

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project 19 Broad Lane (land adj), Burnedge, Rochdale				Job Ref. calc-tjba-johnson-19 broad ln-drainage strategy-290424	
	Section DRAINAGE STRATEGY				Sheet no./rev. 1 / 0	
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History.

Revision	Date	Reason
0	April 2024	Original.

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Introduction.

Reference:

Planning application for the redevelopment of a former agricultural stable into a single detached residential dwelling.

Purpose of Report:

The primary purpose of this report is to identify specific drainage proposals for parts of the proposed site in accordance with the national drainage hierarchy for surface water disposal & exceedance characteristics, also considering the proposed end adopters and their requirements.

Regarding site assessment, this report will appraise the existing site and local drainage infrastructure, assess the suitability of the proposed development, giving recommendations for drainage design & management, specifically for approval of the LLFA/EA/sewerage undertakers, as applicable.

General principles:

Drainage from new developments is to be designed to follow the national drainage hierarchy for surface water discharge to the following networks in order of preference:

- *infiltration*
- *watercourse*
- *public sewer*

Flow rates (existing & proposed) are to be estimated for approval using the following methodology:

- *Development should aim to deliver greenfield runoff on greenfield sites up to a 100yr rainfall event, considering climate change.*
- *Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites on a 1yr rainfall event.*
- *Development should be designed so that there is no flooding to the development in a 30yr event and so that there is no property flooding in a 100yr event considering climate change.*

Plans.

Location Plan.

The Application Site (red line plan in Appendix) is located to the northwest side of No.19 Broad Lane, Rochdale.

The Site sits within a small hamlet in a predominantly rural area.

The closest open watercourses are an unnamed tributary to Suden Brook 250m southwest, and Suden Brook itself located 325m southwest.

Site Plan.

The Site comprises a rectangular plot of land 690sqm in area. It has a Site building currently used as a horse stable, with a small paddock area to the front, and open space adjacent.

The Proposed Site Plan in the Appendix shows the existing building to be renovated into a residential dwelling.

Site access is to the northeast side adjacent No.19 Broad Lane, and the remainder of the site area is to comprise soft landscaping/garden area.

Existing Site areas are as follows:

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- *Stable roof areas (impermeable)* 100 sqm
- *Soft landscaping (permeable)* 590 sqm
- *General hardstanding (permeable)* 0 sqm
- *Total* 690 sqm

Proposed Site areas are as follows:

- *Dwelling roof area (impermeable)* 100 sqm
- *Gardens/pathways (permeable)* 485 sqm
- *General hardstanding/drive (permeable)* 105 sqm
- *Total* 690 sqm

Desk Surveys & Investigations.

Existing and proposed topography.

No topographic survey has yet been undertaken.

Geology & Site Investigations.

BGS maps indicate the Site to be underlain by undifferentiated Pennine Lower Coal Measures – generally mudstone with thin interbedded sandstone layers.

The maps show Hummocky Glacial Deposits (clay).

HR Wallingford maps suggest the Site comprises heavy clay subsoil, soil class 4.

Shallow trenching across the Site for foundations noted a relatively impermeable clay subsoil below a more permeable slightly sandy slightly gravelly silty made ground to the rear of the Site approximately 1.25m deep.

Drainage Surveys.

No drainage survey of the Site has yet been undertaken.

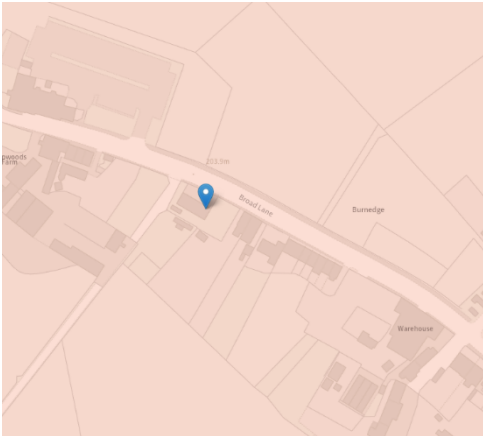
There are no sewer mains in the local area.

Assessments.

Climate change impacts.

Climate change allowances allow for uncertainty in the climate model, and the resultant change assumed through time. Allowances are thus related to the type of development and the potential lifetime expected of such development set within specific catchment areas. The Site is within the Ribble Management catchment area, and the associated climate change allowances are defined as per the map inset:

Residential developments are classified within the '2070s' timeframe resulting in a 45% climate change allowance to be included on a



Irwell Management
Catchment peak rainfall
allowances

3.3% annual exceedance
rainfall event

Epoch	Central allowance	Upper end allowance
2050s	25%	35%
2070s	30%	40%

1% annual exceedance
rainfall event

Epoch	Central allowance	Upper end allowance
2050s	25%	40%
2070s	30%	45%

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1% annual exceedance (100yr) rainfall event and a 40% climate change allowance to be included on the 3.3 & annual exceedance rainfall event (30yr).

Existing surface water system.

Hydrological characteristics for the site were obtained from the HR Wallingford mapping database:

SAAR (mm) ⓘ

1156

M5-60 rainfall depth (mm) ⓘ

20 ▾

'r' ratio M5-60 / M5-2day ⓘ

0.3 ▾

FEH/FSR conversion factor ⓘ

1.14

Hydrological region ⓘ

10

Specify SOIL type ⓘ

1 ▾

SPR ⓘ

0.1

DESIGN RAINFALL 1YR (THE WALLINGFORD PROCEDURE)

Design rainfall in accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Other
Storm duration	D = 30 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.300
5-year return period rainfall of 60 minutes duration	M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.77
Rainfall for 30min storm with 5 year return period	M5_30min _i = Z1 ' M5_60min = 15.4 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.62
Rainfall for 30min storm with 1 year return period	M1_30min = Z2 ' M5_30min _i = 9.6 mm
Design rainfall intensity	I _{max} = M1_30min / D = 19.1 mm/hr

