance has been published under the changes.

3.8 The changes follow a joint Defra/DCLG consultation on delivering SuDS published in September 2014 in which the Government dropped all the key provisions of Schedule 3 of the Flood & Water Management Act 2010 and SuDS Approval Bodies (SABs) in favour of passing oversight of SuDS from county councils (who are also LLFAs) to local planning authorities. According to the new planning policy, local planning authorities are expected, when considering planning applications:

- To consult the relevant lead local flood authority on the management of surface water,
- To satisfy themselves that the proposed minimum standards of operation are appropriate, and
- To ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

3.9 The policy also states that the sustainable drainage system should be designed to ensure that the maintenance and operation requirements are economically proportionate.

Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems – 2015

3.10 The non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems to drain surface water have been published by Defra. The standards apply to systems that drain surface water from housing, non-residential or mixed use developments for the lifetime of the developments. The non-statutory technical standards are to be used in conjunction with the National Planning Policy Framework, and Planning Practice Guidance on Flood Risk & Coastal Change - 2015.

East Staffordshire Borough Council SFRA Update (2013)

3.11 A Level 1 Strategic Flood Risk Assessment (SFRA) was carried out in 2008 by Royal Haskoning for East Staffordshire Borough Councils. This was the followed by a more detailed Level 2 Assessment in August 2008.

3.12 The objective of the assessments was to inform the plan-making process for each of the council's Local Plan. WSP UK Ltd were commissioned in 2013 to update the Level 1 and 2 SFRA documents and take into account the latest guidance and policies as well as recent flooding in 2012.

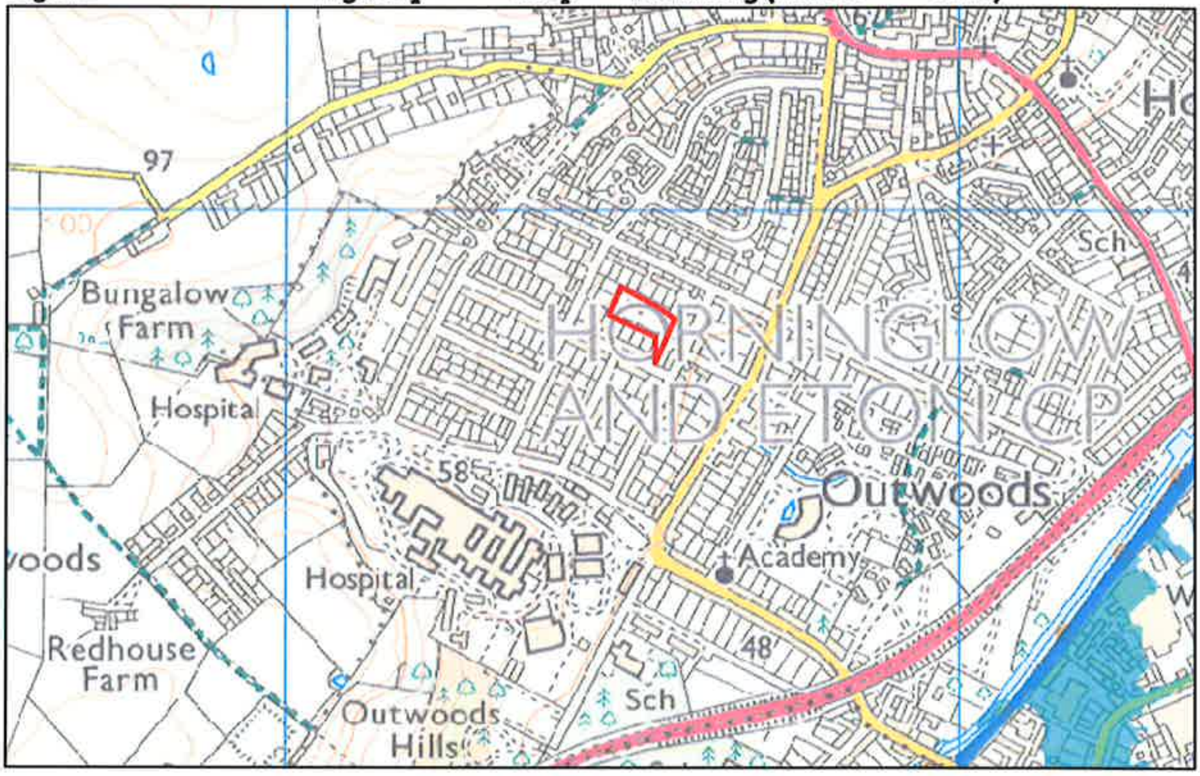
3.13 The Assessment has been prepared in accordance with best practice, Planning Policy statement 25 Development and Flood Risk (PPS25). The SFRA will assist the local authorities to make spatial planning decisions required to inform their local development frameworks (LDF).

4.0 FLOOD RISK TO THE SITE

Fluvial Sources

4.1 The site has been checked in accordance with the Environment Agency flood zone maps which give guidance for fluvial and tidal flood risk. The results are shown in Figure 2 below.

Figure 2: Environment Agency Flood Map for Planning (Rivers and Seas)



Key

- Site Location
- Flood Zone 3, High Risk, flooding from rivers or sea without defences
- Flood Zone 2, Moderate Risk, extent of extreme flood
- Flood Zone 1, Low Risk, flooding can be effectively discounted
- Flood defences
- Areas benefiting from flood defences
- Main River

Not To Scale

Source: http://maps.environment-agency.gov.uk

Note: Environment Agency flood maps give guidance on fluvial flood risk only for watercourses with a catchment of greater than 3km². Other information sources should be checked for flood risk on ordinary watercourses with catchments less than 3km².

4.2 The Environment Agency flood maps show that the site is located within Flood Zone 1 with an annual probability of fluvial flooding of less than 1 in 1000 (0.1%),

4.3 The proposed development is residential. Using Table 2 Flood Risk Vulnerability Classification from the Planning Practice Guidance (Ref. 18) the development is classified as 'more vulnerable'.

4.4 In accordance with Table 3 of the Planning Practice Guidance (Ref. 18) the development is sequentially acceptable and therefore an exception test is not required (a copy of table 3 is shown below).

Table 1: Copy of Table 3 (Flood Risk Vulnerability and Flood Zone 'compatibility') from the National Planning Practice Guidance (Ref. 17)

Flood Risk Vulnerability classification (see Table 2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	√	√	√	√	√
	Zone 2	√	√	Exception Test Required	√	√
	Zone 3a	Exception Test required	√	x	Exception Test Required	√
	Zone 3b 'Functional Floodplain'	Exception Test Required	√	x	x	x

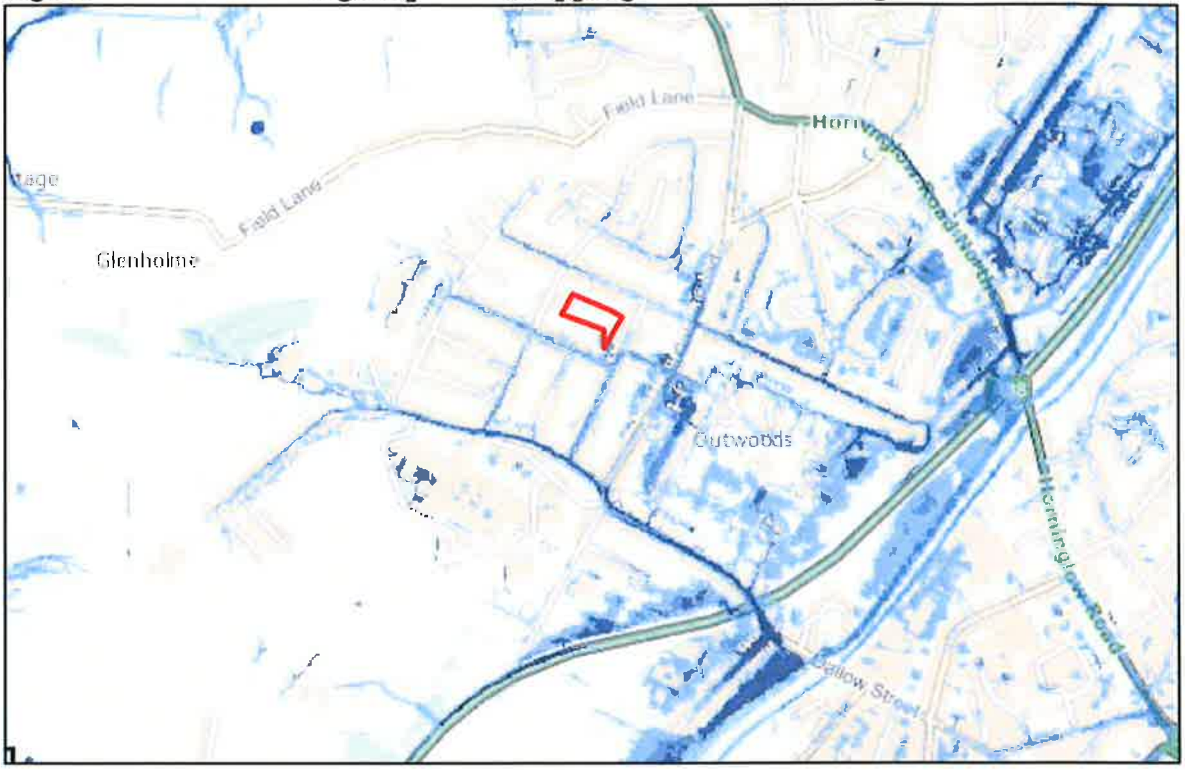
Key:
√ Development is appropriate
X Development should not be permitted

Pluvial Flooding

4.5 Pluvial flooding occurs when natural and engineered systems have insufficient capacity to deal with the volume of rainfall. Pluvial flooding can sometimes occur in urban areas during an extreme, high intensity, low duration summer rainfall event which overwhelms the local surface water drainage systems, or in rural areas during medium intensity, long duration events where saturated ground conditions prevent infiltration into the subsoil. This flood water would then be conveyed via overland flow routes dictated by the local topography.

4.6 The Environment Agency Risk of Flooding from Surface Water mapping for the site area is shown in Figure 3 below.

Figure 3: Environment Agency Flood Mapping – Risk of Flooding from Surface Water



Not To Scale	**Key** Site Location High Risk, 1 in 30 (3.3%) Medium Risk, 1 in 100 (1%) and 1 in 30 (3.3%) Low Risk, 1 in 1000 (0.1%) and 1 in 100 (1%) Source: http://maps.environment-agency.gov.uk

4.7 There are only a few low risk areas identified within the sites boundary being confined entirely to the sites entrance roadway. Local topography dictates that any overland flow would be directed across the site east to west and there are limited flow control features on site. A long section of Medium to High Risk areas lie along Harbury Street running off from the hills to the west.

4.8 The majority of these surface water accumulations are thought to be based on heavy rainfall events of between 1 in 100 (1%) and 1 in 1000 (0.1%) severity and as such pose a low flood risk to the site.

4.9 Mitigation measures for potential pluvial flooding are outlined in section 8.0 of this report.

Sewer Sources

4.10 Information on flooding sewers has been provided by Severn Trent Water (see Appendix D). These records show that no surface or foul sewers exist within the sites boundary. The closest 150mm combined sewers are running west along Manor Close approximately 10 metres west of the sites west boundary.

