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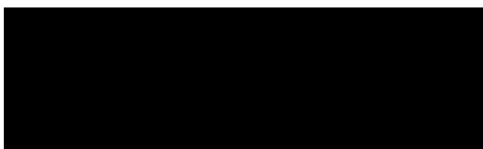
FLOOD RISK & DRAINAGE ASSESSMENT

Burndell Road, Yapton, West Sussex BN18 0HR

For Brookworth Homes Limited

MARCH 2015

Stilwell Limited
Consulting Engineers
Satelliet House
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Version No: 4.0



Stilwell Partnership
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Approvals

This document requires the following approvals:

Name	Title & Organisation
David Brooke	Director – Stilwell Limited

Distribution

This document has also been distributed to:

Name	Organisation
Gavin Rowley	Brookworth Homes Limited
Cian Cronin	Arun District Council
John Escott	Robinson Escott Planning

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1.0 INTRODUCTION

- 1.1 Brookworth Homes Limited is in the process of submitting a Planning Application for a residential scheme, at land to the south of Burndell Road, Yapton, West Sussex, BN18 0HR.
- 1.2 The Stilwell Partnership has been instructed by Brookworth Homes Limited, to produce a Flood Risk Assessment (FRA) to comply with NPPF.
- 1.3 This report aims to demonstrate that the development is located in an area of low annual probability of flooding and it does not increase the likelihood of flooding elsewhere.

2.0 LOCATION OF SITE

- 2.1 The site is located to the south of the B2233 Burndell Road, to the west of Fordwater Gardens. A Site Location Plan is shown in **Appendix A**.
- 2.2 The Local Authorities serving the site are West Sussex County Council and Arun District Council.

3.0 DESCRIPTION OF SITE

Existing Site

- 3.1** The site is primarily farm land with no previous development.
- 3.2** The site is generally reasonably flat with a slight fall from north to south. Levels range from 7.12m AOD in the north to 6.30m AOD in the south. A Topographical Survey is attached at **Appendix B**.

Existing Drainage

- 3.3** Sewer records provided by Southern Water indicate an existing 175mm diameter foul water sewer running along Burndell Road.
- 3.4** The topographical survey shows a comprehensive ditch system surrounding the site with a sizeable ditch running along the southern and western boundary of the site.

Geology

- 3.5** Boreholes in the local area indicate that the site would be primarily formed on Lewes Nodular Chalk described as follows:

“Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Forma. Sedimentary Bedrock formed approximately 71 to 94 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.

Setting: warm chalk seas. These rocks were formed in warm shallow 'Chalk' shelf seas with little sediment input from land. They often consist of a calcareous ooze of the microscopic remains of plankton, especially the disc shaped calcite plates or coccoliths that make up the spherical coccolithophores.”

Hydrogeology

- 3.6** The Environment agency online maps indicate that the site does not lie within any groundwater protection zones. The Environment Agency Groundwater Map can be found at **Appendix C**.
- 3.7** The Environment Agency online maps indicate that the site lies within a Major Aquifer Intermediate zone. This is defines the chalk strata beneath the site as:

“These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.”

Hydrology

- 3.8** The nearest watercourse is the Ryebank Rife which can be found approximately 500m to the west and 750m to the south of the site. Smaller watercourses can be found closer to the site include ditches located along the southern and western boundary of the site.

Existing Surface Water Run-off

- 3.9** The Greenfield run-off rates have been calculated for the existing site. The existing site run-off rates have been calculated using the Institute of Hydrology's Report 124 'Flood Estimation for Small Catchment' using WinDES design software. The output from the software analysis can be found at **Appendix D**.
- 3.10** The run-off rate has been calculated for the site for different storm return periods. This rate has been multiplied by a growth factor of 0.88 for a 1 in 2 year storm event and 3.19 for a 1 in 100 year storm event. The run-off rates calculated for the range of return period are as shown in **Table 1** and they are based on 2.25 hectares for the site.

