



Civil Engineers & Transport Planners

Rideworx Unit 1,
125 Reading Road

Flood Risk Assessment

October 2024

241869/FRA/AG/KBL/01



Civil Engineers & Transport Planners

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1 INTRODUCTION

1.1 Scope

1.1.1 Lanmor Consulting Ltd has been appointed to prepare a Flood Risk Assessment (FRA) report for the proposed development site at Unit, 125 Reading Road, Wokingham, Berkshire, RG41 1HD. Figure 1.1 below shows the location of the proposed development.

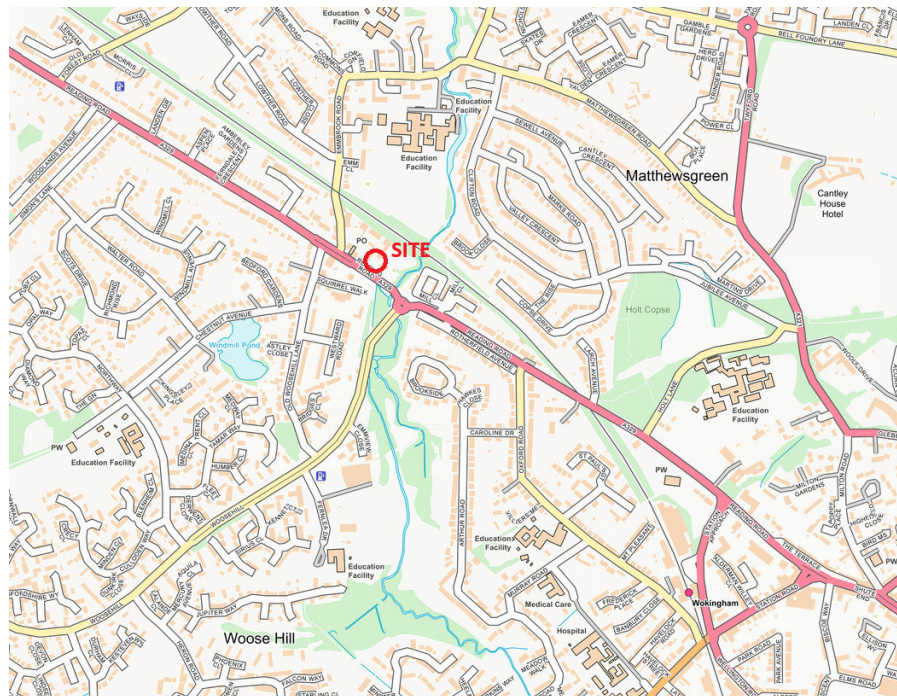


Figure 1.1 – Site Location Plan

1.1.2 This report describes the existing and proposed development, the implications of flooding and the impact the development will have on the flood plain in accordance with the governments guidance document; National Planning Policy Framework (NPPF) and its Planning Practice Guidance (PPG).

1.1.3 This report will consider the following:

- Location of the site;
- Development Proposals;
- Existing information on extents and depths of flood events or on flood predictions;
- Sources of flooding;
- The impact of flooding on site;
- Safe access and egress from the site and;
- An assessment of the run-off likely to be generated and associated risk.

1.1.4 This Flood Risk Assessment report has been prepared in accordance with the requirements of the National Planning Policy Framework and will demonstrate that the proposed development will be safe and will not increase the risk of flooding in the surrounding areas.

1.1.5 The drainage strategy will consider the alternative means for the disposal of runoff from the development and suitable SuDS features to limit flood risk.

2 BASELINE PARAMETRES

2.1 Existing Site

2.1.1 The site is located to the north of Reading Road, Wokingham. The existing site is currently occupied by commercial unit with parking to the front and side, access to the site is obtained from Reading Road.

2.1.2 Levels across the site falls from in a northerly direction with levels falling from 47.00m AOD to 45.5m AOD at the rear. The topographical survey for the site is included in Appendix A as Drawing 01.

2.2 Existing Geology

2.2.1 The British Geological Survey indicates that the site sits on a sedimentary bedrock formation of London Clay Formation, which consists of mudstone. Sedimentary bedrock formed between 56 and 47.8 million years ago during the Palaeogene period

2.2.2 No superficial deposits have been recorded overlaying the bedrock.

2.3 Proposed Development

2.3.1 The proposal seeks a 2 storey extension of the existing commercial unit, to provide more retail space at ground floor and café at first. The proposals will extend the existing single storey building to the front of the site with a 2-storey extension.

2.3.2 Drawing 24-P091-SK01 in Appendix A Indicates the proposed layout for the development.

3 SOURCES OF FLOODING

3.1 Fluvial/Tidal Flooding

3.1.1 Detailed flood information was requested from the Environment Agency (EA) for the site. The National Planning Policy Framework (NPPF) defines the flood zones as follows:

- Zone 1: 'Low Probability' – This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (less than 0.1%) in any year.
- Zone 2: 'Medium Probability' – This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-0.1%) in any year.
- Zone 3a: 'High Probability' – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of sea flooding (>0.5%) in any year.
- Zone 3b: 'The Functional Floodplain' – This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes.

3.1.2 The most significant source of fluvial flooding to the development comes from the watercourse to the east of the site. The water course presents the greatest risk of fluvial flooding to the site and the Environment Agency (EA) flood mapping indicates the application site lies within Flood Zones 1. Figure 3.1 below shows the location of the site and its relationship to the flood zones, provided by the EA.

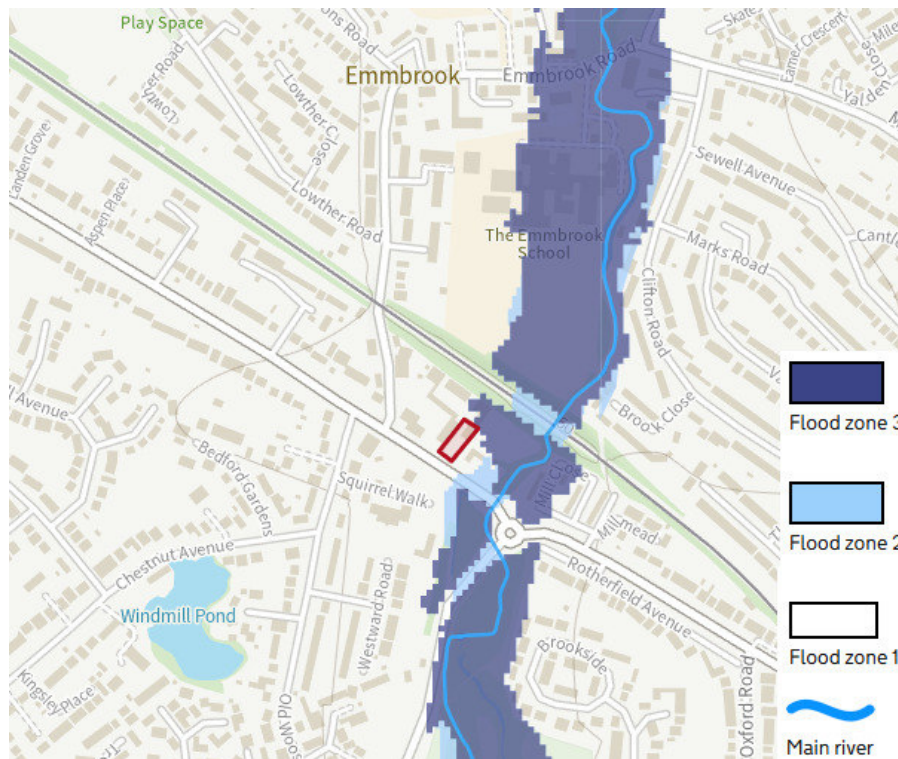


Figure 3.1 – EA Flood Map

- 3.1.3 The dark blue areas show the extent of Flood Zone 3 and the light blue Flood Zone 2. The information provided by the EA shows the site is within Flood Zone 1. It therefore has a 1 in 1000 year or greater annual probability of river flooding (>0.1%).