Tidal/Coastal

4.11 The site is not coastal and is not affected by coastal or tidal flooding.

Groundwater Sources

4.12 Groundwater flooding occurs as a result of water rising up from the underlying aquifer or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is more likely to be at shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels.

4.13 The British Geological Survey (BGS) viewer shows the site is underlain by 'Mercia Mudstone Group – Mudstone'. No superficial deposits are present within the sites boundaries but the area is in close proximity to "Etwall Sand and Gravel Member – Sand and Gravel".

4.14 Environment Agency Groundwater Vulnerability mapping shows the sites underlying bedrock is defined as Secondary B aquifer. The site does not lie within any Groundwater Protection Zones as defined by the Environment Agency.

4.15 Potential flood mitigation measures are considered in Section 8.0 of this report.

Artificial Water Bodies

4.16 There are no artificial water bodies in close proximity to the site.

Historic Flooding

4.17 Information provided by Staffordshire Highways shows that no historic records of flooding are available for the site.

4.18 Current EA mapping (see Figure 3) shows that the entrance roadway maybe affected by surface water runoff, however these areas are limited and could arguably be landscaped out within any future proposal.

4.19 Potential flood mitigation measures are considered in Section 8.0 of this report.

5.0 FLOOD RISK FROM THE DEVELOPMENT

5.1 The requirements of a Site Specific Flood Risk Assessment, as outlined in the Planning Practice Guidance (Ref. 17), should assess the following off-site impacts.

- How will it be ensured that the proposed development and the measures to protect the site from flooding will not increase flood risk elsewhere?
- How will run-off from the completed development be prevented from causing an impact elsewhere?
- Are there any opportunities offered by the development to reduce flood risk elsewhere?

5.2 The primary flood risk generated by the new development is most likely to be the risk posed to others by surface water runoff.

Existing Discharges

5.3 The existing 0.37ha site is currently comprised of an open greenfield areas with a large section of existing section of hardstanding entrance roadway with wooden buildings/sheds in its centre.

5.4 The methods described in the Institute of Hydrology Report 124 – Flood estimation for small catchments (Ref. 10) were used to determine existing greenfield run-off flows for various storm return periods. Greenfield run off rate calculations using Microdrainage ICP SUDS for sites less than 50ha are shown as follows, and are included in Appendix F.

Table 2: Runoff Rates

	Greenfield Run off (l/s)	Greenfield Run off (l/s/ha)
Qbar	1.4	3.78
Q1year	1.1	2.97
Q30year	2.7	7.30
Q100year	3.5	9.46
Q100year + 30%	4.55	12.30

Climate Change

5.5 Environment Agency 'Flood Risk Assessments – Climate Change Allowances' (Ref. 6) provides support to the National Planning Policy Framework (Ref. 4) on the impacts of climate change on flooding from the land, rivers and sea as part of a flood risk assessment. The recommended sensitivity ranges in Tables 1 to 4 provide an appropriate precautionary approach to the uncertainty about climate change impacts on rainfall intensities, river flow, wave height and wind speed.

5.6 Table 3 shows anticipated changes in extreme rainfall intensity in small and urban catchments. For flood risk assessments and strategic flood risk assessments, both the central and upper end allowances should be assessed to understand the range of impact.

Table 3 – Copy of Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline) from Environment Agency 'Flood Risk Assessments – Climate Change Allowances' (Ref. 6)

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

5.7 When considering the assumed 100 year lifetime of residential type developments, up to a 40% climate change allowance is appropriate for peak rainfall intensities up to 2115.

Proposed Discharges

5.8 The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development.

5.8 The surface water discharge rate will be limited to the Qbar Greenfield run-off rate calculated as 3.78 l/s/ha. For the currently proposed impermeable area (calculated as 0.25ha) this equates to 0.945 l/s. This figure however falls below the practical minimum discharge rate of 5.0 l/s in order to minimise the risk of flow control blockages.

5.9 The practical minimum discharge rate of 5 l/s will be applied for all rainfall events up to the 1 in 100 year (+40% climate change) critical rain storm and not increase the risk of flooding off-site.

6.0 CONSIDERATION OF SUSTAINABLE DRAINAGE SYSTEMS

6.1 Surface water arising from a developed site should, as far as practical, be managed in a sustainable manner to mimic the surface water flows arising from the undeveloped site.

6.2 Part H of the Building Regulations 2002 recommends that surface water run-off shall discharge to one of the following, listed in order of priority:

a) an adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable,
b) a watercourse, or, where that is not reasonably practicable,
c) a sewer.

6.3 Disposal of surface water run-off by the preferred method of infiltration is subject to verification of suitable ground soakage capacity and no contaminated ground issues. If the site is not suitable for infiltration drainage, evidence must be provided to the drainage authorities in the form of soakage test results or a statement from a suitable site investigation. If this is the case and no watercourses are within a reasonable distance from the site, the drainage authorities would consider a connection to the public sewer system.

6.4 The British Geological Survey (BGS) viewer shows the site is underlain by 'Mercia Mudstone Group - Mudstone'. No superficial deposits are present within the sites boundaries but the area is in close proximity to "Etwall Sand and Gravel Member – Sand and Gravel".

6.5 It is usual for soakage testing to be undertaken in accordance with BRE Digest 365 (Ref. 12) and Figure 6 of BS8004:1986 (Ref. 11), to ascertain if soakaway's can be used as a viable method of draining the surface water from the site.

6.6 Soakage Testing undertaken by M-EC Consulting in March 2016 have identified that the sites geology is not suitable for the use of soakaway drainage due to high levels of clay and mudstone present (see Appendix H). Infiltration drainage has therefore not been considered at this stage as a primary means of surface water disposal.

6.7 In the absence of local watercourses, the strategy proposes to connect to the existing public surface water sewerage systems beneath Harbury Street.

6.8 The National Standards Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems – March 2015 (Ref. 17) that deals with SuDS which covers the whole range of sustainable approaches to surface water drainage management including:

- Source control measures including rainwater recycling and drainage;
- Infiltration devices to allow water to soak into ground, that can include individual soakaways and communal facilities;
- Filter strips and swales, which are vegetated features that hold and drain water downhill mimicking natural drainage patterns;
- Filter drains and porous pavements to allow rainwater and run-off to infiltrate into permeable material below ground and provide storage if needed; and
- Basins and ponds to hold excess water after rain and allow controlled discharge that avoids flooding.

6.8 Each of the SuDS considerations listed above are discussed below with reference to their suitability for the proposed development.

Table 4: Suitability of SuDS techniques

	COMPONENT	SUITABILITY	REASON
Source Control	Rainwater Harvesting	Yes	Due to limited infiltration on site, use may be considered but would only mitigate a small proportion of the increase in volume of runoff created by the proposed development. Rainwater butts can be used to save water use.
Infiltration Devices	Permeable paving	Only for attenuating run-off and water quality	Unsuitable for infiltration due to likely ground conditions. Can be used with limited benefit for attenuation and water quality in private car parking bays, but at increased maintenance cost/issues.
	Infiltration trenches/basins	No	Unsuitable for infiltration due to likely ground conditions.
Filtration	Soakaways	No	Unsuitable for infiltration due to likely ground conditions.
	Open Swales	Only for attenuating run-off and water quality	Use for attenuation, evaporation and water quality control. Unsuitable for infiltration due to likely ground conditions.

	Filter Strips	No	Use for attenuation, evaporation and water quality. Unsuitable for infiltration due to likely ground conditions.
Retention / Detention	Detention Basin	No	Suitable for controlling discharge via a pipe outfall, evaporation and treatment of run-off. Land uptake is not available in this site for this method
	Attenuation Pond	Yes	Suitable for controlling discharge via a pipe outfall, evaporation and treatment of run-off. Land uptake is not available in this site for this method

7.0 DRAINAGE STRATEGY

Surface Water

7.1 The surface water strategy proposes that run off arising from the developed site will be managed in a sustainable manner to mimic the surface water flows from the undeveloped site, including attenuation to restrict run-off to pre-development rates for storms up to the 1 in 100 year (+40% allowance for climate change) return period event.

7.2 The strategy proposes a system of surface water sewers will collect runoff from a series of permeable parking bays, attenuation will be provided by a series of oversized pipes and a geo-cellular storage tank. This system will outfall into the existing public surface sewers located on Harbury Street in the absence of other watercourses. The oversized pipes attenuate run-off for storms up to the 1 in 30 year return period event.

7.3 Attenuation for a 1 in 100 year (+40% climate change) will be provided via a cumulative 67.1m^3 of permeable paving installed in all driveways. Should the capacity of the oversized sewer system (83.06m^3) be exceeded the excess flow will be diverted into a geo-cellular storage unit (total volume 164.2m^3) installed under the neighbouring parking bays. These two systems give a total combined storage volume of 281.2m^3.

7.4 Flows between the oversized pipe system and the final outfall into the existing public surface sewer systems will be controlled through the use of a suitable flow control device limiting flows to 5 l/s.

7.5 The outfall from the drainage system is subject to the Section 106 approval from Severn Trent Water.

7.6 The proposed surface water drainage strategy is included on drawing 21420_01_230_01a included in Appendix G. MicroDrainage calculations are included in Appendix F.

7.7 The proposed on-site surface water drainage system would be designed in accordance with Sewers for Adoption standards and offered to Severn Trent Water for future adoption and maintenance. The system would be designed for no pipe surcharging during a 1 in 2 year storm event and no surface flooding during a 1 in 30 year storm event. Details would also be provided to confirm that surface water will not leave the proposed site in the 1 in 100 year (+40% climate change) storm event. If the system surcharged, details would be provided to demonstrate resultant overland flood flow routes and the additional space made available for exceedance flows. Any excess surface water should be routed away from any proposed or existing properties. Detailed drainage calculations would be provided at reserved matters to demonstrate this using MicroDrainage or similar computer package calculations.

7.8 It should be noted that the drainage design and calculations enclosed as part of this report are for strategy purposes only and are subject to change and refinement as part of the detailed drainage design.

CIRIA Document C753

7.9 Table 26.2 of The SuDS Manual CIRIA document C753 (Ref. 6), as shown below, indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications (see Tables 6 & 7). To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index.

7.10 For a residential type development, roof water requires a very low treatment of 0.2 for total suspended solids, 0.2 for heavy metals and 0.05 for hydrocarbons, and run-off from low traffic roads such as cul-de-sacs and individual property driveways requires low treatment of 0.5 for total suspended solids, 0.4 for heavy metals and 0.4 for hydrocarbons.

7.11 To provide the correct level of treatment, an assessment needs to be made of the mitigation provided by each SuDS feature. Table 26.3 of The SuDS Manual CIRIA document C753 shown above indicates the treatment provided by each SuDS feature.

Table 6: CIRIA 753 Table 26.2 Pollution Hazard Indices

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4

Table 7: CIRIA 753 Table 26.3 SuDS Mitigation Indices

	Mitigation indices		
Type of SuDS component	**Total Suspended Solids**	**Metals**	**Hydrocarbons**
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bio-retention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

7.12 Where more than one mitigation feature is to be used, CIRIA guidance states that the total mitigation index shall be calculated as follows:

Total SUDS mitigation index = Mitigation Index 1 + 0.5 x Mitigation Index 2

7.13 The final treatment train combination will be determined at detailed design stage but is likely to incorporate the following components:

- Permeable Paving will be utilised for attenuation before the final outfall providing acceptable treatment of the surface water with indices of 0.7 for total suspended solids, 0.6 for heavy metals and 0.7 for hydrocarbons.

