

**FLOOD CONSEQUENCE ASSESSMENT,
SUDS & FOUL DRAINAGE ASSESSMENT
FOR
PROPOSED ROADSIDE SERVICES DEVELOPMENT
AT
HOLT ROAD
WREXHAM**

PREPARED FOR:

Liberty Properties Developments

GC/13136/FCA
20 May 2016

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1. INTRODUCTION

- 1.1 This report has been prepared by Simpson Associates, on behalf of Liberty Properties Developments Ltd to accompany a planning application for a proposed Roadside Services Development on vacant land to the north of the roundabout linking the A534 Holt Road and the A5156.
- 1.2 The report considers the flood risk associated with the development proposals, which will comprise of a pub restaurant, drive thru and petrol filling station with associated access roads, infrastructure and hard / soft landscaping.
- 1.3 The report also details a strategy for the disposal of foul and surface water runoff from the development including proposals for the management of surface water runoff using Sustainable Urban Drainage Systems (SUDS).
- 1.4 The report has been prepared in accordance with Welsh Assembly Government's "Technical Advice Note 15 (TAN 15)", which provides guidance to local planning authorities (LPA's), developers, the public and National Resources Wales (NRW) on development and flood risk in Wales.

2. SITE LOCATION AND TOPOGRAPHY

- 2.1 The application site is located to the north of the roundabout linking the A534 Holt Road and the A5156 in Wrexham as indicated on *Figure 1* below.

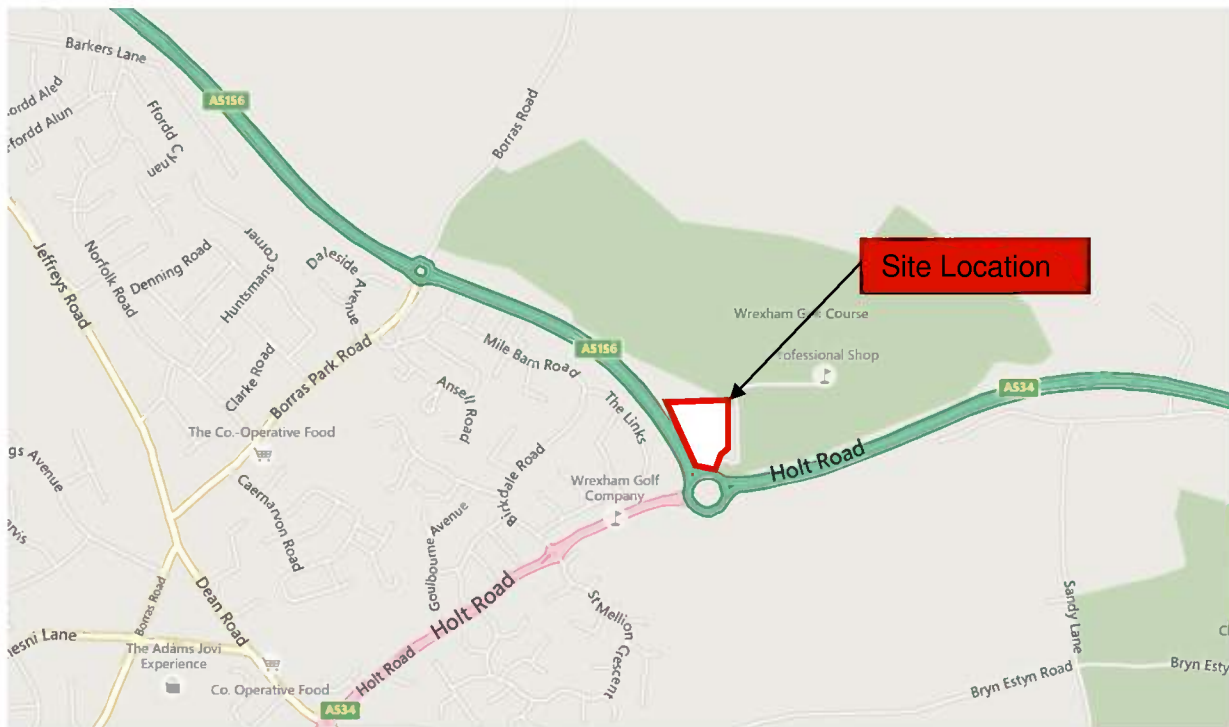


Figure 1: Site Location

- 2.2 The site is centered on Ordnance Survey grid reference SJ 35929 51828 and co-ordinates X: 335929 / Y: 351828, while the nearby post code is LL13 9PZ.