3.2 Surface Water Flooding

- 3.2.1 The surface water flood mapping provided by the EA is the best available source of national information on surface water flooding. It is a starting point for understanding patterns and probability of surface water flooding. The EA accept that the mapping has limitations and state that “these maps cannot definitively show that an area of land or property is, or is not, at risk of flooding, and the maps are not suitable for use at an individual property level”.
- 3.2.2 The site is indicated as having a low risk of surface water flooding. The site is not in a high or medium surface water flood risk area. Figure 3.2 below shows the extent and depth of flooding for a medium risk surface water event. As can be seen the site is not at risk of flooding.

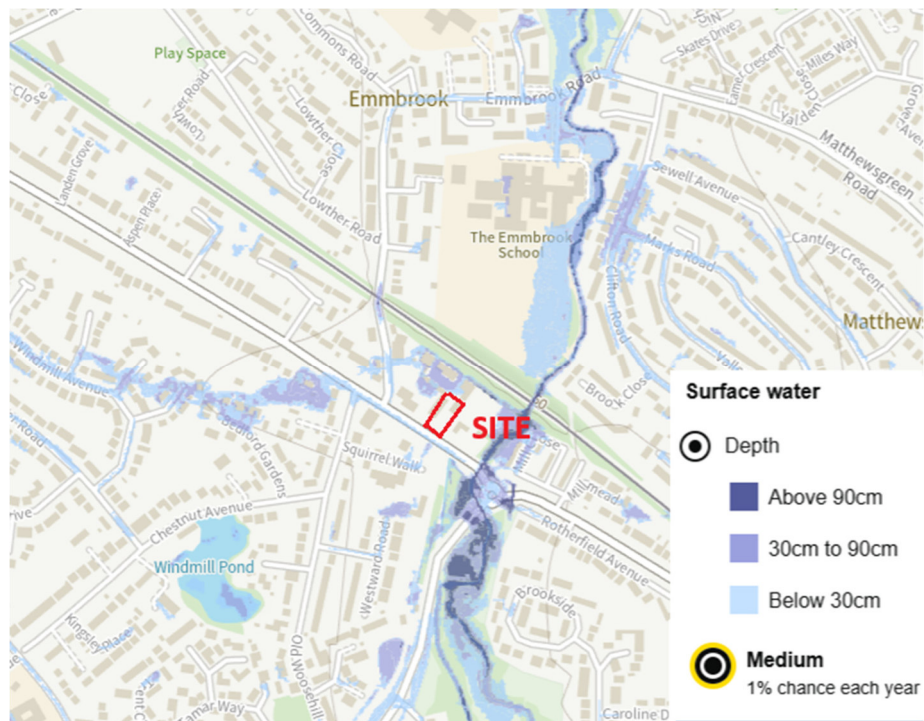


Figure 3.2 – EA Surface Water Map

3.3 Groundwater Flooding

3.3.1 The Council's SFRA reviewed groundwater flooding in the borough, if identified the northern area of Wokingham, Emmbrook and Winnersh but follows the river Loddon. The geology is London Clay which has poor permeability prevent the flow of groundwater, the site is also covered entirely by impermeable surfaces, so the risk of ground water flooding is considered low.

3.4 Flooding from Reservoirs

3.4.1 The flood mapping prepared by the EA shows there is a potential for reservoir flooding when there is also a fluvial flood event. The site is indicated to be free from flooding from a reservoir failure.

3.5 Sewer Flooding

- 3.5.1 Sewer flooding reviewed in the SFRA shows that in the local post code no flooding incidents has been recorded by Thames Water in the last 5 years and prior to that there had only been 8 incidents from 2000. The risk of flooding from sewer is considered low.

4 MODELLED FLOOD EVENTS AND CLIMATE CHANGE

4.1 Flood Probability

4.1.1 The main source of flooding to the site is from the watercourse located directly to the east of the site. The site is shown to be in Flood Zones 1 as indicated on the Environment Agency (EA) flood maps for planning.

4.1.2 Based on the EA flood data the site is within flood zones 1 so is considered to have an annual probability of flooding from a 1 in 1000 year event or 0.1% or greater.

4.2 Climate Change

4.2.1 The Environment Agency have published new climate change allowances. The allowance to be implemented is based on the management catchment area, flood zone and site vulnerability. The site is within the Loddon and Tributaries Catchment Area, as identified on the Department for Environment Food & Rural Affairs climate change allowances website.

4.2.2 The site lies within Flood Zone 1 it is a commercial use which is considered a less vulnerable use. Based on the "Flood Risk Assessment: Climate Change Allowance guidance", sites in Flood Zones 1 do not need to apply a climate change allowance.

4.2.3 The website also provides climate change allowances for rainfall event, as stated above the use is a commercial use so has a life expectancy of 50 years, the upper end allowance is be used for assessing new developments so a 40% increase should be factored into the rainfall intensities.

5 IMPACT OF FLOODING

5.1 Impact on Flood Waters

5.1.1 As mentioned, the nearest source of flooding to the site is from the east the EA flood maps confirmed that the site is located within Flood Zone 1.

5.1.2 The proposals involve the construction of a 2-storey extension to the front of the existing signal storey building. The proposed use will be commercial and will not be subject to flooding with a probability of 0.1% or greater, therefore it will not impede the free flow of flood waters for the design event of 1.0%+CC allowance.

5.2 Impact on Storage Volumes

5.2.1 As stated previously, the proposed development is located in zone 1, the proposed extension is located outside of the flood event with a probability of 1.0% + climate change allowance. The proposed development will therefore not result in the loss of flood storage volumes across the site.

5.3 Impact of Flooding on Development

5.3.1 The proposed development is for a commercial extension of the existing unit. This assessment has demonstrated that the building will not be affected by a flood with a probability of 1.0% + allowance for climate change. Therefore, a flood with a probability of 1.0% plus allowances for climate change will not reach the proposed extension so it will be safe from flooding in an extreme event.

5.4 Access from Site

5.4.1 The site is located off Reading Road access to and from the site is achieved from Reading Road and the flood mapping indicates the route to the west of the site to be free of flooding in an extreme event.

5.4.2 The road to the east is indicated to be in zones 2 and 3, but a safe dry access can always be provided to and from the site from the west during a flood.

6 SEQUENTIAL TEST

- 6.1.1 The principal of the sequential test is to assess locations and prioritise developments to areas at less risk of flooding. National Planning Policy Framework suggests that Regional Planning bodies and Local Planning Authorities should ensure their regional spatial strategies include a broad consideration of flood risk.
- 6.1.2 The proposals are for an extension of an existing commercial unit so there are no other suitable sites that could accommodate this development that would be at less risk of flooding. The development site is also located in a low flood risk area so given the above it is concluded the sequential test has been met and the exception test is not required, as there are no other suitable sites and it is in a low flood risk area.

