DEVELOPMENT OF LAND at 58 COMMON EDGE ROAD, BLACKPOOL.

DRAINAGE STRATEGY

HAMILTON TECHNICAL SERVICES
1 CHILTERN AVE, EUXTON, CHORLEY, LANCS, PR7 6NU

ISSUE 1
5/10/2022
C-1014

Document Control Sheet

Development of land at, 58 Common Edge Road, Blackpool, Lancashire.

Drainage Strategy Report

Job	Date	Issue	Copy
C1014	10th May 2022	1	

Originator……..G Hamilton

Checker……G Hamilton

Approver……G Hamilton

Contents

1.0 Introduction

2.0 Description of existing site

3.0 Proposals for Development

4.0 Maintenance

Figures, Plans and Calculations

1. Introduction

1.1. Hamilton Technical Services have been commissioned by Ben Jurin Architects, to prepare a Drainage Strategy Report, in support of a residential development scheme, located on land at 58 Common Edge Road, Blackpool, Lancashire.

1.2. The site comprises an existing residential property with associated access and garden areas. The location of the site is illustrated in **Figure 1** appended to this report.

1.3. The national grid reference for the site is 332638E, 432838N.

1.4. It is understood that permission is being sought to construct two residential dwelling blocks with associate access driveway and gardens to replace part of an existing residential property garden. The existing property at 58 Common Edge Road will be retained in occupation.

2. Description of the existing site.

2.1. The site lies on the east side of Common Edge Road opposite to its junction with Hampshire place. The site is bounded to the north, east and south by residential properties. To the west the site is bounded by Common Edge Road and further residential properties.

2.2. The site is in an area where the prevalent ground conditions are of a layer of topsoil overlying blown sand; sandy gravelly soils overlying the Singleton Mudstone Member, as shown on the British Geological Survey maps.

2.3. The site has been investigated to ascertain any existing drainage. The existing property at 58 Common Edge Road is served by a system of combined drains that runs to the west edge of the site and discharge to a public combined sewer in Common Edge Road. Rainfall and surface run-off from the remainder of the site soaks into the garden areas.

2.4. There have been two pits excavated to ascertain the permeability of the ground on the site. These pits showed the ground to be sandy and slightly gravelly and suitable for the use of soak-aways for roof drainage and for porous surfacing to the road access and parking bays.

2.5. The location of the test pits are illustrated on **Figure** 3 of this report along with the proposed drainage arrangements for the developed site. Percolation tests were carried out in accordance with BRE 365 to determine the Infiltration Co-efficient of the ground at the excavation positions. Copies of the test details and observations are contained in **Appendix 1** of this report.

3. Proposals for Development

3.1. The development of the site will consist of the clearance of rough grass and debris and the construction of two new residential blocks along with associated access road, driveways and gardens.

3.2. The proposed developed layout is illustrated on **Figure 2** of this report. The plan attached as **Figure** 3, shows the proposed site drainage layout with separate foul and surface water drainage systems. The foul drainage serving the new block fronting onto Common Edge Road will be directed towards the front of number 58 Common Edge Road and will be connected to the same outfall as the existing property. No surface water run-off will be connected to this outfall. The foul drainage serving the new block at the rear of the site, close to 21 Lismore Avenue, will be connected into the foul drainage serving number 21 Lismore and thence into the public foul sewer in Lismore Avenue. Both connections are to be made under legal agreements with the occupiers of the properties concerned.

3.3. The new surface water run-off from the new blocks will flow into two separate soak-away systems as illustrated on **Figure 3**, to allow rainwater to disperse into the soil to replenish the local water table in accordance with SUDS best practice.

3.4. The soak-aways will be of cellular construction to provide the require attenuation during storm events and to allow the sustainable dispersal of surface water flows without surface flooding or exceedance on the site or outside the site. A series of calculations has been carried out for the design of each soak-away. The calculations contain an allowance for climate change of 40% rainfall increase and an allowance for urban creep of 10%. Calculations cover storms up to the 1 in 100 Yr events. Copies of a selection of the calculations are contained in **Appendix 2** of this report.

3.5. As the site is very suitable for infiltration use, the site access road, footways and parking bays will be surfaced using porous macadam or porous block paviors, to allow rainfall to disperse directly to ground. Calculations for these areas have also been included in **Appendix 2**.

4. Maintenance

The developed site will remain in private ownership and will be the responsibility of the owners/occupiers of the development.

The drains and chambers, including the soak-aways and the outfalls to 58 Common Edge Road and 21 Lismore Avenue, will be inspected at six monthly intervals and will be cleaned and repaired as necessary to maintain a fully operational system of drainage and roadways.