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- 2.3 The site is approximately 1.6 Ha in area and is presently undeveloped.
- 2.4 To the north and east, the site is bounded by a golf course. To the south, the site is bounded by the A534 and to the west, the site is bounded by the A5156 with residential properties beyond.
- 2.5 A topographical survey of the site is included in *Appendix A*. The survey shows the site to fall from a contour level of 78.60mAOD along the northern boundary to a contour level of 73.50mAOD along the eastern boundary and a contour level of 76.20mAOD along the southern boundary.

3. EXISTING GROUND CONDITIONS

- 3.1 A site investigation carried out in September 2014 by Enzygo Ltd reported ground conditions at the site to predominantly comprise of topsoil like Ground up to 0.5m in thickness over up to 4.0m of Glaciofluvial sand and gravel.
- 3.2 Groundwater was not encountered during the initial site works carried out as part of the investigation or in subsequent groundwater monitoring carried out following the site works.
- 3.3 No evidence of contamination was identified by the site investigation that would warrant remediation.

4. EXISTING DRAINAGE CHARACTERISTICS

- 4.1 The site is predominantly greenfield and has no existing drainage outfalls. It appears to dispose of surface water runoff either by overland flow or by infiltration into the ground.

5. PROPOSED SCHEME

- 5.1 The proposed scheme comprises of a pub restaurant, drive thru and petrol filling station with associated access roads, infrastructure and hard / soft landscaping.
- 5.2 Access to the site would be gained from an existing access road off the roundabout located on the sites southern boundary.
- 5.3 A plan showing the layout of the proposed development is included in *Appendix B*.

6. SOURCES OF FLOODING

- 6.1 Planning authorities are responsible for the production of Strategic Flood Consequence Assessments (SFCA's). These are studies that provide an assessment of the extent and nature of flood risk in the local area, allowing more detailed examination of the likely appropriateness of developing sites. However, at the time of this report, no Strategic Flood Consequence Assessments were available on Wrexham County Councils website.

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- 6.2 The possible flood risk associated with sources of flooding has been reviewed under the headings below using publically available information available on Natural Resource Wales and WAG'S websites.

Fluvial / Tidal Flooding

- 6.3 WAG's development advice map on flood risk is included in *Appendix C*. An extract from the map is shown in Figure 2 below with the location of the site indicated. The map indicates that the site is not located in flood zone C or B, therefore the site is deemed to fall in Flood Zone A, which TAN 15 classifies as land to be at little or no risk of fluvial or tidal/coastal flooding with there being no need to consider flood risk from this source any further.

