Glanville

FLOOD RISK ASSESSMENT

Fewcott Road, Fritwell

Prepared for: CALA Homes (Chiltern) Ltd
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Document History

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1	19 Mar 19	First Re-Issue	S McNair	K Rayner
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Glanville

Glanville Consultants is a multi-disciplinary engineering, design and surveying consultancy with the following expertise:

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Appendices

1.0 Introduction

1.1 This Flood Risk Assessment has been prepared by Glanville Consultants on behalf of CALA Homes (Chiltern) Ltd in support of an outline planning application to develop land off Fewcott Road, Fritwell to provide 38 new homes.

1.2 The purpose of this document is to assess the existing level of flood risk to the site and its surroundings within the context of the development proposals and to demonstrate a suitable drainage strategy for the disposal of surface water from the site.

1.3 This report has been prepared in accordance with the National Planning Policy Framework (NPPF), dated July 2018, and the Planning Practice Guidance (PPG) to the NPPF, dated March 2014.

1.4 This assessment was undertaken with reference to information provided and/or published by the following bodies:

- Ordnance Survey;
- British Geological Society;
- Cherwell District Council; and
- Environmental Agency.

1.5 This report concludes that the site is not at risk of flooding and can be developed safely without increasing flood risk elsewhere, and that the development proposals comply with relevant planning policy concerning flood risk. The report demonstrates that suitable provision for the disposal of surface water from the proposed development is capable of being provided.

2.0 Site Description and Proposed Development

Site Description

2.1 The site is located in the village of Fritwell, approximately 7km north-west of Bicester. The approximate centre of the site is located at Ordnance Survey National Grid reference SP 52957 29070 and a nearby postcode is OX27 7QP. A site location plan is included as Appendix A.

2.2 The site is roughly rectangular in shape and extends to approximately 1.57ha in area. The vast majority of the land on-site was previously used as agricultural fields, with a residential dwelling and an out building located close to the sites eastern corner. The site is almost entirely lined by a combination of trees and hedgerows, with breaks for the sites access points from Fritwell Road.

2.3 The site is bound by Fritwell Road/Fewcott Road on the sites north-eastern boundary, residential dwellings to the north-west and agricultural fields to the south-west. A Private unmetalled track leading to Lodge Farm and a drainage ditch forms the sites south-eastern boundary. Access to the site is proposed to be gained by widening one of the sites existing access points on the north-eastern boundary.

Topographical Survey

2.4 A copy of the detailed topographical survey of the site by Groundsurveys Ltd, drawing numbers 6028-01 and 6028-02 are included as Appendix B. The survey indicates that the site generally falls towards south of the site with levels ranging from approximately 128.20m AOD to 125.20m AOD.

Existing Watercourses

2.5 There is a large pond located approximately 140m to the south west of the site. The closest watercourse designated by the Environment Agency (EA) as a main river is the River Cherwell and is located 3.4km to the west of the site. Existing drainage ditches are located along the sites eastern boundaries, as indicated on the topographical survey.

Geological Characteristics

2.6 An intrusive site investigation was undertaken by The Brownfield Consultancy in November 2015 (Report ref: BC195 L001/JT). The site investigation comprised excavating fourteen trial pits across the site.

2.7 Made Ground was encountered in five trial pits excavated close to the sites south-western boundary, where it is believed ground levels have been previously raised. The Made Ground was proven in all trial pits to depths of between 0.80m and 1.80m below ground level (bgl). In the remaining nine trial pits, a layer of topsoil was found to superpose the bedrock geology. The bedrock geology on-site consisted of soils associated with the Great Oolite Group, and was encountered in all trial pits below either the Made Ground or topsoil. The Great Oolite soils were found to the base of all the trial pits, with no superficial deposits indicated.

2.8 Groundwater was encountered on-site in TP12 only. The groundwater strike occurred at a depth of 2.35m bgl, which saw moderate ingress into the granular Great Oolite. The water level rose to 2.30m bgl after half an hour.

Hydrological and Hydrogeological Context

2.9 There are no major artificial water bodies on or located in the vicinity of the site.

2.10 The EA defines Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The SPZs mapping indicates that the site is not located within an SPZ.

2.11 A Nitrate Vulnerable Zone (NVZ) is a conservative designation for areas of land that drain to nitrate polluted waters or waters which could become polluted by nitrates. The NVZs mapping indicates that the site is located within an NVZ.

2.12 The EA defines Drinking Water Safeguard Zones (SgZs) and Drinking Water Protected Areas (DWPAs) for water sources used for public drinking water supply. SgZs define areas where additional pollution control measures are needed to avoid deterioration in water quality. DWPAs are areas where water sources need to be protected to prevent pollution. The site is not located within an SgZ or a DWPA.

2.13 The bedrock Aquifer Designation map published by the EA indicates that the bedrock underlying the proposed development is classed as a Principal Aquifer. Principal Aquifers indicate regions where the geology exhibits high permeability and/or provides a high level of water storage. They may also be capable of supporting water supply and may provide a source of base flow to rivers on a strategic scale.

2.14 The Groundwater Vulnerability map published by the EA indicates that the site is above a highly permeable major aquifer of high leaching potential.

2.15 Although the site is not located within an SPZ, SgZ or DWPA, given the Aquifer and Groundwater Vulnerability designations by the EA, careful consideration will be given to the surface water drainage strategy for the site. This is discussed in further detail in section 6 of this report.

Existing Surface Water Drainage

2.16 Drainage records obtained from Anglian Water are included in Appendix C. The records indicate a 300mm diameter surface water sewer passing through the site, which is understood to drain surface water run-off from the neighbouring properties in the Hodgson Close. The pipe runs in a south easterly direction to an outfall with a drainage ditch close to the sites south-eastern boundary. The headwall showing this outfall, as well a manhole from this sewer can be seen on the Topographical survey.

2.17 The records show only those sewers that are known to be maintained by Anglian Water, other privately owned sewers may be present in the vicinity of the site that are not shown on public records.

Proposed Development

2.18 The proposals are for the demolition of the existing buildings on the site and the erection of 38 residential units with associated access, car parking, refuse/recycling storage, infrastructure and landscaping.

2.19 A copy of the proposed site layout is provided in Appendix D.

3.0 Planning Policy and Guidance

3.1 Set out below is a summary of the national and local planning policy and guidance relating to flood risk and surface water management that are relevant to the development proposals.

National

3.2 At a national level, the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG) to the NPPF ensure flood risk is taken into account at all stages of the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development towards areas at lowest flood risk. The NPPF retains a risk-based approach to the planning process and defines four Flood Zones to be used as the basis for applying the sequential test, as well as Flood Risk Vulnerability Classifications, which define the type of development that is considered appropriate within each zone.

3.3 The NPPF establishes the Flood Zones as the starting point for assessment with the overarching aim to steer new development to areas with the lowest probability of flooding. The Flood Zones are defined as follows:

- Flood Zone 1 (Low Probability) comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
- Flood Zone 2 (Medium Probability) comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
- Flood Zone 3a (High Probability) comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- Flood Zone 3b (The Functional Floodplain) comprises land where water has to flow or be stored in times of flood.

Local Policy and Guidance

Cherwell District Council (CDC) Strategic Flood Risk Assessment (SFRA), May 2017

3.4 This SFRA was produced by CDC to inform the planning process. The SFRA included flood maps covering the entire district and summarises the flood risk from each source of flooding in the district. The site is identified in the accompanying mapping as a Level 1 SFRA site (Reference: SRFA102 & SFRA69).

3.5 The SFRA provides a reference and policy document to advise and inform developers of their obligations under the NPPF. The maps and accompanying report provide a sound framework enabling consistent and sustainable decisions to be made when asking future planning decisions.

4.0 Flood Risk Assessment

4.1 Flood risk to the site is considered from all likely sources of flooding, as defined in the NPPF and the PPG to the NPPF. These include fluvial, tidal, reservoir, groundwater, sewer and surface water. The following paragraphs consider flood risk to the site from all of these sources.

Fluvial

4.2 The Environment Agency (EA) publishes flood zone mapping on the GOV.UK website which shows the modelled extents of fluvial flooding. The flood zone mapping indicates that the site is entirely located within Flood Zone 1, at the lowest risk of fluvial flooding. An extract from the EA mapping is included in Appendix E.

4.3 Table 1 of the PPG to the NPPF defines land located within Flood Zone 1 as areas which are outside the floodplain and have little or no chance of flooding.

Tidal

4.4 Given that there are no tidally influenced watercourses on or within the vicinity of the site it is considered that tidal flooding is not an issue that would prevent the development of the site for its intended end use and the risk posed to the site from this source of flooding is considered to be negligible.

Reservoir

4.5 The EA publishes indicative mapping on its website which shows the maximum extent of reservoir flooding in the unlikely event that a reservoir should fail. The mapping indicates the site is not at risk of reservoir flooding.

Groundwater

4.6 The Level 1 SFRA includes mapping published by the EA showing areas within the district that are at an increased risk of groundwater flooding. The mapping is a strategic-scale map showing flood areas on a 1km square grid, with areas highlighted showing the proportion of the 1km grid square where geological and hydrogeological conditions indicate the possibility of groundwater emergence. The site is indicated to be in a square where less than 25% of the area within the square is at risk of flooding and so therefore is considered at low risk to flooding from this source.

Sewer

4.7 The SFRA includes data from the Thames Water DG5 sewer flooding register. This register provides information on the number of recorded sewer flooding incidents on a postcode basis. There are between 10-15 recorded incidents of sewer flooding occurring in the postcode area associated with the site for the relevant time period, however these records do not necessarily represent the current or future sewer flood risk situation as maintenance work or upgrades to the network may have been undertaken since the flooding incidents occurred.

Surface Water

4.8 The Environment Agency publishes a 'Flood Risk from Surface Water' map (FRfSW) on the GOV.UK website which indicates the predicted risk of surface water flooding in the event that rainwater does not drain away through normal drainage systems or soak into the ground. The mapping indicates that the entirety of the site is considered at a very low risk of surface water flooding.

Historic Flooding

4.9 The SFRA includes mapping showing all previous instances of flooding reported to the Lead Local Flood Authority (LLFA), the EA Historic Flood Map and the Canal & River Trust. The mapping shows there are no known flooding incidents on or in the vicinity of the site.

Summary

4.10 In summary, the site is at low risk or very low risk of flooding from all sources. The proposed development of the site is therefore considered appropriate in flood risk terms according to the NPPF.

5.0 Flood Risk Assessment

5.1 The NPPF encourages a sequential, risk-based approach to determine the suitability of land for development. This document advises that the development of sites within Flood Zone 1 should be given preference where available.

5.2 Table 2 of the Planning Practice Guidance (PPG) to the NPPF categorises different types of development into five flood risk vulnerability classifications:

- Essential Infrastructure;
- Highly Vulnerable;
- More Vulnerable;
- Less Vulnerable; and
- Water Compatible Development.

5.3 The NPPF classifies the proposed residential use of the site as being 'More Vulnerable'.

5.4 As discussed in Section 4, the site is located entirely within Flood Zone 1. Table 3 of the PPG states that all uses of land are appropriate for Flood Zone 1. Therefore, the proposed development use is compatible with the flood zone of the site and developing the site for its intended purpose is considered appropriate in terms of flood risk. As such, the Sequential Test and Exception Test are not required to be applied to this development.

