

# Flood Risk Assessment & Drainage Strategy

<b>Title</b>	Beck Lane, Sutton in Ashfield
<b>Client</b>	Griffiths Services and Developments Ltd & Nottingham Community Housing Ltd
<b>Location</b>	Land off Beck Lane, Sutton in Ashfield, Nottinghamshire
<b>Project number</b>	23-0339
<b>BIM reference</b>	BLSA-BSP-XX-XX-T-W-0001-P02_Drainage_Strategy
<b>Date</b>	26 NOV 2024

### **3.0 Sustainable Drainage Strategy**

#### **3.1 Detailed Development Proposals**

3.1.1 The development proposals are for the construction of 36 residential dwellings, complete with car parking, access, landscaping and supporting infrastructure. The proposed site plan is included in **Appendix C**.

##### **Sustainable Drainage Systems**

3.1.2 Part H of the Building Regulations 2010 recommends that surface water run-off shall discharge to one of the following, listed in order of priority:

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

3.1.3 It is necessary to identify the most appropriate method of controlling and discharging surface water. The design should seek to improve the local run-off profile by using systems that can either attenuate run-off and reduce peak flow rates or positively impact on the existing flood profile.

#### **3.2 Existing Constraints**

##### **Infiltration Based Systems**

3.2.1 The British Geological Survey's Geology of Britain mapping indicates that the site is situated upon bedrock geology consisting of Lenton Sandstone Formation – Sandstone. No superficial deposits have been recorded at this location.

3.2.2 The Cranfield Soil and Agrifood Institute's Soilscape mapping indicates the western half of the site to be situated on soils categorised as Soilscape 5: freely draining lime-rich loamy soils, while the eastern half is indicated to be situated on soils categorised as Soilscape 18: slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

3.2.3 Initial BRE 365 soakaway testing was undertaken at the site, which included five trial pit locations within and adjacent to the site. Of these five locations, two of the tests failed due to a layer of clay beneath the surface. The remaining three locations provided average infiltration results of  $6.83 \times 10^{-5} \text{m/s}$ , suggesting that the use of soakaways is unlikely. Two further BRE 365 soakaway tests were then undertaken, examining four trial pit locations across the site. This testing concluded that the site is "not suitable for

soakaway drainage”. The soakaway test results and trial pit locations from all the tests have been included in **Appendix D**.

- 3.2.4 Based on the above information, permeable ground conditions do not appear to be present at the site. As a result, the discharge of surface water runoff by infiltration-based systems has been ruled out.

### Open Watercourses

- 3.2.5 There are no watercourses in close proximity to the site which are suitably located to receive a direct surface water outfall from the site.

### Sewers

- 3.2.6 As it is not possible to discharge surface water to ground or an open watercourse, it is therefore proposed to discharge surface water flows at an attenuated rate to the 225mm diameter combined sewer located in Omberley Avenue to the southwest of the site.. Any new public sewer connections will be subject to a Section 106 (Water Industry Act 1991) application to STW.

## 3.3 Sustainable Urban Drainage Systems

- 3.3.1 Sustainable Urban Drainage Systems (SuDS) are designed to reduce the risk of surface water runoff in urbanised areas in an effective manner while offering cost-benefits, reduced maintenance and increased amenity value. A summary of the different types of SuDS options available and their viability in the context of the proposed development are included in Table 3.1 below:

**Table 3.1: Sustainable Urban Drainage Systems Options**

SuDS Category	SuDS Technique	Viability	Explanation
<b>Infiltration</b>	Infiltration Trenches	X	Due to the indicated geology on-site, formal infiltration-based systems have been ruled out. This has been confirmed through BRE 365 testing.
	Infiltration Basins	X	
	Soakaways	X	
	Bioretention/Filter Strips	X	
<b>Filtration</b>	Bioretention/Rain Gardens	✓	Filtration devices could be incorporated within soft landscaped areas across the site, adjacent to impermeable roads and walkways; however, these would likely need to be positively drained due to the indicated geology beneath the site. The development proposals include a small amount of
	Filter Strips	✓	