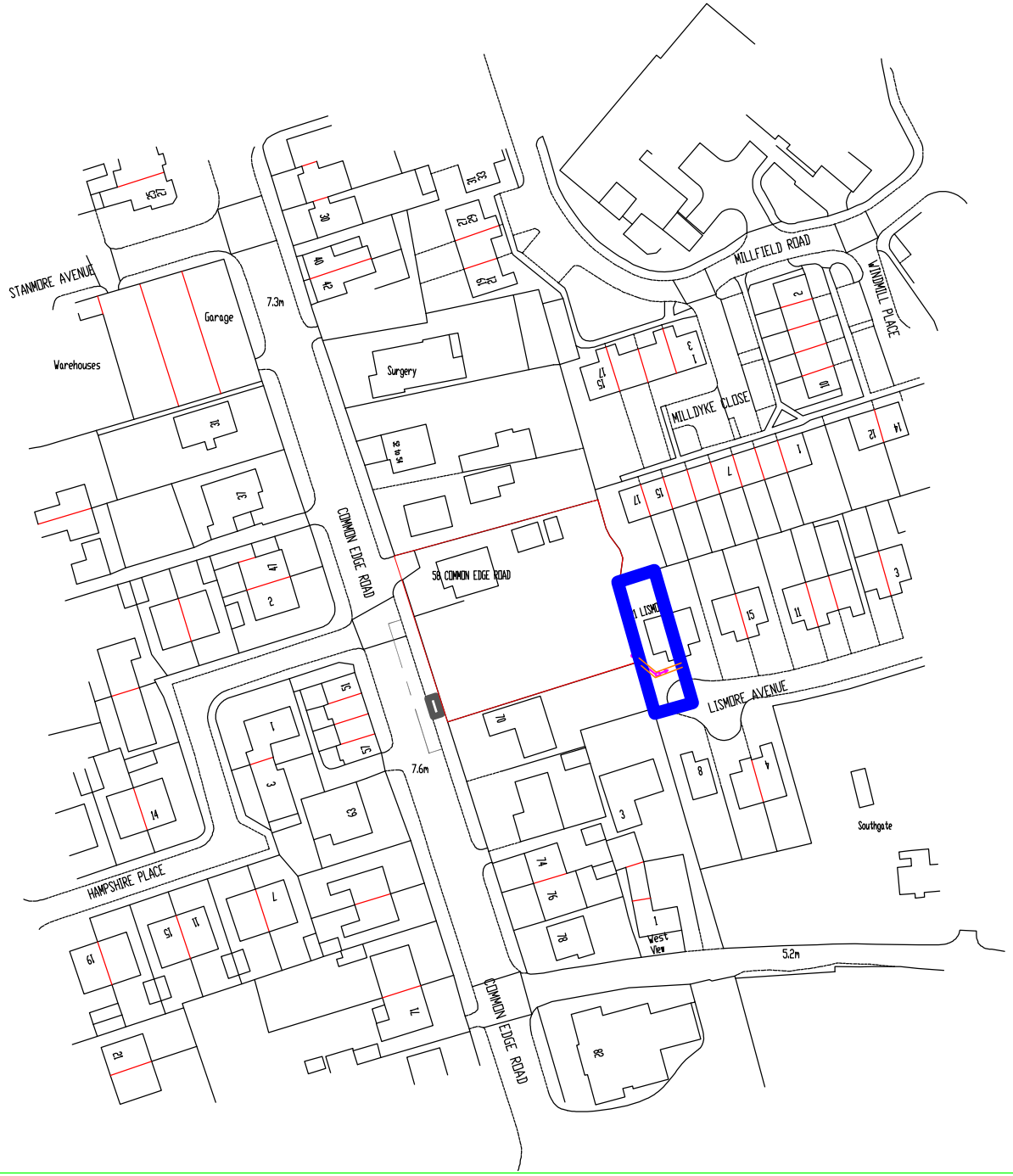
On completion of the development a suitably qualified Management Company will be contracted to carry out all inspections, repairs and maintenance on the property.

Each property will enter into a legal maintenance agreement and will be charged an annual fee by the Management Company and in this way all maintenance costs will be borne by the owners.

Figures;

Figure 1 – Site Location Plan
Figure 2 – Proposed Site Layout
Figure 3 – Proposed Drainage Layout

Appendix 1 – Infiltration Test Observations and Calcs
Appendix 2 – Proposed SW Run-off Calcs for Roofs and roads



Rev	Details	By	Date
-	-	-	-

Hamilton Technical Services
Civil & Environmental Engineering Consultants

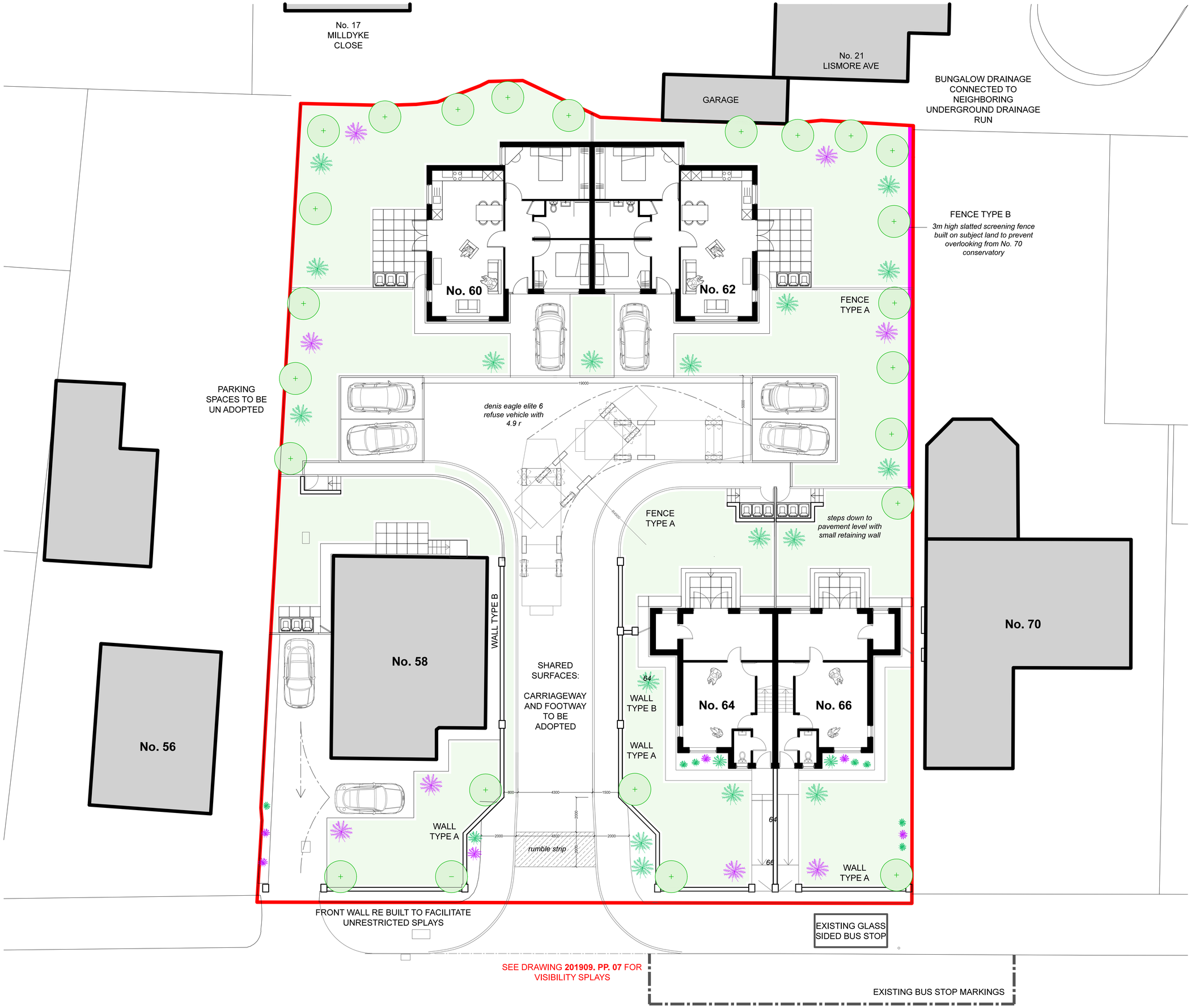
1 Chiltern Ave.,
Euxton, Chorley,
Lancs., PR7 6NU
Tel:- 01257 278938
Mob:- 07977 680913
email:- hamiltontecsers@gmail.com