DESIGN RAINFALL 30YR (THE WALLINGFORD PROCEDURE)

Design rainfall in accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Other
Storm duration	D = 30 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.300
5-year return period rainfall of 60 minutes duration	M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.77
Rainfall for 30min storm with 5 year return period	M5_30min _i = Z1 ' M5_60min = 15.4 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.53
Rainfall for 30min storm with 30 year return period	M30_30min = Z2 ' M5_30min _i = 23.5 mm
Design rainfall intensity	I _{max} = M30_30min / D = 47.1 mm/hr

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DESIGN RAINFALL 100YR (THE WALLINGFORD PROCEDURE)

Design rainfall in accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Other
Storm duration	D = 30 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.300
5-year return period rainfall of 60 minutes duration	M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.77
Rainfall for 30min storm with 5 year return period	M5_30min _i = Z1 ' M5_60min = 15.4 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.99
Rainfall for 30min storm with 100 year return period	M100_30min = Z2 ' M5_30min _i = 30.7 mm
Design rainfall intensity	I _{max} = M100_30min / D = 61.4 mm/hr

Proposed Surface Water System.

Following the guidance of hierarchy for disposal of surface water (SUDS):

- **INFILTRATION:** Due to the absence of sewers in the local area, and potential for infiltration to the on-site made ground, infiltration tests were undertaken. An infiltration test pit was excavated to the rear of the southeast site corner to 1.2m depth, and tested in accordance with BRE365 guidance.

Refer to photos/test sheets in Appendix; as well as calculation summary below:

soakaway test		as per BRE Digest 365	
client	John Johnson		
project	19 Broad Lane		
locn	adjacent TH1		
date			
provide a clean vertical sided pit or trench			
pit length	1.2 m		
pit width	0.3 m		
pit depth b GL	1.0 m		
pit equiv dia	0.1 m		
pit base area	0.36 sqm		
TEST	DATE	INFILTRATION RATE	
		m/s	m/hr
TEST 1	16.04.2024	1.6E-05	5.7E-02
TEST 2	20.05.2024	1.1E-05	4.0E-02
TEST 3	03.06.2024	1.4E-05	4.9E-02
Design infiltration rate		1.4E-05	4.9E-02

A design infiltration rate was identified for the Site and used in Microdrainage to design a soakaway which accounts for the 100+45% pluvial event. Refer to full soakaway test results and Microdrainage storm analysis in the Appendix.

- **WATERCOURSE:** Not available.
- **SW SEWER:** Not available.
- **COMBINED SEWER:** Not available.

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	DS	03/05/2024				

Proposed Foul Water System.

There are no sewer mains locally so a package sewage treatment plant (PSTP) will be required.

There is no watercourse in close proximity to the Site, and due to the Site constraints, neither a drainage field nor mound can be designed due to size and proximity requirements set out in the Building Regulations.

Usually a drainage field/mound would provide the requisite tertiary treatment of final effluent in the upper soil layers, prior to deeper infiltration. However, as this will not be possible at the Site, a tertiary treatment filter unit will be used to mimic the biological effects of the drainage field/mound, prior to discharge to soakaway as per section H2.1.38 of Building Regulations Approved Document H:

1.38 Drainage field disposal should only be used when percolation tests indicate average values of V_p of between 12 and 100 and the preliminary site assessment report and trial hole tests have been favourable. This minimum value ensures that untreated effluent cannot percolate too rapidly into groundwater. Where V_p is outside these limits effective treatment is unlikely to take place in a drainage field. However, provided that an alternative form of secondary treatment is provided to treat the effluent from the septic tanks, it may still be possible to discharge the treated effluent to a soakaway.

The proposed development is for a residential dwelling with 2No. bedrooms.

Package treatment plants are sized in accordance with British Water Flows & Loads 4.

Regarding domestic housing specifically, treatment systems for a single house with up to and including 3 bedrooms are designed for a minimum population (P) of 5 people. For single dwellings with more than 3 bedrooms, an additional 1 P is added for each additional bedroom.

Given the proposed dwelling has 2 bedrooms, this equates to a population equivalent of 5P.

The expected loadings from such a system are as follows:

Per person/activity/day		Flow (l/d)		BOD (g)		Ammonia (N)	
	Population (P)	per head	total	per head	total	per head	total
Domestic standard residential	5	150	750	60	300	8	40

The package sewage treatment plant proposed for primary/secondary effluent treatment is a Rewatec ASP6 PE (or similar), suitable to treat loads per day of up to 900l, 360gBOD5 & 48g NH3 as per the below specification, (drawing in Appendix):

Rewatec ASP specifications

Rewatec ASP	6 PE	8 PE	12 PE	16 PE	20 PE	25 PE
Hydraulic (L/d)	900	1,200	1,800	2,400	3,000	3,750
Organic load (g BOD5/day)	360	480	720	960	1200	1500
Ammonia (g NH ₃ /day)	48	64	96	128	160	200
O/A diameter	2,000	2,000	2,000	2,000	2,000	2,000
Standard inlet invert (mm)	700	700	700	700	700	700
Standard outlet invert (mm)	800	800	800	800	800	800
Outlet invert to base - gravity (mm)	1,400	1,400	1,800	1,800	1,900	2,200
Outlet invert to base - pumped (mm)	2,050	2,050	2,650	2,650	2,750	3,150
Pipework fitting (mm)	110	110	110	110	110	110
Weight (Kg)	230	230	300	300	360	440

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The tertiary treatment prior to discharge is proposed using a PremierTech Ecolflo 6, which comprises a coconut husk filtering medium to further reduce COD, BOD, SS & NH4.