7.14 This is equal to or greater than the existing Pollution Hazard Indices and therefore would be considered satisfactory.

Foul Water

7.15 The strategy proposes a foul water system will collect discharges generated by the development, and convey them towards the existing 225/300mm public foul sewer under Harbury Street. The STW foul development enquiry has stated that foul flows from the proposed 17 dwellings will have a peak flow of 0.265 l/s, which should have no adverse effects on the existing hydraulic network.

7.16 The proposed foul water drainage strategy is included on drawing 21420_01_230_01a included in Appendix G.

Maintenance

7.17 The proposed on site surface water drainage system would be designed in accordance with Sewers for Adoption standards and offered to Seven Trent Water for future adoption and maintenance.

7.18 The various SUDS such as permeable paving and geo-cellular units will not be offered to the District Council or other local bodies and will be maintained by a specialist management / maintenance company.

7.19 In any eventuality, it is considered the SUDS features will be adopted and maintained in perpetuity.

8.0 FLOOD MITIGATION MEASURES

8.1 Based on the layout of the site and development layout, drainage network and levels of the proposed development will be designed to direct overland flow through the development and towards the drainage ditch beyond the eastern corner of the site.

8.2 The development layout, drainage network and levels of the proposed development will be designed to direct overland flow through the development and away from proposed buildings. Detailed layout and levels design will play a significant part in the management of any residual risk of flooding to the development, for example due to blockage or failure of drainage systems.

8.3 The flood risk management measures included on the proposed development site will include the following:

- The proposed development will include permeable driveways and a surface water drainage system that will intercept the majority of run-off generated within the development roads. This will minimise the risk to the new buildings and also reduce the incidence of overland flows.
- Installing a filter strip drain or raised buffer across the sites main entrance roadway can also prevent surface runoff from Harbury Street itself from entering the site.
- All buildings must be designed with the finished floor level at least 150mm above adjacent external ground levels.
- Where possible, the external ground profile should be designed to slope away from the buildings to divert any flows away from vulnerable areas. Where flush thresholds are required, these must be achieved using a suitable ramp to ensure that water will not be able to use this route to enter the building.

9.0 REFERENCES

9.1 The following documents have been referred to in this report:

1. The Building Regulations 2000, Approved Document H.
2. Sewers for Adoption 7th Edition.
3. Civil Engineering Specification for the Water Industry, 7th Edition.
4. National Planning Policy Framework – March 2012.
5. Environment Agency Flood Risk Standing Advice.
6. Environment Agency 'Flood Risk Assessments – Climate Change Allowances' - February 2016.
7. The SuDS Manual – CIRIA C753.
8. Interim Code of Practice for Sustainable Drainage Systems – National SuDS Working Group, July 2004.
9. British Geological Survey – Geology of Britain viewer, http://mapapps.bgs.ac.uk /geologyofbritain/home.html
10. Design and analysis of urban storm drainage. The Wallingford Procedure Vol.1.
11. Institute of Hydrology Report No. 124 – Flood Estimation for small catchments.
12. BS 8004 : 1986 – Foundations.
13. BRE Digest 365 : 2007 – Soakaway's.
14. Centre for Ecology and Hydrology FEH CD Rom version 3.
15. Flood and Water Management Act 2010.
16. Water Industry Act 1999.
17. Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems – March 2015
18. Planning Practice Guidance – March 2015.
19. Level 1 and 2 Strategic Flood Risk Assessment East Staffordshire Borough Council

APPENDIX A

M-EC
Wellington House
Leicester Road
Ibstock
Leicestershire
LE67 6HP

SITE LOCATION PLAN

Project:	**HARBURY STREET, BURTON-ON-TRENT**
File Ref:	**21420**
O.S. Grid Ref:	**423514, 324855**
Postcode:	**DE13 0RU**

APPENDIX B

Proposed Site Plan 1:250

North point:

NORTH

Notes:

Schedule of Accommodation

14 no. Units - 6 no. x 2 bed 4 person house - 67.4m² (725sqft)
6 no. x 3 bed 5 person house - 82m² (883sqft)
(2 allocated parking spaces, plus 10 additional parking spaces)

Total Site Area = 3,720m² (0.919 acres).

Revision Log:

Rev:	Description:	By:	Date:

Project:
Development of the land at Harbury Street, Burton on Trent

Client:
Andrew Granger and Co Ltd

Scale: 1:250

Drawn by:	Checked:	Date:	Paper Size:
JAE	-	Feb 2016	A1

Drawing Title: Proposed Site Plan

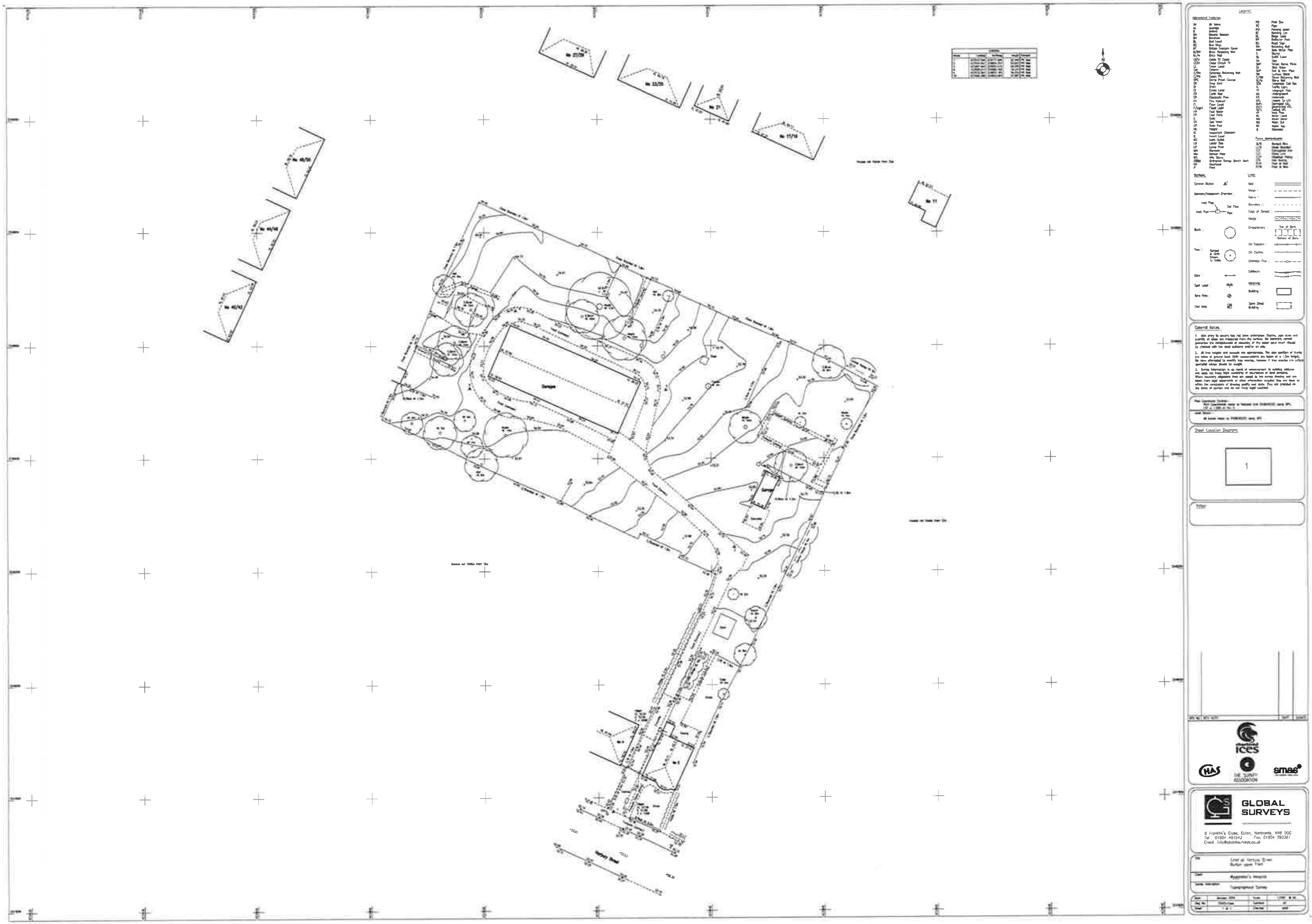
Drawing Status: FOR DISCUSSION

Drawing Number:	Revision Number:
3973/AG/16/003	-

CORPORATE ARCHITECTURE LIMITED
CHARTERED ARCHITECTS
HEAD OFFICE
Venad House | Trimbush Way
Market Harborough
Leicestershire LE16 7XY
Tel: 01858 467476
www.corporatearchitecture.co.uk

RIBA

APPENDIX C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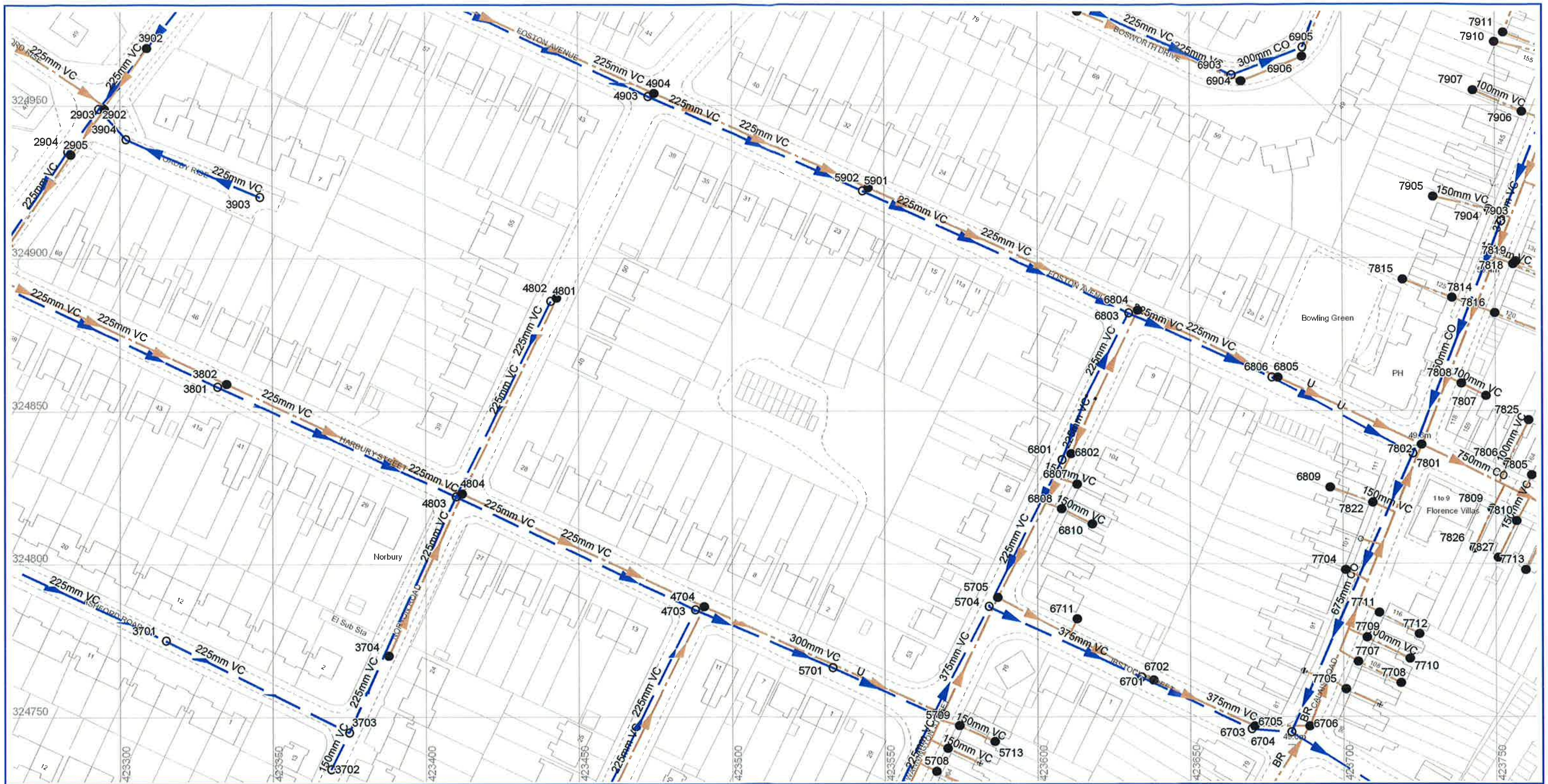
No 23/25
No 21
No 17/19
No 11
No 48/50
No 44/46
No 40/42
Legend
General Notes
Sheet Location Diagram
1
Notes
THE SURVEY ASSOCIATION
GLOBAL
SURVEYS
8 Franklin's Close, Ecton, Northants, NN6 0QG
Tel 01604 491543 Fax: 01604 790367
Email info@globalsurveys.co.uk
Topographical Survey