5.5 The site is considered to be at low or very low risk from all other sources of flooding.

<u>Consideration for Flood Risk Mitigation Measures</u>

5.6 Given the development is located within Flood Zone 1, flood compensation or resilience measures will not be required to mitigate against the risk of fluvial flooding.

5.7 The development is proposed to be accessed from Fritwell Road/Fewcott Road which is located entirely within Flood Zone 1. As such, safe, dry access and egress is capable of being provided to the entirety of the development during times of flooding.

6.0 Surface Water Drainage Strategy

Sustainable Drainage

6.1 The PPG recommends that priority should be given to the use of sustainable drainage systems (SuDS) as they are designed to control surface water run-off where it falls and mimic natural drainage as closely as possible. SuDS also provide opportunities for the following:

- Reduce the causes and impacts of flooding
- Remove pollutants from urban run-off at source; and
- Combine water management with green space with benefits for amenity, recreation and wildlife.

6.2 SuDS encompass a wide range of drainage techniques intended to minimise the rate of discharge, volume and environmental impact of run-off. Infiltration based techniques are high up in the hierarchy of techniques available due to the ability for close to source dispersion of surface water. These techniques are considered the closest solution to mimic the natural drainage of undeveloped sites.

6.3 The Building Regulations part H3 stipulates that rainwater from roofs and paved areas is carried away from surface to 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 practical;
b) A watercourse; or, where that is not practical
c) A sewer.

Proposed Surface Water Drainage Strategy

6.4 It is proposed to discharge surface water flows generated as a result of the development through a combination of domestic soakaways, permeable paving and restricted discharge to the drainage ditch on the south-eastern boundary of the site.

6.5 An intrusive site investigation conducted on-site encountered soils associated with the Great Oolite group and concluded infiltration drainage may be feasible, subject to BRE 365 testing. At the detailed design stage, infiltration testing will be undertaken and infiltration rates for the site will be calculated in accordance with the guidance given in BRE 365. The estimated size of the infiltration devices included in this drainage strategy assumes that the underlying ground conditions will support infiltration at a relatively conservative rate of $2x10^{-5}$ m/s.

6.6 The domestic soakaway's will be constructed in accordance with Building Regulations part H, which states soakaway's must be installed at a minimum distance of 5m from building foundations.

6.7 Properties where there is insufficient area to maintain the 5.0m stand-off for domestic soakaways will discharge to either neighbouring/shared soakaways or the drainage ditch on the south-eastern boundary. Surface water attenuation will be provided for each property prior to discharge to the ditch within a lined porous sub-base constructed beneath the resident's car parking spaces.

6.8 The outline surface water drainage strategy is illustrated on the drawing included in Appendix F. Supporting MicroDrainage calculations are provided in Appendix G. These demonstrate that the attenuation proposed can provide storage up to and including the 1 in 100 year + 40% climate change storm event without flooding from surface water.

6.9 The internal highway through the development will be constructed using permeable paving with a deepened sub-base, which will allow this area to drain under its own footprint via infiltration to the underlying geology. In order to size the sub-base of this feature, a 20m long and 4.8m wide section of road has been used in the MicroDrainage Calculations.

Pollution Control

6.10 Pollution control measures are designed to minimise the transmittal of any pollutants collected by run-off flowing over hard surfaces to the receiving geology or watercourse.

6.11 Run-off from road and driveways will drain via permeable paving, which is effective at removing pollutants such as hydrocarbons. Ciria C753 provides guidance on pollution control measures; run-off from residential roofs is considered to have a low hazard potential. Run-off from the lightly trafficked roads will also drain via permeable paving which is effective at removing pollutants such as hydrocarbons.

6.12 An appropriate buffer zone between the base of any infiltration features and groundwater levels will also be provided, affording protection the groundwater. As such, discharging surface water run-off generated by the development via the proposed strategy is considered to provide a suitable level of protection against pollution.

Maintenance

6.13 All new surface water infrastructure will be constructed in accordance with Sewers for Adoption, Building Regulations and best practice as appropriate.

6.14 The drainage system would remain under private ownership and be maintained by a management company. All drainage located within private areas will be the responsibility of the property owner or will be maintained by a private management company as appropriate.

6.15 Suitable maintenance regimes for SuDS, incorporating advice from system manufacturers and installers, will be developed by the site management company and implemented prior to occupation of the development. A summary of typical items is included in Table 1 overleaf.

Table 1: SuDS Maintenance Schedule

Drainage Feature	Inspection and Maintenance	Frequency
Permeable pavements	Brushing and vacuuming of surface to remove detrimental materials such as debris, dirt and sediment.	Annually
	Stabilise / mow adjacent verges, and remove weeds from pavement surface.	Occasional (as required)
	Ensure paving dewaters after rain and between storms: check joints for sedimentation; mechanically clean or jet wash and sweep surface free from silt, etc; refill joints with sealing grit.	As required
	Inspect and repair any rutting and cracked or broken blocks, and replace lost jointing material.	Occasional (as required)
	Rehabilitate surface and upper substructure.	Occasional (every 10-15 years)
Geocellular storage tank*	Ensure inlets and pre-treatment structures are clear and free of debris.	Annually
Hardstanding areas	Sweep regularly to prevent silt being washed off the surface.	Frequently

*Refer to manufacturer's guidance for specific maintenance instructions.

7.0 Summary and Conclusions

7.1 This Flood Risk Assessment has been prepared by Glanville Consultants on behalf of CALA Homes (Chiltern) Ltd in support of an outline planning application to develop land off Fewcott Road, Fritwell to provide 38 new homes.

7.2 This site-specific Flood Risk Assessment has been prepared in accordance with the requirements of National and Local Planning Policy and concludes that the site is at low risk of flooding from all sources and can be developed safely without increasing flood risk elsewhere. This report has undertaken as assessment considering flood risk from all identifiable sources, including an allowance for climate change.

7.3 An intrusive site investigation undertaken on-site encountered a bedrock geology of Great Oolite Group soils. At detailed design stage, further site investigation work will be undertaken, incorporating percolation testing to BRE 365.

7.4 The proposed surface water drainage strategy strives to utilise sustainable drainage techniques in accordance with the guidance described in CIRIA C753 and employs soakaways and permeable paving to disperse surface water run-off and to provide attenuation. Where domestic soakaways could not be incorporated into the strategy, properties will discharge to the drainage ditch located adjacent to the south-eastern boundary at a restricted rate.

7.5 Infiltration and attenuation features will provide storage up to and including the 1 in 100 year +40% climate change storm event without flooding from surface water.

Conclusion

7.6 In conclusion, this report has demonstrated that the proposed residential development:

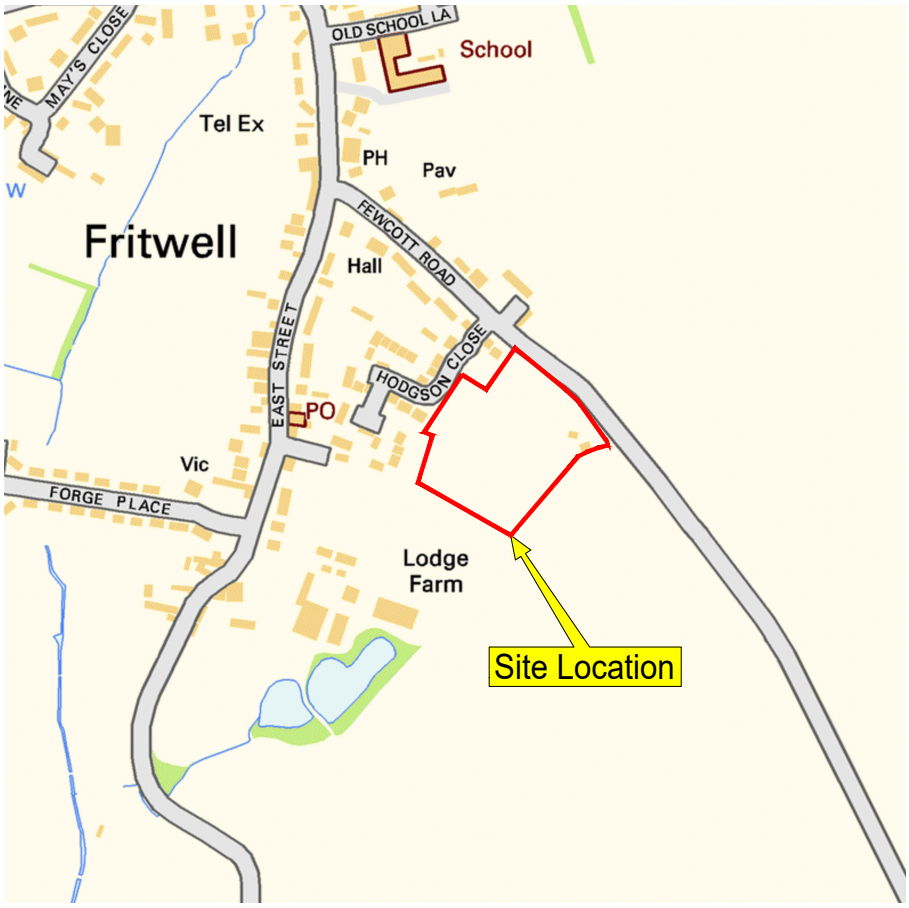
- Is in accordance with the National Planning Policy Framework;
- Will not be at an unacceptable risk from fluvial flooding;
- Will not increase flood risk elsewhere; and
- Will employ a surface water drainage strategy based on the principles of sustainable drainage.