Table 1 Greenfield Run-off Rates

Return Event	Q ₂	Q _{bar}	Q ₁₀	Q ₃₀	Q ₁₀₀
Run-off Rates (l/s)	10.4	11.8	19.1	26.7	37.6

- 3.11** The run-off rate of 10.4 l/s will be used for design purposes should there be a requirement to positively drain the surface water.

4.0 DEVELOPMENT PROPOSAL

4.1 The proposal is to convert the existing parcel of land into developable land and build 45 residential units (a mixture of houses and apartments). The proposal will include a new access point from Burndell Road and improvement works to the existing highway. The Proposed Site Layout Plan is attached at **Appendix E**.

4.2 Post-development, the overall site area will remain as per existing. However, the amount of impermeable at the site will increase from to 3,560m² of roof area and 4,890m² of access road/parking.

Surface Water

4.3 A surface water drainage system will be designed at the detailed design stage and will promote sustainable design. The Proposed Drainage Schematic Layout can be found at **Appendix F**.

4.4 It is proposed that all internal parking areas and drives be constructed as permeable surfaces. Runoff from the roof areas will be collected in water butts that will be fitted with overflows discharging into the surface water sewer system.

4.5 The permeable paving systems will be performance designed by a specialist to enable them to accommodate impermeable area typically up to 50% greater than the area of paving. This will enable the direct discharge of rainwater pipes into the permeable layers and reduce the rate of flow for water into the drainage system (subject to detailed design).

4.6 Swales and conveyance channels will be promoted as part of the landscaping design and integrated with the surface water drainage network to provide a sustainable solution for surface water conveyance and attenuation.

4.7 All surface water run-off from site will be restricted to the flow for a 1 in 1 year storm event. Any excess water up to a 1 in 100 year storm event including 30% climate change will be attenuated within the curtilage of the site in swales and an attenuation pond located in the South West corner.

4.8 National SuDS standards and Sewers for Adoption recommend that the 1 in 30 year storm event is managed below ground with exceedance flows managed above ground.

4.9 The British Geological Survey, Geology Map of Britain shows the site to be underlain by chalk. Therefore the possibility of infiltration should be considered pending on-site infiltration tests. If infiltration is not feasible then all surface water will gravitate to a pond located in the south west corner, as shown on the layout plans. Water will then be attenuated and will either discharge into the ditch located on the southern boundary, at a restricted rate or infiltrate into

the existing ground. The proposed attenuation measures shown in this strategy report have assumed zero infiltration into the ground. The pond is to be designed to maintain a constant level of water in the dry periods.

- 4.10** An initial storage estimate in Micro Drainage software has returned the following attenuation volumes required on site:

1 in 30 year storm plus climate change: 220m² to 350m²

1 in 100 year storm plus climate change: 400m² to 600m²

- 4.11** Using an assumption that 50% of the attenuation volume is to be stored in the pond (and 50% in the swales and permeable paving system), there is an average operating depth of the proposed pond of 0.95m,

Foul Water

- 4.12** A simple gravity system will be provided at the detailed design stage, this will connect into the nearest public sewer located in Burndell Road at existing manhole No. 5902 at an invert level of 5.26m AOD (for a 175mm diameter pipe). Levels dictate that the connection will need to be pumped subject to a detailed design and an indicative location has been shown on the attached Proposed Drainage Layout (see **Appendix F**). A capacity check has been issued to Southern Water to ensure that there is capacity in the local network.
- 4.13** The initial response from Southern Water (see **Appendix G**) shows that the proposed foul water flows will discharge into the Ford Water treatment works. A review of the existing sewer capacity indicates there will be the need to upgrade approximately 500m of public sewer to accommodate the additional flows. The exact limit of the work will have to be agreed with Southern Water as there are a number of developments in the area and all the works need to be coordinated to avoid unnecessary excavations.
- 4.14** The expected foul water flows are 2.31 litres per second based on 4000 litres per dwelling per day in accordance with Sewers for Adoption 7th Edition.

