TECHNICAL NOTE

Drainage Calculations

62 Broadwood Road, Ruislip

1.0 Introduction

1.1 Lanmor Consulting Ltd has been appointed to prepare drainage calculations for the proposed development located at 62 Broadwood Avenue Ruislip. The proposals involves the erection of a single story ground floor extension to the approved dwelling.

1.2 This report has been prepared in order to demonstrate that runoff from the proposed extension will be controlled to manage the risk of flooding.

2.0 Existing Site Conditions

2.1 The site is located in the north of Ruislip, in the London Borough of Hillingdon. The site is located within a predominantly residential area. To the north of the site is Park Wood SSSI. The site is surrounded to the south, east and west with residential houses. The nearest source of fluvial flooding is the River Pinn, which at its closest point lies 0.28km south of the site.

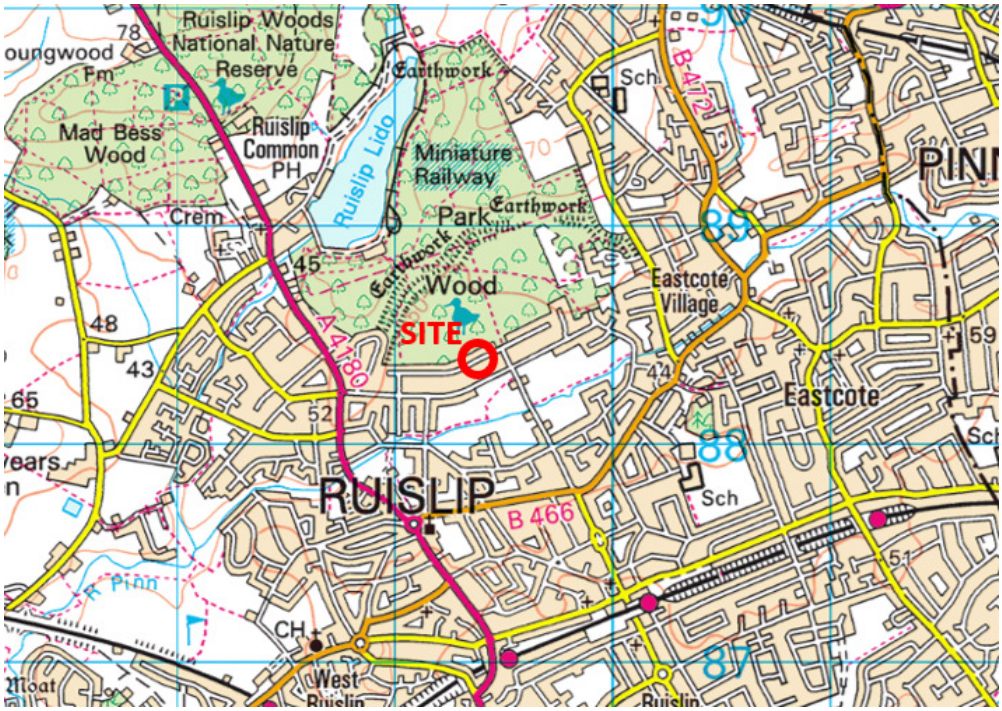


Figure 2.1 – Site Location Plan

2.2 Figure 2.1 above shows the location of the application site. The site received planning consent to replace the existing property with a similar sized dwelling. The proposed rear single storey extensions is indicated on the drawing 240816-02 included in appendix A.

2.3 The British Geological Survey (BGS), mapping indicates the underlying bedrock at the application site to be Lambeth Group – Clay, silt and sand. This is a sedimentary bedrock formed between 59.2 and 47.8 million years ago during the Palaeogene period.

3.0 Existing Drainage

3.1 The approved dwelling used permeable paving to discharge the runoff from the roof and hardstandings.

4.0 Proposed Drainage

Surface Water

4.1 Sustainable Drainage Systems (SuDS) were considered as part of the original drainage strategy submitted with the planning application. Green/blue roofs were discounted as the extension will have a light weigh roof.

4.2 Next on the SuDS hierarchy is the use of infiltration techniques. The geology is suitable for infiltration, so permeable paving was used around the building and parking area to the front to attenuate runoff from the paved areas and roof and allow it to soak into the underlying ground.

4.3 It is therefore proposed to extent this to cover the proposed extension. The paving has been designed to accommodate a 1 in 100 year event plus an allowance of 40% for climate change. The drainage design is included in Appendix B as drawing 241822/500/01. The subbase thickness has been designed at 400m with 30% voids to accommodate the above storm event based on infiltration rate of $1x10^{-5}$. The full drainage calculation for different return periods is included in Appendix C.

5.0 Management and Timing of Drainage

5.1 The drainage for the current building will be retained and used for the discharge of runoff from the site for a long as possible during the construction phase, once the external building fabric is up the permeable paving will be installed and the proposed drainage will be direct to the paved area. During construction silt-laden runoff can represent a common form of waterborne pollution on many construction sites. Such waters cannot enter the drainage system unless the system has specifically been designed to manage this risk since it can cause blockages or downstream pollution of the receiving waters.

5.2 Sediment fences or other suitable control devices will be installed around the perimeter of the site during the initial excavation works to intercept any loose sediment. Other possible drainage control measures include grading the land to form temporary perimeter ditches / channels or bunded embankments intended for the attenuation of runoff within the site.

6.0 Surface Water Drainage Treatment

6.1 As part of the CIRIA SuDS Manual C753, Section 26 provides guidance regarding methods for managing pollution risks from surface water runoff.

6.2 Part of the assessment is to determine which land use classification the proposed development falls under, Table 26.1 of the CIRIA Report C753 sets out the approaches to water quality risk management. For this site the Simple Index Approach will be used

6.3 Table 26.2 in C753 reproduced as Table 6.1, show the potential hazard associated with different land uses the hazard indices. The development will consist of residential houses, it is concluded that the site should be classed within the sections shown in Table 6.1 below.

6.4 The roof of the residential building is considered to have a "very low" pollution hazard, generating 0.2 total suspended solids, 0.2 metals and 0.05 hydro-carbons. The parking area is considered to have a "low" pollution hazard, generating 0.5 total suspended solids, 0.4 metals and 0.4 hydro-carbons.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Table 6.1 – CIRIA SuDS Manual C753 (Land use classifications)

6.5 The proposed development will incorporate permeable paving for storage and disposal of runoff from the site. Suitable treatment measures offered by SuDS features are also set out in CIRA report.

6.6 Table 26.4 of C753 reproduced as Table 6.2 sets out the mitigation indices provided by SuDS features for discharge to groundwaters. The disposal of runoff will be via permeable paving which will provide a level of treatment for total suspended solids of 0.7, 0.6 for metals and 0.7 for hydrocarbons, all in excess of the indices in Table 6.1.