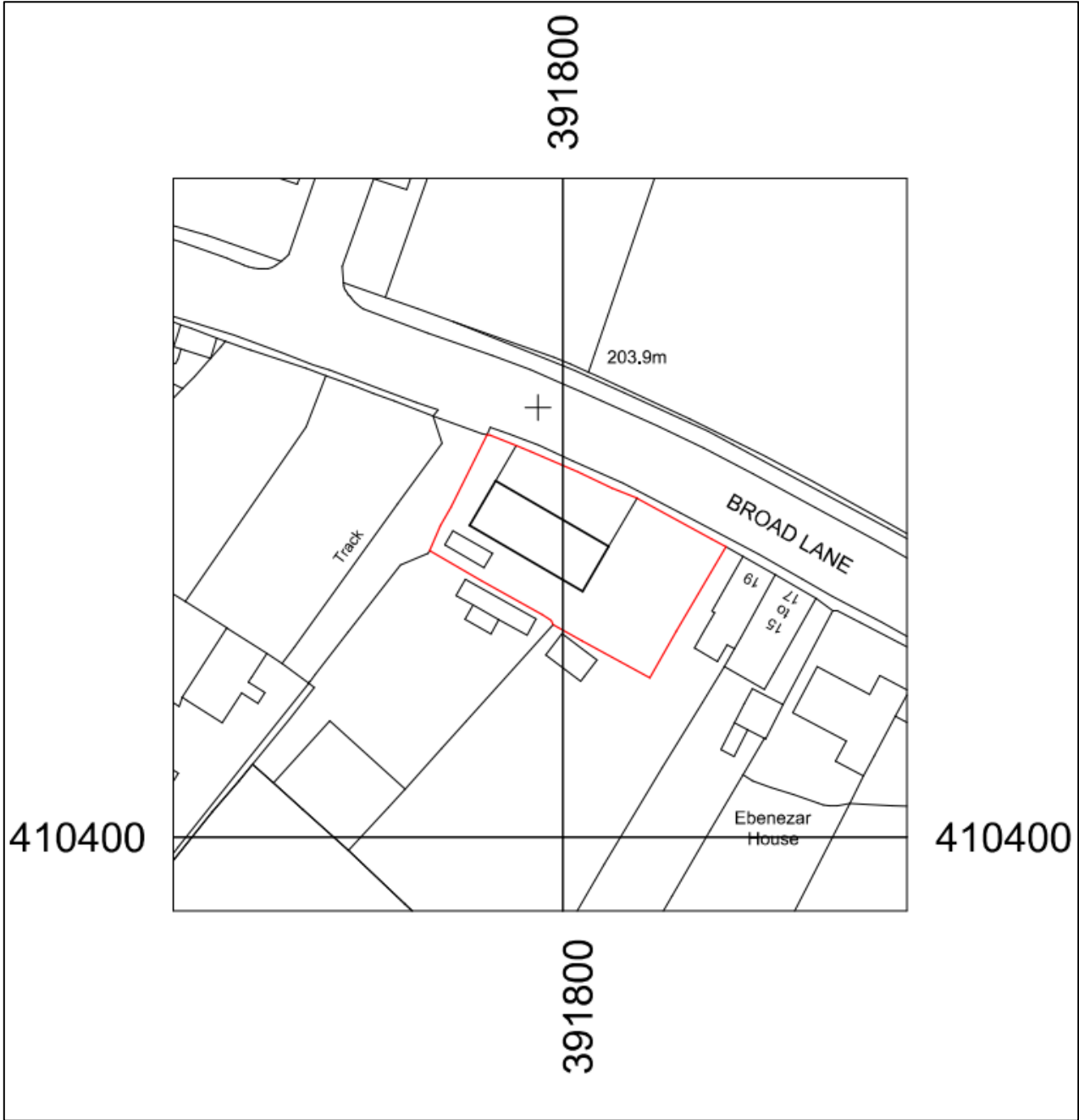
Additional Recommendations.

This report should be issued to the LPA/B.Control for approval prior to construction.

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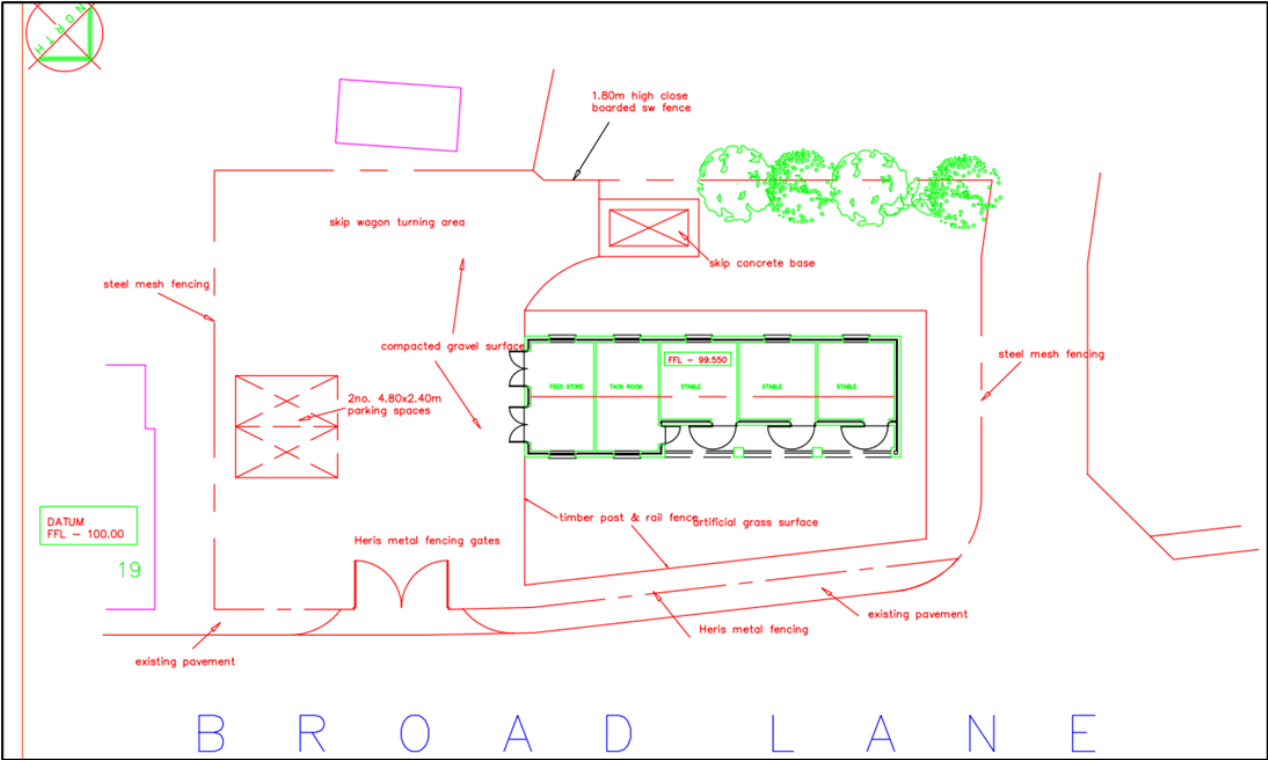
Appendix.

