Technical Note 1: Flood Risk and Drainage Appraisal

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Final A



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1.0 Introduction

Project:

Date:

Issue:

Prepared by:

Approved by:

1.1 Motion has been instructed by Barratt David Wilson Homes to provide flood risk and drainage advice in relation to a proposal to provide 200 new dwellings on land to the south of Crawley Down Road. The site is identified in Mid Sussex District Council's SHELAA with reference 196. The site itself lies within Mid-Sussex District (County of West Sussex) with the access in Tandridge (Surrey County Council).

Crawley Down Road, Felbridge, East Grinstead

- 1.2 The site lies within Felbridge, which is strategically located to the east of Crawley and north west of East Grinstead.
- 1.3 The development is located on the south side of Crawley Down Road, which runs west from Felbridge village centre. A site location plan can be found at **Appendix A**.
- 1.4 The existing site is classed as greenfield and is currently used for agricultural purposes. The proposed is for the construction of a new residential area with new access road to the site. An illustrative layout can be found at **Appendix B**.

2.0 Existing Site Conditions

Geology and Groundwater

- 2.1 The British Geological Survey (BGS) online Geoindex Mapping indicates that the site is underlain by Upper Tunbridge Wells Sand - Sandstone and Siltstone, Interbedded with no superficial deposits recorded. Also, there is a small part of the site underlain by Upper Tunbridge Wells Sand – Mudstone with no superficial deposits recorded. This indicates that the use of infiltration methods may be possible, subject to an infiltration test.
- 2.2 There is a borehole close to the site which confirms the data from BGS map and can be found at **Appendix C**.

Existing Surface Water

2.3 UK Suds has been used to calculate the QBar Greenfield runoff rate for the site as 52.49l/s. This output can be found in **Appendix D**.

Existing Foul Water

2.4 Southern Water sewer records can be found in full in **Appendix E**. The plans show an existing public foul water sewer running along Crawley Down Road. The nearest foul water manhole is MH5501 with 89.5m AOD cover level and 87.61m AOD invert level.

Proposed Foul Water

- 2.5 The site falls from north-west to south-east with levels between 90.0m AOD and 85.0m AOD.
- 2.6 As the existing public foul water sewer is located within Crawley Down Road (north-west of the site), the proposed foul water cannot discharge into the existing sewer by gravity and will need to be pumped.



3.0 Sustainable Drainage Overview and Hierarchy

- 3.1 Current planning policy and Environment Agency (EA) guidance requires developments to employ SuDS techniques wherever feasible. Careful design of SuDS features can ensure that the site surface water drainage closely reflects the natural hydrology and hydrogeology of the predeveloped greenfield site.
- 3.2 SuDS will attenuate and treat surface water run-off quantities at source (source control) in line with National Planning Policy Framework (NPPF) and EA policies. This use of SuDS is needed to replicate the pre-developed Greenfield conditions so as not to increase flood risk to the site or surrounding sites by managing excess run-off at the source.
- 3.3 The key benefits of SuDS are as follows:
 - Improving water quality over a conventional piped system by removing pollutants from diffuse pollutant sources (e.g. roads);
 - > Improving amenity through the provision of open green space and wildlife habitat; and
 - ▶ Enabling a natural drainage regime which recharges groundwater (where possible).
- 3.4 SuDS provide a flexible approach to drainage, with a wide range of components from house soakaways to large-scale basins or ponds. The individual techniques should be used where possible in a management train which mimics the natural pre-development pattern of drainage. The Interim Code of Practice for SuDS set out the hierarchy of techniques. These are:
 - Prevention the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution;
 - Source control control of runoff at or very near its source (such as permeable paving or soakaways for individual houses);
 - Site control management of water from several sub-catchments (including routeing water from roofs and car parks to one large soakaway or infiltration basin for the whole site); and
 - > Regional control management of runoff from several sites, typically in a detention pond or wetland.
- 3.5 Figure 4.1 shows the SuDS drainage hierarchy from the Ciria SuDS Manual C753.