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates[1]	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.6[4]	0.5	0.6
A soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.8[4]	0.8	0.8
Proprietary treatment systems[5, 6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area.		

Table 6.2 – CIRIA SuDS Manual C753 (Mitigation Indices to Groundwater)

6.7 The above assessment has demonstrated that the proposed SuDS features will provide a suitable level of treatment appropriate to the type of development proposed.

7.0 Surface Water Drainage Maintenance

7.1 Regular inspection of the surface water drainage network for blockages and clearing unwanted debris/silt from the system should improve the performance of the surface water network and decrease the need for future repairs. In the event of blockages, high pressure water jets can be used to clear the gullies and pipes to ensure they are functioning correctly. This should be undertaken by certified trained professionals.

7.2 The level and frequency of maintenance required on site is dependent on the type of facility. The type of maintenance will fall into one of three categories “regular maintenance”, “occasional maintenance” and “remedial maintenance”.

7.3 Regular maintenance of the drainage and SuDS features will include inspections, removal of litter/debris and sweeping of the surfaces. Occasional maintenance will include removal of sediment etc. and remedial maintenance may include structural repairs and infiltration reconditioning if required.

7.4 The drainage and SuDS elements after an initial inspection following construction should be inspected on a monthly basis for the first 12 months and after large storms. Thereafter the following maintenance regime should be applied and adjusted if the 12-month monitoring process has identified any issues.

7.5 The freeholder will be responsible for the drainage and SuDS elements across the site. The appropriate health and safety equipment must be used when accessing manholes. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained.

Permeable Paving

7.6 For permeable paving areas, the following maintenance is recommended.

Permeable Paving Maintenance Schedule		
	Required Action	**Typical Frequency**
Regular maintenance	Remove debris and leaves etc.	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surfaces from adjacent impermeable areas as this area is most likely to collect the most sediment.
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds	As required- once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting etc	As required
	Rehabilitation of surface and upper substructure	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)

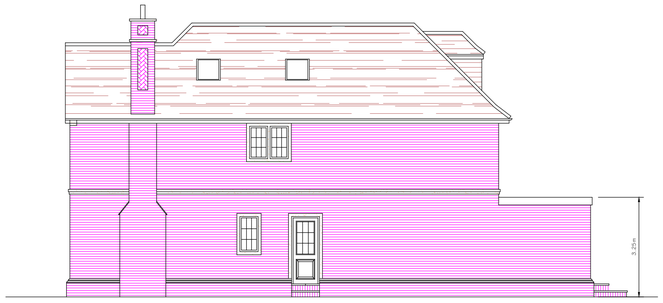
Monitoring	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action.	Three-monthly, 48 hours after large storms in the first six months
	Inspect silt accumulation rates and establish appropriate frequencies for rehabilitation	Annually
	Monitor inspection chambers	Annually

Table 7.1 – Permeable Paving Maintenance Schedule

APPENDIX A

Drawing 240816-02 – Proposed Site Layout

FRONT ELEVATION (SOUTH EAST)



SIDE ELEVATION (SOUTH WEST)

HANDMADE BROWN CLAY PLAIN TILES
BONNET TILES TO HIPS

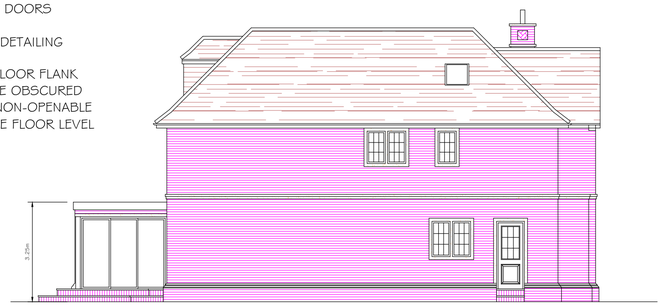
HANDMADE RED STOCK BRICKS

WHITE WINDOWS & DOORS

PORTLAND STONE DETAILING

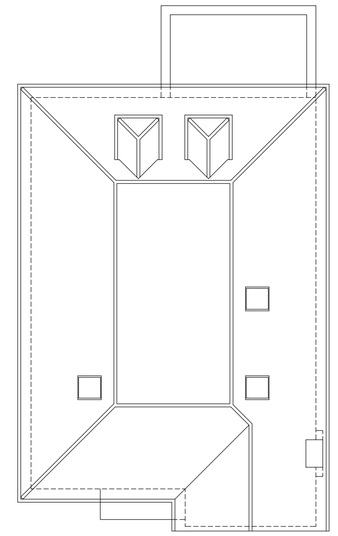
FIRST & SECOND FLOOR FLANK WINDOWS TO HAVE OBSCURED GLAZING & TO BE NON-OPENABLE UP TO 1.7m ABOVE FLOOR LEVEL

REAR ELEVATION (NORTH WEST)

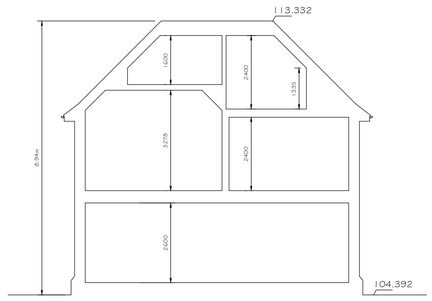


SIDE ELEVATION (NORTH EAST)