3.3.3 With a site area of 0.88ha and using Flood Studies Report values for SAAR (731mm) and SPR (0.450), this results in a **QBAR<sub>RURAL</sub>** rate of **4.1l/s** and discharge rates for the following return periods:

Rainfall Event	Runoff Rate (l/s)
1 in 1-year	3.4
1 in 30-year	8.0
1 in 30-year + 35% Climate Change	10.8
1 in 100-year	10.5
1 in 100-year + 40% Climate Change	14.7

3.3.4 Greenfield runoff calculations are provided in **Appendix E**.

#### Return Period Design

3.3.5 The proposed surface water drainage system should be designed to accommodate the 1 in 30-year rainfall event without any surface water flooding and should be capable of retaining the 1 in 100-year plus climate change (40%) storm event on site without flooding any buildings.

#### Discharge Rate

3.3.6 In accordance with DEFRA guidance, the peak surface water runoff rate for greenfield developments should be restricted to the pre-development discharge rate where reasonably practicable. However, in order to ensure there is no risk of blockage due to a smaller control orifice it is recommended that a reasonably practicable maximum discharge rate of **5.0l/s** should be applied.

#### Drainage Proposals – Main Strategy

3.3.7 In order to maintain the discharge rate of **5.0l/s** for all storms up to and including the 100-year return period with a 40% allowance for climate change, attenuation is required which provides in the order of **345m<sup>3</sup>** of surface water storage.

3.3.8 The required surface water attenuation volume is proposed to be provisioned by a surface level detention basin before restricted discharge into the 225mm diameter combined sewer located in Omberley Avenue to the southwest of the site.

3.3.9 It is recommended that bioretention features, such as raingardens, are utilised where possible. This source control method will act to increase the rainfall-runoff response time by intercepting rainfall at source while also providing improvements to water quality.

3.3.10 An initial surface water drainage strategy plan and supporting calculations are provided in **Appendix E**.

Project Number: 23-0339  
Project Title: Beck Lane, Sutton in Ashfield  
Location: Land off Beck Lane, Sutton in Ashfield, Nottinghamshire  
BSP Document Ref: BLSA-BSP-XX-XX-T-W-0001-P02\_Drainage\_Strategy



## **Appendix D**

### **Soakaway Test Results and Trial Pit Locations**









# IN-SITU SOAKAWAY TEST RESULTS

## Trial pit No.: SK4

### Soil Profile

Depth (m)		Description
From	To	
0.00	0.35	MADE GROUND: Brown slightly gravelly sand.
0.35	0.75	Firm reddish brown slightly silty slightly gravelly CLAY.
0.75	1.10	Light brown slightly gravelly to gravelly SAND.
1.10	1.25	Strong yellowish brown and brown SANDSTONE.

### Sketch plan of test zone

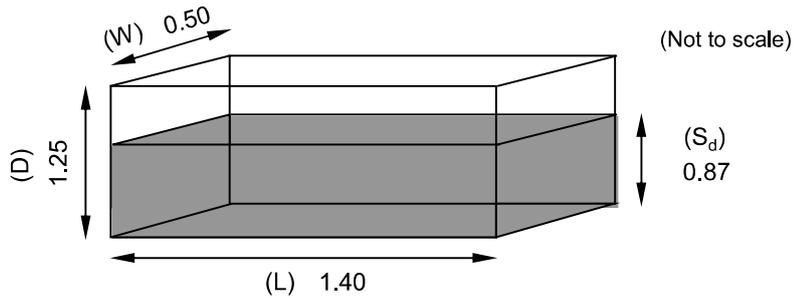
All dimensions in metres

D = Depth of test pit

W = Width of test pit

L = Length of test pit

S<sub>d</sub> = Storage depth (of water)