7.7 On this basis, the proposals are considered to fully comply with National, Regional and Local planning policy.

Appendices

Appendix A

Site Location Plan



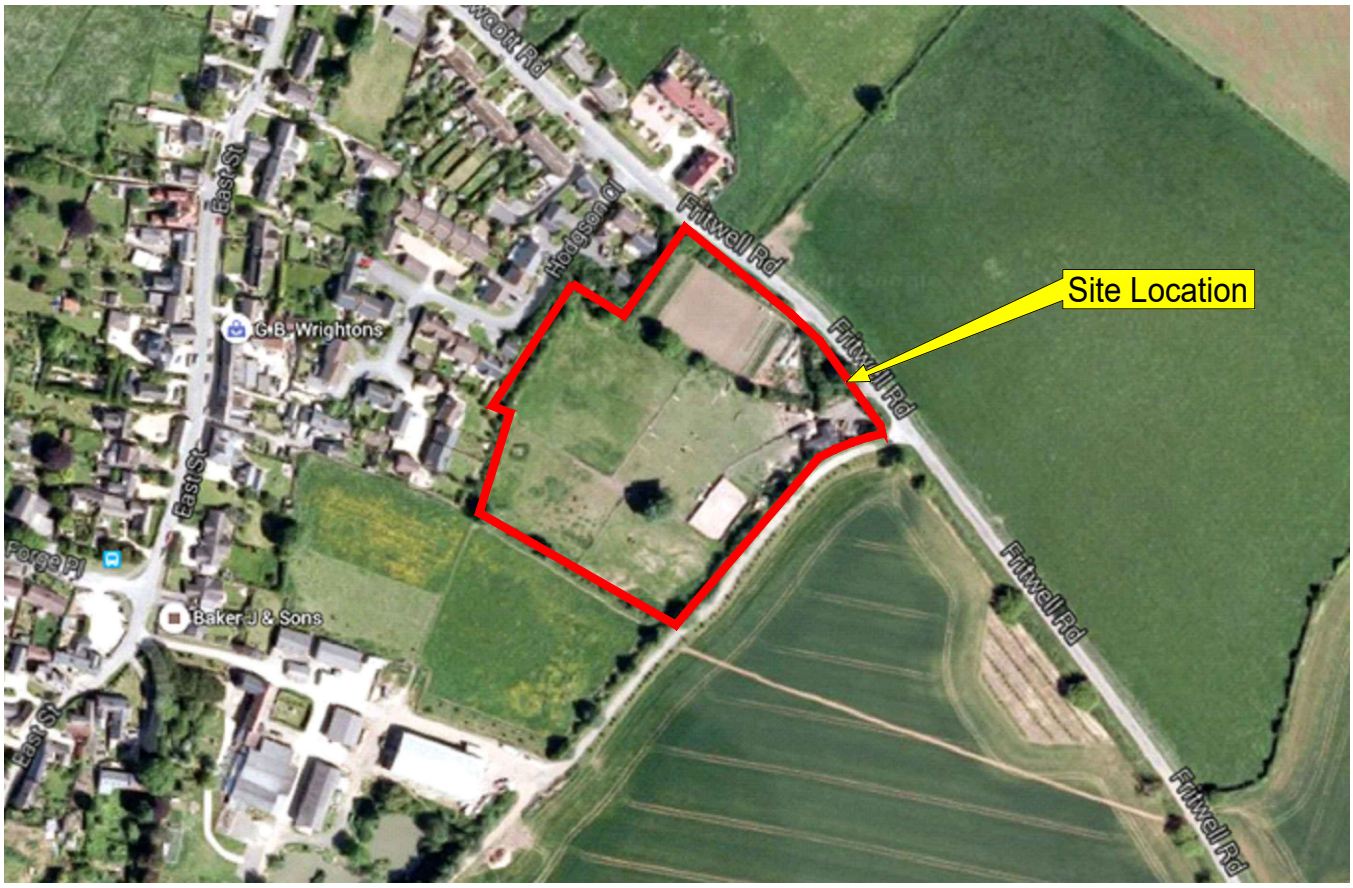
NOTES

1. This drawing is to be read in conjunction with all relevant documents and specifications.
2. Dimensions not to be scaled.

LOCATION

Address: Fewcott Road
Fritwell
Oxfordshire
OX27 7QA

Grid reference: SP 52957 29070



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Project :	Fewcott Road, Fritwell				
Title :	Site Location Plan				
Project Engineer :	S McNair	Scale :	NTS	Drawing No. 8180850-SK01	Rev -
Project Director :	K Rayner	Date :	March 2019		

Appendix B

Topographical Survey

LEGEND

FEATURE STYLES

SURVEY CONTROL
FENCE
HEDGE
FWS
SWS
WATER
POWER LINE (OVERHEAD)
TELECOM LINE (OVERHEAD)
ELECTRIC MAIN
GAS MAIN
EMBANKMENT

FEATURE ABREVIATIONS

AV	Air Valve
BS	Bus Stop
BT	British Telecom
BW	Brick Wall
CB	Conc Bollard
CL	Cover Level
CTO	cable TV outlet
EB	Electric Box
EC	Electric Cover
EP	Electricity Pole
FH	Fire Hydrant
FL	Floor level
G	Gully
GM	Gas Meter
GV	Gas Valve
IL	Invert Level
IC	Inspection Chamber
KLS	Keep Left Sign
KO	Kerb Offset
LB	Letter Box
LP	Lamp Post
MKR	Marker
MP	Metal Post
MH	Manhole
MB	Metal Bollard
P	Post
PI	Petrol Interceptor
RG	Road Gully
RNB	Road Name Board
RS	Road Sign
RW	Retaining Wall
SA	Soakaway
SC	Stopcock
SV	Sluice Valve
TP	Telegraph Pole
TCB	Telephone Box
TJB	Tel.Junc.Box
TL	Traffic Light
V	Valve
VP	Vent Pipe
WL	Water Level
WM	Water Meter
WO	Water Outlet
WV	Water Valve

FENCE TYPES

BWR	Barbed Wire
CB	Close Board
CI	Corrugated Iron
CL	Chain Link
CPL	Conc Panel
CP	Chestnut Paling
CW	Chicken Wire
IW	Interwoven
IR	Iron Railing
OB	Openboard
PR	Post and rail
PW	Post and Wire

DATUM
GRID – ORDNANCE SURVEY NATIONAL GRID (OSTN02)
LEVELS – ORDNANCE SURVEY (OSGM02)

SURVEY CONTROL

STN	-E-	-N-	-Z-
1	453098.798	229038.354	127.100
2	453045.301	229093.712	126.744
3	452946.238	229192.346	128.894
4	452980.212	229165.128	128.285
5	452997.564	229152.205	127.922
6	453021.184	229133.381	127.537
7	453061.771	229073.692	126.657
8	453035.424	229089.210	126.369
9	453017.653	229079.663	126.189
10	453003.942	229069.623	125.814
11	452995.371	229043.822	125.588
12	452976.260	229025.033	125.383
13	452958.114	229006.157	125.840
14	452973.618	228999.991	124.897
15	452919.379	229034.302	126.413
16	452896.099	229046.709	126.808
17	452889.960	229084.231	127.344
18	452896.154	229087.128	127.622
19	452918.782	229134.633	128.101
20	452921.059	229145.340	128.283
21	452911.774	229137.000	128.131
22	452939.571	229132.278	127.785
23	452912.952	229151.726	128.383
24	452916.243	229162.762	128.544
25	452891.203	229121.823	128.202
26	453032.567	229063.815	125.661
27	453017.004	229050.181	125.355
28	453002.595	229032.302	125.034
29	452989.268	229013.878	124.920
30	452963.877	228986.222	124.642

NOTES

Surveyed boundaries are not necessarily the site legal boundaries. Client should refer to the relevant Land Registry document for confirmation of title.

Drainage and service covers that were buried, obscured or not visible at the time of the survey cannot be shown. Sewer connections between manholes are assumed to be straight and only pipes visible from the cover are shown.

Tree canopy measured values are written as maximum spreads.
Tree species and condition to be confirmed by an arboriculturist

SURVEYED BY
groundsurveys ltd
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CLIENT

CALA HOMES (CHILTERN) LTD

SITE

FEWCOTT ROAD
FRITWELL
OX27

TITLE

SITE SURVEY

AS EXISTING

SCALE	DATE
1/200 (A0)	MAY 2015
DRAWING No. 01	JOB No. 6028

TREE SCHEDULE

TREE	GIRTH	HEIGHT	SPREAD	SPECIES
1	0.7	6.0	3.0	PURPLE PRUNUS
2	3X0.5	12.0	5.0	ASH
3	3X0.5	12.0	5.0	ASH
4	2X0.4	8.0	6.0	ASH
5	MB	12.0	5.0	FIELD MAPLE
6	MB	12.0	5.0	ELM
7	5X0.4	10.0	5.0	FIELD MAPLE
8	0.6	9.0	3.0	ELM
9	MB	10.0	5.0	ASH
10	0.4	10.0	3.0	HAWTHORN
11	0.4	8.0	3.0	HAZEL
12	MB	8.0	5.0	HAZEL
13	MB	7.0	3.0	PRUNUS
14	MB	7.0	3.0	PRUNUS
15	10X0.7	15.0	7.0	MAPLE
16	1.5	13.0	7.0	ASH
17	1.5	13.0	5.0	ASH
18	1.0	12.0	5.0	ASH
19	2.6	13.0	6.0	OAK
20	MB	7.0	3.5	MAPLE
21	0.6	9.0	3.5	ASH
22	0.4	7.0	2.5	ELM
23	0.4	7.0	2.5	ELM
24	0.4	6.0	1.5	HAWTHORN
25	0.6	6.0	2.0	HAWTHORN
26	0.6	4.0	1.5	HAWTHORN
27	0.4	6.0	2.0	HAZEL
28	0.4/0.6	6.0	2.5	HAZEL
29	MB	4.0	2.0	HAWTHORN
30	0.6	5.0	2.0	PRUNUS
31	2X0.7	8.0	3.5	PRUNUS
32	2X0.8	10.0	5.0	MAPLE
33	0.9	7.0	3.0	ELDER
34	MB	6.0	3.5	HAWTHORN
35	2.6	15.0	9.0	MAPLE
36	1.4	13.0	6.5	WILLOW
37	1.4	16.0	6.0	MAPLE
38	1.6	16.0	7.0	MAPLE
39	0.4	9.0	2.0	PRUNUS
40	0.6	9.0	3.0	PRUNUS
41	0.7	9.0	3.0	PRUNUS
42	3X0.4	6.0	2.0	HAZEL
43	0.4	6.0	1.5	SPRUCE
44	3X0.4	8.0	3.0	MAPLE
45	0.5	6.0	2.0	SILVER BIRCH
46	0.4	6.0	2.0	SILVER BIRCH
47	0.4	6.0	2.0	SILVER BIRCH
48	0.4	5.0	2.0	MAPLE
49	2X0.6	8.0	4.0	MAPLE
50	MB	9.0	5.0	HAWTHORN

TREE SCHEDULE

TREE	GIRTH	HEIGHT	SPREAD	SPECIES
51	0.4/2X0.6	9.0	5.0	MAPLE
52	MB	6.0	3.5	ELDER
53	3X1.4	16.0	7.0	ASH
54	1.6	15.0	7.0	ASH
55	0.7	6.0	3.0	OAK
56	0.7	10.0	4.0	PRUNUS
57	2X0.6	12.0	4.0	FIELD MAPLE
58	0.4	6.0	2.0	BEECH
59	0.7	9.0	4.0	FIELD MAPLE
60	0.4	8.0	3.0	FIELD MAPLE
61	0.5	10.0	4.0	BEECH
62	0.7	8.0	4.0	FIELD MAPLE
63	0.7	9.0	4.0	FIELD MAPLE
64	0.6	7.0	3.0	WHITEBEAM
65	0.6	9.0	3.0	PRUNUS
66	0.6	9.0	4.0	FIELD MAPLE
67	0.5	10.0	5.0	FIELD MAPLE
68	MB	10.0	5.0	HAWTHORN
69	0.7	9.0	5.0	HAWTHORN
70	MB	9.0	5.0	HAWTHORN
71	2X0.5	10.0	3.0	FIELD MAPLE
72	0.6	10.0	3.0	FIELD MAPLE
73	3X0.4	10.0	3.0	FIELD MAPLE
74	0.4	10.0	3.0	FIELD MAPLE
75	0.6	10.0	4.0	FIELD MAPLE
76	0.6	8.0	4.0	PRUNUS
77	0.5	8.0	2.0	PRUNUS
78	0.5	8.0	3.0	FIELD MAPLE
79	0.5	9.0	4.0	PRUNUS
80	2X0.4	8.0	3.0	ASH
81	0.4	8.0	3.0	FIELD MAPLE
82	0.5	8.0	3.0	PRUNUS
83	2.0	13.0	5.0	ASH
84	0.6	9.0	3.0	PRUNUS
85	0.6	5.0	2.5	WALNUT
86	2X0.4	5.0	2.0	WALNUT
87	2X0.4	5.0	3.0	WALNUT
88	1.3	12.0	5.0	FIELD MAPLE
89	0.5	4.0	2.0	WALNUT
90	0.5	4.0	2.0	WALNUT
91	0.4	3.0	2.0	WALNUT
92	0.7	4.0	3.0	WALNUT
93	0.4	4.0	2.0	WALNUT
94	0.4	9.0	2.5	ASH
95	0.4	9.0	2.5	ASH
96	0.4	8.0	3.0	WALNUT
97	0.5	9.0	4.0	WALNUT
98	0.4	12.0	3.0	FIELD MAPLE
99	1.1	14.0	7.0	ASH
100	2X1.0	14.0	4.0	FIELD MAPLE