APPENDIX D



Abandoned Gravity Sewer
Private Combined Gravity Sewer
Private Foul Gravity Sewer
Private Surface Water Gravity Sewer
Public Combined Gravity Sewer
Public Foul Gravity Sewer
Public Surface Water Gravity Sewer
Trunk Combined Gravity Sewer
Trunk Foul Use Gravity Sewer
Trunk Surface Water Gravity Sewer
Combined Use Pressurised Sewer
Foul Use Pressurised Sewer
Surface Water Pressurised Sewer
Highway Drain
Combined Lateral Drain (SS)
Foul Lateral Drain (SS)
Surface Water Lateral Drain (SS)

All Private Sewers are shown in magenta
All section 104 sewers are shown in green
All Sewers that have been transferred to Severn Trent Water after the 1st October 2011, but have not been surveyed and confirmed by Severn Trent Water are shown in orange

Culverted Watercourse
Cable, Earthing
Cable Junction
Cable, Optical Fibre/Instrumentation
Cable, Low Voltage
Cable, High Voltage
Cable, Other
Housing, Building
Housing, Kiosk
Disposal Site
Sewage Treatment Works
Housing, Other
Pipe Support Structure
Sewage Pumping Facility
Sewer Facility Connection Inlet / Outlet

Blind Shaft
Combined Use Manhole
Flushing Chamber
Foul Use Manhole
Grease Trap
Head Node
Hydrobrake
Lamphole
Outfall
Overflow
Penstock
Petrol Interceptor

Sewer Chemical Injection Point
Sewer Junction
Sewerage Air Valve
Sewerage Hatch Box Point
Sewerage Isolation Valve
Soakaway
Surface Water Manhole
Vent Column
Waste Water Storage
Pre-1937 Properties

MATERIALS

- \- NONE
- AC - ASBESTOS CEMENT
- BR - BRICK
- CC - CONCRETE BOX CULVERT
- CI - CAST IRON
- CO - CONCRETE
- CSB - CONCRETE SEGMENTS (BOLTED)
- CSU - CONCRETE SEGMENTS (UNBOLTED)
- DI - DUCTILE IRON
- GRC - GLASS REINFORCED CONCRETE
- GRP - GLASS REINFORCED PLASTIC
- MAC - MASONRY IN REGULAR COURSES
- MAR - MASONRY RANDOMLY COURSED
- PE - POLYETHLENE
- PF - PITCH
- PP - POLYPROPYLENE
- PSC - PLASTIC STEEL COMPOSITE
- PVC - POLYVINYL CHLORIDE
- RPM - REINFORCED PLASTIC MATRIX
- SI - SPUN (GREY) IRON
- ST - STEEL
- U - UNKNOWN
- VC - VITRIFIED CLAY
- XXX - OTHER

SHAPE

- C - CIRCULAR
- E - EGG SHAPED
- O - OTHER
- R - RECTANGLE
- S - SQUARE
- T - TRAPEZOIDAL
- U - UNKNOWN

CATEGORIES

- W - WEIR
- C - CASCADE
- DB - DAMBOARD
- SE - SIDE ENTRY
- FV - FLAP VALVE
- BD - BACK DROP
- S - SIPHON
- HD - HIGHWAY DRAIN
- S104 - SECTION 104

PURPOSE

- C - COMBINED
- E - FINAL EFFLUENT
- F - FOUL
- L - SLUDGE
- S - SURFACE WATER

N W E S

SEVERN TRENT WATER

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD

O/S Map scale:	1:1250	**This map is centred upon:**	
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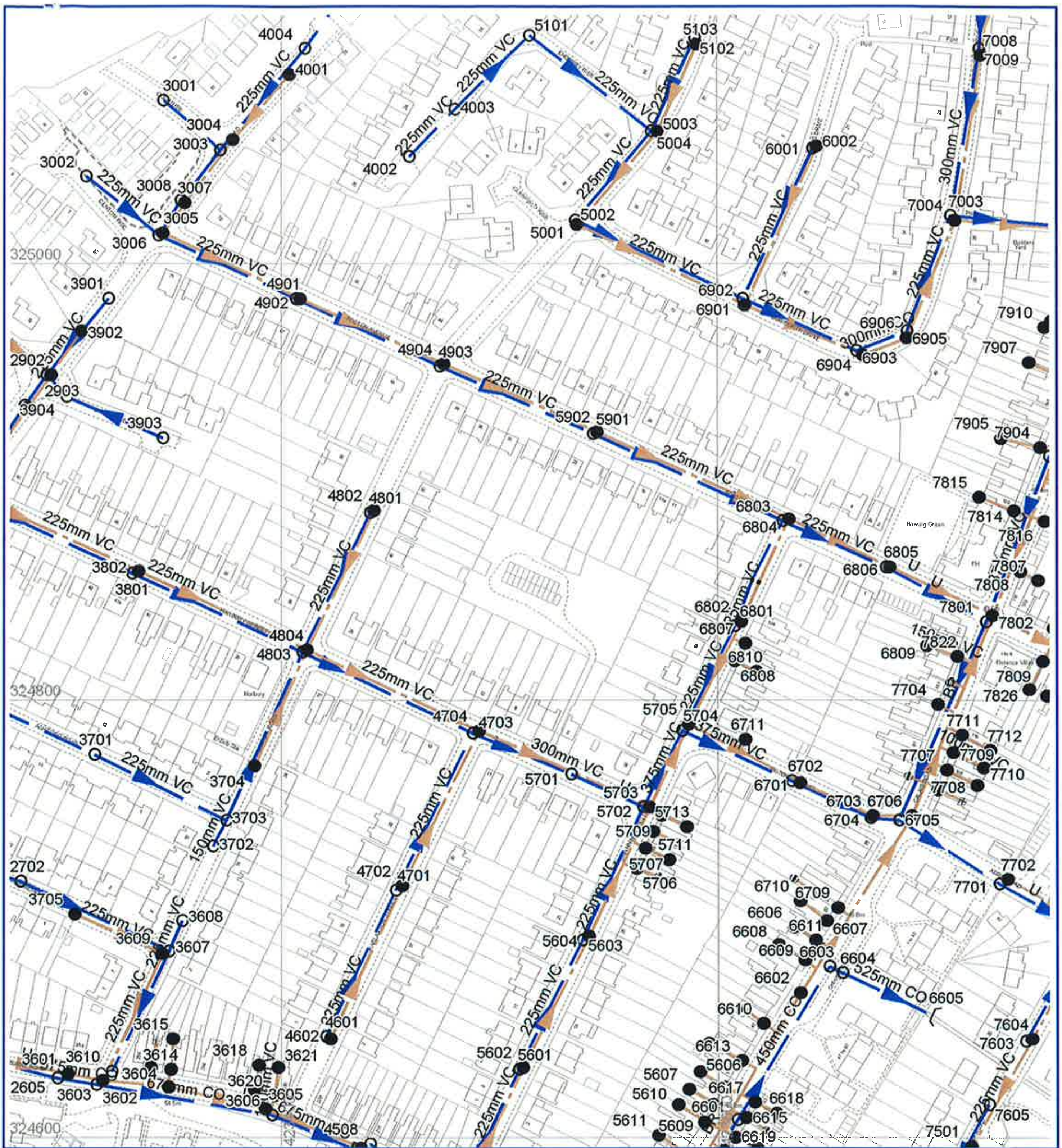
		x :	423514
		y :	324855



Abandoned Gravity Sewer	Blind Shaft	Sewer Chemical Injection Point
Private Combined Gravity Sewer	Combined Use Manhole	Sewer Junction
Private Foul Gravity Sewer	Disposal Site	Sewerage Air Valve
Private Surface Water Gravity Sewer	Flushing Chamber	Sewerage Hatch Box Point
Public Combined Gravity Sewer	Foul Use Manhole	Sewerage Isolation Valve
Public Foul Gravity Sewer	Grease Trap	Soakaway
Public Surface Water Gravity Sewer	Head Node	Surface Water Manhole
Trunk Combined Gravity Sewer	Hydrobrake	Vent Column
Trunk Foul Use Gravity Sewer	Lamphole	Waste Water Storage
Trunk Surface Water Gravity Sewer	Outfall	Culverted Watercourse
Abandoned Pressurised Sewer	Overflow	Pre-1937 Properties
Combined Use Pressurised Sewer	Penstock	Sewage Pumping Facility
Foul Use Pressurised Sewer	Petrol Interceptor	Sewer Facility Connection Inlet / Outlet
Surface Water Pressurised Sewer	STW Sewage Treatment Works	
Highway Drain		
Combined Lateral Drain (SS)		
Foul Lateral Drain (SS)		
Surface Water Lateral Drain (SS)		

All Private Sewers are shown in magenta
All section 104 sewers are shown in green

SEVERN TRENT WATER

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Asset Data Management
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SEWER RECORD

O/S Map scale:	1:2500	This map is centred upon: O / S Grid reference:
Date of issue:	08.02.16	x : 423514
Sheet No:	1 of 5	y : 324855