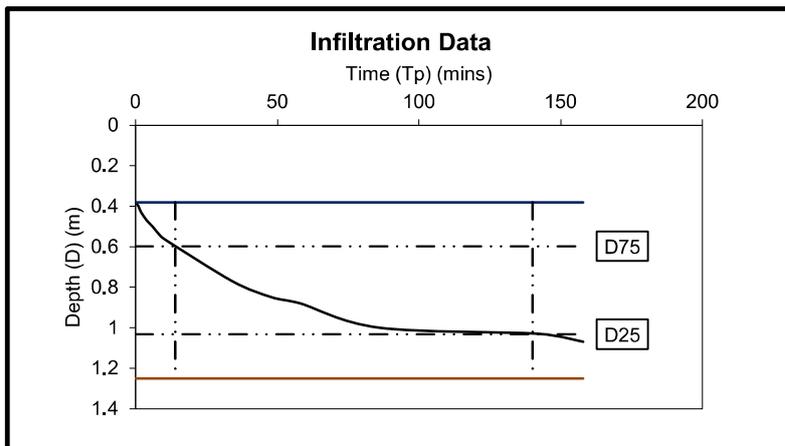


Gravel infill? No

Porosity (n) = 1

### Soakaway Test Run 1

Test Date: 16.08.24



Time (minutes)	Depth (m)
0	0.38
1	0.40
2	0.43
4	0.47
6	0.50
9	0.55
11	0.57
34	0.77
48	0.85
58	0.88
86	1.00
142	1.03
158	1.07

Notes:

Therefore:

$$S = 0.87 \text{ m} \quad a_{s50} = 2.35 \text{ m}^2 \quad V_{p75-25} = 0.30 \text{ m}^3$$

From the above graph,

$$t_{p25} = 14.00 \text{ min} \quad t_{p75} = 140.00 \text{ min} \quad t_{p75-25} = 126.00 \text{ min}$$

$$\text{Soil Infiltration Rate (f)} = \frac{V_{p75-25} \times n}{a_{s50} \times t_{p75-25}}$$

$$f_{run1} = \frac{1.71 \times 10^{-5}}{126} \text{ m/s}$$

$$\text{or } \frac{6.16 \times 10^{-2}}{60} \text{ m/hr}$$

Test and analysis carried out in general accordance with BRE Digest 365 : 2007

**Job No.:** IV.77.23  
**Site:** Land off Beck Lane, Sutton in Ashfield  
**Client:** Griffiths Developments Ltd

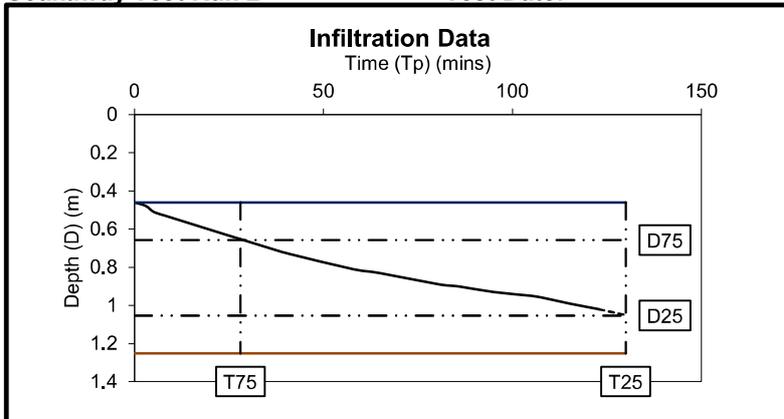


# IN-SITU SOAKAWAY TEST RESULTS

## Trial pit No.: SK4

Soakaway Test Run 2

Test Date:



Time (minutes)	Depth (m)
0	0.46
3	0.48
5	0.51
8	0.53
39	0.72
41	0.73
58	0.81
65	0.83
81	0.89
86	0.9
95	0.93
105	0.95
108	0.96
115	0.99
123	1.02

Notes:

Therefore:

$$S = 0.79 \text{ m} \quad a_{s50} = 2.20 \text{ m}^2 \quad V_{p75-25} = 0.28 \text{ m}^3$$