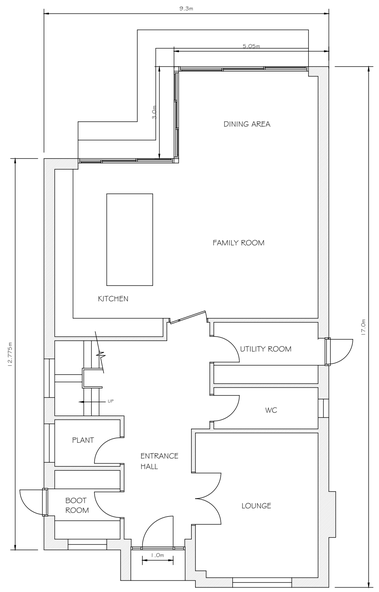
SCALE BAR ~ 1:100



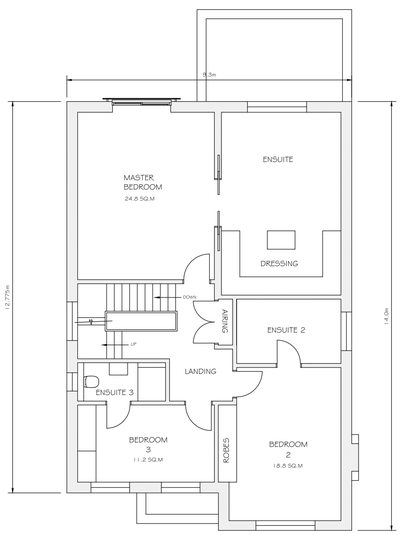
ROOF PLAN



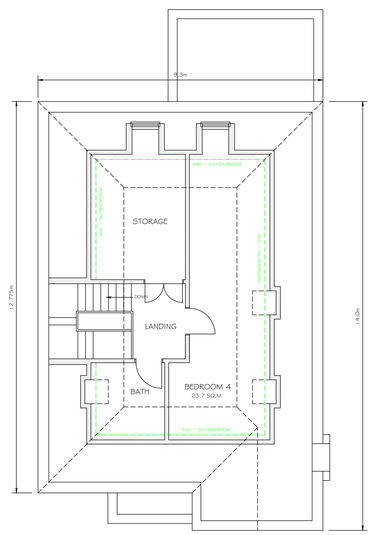
TYPICAL SIDE TO SIDE SECTION



GROUND FLOOR PLAN ~ 125 SQ.M / 1345 SQ.FT



FIRST FLOOR PLAN ~ 109 SQ.M / 1175 SQ.FT



SECOND FLOOR PLAN ~ 50 SQ.M / 533 SQ.FT

REVISIONS	DATE
F - REAR SINGLE STOREY ELEMENT REDUCED IN HEIGHT.	08/05/2025
E - STAIRCASE BROUGHT FORWARD.	06/05/2025
D - MASTER BED VAULTED CEILING SHOWN.	29/04/2025
C - GROUND FLOOR INTERNAL FLOOR AREA REVISED.	29/04/2025
B - REAR EXTENSION REDUCED IN WIDTH.	29/04/2025
A - 3.0m SINGLE STOREY REAR EXTENSION SHOWN.	07/04/2025

MINOLI DESIGN
E: declan@minoli.design
W: www.minoli.design
77 HOWARDS THICKET GERRARDS CROSS BUCKS SL9 7NU
O: 01753 882010 M: 07973 548828

TITLE

Proposed Plans

ADDRESS

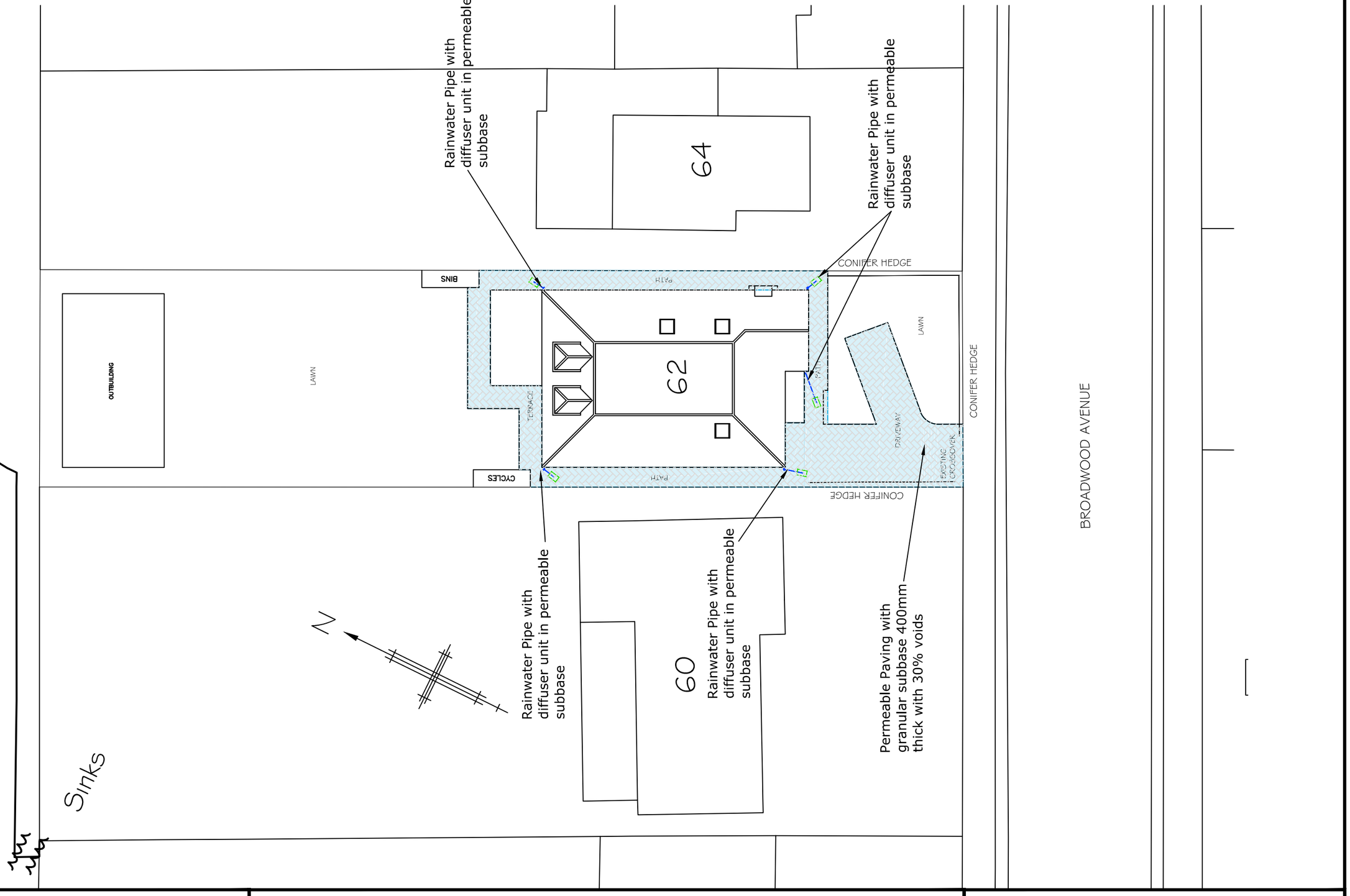
62 Broadwood Avenue
Ruislip HA4 7XR

CLIENT

SCALE	DATE
@ A1 1:100	February 2025
DRAWING No. 250220-02	REV. F

APPENDIX B

241822/500/01 – Proposed Drainage Layout



62 Broadwood Road
Ruislip

Proposed Drainage Layout

SCALE	DRAWN BY	PRJ No.	DWG No.
1:200	AG	241822	241822/500/01 Rev B

LANMOR Consulting
Civil Engineers & Transport Planning
Thorogood House, 34 Tolworth Close, Surbiton, Surrey, KT6 7EW
Telephone: 0208 339 7899 Fax: 0208 339 7898
E-mail: info@lanmor.co.uk
www.lanmor.co.uk