5.0 FLOODING INFORMATION

- 5.1 The recently updated interactive flood maps available from the Environment Agency (EA) website show the site to fall outside of any area at risk of flooding from rivers. The flood mapping shows the site to be in an area classified as having a 'very low' annual probability of flooding from any river. The EA classify areas having a very-low flood risk as;

'There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year'.

Information from the EA website is included at **Appendix H** which locates the site within Flood Zone 1.

- 5.2 Since the site lies within Flood Zone 1, no further information was sought from the Environment Agency.

6.0 FLOOD RISK

- 6.1** The proposed development is to be residential in nature and therefore is classified, according to Table 2 of NPPF as “more vulnerable”. It has been proven that all dwellings will be constructed in Flood Zone 1 i.e. land assessed as having an annual probability of flooding greater than 1 in 1000 years. Therefore, according to NPPF Table 3 ‘Flood Risk Vulnerability and Flood Zone Compatibility’, all development is appropriate in this area.

Table 3: Flood risk vulnerability and flood zone ‘compatibility’

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	*	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	*	*	*

Key: ✓ Development is appropriate.
 * Development should not be permitted.

Flood Sources

- 6.2** There is a requirement under NPPF to assess all possible flood risks to the site. The potential for flooding from a wide range of sources will therefore be considered here. Due to the topography of the site, surface water or overland flooding is considered the most likely from the adjacent ditch, groundwater, fluvial, sewer and reservoir flood are secondary.

Fluvial Flood risk

- 6.3** The nearest river to the site is the Ryebank Rife which is located to the west and south of the site. The EA flood mapping shows that there is no danger from fluvial flooding on this site.

Historic Flood Data

- 6.4** The West Sussex Strategic Flood Risk Assessment (SFRA) contains information on historical flood events in the county. Their mapping indicates no major historical flood events in the Yapton area near the site.

Groundwater

- 6.6** Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata. A ground water flood event results from a rise in ground water level sufficient for the water table to intersect the ground surface and inundate low lying land. Groundwater floods may emerge from either a single point or diffuse locations.
- 6.7** There is no evidence that the site has been affected by a groundwater flooding incident. There is also no recorded groundwater flooding incidents for that area in the West Sussex SFRA.
- 6.8** Due to the topography of the site and it being underlain by Lewes Nodular Chalk, which will allow infiltration, the risk of groundwater flooding is minimal and can be discounted.

Flooding from sewers

- 6.9** Flooding from sewers can occur due to the different reasons; if sewers are blocked during the heavy rainfalls, or if sewer cannot provide adequate capacity, then flooding can cause a large amount of damage.
- 6.10** There is no indication of any historical problems with the foul water sewer in Burndell Road in the West Sussex SFRA.

Surface Water Flooding

- 6.11** Flooding of land from surface water run-off is usually caused by intense rainfall that may only last a few hours. Usually this occurs in lower lying areas often where the drainage system is unable to cope with the volume of water.
- 6.12** Development may increase surface water flood risk by increasing impermeable surface area and thus run-off volume. The development will promoted the use of permeable surfacing techniques for parking areas and driveways and look to incorporate SuDS, in the form of a pond and infiltration trenches, to minimise run-off from the site.

Reservoirs Flood Risk

- 6.13** Flooding due to reservoir failure occurs if there is a catastrophic failure of a reservoirs structure. Reservoir flooding is extremely unlikely due to reservoirs being constantly inspected and supervised, in line with the Reservoirs Act 1975. The Environment Agency enforces this.
- 6.14** There are no reservoirs located close to the site or near Yapton so the site will not be at risk of reservoir flooding.

7.0 DRY ESCAPE ROUTE

- 7.1** During an extreme flood event, up to and including the 1 in 1000 year event, all dwellings within the site would remain unaffected. However, if residents / users need to evacuate a dry route of escape will be available. Residents / users should exit the site north onto Burndell Road.

8.0 FLOOD COMPENSATION

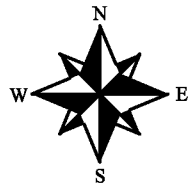
- 8.1** Since the site lies within Flood Zone 1, no flood compensation measures are required.