Client: D Y GROUP
BEN JURIN
ARCHITECTS

Project: RESIDENTIAL DEVELOPMENT
LAND ADJACENT TO
58 COMMON EDGE ROAD, BLACKPOOL

Title: SITE
LOCATION
PLAN

Proj. No. C - 1014 - 01
Rev. -
Date 10.06.2022
Drawn RGH
Scale 1:500@A1
Check RGH



proposed site plan 1:100

NOTES

DO NOT scale from this drawing. Contractor to check and verify all dimensions on site prior to commencement. All work to comply with current UK Building Regulations and European Standards.

DRAWING FOR PLANNING APPROVAL ONLY

0m 1m 2m 3m

DRAWING **SCALE** CHECKER **1:50 @ A1**

LEGEND

BOUNDARY

NOTES

ADOPTION: THE DEVELOPER WILL LIAISE WITH BLACKPOOL COUNCIL AND ENTER INTO SECTION 38 AGREEMENT REGARDING CARRIAGEWAY AND FOOTWAY ADOPTION.

PARKING SPACES TO BE UN ADOPTED AND REMAIN PRIVATE

BINS LOCATED IN PURPOSE BUILT STORES WITHIN PROPERTY BOUNDARY

NEW STREET LIGHTING SCHEME TO BE AGREED WITH LIGHTING PROVIDER

FORMAL ADDRESSES: THE DEVELOPER WILL CONTACT BLACKPOOL COUNCIL STREET NAMING AND NUMBERING TO DISCUSS FURTHER

REVISION B 11/06/19.
Plan amended further to planning officer comments

REVISION C 10/07/19.
Plan amended further to planning officer comments

DRAWING TITLE

PROPOSED SITE PLAN 1:100

ADDRESS

LAND ADJACENT TO 58 COMMON EDGE ROAD, BLACKPOOL, FY4 5AU

CLIENT

DY GROUP

N

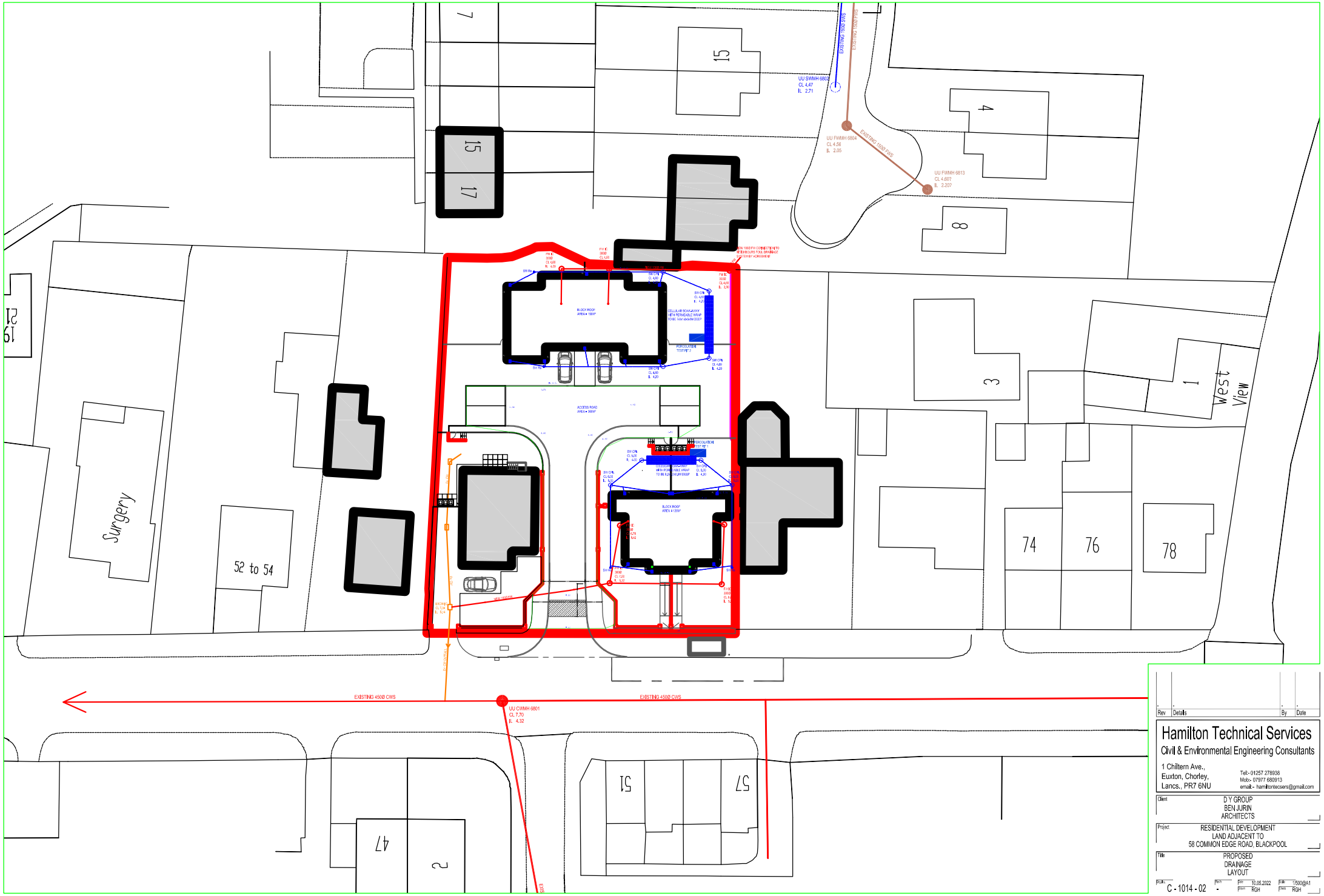
STATUS

PLANNING SUBMISSION

SCALE	DATE	REVISION
1100 @ A1	MARCH 2019	C

JOB NO.	DRAWING
201909	PP.03

BENJURIN
ARCHITECTURE



Rev	Details	By	Date
-	-	-	-

Hamilton Technical Services
Civil & Environmental Engineering Consultants

1 Chiltern Ave.,
Euxton, Chorley,
Lancs., PR7 6NU
Tel:- 01257 278938
Mob:- 07977 680913
email:- hamiltontecsers@gmail.com

Client: D Y GROUP
BEN JURIN
ARCHITECTS

Project: RESIDENTIAL DEVELOPMENT
LAND ADJACENT TO
58 COMMON EDGE ROAD, BLACKPOOL

Title: PROPOSED
DRAINAGE
LAYOUT

Proj. No. C - 1014 - 02
Rev -
Date 10.06.2022
Drawn RGH
Scale 1:500@A1
Check RGH

Residential development, on land adjacent to 58 Common Edge Road, Blackpool.

Appendix 1

Percolation Test Observations and Calculations.

HAMILTON TECHNICAL SERVICES

1 Chiltern Avenue, Euxton,
Nr Chorley, Lancs.
PR7 6NU

Telephone :- 01257 278 938
Mobile :- 07977 680 913
Email :- hamiltontecsers@gmail.com

SURFACE WATER - PERCOLATION TEST OBSERVATIONS

BRE 365 TESTS.
Trial holes excavated to following approximate dims; 1.0m long, 500mm wide, 1.2m deep.
Filled the pits to approximately 900mm deep and inspected on the morning.