APPENDIX C

MicroDrainage Calculations

Summary of Results for 1 year Return Period

Half Drain Time : 42 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	59.483	0.033	0.3	1.0	O K
30 min Summer	59.493	0.043	0.4	1.3	O K
60 min Summer	59.499	0.049	0.5	1.5	O K
120 min Summer	59.503	0.053	0.5	1.6	O K
180 min Summer	59.503	0.053	0.5	1.6	O K
240 min Summer	59.501	0.051	0.5	1.5	O K
360 min Summer	59.497	0.047	0.5	1.4	O K
480 min Summer	59.493	0.043	0.4	1.3	O K
600 min Summer	59.489	0.039	0.4	1.2	O K
720 min Summer	59.486	0.036	0.4	1.1	O K
960 min Summer	59.482	0.032	0.3	0.9	O K
1440 min Summer	59.475	0.025	0.3	0.8	O K
2160 min Summer	59.470	0.020	0.2	0.6	O K
2880 min Summer	59.466	0.016	0.2	0.5	O K
4320 min Summer	59.463	0.013	0.1	0.4	O K
5760 min Summer	59.460	0.010	0.1	0.3	O K
7200 min Summer	59.459	0.009	0.1	0.3	O K
8640 min Summer	59.458	0.008	0.1	0.2	O K
10080 min Summer	59.457	0.007	0.1	0.2	O K
15 min Winter	59.483	0.033	0.3	1.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	31.597	0.0	17
30 min Summer	20.540	0.0	30
60 min Summer	12.944	0.0	44
120 min Summer	7.990	0.0	78
180 min Summer	5.996	0.0	112
240 min Summer	4.885	0.0	144
360 min Summer	3.636	0.0	206
480 min Summer	2.941	0.0	268
600 min Summer	2.495	0.0	330
720 min Summer	2.181	0.0	390
960 min Summer	1.764	0.0	512
1440 min Summer	1.308	0.0	752
2160 min Summer	0.971	0.0	1120
2880 min Summer	0.785	0.0	1472
4320 min Summer	0.582	0.0	2204
5760 min Summer	0.471	0.0	2936
7200 min Summer	0.399	0.0	3608
8640 min Summer	0.349	0.0	4384
10080 min Summer	0.312	0.0	5144
15 min Winter	31.597	0.0	17

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	59.493	0.043	0.4	1.3	O K
60 min Winter	59.499	0.049	0.5	1.5	O K
120 min Winter	59.500	0.050	0.5	1.5	O K
180 min Winter	59.498	0.048	0.5	1.4	O K
240 min Winter	59.495	0.045	0.5	1.4	O K
360 min Winter	59.490	0.040	0.4	1.2	O K
480 min Winter	59.485	0.035	0.3	1.0	O K
600 min Winter	59.481	0.031	0.3	0.9	O K
720 min Winter	59.478	0.028	0.3	0.8	O K
960 min Winter	59.474	0.024	0.2	0.7	O K
1440 min Winter	59.468	0.018	0.2	0.5	O K
2160 min Winter	59.464	0.014	0.1	0.4	O K
2880 min Winter	59.461	0.011	0.1	0.3	O K
4320 min Winter	59.458	0.008	0.1	0.2	O K
5760 min Winter	59.457	0.007	0.1	0.2	O K
7200 min Winter	59.456	0.006	0.1	0.2	O K
8640 min Winter	59.455	0.005	0.0	0.1	O K
10080 min Winter	59.454	0.004	0.0	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	20.540	0.0	30
60 min Winter	12.944	0.0	46
120 min Winter	7.990	0.0	84
180 min Winter	5.996	0.0	118
240 min Winter	4.885	0.0	152
360 min Winter	3.636	0.0	216
480 min Winter	2.941	0.0	278
600 min Winter	2.495	0.0	338
720 min Winter	2.181	0.0	400
960 min Winter	1.764	0.0	520
1440 min Winter	1.308	0.0	754
2160 min Winter	0.971	0.0	1108
2880 min Winter	0.785	0.0	1460
4320 min Winter	0.582	0.0	2168
5760 min Winter	0.471	0.0	2904
7200 min Winter	0.399	0.0	3728
8640 min Winter	0.349	0.0	4408
10080 min Winter	0.312	0.0	5040

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.200	Shortest Storm (mins)	15
Ratio R	0.411	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.022