TREE SCHEDULE

TREE	GIRTH	HEIGHT	SPREAD	SPECIES
101	2X0.7	9.0	2.5	HAWTHORN
102	0.5	9.0	4.0	ASH
103	0.6	6.0	3.0	SPRUCE
104	0.5	6.0	2.5	WALNUT
105	0.5	6.0	3.0	FIELD MAPLE
106	MB	9.0	3.0	HAWTHORN

TREE SCHEDULE				
TREE	GIRTH	HEIGHT	SPREAD	SPECIES
1	0.7	6.0	3.0	PURPLE PRUNUS
2	3X0.5	12.0	5.0	ASH
3	3X0.5	12.0	5.0	ASH
4	2X0.4	8.0	6.0	ASH
5	MB	12.0	5.0	FIELD MAPLE
6	MB	12.0	5.0	ELM
7	5X0.4	10.0	5.0	FIELD MAPLE
8	0.6	9.0	3.0	ELM
9	MB	10.0	5.0	ASH
10	0.4	10.0	3.0	HAWTHORN
11	0.4	8.0	3.0	HAZEL
12	MB	8.0	5.0	HAZEL
13	MB	7.0	3.0	PRUNUS
14	MB	7.0	3.0	PRUNUS
15	10X0.7	15.0	7.0	MAPLE
16	1.5	13.0	7.0	ASH
17	1.5	13.0	5.0	ASH
18	1.0	12.0	5.0	ASH
19	2.6	13.0	6.0	OAK
20	MB	7.0	3.5	MAPLE
21	0.6	9.0	3.5	ASH
22	0.4	7.0	2.5	ELM
23	0.4	7.0	2.5	ELM
24	0.4	6.0	1.5	HAWTHORN
25	0.6	6.0	2.0	HAWTHORN
26	0.6	4.0	1.5	HAWTHORN
27	0.4	6.0	2.0	HAZEL
28	0.4/0.6	6.0	2.5	HAZEL
29	MB	4.0	2.0	HAWTHORN
30	0.6	5.0	2.0	PRUNUS
31	2X0.7	8.0	3.5	PRUNUS
32	2X0.8	10.0	5.0	MAPLE
33	0.9	7.0	3.0	ELDER
34	MB	6.0	3.5	HAWTHORN
35	2.6	15.0	9.0	MAPLE
36	1.4	13.0	6.5	WILLOW
37	1.4	16.0	6.0	MAPLE
38	1.6	16.0	7.0	MAPLE
39	0.4	9.0	2.0	PRUNUS
40	0.6	9.0	3.0	PRUNUS
41	0.7	9.0	3.0	PRUNUS
42	3X0.4	6.0	2.0	HAZEL
43	0.4	6.0	1.5	SPRUCE
44	3X0.4	8.0	3.0	MAPLE
45	0.5	6.0	2.0	SILVER BIRCH
46	0.4	6.0	2.0	SILVER BIRCH
47	0.4	6.0	2.0	SILVER BIRCH
48	0.4	5.0	2.0	MAPLE
49	2X0.6	8.0	4.0	MAPLE
50	MB	9.0	5.0	HAWTHORN

TREE SCHEDULE				
TREE	GIRTH	HEIGHT	SPREAD	SPECIES
51	0.4/2X0.6	9.0	5.0	MAPLE
52	MB	6.0	3.5	ELDER
53	3X1.4	16.0	7.0	ASH
54	1.6	15.0	7.0	ASH
55	0.7	6.0	3.0	OAK
56	0.7	10.0	4.0	PRUNUS
57	2X0.6	12.0	4.0	FIELD MAPLE
58	0.4	6.0	2.0	BEECH
59	0.7	9.0	4.0	FIELD MAPLE
60	0.4	8.0	3.0	FIELD MAPLE
61	0.5	10.0	4.0	BEECH
62	0.7	8.0	4.0	FIELD MAPLE
63	0.7	9.0	4.0	FIELD MAPLE
64	0.6	7.0	3.0	WHITEBEAM
65	0.6	9.0	3.0	PRUNUS
66	0.6	9.0	4.0	FIELD MAPLE
67	0.5	10.0	5.0	FIELD MAPLE
68	MB	10.0	5.0	HAWTHORN
69	0.7	9.0	5.0	HAWTHORN
70	MB	9.0	3.0	HAWTHORN
71	2X0.5	10.0	3.0	FIELD MAPLE
72	0.6	10.0	3.0	FIELD MAPLE
73	3X0.4	10.0	3.0	FIELD MAPLE
74	0.4	10.0	3.0	FIELD MAPLE
75	0.6	10.0	4.0	FIELD MAPLE
76	0.6	8.0	4.0	PRUNUS
77	0.5	8.0	2.0	PRUNUS
78	0.5	8.0	3.0	FIELD MAPLE
79	0.5	9.0	4.0	PRUNUS
80	2X0.4	8.0	3.0	ASH
81	0.4	8.0	3.0	FIELD MAPLE
82	0.5	8.0	3.0	PRUNUS
83	2.0	13.0	5.0	ASH
84	0.6	9.0	3.0	PRUNUS
85	0.6	5.0	2.5	WALNUT
86	2X0.4	5.0	2.0	WALNUT
87	2X0.4	5.0	3.0	WALNUT
88	1.3	12.0	5.0	FIELD MAPLE
89	0.5	4.0	2.0	WALNUT
90	0.5	4.0	2.0	WALNUT
91	0.4	3.0	2.0	WALNUT
92	0.7	4.0	3.0	WALNUT
93	0.4	4.0	2.0	WALNUT
94	0.4	9.0	2.5	ASH
95	0.4	9.0	2.5	ASH
96	0.4	8.0	3.0	WALNUT
97	0.5	9.0	4.0	WALNUT
98	0.4	12.0	3.0	FIELD MAPLE
99	1.1	14.0	7.0	ASH
100	2X1.0	14.0	4.0	FIELD MAPLE

TREE SCHEDULE				
TREE	GIRTH	HEIGHT	SPREAD	SPECIES
101	2X0.7	9.0	2.5	HAWTHORN
102	0.5	9.0	4.0	ASH
103	0.6	6.0	3.0	SPRUCE
104	0.5	6.0	2.5	WALNUT
105	0.5	6.0	3.0	FIELD MAPLE
106	MB	9.0	3.0	HAWTHORN

LEGEND

FEATURE STYLES

SURVEY CONTROL
FENCE
HEDGE
FWS
SWS
WATER
POWER LINE (OVERHEAD)
TELECOM LINE (OVERHEAD)
ELECTRIC MAIN
GAS MAIN
EMBANKMENT

FENCE TYPES

BWR Barbed Wire
CB Close Board
CI Corrugated Iron
CL Chain Link
CPL Conc Panel
CP Chestnut Paling
CW Chicken Wire
IW Interwoven
IR Iron Railing
OB Openboard
PR Post and rail
PW Post and Wire

FEATURE ABREVIATIONS

AV Air Valve
BS Bus Stop
BT British Telecom
BW Brick Wall
CB Conc Bollard
CL Cover Level
CTO cable TV outlet
EB Electric Box
EC Electric Cover
EP Electricity Pole
FH Fire Hydrant
FL Floor level
G Gully
GM Gas Meter
GV Gas Valve
IL Invert Level
IC Inspection Chamber
KLS Keep Left Sign
KO Kerb Offset
LB Letter Box
LP Lamp Post
MKR Marker
MP Metal Post
MH Manhole
MB Metal Bollard
P Post
PI Petrol Interceptor
RG Road Gully
RNB Road Name Board
RS Road Sign
RW Retaining Wall
SA Soakaway
SC Stopcock
SV Sluice Valve
TP Telegraph Pole
TCB Telephone Box
TJB Tel.Junc.Box
TL Traffic Light
V Valve
VP Vent Pipe
WL Water Level
WM Water Meter
WO Water Outlet
WV Water Valve

DATUM
GRID – ORDNANCE SURVEY NATIONAL GRID (OSTN02)
LEVELS – ORDNANCE SURVEY (OSGM02)

SURVEY CONTROL			
STN	-E-	-N-	-Z-
1	453098.798	229038.354	127.100
2	453045.301	229093.712	126.744
3	452946.238	229192.346	128.894
4	452980.212	229165.128	128.285
5	452897.564	229152.205	127.922
6	453021.184	229133.381	127.537
7	453061.771	229073.692	126.657
8	453035.424	229089.210	126.369
9	453017.653	229079.663	126.189
10	453003.942	229069.623	125.814
11	452995.371	229043.822	125.588
12	452976.260	229025.033	125.383
13	452958.114	229006.157	125.840
14	452973.618	228999.991	124.897
15	452919.379	229034.302	126.413
16	452896.099	229046.709	126.808
17	452889.960	229064.231	127.344
18	452896.154	229087.128	127.622
19	452918.782	229134.633	128.101
20	452921.059	229145.340	128.283
21	452911.774	229137.002	128.131
22	452939.571	229132.278	127.785
23	452912.952	229151.726	128.383
24	452916.243	229162.762	128.544
25	452891.203	229121.823	128.202
26	453032.567	229063.815	125.661
27	453017.004	229050.181	125.355
28	453002.595	229032.302	125.034
29	452989.268	229013.878	124.920
30	452963.877	228986.222	124.642

NOTES

Surveyed boundaries are not necessarily the site legal boundaries. Client should refer to the relevant Land Registry document for confirmation of title.

Drainage and service covers that were buried, obscured or not visible at the time of the survey cannot be shown. Sewer connections between manholes are assumed to be straight and only pipes visible from the cover are shown.