Water has drained; away carry out tests as below.

TEST

Fill hole to 1.0m deep.
Note time of completion of filling. (Start time)
Record time when the hole is approximately 25% emptied.
Record time when the hole is approximately 75% emptied.
Stop timing when the water has drained away. (Empty)

DATE :- 5th May 2022 Weather :- Dry

TEST 1

	T Pit 1		T Pit 2
Start	09.30	Start	09.40
25%	09.40	25%	09.50
75%	09.52	75%	10.00
Empty	10.05	Empty	10.10

TEST 2

	T Pit 1		T Pit 2
Start	12.00	Start	12.05
25%	12.12	25%	12.17
75%	12.25	75%	12.30
Empty	12.40	Empty	12.48

INFILTRATION CO-EFFICIENT	INFILTRATION CO-EFFICIENT
0.65076 (m/hr)	0.63830 (m/hr)

DIMENSIONS

L= 1.01	L = 1.00
W = 0.50	W = 0.50
D = 1.15	D = 1.20

Residential development, on land adjacent to 58 Common Edge Road, Blackpool.

Appendix 2

Soak-away and Porous Surfacing Infiltration Calculations.

Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 21 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	4.237	0.237	0.8	1.3	O K
30 min Summer	4.286	0.286	0.9	1.6	O K
60 min Summer	4.293	0.293	0.9	1.7	O K
120 min Summer	4.262	0.262	0.9	1.5	O K
180 min Summer	4.225	0.225	0.8	1.3	O K
240 min Summer	4.191	0.191	0.8	1.1	O K
360 min Summer	4.133	0.133	0.7	0.8	O K
480 min Summer	4.093	0.093	0.7	0.5	O K
600 min Summer	4.066	0.066	0.6	0.4	O K
720 min Summer	4.051	0.051	0.6	0.3	O K
960 min Summer	4.042	0.042	0.5	0.2	O K
1440 min Summer	4.031	0.031	0.4	0.2	O K
2160 min Summer	4.023	0.023	0.3	0.1	O K
2880 min Summer	4.019	0.019	0.2	0.1	O K
4320 min Summer	4.014	0.014	0.2	0.1	O K
5760 min Summer	4.012	0.012	0.1	0.1	O K
7200 min Summer	4.010	0.010	0.1	0.1	O K
8640 min Summer	4.009	0.009	0.1	0.0	O K
10080 min Summer	4.008	0.008	0.1	0.0	O K
15 min Winter	4.271	0.271	0.9	1.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	91.003	0.0	21
30 min Summer	60.610	0.0	30
60 min Summer	38.715	0.0	46
120 min Summer	24.041	0.0	80
180 min Summer	18.003	0.0	112
240 min Summer	14.597	0.0	144
360 min Summer	10.800	0.0	204
480 min Summer	8.722	0.0	262
600 min Summer	7.385	0.0	318
720 min Summer	6.443	0.0	372
960 min Summer	5.193	0.0	492
1440 min Summer	3.826	0.0	736
2160 min Summer	2.815	0.0	1104
2880 min Summer	2.262	0.0	1456
4320 min Summer	1.660	0.0	2168
5760 min Summer	1.332	0.0	2904
7200 min Summer	1.122	0.0	3632
8640 min Summer	0.976	0.0	4288
10080 min Summer	0.867	0.0	4976
15 min Winter	91.003	0.0	21