Time (mins) From:	To:	Area (ha)
0	4	0.022

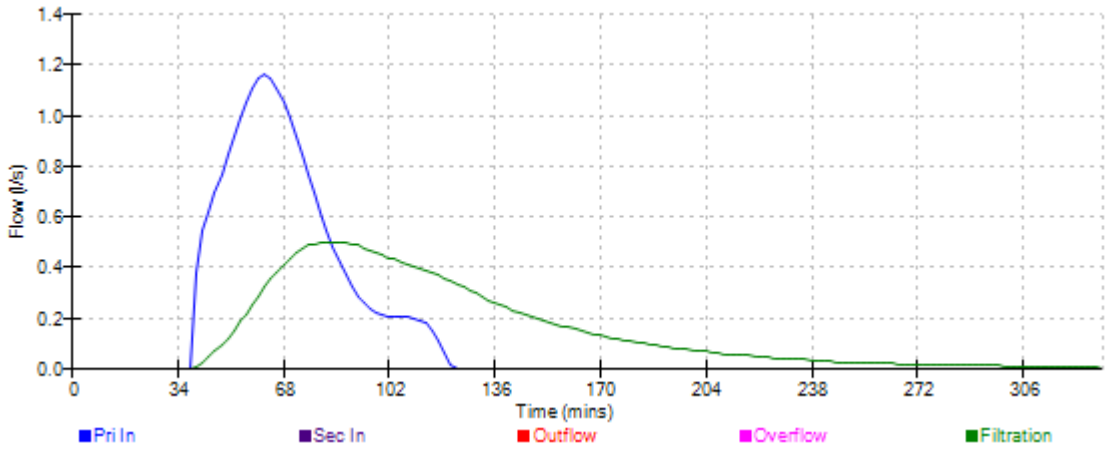
Model Details

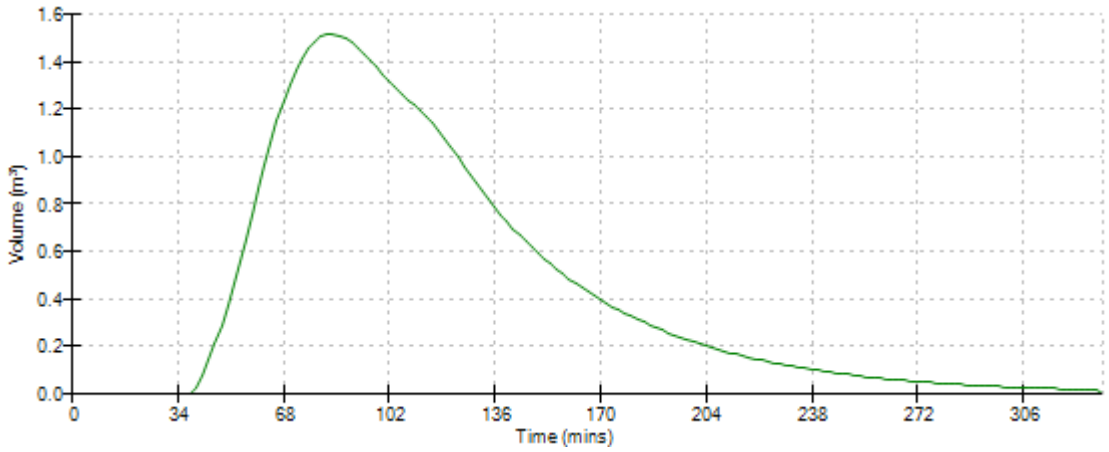
Storage is Online Cover Level (m) 60.000

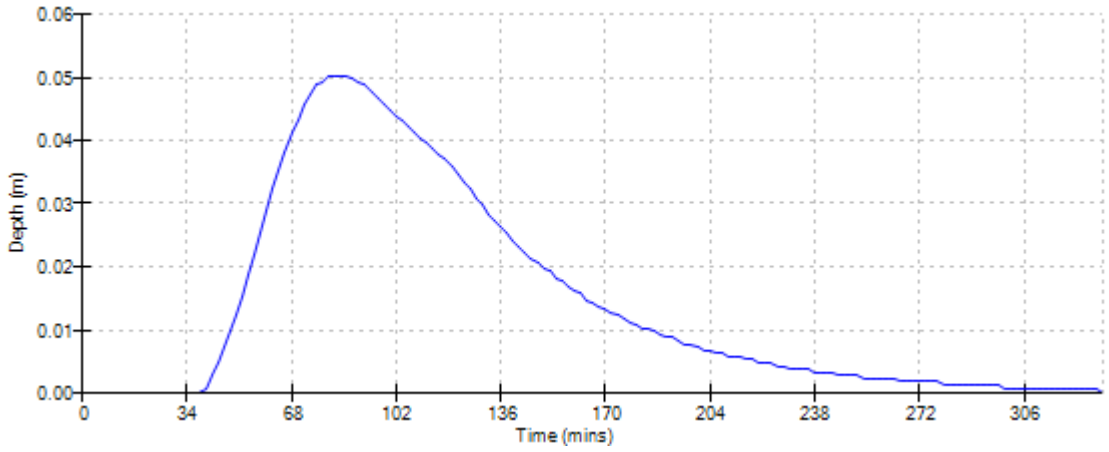
Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	27.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	59.450	Cap Volume Depth (m)	0.400

Event: 120 min Winter







Summary of Results for 30 year Return Period

Half Drain Time : 88 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	59.558	0.108	0.5	3.2	O K
30 min Summer	59.589	0.139	0.5	4.2	O K
60 min Summer	59.611	0.161	0.5	4.8	O K
120 min Summer	59.619	0.169	0.5	5.1	O K
180 min Summer	59.617	0.167	0.5	5.0	O K
240 min Summer	59.611	0.161	0.5	4.8	O K
360 min Summer	59.597	0.147	0.5	4.4	O K
480 min Summer	59.582	0.132	0.5	4.0	O K
600 min Summer	59.568	0.118	0.5	3.5	O K
720 min Summer	59.554	0.104	0.5	3.1	O K
960 min Summer	59.532	0.082	0.5	2.5	O K
1440 min Summer	59.503	0.053	0.5	1.6	O K
2160 min Summer	59.490	0.040	0.4	1.2	O K
2880 min Summer	59.483	0.033	0.3	1.0	O K
4320 min Summer	59.475	0.025	0.2	0.7	O K
5760 min Summer	59.470	0.020	0.2	0.6	O K
7200 min Summer	59.467	0.017	0.2	0.5	O K
8640 min Summer	59.464	0.014	0.1	0.4	O K
10080 min Summer	59.463	0.013	0.1	0.4	O K
15 min Winter	59.558	0.108	0.5	3.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	77.546	0.0	18
30 min Summer	50.252	0.0	32
60 min Summer	31.124	0.0	60
120 min Summer	18.709	0.0	98
180 min Summer	13.746	0.0	130
240 min Summer	10.999	0.0	164
360 min Summer	8.017	0.0	232
480 min Summer	6.402	0.0	298
600 min Summer	5.374	0.0	362
720 min Summer	4.657	0.0	424
960 min Summer	3.712	0.0	540
1440 min Summer	2.694	0.0	764
2160 min Summer	1.953	0.0	1108
2880 min Summer	1.553	0.0	1472
4320 min Summer	1.124	0.0	2204
5760 min Summer	0.893	0.0	2936
7200 min Summer	0.747	0.0	3664
8640 min Summer	0.645	0.0	4400
10080 min Summer	0.570	0.0	5072
15 min Winter	77.546	0.0	18

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	59.589	0.139	0.5	4.2	O K
60 min Winter	59.611	0.161	0.5	4.8	O K
120 min Winter	59.616	0.166	0.5	5.0	O K
180 min Winter	59.612	0.162	0.5	4.9	O K
240 min Winter	59.603	0.153	0.5	4.6	O K
360 min Winter	59.581	0.131	0.5	3.9	O K
480 min Winter	59.559	0.109	0.5	3.3	O K
600 min Winter	59.539	0.089	0.5	2.7	O K
720 min Winter	59.522	0.072	0.5	2.2	O K
960 min Winter	59.500	0.050	0.5	1.5	O K
1440 min Winter	59.488	0.038	0.4	1.1	O K
2160 min Winter	59.478	0.028	0.3	0.8	O K
2880 min Winter	59.472	0.022	0.2	0.7	O K
4320 min Winter	59.466	0.016	0.2	0.5	O K
5760 min Winter	59.463	0.013	0.1	0.4	O K
7200 min Winter	59.461	0.011	0.1	0.3	O K
8640 min Winter	59.459	0.009	0.1	0.3	O K
10080 min Winter	59.458	0.008	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	50.252	0.0	31
60 min Winter	31.124	0.0	60
120 min Winter	18.709	0.0	100
180 min Winter	13.746	0.0	136
240 min Winter	10.999	0.0	174
360 min Winter	8.017	0.0	246
480 min Winter	6.402	0.0	314
600 min Winter	5.374	0.0	374
720 min Winter	4.657	0.0	432
960 min Winter	3.712	0.0	522
1440 min Winter	2.694	0.0	764
2160 min Winter	1.953	0.0	1124
2880 min Winter	1.553	0.0	1472
4320 min Winter	1.124	0.0	2204
5760 min Winter	0.893	0.0	2936
7200 min Winter	0.747	0.0	3640
8640 min Winter	0.645	0.0	4264
10080 min Winter	0.570	0.0	5128