Tree canopy measured values are written as maximum spreads. Tree species and condition to be confirmed by an arboriculturist

SURVEYED BY
groundsurveys ltd
land & engineering surveyors

units 9&10
woodlands farm
spring lane
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berkshire
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CLIENT

CALA HOMES (CHILTERN) LTD

SITE

FEWCOTT ROAD
FRITWELL
OX27

TITLE

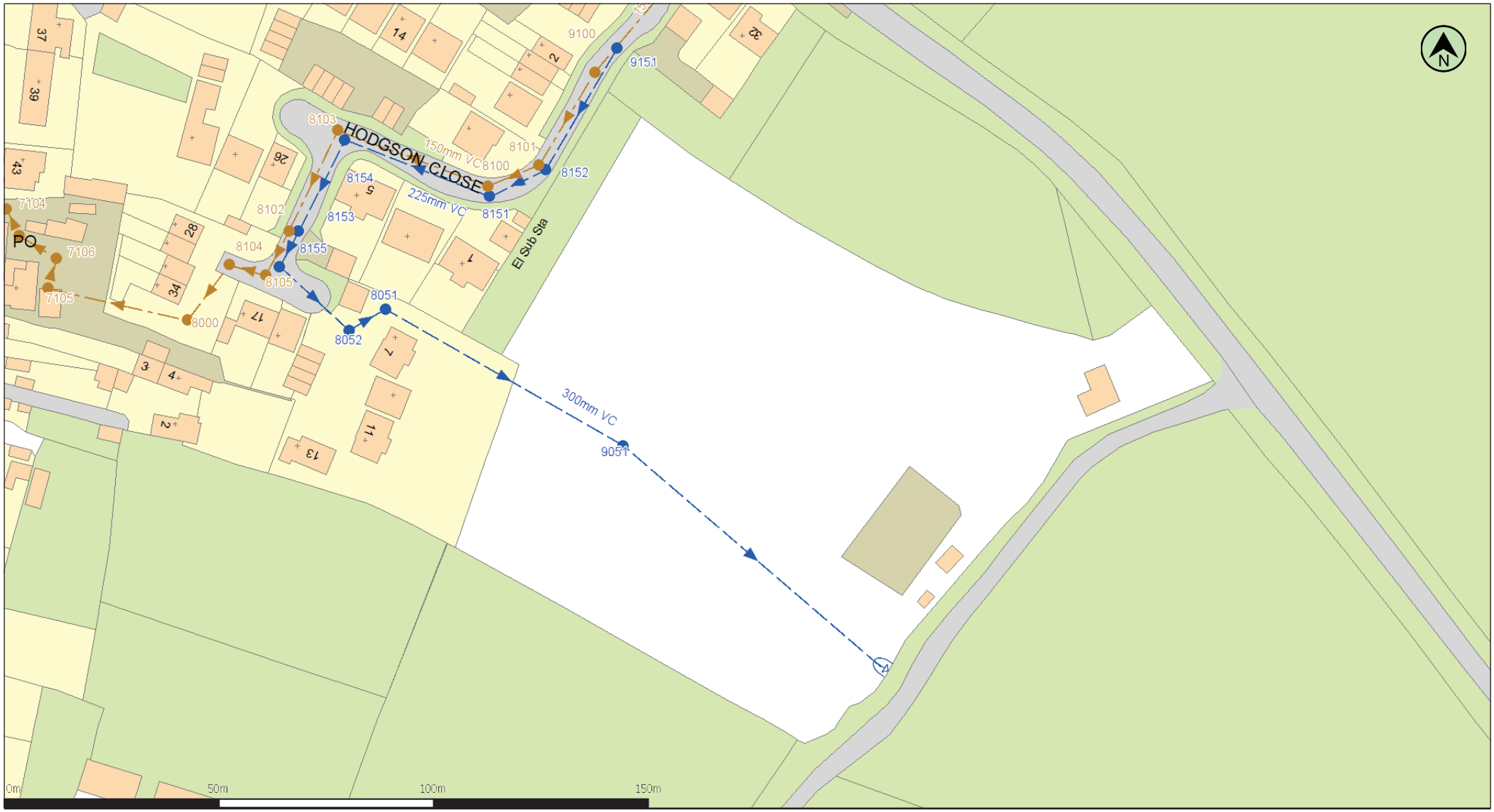
SITE SURVEY

AS EXISTING

SCALE 1/200 (A0)	DATE MAY 2015
DRAWING No. 02	JOB No. 6028

Appendix C

Anglian Water Sewer Records



(c) Crown copyright and database rights 2016 Ordnance Survey 100022432 | Date: 15/06/16 | Scale: 1:1250 | Map Centre: 452945,229073 | Data updated: 04/12/15 | Our Ref: 188740 - 1 | Wastewater Plan A4

- Foul Sewer
- Surface Sewer
- Combined Sewer
- Final Effluent
- Rising Main (Colour denotes effluent type)
- Private Sewer (Colour denotes effluent type)
- Decommissioned Sewer (Colour denotes effluent type)
- Outfall (Colour denotes effluent type)
- Inlet (Colour denotes effluent type)
- Manhole (Colour denotes effluent type)
- Sewage Treatment Works
- Pumping Station

dwigston@glanvillegroup.com

CV8160423

love every drop anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
7103	F	127.3	125.035	2.265
7104	F	127.3	124.989	2.311
7105	F	127.81	125.183	2.627
7106	F	127.77	125.129	2.641
8000	F	128.2	125.454	2.746
8100	F	128.3	126.325	1.975
8101	F	128.2	126.445	1.755
8102	F	128.2	125.766	2.434
8103	F	128.6	125.94	2.66
8104	F	128.36	126.586	1.774
8105	F	128.1	126.652	1.448
9100	F	128.4	126.7	1.7
8051	S	128	125.701	2.299
8052	S	128.15	125.784	2.366
8151	S	128.3	126.625	1.675
8152	S	128.2	126.75	1.45
8153	S	128.2	125.065	3.135
8154	S	128.6	126.24	2.36
8155	S	128.1	126.025	2.075
9051	S	126.7	125.195	1.505
9151	S	128.5	127	1.5

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix D

Proposed Site Layout

REV	DATE	DESCRIPTION
H	29.10.18	Plot 1 amendment
G	24.10.18	minor layout amendments
F	24.10.18	access relocated
E	26.09.18	reduced to 38 units
D	20.08.18	road increased to 5.5m
C	30.07.18	minor amendments

CALA HOMES

CALA GROUP LIMITED
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DX: 123610 Wooburn Green E-mail: info@cala.co.uk

Fewcott Road
Fritwell

Feasibility Study

1 : 1000 @ A3
0 10 20 30 40 50

Scale	Dwg No.
1:1000@ A3	SK.01
Date: 24.07.18	Rev: H
Drawn: CLC	

Appendix E

Environment Agency Fluvial Flood Mapping

Flood map for planning

Your reference	Location (easting/northing)	Created
8180850_EAFM	**452964/229076**	**15 Mar 2019 4:30**

Your selected location is in flood zone 1, an area with a low probability of flooding.

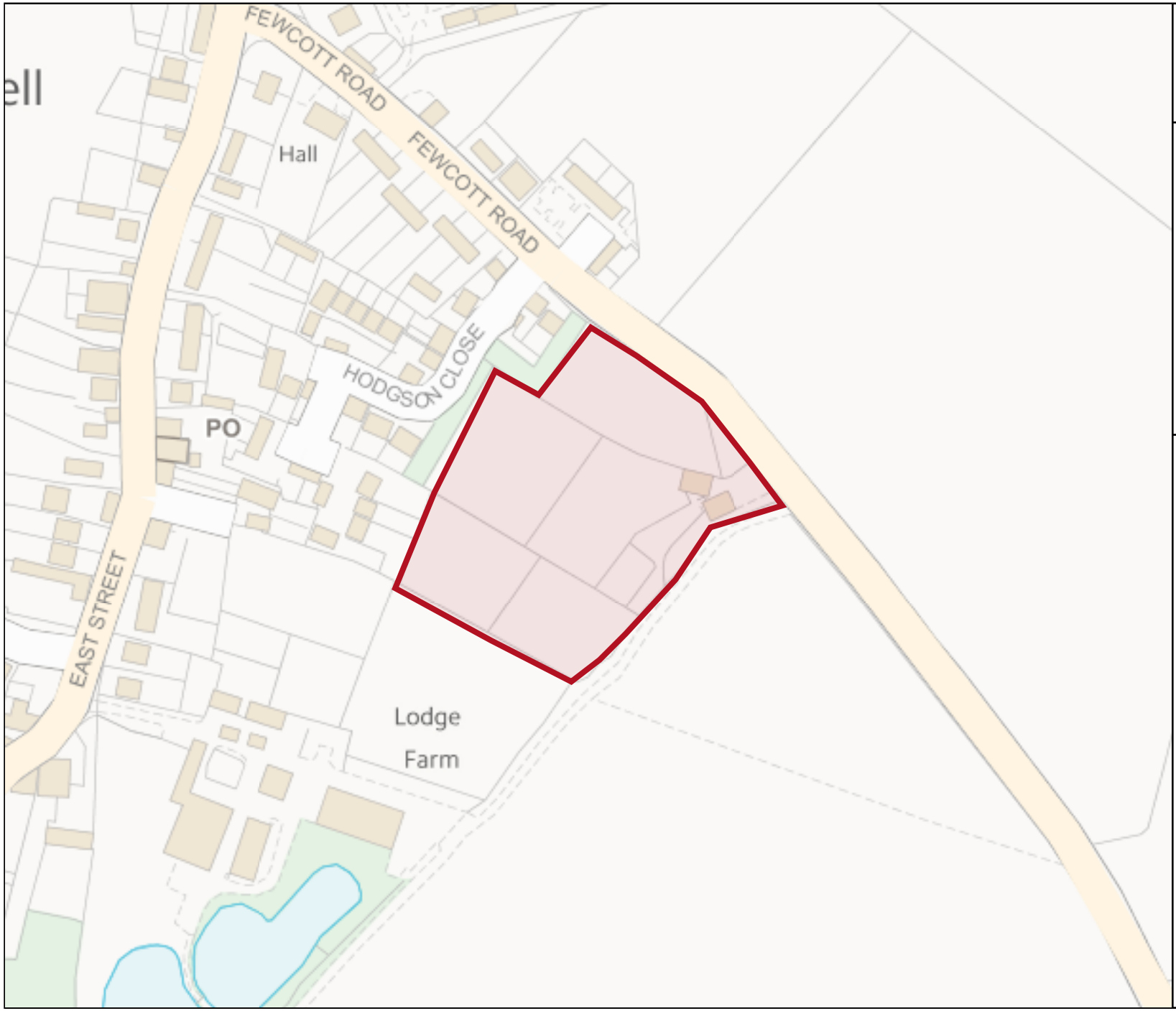
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
8180850_EAFM

Location (easting/northing)
452964/229076

Scale
1:2500

Created
15 Mar 2019 4:30

- Selected area
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

Appendix F

Proposed Outline Surface Water Drainage Strategy

NOTES

1. Dimensions not to be scaled.
2. Outline Layout taken from CALA Homes Drawing No: SK01-H

KEY

- Approximate site boundary
- Permeable paving
- Proposed permeable paving with lined sub-base
- Geocellular crates
- Proposed surface water sewer
- Existing Anglian Water sewer
- Proposed Surface Water Manhole

SuDS Feature	Plots Served	Dimensions	File Reference
Geocellular Crates	Plots 1 and 20 / 38	2.5m x 4.5m x 0.8m	Soakaway1.srcx
Geocellular Crates	Plots 3 and 23	6.5m x 1.5m x 0.8m	Soakaway2.srcx
Geocellular Crates	Plots 26, 27, 28, 29, 10, 18, 19	4.0m x 2.0m x 0.4m	Soakaway3.srcx
Geocellular Crates	Plots 15, 16, 21, 22, 24, 25	3.5m x 2.5m x 0.4m	Soakaway4.srcx
Geocellular Crates	Plots 30-35	7.5m x 4.5m x 0.4m	Soakaway5.srcx
Geocellular Crates	Plots 11/ 12 and 36 /37	4.5m x 5.0m x 0.4m	Soakaway6.srcx
Geocellular Crates	Plots 13/14/17	5.5m x 4.0m x 0.8m	Soakaway7.srcx
Permeable Paving	-	-	Roads.srcx

Rev.	Description	Date	Chkd
P1	First Issue	18.03.2019 SM	KR

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Client : CALA Homes (Chiltern) Ltd

Project : Fewcott Road, Fritwell

Title : Outline Surface Water Drainage Strategy

Project Engineer :	S McNair	Scale :	1:500 @ A1
Project Director :	K Rayner	Date :	March 2019
Status :	PRELIMINARY		