From the above graph,

$$t_{p25} = 130.00 \text{ min} \quad t_{p75} = 28.00 \text{ min} \quad t_{p75-25} = 102.00 \text{ min}$$

$$\text{Soil Infiltration Rate (f)} = \frac{V_{p75-25} \times n}{a_{s50} \times t_{p75-25}}$$

$$f_{\text{run2}} = \frac{2.05 \times 10^{-5}}{\text{m/s}}$$

$$\text{or } \frac{7.39 \times 10^{-2}}{\text{m/hr}}$$

Test and analysis carried out in general accordance with BRE Digest 365 : 2007

**Job No.:** IV.77.23  
**Site:** Land off Beck Lane, Sutton in Ashfield  
**Client:** Griffiths Developments Ltd



# IN-SITU SOAKAWAY TEST RESULTS

## Trial pit No.: SK5

### Soil Profile

Depth (m)		Description
From	To	
0.00	0.35	MADE GROUND: Brown slightly gravelly sand.
0.35	0.75	Firm reddish brown slightly silty slightly gravelly CLAY.
0.75	1.10	Light brown slightly gravelly to gravelly SAND.
1.10	1.25	Strong yellowish brown and brown SANDSTONE.

### Sketch plan of test zone

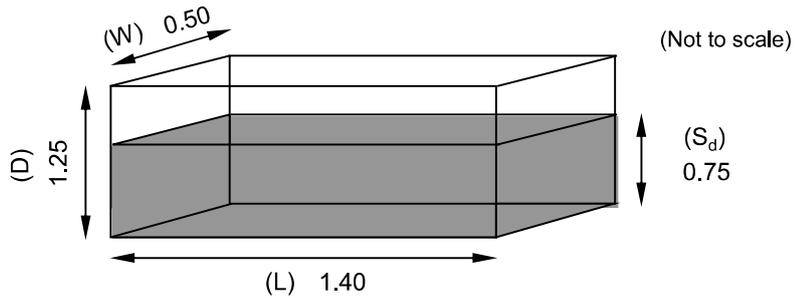
All dimensions in metres

D = Depth of test pit

W = Width of test pit

L = Length of test pit

S<sub>d</sub> = Storage depth (of water)

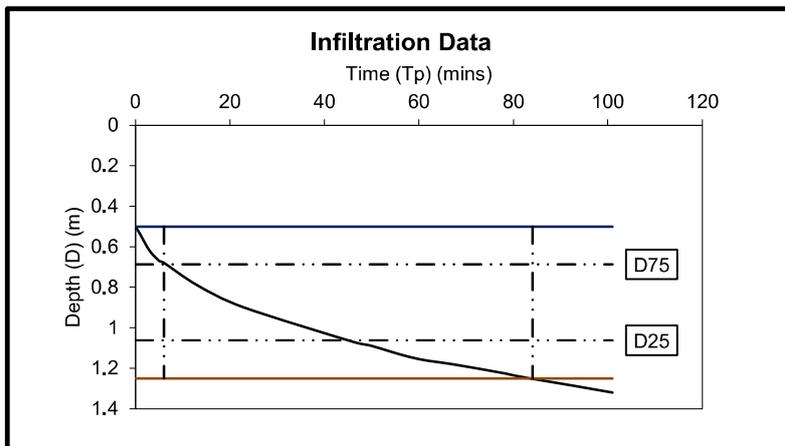


Gravel infill? No

Porosity (n) = 1

### Soakaway Test Run 1

Test Date: 16.08.24



Time (minutes)	Depth (m)
0	0.50
1	0.54
3	0.62
5	0.67
6	0.68
13	0.79
23	0.90
46	1.07
50	1.09
59	1.15
67	1.18
77	1.22
81	1.24
86	1.26
101	1.32

Notes:

Therefore:

$$S = 0.75 \text{ m} \quad a_{s50} = 2.13 \text{ m}^2 \quad V_{p75-25} = 0.26 \text{ m}^3$$

From the above graph,

$$t_{p25} = 6.00 \text{ min} \quad t_{p75} = 84.00 \text{ min} \quad t_{p75-25} = 78.00 \text{ min}$$

$$\text{Soil Infiltration Rate (f)} = \frac{V_{p75-25} \times n}{a_{s50} \times t_{p75-25}}$$

$$f_{\text{run1}} = \frac{2.64 \times 10^{-5}}{1} \text{ m/s}$$

$$\text{or } \frac{9.50 \times 10^{-2}}{1} \text{ m/hr}$$

Test and analysis carried out in general accordance with BRE Digest 365 : 2007

**Job No.:** IV.77.23

**Site:** Land off Beck Lane, Sutton in Ashfield

**Client:** Griffiths Developments Ltd





Pit Schedule

Pit	Type	Occupancy	QA	NGSS	
1	Type B1	304p	70.9	79	90%
2	Type B1	304p	70.9	79	90%
3	Type C1	305p	84.4	93	91%
4	Type C2	305p	84.4	93	91%
5	Type C2	305p	84.4	93	91%
6	Type C1	305p	84.4	93	91%
7	Type B1	304p	70.9	79	90%