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.200	Shortest Storm (mins)	15
Ratio R	0.411	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.022

Time (mins) From:	To:	Area (ha)
0	4	0.022

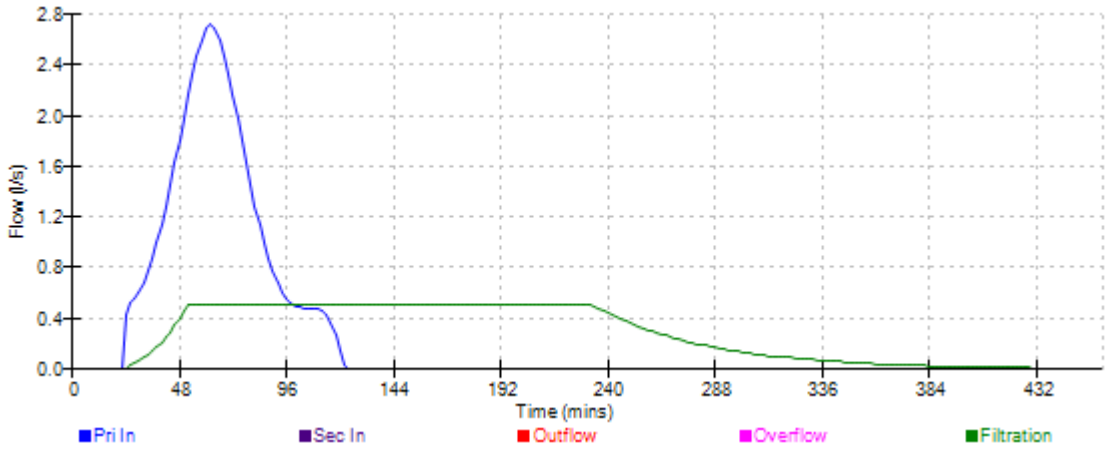
Model Details

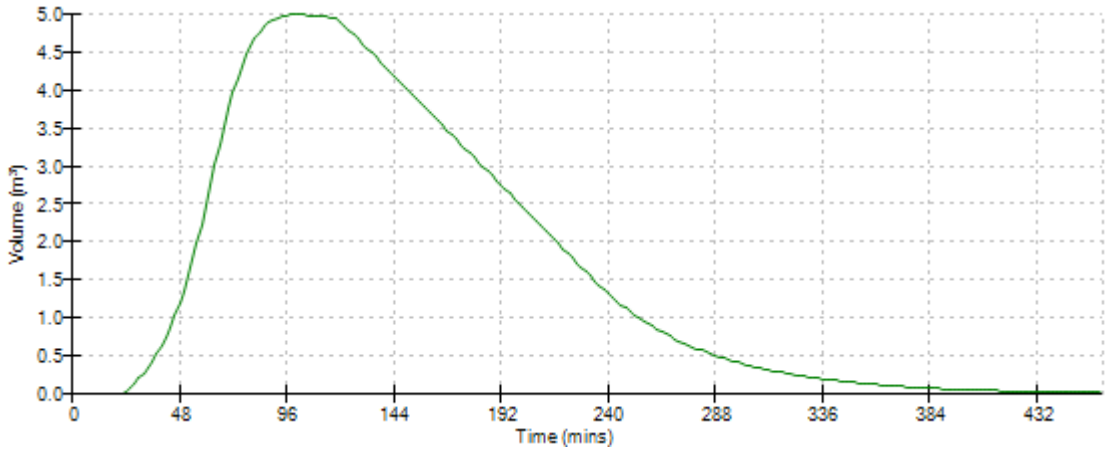
Storage is Online Cover Level (m) 60.000

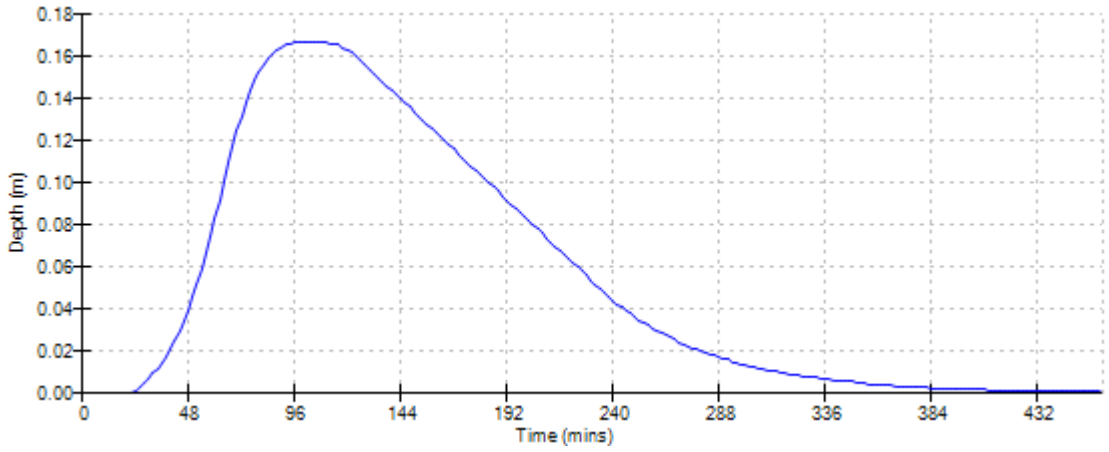
Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	27.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	59.450	Cap Volume Depth (m)	0.400