7 ONSITE DRAINAGE

7.1 Existing Drainage

7.1.1 The site is covered by buildings or hard surfaces, the site is 100% impermeable. There are a number of manholes on site and while investigations on site couldn't establish the route of connections from the existing building to the on site drains but it is assumed these are connected to the drainage network on site.

7.1.2 The sewer records indicate that there is an adopted sewer running through the site from south to north, the assumed route of the sewer and its easement is shown on the drainage strategy layout drawing 241869/DS/01 and is included in Appendix B. Given the proximity of the building to the sewer a build over agreement will be required with Thames Water.

7.2 Proposed Drainage Strategy

7.2.1 The proposals will not change the existing foul discharges from the building so these will remain. The proposals seek approval for a 2-storey extension to the front of the existing building.

7.2.2 The use of SuDS has been considered for the disposal of run off from the development. First on the hierarchy list is the use of green roofs, the proposed building extension is not suitable so green/blue roofs have been discounted.

7.2.3 Next on the hierarchy is the use of ground infiltration techniques such as soakaways etc. The geology in the area consists of London Clay so infiltration SuDS are not practical and have been discounted.

7.2.4 Next on the hierarchy is discharge to an adjacent water course, there is no water course in the area, so this has also been discounted. Next is discharge to a sewer, there is a sewer running through the site so this would provide a suitable means of discharge from the development.

7.2.5 Given the above, the strategy for draining the site will be to use permeable paving to attenuate runoff from the site. The permeable paving will act as storage only as infiltration to ground is not possible in the clay geology.

- 7.2.6 The roofs rainwater pipes will discharge via diffuser units into the sub-base of the permeable paving to the front of the site. The parking area to the front will be formed in a permeable construction. The paving will provide attenuation of runoff from the roof extension and front parking area.
- 7.2.7 The discharge for the paving will be restricted to as near greenfield rate as possible. An assessment of the greenfield runoff has been undertaken, the area is so small the greenfield rate is near zero. It is not possible to achieve greenfield rates so the runoff from the site will be limited 0.8 l/s, but is considerably less than the existing brownfield rates.
- 7.2.8 NPPF and PPG requires climate change allowances to be factored into drainage strategies. As set out above the allowance for this site to be included in the design is 40%. The permeable paving will have a 400mm thick sub-base with a void ratio of 30%, this has been designed to accommodate a 1 in 100 year storm + 40% allowance. Discharge from the paving to the local sewer will be controlled by a 25mm orifice in the flow control manhole. The full drainage calculations for the relevant return periods have been included in Appendix C.
- 7.3 Flood Exceedance Routes**
- 7.3.1 The site falls from the south to the north, the area is 100% impermeable so any a blockage of failure of the drainage network on will result in exceedance flows being forced north by the sites topography as per the current situation.

8 MANAGING POLLUTION FROM SURFACE WATER

8.1.1 As part of the CIRIA SuDS Manual C753, Section 26.7 provides information regarding methods for managing pollution risks from surface water runoff.

8.1.2 Part of the assessment is to determine which land use classification the proposed development falls under. Since the development will consist of a commercial uses with associated car parking, it has been concluded that the site should be classed within the sections shown in Table 8.1 below.

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 8.1 – Extract from CIRIA SuDS Manual C753 (Land use classifications)

8.1.3 Suitable treatment measures offered by SuDS features are set out in CIRA report, the results have been cross referenced with Table 8.2 below of the CIRA C753 report

8.1.4 The proposed development will incorporate permeable paving for storage of runoff from the development. Table 8.2 below indicates that the permeable paving will provide mitigation of 0.7 for total suspended solids, 0.6 for metals and 0.7 for hydrocarbons.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters			
Type of SuDS component	Mitigation indices ¹		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	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 frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Table 8.2 – Extract from CIRIA SuDS Manual C753 (mitigation indices)

8.1.5 The level treatment provided by the permeable paving all greater than the pollution hazard indices identified in table 8.1 above. The above assessment has demonstrated that the proposed SuDS features will provide a suitable level of treatment appropriate to the type of development proposed.

9 SUDS MANAGEMENT & MAINTENANCE

- 9.1.1 Regularly 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.
- 9.1.2 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”.
- 9.1.3 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.
- 9.1.4 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.
- 9.1.5 Following completion of the development the occupiers will be responsible for the maintenance and repair of all drainage site. It will be their responsibility to maintain the drainage network, including the SuDS elements.

Permeable Paving

9.1.6 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

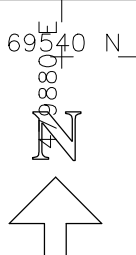
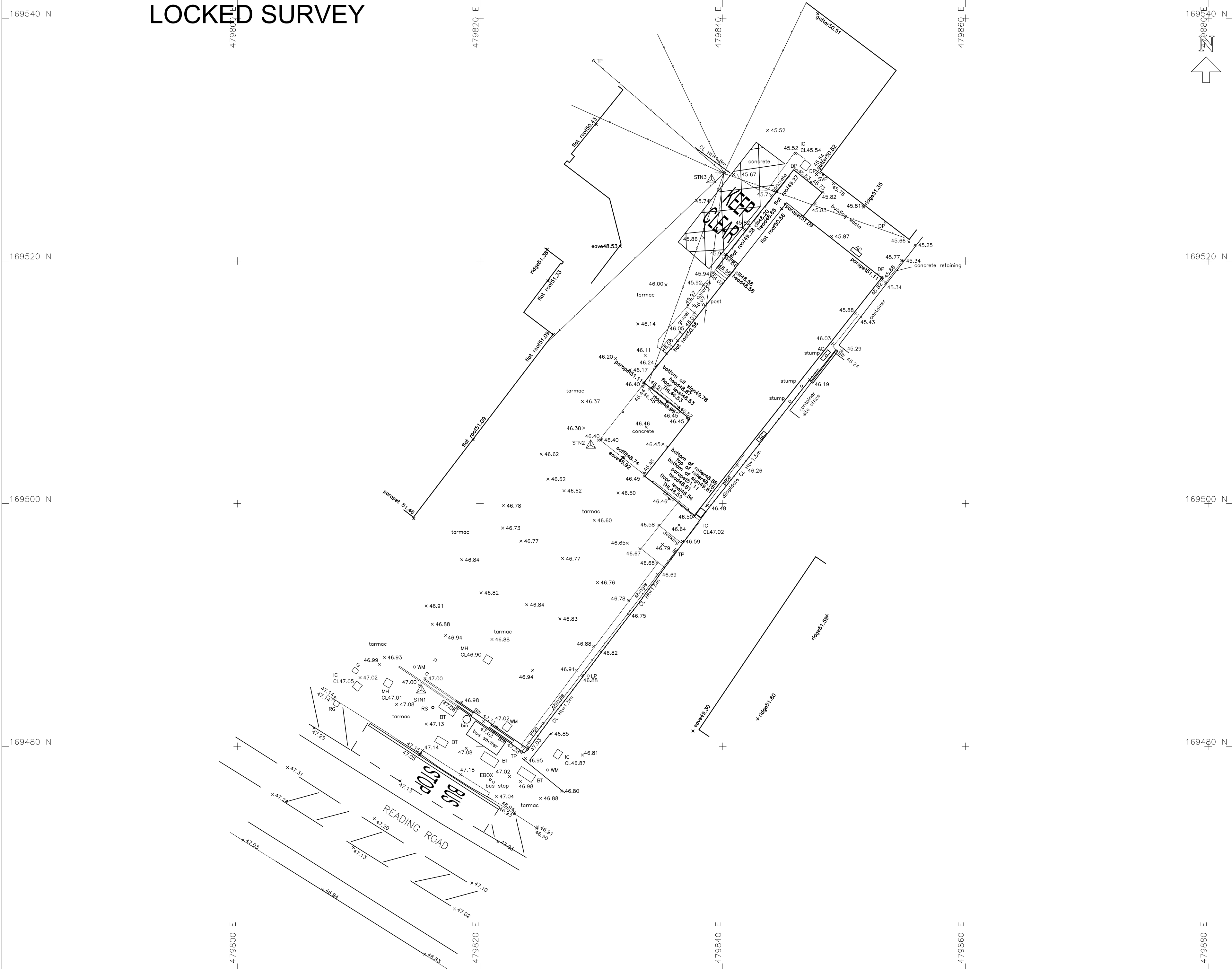
Table 9.1 – Permeable Paving Maintenance Schedule