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	4.327	0.327	1.0	1.9	O K
60 min Winter	4.327	0.327	1.0	1.9	O K
120 min Winter	4.274	0.274	0.9	1.6	O K
180 min Winter	4.216	0.216	0.8	1.2	O K
240 min Winter	4.166	0.166	0.8	0.9	O K
360 min Winter	4.091	0.091	0.7	0.5	O K
480 min Winter	4.051	0.051	0.6	0.3	O K
600 min Winter	4.043	0.043	0.5	0.2	O K
720 min Winter	4.038	0.038	0.5	0.2	O K
960 min Winter	4.031	0.031	0.4	0.2	O K
1440 min Winter	4.023	0.023	0.3	0.1	O K
2160 min Winter	4.017	0.017	0.2	0.1	O K
2880 min Winter	4.014	0.014	0.2	0.1	O K
4320 min Winter	4.011	0.011	0.1	0.1	O K
5760 min Winter	4.009	0.009	0.1	0.0	O K
7200 min Winter	4.008	0.008	0.1	0.0	O K
8640 min Winter	4.007	0.007	0.1	0.0	O K
10080 min Winter	4.006	0.006	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	60.610	0.0	31
60 min Winter	38.715	0.0	50
120 min Winter	24.041	0.0	84
180 min Winter	18.003	0.0	118
240 min Winter	14.597	0.0	150
360 min Winter	10.800	0.0	208
480 min Winter	8.722	0.0	254
600 min Winter	7.385	0.0	316
720 min Winter	6.443	0.0	372
960 min Winter	5.193	0.0	488
1440 min Winter	3.826	0.0	728
2160 min Winter	2.815	0.0	1096
2880 min Winter	2.262	0.0	1428
4320 min Winter	1.660	0.0	2168
5760 min Winter	1.332	0.0	2920
7200 min Winter	1.122	0.0	3632
8640 min Winter	0.976	0.0	4568
10080 min Winter	0.867	0.0	4976

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	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)	Time From:	(mins) To:	Area (ha)
0	4	0.004	4	8	0.004	8	12	0.004

Model Details

Storage is Online Cover Level (m) 5.000

Cellular Storage Structure

Invert Level (m) 4.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.65076 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.65076

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	6.0	6.0	0.800	6.0	17.2
0.400	6.0	11.6	0.801	0.0	17.2

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

Half Drain Time : 27 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	4.324	0.324	1.0	1.8	O K
30 min Summer	4.397	0.397	1.0	2.3	O K
60 min Summer	4.417	0.417	1.1	2.4	O K
120 min Summer	4.388	0.388	1.0	2.2	O K
180 min Summer	4.345	0.345	1.0	2.0	O K
240 min Summer	4.302	0.302	0.9	1.7	O K
360 min Summer	4.228	0.228	0.8	1.3	O K
480 min Summer	4.172	0.172	0.8	1.0	O K
600 min Summer	4.129	0.129	0.7	0.7	O K
720 min Summer	4.096	0.096	0.7	0.5	O K
960 min Summer	4.056	0.056	0.6	0.3	O K
1440 min Summer	4.040	0.040	0.5	0.2	O K
2160 min Summer	4.029	0.029	0.3	0.2	O K
2880 min Summer	4.024	0.024	0.3	0.1	O K
4320 min Summer	4.018	0.018	0.2	0.1	O K
5760 min Summer	4.014	0.014	0.2	0.1	O K
7200 min Summer	4.012	0.012	0.1	0.1	O K
8640 min Summer	4.011	0.011	0.1	0.1	O K
10080 min Summer	4.009	0.009	0.1	0.0	O K
15 min Winter	4.369	0.369	1.0	2.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	117.448	0.0	21
30 min Summer	79.010	0.0	30
60 min Summer	50.812	0.0	48
120 min Summer	31.621	0.0	80
180 min Summer	23.637	0.0	114
240 min Summer	19.105	0.0	146
360 min Summer	14.037	0.0	208
480 min Summer	11.286	0.0	268
600 min Summer	9.522	0.0	328
720 min Summer	8.282	0.0	386
960 min Summer	6.640	0.0	498
1440 min Summer	4.854	0.0	736
2160 min Summer	3.541	0.0	1100
2880 min Summer	2.828	0.0	1452
4320 min Summer	2.055	0.0	2196
5760 min Summer	1.637	0.0	2848
7200 min Summer	1.371	0.0	3560
8640 min Summer	1.186	0.0	4296
10080 min Summer	1.049	0.0	5072
15 min Winter	117.448	0.0	21

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
30 min Winter	4.453	0.453	1.1	2.6	O K
60 min Winter	4.471	0.471	1.1	2.7	O K
120 min Winter	4.416	0.416	1.1	2.4	O K
180 min Winter	4.348	0.348	1.0	2.0	O K
240 min Winter	4.286	0.286	0.9	1.6	O K
360 min Winter	4.187	0.187	0.8	1.1	O K
480 min Winter	4.117	0.117	0.7	0.7	O K
600 min Winter	4.069	0.069	0.6	0.4	O K
720 min Winter	4.049	0.049	0.6	0.3	O K
960 min Winter	4.039	0.039	0.5	0.2	O K
1440 min Winter	4.029	0.029	0.3	0.2	O K
2160 min Winter	4.022	0.022	0.3	0.1	O K
2880 min Winter	4.017	0.017	0.2	0.1	O K
4320 min Winter	4.013	0.013	0.2	0.1	O K
5760 min Winter	4.010	0.010	0.1	0.1	O K
7200 min Winter	4.009	0.009	0.1	0.0	O K
8640 min Winter	4.008	0.008	0.1	0.0	O K
10080 min Winter	4.007	0.007	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
30 min Winter	79.010	0.0	31
60 min Winter	50.812	0.0	50
120 min Winter	31.621	0.0	86
180 min Winter	23.637	0.0	120
240 min Winter	19.105	0.0	154
360 min Winter	14.037	0.0	216
480 min Winter	11.286	0.0	276
600 min Winter	9.522	0.0	330
720 min Winter	8.282	0.0	372
960 min Winter	6.640	0.0	496
1440 min Winter	4.854	0.0	732
2160 min Winter	3.541	0.0	1104
2880 min Winter	2.828	0.0	1472
4320 min Winter	2.055	0.0	2188
5760 min Winter	1.637	0.0	2944
7200 min Winter	1.371	0.0	3672
8640 min Winter	1.186	0.0	4232
10080 min Winter	1.049	0.0	5016