Location Plan.

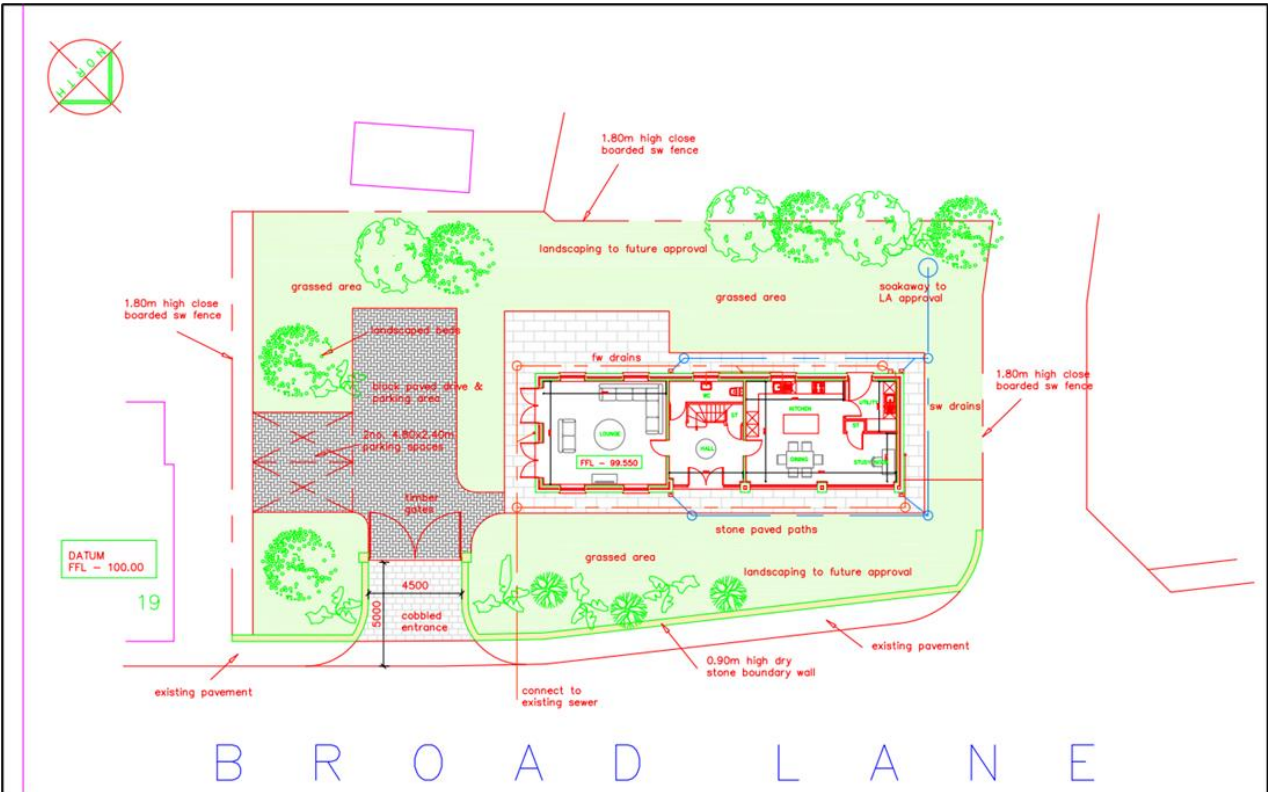


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Existing Site Plans.



Proposed Site Plans.



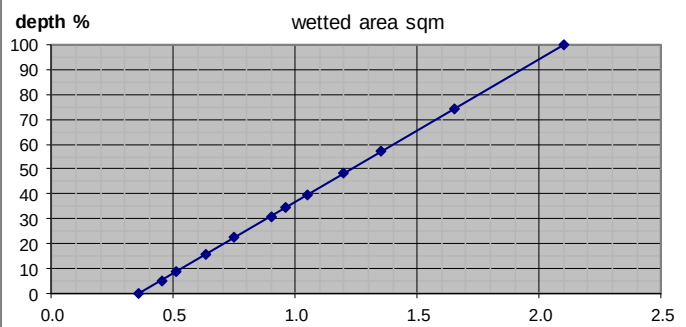
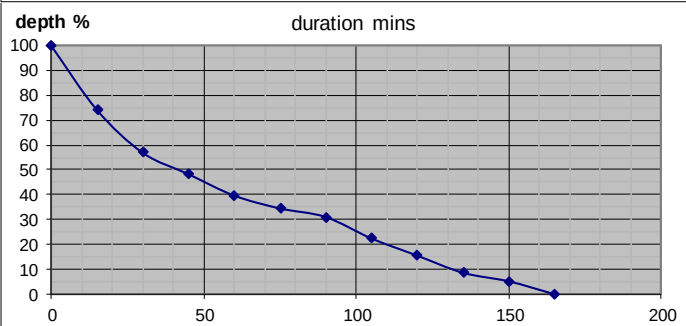
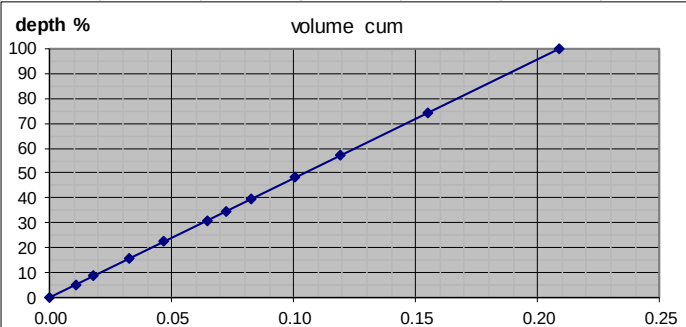
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Infiltration Test & Soakaway Calculations.