10 SUMMARY AND CONCLUSION

- 10.1.1 The proposed development will see the construction of 2-storey extension to an existing single storey commercial unit at 125 Reading Road, Wokingham.
- 10.1.2 The site is in a low flood risk area for all sources of flooding, it will not restrict the flow of flood water or result in the loss of flood storage volumes for an event with a probability of 1.0% + CC allowance. The site meets the sequential test to allocate developments to low flood risk areas and a safe dry access can be provide to the west of the site along Reading Road under extreme flood conditions.
- 10.1.3 The drainage regime for the development will use a permeable paving with a restricted discharge to the local sewer network to attenuate runoff from the development. The SuDS hierarchy was considered when preparing the strategy, the geology was not suitable for infiltration and there are no watercourses in the area so attenuation and discharge to the sewer is considered the most appropriate means to discharge runoff.
- 10.1.4 The paving will have 25mm diameter orifice to restrict the discharge to 0.8l/s, paving will have 400mm thick sub-base with 30% voids to accommodate a 1in100 year storm plus an allowance of 40%.
- 10.1.5 For the reasons set out above, the proposed development is considered suitable for development, as there will be no negative impact on the flood plain, flow paths or flood storage volumes, a suitable drainage system can be provided therefore, we see no reason why the proposal should be refused on the grounds of flooding or drainage capacity.

APPENDIX A

Drawing 01 – Topographical Survey



- LEGEND
- | FEATURE STYLES | FEATURE ABBREVIATIONS |
|-------------------------|-----------------------|
| SURVEY CONTROL | AV Air Valve |
| FENCE | BS Bus Stop |
| HEDGE | BT British Telecom |
| SWS | BW Brick Wall |
| WATER | CB Conc Bollard |
| POWER LINE (OVERHEAD) | CL Cover Level |
| TELECOM LINE (OVERHEAD) | CTO cable TV outlet |
| ELECTRIC MAIN | EB Electric Box |
| GAS MAIN | EC Electric Cover |
| EMBANKMENT | EP Electricity Pole |
| | FH Fire Hydrant |
| | FL Floor level |
| | G Gully |
| | GM Gas Meter |
| | GV Gas Valve |
| | IL Invert Level |
| | IC Inspection Chamber |
| | KLS Keep Left Sign |
| | KO Kerb Offset |
| | LB Letter Box |
| | LP Lamp Post |
| | MKR Marker |
| | MP Metal Post |
| | MH Manhole |
| | MB Metal Bollard |
| | P Post |
| | PI Petrol Interceptor |
| | RG Road Gully |
| | RNB Road Name Board |
| | RS Road Sign |
| | RW Retaining Wall |
| | SA Soakaway |
| | SC Stopcock |
| | SV Sluice Valve |
| | TP Telegraph Pole |
| | TGB Telephone Box |
| | CPL Conc Panel |
| | CP Chestnut Paling |
| | CW Chicken Wire |
| | V Valve |
| | VP Vent Pipe |
| | IR Iron Railing |
| | OB Openboard |
| | PR Post and rail |
| | WO Water Outlet |
| | WV Water Valve |
- FENCE TYPES
- | |
|--------------------|
| BWR Barbed Wire |
| CB Close Board |
| CI Corrugated Iron |
| CL Chain Link |
| CPL Conc Panel |
| CP Chestnut Paling |
| CW Chicken Wire |
| IR Iron Railing |
| OB Openboard |
| PR Post and rail |
| PW Post and Wire |

DATUM
GRID - ORDNANCE SURVEY NATIONAL GRID (OSTN15)
LEVELS - ORDNANCE SURVEY (OSGM15)
SCALE FACTOR REMOVED

SURVEY CONTROL			
STN	-E-	-N-	-Z-
1	479815.150	169484.642	47.068
2	479829.125	169504.817	46.429
3	479839.067	169526.690	45.700

NOTES

Drainage and service covers that were buried, obscured or not visible at the time of the survey cannot be shown. Sewer connections between manholes are assumed to be straight and only pipes visible from above ground are shown. All critical dimensions and connections should be checked and verified prior to starting work.

Tree canopy measured values are written as maximum spreads.
Tree species/condition to be verified by arboriculturist.
Offset/Tree positions/sizes are approximate.
Surveyed physical features may not necessarily represent the legal boundary and should be checked with support of the Land Registry Title.



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CLIENT
RIDEWORX

SITE
RIDEWORX
125 READING ROAD
WOKINGHAM
BERKSHIRE
RG41 1HD

TITLE
SITE SURVEY
AS EXISTING

SCALE	1/200 (A2)	DATE	OCT 2023
DRAWING No.	01	JOB No.	23101901

Drawing 24-P091-SK01 – Proposed Site Plan



LEGEND	
	DENOTES SITE BOUNDARY
	DENOTES SINGLE STOREY EXTENSION
	DENOTES TWO STOREY EXTENSION
	DENOTES EXISTING BUILDING
	PROPOSED TREES
	EXISTING TREES TO BE RETAINED
	TREES TO BE REMOVED
	PROPOSED INDICATIVE PLANTING
	EXISTING PLANTING
	00.00 EXISTING SPOT SITE LEVELS
	00.00 PROPOSED SPOT SITE LEVELS
	FFL 00.00 PROPOSED HOUSE FINISHED FLOOR LEVELS (SUBJECT TO CONFIRMATION AT WORKING DRAWINGS STAGE)
	FLT 00.00 FLUSH LEVEL THRESHOLD
	BANK
	SECTION LINE

	CADCRE8 LTD ARCHITECTURAL DESIGNERS & PLANNERS 1 Peach Street Wokingham RG40 1XJ matt-cadcre8@outlook.com	Status		PLANNING ISSUE		Rev.	Date	Detail			
		Client		MR C TEMPLE		DRAWING Title					
		Project Title		RIDEWORX, UNIT 1, 125 READING ROAD, WOKINGHAM, BERKSHIRE		Scale	1:250 @ A1	Date	SEP-24	Drawn	MM
						Drawing No.	24 - P091 - 01		Rev.		