9.0 SUMMARY AND CONCLUSIONS

- 9.1** Brookworth Homes Limited are in the process of submitting a Planning Application for a residential scheme at land to the south of Burndell Road, Yapton, West Sussex, BN18 0HR.
- 9.2** The Stilwell Partnership has been instructed by Brookworth Homes Limited to produce a Flood Risk Assessment under NPPF to support a Planning Application.
- 9.3** The site is located to the south of Burndell Road. The site at present is predominantly agricultural land.
- 9.4** This report has shown that all proposed dwellings will be outside of any flood extent up to and including the 1 in 1000 year event.
- 9.5** This report has shown that there is minimal flood risk from any other source at the site.
- 9.6** In order to accommodate the foul water discharge from site it will be necessary to upgrade some of the local foul sewers.
- 9.7** This Flood Risk Assessment has confirmed that the proposed development is appropriate and sustainable in the terms as set out in NPPF.

APPENDIX A

Site Location Plan



THIS IS A CONTROLLED
DOCUMENT

Stilwell
PARTNERSHIP
SAFETY, TRAFFIC & HIGHWAY
ENGINEERING CONSULTANTS

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Web: www.stilwell-ttd.co.uk

PROJECT: Land off Burndell Road Yapton, West Sussex	
TITLE: Site Location Plan	
SCALE: NTS @ A4	DRAWN: AL
DATE: JANUARY 2014	CHECKED:
DWG No:	TSP/BRO/P2555/03

APPENDIX B

Topographical Survey

APPENDIX C

Environment Agency Groundwater Map

Map legend

- ☒ Groundwater source protection zones 
- ☐ Aquifer Maps - Superficial Deposits Designation 
- ☐ Aquifer Maps - Bedrock Designation 
- ☒ Groundwater Vulnerability Zones 
- ☒ Major Aquifer High
- ☐ Major Aquifer Intermediate
- ☐ Major Aquifer Low
- ☐ Minor Aquifer High
- ☐ Minor Aquifer Intermediate
- ☐ Minor Aquifer Low

Map of X: 498,564; Y: 102,887 at scale 1:10,000

Data search  Text only version 



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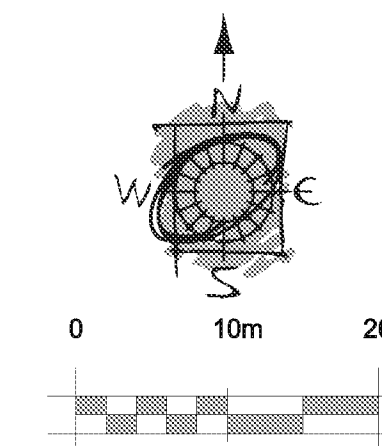
APPENDIX D

Greenfield Run-off Calculations

The Stilwell Partnership		Page 1
Satelliet House 2 Nexus Park Ash Vale GU12 5QE	Burndell Road Yapton P2551	
Date 24/01/2014 13:43 File	Designed by A Johnson Checked by D Brooke	
Micro Drainage Source Control 2013.1.1		
<u>IH 124 Mean Annual Flood</u> Input Return Period (years) 1 Soil 0.400 Area (ha) 2.250 Urban 0.000 SAAR (mm) 756 Region Number Region 7 Results l/s QBAR Rural 11.8 QBAR Urban 11.8 Q1 year 10.0 Q1 year 10.0 Q2 years 10.4 Q5 years 15.1 Q10 years 19.1 Q20 years 23.6 Q25 years 25.3 Q30 years 26.7 Q50 years 30.9 Q100 years 37.6 Q200 years 44.2 Q250 years 46.3 Q1000 years 60.8 Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required area. The ICP SUDS tab will do this automatically.		
©1982-2013 Micro Drainage Ltd		

APPENDIX E

Proposed Site Layout



OSP
ARCHITECTURE

Proposed Sketch Layout Plan
Burndell Road, Yapton
14004 / C101D
Scale 1:500 @ A1 March 2015

APPENDIX F

Proposed Drainage layout