KEY:

**X** Soakaway Location



**IVY HOUSE**  
environmental

Scotland Farm, Ockbrook, Derby, DE72 3RX  
rps@ivyhousenv.co.uk • www.ivyhousenv.co.uk • 01332 661 987

TITLE:

**Site Layout**

PROJECT:

**Land off Beck Lane, Sutton in Ashfield**

PROJECT No:

**IV.77.23**

DATE:

**09/2023**

SCALE:

**NTS**

DRAWN:

**VS**

DWG No:

**Figure 4**

DO NOT SCALE

IV.77.23.L1  
Date: 18<sup>th</sup> November 2024

Griffiths Services and Developments Ltd  
Suite 10  
32-46 King Street  
Alfreton  
Derbyshire  
DE55 7DQ

Dear Sirs,

**RE: Land off Beck Lane, Sutton in Ashfield, Nottinghamshire – Percolation Testing**

Introduction

Ivy House Environmental (IHE) were appointed to assess ground conditions at the above site with a view to completing a percolation testing exercise to establish drainage characteristics for the development of the site for residential development.

Ivy House completed two visits to the site, one in August 2024 and a second visit in October 2024.

The development proposal for the site is for residential properties with associated private gardens and roadways.

Fieldwork – August 2024

4No trial pits were excavated across the site at 1m<sup>3</sup> dimensions to accommodate the percolation tests.

Each pit was filled with 75% volume of water and the percolation rate was recorded by the IVYH Engineer.

Field Data

During the August visit the following results were recorded:

- SK1 Test – No movement over 4hrs. Pit backfilled.
- SK2 Test – 1 Test completed. The run drained in 3 Hrs.
- SK3 Test – Test 1 - 4hrs, 0.1m movement. Pit backfilled.
- SK4 Test – 2 tests completed – 2hrs, 0.5m movement.

None of the above are satisfactory percolation rates. Subsequently, a second visit was planned.

Fieldwork – October 2024

During the October fieldwork, the following percolation rates were recorded:

- SA1 – 180 minutes, 3cm percolation.
- SA2 – 180 minutes, 0.5m percolation.
- SA3 – 180 minutes, 4cm percolation.
- SA4 – 180 minutes, 4cm percolation.

Only pit SA2 produced satisfactory percolation rates, however, only 1 run was completed.

Conclusion

Both percolation assessments illustrated that the site specific strata is not suitable for soakaway drainage.



Pit Schedule

Pit	Type	Occupancy	QA	NGSS
1	Type B1	20tp	70.9	90%
2	Type B1	20tp	70.9	90%
3	Type C1	30tp	84.4	91%
4	Type C2	30tp	84.4	93%
5	Type C2	30tp	84.4	93%
6	Type C1	30tp	84.4	93%
7	Type B1	20tp	70.9	90%

KEY:

**X** Soakaway Location



Scotland Farm, Ockbrook, Derby, DE72 3RX  
 rps@ivyhousenv.co.uk • www.ivyhousenv.co.uk • 01332 661 987

TITLE:

Site Layout

PROJECT:

Land off Beck Lane, Sutton in Ashfield

PROJECT No:

IV.77.23

DATE:

08/2024

SCALE:

NTS

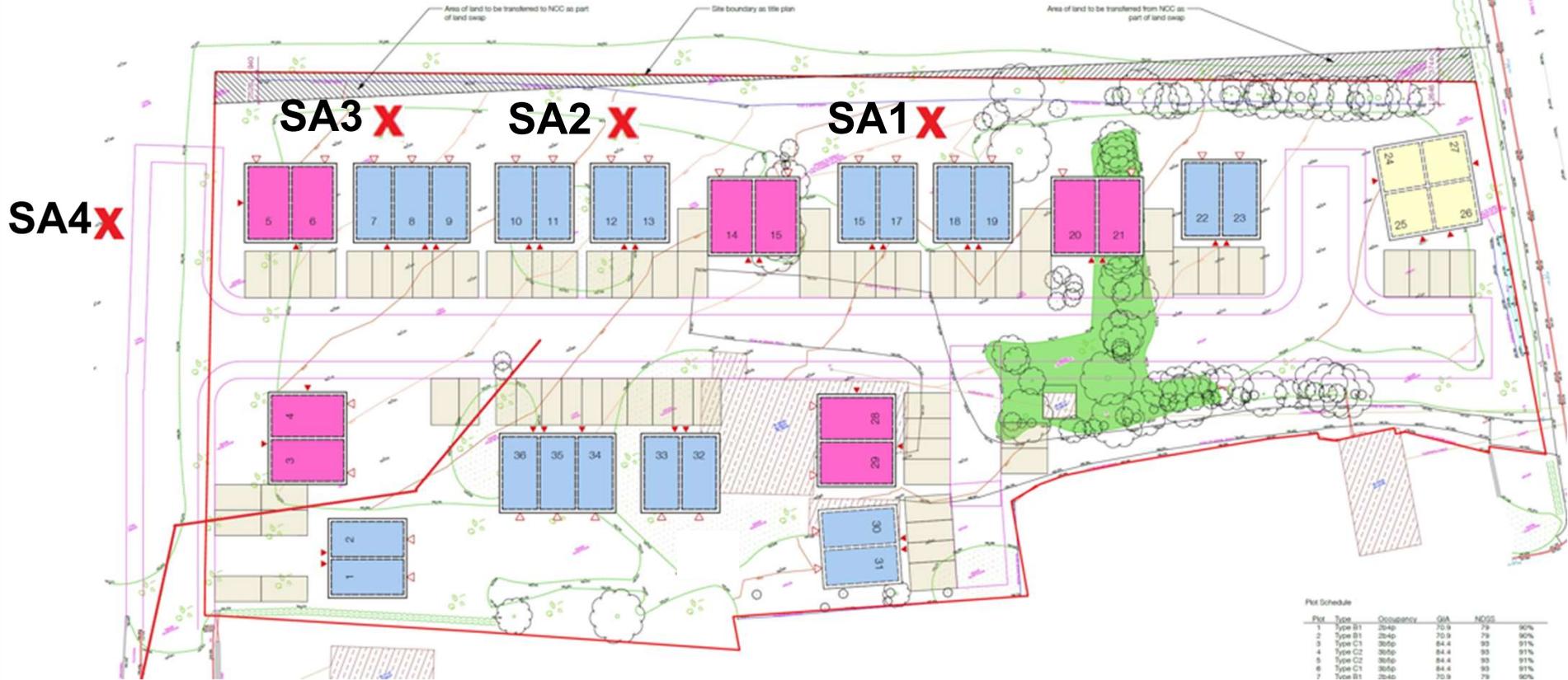
DRAWN:

VS

DWG No:

Figure 4

DO NOT SCALE



Plot Schedule

Plot	Type	Occupancy	GVA	MGSS
1	Type B1	20-40	70.9	90%
2	Type B1	20-40	70.9	90%
3	Type C1	30-50	84.4	91%
4	Type C2	30-50	84.4	93%
5	Type C2	30-50	84.4	93%
6	Type C1	30-50	84.4	93%
7	Type B1	20-40	70.9	90%

KEY:

**X** Soakaway Location



Scotland Farm, Ockbrook, Derby, DE72 3RX  
 rps@ivyhousenv.co.uk • www.ivyhousenv.co.uk • 01332 661 987

TITLE:

Site Layout

PROJECT:

Land off Beck Lane, Sutton in Ashfield

PROJECT No:

IV.77.23

DATE:

10/2024

SCALE:

NTS

DRAWN:

VS

DWG No:

Figure 4

DO NOT SCALE