Sewer Node | Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK23242605	56.03	53.42	nil	S	CO	C	675	nil	0.00	nill
SK23242702	59.30	57.44	54.83	S	VC	C	225	nil	28.79	1944
SK23242902	68.46	65.68	64.33	S	VC	C	225	nil	12.74	1944
SK23242903	68.64	66.27	64.76	F	VC	C	225	nil	12.32	1944
SK23242904	66.33	64.20	61.02	S	VC	C	225	nil	15.61	1944
SK23242905	66.34	64.63	60.52	F	VC	C	225	nil	11.54	1944
SK23243601	55.88	54.36	53.99	F	VC	C	300	nil	44.00	1944
SK23243602	nil	nil	51.06	S	CO	C	675	nil	0.00	nill
SK23243603	55.47	53.95	nil	F	VC	C	300	nil	0.00	2003
SK23243604	nil	nil	nil	F	U	U	nil	nil	0.00	2003
SK23243605	53.54	nil	nil	F	U	U	nil	nil	0.00	2003
SK23243606	53.38	50.99	49.90	S	CO	C	675	nil	38.67	nill
SK23243607	55.62	54.81	54.45	S	VC	C	225	nil	169.00	2003
SK23243608	55.70	54.90	54.83	S	VC	C	225	nil	217.57	2003
SK23243609	55.66	54.29	54.05	F	VC	C	225	nil	266.58	2003
SK23243612	55.02	53.72	nil	F	VC	C	150	nil	0.00	nill
SK23243614	54.92	54.02	nil	F	VC	C	150	nil	0.00	nill
SK23243615	54.97	54.66	54.04	F	VC	C	150	nil	22.65	nill
SK23243617	53.86	52.91	nil	F	VC	C	150	nil	0.00	nill
SK23243618	54.06	53.51	52.91	F	VC	C	150	nil	18.63	nill
SK23243620	53.65	52.82	nil	F	VC	C	150	nil	0.00	nill
SK23243621	53.80	53.26	52.84	F	VC	C	150	nil	31.31	nill
SK23243701	58.53	56.95	54.30	S	VC	C	225	nil	25.31	1944
SK23243702	55.79	54.48	54.32	S	VC	C	150	nil	83.88	1944
SK23243703	55.83	54.26	53.89	S	VC	C	225	nil	228.59	1944
SK23243704	55.90	53.72	53.31	F	VC	C	225	nil	141.90	1944
SK23243705	57.31	55.86	54.31	F	VC	C	225	nil	28.30	1944
SK23243801	58.50	55.83	54.14	S	VC	C	225	nil	50.83	1944
SK23243802	58.42	55.64	53.59	F	VC	C	225	nil	41.46	1944
SK23243901	74.21	71.83	67.24	S	VC	C	225	nil	9.76	1944
SK23243902	71.59	69.00	nil	F	VC	C	225	nil	0.00	1944
SK23243903	68.54	67.04	66.12	S	VC	C	225	nil	52.10	1944
SK23243904	68.20	66.08	65.87	S	VC	C	225	nil	64.05	1944
SK23244508	52.50	51.32	49.43	S	VC	C	450	nil	66.55	2003
SK23244601	53.43	52.17	51.88	S	VC	C	225	nil	256.03	2003
SK23244602	53.42	51.73	51.31	F	VC	C	225	nil	184.26	2003
SK23244701	53.58	51.91	51.56	S	VC	C	225	nil	228.74	1944
SK23244702	53.56	51.28	50.90	F	VC	C	225	nil	208.32	1944
SK23244703	53.68	51.30	nil	S	VC	C	225	nil	0.00	1944
SK23244704	53.60	50.70	49.06	F	VC	C	300	nil	52.13	1944
SK23244801	59.51	57.21	53.86	S	VC	C	225	nil	21.23	1944
SK23244802	59.62	56.67	54.19	F	VC	C	225	nil	28.67	1944
SK23244803	56.10	53.64	52.21	S	VC	C	225	nil	60.37	1944
SK23244804	56.02	53.13	51.72	F	VC	C	225	nil	61.87	1944
SK23244901	71.93	69.18	63.30	S	VC	C	225	nil	12.40	1979
SK23244902	71.72	68.71	62.99	F	VC	C	225	nil	12.67	1979

MATERIALS

- - NONE
- AC - ASBESTOS CEMENT
- BR - BRICK
- CC - CONCRETE BOX CULVERT
- CI - CAST IRON
- CO - CONCRETE
- CSB - CONCRETE SEGMENTS (BOLTED)
- CSU - CONCRETE SEGMENTS (UNBOLTED)
- DI - DUCTILE IRON
- GRC - GLASS REINFORCED CONCRETE
- RP - GLASS REINFORCED PLASTIC
- MAC - MASONRY IN REGULAR COURSES
- MAR - MASONRY RANDOMLY COURSED
- PE - POLYETHLENE
- PF - PITCH
- PP - POLYPROPYLENE
- PSC - PLASTIC STEEL COMPOSITE
- PVC - POLYVINYL CHLORIDE
- RPM - REINFORCED PLASTIC MATRIX
- SI - SPUN (GREY) IRON
- ST - STEEL
- U - UNKNOWN
- VC - VITRIFIED CLAY
- XXX - OTHER

SHAPE

- C - CIRCULAR
- E - EGG SHAPED
- O - OTHER
- R - RECTANGLE
- S - SQUARE
- T - TRAPEZOIDAL
- U - UNKNOWN

PURPOSE

- C - COMBINED
- E - FINAL EFFLUENT
- F - FOUL
- L - SLUDGE
- S - SURFACE WATER

TABULAR KEY

A. **Sewer pipe data refers to downstream sewer pipe.**

B. **Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.**

C. **Gradient is stated a 1 in...**

SEVERN TRENT WATER

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD DATA TABLE

O/S Map scale:	1:2500	**This map is centred upon: O / S Grid reference:**	
Date of issue:	08.02.16	**x:**	423514
Sheet No.	2 of 5	**y :**	324855

Disclaimer Statement:

1. Do not scale off this Map.

2. This map and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this Map and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of Severn Trent Water's assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems.

3. On **1 October 2011** most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012 (date to be confirmed).
Private pumping stations, which form part of these sewers or lateral drains, will transfer to the ownership of Severn Trent Water on or before 1 October 2016.
Severn Trent Water does not possess complete records of these assets.
These assets may not be displayed on this Map.

Sewer Node — Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK23244903	64.57	61.76	55.59	S	VC	C	225	nil	12.41	1979
SK23244904	64.41	61.40	55.33	F	VC	C	225	nil	12.61	1979
SK23245601	51.30	49.90	49.68	S	VC	C	225	nil	298.82	2003
SK23245602	51.32	49.43	49.22	F	VC	C	225	nil	319.43	2003
SK23245603	51.32	49.66	49.49	S	VC	C	225	nil	394.82	1944
SK23245604	51.33	49.18	49.02	F	VC	C	225	nil	408.19	1944
SK23245605	49.60	49.06	48.63	F	VC	C	100	nil	40.48	nill
SK23245606	49.76	49.32	48.60	F	VC	C	150	nil	18.37	nill
SK23245607	49.81	49.32	48.70	F	VC	C	150	nil	21.03	nill
SK23245608	49.66	48.70	nil	F	VC	C	150	nil	0.00	nill
SK23245609	49.86	48.87	nil	F	VC	C	150	nil	0.00	nill
SK23245610	50.02	49.40	48.91	F	VC	C	150	nil	29.43	nill
SK23245611	50.20	49.54	48.79	F	VC	C	150	nil	19.23	nill
SK23245701	52.34	nil	49.55	S	U	U	nil	nil	0.00	1944
SK23245702	51.39	49.48	49.33	S	VC	C	375	nil	262.40	1944
SK23245703	51.34	48.98	48.84	F	VC	C	375	nil	323.46	1944
SK23245704	51.30	49.31	48.53	S	VC	C	375	nil	70.56	1944
SK23245705	51.32	48.84	48.06	F	VC	C	375	nil	73.99	1944
SK23245706	51.40	50.27	nil	F	VC	C	150	nil	0.00	nill
SK23245707	51.31	50.26	nil	F	VC	C	150	nil	0.00	nill
SK23245708	51.31	50.20	nil	F	VC	C	150	nil	0.00	nill
SK23245709	51.38	50.59	nil	F	nil	nil	nil	nil	0.00	nill
SK23245711	51.20	50.67	50.29	F	VC	C	150	nil	32.13	nill
SK23245713	51.15	50.59	50.59	F	VC	C	150	nil	0.00	nill
SK23245901	57.01	54.65	51.16	S	VC	C	225	nil	27.44	1979
SK23245902	56.92	54.35	50.68	F	VC	C	225	nil	26.34	1979
SK23246601	49.54	48.53	48.02	S	CO	C	450	nil	156.98	1979
SK23246602	49.03	47.49	47.34	F	BR	E	625	400	638.13	nill
SK23246603	48.98	47.98	47.87	S	CO	C	450	nil	61.00	nill
SK23246604	48.78	47.87	47.65	S	CO	C	525	nil	191.14	1979
SK23246606	49.11	48.36	48.23	F	VC	C	150	nil	89.69	nill
SK23246607	49.09	47.85	nil	F	VC	C	150	nil	0.00	nill
SK23246608	49.04	48.39	48.07	F	VC	C	150	nil	43.41	nill
SK23246609	48.99	48.06	nil	F	VC	C	150	nil	0.00	nill
SK23246610	49.26	48.21	nil	F	VC	C	150	nil	0.00	nill
SK23246611	48.97	48.22	nil	F	VC	C	150	nil	0.00	nill
SK23246613	49.42	48.56	nil	F	VC	C	150	nil	0.00	nill
SK23246614	49.63	48.53	nil	F	VC	C	150	nil	0.00	nill
SK23246615	49.68	48.67	nil	F	VC	C	150	nil	0.00	nill
SK23246617	49.63	48.69	nil	F	VC	C	150	nil	0.00	nill
SK23246618	49.48	48.97	48.70	F	VC	C	150	nil	41.41	nill
SK23246619	49.77	48.76	nil	F	VC	C	150	nil	0.00	nill
SK23246701	50.16	48.04	47.51	F	VC	C	375	nil	68.40	1944
SK23246702	50.18	48.50	47.98	S	VC	C	375	nil	75.11	1944
SK23246703	49.30	47.49	47.35	F	VC	C	375	nil	128.57	1979
SK23246704	49.32	47.96	46.89	S	VC	C	375	nil	12.07	1979

MATERIALS

-	- NONE	PE	- POLYETHLENE
AC	- ASBESTOS CEMENT	PF	- PITCH
BR	- BRICK	PP	- POLYPROPYLENE
CC	- CONCRETE BOX CULVERT	PSC	- PLASTIC STEEL COMPOSITE
CI	- CAST IRON	PVC	- POLYVINYL CHLORIDE
CO	- CONCRETE	RPM	- REINFORCED PLASTIC MATRIX
CSB	- CONCRETE SEGMENTS (BOLTED)	SI	- SPUN (GREY) IRON
CSU	- CONCRETE SEGMENTS (UNBOLTED)	ST	- STEEL
DI	- DUCTILE IRON	U	- UNKNOWN
GRC	- GLASS REINFORCED CONCRETE	VC	- VITRIFIED CLAY
RP	- GLASS REINFORCED PLASTIC	XXX	- OTHER
MAC	- MASONRY IN REGULAR COURSES		
MAR	- MASONRY RANDOMLY COURSED		

SHAPE

- C - CIRCULAR
- E - EGG SHAPED
- O - OTHER
- R - RECTANGLE
- S - SQUARE
- T - TRAPEZOIDAL
- U - UNKNOWN

PURPOSE

- C - COMBINED
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TABULAR KEY

A. **Sewer pipe data refers to downstream sewer pipe.**

B. **Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.**

C. **Gradient is stated a 1 in...**

SEVERN TRENT WATER

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD DATA TABLE

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Date of issue:	08.02.16	**x:**	423514
Sheet No.	3 of 5	**y :**	324855

Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK23246705	49.00	46.25	nil	S	CO	C	825	nil	0.00	nill
SK23246706	49.00	47.34	46.75	F	BR	E	600	425	168.07	nill
SK23246709	48.97	nil	nil	F	nil	nil	nil	nil	0.00	nill
SK23246710	49.10	48.14	47.87	F	VC	C	150	nil	55.56	nill
SK23246711	50.78	49.50	nil	F	VC	C	150	nil	0.00	nill
SK23246801	51.92	50.53	49.95	S	VC	C	225	nil	94.16	1944
SK23246802	51.93	50.09	49.52	F	VC	C	225	nil	92.58	1944
SK23246803	52.63	51.12	nil	S	VC	C	225	nil	0.00	1944
SK23246804	52.53	50.62	nil	F	VC	C	225	nil	0.00	1944
SK23246805	50.66	nil	47.18	S	U	U	nil	nil	0.00	1979
SK23246806	50.59	nil	46.75	F	U	U	nil	nil	0.00	1979
SK23246807	51.92	51.10	nil	F	VC	C	150	nil	0.00	nill
SK23246808	51.83	50.54	nil	F	VC	C	150	nil	0.00	nill
SK23246809	50.02	48.98	48.21	F	VC	C	150	nil	19.06	nill
SK23246810	51.78	50.69	50.56	F	VC	C	150	nil	86.00	nill
SK23246901	56.13	53.87	51.59	S	VC	C	225	nil	25.12	1979
SK23246902	56.09	53.44	51.13	F	VC	C	225	nil	25.30	1979
SK23246903	53.00	51.52	51.09	S	CO	C	300	nil	57.44	1979
SK23246904	53.01	51.07	50.67	F	VC	C	225	nil	53.85	1979
SK23246905	52.39	50.94	50.76	S	CO	C	450	nil	314.72	1979
SK23246906	52.43	50.63	50.28	F	VC	C	225	nil	166.60	1979
SK23247501	48.55	46.48	46.28	F	VC	C	225	nil	272.90	1914
SK23247603	48.58	47.65	47.54	S	VC	C	225	nil	521.00	1979
SK23247604	48.58	46.66	46.48	F	VC	C	225	nil	313.56	1979
SK23247605	48.53	47.20	47.08	S	VC	C	225	nil	391.75	1979
SK23247701	nil	nil	45.91	S	U	U	nil	nil	0.00	1979
SK23247702	48.79	47.00	46.88	F	VC	C	225	nil	365.92	1979
SK23247704	49.49	48.15	nil	F	VC	C	150	nil	0.00	nill
SK23247705	49.21	48.09	nil	F	VC	C	150	nil	0.00	nill
SK23247707	49.30	47.87	nil	F	VC	C	150	nil	0.00	nill
SK23247708	49.32	48.39	47.92	F	VC	C	100	nil	33.30	nill
SK23247709	49.34	47.91	nil	F	VC	C	150	nil	0.00	nill
SK23247710	49.42	48.52	47.91	F	VC	C	100	nil	25.66	nill
SK23247711	49.34	47.87	nil	F	VC	C	150	nil	0.00	nill
SK23247712	49.32	48.45	47.87	F	VC	C	100	nil	25.45	nill
SK23247801	49.61	46.75	46.38	S	CO	C	675	nil	268.65	1979
SK23247802	49.65	46.75	46.29	F	CO	C	750	nil	152.63	nill
SK23247807	49.47	48.75	48.51	F	VC	C	100	nil	37.25	nill
SK23247808	49.95	48.48	nil	F	VC	C	150	nil	0.00	nill
SK23247809	49.32	47.99	nil	F	VC	C	150	nil	0.00	nill
SK23247814	50.44	49.22	nil	F	VC	C	150	nil	0.00	nill
SK23247815	50.62	49.96	49.22	F	VC	C	150	nil	22.79	nill
SK23247816	50.20	49.14	nil	F	VC	C	150	nil	0.00	nill
SK23247822	49.61	48.19	nil	F	VC	C	150	nil	0.00	nill
SK23247826	49.15	48.60	48.00	F	VC	C	100	nil	23.87	nill
SK23247827	49.18	48.26	47.90	F	VC	C	100	nil	36.27	nill

MATERIALS

-	- NONE	PE	- POLYETHLENE
AC	- ASBESTOS CEMENT	PF	- PITCH
BR	- BRICK	PP	- POLYPROPYLENE
CC	- CONCRETE BOX CULVERT	PSC	- PLASTIC STEEL COMPOSITE
CI	- CAST IRON	PVC	- POLYVINYL CHLORIDE
CO	- CONCRETE	RPM	- REINFORCED PLASTIC MATRIX
CSB	- CONCRETE SEGMENTS (BOLTED)	SI	- SPUN (GREY) IRON
CSU	- CONCRETE SEGMENTS (UNBOLTED)	ST	- STEEL
DI	- DUCTILE IRON	U	- UNKNOWN
GRC	- GLASS REINFORCED CONCRETE	VC	- VITRIFIED CLAY
RP	- GLASS REINFORCED PLASTIC	XXX	- OTHER
MAC	- MASONRY IN REGULAR COURSES		
MAR	- MASONRY RANDOMLY COURSED		

SHAPE

C	- CIRCULAR
E	- EGG SHAPED
O	- OTHER
R	- RECTANGLE
S	- SQUARE
T	- TRAPEZOIDAL
U	- UNKNOWN

PURPOSE

C	- COMBINED
E	- FINAL EFFLUENT
F	- FOUL
L	- SLUDGE
S	- SURFACE WATER

TABULAR KEY

A. **Sewer pipe data refers to downstream sewer pipe.**

B. **Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.**

C. **Gradient is stated a 1 in...**

SEVERN TRENT WATER

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD DATA TABLE

O/S Map scale:	1:2500	**This map is centred upon: O / S Grid reference:**	
Date of issue:	08.02.16	**x:**	423514
Sheet No.	4 of 5	**y :**	324855

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3. On **1 October 2011** most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012 (date to be confirmed).
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Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK23247903	50.38	48.16	47.10	S	CO	C	450	nil	76.74	1979
SK23247904	50.57	49.19	nil	F	VC	C	150	nil	0.00	nill
SK23247905	50.74	50.04	49.27	F	VC	C	150	nil	23.95	nill
SK23247907	51.25	50.47	49.83	F	VC	C	100	nil	27.28	nill
SK23247910	51.26	50.65	50.03	F	VC	C	150	nil	28.16	nill
SK23253001	82.94	80.85	77.35	S	VC	C	225	nil	9.92	1979
SK23253002	82.44	80.20	76.35	S	VC	C	225	nil	11.08	1979
SK23253003	79.08	77.27	76.75	S	VC	C	225	nil	56.17	1979
SK23253004	79.26	77.12	76.26	F	VC	C	225	nil	42.33	nill
SK23253005	78.01	75.58	70.48	F	VC	C	225	nil	13.68	1944
SK23253006	78.02	76.26	70.68	S	VC	C	225	nil	12.43	1944
SK23253007	78.38	76.21	75.80	F	VC	C	225	nil	41.95	1979
SK23253008	78.40	76.72	76.45	S	VC	C	225	nil	69.89	1979
SK23254001	80.65	79.12	77.17	F	VC	C	150	nil	20.36	1979
SK23254002	68.23	66.29	65.61	S	VC	C	225	nil	44.72	1979
SK23254003	67.47	65.60	64.94	S	VC	C	225	nil	72.85	1979
SK23254004	80.95	78.41	77.30	S	VC	C	225	nil	55.02	1979
SK23255001	60.51	57.42	54.02	F	VC	C	225	nil	25.13	1979
SK23255002	60.47	57.82	54.48	S	VC	C	225	nil	25.45	1979
SK23255003	60.30	58.02	57.47	F	VC	C	225	nil	103.15	1979
SK23255004	60.29	58.25	57.87	S	VC	C	225	nil	141.87	1979
SK23255101	67.20	64.89	58.44	S	VC	C	225	nil	11.04	1979
SK23255102	61.68	59.40	58.28	S	VC	C	225	nil	42.34	1979
SK23255103	61.68	59.15	58.04	F	VC	C	225	nil	39.51	1979
SK23256001	57.16	55.26	54.04	S	VC	C	225	nil	61.84	1979
SK23256002	57.16	54.98	53.57	F	VC	C	225	nil	56.82	1979
SK23257003	53.22	50.71	50.53	S	CO	C	450	nil	306.83	1979
SK23257004	53.18	50.26	50.06	F	VC	C	225	nil	269.26	1979
SK23257008	54.76	52.56	51.56	F	VC	C	225	nil	77.72	1979
SK23257009	54.82	52.84	51.87	S	VC	C	300	nil	80.51	1979

MATERIALS

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- CI - CAST IRON
- CO - CONCRETE
- CSB - CONCRETE SEGMENTS (BOLTED)
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- PSC - PLASTIC STEEL COMPOSITE
- PVC - POLYVINYL CHLORIDE
- RPM - REINFORCED PLASTIC MATRIX
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SEVERN TRENT WATER

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APPENDIX E

Staffordshire County Council

Lead Local Flood Authority Planning Application response

Lead SCC Officer	Dave Hughes (Staffordshire Moorlands, east Staffordshire)
Local Planning Authority	East Staffordshire Borough Council
Planning application reference	2014/01353
Type of application	Outline
Date consulted	9/1/15
Date of response	26/1/15

Disclaimer
This response is made by the County Council in its capacity as a Lead Local Flood Authority as a non-statutory consultee. As a Lead Local Flood Authority we respond to Planning Applications where resources allow and considering where development has the greatest ability to affect flood risk.

These comments should be taken as general comments on flood risk and drainage only. A detailed review of any technical methodology and results has not been undertaken by the Council. Liability for such technical work therefore rests with organisation(s) who have undertaken the said work.

General observations/ local flooding information

Flood Zone	Flood Zone 1
Surface water risk	No
Past flooding	A resident has written in claiming that back gardens flood because of an old culverted watercourse.
Watercourse within 5m of site	Yes. If you look at the accompanying screenshots an un-named watercourse passed through the site and this was probably culverted in intervening years.
Other observations	We would ask the developer to investigate the existence of such a watercourse and ensure it is dealt with as part of the development.

RESPONSE

Thank you for consulting us on this planning application, our response is as follows:

Advice to LPA
We recommend refusal on the following grounds. If you are minded to approve the application contrary to this advice, we request that you contact us again to allow further discussion.

Staffordshire County Council Flood Risk Management position
In the absence of an acceptable assessment of flood risk we OBJECT to the grant of planning permission and recommend refusal on this basis for the following reasons:

Reason
The submitted documents do not provide a suitable basis for assessment to be made of the flood risks arising from the proposed development.

In particular, the submitted documents are not acceptable because:

1. *There is evidence that a culverted watercourse passes through the site (see attached screenshots). As well as a surface water strategy for the site, you would need to show how you will deal with any culverted watercourse so as not to increase flood risk to the development itself, or other property.*

If the applicants or agents wish to discuss this position with us, they should contact Dave Hughes (01543) 334064.

Please contact us on flood.team@staffordshire.gov.uk if you have any queries about this response.