Drawing No. 8180850-SK02 Rev P1

Appendix G

MicroDrainage Calculations

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 504 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	98.834	0.334	0.1	3.6	O K
30 min Summer	98.932	0.432	0.1	4.6	O K
60 min Summer	99.026	0.526	0.1	5.6	O K
120 min Summer	99.105	0.605	0.1	6.5	O K
180 min Summer	99.137	0.637	0.1	6.8	O K
240 min Summer	99.150	0.650	0.1	6.9	O K
360 min Summer	99.150	0.650	0.1	7.0	O K
480 min Summer	99.145	0.645	0.1	6.9	O K
600 min Summer	99.137	0.637	0.1	6.8	O K
720 min Summer	99.128	0.628	0.1	6.7	O K
960 min Summer	99.108	0.608	0.1	6.5	O K
1440 min Summer	99.065	0.565	0.1	6.0	O K
2160 min Summer	99.005	0.505	0.1	5.4	O K
2880 min Summer	98.954	0.454	0.1	4.9	O K
4320 min Summer	98.869	0.369	0.1	3.9	O K
5760 min Summer	98.803	0.303	0.1	3.2	O K
7200 min Summer	98.749	0.249	0.1	2.7	O K
8640 min Summer	98.706	0.206	0.1	2.2	O K
10080 min Summer	98.669	0.169	0.1	1.8	O K
15 min Winter	98.875	0.375	0.1	4.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	139.350	0.0	22
30 min Summer	91.106	0.0	37
60 min Summer	56.713	0.0	66
120 min Summer	34.106	0.0	124
180 min Summer	24.997	0.0	184
240 min Summer	19.934	0.0	242
360 min Summer	14.444	0.0	342
480 min Summer	11.493	0.0	396
600 min Summer	9.620	0.0	458
720 min Summer	8.314	0.0	522
960 min Summer	6.600	0.0	658
1440 min Summer	4.760	0.0	938
2160 min Summer	3.427	0.0	1344
2880 min Summer	2.712	0.0	1756
4320 min Summer	1.948	0.0	2512
5760 min Summer	1.538	0.0	3288
7200 min Summer	1.281	0.0	4032
8640 min Summer	1.102	0.0	4752
10080 min Summer	0.970	0.0	5448
15 min Winter	139.350	0.0	22

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	98.985	0.485	0.1	5.2	O K
60 min Winter	99.091	0.591	0.1	6.3	O K
120 min Winter	99.183	0.683	0.2	7.3	O K
180 min Winter	99.222	0.722	0.2	7.7	O K
240 min Winter	99.239	0.739	0.2	7.9	O K
360 min Winter	99.245	0.745	0.2	8.0	O K
480 min Winter	99.237	0.737	0.2	7.9	O K
600 min Winter	99.227	0.727	0.2	7.8	O K
720 min Winter	99.216	0.716	0.2	7.6	O K
960 min Winter	99.189	0.689	0.2	7.4	O K
1440 min Winter	99.128	0.628	0.1	6.7	O K
2160 min Winter	99.043	0.543	0.1	5.8	O K
2880 min Winter	98.971	0.471	0.1	5.0	O K
4320 min Winter	98.856	0.356	0.1	3.8	O K
5760 min Winter	98.769	0.269	0.1	2.9	O K
7200 min Winter	98.702	0.202	0.1	2.2	O K
8640 min Winter	98.649	0.149	0.1	1.6	O K
10080 min Winter	98.607	0.107	0.1	1.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	91.106	0.0	36
60 min Winter	56.713	0.0	66
120 min Winter	34.106	0.0	122
180 min Winter	24.997	0.0	180
240 min Winter	19.934	0.0	236
360 min Winter	14.444	0.0	346
480 min Winter	11.493	0.0	444
600 min Winter	9.620	0.0	476
720 min Winter	8.314	0.0	554
960 min Winter	6.600	0.0	708
1440 min Winter	4.760	0.0	1010
2160 min Winter	3.427	0.0	1448
2880 min Winter	2.712	0.0	1872
4320 min Winter	1.948	0.0	2680
5760 min Winter	1.538	0.0	3456
7200 min Winter	1.281	0.0	4184
8640 min Winter	1.102	0.0	4920
10080 min Winter	0.970	0.0	5552

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.410	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.014

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.007	4	8	0.007

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 98.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.07200

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	11.3	11.3	0.900	0.0	22.5
0.800	11.3	22.5			

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 431 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	98.829	0.329	0.1	3.1	O K
30 min Summer	98.925	0.425	0.1	3.9	O K
60 min Summer	99.016	0.516	0.1	4.8	O K
120 min Summer	99.089	0.589	0.1	5.5	O K
180 min Summer	99.116	0.616	0.1	5.7	O K
240 min Summer	99.124	0.624	0.1	5.8	O K
360 min Summer	99.120	0.620	0.1	5.7	O K
480 min Summer	99.114	0.614	0.1	5.7	O K
600 min Summer	99.105	0.605	0.1	5.6	O K
720 min Summer	99.095	0.595	0.1	5.5	O K
960 min Summer	99.073	0.573	0.1	5.3	O K
1440 min Summer	99.026	0.526	0.1	4.9	O K
2160 min Summer	98.965	0.465	0.1	4.3	O K
2880 min Summer	98.913	0.413	0.1	3.8	O K
4320 min Summer	98.831	0.331	0.1	3.1	O K
5760 min Summer	98.768	0.268	0.1	2.5	O K
7200 min Summer	98.719	0.219	0.1	2.0	O K
8640 min Summer	98.679	0.179	0.1	1.7	O K
10080 min Summer	98.647	0.147	0.1	1.4	O K
15 min Winter	98.869	0.369	0.1	3.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	139.350	0.0	22
30 min Summer	91.106	0.0	37
60 min Summer	56.713	0.0	66
120 min Summer	34.106	0.0	124
180 min Summer	24.997	0.0	182
240 min Summer	19.934	0.0	240
360 min Summer	14.444	0.0	308
480 min Summer	11.493	0.0	370
600 min Summer	9.620	0.0	434
720 min Summer	8.314	0.0	502
960 min Summer	6.600	0.0	640
1440 min Summer	4.760	0.0	914
2160 min Summer	3.427	0.0	1320
2880 min Summer	2.712	0.0	1728
4320 min Summer	1.948	0.0	2472
5760 min Summer	1.538	0.0	3232
7200 min Summer	1.281	0.0	3968
8640 min Summer	1.102	0.0	4672
10080 min Summer	0.970	0.0	5440
15 min Winter	139.350	0.0	22

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	98.978	0.478	0.1	4.4	O K
60 min Winter	99.080	0.580	0.1	5.4	O K
120 min Winter	99.166	0.666	0.2	6.2	O K
180 min Winter	99.199	0.699	0.2	6.5	O K
240 min Winter	99.210	0.710	0.2	6.6	O K
360 min Winter	99.208	0.708	0.2	6.6	O K
480 min Winter	99.198	0.698	0.2	6.5	O K
600 min Winter	99.187	0.687	0.2	6.4	O K
720 min Winter	99.173	0.673	0.2	6.2	O K
960 min Winter	99.141	0.641	0.2	5.9	O K
1440 min Winter	99.076	0.576	0.1	5.3	O K
2160 min Winter	98.989	0.489	0.1	4.5	O K
2880 min Winter	98.918	0.418	0.1	3.9	O K
4320 min Winter	98.809	0.309	0.1	2.9	O K
5760 min Winter	98.730	0.230	0.1	2.1	O K
7200 min Winter	98.670	0.170	0.1	1.6	O K
8640 min Winter	98.624	0.124	0.1	1.2	O K
10080 min Winter	98.589	0.089	0.1	0.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	91.106	0.0	36
60 min Winter	56.713	0.0	64
120 min Winter	34.106	0.0	122
180 min Winter	24.997	0.0	178
240 min Winter	19.934	0.0	234
360 min Winter	14.444	0.0	340
480 min Winter	11.493	0.0	384
600 min Winter	9.620	0.0	460
720 min Winter	8.314	0.0	536
960 min Winter	6.600	0.0	690
1440 min Winter	4.760	0.0	984
2160 min Winter	3.427	0.0	1408
2880 min Winter	2.712	0.0	1820
4320 min Winter	1.948	0.0	2600
5760 min Winter	1.538	0.0	3352
7200 min Winter	1.281	0.0	4104
8640 min Winter	1.102	0.0	4840
10080 min Winter	0.970	0.0	5544

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.410	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.012

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.006	4	8	0.006

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 98.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.07200

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	9.8	9.8	0.900	0.0	22.6
0.800	9.8	22.6			

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 362 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.199	0.199	0.1	1.5	O K
30 min Summer	99.257	0.257	0.1	2.0	O K
60 min Summer	99.310	0.310	0.1	2.4	O K
120 min Summer	99.351	0.351	0.1	2.7	O K
180 min Summer	99.363	0.363	0.1	2.8	O K
240 min Summer	99.364	0.364	0.1	2.8	O K
360 min Summer	99.359	0.359	0.1	2.7	O K
480 min Summer	99.353	0.353	0.1	2.7	O K
600 min Summer	99.345	0.345	0.1	2.6	O K
720 min Summer	99.337	0.337	0.1	2.6	O K
960 min Summer	99.319	0.319	0.1	2.4	O K
1440 min Summer	99.286	0.286	0.1	2.2	O K
2160 min Summer	99.242	0.242	0.1	1.8	O K
2880 min Summer	99.206	0.206	0.1	1.6	O K
4320 min Summer	99.149	0.149	0.1	1.1	O K
5760 min Summer	99.109	0.109	0.1	0.8	O K
7200 min Summer	99.080	0.080	0.0	0.6	O K
8640 min Summer	99.060	0.060	0.0	0.5	O K
10080 min Summer	99.050	0.050	0.0	0.4	O K
15 min Winter	99.224	0.224	0.1	1.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	139.350	0.0	22
30 min Summer	91.106	0.0	37
60 min Summer	56.713	0.0	66
120 min Summer	34.106	0.0	124
180 min Summer	24.997	0.0	182
240 min Summer	19.934	0.0	236
360 min Summer	14.444	0.0	290
480 min Summer	11.493	0.0	354
600 min Summer	9.620	0.0	422
720 min Summer	8.314	0.0	490
960 min Summer	6.600	0.0	628
1440 min Summer	4.760	0.0	900
2160 min Summer	3.427	0.0	1300
2880 min Summer	2.712	0.0	1680
4320 min Summer	1.948	0.0	2424
5760 min Summer	1.538	0.0	3120
7200 min Summer	1.281	0.0	3824
8640 min Summer	1.102	0.0	4496
10080 min Summer	0.970	0.0	5144
15 min Winter	139.350	0.0	22