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)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	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)	Time From:	(mins) To:	Area (ha)
0	4	0.004	4	8	0.004	8	12	0.004

Model Details

Storage is Online Cover Level (m) 5.000

Cellular Storage Structure

Invert Level (m) 4.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.65076 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.65076

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	6.0	6.0	0.800	6.0	17.2
0.400	6.0	11.6	0.801	0.0	17.2

Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 24 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	3.947	0.347	1.1	2.3	O K
30 min Summer	4.021	0.421	1.2	2.8	O K
60 min Summer	4.041	0.441	1.2	2.9	O K
120 min Summer	4.012	0.412	1.2	2.7	O K
180 min Summer	3.970	0.370	1.1	2.5	O K
240 min Summer	3.928	0.328	1.1	2.2	O K
360 min Summer	3.855	0.255	1.0	1.7	O K
480 min Summer	3.798	0.198	0.9	1.3	O K
600 min Summer	3.753	0.153	0.8	1.0	O K
720 min Summer	3.718	0.118	0.8	0.8	O K
960 min Summer	3.670	0.070	0.7	0.5	O K
1440 min Summer	3.643	0.043	0.6	0.3	O K
2160 min Summer	3.632	0.032	0.4	0.2	O K
2880 min Summer	3.626	0.026	0.4	0.2	O K
4320 min Summer	3.620	0.020	0.3	0.1	O K
5760 min Summer	3.616	0.016	0.2	0.1	O K
7200 min Summer	3.614	0.014	0.2	0.1	O K
8640 min Summer	3.612	0.012	0.2	0.1	O K
10080 min Summer	3.611	0.011	0.1	0.1	O K
15 min Winter	3.994	0.394	1.2	2.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	91.003	0.0	21
30 min Summer	60.610	0.0	31
60 min Summer	38.715	0.0	48
120 min Summer	24.041	0.0	82
180 min Summer	18.003	0.0	114
240 min Summer	14.597	0.0	146
360 min Summer	10.800	0.0	210
480 min Summer	8.722	0.0	270
600 min Summer	7.385	0.0	330
720 min Summer	6.443	0.0	390
960 min Summer	5.193	0.0	502
1440 min Summer	3.826	0.0	736
2160 min Summer	2.815	0.0	1100
2880 min Summer	2.262	0.0	1452
4320 min Summer	1.660	0.0	2188
5760 min Summer	1.332	0.0	2888
7200 min Summer	1.122	0.0	3624
8640 min Summer	0.976	0.0	4368
10080 min Summer	0.867	0.0	5040
15 min Winter	91.003	0.0	22

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	4.081	0.481	1.3	3.2	O K
60 min Winter	4.098	0.498	1.3	3.3	O K
120 min Winter	4.044	0.444	1.2	2.9	O K
180 min Winter	3.977	0.377	1.2	2.5	O K
240 min Winter	3.916	0.316	1.1	2.1	O K
360 min Winter	3.816	0.216	0.9	1.4	O K
480 min Winter	3.743	0.143	0.8	0.9	O K
600 min Winter	3.691	0.091	0.7	0.6	O K
720 min Winter	3.656	0.056	0.7	0.4	O K
960 min Winter	3.643	0.043	0.6	0.3	O K
1440 min Winter	3.632	0.032	0.4	0.2	O K
2160 min Winter	3.624	0.024	0.3	0.2	O K
2880 min Winter	3.619	0.019	0.3	0.1	O K
4320 min Winter	3.614	0.014	0.2	0.1	O K
5760 min Winter	3.612	0.012	0.2	0.1	O K
7200 min Winter	3.610	0.010	0.1	0.1	O K
8640 min Winter	3.609	0.009	0.1	0.1	O K
10080 min Winter	3.608	0.008	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	60.610	0.0	32
60 min Winter	38.715	0.0	50
120 min Winter	24.041	0.0	86
180 min Winter	18.003	0.0	122
240 min Winter	14.597	0.0	154
360 min Winter	10.800	0.0	218
480 min Winter	8.722	0.0	280
600 min Winter	7.385	0.0	336
720 min Winter	6.443	0.0	384
960 min Winter	5.193	0.0	496
1440 min Winter	3.826	0.0	740
2160 min Winter	2.815	0.0	1092
2880 min Winter	2.262	0.0	1456
4320 min Winter	1.660	0.0	2148
5760 min Winter	1.332	0.0	3000
7200 min Winter	1.122	0.0	3552
8640 min Winter	0.976	0.0	4168
10080 min Winter	0.867	0.0	5040

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.019

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.006	4	8	0.006	8	12	0.007

Model Details

Storage is Online Cover Level (m) 4.600

Cellular Storage Structure

Invert Level (m) 3.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.63830 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.63830

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	7.0	7.0	0.800	7.0	19.8
0.400	7.0	13.4	0.801	0.0	19.8