APPENDIX F

Wellington House Leicester Road Ibstock Leicestershire LE67 6HP

Telephone 01530 264753
Fax 01530 588116
Email Ibstock@m-ec.co.uk
www.m-ec.co.uk

M·EC

Project No	21420
Sheet	1 of 8
Engineer	BD
Date	05/05/2016
Revision	-

DESIGN CALCULATIONS FRONT SHEET

SCHEME	Land off Harbury Street, Burton-upon-Trent
CLIENT	Andrew Granger
ASPECTS OF SCHEME TO BE DESIGNED	1. Greenfield Runoff Rates 2. Greenfield Volume Rates 3. Surface Water Network Calculations
CODES OF PRACTICE, DESIGN SPECIFICATIONS & BRITISH STANDARDS	1. Wallingford Procedure. 2. Sewers for Adoption 6th Edition. 3. Severn Trent Water additions/deletions to Sewers For Adoption 6th Edition.
NOTES	Calculations carried out using WinDes Microdrainage computer program. Refer to design drawing 21420_01_230_01 for layout details.

INDEX

Pages	Calculations	Checked by	Date
2	Greenfield Runoff Rates	NO	29.01.2016
3	Greenfield Volume Rates	NO	29.01.2016
4 - 8	Network Calculations	NO	05.05.2016

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	SAAR (mm)	647	Urban	0.000
Area (ha)	0.344	Soil	0.450	Region Number	Region 4

Results l/s

QBAR Rural 1.4
QBAR Urban 1.4

Q100 years 3.5

Q1 year 1.1
Q30 years 2.7
Q100 years 3.5

Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
Site Location	GB 453050 272650 SP 53050 72650
C(1km)	-0.026
D1(1km)	0.363
D2(1km)	0.302
D3(1km)	0.243
E(1km)	0.298
F(1km)	2.457
Areal Reduction Factor	1.00
Area (ha)	0.344
SAAR (mm)	647
CWI	95.460
SPR Host	47.220
URBEXT (1990)	0.0302

Results

Percentage Runoff (%)	45.29
Greenfield Runoff Volume (m^3)	110.762

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	1
Site Location	GB 453050 272650 SP 53050 72650
C (1km)	-0.026
D1 (1km)	0.363
D2 (1km)	0.302
D3 (1km)	0.243
E (1km)	0.298
F (1km)	2.457
Maximum Rainfall (mm/hr)	100
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.192	4-8	0.064

Total Area Contributing (ha) = 0.256

Total Pipe Volume (m³) = 82.465

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S1.000	43.225	0.262	165.0	0.132	5.00	0.0	0.600	o	750	
S1.001	7.855	0.029	270.9	0.071	0.00	0.0	0.600	o	750	
S1.002	52.558	0.195	269.5	0.039	0.00	0.0	0.600	o	1200	
S1.003	11.498	0.314	36.6	0.014	0.00	5.0	0.600	o	225	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	54.55	5.33	50.943	0.132	0.0	0.0	0.0	2.18	961.4	19.5
S1.001	54.05	5.41	50.681	0.203	0.0	0.0	0.0	1.70	749.1	29.7
S1.002	51.73	5.79	50.202	0.242	0.0	0.0	0.0	2.27	2571.9	33.9
S1.003	51.23	5.88	49.860	0.256	5.0	0.0	0.0	2.17	86.2	40.6

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	750	S1	54.220	50.943	2.527	Open Manhole	1800
S1.001	o	750	S2	52.800	50.681	1.369	Open Manhole	1800
S1.002	o	1200	S3	52.800	50.202	1.398	Open Manhole	2100
S1.003	o	225	S4	52.380	49.860	2.295	Open Manhole	2100

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	43.225	165.0	S2	52.800	50.681	1.369	Open Manhole	1800
S1.001	7.855	270.9	S3	52.800	50.652	1.398	Open Manhole	2100
S1.002	52.558	269.5	S4	52.380	50.007	1.173	Open Manhole	2100
S1.003	11.498	36.6	S	52.340	49.546	2.569	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.132	0.132	0.132
1.001	User	-	100	0.071	0.071	0.071
1.002	User	-	100	0.039	0.039	0.039
1.003	User	-	100	0.014	0.014	0.014
				Total	Total	Total
				0.256	0.256	0.256

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	52.340	49.546	49.550	0	0

Online Controls for Storm

Hydro-Brake Optimum® Manhole: S4, DS/PN: S1.003, Volume (m³): 65.8

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	105
Invert Level (m)	49.896
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**	**Control Points**	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.000	5.0	Kick-Flo®	0.636	4.0
Flush-Flo™	0.295	4.9	Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	3.6	0.800	4.5	2.000	6.9	4.000	9.5	7.000	12.4
0.200	4.8	1.000	5.0	2.200	7.2	4.500	10.1	7.500	12.8
0.300	4.9	1.200	5.4	2.400	7.5	5.000	10.6	8.000	13.2
0.400	4.9	1.400	5.8	2.600	7.8	5.500	11.1	8.500	13.6
0.500	4.7	1.600	6.2	3.000	8.3	6.000	11.5	9.000	14.0
0.600	4.3	1.800	6.5	3.500	8.9	6.500	12.0	9.500	14.4

Storage Structures for Storm

Porous Car Park Manhole: S1, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	49.7
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	138.1	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	53.920	Cap Volume Depth (m)	0.000

Tank or Pond Manhole: S3, DS/PN: S1.002

Invert Level (m) 51.430

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	144.0	0.600	144.0	1.200	144.0	1.800	0.0	2.400	0.0
0.100	144.0	0.700	144.0	1.201	0.0	1.900	0.0	2.500	0.0
0.200	144.0	0.800	144.0	1.400	0.0	2.000	0.0		
0.300	144.0	0.900	144.0	1.500	0.0	2.100	0.0		
0.400	144.0	1.000	144.0	1.600	0.0	2.200	0.0		
0.500	144.0	1.100	144.0	1.700	0.0	2.300	0.0		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.243
Site Location	GB 453050 272650 SP 53050 72650	E (1km)	0.298
C (1km)	-0.026	F (1km)	2.457
D1 (1km)	0.363	Cv (Summer)	0.750
D2 (1km)	0.302	Cv (Winter)	0.840

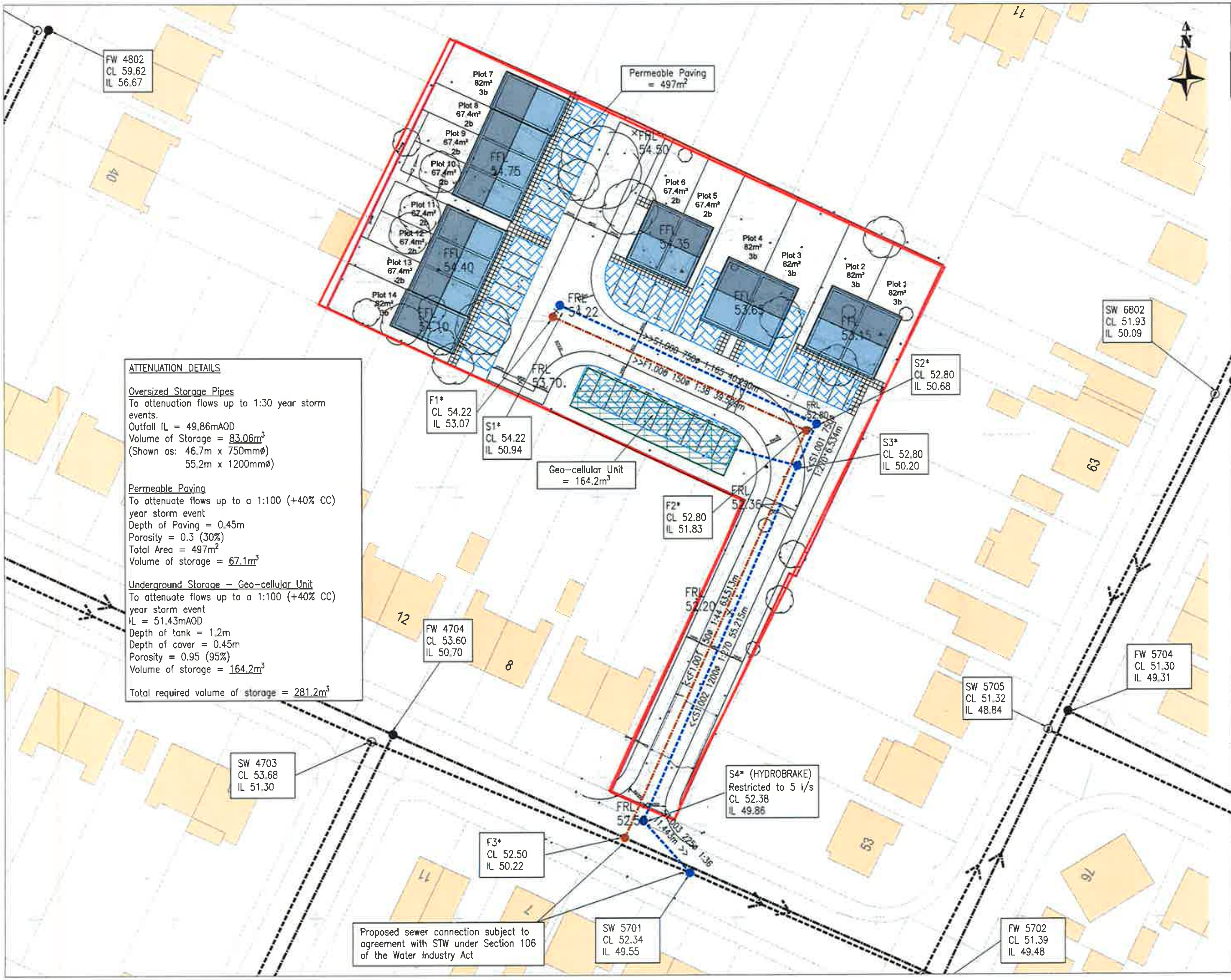
Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	1440 Winter	100	+40%	100/60 Winter				
S1.001	1440 Winter	100	+40%	30/180 Winter				
S1.002	1440 Winter	100	+40%	30/180 Winter				
S1.003	480 Winter	100	+40%	1/15 Summer	100/480 Winter			2

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	52.346	0.653	0.000	0.01	0.0	4.2	SURCHARGED
S1.001	S2	52.346	0.915	0.000	0.02	0.0	6.4	SURCHARGED
S1.002	S3	52.346	0.944	0.000	0.00	0.0	2.6	SURCHARGED
S1.003	S4	52.380	2.295	0.430	0.10	0.0	7.3	FLOOD

APPENDIX G



GENERAL NOTES

1. DO NOT SCALE THIS DRAWING.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SPECIALIST DESIGN DRAWINGS AND DETAILS.
3. ALL DIMENSIONS AND LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
4. THIS DRAWING IS FOR STRATEGY PURPOSES ONLY AND IS NOT TO BE USED FOR CONSTRUCTION PURPOSES.