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.289	0.289	0.1	2.2	O K
60 min Winter	99.349	0.349	0.1	2.7	O K
120 min Winter	99.397	0.397	0.1	3.0	O K
180 min Winter	99.417	0.417	0.1	3.1	O K
240 min Winter	99.422	0.422	0.1	3.2	O K
360 min Winter	99.412	0.412	0.1	3.1	O K
480 min Winter	99.402	0.402	0.1	3.1	O K
600 min Winter	99.391	0.391	0.1	3.0	O K
720 min Winter	99.380	0.380	0.1	2.9	O K
960 min Winter	99.355	0.355	0.1	2.7	O K
1440 min Winter	99.306	0.306	0.1	2.3	O K
2160 min Winter	99.244	0.244	0.1	1.9	O K
2880 min Winter	99.194	0.194	0.1	1.5	O K
4320 min Winter	99.120	0.120	0.1	0.9	O K
5760 min Winter	99.072	0.072	0.0	0.5	O K
7200 min Winter	99.049	0.049	0.0	0.4	O K
8640 min Winter	99.042	0.042	0.0	0.3	O K
10080 min Winter	99.037	0.037	0.0	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	91.106	0.0	36
60 min Winter	56.713	0.0	64
120 min Winter	34.106	0.0	122
180 min Winter	24.997	0.0	178
240 min Winter	19.934	0.0	234
360 min Winter	14.444	0.0	330
480 min Winter	11.493	0.0	374
600 min Winter	9.620	0.0	452
720 min Winter	8.314	0.0	528
960 min Winter	6.600	0.0	678
1440 min Winter	4.760	0.0	970
2160 min Winter	3.427	0.0	1384
2880 min Winter	2.712	0.0	1784
4320 min Winter	1.948	0.0	2512
5760 min Winter	1.538	0.0	3176
7200 min Winter	1.281	0.0	3696
8640 min Winter	1.102	0.0	4488
10080 min Winter	0.970	0.0	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.410	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.006

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.003	4	8	0.003

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 99.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.07200

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	8.0	8.0	0.500	0.0	12.8
0.400	8.0	12.8			

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 354 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.182	0.182	0.1	1.5	O K
30 min Summer	99.234	0.234	0.1	1.9	O K
60 min Summer	99.283	0.283	0.1	2.4	O K
120 min Summer	99.320	0.320	0.1	2.7	O K
180 min Summer	99.331	0.331	0.1	2.8	O K
240 min Summer	99.332	0.332	0.1	2.8	O K
360 min Summer	99.327	0.327	0.1	2.7	O K
480 min Summer	99.321	0.321	0.1	2.7	O K
600 min Summer	99.314	0.314	0.1	2.6	O K
720 min Summer	99.306	0.306	0.1	2.5	O K
960 min Summer	99.289	0.289	0.1	2.4	O K
1440 min Summer	99.258	0.258	0.1	2.1	O K
2160 min Summer	99.216	0.216	0.1	1.8	O K
2880 min Summer	99.182	0.182	0.1	1.5	O K
4320 min Summer	99.129	0.129	0.1	1.1	O K
5760 min Summer	99.092	0.092	0.1	0.8	O K
7200 min Summer	99.067	0.067	0.1	0.6	O K
8640 min Summer	99.052	0.052	0.0	0.4	O K
10080 min Summer	99.046	0.046	0.0	0.4	O K
15 min Winter	99.204	0.204	0.1	1.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	139.350	0.0	22
30 min Summer	91.106	0.0	36
60 min Summer	56.713	0.0	66
120 min Summer	34.106	0.0	124
180 min Summer	24.997	0.0	182
240 min Summer	19.934	0.0	236
360 min Summer	14.444	0.0	290
480 min Summer	11.493	0.0	354
600 min Summer	9.620	0.0	422
720 min Summer	8.314	0.0	490
960 min Summer	6.600	0.0	628
1440 min Summer	4.760	0.0	900
2160 min Summer	3.427	0.0	1300
2880 min Summer	2.712	0.0	1676
4320 min Summer	1.948	0.0	2420
5760 min Summer	1.538	0.0	3112
7200 min Summer	1.281	0.0	3816
8640 min Summer	1.102	0.0	4416
10080 min Summer	0.970	0.0	5144
15 min Winter	139.350	0.0	22

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.264	0.264	0.1	2.2	O K
60 min Winter	99.319	0.319	0.1	2.7	O K
120 min Winter	99.363	0.363	0.1	3.0	O K
180 min Winter	99.378	0.378	0.1	3.1	O K
240 min Winter	99.381	0.381	0.1	3.2	O K
360 min Winter	99.374	0.374	0.1	3.1	O K
480 min Winter	99.366	0.366	0.1	3.0	O K
600 min Winter	99.356	0.356	0.1	3.0	O K
720 min Winter	99.345	0.345	0.1	2.9	O K
960 min Winter	99.321	0.321	0.1	2.7	O K
1440 min Winter	99.276	0.276	0.1	2.3	O K
2160 min Winter	99.217	0.217	0.1	1.8	O K
2880 min Winter	99.169	0.169	0.1	1.4	O K
4320 min Winter	99.100	0.100	0.1	0.8	O K
5760 min Winter	99.058	0.058	0.1	0.5	O K
7200 min Winter	99.045	0.045	0.0	0.4	O K
8640 min Winter	99.039	0.039	0.0	0.3	O K
10080 min Winter	99.034	0.034	0.0	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	91.106	0.0	36
60 min Winter	56.713	0.0	64
120 min Winter	34.106	0.0	122
180 min Winter	24.997	0.0	178
240 min Winter	19.934	0.0	232
360 min Winter	14.444	0.0	330
480 min Winter	11.493	0.0	374
600 min Winter	9.620	0.0	452
720 min Winter	8.314	0.0	528
960 min Winter	6.600	0.0	678
1440 min Winter	4.760	0.0	970
2160 min Winter	3.427	0.0	1384
2880 min Winter	2.712	0.0	1764
4320 min Winter	1.948	0.0	2508
5760 min Winter	1.538	0.0	3112
7200 min Winter	1.281	0.0	3744
8640 min Winter	1.102	0.0	4416
10080 min Winter	0.970	0.0	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.410	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.006

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.003	4	8	0.003

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 99.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.07200

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	8.8	8.8	0.500	0.0	13.6
0.400	8.8	13.6			

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 437 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.174	0.174	0.2	5.6	O K
30 min Summer	99.224	0.224	0.2	7.2	O K
60 min Summer	99.272	0.272	0.2	8.7	O K
120 min Summer	99.311	0.311	0.2	10.0	O K
180 min Summer	99.325	0.325	0.2	10.4	O K
240 min Summer	99.329	0.329	0.2	10.6	O K
360 min Summer	99.326	0.326	0.2	10.4	O K
480 min Summer	99.320	0.320	0.2	10.3	O K
600 min Summer	99.314	0.314	0.2	10.1	O K
720 min Summer	99.307	0.307	0.2	9.8	O K
960 min Summer	99.292	0.292	0.2	9.4	O K
1440 min Summer	99.263	0.263	0.2	8.4	O K
2160 min Summer	99.224	0.224	0.2	7.2	O K
2880 min Summer	99.189	0.189	0.2	6.1	O K
4320 min Summer	99.135	0.135	0.2	4.3	O K
5760 min Summer	99.095	0.095	0.2	3.1	O K
7200 min Summer	99.068	0.068	0.2	2.2	O K
8640 min Summer	99.052	0.052	0.2	1.7	O K
10080 min Summer	99.046	0.046	0.2	1.5	O K
15 min Winter	99.195	0.195	0.2	6.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	139.350	0.0	22
30 min Summer	91.106	0.0	37
60 min Summer	56.713	0.0	66
120 min Summer	34.106	0.0	124
180 min Summer	24.997	0.0	182
240 min Summer	19.934	0.0	242
360 min Summer	14.444	0.0	326
480 min Summer	11.493	0.0	384
600 min Summer	9.620	0.0	446
720 min Summer	8.314	0.0	512
960 min Summer	6.600	0.0	650
1440 min Summer	4.760	0.0	924
2160 min Summer	3.427	0.0	1324
2880 min Summer	2.712	0.0	1708
4320 min Summer	1.948	0.0	2464
5760 min Summer	1.538	0.0	3168
7200 min Summer	1.281	0.0	3816
8640 min Summer	1.102	0.0	4416
10080 min Summer	0.970	0.0	5144
15 min Winter	139.350	0.0	22

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.252	0.252	0.2	8.1	O K
60 min Winter	99.306	0.306	0.2	9.8	O K
120 min Winter	99.352	0.352	0.3	11.3	O K
180 min Winter	99.370	0.370	0.3	11.9	O K
240 min Winter	99.377	0.377	0.3	12.1	O K
360 min Winter	99.376	0.376	0.3	12.1	O K
480 min Winter	99.367	0.367	0.3	11.8	O K
600 min Winter	99.359	0.359	0.3	11.5	O K
720 min Winter	99.350	0.350	0.3	11.2	O K
960 min Winter	99.330	0.330	0.2	10.6	O K
1440 min Winter	99.288	0.288	0.2	9.2	O K
2160 min Winter	99.231	0.231	0.2	7.4	O K
2880 min Winter	99.182	0.182	0.2	5.8	O K
4320 min Winter	99.106	0.106	0.2	3.4	O K
5760 min Winter	99.059	0.059	0.2	1.9	O K
7200 min Winter	99.045	0.045	0.2	1.4	O K
8640 min Winter	99.039	0.039	0.1	1.3	O K
10080 min Winter	99.035	0.035	0.1	1.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	91.106	0.0	36
60 min Winter	56.713	0.0	64
120 min Winter	34.106	0.0	122
180 min Winter	24.997	0.0	180
240 min Winter	19.934	0.0	236
360 min Winter	14.444	0.0	346
480 min Winter	11.493	0.0	440
600 min Winter	9.620	0.0	474
720 min Winter	8.314	0.0	550
960 min Winter	6.600	0.0	704
1440 min Winter	4.760	0.0	1000
2160 min Winter	3.427	0.0	1428
2880 min Winter	2.712	0.0	1820
4320 min Winter	1.948	0.0	2552
5760 min Winter	1.538	0.0	3168
7200 min Winter	1.281	0.0	3744
8640 min Winter	1.102	0.0	4416
10080 min Winter	0.970	0.0	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.410	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.022

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.011	4	8	0.011

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 99.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.07200

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	33.8	33.8	0.500	0.0	43.4
0.400	33.8	43.4			

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 442 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.189	0.189	0.1	4.0	O K
30 min Summer	99.245	0.245	0.2	5.2	O K
60 min Summer	99.297	0.297	0.2	6.3	O K
120 min Summer	99.340	0.340	0.2	7.3	O K
180 min Summer	99.355	0.355	0.2	7.6	O K
240 min Summer	99.360	0.360	0.2	7.7	O K
360 min Summer	99.356	0.356	0.2	7.6	O K
480 min Summer	99.351	0.351	0.2	7.5	O K
600 min Summer	99.344	0.344	0.2	7.3	O K
720 min Summer	99.337	0.337	0.2	7.2	O K
960 min Summer	99.321	0.321	0.2	6.9	O K
1440 min Summer	99.291	0.291	0.2	6.2	O K
2160 min Summer	99.249	0.249	0.2	5.3	O K
2880 min Summer	99.213	0.213	0.2	4.6	O K
4320 min Summer	99.155	0.155	0.1	3.3	O K
5760 min Summer	99.113	0.113	0.1	2.4	O K
7200 min Summer	99.081	0.081	0.1	1.7	O K
8640 min Summer	99.061	0.061	0.1	1.3	O K
10080 min Summer	99.050	0.050	0.1	1.1	O K
15 min Winter	99.213	0.213	0.2	4.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	139.350	0.0	22
30 min Summer	91.106	0.0	37
60 min Summer	56.713	0.0	66
120 min Summer	34.106	0.0	124
180 min Summer	24.997	0.0	182
240 min Summer	19.934	0.0	242
360 min Summer	14.444	0.0	326
480 min Summer	11.493	0.0	384
600 min Summer	9.620	0.0	446
720 min Summer	8.314	0.0	512
960 min Summer	6.600	0.0	650
1440 min Summer	4.760	0.0	924
2160 min Summer	3.427	0.0	1324
2880 min Summer	2.712	0.0	1728
4320 min Summer	1.948	0.0	2468
5760 min Summer	1.538	0.0	3176
7200 min Summer	1.281	0.0	3888
8640 min Summer	1.102	0.0	4496
10080 min Summer	0.970	0.0	5144
15 min Winter	139.350	0.0	22