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

Half Drain Time : 29 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	4.067	0.467	1.3	3.1	O K
30 min Summer	4.176	0.576	1.4	3.8	O K
60 min Summer	4.218	0.618	1.5	4.1	O K
120 min Summer	4.192	0.592	1.5	3.9	O K
180 min Summer	4.143	0.543	1.4	3.6	O K
240 min Summer	4.092	0.492	1.3	3.3	O K
360 min Summer	3.999	0.399	1.2	2.7	O K
480 min Summer	3.927	0.327	1.1	2.2	O K
600 min Summer	3.868	0.268	1.0	1.8	O K
720 min Summer	3.820	0.220	0.9	1.5	O K
960 min Summer	3.746	0.146	0.8	1.0	O K
1440 min Summer	3.662	0.062	0.7	0.4	O K
2160 min Summer	3.640	0.040	0.5	0.3	O K
2880 min Summer	3.633	0.033	0.4	0.2	O K
4320 min Summer	3.624	0.024	0.3	0.2	O K
5760 min Summer	3.619	0.019	0.3	0.1	O K
7200 min Summer	3.616	0.016	0.2	0.1	O K
8640 min Summer	3.614	0.014	0.2	0.1	O K
10080 min Summer	3.613	0.013	0.2	0.1	O K
15 min Winter	4.130	0.530	1.4	3.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	117.448	0.0	21
30 min Summer	79.010	0.0	31
60 min Summer	50.812	0.0	48
120 min Summer	31.621	0.0	82
180 min Summer	23.637	0.0	116
240 min Summer	19.105	0.0	148
360 min Summer	14.037	0.0	212
480 min Summer	11.286	0.0	274
600 min Summer	9.522	0.0	336
720 min Summer	8.282	0.0	396
960 min Summer	6.640	0.0	514
1440 min Summer	4.854	0.0	744
2160 min Summer	3.541	0.0	1100
2880 min Summer	2.828	0.0	1464
4320 min Summer	2.055	0.0	2180
5760 min Summer	1.637	0.0	2904
7200 min Summer	1.371	0.0	3640
8640 min Summer	1.186	0.0	4368
10080 min Summer	1.049	0.0	4976
15 min Winter	117.448	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	4.256	0.656	1.6	4.4	O K
60 min Winter	4.299	0.699	1.6	4.6	O K
120 min Winter	4.247	0.647	1.5	4.3	O K
180 min Winter	4.168	0.568	1.4	3.8	O K
240 min Winter	4.093	0.493	1.3	3.3	O K
360 min Winter	3.966	0.366	1.1	2.4	O K
480 min Winter	3.872	0.272	1.0	1.8	O K
600 min Winter	3.800	0.200	0.9	1.3	O K
720 min Winter	3.743	0.143	0.8	0.9	O K
960 min Winter	3.666	0.066	0.7	0.4	O K
1440 min Winter	3.640	0.040	0.5	0.3	O K
2160 min Winter	3.629	0.029	0.4	0.2	O K
2880 min Winter	3.624	0.024	0.3	0.2	O K
4320 min Winter	3.618	0.018	0.2	0.1	O K
5760 min Winter	3.614	0.014	0.2	0.1	O K
7200 min Winter	3.612	0.012	0.2	0.1	O K
8640 min Winter	3.611	0.011	0.1	0.1	O K
10080 min Winter	3.609	0.009	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	79.010	0.0	32
60 min Winter	50.812	0.0	52
120 min Winter	31.621	0.0	88
180 min Winter	23.637	0.0	122
240 min Winter	19.105	0.0	156
360 min Winter	14.037	0.0	222
480 min Winter	11.286	0.0	286
600 min Winter	9.522	0.0	346
720 min Winter	8.282	0.0	406
960 min Winter	6.640	0.0	514
1440 min Winter	4.854	0.0	720
2160 min Winter	3.541	0.0	1108
2880 min Winter	2.828	0.0	1448
4320 min Winter	2.055	0.0	2204
5760 min Winter	1.637	0.0	2888
7200 min Winter	1.371	0.0	3576
8640 min Winter	1.186	0.0	4400
10080 min Winter	1.049	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)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.019

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.006	4	8	0.006	8	12	0.007

Model Details

Storage is Online Cover Level (m) 4.600

Cellular Storage Structure

Invert Level (m) 3.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.63830 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.63830

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	7.0	7.0	0.800	7.0	19.8
0.400	7.0	13.4	0.801	0.0	19.8

Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 2 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	4.146	0.046	7.5	0.6	O K
30 min Summer	4.148	0.048	8.2	0.7	O K
60 min Summer	4.147	0.047	7.8	0.6	O K
120 min Summer	4.141	0.041	5.9	0.5	O K
180 min Summer	4.137	0.037	4.8	0.4	O K
240 min Summer	4.134	0.034	4.1	0.3	O K
360 min Summer	4.130	0.030	3.1	0.3	O K
480 min Summer	4.127	0.027	2.5	0.2	O K
600 min Summer	4.125	0.025	2.2	0.2	O K
720 min Summer	4.123	0.023	1.8	0.2	O K
960 min Summer	4.121	0.021	1.5	0.1	O K
1440 min Summer	4.118	0.018	1.1	0.1	O K
2160 min Summer	4.116	0.016	0.9	0.1	O K
2880 min Summer	4.115	0.015	0.8	0.1	O K
4320 min Summer	4.113	0.013	0.6	0.0	O K
5760 min Summer	4.111	0.011	0.4	0.0	O K
7200 min Summer	4.111	0.011	0.4	0.0	O K
8640 min Summer	4.110	0.010	0.3	0.0	O K
10080 min Summer	4.109	0.009	0.3	0.0	O K
15 min Winter	4.149	0.049	8.5	0.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	91.003	0.0	16
30 min Summer	60.610	0.0	23
60 min Summer	38.715	0.0	38
120 min Summer	24.041	0.0	66
180 min Summer	18.003	0.0	98
240 min Summer	14.597	0.0	128
360 min Summer	10.800	0.0	188
480 min Summer	8.722	0.0	244
600 min Summer	7.385	0.0	306
720 min Summer	6.443	0.0	370
960 min Summer	5.193	0.0	482
1440 min Summer	3.826	0.0	734
2160 min Summer	2.815	0.0	1068
2880 min Summer	2.262	0.0	1468
4320 min Summer	1.660	0.0	2128
5760 min Summer	1.332	0.0	2920
7200 min Summer	1.122	0.0	3544
8640 min Summer	0.976	0.0	4264
10080 min Summer	0.867	0.0	5216
15 min Winter	91.003	0.0	16