APPENDIX B

Drawing 241869/DS/01 – Proposed Drainage Strategy



Mr C Temple

Rideworx
Unit 1 125 Reading Road
Proposed
Drainage Strategy

LANMOR Consulting
Civil Engineers & Transport Planning

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SCALE 1 : 250

DRAWN BY KL

PRJ No. 241869

DWG No. 241869/DS/01

APPENDIX C

Microdrainage Calculations

Lanmor Consulting Ltd		Page 3
Thorogood House 34 Tolworth Close Surbition Surrey KT6 7EW		
Date 01/10/2024 20:13 File Paving.srcx	Designed by Kunal Checked by	
XP Solutions		
Source Control 2015.1		

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)	19.100	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

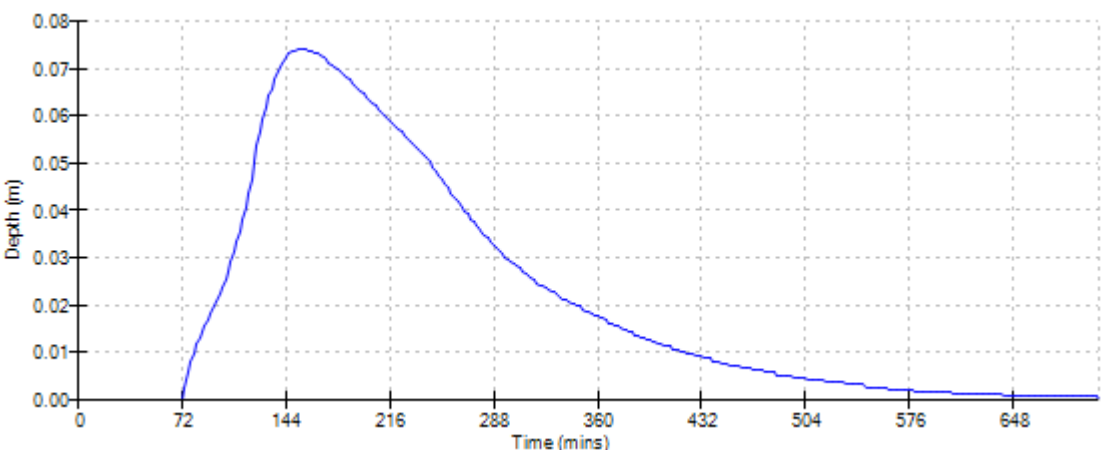
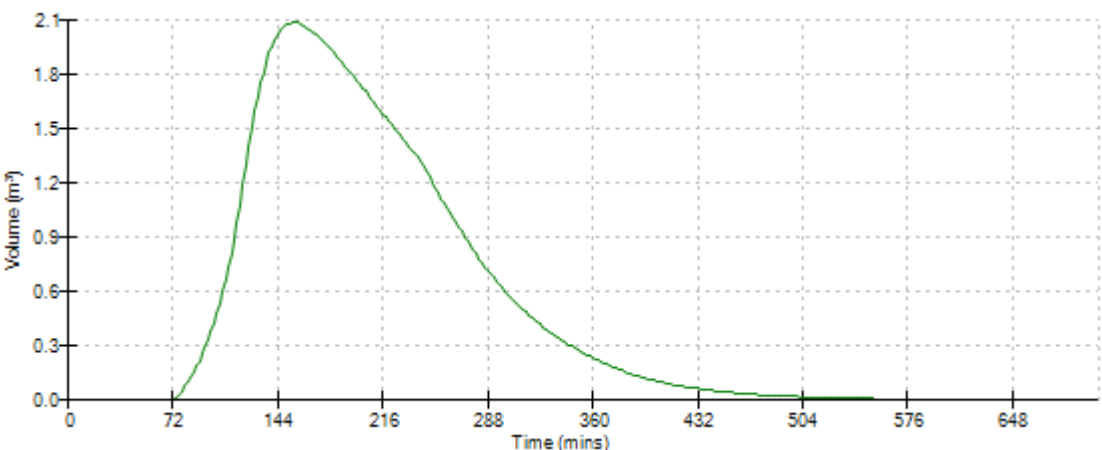
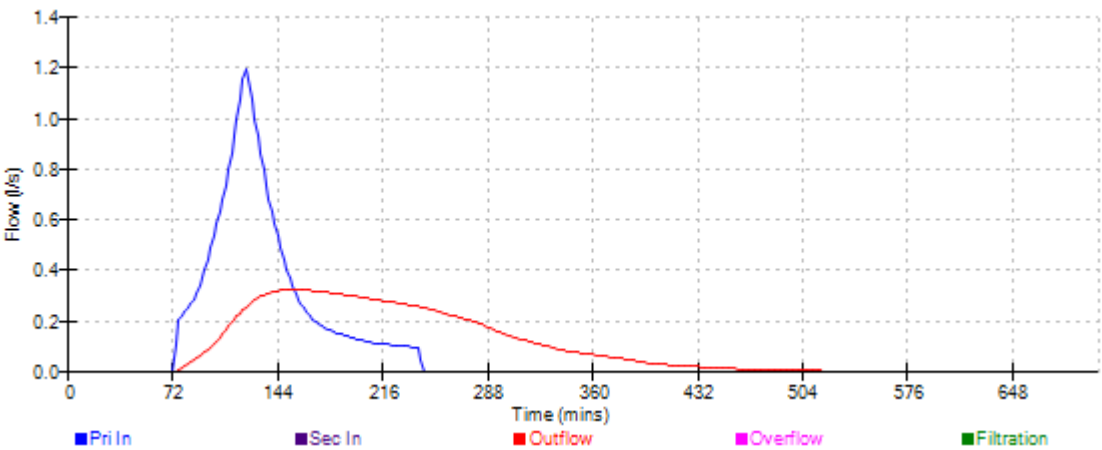
Time Area Diagram

Total Area (ha) 0.025

Time (mins)	Area
From:	To: (ha)
0	4 0.025

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Thorogood House 34 Tolworth Close Surbition Surrey KT6 7EW														
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<u>Model Details</u> Storage is Online Cover Level (m) 46.800 <u>Porous Car Park Structure</u> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Infiltration Coefficient Base (m/hr) 0.00000</td> <td style="width: 50%;">Width (m) 10.0</td> </tr> <tr> <td>Membrane Percolation (mm/hr) 1000</td> <td>Length (m) 11.0</td> </tr> <tr> <td>Max Percolation (l/s) 30.6</td> <td>Slope (1:X) 500.0</td> </tr> <tr> <td>Safety Factor 2.0</td> <td>Depression Storage (mm) 5</td> </tr> <tr> <td>Porosity 0.30</td> <td>Evaporation (mm/day) 3</td> </tr> <tr> <td>Invert Level (m) 46.250</td> <td>Cap Volume Depth (m) 0.400</td> </tr> </table> <u>Orifice Outflow Control</u> Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 46.250			Infiltration Coefficient Base (m/hr) 0.00000	Width (m) 10.0	Membrane Percolation (mm/hr) 1000	Length (m) 11.0	Max Percolation (l/s) 30.6	Slope (1:X) 500.0	Safety Factor 2.0	Depression Storage (mm) 5	Porosity 0.30	Evaporation (mm/day) 3	Invert Level (m) 46.250	Cap Volume Depth (m) 0.400
Infiltration Coefficient Base (m/hr) 0.00000	Width (m) 10.0													
Membrane Percolation (mm/hr) 1000	Length (m) 11.0													
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Event: 240 min Summer



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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)	19.100	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.025

Time (mins)		Area
From:	To:	(ha)
0	4	0.025

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Thorogood House 34 Tolworth Close Surbition Surrey KT6 7EW		
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Model Details