soakaway test				as per BRE Digest 365	
client	John Johnson				
project	19 Broad Lane				
locn	adjacent TH1				
pit length		1.2	m		
pit width		0.3	m		
pit depth b GL		1.0	m		
pit equiv dia		0.1	m		
pit base area		0.36	sqm		
TEST	DATE		INFILTRATION RATE		
			m/s	m/hr	
TEST 1	16.04.2024		1.6E-05	5.7E-02	
TEST 2	20.05.2024		1.1E-05	4.0E-02	
TEST 3	03.06.2024		1.4E-05	4.9E-02	
Design infiltration rate			1.4E-05	4.9E-02	
Test 1		Test 2		Test 3	
13-45 14"		11-15 14"		12.15 6"	
14-00 20"		11-30 20"		12.45 12"	
14-15 24"		11-45 22"		13-15 18"	
14-30 26"		12-00 24"		13.45 22"	
14-45 28"		12-30 27"		14-15 24"	
15-00 29"		13-00 30"		14.45 26"	
15-15 30.5"		13-30 31.5"		15-15 27.5"	
15-30 32"		14-00 33"		15.45 28.5	
15-45 33.5"		14-30 34"		16-15 29.5	
16-00 35"		15-00 36"		16.45 30.5	
16-15 36"		15-30 38"		17.15 31.5	
16-30 37"					

test 1 16.04.2024

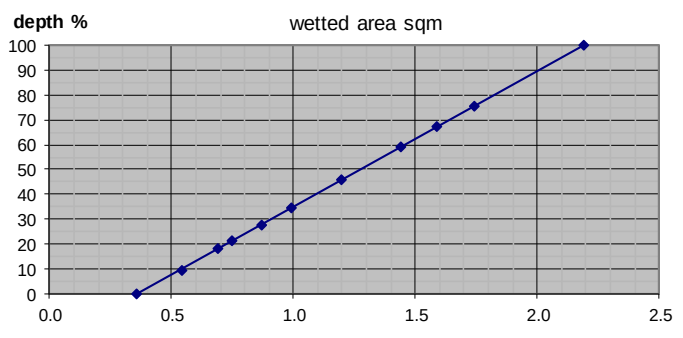
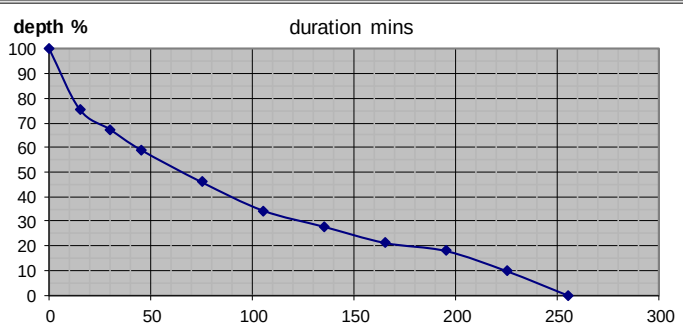
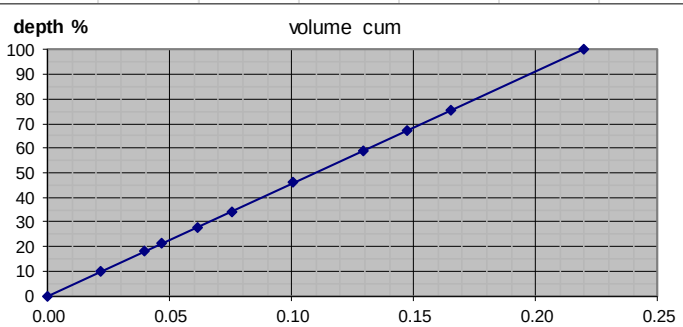
time	duration	depth from GL	depth from base	depth from wt	% depth	wetted area sqm	volume cum
hr	min	mins	m	m	m		
13	45	0	0.36	0.64	0.58	100	2.1
14	0	15	0.51	0.49	0.43	74	1.7
14	15	30	0.61	0.39	0.33	57	1.4
14	30	45	0.66	0.34	0.28	48	1.2
14	45	60	0.71	0.29	0.23	40	1.1
15	0	75	0.74	0.26	0.2	34	1.0
15	15	90	0.76	0.24	0.18	31	0.9
15	30	105	0.81	0.19	0.13	22	0.8
15	45	120	0.85	0.15	0.09	16	0.6
16	0	135	0.89	0.11	0.05	9	0.5
16	15	150	0.91	0.09	0.03	5	0.4
16	30	165	0.94	0.06	0	0	0.4



volume @ 75% depth	V75	0.155	cu m
volume @ 25% depth	V25	0.055	cu m
time @ 75% depth	t75	15	mins
time @ 25% depth	t25	100	mins
surface area @ 50% depth	Ap50	1.23	sq m
infiltration rate	f	1.6E-05	m/s