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
30 min Winter	4.150	0.050	8.9	0.7	O K
60 min Winter	4.145	0.045	7.2	0.6	O K
120 min Winter	4.137	0.037	4.8	0.4	O K
180 min Winter	4.133	0.033	3.8	0.3	O K
240 min Winter	4.130	0.030	3.1	0.3	O K
360 min Winter	4.126	0.026	2.4	0.2	O K
480 min Winter	4.123	0.023	1.8	0.2	O K
600 min Winter	4.122	0.022	1.7	0.1	O K
720 min Winter	4.120	0.020	1.4	0.1	O K
960 min Winter	4.118	0.018	1.1	0.1	O K
1440 min Winter	4.116	0.016	0.9	0.1	O K
2160 min Winter	4.114	0.014	0.7	0.1	O K
2880 min Winter	4.112	0.012	0.5	0.0	O K
4320 min Winter	4.111	0.011	0.4	0.0	O K
5760 min Winter	4.110	0.010	0.3	0.0	O K
7200 min Winter	4.109	0.009	0.3	0.0	O K
8640 min Winter	4.109	0.009	0.3	0.0	O K
10080 min Winter	4.108	0.008	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
30 min Winter	60.610	0.0	23
60 min Winter	38.715	0.0	38
120 min Winter	24.041	0.0	68
180 min Winter	18.003	0.0	96
240 min Winter	14.597	0.0	132
360 min Winter	10.800	0.0	194
480 min Winter	8.722	0.0	256
600 min Winter	7.385	0.0	308
720 min Winter	6.443	0.0	372
960 min Winter	5.193	0.0	478
1440 min Winter	3.826	0.0	736
2160 min Winter	2.815	0.0	1120
2880 min Winter	2.262	0.0	1424
4320 min Winter	1.660	0.0	2244
5760 min Winter	1.332	0.0	2960
7200 min Winter	1.122	0.0	3936
8640 min Winter	0.976	0.0	4232
10080 min Winter	0.867	0.0	5224

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.036

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.012	4	8	0.012	8	12	0.012

Model Details

Storage is Online Cover Level (m) 4.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.65076	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	36.0
Max Percolation (l/s)	100.0	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	4.100	Cap Volume Depth (m)	0.300

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

Half Drain Time : 1 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	4.154	0.054	9.7	0.9	O K
30 min Summer	4.158	0.058	10.4	1.0	O K
60 min Summer	4.155	0.055	9.9	0.9	O K
120 min Summer	4.147	0.047	7.8	0.6	O K
180 min Summer	4.142	0.042	6.2	0.5	O K
240 min Summer	4.139	0.039	5.4	0.4	O K
360 min Summer	4.134	0.034	4.1	0.3	O K
480 min Summer	4.131	0.031	3.4	0.3	O K
600 min Summer	4.128	0.028	2.7	0.2	O K
720 min Summer	4.127	0.027	2.5	0.2	O K
960 min Summer	4.124	0.024	2.0	0.2	O K
1440 min Summer	4.121	0.021	1.5	0.1	O K
2160 min Summer	4.118	0.018	1.1	0.1	O K
2880 min Summer	4.116	0.016	0.9	0.1	O K
4320 min Summer	4.114	0.014	0.7	0.1	O K
5760 min Summer	4.113	0.013	0.6	0.0	O K
7200 min Summer	4.112	0.012	0.5	0.0	O K
8640 min Summer	4.111	0.011	0.4	0.0	O K
10080 min Summer	4.110	0.010	0.3	0.0	O K
15 min Winter	4.160	0.060	10.8	1.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	117.448	0.0	16
30 min Summer	79.010	0.0	24
60 min Summer	50.812	0.0	38
120 min Summer	31.621	0.0	68
180 min Summer	23.637	0.0	96
240 min Summer	19.105	0.0	126
360 min Summer	14.037	0.0	186
480 min Summer	11.286	0.0	248
600 min Summer	9.522	0.0	308
720 min Summer	8.282	0.0	366
960 min Summer	6.640	0.0	484
1440 min Summer	4.854	0.0	734
2160 min Summer	3.541	0.0	1096
2880 min Summer	2.828	0.0	1456
4320 min Summer	2.055	0.0	2208
5760 min Summer	1.637	0.0	2784
7200 min Summer	1.371	0.0	3720
8640 min Summer	1.186	0.0	4280
10080 min Summer	1.049	0.0	5112
15 min Winter	117.448	0.0	16

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
30 min Winter	4.162	0.062	11.1	1.1	O K
60 min Winter	4.152	0.052	9.3	0.8	O K
120 min Winter	4.143	0.043	6.5	0.5	O K
180 min Winter	4.137	0.037	4.8	0.4	O K
240 min Winter	4.134	0.034	4.1	0.3	O K
360 min Winter	4.129	0.029	2.9	0.2	O K
480 min Winter	4.126	0.026	2.4	0.2	O K
600 min Winter	4.124	0.024	2.0	0.2	O K
720 min Winter	4.123	0.023	1.8	0.1	O K
960 min Winter	4.121	0.021	1.5	0.1	O K
1440 min Winter	4.118	0.018	1.1	0.1	O K
2160 min Winter	4.115	0.015	0.8	0.1	O K
2880 min Winter	4.114	0.014	0.7	0.1	O K
4320 min Winter	4.112	0.012	0.5	0.0	O K
5760 min Winter	4.111	0.011	0.4	0.0	O K
7200 min Winter	4.110	0.010	0.3	0.0	O K
8640 min Winter	4.109	0.009	0.3	0.0	O K
10080 min Winter	4.109	0.009	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
30 min Winter	79.010	0.0	23
60 min Winter	50.812	0.0	38
120 min Winter	31.621	0.0	68
180 min Winter	23.637	0.0	100
240 min Winter	19.105	0.0	128
360 min Winter	14.037	0.0	178
480 min Winter	11.286	0.0	252
600 min Winter	9.522	0.0	312
720 min Winter	8.282	0.0	374
960 min Winter	6.640	0.0	502
1440 min Winter	4.854	0.0	744
2160 min Winter	3.541	0.0	1068
2880 min Winter	2.828	0.0	1352
4320 min Winter	2.055	0.0	2304
5760 min Winter	1.637	0.0	3152
7200 min Winter	1.371	0.0	3888
8640 min Winter	1.186	0.0	4248
10080 min Winter	1.049	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)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.036

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.012	4	8	0.012	8	12	0.012

Model Details

Storage is Online Cover Level (m) 4.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.65076	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	36.0
Max Percolation (l/s)	100.0	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	4.100	Cap Volume Depth (m)	0.300