Event: 120 min Winter







Summary of Results for 100 year Return Period

Half Drain Time : 126 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	59.598	0.148	0.5	4.4	O K
30 min Summer	59.641	0.191	0.5	5.7	O K
60 min Summer	59.676	0.226	0.5	6.8	O K
120 min Summer	59.691	0.241	0.5	7.2	O K
180 min Summer	59.688	0.238	0.5	7.2	O K
240 min Summer	59.682	0.232	0.5	7.0	O K
360 min Summer	59.665	0.215	0.5	6.5	O K
480 min Summer	59.648	0.198	0.5	5.9	O K
600 min Summer	59.630	0.180	0.5	5.4	O K
720 min Summer	59.614	0.164	0.5	4.9	O K
960 min Summer	59.583	0.133	0.5	4.0	O K
1440 min Summer	59.537	0.087	0.5	2.6	O K
2160 min Summer	59.501	0.051	0.5	1.5	O K
2880 min Summer	59.491	0.041	0.4	1.2	O K
4320 min Summer	59.481	0.031	0.3	0.9	O K
5760 min Summer	59.474	0.024	0.2	0.7	O K
7200 min Summer	59.470	0.020	0.2	0.6	O K
8640 min Summer	59.468	0.018	0.2	0.5	O K
10080 min Summer	59.466	0.016	0.2	0.5	O K
15 min Winter	59.598	0.148	0.5	4.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	100.712	0.0	18
30 min Summer	65.803	0.0	32
60 min Summer	40.926	0.0	62
120 min Summer	24.583	0.0	114
180 min Summer	18.002	0.0	142
240 min Summer	14.347	0.0	174
360 min Summer	10.396	0.0	242
480 min Summer	8.270	0.0	310
600 min Summer	6.921	0.0	376
720 min Summer	5.981	0.0	440
960 min Summer	4.747	0.0	568
1440 min Summer	3.422	0.0	796
2160 min Summer	2.463	0.0	1124
2880 min Summer	1.949	0.0	1472
4320 min Summer	1.399	0.0	2204
5760 min Summer	1.105	0.0	2936
7200 min Summer	0.920	0.0	3672
8640 min Summer	0.791	0.0	4376
10080 min Summer	0.697	0.0	5136
15 min Winter	100.712	0.0	18

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	59.641	0.191	0.5	5.7	O K
60 min Winter	59.676	0.226	0.5	6.8	O K
120 min Winter	59.691	0.241	0.5	7.2	O K
180 min Winter	59.686	0.236	0.5	7.1	O K
240 min Winter	59.676	0.226	0.5	6.8	O K
360 min Winter	59.652	0.202	0.5	6.1	O K
480 min Winter	59.627	0.177	0.5	5.3	O K
600 min Winter	59.601	0.151	0.5	4.5	O K
720 min Winter	59.578	0.128	0.5	3.8	O K
960 min Winter	59.538	0.088	0.5	2.6	O K
1440 min Winter	59.498	0.048	0.5	1.4	O K
2160 min Winter	59.485	0.035	0.4	1.1	O K
2880 min Winter	59.478	0.028	0.3	0.8	O K
4320 min Winter	59.470	0.020	0.2	0.6	O K
5760 min Winter	59.466	0.016	0.2	0.5	O K
7200 min Winter	59.463	0.013	0.1	0.4	O K
8640 min Winter	59.461	0.011	0.1	0.3	O K
10080 min Winter	59.460	0.010	0.1	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	65.803	0.0	32
60 min Winter	40.926	0.0	60
120 min Winter	24.583	0.0	116
180 min Winter	18.002	0.0	146
240 min Winter	14.347	0.0	184
360 min Winter	10.396	0.0	258
480 min Winter	8.270	0.0	330
600 min Winter	6.921	0.0	398
720 min Winter	5.981	0.0	462
960 min Winter	4.747	0.0	578
1440 min Winter	3.422	0.0	764
2160 min Winter	2.463	0.0	1124
2880 min Winter	1.949	0.0	1496
4320 min Winter	1.399	0.0	2176
5760 min Winter	1.105	0.0	2944
7200 min Winter	0.920	0.0	3624
8640 min Winter	0.791	0.0	4408
10080 min Winter	0.697	0.0	5128

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.200	Shortest Storm (mins)	15
Ratio R	0.411	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.022

Time (mins) From:	To:	Area (ha)
0	4	0.022

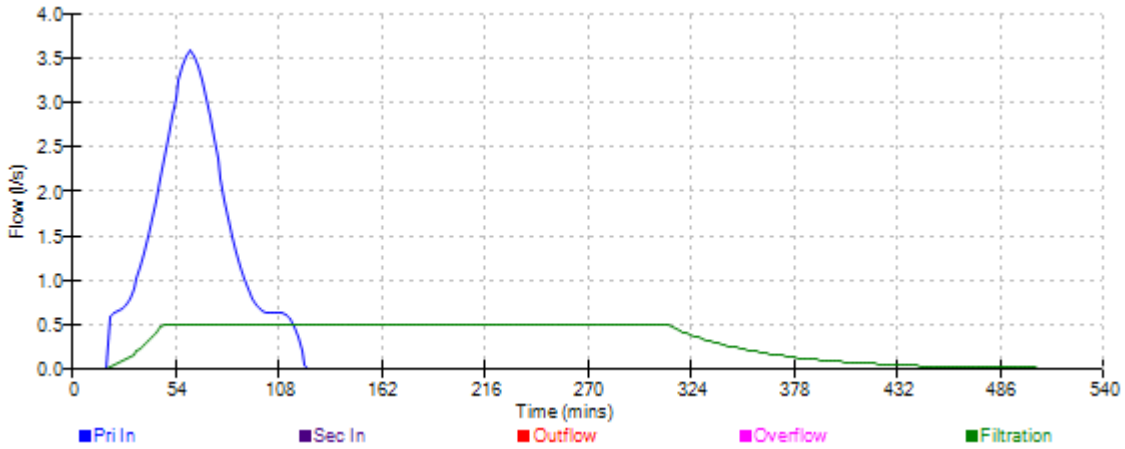
Model Details

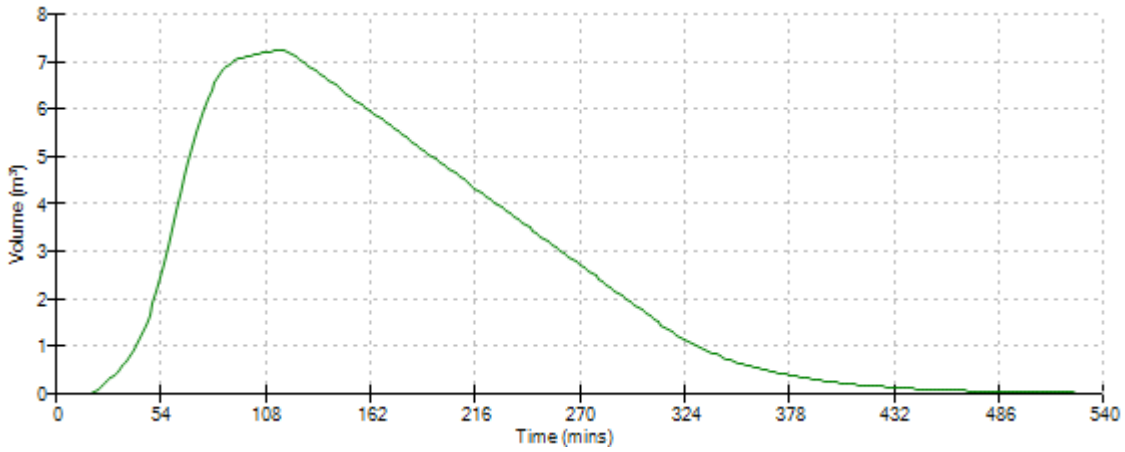
Storage is Online Cover Level (m) 60.000