test 2 20.05.2024

time	duration	depth from GL	depth from base	depth from wt	% depth	wetted area sqm	volume cum
hr	min	mins	m	m	m		
11	15	0	0.36	0.64	0.61	100	2.2
11	30	15	0.51	0.49	0.46	75	1.7
11	45	30	0.56	0.44	0.41	67	1.6
12	0	45	0.61	0.39	0.36	59	1.4
12	30	75	0.69	0.31	0.28	46	1.2
13	0	105	0.76	0.24	0.21	34	1.0
13	30	135	0.8	0.2	0.17	28	0.9
14	0	165	0.84	0.16	0.13	21	0.8
14	30	195	0.86	0.14	0.11	18	0.7
15	0	225	0.91	0.09	0.06	10	0.5
15	30	255	0.97	0.03	0	0	0.4

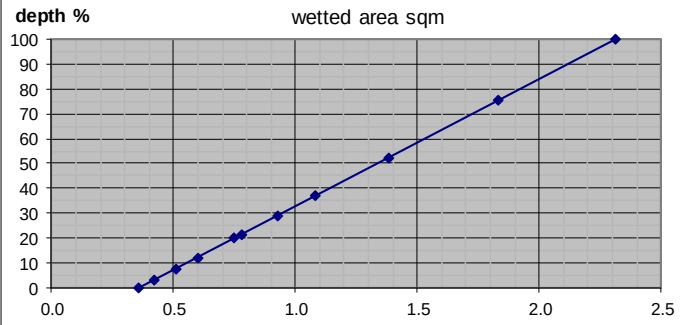
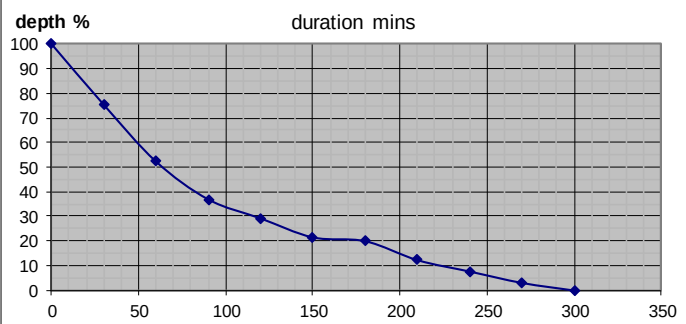
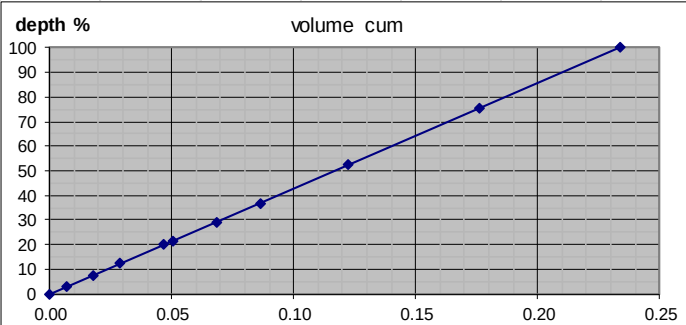


volume @ 75% depth	V75	0.165	cu m
volume @ 25% depth	V25	0.055	cu m
time @ 75% depth	t75	15	mins
time @ 25% depth	t25	145	mins
surface area @ 50% depth	Ap50	1.28	sq m

infiltration rate f **1.1E-05** m/s

test 3 03.06.2024

time	duration	depth from GL	depth from base	depth from wt	% depth	wetted area sqm	volume cum
hr	min	mins	m	m	m		
12	15	0	0.15	0.85	0.65	100	2.3
12	45	30	0.31	0.69	0.49	75	1.8
13	15	60	0.46	0.54	0.34	52	1.4
13	45	90	0.56	0.44	0.24	37	1.1
14	15	120	0.61	0.39	0.19	29	0.9
14	45	150	0.66	0.34	0.14	22	0.8
15	15	180	0.67	0.33	0.13	20	0.8
15	45	210	0.72	0.28	0.08	12	0.6
16	15	240	0.75	0.25	0.05	8	0.5
16	45	270	0.78	0.22	0.02	3	0.4
17	15	300	0.8	0.2	0	0	0.4



volume @ 75% depth	V75	0.175	cu m
volume @ 25% depth	V25	0.06	cu m
time @ 75% depth	t75	30	mins
time @ 25% depth	t25	135	mins
surface area @ 50% depth	Ap50	1.34	sq m
infiltration rate	f	1.4E-05	m/s

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Microdrainage Soakaway Design Calculations.

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Micro Drainage		Source Control W.10.4

Summary of Results for 1 year Return Period

Storm Duration (mins)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
240 Winter	0.0	0.0	98.5518	0.2017	1.7	O K
360 Winter	0.0	0.0	98.5743	0.2242	1.9	O K
480 Winter	0.0	0.0	98.5893	0.2392	2.0	O K
600 Winter	0.0	0.0	98.5998	0.2497	2.1	O K
720 Winter	0.0	0.0	98.6067	0.2567	2.2	O K
960 Winter	0.0	0.0	98.6183	0.2682	2.2	O K
1440 Winter	0.0	0.0	98.6323	0.2822	2.4	O K
2160 Winter	0.0	0.0	98.6392	0.2892	2.4	O K
2880 Winter	0.0	0.0	98.6392	0.2892	2.4	O K
4320 Winter	0.0	0.0	98.6288	0.2787	2.3	O K
5760 Winter	0.0	0.0	98.6142	0.2642	2.2	O K
7200 Winter	0.0	0.0	98.5998	0.2497	2.1	O K
8640 Winter	0.0	0.0	98.5868	0.2367	2.0	O K
10080 Winter	0.0	0.0	98.5738	0.2237	1.9	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
240 Winter	5.47	238
360 Winter	4.21	352
480 Winter	3.50	464
600 Winter	3.03	572
720 Winter	2.70	672
960 Winter	2.25	760
1440 Winter	1.73	1066
2160 Winter	1.33	1516
2880 Winter	1.11	1960
4320 Winter	0.85	2808
5760 Winter	0.71	3624
7200 Winter	0.61	4400
8640 Winter	0.54	5184
10080 Winter	0.49	5952