The SUDS Hierarchy

Figure 3.1 SuDS Hierarchy - Ciria C753



- 3.6 Figure 4.1 details the sustainability level of each of the SuDS techniques, as well as the SuDS system suitability within 3 general criterial areas:
 - Flood Reduction;
 - Pollution Reduction; and
 - Landscape and Wildlife Benefit.
- 3.7 Ideally, any designed SuDS system should be multi-functioning, fulfilling as many of the criteria areas as possible.

SuDS Treatment Trains and Maintenance

3.8 The SuDS treatment train can be defined as an integrated sequence of measures in a SuDS scheme which, taken together, control volumes of run off and reduce pollution before discharge. These measures are designed to mimic the natural catchment processes.

Existing site

SuDS Hierarchy

3.9 Options for the destination for the run-off generated on site have been assessed in line with the prioritisation set out in the Building Regulations Part H document and DEFRA's Draft National Standards for SuDS are detailed in table 3.1 below:

Discharge to Ground	Yes
Discharge to Watercourse	Yes
Discharge to Surface Water Sewer	No
Discharge to Other Sewer	No

Table 3.1 – Run-off destination options



SuDS Feature	Environmental benefits	Water quality improvement	Suitability for low permeability soils (k<10-6)	Ground- water recharge	Suitable for small / confined sites?	Site specific restrictions	Appropriate for subject site?	
Wetlandns	\checkmark	\checkmark	✓	х	x	N/A	No	
Retention ponds	~	~	\checkmark	х	x	None	Yes	
Detention basins	~	~	~	Х	x	None	Yes	
Infiltration basins	~	× ×		\checkmark	~ х		Yes	
Soakaways	х	~	х	\checkmark	~	None	Yes	
Underground storage	х	х	~	х	~	N/A	No	
Swales	~	~	\checkmark	\checkmark	x	None	Yes	
Filter strips	~	~	\checkmark	\checkmark	x	X N/A		
Rainwater harvesting	х	~	\checkmark	\checkmark	~	None	Yes	
Permeable paving	x	~	√	\checkmark	~	None	Yes	
Green roofs	~	~	\checkmark	х	~	N/A	No	
Rain Garden (external)	~	~	\checkmark	х	x	N/A	No	
Rain Garden (planter)	~	~	~	х	x	N/A	No	

3.10 The potential for different SuDS devices has been assessed and can be seen in the table 3.2 below:

Table 3.2 – Potential for different SuDS devices

3.11 The total area of the site (based on illustrative layout) is 9.3ha (93000m2). An impermeable area of 5.6ha (60% of total area) was used to run a quick storage estimate on MicroDrainage that can be found at figures 3.1 and 3.2.



🖌 Quick Storage	Estimate		
6	Variables		
Micro	FSR Rainfall V	Cv (Summer)	0.750
Drainage	Return Period (years) 100	Cv (Winter)	0.840
Variables	Region England and Wales 🗸	Impermeable Area (ha)	5.600
Results	Map M5-60 (mm) 20.000	Maximum Allowable Discharge (I/s)	52.5
Design	Ratio R 0.350	Infiltration Coefficient (m/hr)	0.00000
Ourseign 2D		Safety Factor	2.0
Overview 2D		Climate Change (%)	40
Overview 3D			
Vt			
		Analyse OK	Cancel Help
	Enter Maximum Allowable Disch	arge between 0.0 and 999999.0	

Figure 3.1 – MicroDrainage Input parameters

🖌 Quick Storage	Estimate
	Results
Micro Drainage	Global Variables require approximate storage of between 3227 m ³ and 4623 m ³ .
Veriebles	These values are estimates only and should not be used for design purposes.
variables	
Results	
Design	
Overview 2D	
Overview 3D	
Vt	
	Analyse OK Cancel Help
	Enter Maximum Allowable Discharge between 0.0 and 999999.0

Figure 3.2 – MicroDrainage Results

3.12 The calculations show that a maximum of 4623m³ of attenuation should be provided in order to attenuate the 100 year event plus 40% climate change.



4.0 Flood Risk

4.1 In this section a number of potential sources of flooding have been considered and the probability of any likely impacts assessed.