Storage is Online Cover Level (m) 46.800

Porous Car Park Structure

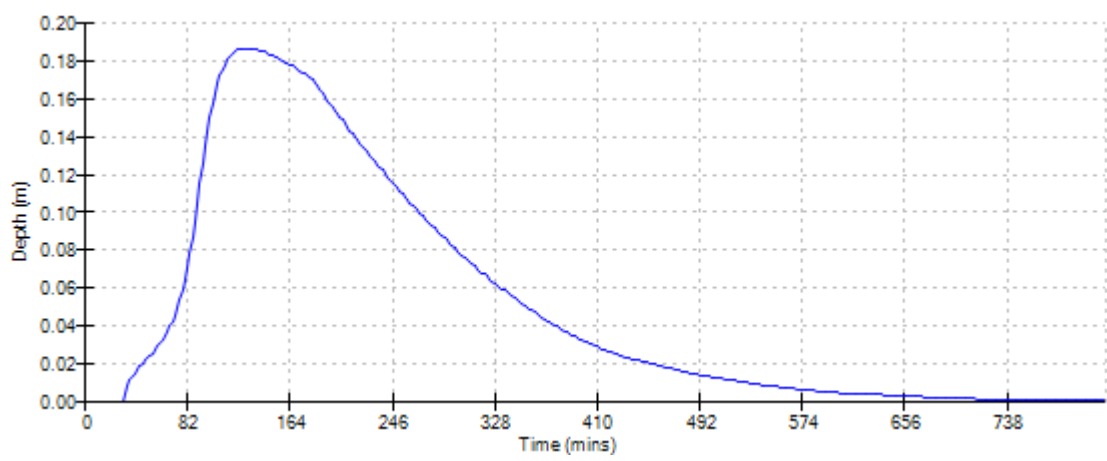
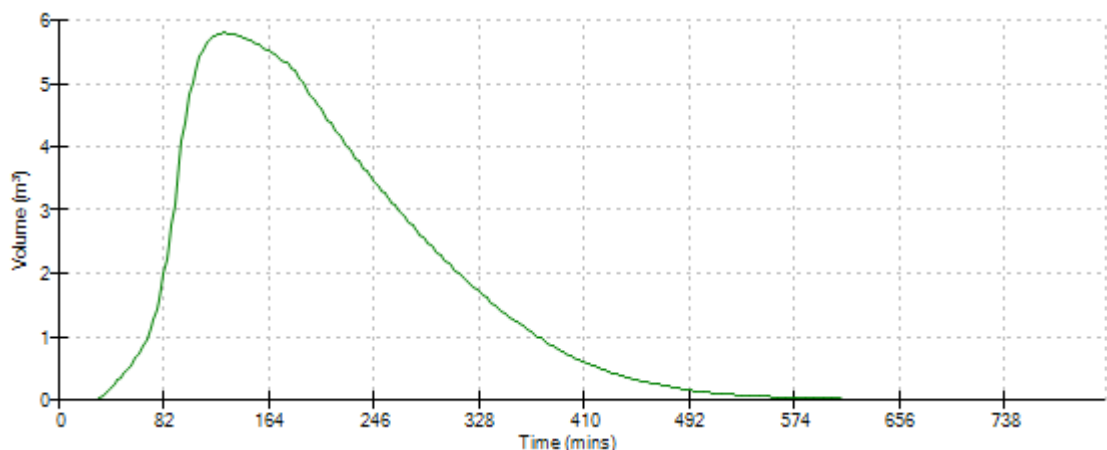
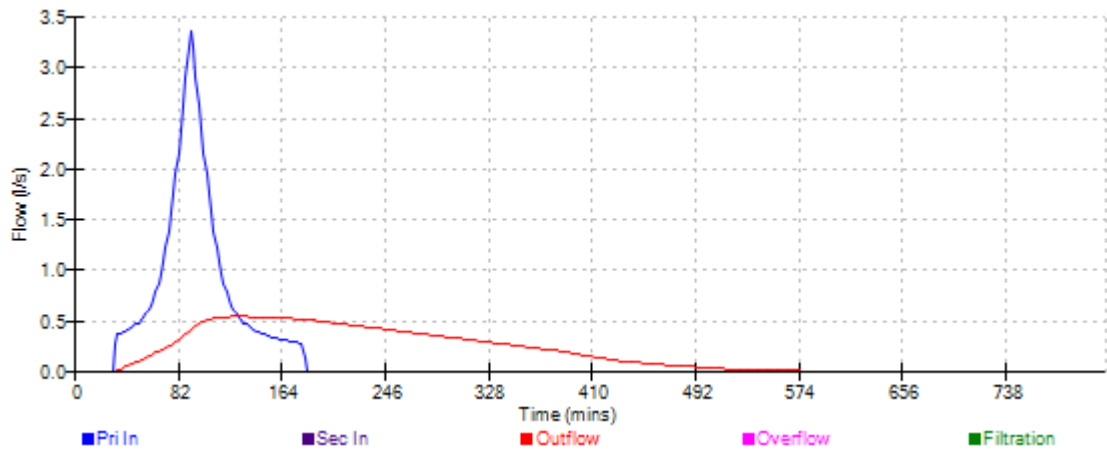
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	11.0
Max Percolation (l/s)	30.6	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	46.250	Cap Volume Depth (m)	0.400