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Rainfall Details

Region	ENG+WAL	Shortest Storm (mins)	15
Return Period (years)	1	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Summer Storms	Yes
Ratio-R	0.300	Winter Storms	Yes
Cv (Summer)	0.750	Climate Change %	+0
Cv (Winter)	0.840		

Time / Area Diagram

Total Area (ha) = 0.010

Time (mins)	Area (ha)
from:	to:
0	4 0.010

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Lined Soakaway Details

Infil Coef - Base (m/hr)	0.000000	Pit Multiplier	2.0
Infil Coef - Sides (m/hr)	0.049000	Number Required	1
Safety Factor	2.0	Invert Level (m)	98.350
Porosity	0.56	Cover Level (m)	99.600
Ring Diameter (m)	1.8		

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Summary of Results for 30 year Return Period						
Half Drain Time : 952 minutes						
Storm Duration (mins)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
15 Summer	0.0	0.0	98.5033	0.1532	1.3	O K
30 Summer	0.0	0.0	98.5583	0.2082	1.7	O K
60 Summer	0.0	0.0	98.6197	0.2697	2.3	O K
120 Summer	0.0	0.0	98.6848	0.3347	2.8	O K
180 Summer	0.0	0.0	98.7217	0.3717	3.1	O K
240 Summer	0.0	0.0	98.7467	0.3967	3.3	O K
360 Summer	0.0	0.0	98.7787	0.4287	3.6	O K
480 Summer	0.0	0.0	98.7972	0.4472	3.7	O K
600 Summer	0.0	0.0	98.8082	0.4582	3.8	O K
720 Summer	0.0	0.0	98.8162	0.4662	3.9	O K
960 Summer	0.0	0.0	98.8282	0.4782	4.0	O K
1440 Summer	0.0	0.0	98.8417	0.4917	4.1	O K
2160 Summer	0.0	0.0	98.8457	0.4957	4.2	O K
2880 Summer	0.0	0.0	98.8412	0.4912	4.1	O K
4320 Summer	0.0	0.0	98.8212	0.4712	3.9	O K
5760 Summer	0.0	0.0	98.7987	0.4487	3.8	O K
7200 Summer	0.0	0.0	98.7772	0.4272	3.6	O K
8640 Summer	0.0	0.0	98.7567	0.4067	3.4	O K
10080 Summer	0.0	0.0	98.7388	0.3887	3.3	O K
15 Winter	0.0	0.0	98.5218	0.1717	1.4	O K
30 Winter	0.0	0.0	98.5832	0.2332	2.0	O K
60 Winter	0.0	0.0	98.6522	0.3022	2.5	O K
120 Winter	0.0	0.0	98.7252	0.3752	3.1	O K
180 Winter	0.0	0.0	98.7668	0.4167	3.5	O K
Storm Duration (mins)	Rain (mm/hr)		Time-Peak (mins)			
15 Summer	68.99		19			
30 Summer	47.08		34			
60 Summer	30.81		64			
120 Summer	19.53		124			
180 Summer	14.75		182			
240 Summer	12.05		242			
360 Summer	9.05		362			
480 Summer	7.38		480			
600 Summer	6.29		572			
720 Summer	5.52		620			
960 Summer	4.49		740			
1440 Summer	3.35		996			
2160 Summer	2.49		1408			
2880 Summer	2.02		1816			
4320 Summer	1.50		2636			
5760 Summer	1.21		3408			
7200 Summer	1.03		4184			
8640 Summer	0.90		4936			
10080 Summer	0.81		5744			
15 Winter	68.99		19			
30 Winter	47.08		33			
60 Winter	30.81		62			
120 Winter	19.53		122			
180 Winter	14.75		180			
(c)1982-2006 Micro Drainage						



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Summary of Results for 30 year Return Period

Storm Duration (mins)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
240 Winter	0.0	0.0	98.7952	0.4452	3.7	O K
360 Winter	0.0	0.0	98.8322	0.4822	4.0	O K
480 Winter	0.0	0.0	98.8542	0.5042	4.2	O K
600 Winter	0.1	0.1	98.8677	0.5177	4.3	O K
720 Winter	0.1	0.1	98.8758	0.5257	4.4	O K
960 Winter	0.1	0.1	98.8863	0.5362	4.5	O K
1440 Winter	0.1	0.1	98.8963	0.5462	4.6	O K
2160 Winter	0.1	0.1	98.8912	0.5412	4.5	O K
2880 Winter	0.1	0.1	98.8762	0.5262	4.4	O K
4320 Winter	0.0	0.0	98.8402	0.4902	4.1	O K
5760 Winter	0.0	0.0	98.8047	0.4547	3.8	O K
7200 Winter	0.0	0.0	98.7732	0.4232	3.5	O K
8640 Winter	0.0	0.0	98.7452	0.3952	3.3	O K
10080 Winter	0.0	0.0	98.7207	0.3707	3.1	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
240 Winter	12.05	238
360 Winter	9.05	352
480 Winter	7.38	464
600 Winter	6.29	572
720 Winter	5.52	672
960 Winter	4.49	760
1440 Winter	3.35	1066
2160 Winter	2.49	1516
2880 Winter	2.02	1960
4320 Winter	1.50	2808
5760 Winter	1.21	3624
7200 Winter	1.03	4400
8640 Winter	0.90	5184
10080 Winter	0.81	5952