KEY

- SITE BOUNDARY
- PROPOSED SURFACE DRAINAGE
- EXISTING FOUL WATER DRAINAGE
- PROPOSED FOUL WATER DRAINAGE
- EXISTING SURFACE WATER DRAINAGE
- PERMEABLE PAVING
- GEO-CELLULAR STORAGE UNIT
- SW 5701 CL 52.34 IL 49.55 — COVER AND INVERT LEVEL TAKEN FROM SEVERN TRENT WATER SEWER RECORDS
- S3* CL 53.08 IL 50.15 — PROPOSED COVER AND INVERT LEVELS FOR PROPOSED SEWER SYSTEMS
- FRL 54.37 — PROPOSED FINISH ROAD LEVELS
- FFL 53.35 — PROPOSED FINISH FLOOR LEVELS

REV	AMENDMENTS	DRN	CHK	DATE
A	UPDATE GENERAL TO MEET THE LATEST PROPOSED SITE LAYOUT	BH	BD	17.05.16

PROJECT: HARBURY STREET BURTON-UPON-TRENT STAFFORDSHIRE

DRAWING TITLE: DRAINAGE STRATEGY

CLIENT: ANDREW GRANGER & CO

DRAWING NUMBER: 21420_01_230_01

REVISION	SHEET SIZE	SCALE
A	A1	1:250
DRAWN BY: BD	CHECKED BY: NO	DATE: 14.04.2016

STATUS: PRELIMINARY

M-EC

APPENDIX H

Wellington House Leicester Road Ibstock Leicestershire LE67 6HP

Telephone 01530 264753
Email group@m-ec.co.uk
www.m-ec.co.uk

M·EC

Project No	21420
Sheet	1 of 4
Engineer	BD
Date	05/05/2016
Revision	-

DESIGN CALCULATIONS FRONT SHEET

SCHEME	Harbury Street, Burton-upon-Trent
CLIENT	Andrew Granger
ASPECTS OF SCHEME TO BE DESIGNED	Soil Infiltration Test
CODES OF PRACTICE, DESIGN SPECIFICATIONS & BRITISH STANDARDS	BRE Digest 365, 2007, Soakaway Design.
NOTES	Proven sequence of soil strata: TOPSOIL comprising: compacted clay and rubble (bricks, roots, building blocks) No superficial deposits have been identified. MERCIA MUDSTONE comprising (locally indistinctly laminated) brown locally mottled grey silty CLAY with mudstone lithorelicts and occasional thin bands of mudstone.

INDEX

Pages	Calculations	Checked by	Date
2 - 3	Soakage Test Results (Pits 1 - 2)	NO	05/05/2016
4	Soakage Pit Location Plan	NO	05/05/2016

M-EC
Wellington House, Leicester Road, Ibstock, Leicestershire LE9 4BP
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Scheme	**Harbury Street, Burton-upon-Tent**	Page No.	2
Client	**Orbit Homes**	Calcs by	BD
Job ref.	**21420**	Date	11/04/16

Soil infiltration test

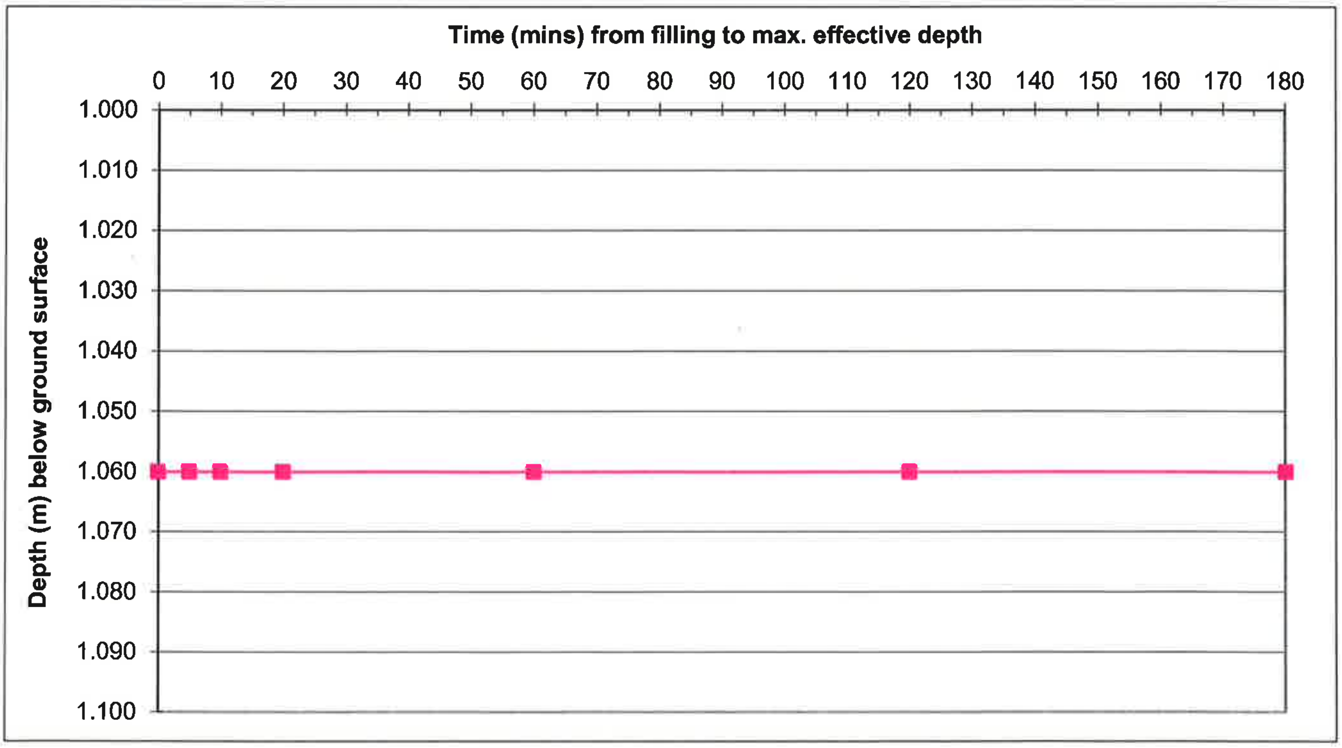
(in accordance with BRE Digest 365, 2007, Soakaway Design)

Trial pit ref.	**TP1**
Length	**1.70** m
Width	**0.40** m
Depth	**1.50** m
Ground water level	**Not found** m
Ground conditions	**(0.00-0.20) Compacted Mix of Clay and Rubble** **(0.20-0.80) Firm Brown Silty Clay** **(0.80-1.50) Firm Stiff Brown Clay / Mudstone**

Time mins	Depth to water
0	1.060
5	1.060
10	1.060
20	1.060
60	1.060
120	1.060
180	1.060

Effective storage depth =	0.440 m
75% effective storage depth =	0.33 m
(ie depth below GL) =	1.17 m
25% effective storage depth =	0.11 m
(ie depth below GL) =	1.39 m
effective storage depth 75%-25% =	0.22 m
Time to fall to 75% effective depth =	0 mins
Time to fall to 25% effective depth =	0 mins
V (75%-25%) =	0.1496 m3
a (50%) =	1.6040 m2
t (75%-25%) =	0 mins
SOIL INFILTRATION RATE =	**#DIV/0! m/s**

Soakage too slow to calculate Infiltration Rate



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Soil infiltration test

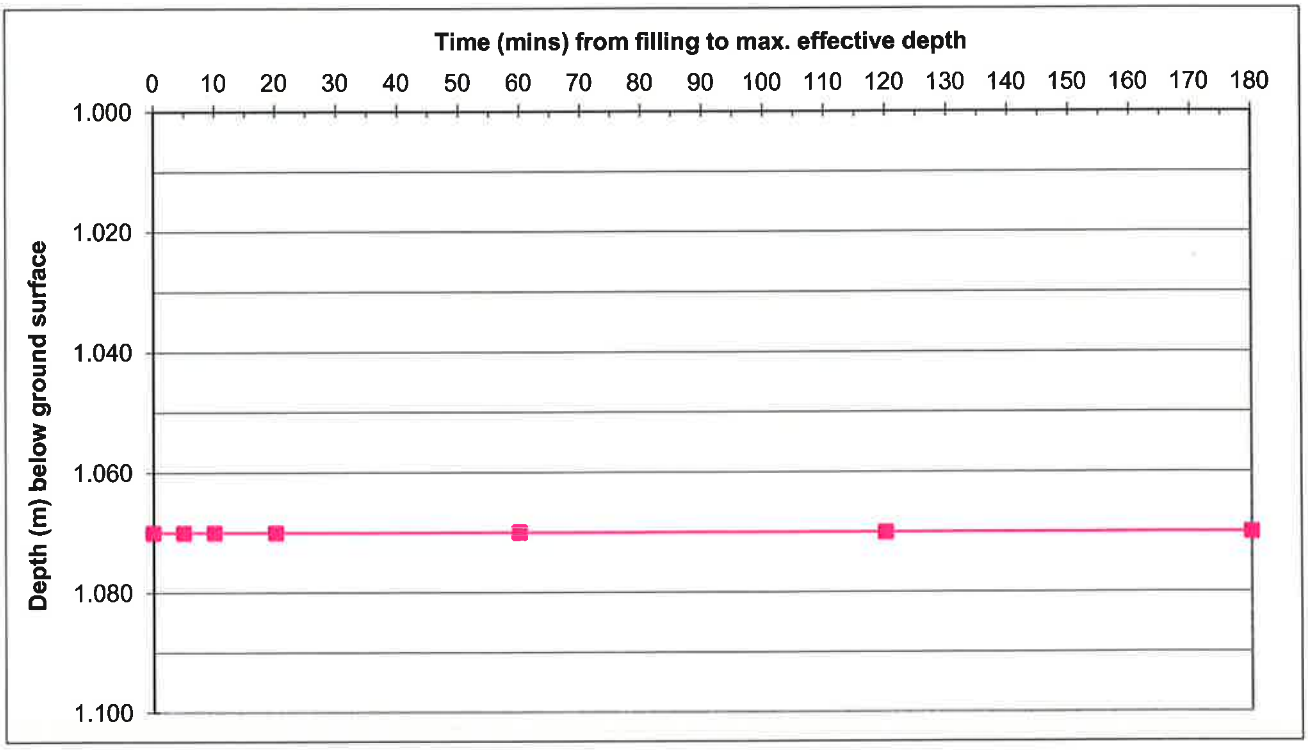
(in accordance with BRE Digest 365, 2007, Soakaway Design)

Trial pit ref.	**TP2**
Length	**1.70** m
Width	**0.40** m
Depth	**1.55** m
Ground water level	**Not found**
Ground conditions	**(0.00-0.20) Compacted Mix of Clay and Rubble**
	(0.20-0.80) Firm Brown Silty Clay
	(0.80-1.55) Firm Stiff Brown Clay / Mudstone

Time mins	Depth to water
0	1.070
5	1.070
10	1.070
20	1.070
60	1.070
120	1.070
180	1.070

Effective storage depth =	0.48	m
75% effective storage depth =	0.36	m
(ie depth below GL) =	1.19	m
25% effective storage depth =	0.12	m
(ie depth below GL) =	1.43	m
effective storage depth 75%-25% =	0.24	m
Time to fall to 75% effective depth =	0	mins
Time to fall to 25% effective depth =	0	mins
V (75%-25%) =	0.1632	m3
a (50%) =	1.6880	m2
t (75%-25%) =	0	mins
SOIL INFILTRATION RATE =	**#DIV/0!**	**m/s**

Soakage too slow to calculate Infiltration Rate



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Leicester Road
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SOAKAGE PIT LOCATION PLAN

Project:	**HARBURY STREET, BURTON-ON-TRENT**
File Ref:	**21420**
O.S. Grid Ref:	**423514, 324855**
Postcode:	**DE13 0RU**

Civil Engineering

Drainage

Flood Risk

Transport

Highways

Structures

Geotechnics

Contamination

Sustainability

Environment

Services

Surveying

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