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.275	0.275	0.2	5.9	O K
60 min Winter	99.334	0.334	0.2	7.1	O K
120 min Winter	99.385	0.385	0.2	8.2	O K
180 min Winter	99.405	0.405	0.2	8.6	O K
240 min Winter	99.413	0.413	0.2	8.8	O K
360 min Winter	99.413	0.413	0.2	8.8	O K
480 min Winter	99.402	0.402	0.2	8.6	O K
600 min Winter	99.394	0.394	0.2	8.4	O K
720 min Winter	99.384	0.384	0.2	8.2	O K
960 min Winter	99.363	0.363	0.2	7.8	O K
1440 min Winter	99.320	0.320	0.2	6.8	O K
2160 min Winter	99.259	0.259	0.2	5.5	O K
2880 min Winter	99.208	0.208	0.2	4.4	O K
4320 min Winter	99.128	0.128	0.1	2.7	O K
5760 min Winter	99.074	0.074	0.1	1.6	O K
7200 min Winter	99.049	0.049	0.1	1.0	O K
8640 min Winter	99.042	0.042	0.1	0.9	O K
10080 min Winter	99.037	0.037	0.1	0.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	91.106	0.0	36
60 min Winter	56.713	0.0	64
120 min Winter	34.106	0.0	122
180 min Winter	24.997	0.0	180
240 min Winter	19.934	0.0	236
360 min Winter	14.444	0.0	346
480 min Winter	11.493	0.0	438
600 min Winter	9.620	0.0	472
720 min Winter	8.314	0.0	548
960 min Winter	6.600	0.0	704
1440 min Winter	4.760	0.0	1000
2160 min Winter	3.427	0.0	1428
2880 min Winter	2.712	0.0	1820
4320 min Winter	1.948	0.0	2560
5760 min Winter	1.538	0.0	3232
7200 min Winter	1.281	0.0	3744
8640 min Winter	1.102	0.0	4416
10080 min Winter	0.970	0.0	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.410	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.016

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.008	4	8	0.008

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 99.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.07200

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	22.5	22.5	0.500	0.0	30.1
0.400	22.5	30.1			

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 604 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	98.818	0.318	0.2	6.6	O K
30 min Summer	98.912	0.412	0.2	8.6	O K
60 min Summer	99.002	0.502	0.2	10.5	O K
120 min Summer	99.082	0.582	0.2	12.2	O K
180 min Summer	99.116	0.616	0.2	12.9	O K
240 min Summer	99.132	0.632	0.2	13.2	O K
360 min Summer	99.140	0.640	0.2	13.4	O K
480 min Summer	99.134	0.634	0.2	13.3	O K
600 min Summer	99.127	0.627	0.2	13.1	O K
720 min Summer	99.119	0.619	0.2	12.9	O K
960 min Summer	99.101	0.601	0.2	12.6	O K
1440 min Summer	99.062	0.562	0.2	11.8	O K
2160 min Summer	99.008	0.508	0.2	10.6	O K
2880 min Summer	98.959	0.459	0.2	9.6	O K
4320 min Summer	98.877	0.377	0.2	7.9	O K
5760 min Summer	98.810	0.310	0.2	6.5	O K
7200 min Summer	98.754	0.254	0.2	5.3	O K
8640 min Summer	98.709	0.209	0.1	4.4	O K
10080 min Summer	98.670	0.170	0.1	3.6	O K
15 min Winter	98.856	0.356	0.2	7.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	139.350	0.0	22
30 min Summer	91.106	0.0	37
60 min Summer	56.713	0.0	66
120 min Summer	34.106	0.0	126
180 min Summer	24.997	0.0	184
240 min Summer	19.934	0.0	242
360 min Summer	14.444	0.0	360
480 min Summer	11.493	0.0	436
600 min Summer	9.620	0.0	494
720 min Summer	8.314	0.0	556
960 min Summer	6.600	0.0	686
1440 min Summer	4.760	0.0	960
2160 min Summer	3.427	0.0	1368
2880 min Summer	2.712	0.0	1784
4320 min Summer	1.948	0.0	2556
5760 min Summer	1.538	0.0	3344
7200 min Summer	1.281	0.0	4040
8640 min Summer	1.102	0.0	4760
10080 min Summer	0.970	0.0	5544
15 min Winter	139.350	0.0	22

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	98.962	0.462	0.2	9.7	O K
60 min Winter	99.065	0.565	0.2	11.8	O K
120 min Winter	99.157	0.657	0.2	13.7	O K
180 min Winter	99.198	0.698	0.2	14.6	O K
240 min Winter	99.218	0.718	0.2	15.0	O K
360 min Winter	99.232	0.732	0.2	15.3	O K
480 min Winter	99.230	0.730	0.2	15.3	O K
600 min Winter	99.220	0.720	0.2	15.0	O K
720 min Winter	99.209	0.709	0.2	14.8	O K
960 min Winter	99.187	0.687	0.2	14.4	O K
1440 min Winter	99.135	0.635	0.2	13.3	O K
2160 min Winter	99.057	0.557	0.2	11.6	O K
2880 min Winter	98.988	0.488	0.2	10.2	O K
4320 min Winter	98.872	0.372	0.2	7.8	O K
5760 min Winter	98.782	0.282	0.2	5.9	O K
7200 min Winter	98.710	0.210	0.1	4.4	O K
8640 min Winter	98.652	0.152	0.1	3.2	O K
10080 min Winter	98.606	0.106	0.1	2.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	91.106	0.0	37
60 min Winter	56.713	0.0	66
120 min Winter	34.106	0.0	122
180 min Winter	24.997	0.0	180
240 min Winter	19.934	0.0	238
360 min Winter	14.444	0.0	350
480 min Winter	11.493	0.0	458
600 min Winter	9.620	0.0	556
720 min Winter	8.314	0.0	578
960 min Winter	6.600	0.0	730
1440 min Winter	4.760	0.0	1038
2160 min Winter	3.427	0.0	1476
2880 min Winter	2.712	0.0	1908
4320 min Winter	1.948	0.0	2724
5760 min Winter	1.538	0.0	3512
7200 min Winter	1.281	0.0	4248
8640 min Winter	1.102	0.0	4936
10080 min Winter	0.970	0.0	5648

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.410	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.026

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.013	4	8	0.013

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 98.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.07200

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	22.0	22.0	0.900	0.0	37.2
0.800	22.0	37.2			

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 36 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	125.627	0.177	0.6	1.6	O K
30 min Summer	125.647	0.197	0.7	2.0	O K
60 min Summer	125.657	0.207	0.7	2.2	Flood Risk
120 min Summer	125.655	0.205	0.7	2.2	Flood Risk
180 min Summer	125.647	0.197	0.7	2.0	O K
240 min Summer	125.637	0.187	0.7	1.8	O K
360 min Summer	125.619	0.169	0.6	1.5	O K
480 min Summer	125.604	0.154	0.5	1.2	O K
600 min Summer	125.592	0.142	0.5	1.1	O K
720 min Summer	125.581	0.131	0.5	0.9	O K
960 min Summer	125.564	0.114	0.4	0.7	O K
1440 min Summer	125.540	0.090	0.3	0.4	O K
2160 min Summer	125.519	0.069	0.2	0.3	O K
2880 min Summer	125.506	0.056	0.2	0.2	O K
4320 min Summer	125.495	0.045	0.1	0.1	O K
5760 min Summer	125.490	0.040	0.1	0.1	O K
7200 min Summer	125.486	0.036	0.1	0.1	O K
8640 min Summer	125.484	0.034	0.1	0.1	O K
10080 min Summer	125.482	0.032	0.1	0.1	O K
15 min Winter	125.640	0.190	0.7	1.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	130.382	0.0	17
30 min Summer	84.926	0.0	28
60 min Summer	52.662	0.0	44
120 min Summer	31.557	0.0	78
180 min Summer	23.087	0.0	112
240 min Summer	18.392	0.0	144
360 min Summer	13.299	0.0	208
480 min Summer	10.568	0.0	268
600 min Summer	8.836	0.0	330
720 min Summer	7.631	0.0	390
960 min Summer	6.050	0.0	510
1440 min Summer	4.356	0.0	750
2160 min Summer	3.131	0.0	1104
2880 min Summer	2.475	0.0	1468
4320 min Summer	1.775	0.0	2196
5760 min Summer	1.401	0.0	2928
7200 min Summer	1.165	0.0	3672
8640 min Summer	1.002	0.0	4376
10080 min Summer	0.882	0.0	5056
15 min Winter	130.382	0.0	17

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	125.662	0.212	0.7	2.4	Flood Risk
60 min Winter	125.670	0.220	0.8	2.5	Flood Risk
120 min Winter	125.664	0.214	0.8	2.4	Flood Risk
180 min Winter	125.651	0.201	0.7	2.1	Flood Risk
240 min Winter	125.637	0.187	0.7	1.8	O K
360 min Winter	125.613	0.163	0.6	1.4	O K
480 min Winter	125.593	0.143	0.5	1.1	O K
600 min Winter	125.578	0.128	0.4	0.9	O K
720 min Winter	125.565	0.115	0.4	0.7	O K
960 min Winter	125.545	0.095	0.3	0.5	O K
1440 min Winter	125.521	0.071	0.2	0.3	O K
2160 min Winter	125.502	0.052	0.2	0.1	O K
2880 min Winter	125.495	0.045	0.1	0.1	O K
4320 min Winter	125.488	0.038	0.1	0.1	O K
5760 min Winter	125.484	0.034	0.1	0.1	O K
7200 min Winter	125.481	0.031	0.1	0.0	O K
8640 min Winter	125.478	0.028	0.1	0.0	O K
10080 min Winter	125.477	0.027	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	84.926	0.0	29
60 min Winter	52.662	0.0	48
120 min Winter	31.557	0.0	84
180 min Winter	23.087	0.0	120
240 min Winter	18.392	0.0	154
360 min Winter	13.299	0.0	218
480 min Winter	10.568	0.0	280
600 min Winter	8.836	0.0	338
720 min Winter	7.631	0.0	398
960 min Winter	6.050	0.0	518
1440 min Winter	4.356	0.0	750
2160 min Winter	3.131	0.0	1100
2880 min Winter	2.475	0.0	1464
4320 min Winter	1.775	0.0	2160
5760 min Winter	1.401	0.0	2872
7200 min Winter	1.165	0.0	3672
8640 min Winter	1.002	0.0	4368
10080 min Winter	0.882	0.0	5008

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.419	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.010

Time (mins) From:	To:	Area (ha)
0	4	0.010

Model Details

Storage is Online Cover Level (m) 125.950

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.07200	Width (m)	4.8
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	26.7	Slope (1:X)	73.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	125.450	Membrane Depth (m)	0

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