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Rainfall Details

Region	ENG+WAL	Shortest Storm (mins)	15
Return Period (years)	30	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Summer Storms	Yes
Ratio-R	0.300	Winter Storms	Yes
Cv (Summer)	0.750	Climate Change %	+0
Cv (Winter)	0.840		

Time / Area Diagram

Total Area (ha) = 0.010

Time	(mins)	Area
from:	to:	(ha)
0	4	0.010

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Lined Soakaway Details

Infil Coef - Base (m/hr)	0.000000	Pit Multiplier	2.0
Infil Coef - Sides (m/hr)	0.049000	Number Required	1
Safety Factor	2.0	Invert Level (m)	98.350
Porosity	0.56	Cover Level (m)	99.600
Ring Diameter (m)	1.8		

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project				Job Ref.	
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Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 951 minutes

Storm Duration (mins)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
15 Summer	0.0	0.0	98.6378	0.2877	2.4	O K
30 Summer	0.0	0.0	98.7447	0.3947	3.3	O K
60 Summer	0.1	0.1	98.8642	0.5142	4.3	O K
120 Summer	0.1	0.1	98.9873	0.6373	5.3	O K
180 Summer	0.1	0.1	99.0528	0.7028	5.9	O K
240 Summer	0.1	0.1	99.0958	0.7458	6.2	O K
360 Summer	0.1	0.1	99.1503	0.8003	6.7	O K
480 Summer	0.1	0.1	99.1798	0.8298	7.0	O K
600 Summer	0.1	0.1	99.1958	0.8458	7.1	O K
720 Summer	0.1	0.1	99.2073	0.8573	7.2	O K
960 Summer	0.1	0.1	99.2233	0.8733	7.3	O K
1440 Summer	0.1	0.1	99.2383	0.8883	7.4	O K
2160 Summer	0.1	0.1	99.2358	0.8858	7.4	O K
2880 Summer	0.1	0.1	99.2193	0.8693	7.3	O K
4320 Summer	0.1	0.1	99.1743	0.8243	6.9	O K
5760 Summer	0.1	0.1	99.1283	0.7783	6.5	O K
7200 Summer	0.1	0.1	99.0858	0.7358	6.2	O K
8640 Summer	0.1	0.1	99.0473	0.6973	5.8	O K
10080 Summer	0.1	0.1	99.0133	0.6633	5.6	O K
15 Winter	0.0	0.0	98.6723	0.3222	2.7	O K
30 Winter	0.0	0.0	98.7922	0.4422	3.7	O K
60 Winter	0.1	0.1	98.9263	0.5762	4.8	O K
120 Winter	0.1	0.1	99.0643	0.7143	6.0	O K
180 Winter	0.1	0.1	99.1383	0.7883	6.6	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	89.23	19
30 Summer	61.54	34
60 Summer	40.51	64
120 Summer	25.63	124
180 Summer	19.23	182
240 Summer	15.63	242
360 Summer	11.65	362
480 Summer	9.44	480
600 Summer	8.01	572
720 Summer	7.00	620
960 Summer	5.65	740
1440 Summer	4.17	996
2160 Summer	3.07	1408
2880 Summer	2.46	1816
4320 Summer	1.81	2636
5760 Summer	1.45	3408
7200 Summer	1.23	4184
8640 Summer	1.07	4936
10080 Summer	0.95	5744
15 Winter	89.23	19
30 Winter	61.54	33
60 Winter	40.51	62
120 Winter	25.63	122
180 Winter	19.23	180



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19 Broad Lane (land adj), Burnedge, Rochdale

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Summary of Results for 100 year Return Period (+45%)

Storm Duration (mins)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
240 Winter	0.1	0.1	99.1868	0.8368	7.0	O K
360 Winter	0.1	0.1	99.2498	0.8998	7.5	O K
480 Winter	0.1	0.1	99.2853	0.9353	7.8	O K
600 Winter	0.1	0.1	99.3053	0.9553	8.0	O K
720 Winter	0.1	0.1	99.3163	0.9663	8.1	O K
960 Winter	0.1	0.1	99.3288	0.9788	8.2	O K
1440 Winter	0.1	0.1	99.3368	0.9868	8.3	O K
2160 Winter	0.1	0.1	99.3163	0.9663	8.1	O K
2880 Winter	0.1	0.1	99.2813	0.9313	7.8	O K
4320 Winter	0.1	0.1	99.2068	0.8568	7.2	O K
5760 Winter	0.1	0.1	99.1383	0.7883	6.6	O K
7200 Winter	0.1	0.1	99.0788	0.7288	6.1	O K
8640 Winter	0.1	0.1	99.0278	0.6778	5.7	O K
10080 Winter	0.1	0.1	98.9833	0.6333	5.3	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
240 Winter	15.63	238
360 Winter	11.65	352
480 Winter	9.44	464
600 Winter	8.01	572
720 Winter	7.00	672
960 Winter	5.65	760
1440 Winter	4.17	1066
2160 Winter	3.07	1516
2880 Winter	2.46	1960
4320 Winter	1.81	2808
5760 Winter	1.45	3624
7200 Winter	1.23	4400
8640 Winter	1.07	5184
10080 Winter	0.95	5952

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Rainfall Details

Region	ENG+WAL	Shortest Storm (mins)	15
Return Period (years)	100	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Summer Storms	Yes
Ratio-R	0.300	Winter Storms	Yes
Cv (Summer)	0.750	Climate Change %	+45
Cv (Winter)	0.840		

Time / Area Diagram

Total Area (ha) = 0.010

Time from:	(mins) to:	Area (ha)
0	4	0.010

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Lined Soakaway Details

Infil Coef - Base (m/hr)	0.000000	Pit Multiplier	2.0
Infil Coef - Sides (m/hr)	0.049000	Number Required	1
Safety Factor	2.0	Invert Level (m)	98.350
Porosity	0.56	Cover Level (m)	99.600
Ring Diameter (m)	1.8		