Orifice Outflow Control

Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 46.250

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Event: 180 min Summer



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Thorogood House 34 Tolworth Close Surbition Surrey KT6 7EW																																																																																																																																																																																																																																																																																								
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<u>Summary of Results for 100 year Return Period</u> Half Drain Time : 128 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Control (l/s)</th><th>Max E Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>46.404</td><td>0.154</td><td>0.0</td><td>0.5</td><td>0.5</td><td>4.7</td><td>O K</td></tr><tr><td>30 min Summer</td><td>46.447</td><td>0.197</td><td>0.0</td><td>0.6</td><td>0.6</td><td>6.2</td><td>O K</td></tr><tr><td>60 min Summer</td><td>46.482</td><td>0.232</td><td>0.0</td><td>0.6</td><td>0.6</td><td>7.3</td><td>O K</td></tr><tr><td>120 min Summer</td><td>46.499</td><td>0.249</td><td>0.0</td><td>0.6</td><td>0.6</td><td>7.9</td><td>O K</td></tr><tr><td>180 min Summer</td><td>46.502</td><td>0.252</td><td>0.0</td><td>0.6</td><td>0.6</td><td>8.0</td><td>Flood Risk</td></tr><tr><td>240 min Summer</td><td>46.500</td><td>0.250</td><td>0.0</td><td>0.6</td><td>0.6</td><td>7.9</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>46.490</td><td>0.240</td><td>0.0</td><td>0.6</td><td>0.6</td><td>7.6</td><td>O K</td></tr><tr><td>480 min Summer</td><td>46.479</td><td>0.229</td><td>0.0</td><td>0.6</td><td>0.6</td><td>7.2</td><td>O K</td></tr><tr><td>600 min Summer</td><td>46.467</td><td>0.217</td><td>0.0</td><td>0.6</td><td>0.6</td><td>6.8</td><td>O K</td></tr><tr><td>720 min Summer</td><td>46.455</td><td>0.205</td><td>0.0</td><td>0.6</td><td>0.6</td><td>6.4</td><td>O K</td></tr><tr><td>960 min Summer</td><td>46.434</td><td>0.184</td><td>0.0</td><td>0.5</td><td>0.5</td><td>5.7</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>46.401</td><td>0.151</td><td>0.0</td><td>0.5</td><td>0.5</td><td>4.6</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>46.366</td><td>0.116</td><td>0.0</td><td>0.4</td><td>0.4</td><td>3.5</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>46.343</td><td>0.093</td><td>0.0</td><td>0.4</td><td>0.4</td><td>2.7</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>46.315</td><td>0.065</td><td>0.0</td><td>0.3</td><td>0.3</td><td>1.8</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>46.300</td><td>0.050</td><td>0.0</td><td>0.3</td><td>0.3</td><td>1.3</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>46.291</td><td>0.041</td><td>0.0</td><td>0.2</td><td>0.2</td><td>1.0</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>46.285</td><td>0.035</td><td>0.0</td><td>0.2</td><td>0.2</td><td>0.8</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>46.282</td><td>0.032</td><td>0.0</td><td>0.2</td><td>0.2</td><td>0.7</td><td>O K</td></tr><tr><td>15 min Winter</td><td>46.404</td><td>0.154</td><td>0.0</td><td>0.5</td><td>0.5</td><td>4.7</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>93.822</td><td>0.0</td><td>5.0</td><td>18</td></tr><tr><td>30 min Summer</td><td>61.653</td><td>0.0</td><td>6.8</td><td>32</td></tr><tr><td>60 min Summer</td><td>38.624</td><td>0.0</td><td>8.6</td><td>62</td></tr><tr><td>120 min Summer</td><td>23.402</td><td>0.0</td><td>10.5</td><td>102</td></tr><tr><td>180 min Summer</td><td>17.234</td><td>0.0</td><td>11.7</td><td>134</td></tr><tr><td>240 min Summer</td><td>13.794</td><td>0.0</td><td>12.5</td><td>168</td></tr><tr><td>360 min Summer</td><td>10.013</td><td>0.0</td><td>13.6</td><td>236</td></tr><tr><td>480 min Summer</td><td>7.982</td><td>0.0</td><td>14.5</td><td>304</td></tr><tr><td>600 min Summer</td><td>6.690</td><td>0.0</td><td>15.2</td><td>372</td></tr><tr><td>720 min Summer</td><td>5.789</td><td>0.0</td><td>15.8</td><td>438</td></tr><tr><td>960 min Summer</td><td>4.604</td><td>0.0</td><td>16.7</td><td>568</td></tr><tr><td>1440 min Summer</td><td>3.329</td><td>0.0</td><td>18.1</td><td>822</td></tr><tr><td>2160 min Summer</td><td>2.403</td><td>0.0</td><td>19.5</td><td>1188</td></tr><tr><td>2880 min Summer</td><td>1.905</td><td>0.0</td><td>20.5</td><td>1552</td></tr><tr><td>4320 min Summer</td><td>1.371</td><td>0.0</td><td>21.9</td><td>2252</td></tr><tr><td>5760 min Summer</td><td>1.085</td><td>0.0</td><td>22.9</td><td>2992</td></tr><tr><td>7200 min Summer</td><td>0.904</td><td>0.0</td><td>23.6</td><td>3680</td></tr><tr><td>8640 min Summer</td><td>0.779</td><td>0.0</td><td>24.1</td><td>4408</td></tr><tr><td>10080 min Summer</td><td>0.686</td><td>0.0</td><td>24.5</td><td>5136</td></tr><tr><td>15 min Winter</td><td>93.822</td><td>0.0</td><td>5.0</td><td>18</td></tr></tbody></table>								Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	46.404	0.154	0.0	0.5	0.5	4.7	O K	30 min Summer	46.447	0.197	0.0	0.6	0.6	6.2	O K	60 min Summer	46.482	0.232	0.0	0.6	0.6	7.3	O K	120 min Summer	46.499	0.249	0.0	0.6	0.6	7.9	O K	180 min Summer	46.502	0.252	0.0	0.6	0.6	8.0	Flood Risk	240 min Summer	46.500	0.250	0.0	0.6	0.6	7.9	Flood Risk	360 min Summer	46.490	0.240	0.0	0.6	0.6	7.6	O K	480 min Summer	46.479	0.229	0.0	0.6	0.6	7.2	O K	600 min Summer	46.467	0.217	0.0	0.6	0.6	6.8	O K	720 min Summer	46.455	0.205	0.0	0.6	0.6	6.4	O K	960 min Summer	46.434	0.184	0.0	0.5	0.5	5.7	O K	1440 min Summer	46.401	0.151	0.0	0.5	0.5	4.6	O K	2160 min Summer	46.366	0.116	0.0	0.4	0.4	3.5	O K	2880 min Summer	46.343	0.093	0.0	0.4	0.4	2.7	O K	4320 min Summer	46.315	0.065	0.0	0.3	0.3	1.8	O K	5760 min Summer	46.300	0.050	0.0	0.3	0.3	1.3	O K	7200 min Summer	46.291	0.041	0.0	0.2	0.2	1.0	O K	8640 min Summer	46.285	0.035	0.0	0.2	0.2	0.8	O K	10080 min Summer	46.282	0.032	0.0	0.2	0.2	0.7	O K	15 min Winter	46.404	0.154	0.0	0.5	0.5	4.7	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	93.822	0.0	5.0	18	30 min Summer	61.653	0.0	6.8	32	60 min Summer	38.624	0.0	8.6	62	120 min Summer	23.402	0.0	10.5	102	180 min Summer	17.234	0.0	11.7	134	240 min Summer	13.794	0.0	12.5	168	360 min Summer	10.013	0.0	13.6	236	480 min Summer	7.982	0.0	14.5	304	600 min Summer	6.690	0.0	15.2	372	720 min Summer	5.789	0.0	15.8	438	960 min Summer	4.604	0.0	16.7	568	1440 min Summer	3.329	0.0	18.1	822	2160 min Summer	2.403	0.0	19.5	1188	2880 min Summer	1.905	0.0	20.5	1552	4320 min Summer	1.371	0.0	21.9	2252	5760 min Summer	1.085	0.0	22.9	2992	7200 min Summer	0.904	0.0	23.6	3680	8640 min Summer	0.779	0.0	24.1	4408	10080 min Summer	0.686	0.0	24.5	5136	15 min Winter	93.822	0.0	5.0	18
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<u>Summary of Results for 100 year Return Period</u>							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	46.448	0.198	0.0	0.6	0.6	6.2	O K
60 min Winter	46.483	0.233	0.0	0.6	0.6	7.3	O K
120 min Winter	46.500	0.250	0.0	0.6	0.6	7.9	O K
180 min Winter	46.501	0.251	0.0	0.6	0.6	7.9	Flood Risk
240 min Winter	46.496	0.246	0.0	0.6	0.6	7.8	O K
360 min Winter	46.481	0.231	0.0	0.6	0.6	7.3	O K
480 min Winter	46.464	0.214	0.0	0.6	0.6	6.7	O K
600 min Winter	46.448	0.198	0.0	0.6	0.6	6.2	O K
720 min Winter	46.433	0.183	0.0	0.5	0.5	5.7	O K
960 min Winter	46.407	0.157	0.0	0.5	0.5	4.8	O K
1440 min Winter	46.368	0.118	0.0	0.4	0.4	3.5	O K
2160 min Winter	46.332	0.082	0.0	0.3	0.3	2.4	O K
2880 min Winter	46.312	0.062	0.0	0.3	0.3	1.7	O K
4320 min Winter	46.291	0.041	0.0	0.2	0.2	1.0	O K
5760 min Winter	46.283	0.033	0.0	0.2	0.2	0.7	O K
7200 min Winter	46.279	0.029	0.0	0.1	0.1	0.6	O K
8640 min Winter	46.276	0.026	0.0	0.1	0.1	0.5	O K
10080 min Winter	46.274	0.024	0.0	0.1	0.1	0.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	61.653	0.0	6.8	32			
60 min Winter	38.624	0.0	8.6	60			
120 min Winter	23.402	0.0	10.5	112			
180 min Winter	17.234	0.0	11.7	140			
240 min Winter	13.794	0.0	12.5	178			
360 min Winter	10.013	0.0	13.6	254			
480 min Winter	7.982	0.0	14.5	326			
600 min Winter	6.690	0.0	15.2	396			
720 min Winter	5.789	0.0	15.8	464			
960 min Winter	4.604	0.0	16.7	596			
1440 min Winter	3.329	0.0	18.1	850			
2160 min Winter	2.403	0.0	19.5	1212			
2880 min Winter	1.905	0.0	20.5	1560			
4320 min Winter	1.371	0.0	21.9	2248			
5760 min Winter	1.085	0.0	22.9	2944			
7200 min Winter	0.904	0.0	23.6	3680			
8640 min Winter	0.779	0.0	24.1	4352			
10080 min Winter	0.686	0.0	24.6	5136			
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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)	19.100	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.025