Flooding from Rivers and the Sea

- 4.2 The nearest watercourse to the site is Felbridge Water which runs along the southern east boundary of the development.
- 4.3 The Environmental Agency (EA) Flood Map shows that the majority of the site is located within Flood Zone 1 (less than 1 in 1000 annual probability of flooding from rivers or the sea). However, part of the site is located within flood zone 2 (between 1 in 100 and 1 in 1,000 annual probability of flooding from rivers or the sea) and 3 (1 in 100 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding from rivers 1 in 200 or greater annual probability of flooding flood



Figure 4.1 Flood Zone

4.4 It is proposed to locate all properties within flood zone 1.

4.5 The site is therefore considered to be at very low risk of flooding from Rivers and Sea.

Groundwater Flooding

- 4.6 It has been identified using public data provided by the British Geological Survey (BGS) that the site is underlain by Upper Tunbridge Wells Sand - Sandstone and Siltstone, Interbedded with no superficial deposits recorded. Also, there is a small part of the site underlain by Upper Tunbridge Wells Sand – Mudstone with no superficial deposits recorded.
- 4.7 The EA online mapping confirms that the site is located within a Secondary A Aquifer for the superficial deposits and bedrock level. The EA online mapping shows the site is located between a Major Aquifer Intermediate and a Minor Aquifer Intermediate groundwater vulnerability zone.



4.8 The West Sussex Strategic Flood Risk Assessment (SFRA) has no record of the site being affected by groundwater flooding.

4.9 It is therefore concluded that the site is at low risk from groundwater flooding.

Surface Water Flooding

4.10 Flooding from overland flow occurs when intense rainfall is unable to infiltrate into the ground or enter drainage systems resulting in localised flooding in low spots that provide no means of outfall.



Figure 4.2 Surface Water Flooding

4.11 The Surface Water flood map provides information concerning the risk of surface water flooding to the site. The surface water flood map shows that the majority of the site is within the area classed as 'Very Low' risk of surface water flooding (having less than 0.1% chance every year). However, there is an area at medium to high risk of surface water flooding located to the south of the site following the alignment of Felbridge Water. See Figure 4.2 above:

4.12 The majority of the site is therefore considered to be at very low risk of flooding from Surface Water.

Flooding from Infrastructure Failure

4.13 In order to control and convey surface water runoff from impermeable surfaces in urban areas, underground surface water sewers or combined sewers (foul and surface water) are often utilised in urban areas. Pipes, culverts etc. have a finite capacity and therefore pose a risk of flooding due to the risk of siltation, blockage or collapse.



4.14 Southern Water has been contacted so as to ascertain any historical sewer flood data within the area. At the time of preparing this report Southern Water has not been able to provide any evidence to suggest that the site is susceptible to flooding or has any historic flooding caused by failure of local infrastructure.

4.15 The site is therefore considered to be at low risk of flooding from infrastructure failure.

Flooding from Artificial sources

4.16 The EA provides a map showing the maximum potential flood extent, in the event that all reservoirs with a capacity of greater than 25,000 cubic metres were to fail and release the water they hold. The map shows that the site would not experience flooding in this scenario. There are no other significant artificial waterbodies in proximity of the site. It is therefore concluded that the site is not at risk of flooding from artificial sources.

4.17 The site is therefore considered to be at very low risk of flooding from artificial sources.



5.0 Summary and Conclusions

- 5.1 This flood risk addendum demonstrates that the majority of the site is located within flood zone 1 with a portion located within flood zones 2 and 3. However, it is proposed to locate all properties within flood zone 1.
- 5.2 The site's Qbar (greenfield discharge rate) has been calculated as 52.51/s using UK Suds. MicroDrainage quick storage estimate have been used to calculate the attenuation required and this is a maximum of 4623m³.
- 5.3 The proposed SuDS will be designed to cater for the 1 in 100 year plus 40% allowance for climate change event.
- 5.4 The site falls from north-west to south-east with levels between 90.0m AOD and 85.0m AOD. As the existing public foul water sewer is located within Crawley Down Road (north-west of the site), the proposed foul water cannot discharge into the existing sewer by gravity and will need to be pumped.
- 5.5 The site is at very low and low risk of flooding from all the sources (rivers and seas, groundwater flooding, surface water flooding, infrastructure failure flooding and artificial sources flooding).