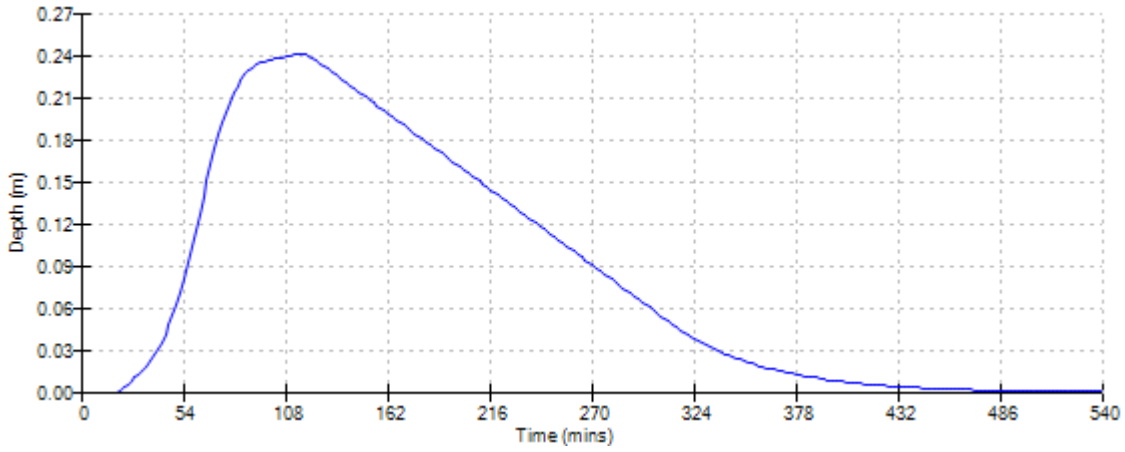
Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	27.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	59.450	Cap Volume Depth (m)	0.400

Event: 120 min Winter







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

Half Drain Time : 189 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	59.667	0.217	0.5	6.5	O K
30 min Summer	59.731	0.281	0.5	8.4	Flood Risk
60 min Summer	59.786	0.336	0.5	10.1	Flood Risk
120 min Summer	59.820	0.370	0.5	11.1	Flood Risk
180 min Summer	59.821	0.371	0.5	11.1	Flood Risk
240 min Summer	59.813	0.363	0.5	10.9	Flood Risk
360 min Summer	59.795	0.345	0.5	10.3	Flood Risk
480 min Summer	59.776	0.326	0.5	9.8	Flood Risk
600 min Summer	59.756	0.306	0.5	9.2	Flood Risk
720 min Summer	59.737	0.287	0.5	8.6	Flood Risk
960 min Summer	59.701	0.251	0.5	7.5	Flood Risk
1440 min Summer	59.636	0.186	0.5	5.6	O K
2160 min Summer	59.563	0.113	0.5	3.4	O K
2880 min Summer	59.519	0.069	0.5	2.1	O K
4320 min Summer	59.493	0.043	0.4	1.3	O K
5760 min Summer	59.484	0.034	0.3	1.0	O K
7200 min Summer	59.479	0.029	0.3	0.9	O K
8640 min Summer	59.475	0.025	0.2	0.7	O K
10080 min Summer	59.472	0.022	0.2	0.7	O K
15 min Winter	59.667	0.217	0.5	6.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	140.997	0.0	18
30 min Summer	92.124	0.0	33
60 min Summer	57.296	0.0	62
120 min Summer	34.417	0.0	120
180 min Summer	25.203	0.0	174
240 min Summer	20.085	0.0	200
360 min Summer	14.554	0.0	262
480 min Summer	11.578	0.0	328
600 min Summer	9.689	0.0	396
720 min Summer	8.373	0.0	464
960 min Summer	6.645	0.0	596
1440 min Summer	4.791	0.0	852
2160 min Summer	3.448	0.0	1192
2880 min Summer	2.728	0.0	1528
4320 min Summer	1.959	0.0	2204
5760 min Summer	1.547	0.0	2936
7200 min Summer	1.287	0.0	3672
8640 min Summer	1.108	0.0	4400
10080 min Summer	0.975	0.0	5136
15 min Winter	140.997	0.0	18

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	59.731	0.281	0.5	8.4	Flood Risk
60 min Winter	59.787	0.337	0.5	10.1	Flood Risk
120 min Winter	59.821	0.371	0.5	11.1	Flood Risk
180 min Winter	59.823	0.373	0.5	11.2	Flood Risk
240 min Winter	59.812	0.362	0.5	10.9	Flood Risk
360 min Winter	59.788	0.338	0.5	10.2	Flood Risk
480 min Winter	59.762	0.312	0.5	9.3	Flood Risk
600 min Winter	59.734	0.284	0.5	8.5	Flood Risk
720 min Winter	59.706	0.256	0.5	7.7	Flood Risk
960 min Winter	59.653	0.203	0.5	6.1	O K
1440 min Winter	59.566	0.116	0.5	3.5	O K
2160 min Winter	59.499	0.049	0.5	1.5	O K
2880 min Winter	59.489	0.039	0.4	1.2	O K
4320 min Winter	59.478	0.028	0.3	0.8	O K
5760 min Winter	59.472	0.022	0.2	0.7	O K
7200 min Winter	59.469	0.019	0.2	0.6	O K
8640 min Winter	59.466	0.016	0.2	0.5	O K
10080 min Winter	59.464	0.014	0.1	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	92.124	0.0	32
60 min Winter	57.296	0.0	62
120 min Winter	34.417	0.0	118
180 min Winter	25.203	0.0	172
240 min Winter	20.085	0.0	220
360 min Winter	14.554	0.0	274
480 min Winter	11.578	0.0	350
600 min Winter	9.689	0.0	424
720 min Winter	8.373	0.0	494
960 min Winter	6.645	0.0	628
1440 min Winter	4.791	0.0	866
2160 min Winter	3.448	0.0	1124
2880 min Winter	2.728	0.0	1472
4320 min Winter	1.959	0.0	2204
5760 min Winter	1.547	0.0	2936
7200 min Winter	1.287	0.0	3656
8640 min Winter	1.108	0.0	4392
10080 min Winter	0.975	0.0	5184

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.200	Shortest Storm (mins)	15
Ratio R	0.411	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.022

Time (mins) From:	To:	Area (ha)
0	4	0.022

Model Details

Storage is Online Cover Level (m) 60.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	27.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	59.450	Cap Volume Depth (m)	0.400

Event: 180 min Winter