Time (mins)		Area
From:	To:	(ha)
0	4	0.025

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Model Details

Storage is Online Cover Level (m) 46.800

Porous Car Park Structure

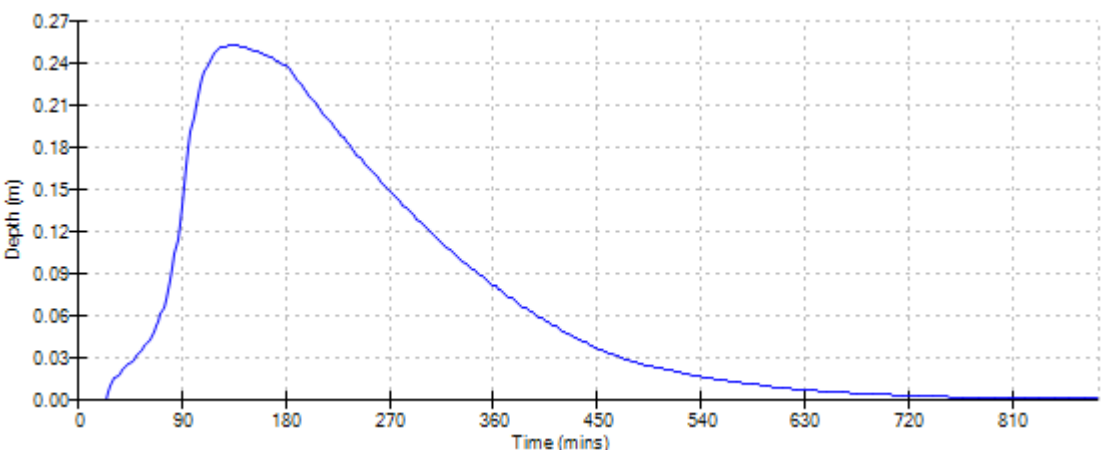
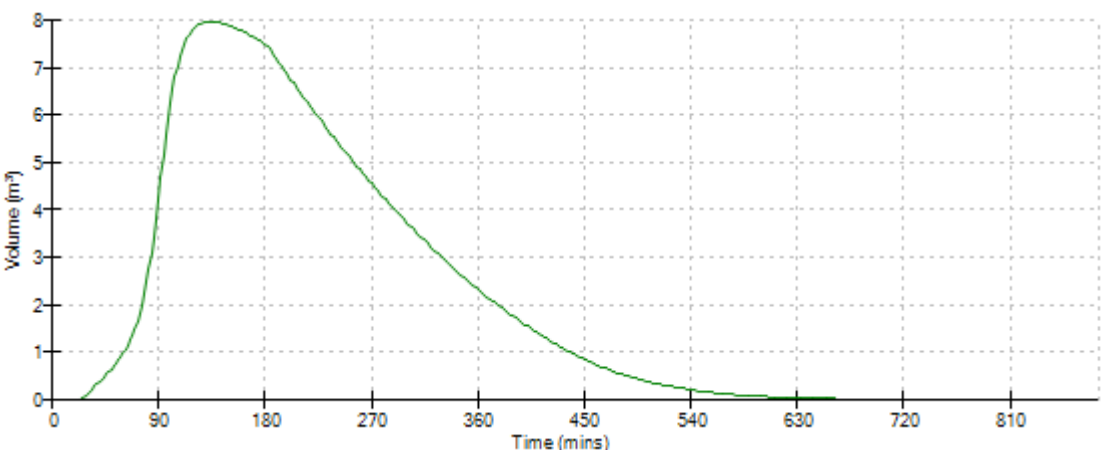
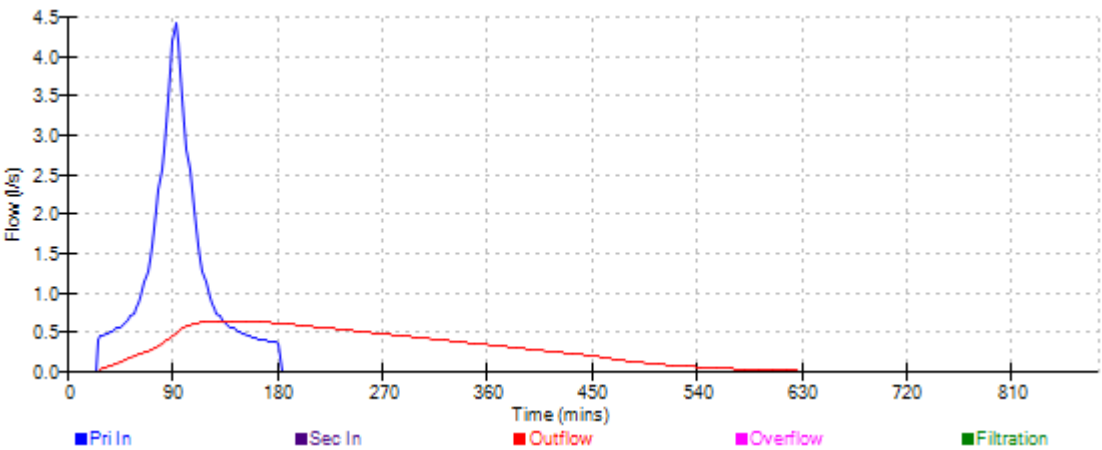
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	11.0
Max Percolation (l/s)	30.6	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	46.250	Cap Volume Depth (m)	0.400

Orifice Outflow Control

Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 46.250

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Event: 180 min Summer



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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)	19.100	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.025

Time (mins)	Area
From:	To: (ha)

0	4 0.025
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Model Details

Storage is Online Cover Level (m) 46.800

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	11.0
Max Percolation (l/s)	30.6	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	46.250	Cap Volume Depth (m)	0.400

Orifice Outflow Control

Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 46.250

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Event: 180 min Summer