Appendix A

Site Location Plan





Appendix B

Illustrative Site Layout





Appendix C

Borehole Data

Su +257.*	rface +280. Yield 360 g. UIW	Shaft 17%; rest bore. Lining tubes: 5 × 4 in f p.h. LeGrand, 1911. 57% British Geological Survey	rom 16½ down. I 57%	R. W. L.
EOLOGICAL CLASSIFICATION		NATURE OF STRATA	THICKNESS	DEPTH
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S. Buchan . 4. 4. 40 .				
British G	ological Survey	British Geological Survey	Briti	h Geological Survey
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British Geological Survey		British Geological Survey	British Geological Survey	
British G	edogical Survey	British Geological Survey	Briti	sh Geological Survey
British Geological Survey		British Geological Survey	British Geological Survey	



Appendix D

UK SuDS QBar Calculations



Calculated by:	
Site name:	Crawley Down Road
Site location:	Felbridge

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Site coordinates

Latitude:	51.13617° N
Longitude:	0.05252° W
Reference:	
Date:	2019-08-14 08:11

IH124	4									
Site characteristics										
		9.3								
Methodology										
Qbar estimation method Calculate fro										
SPR estimation method Calculate fro										
		4	4							
		0.47	0.47							
eristic	s	Default	Edited							
		800	800							
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year		0.85	0.85							
Growth curve factor: 30 year										
00 yea	ar	3.19	3.19							
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Notes:

(1) Is Q _{BAR} < 2.0 l/s/ha?
(2) Are flow rates < 5.0 l/s?
(3) Is SPR/SPRHOST \leq 0.3?

Greenfield runoff rates	Default	Edited
Qbar (l/s)	52.49	52.49
1 in 1 year (l/s)	44.62	44.62
1 in 30 years (l/s)	120.73	120.73
1 in 100 years (l/s)	167.45	167.45

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for use of this data in the design or operational characteristics of any drainage scheme.



Appendix E

Southern Water Asset Mapping



Motion 84 North Street Guildford Surrey GU1 4AU

 Your ref
 bafelb/160741

 Our ref
 348016

 Date
 12 August 2019

 Contact
 searches@southernwater.co.uk Tel 0845 272 0845 0330 303 0276 Fax 01634 844514

Attention: Ana Sofia Moreira

Dear Customer

Re: Provision of public sewer record extract

Location: 123 Crawley Down Road, Felbridge, Surrey RH19 2PS

Thank you for your order regarding the provision of extracts of our sewer and/or water main records. Please find enclosed the extracts from Southern Water's records for the above location.

We confirm payment of your fee in the sum of £49.92 and enclose a VAT receipt for your records.

Customers should be aware that there are areas within our region in which there are neither sewers nor water mains. Similarly, whilst the enclosed extract may indicate the approximate location of our apparatus in the area of interest, it should not be relied upon as showing that further infrastructure does not exist and may subsequently be found following site investigation. Actual positions of the disclosed (and any undisclosed) infrastructure should therefore be determined on site, because Southern Water does not accept any responsibility for inaccuracy or omission regarding the enclosed plan. Accordingly it should not be considered to be a definitive document.

Should you require any further assistance regarding this matter, please contact the LandSearch team.

Yours faithfully

LandSearch

VAT receipt

Ordered by: Motion North Street Guildford Surrey GU1 4AU

VAT registration number:813 0378 56Order reference:348016Your reference:bafelb/160741

Receipt for provision of an extract from the public sewer and/or water main records.

Location	Costs
123 Crawley Down Road Felbridge Surrey RH19 2PS	£41.60
Net total	£41.60
VAT	£8.32
Total	£49.92
Paid	Paid in full

Thank you for your payment:

Received on: 7 August 2019

For enquiries regarding the information provided in this receipt, please contact the LandSearch team:

Tel: 0845 270 0212 0330 303 0276 (individual consumers)

Email: searches@southernwater.co.uk

Web: www.southernwater.co.uk

LandSearch Southern Water Services Southern House Capstone Road Chatham Kent ME5 7QA





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