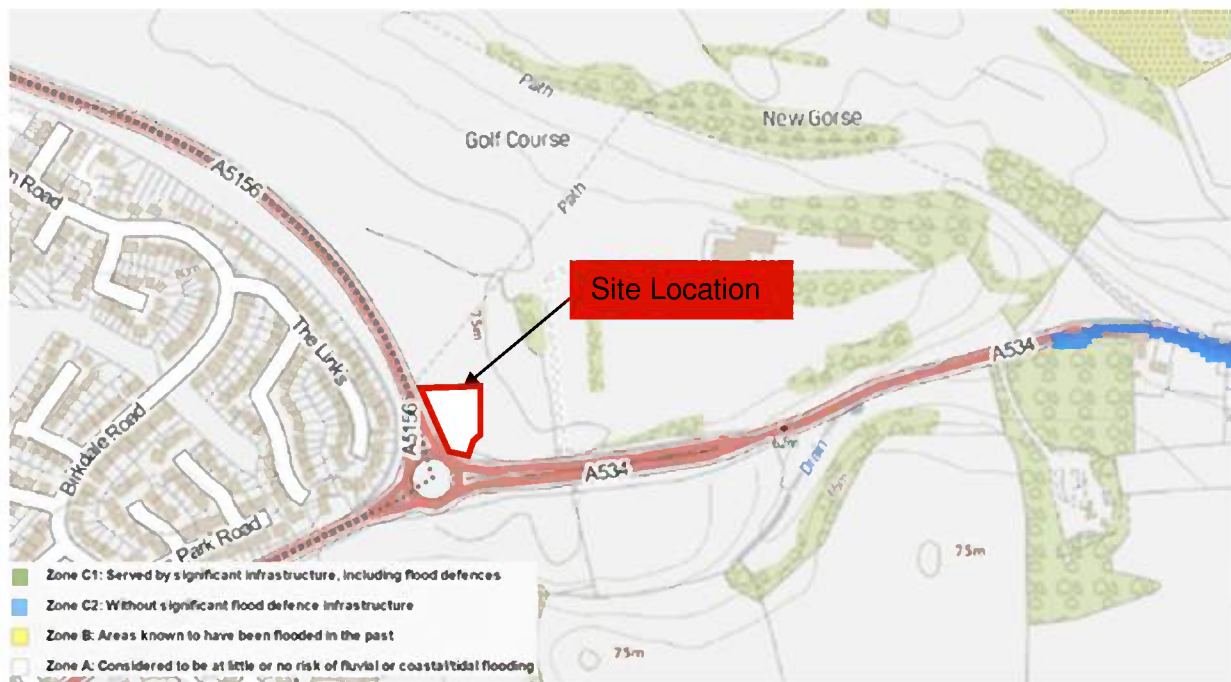


Figure 2: WAG Development Advice Map

Surface Water Flooding

- 6.4 Figure 3 below shows a surface water flood risk map taken from the NRW's website with the location of the site identified. The site and surrounding area is shown to be situated within an area at very low risk of surface water flooding.

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Figure 3: NRW Surface Water Flood Risk Map

- 6.5 New development can increase the volume and rate at which surface water runoff is discharged from a site, which can cause an increase in surface water flood risk both on the site and elsewhere within the catchment. Therefore, it is recommended that surface water runoff from the scheme is managed using Sustainable Urban Drainage Systems (SUDS), which would help to minimise the rate of discharge, volume and environmental impact of surface water runoff.

Groundwater Flooding

- 6.6 Groundwater monitoring undertaken as part of a site investigation carried out in September 2014 did not encounter groundwater to a depth of 4.0m bgl during the initial site works or in subsequent groundwater monitoring, therefore the site is not considered to be at risk of flooding from this source

Sewer Flooding

- 6.7 Welsh Water sewer records in *Appendix D* show no infrastructure in close proximity to the site therefore, the site is not considered to be at risk of flooding from this source. Furthermore Welsh Water have confirmed that the existing foul sewer system is able to accommodate flows from the development with relevant correspondence included in *Appendix D*.

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Flooding from Artificial Sources

- 6.8 Flooding from artificial sources, is most likely to result from burst water mains or from infrastructure failure in an artificial watercourse or water body, i.e. canals or other water features such as reservoirs. These systems are maintained, improved and regularly inspected by British Waterways (canals), Dee Valley Water (water mains) and Natural Resource Wales/EA (water bodies), therefore, flood risk from these sources is generally considered to be low.
- 6.9 Flood maps associated with large reservoirs that hold over 25,000 cubic meters of water are available on the EA website. The maps help to identify areas that could potentially be affected by reservoir flooding and display a realistic worst case scenario of the largest area that may be flooded if a reservoir were to fail and release the water it holds.
- 6.10 The below Reservoir Flood Map taken from the EA's website shows the site to be unaffected by reservoir flooding, therefore, the site is not considered to be at risk of flooding from this source.

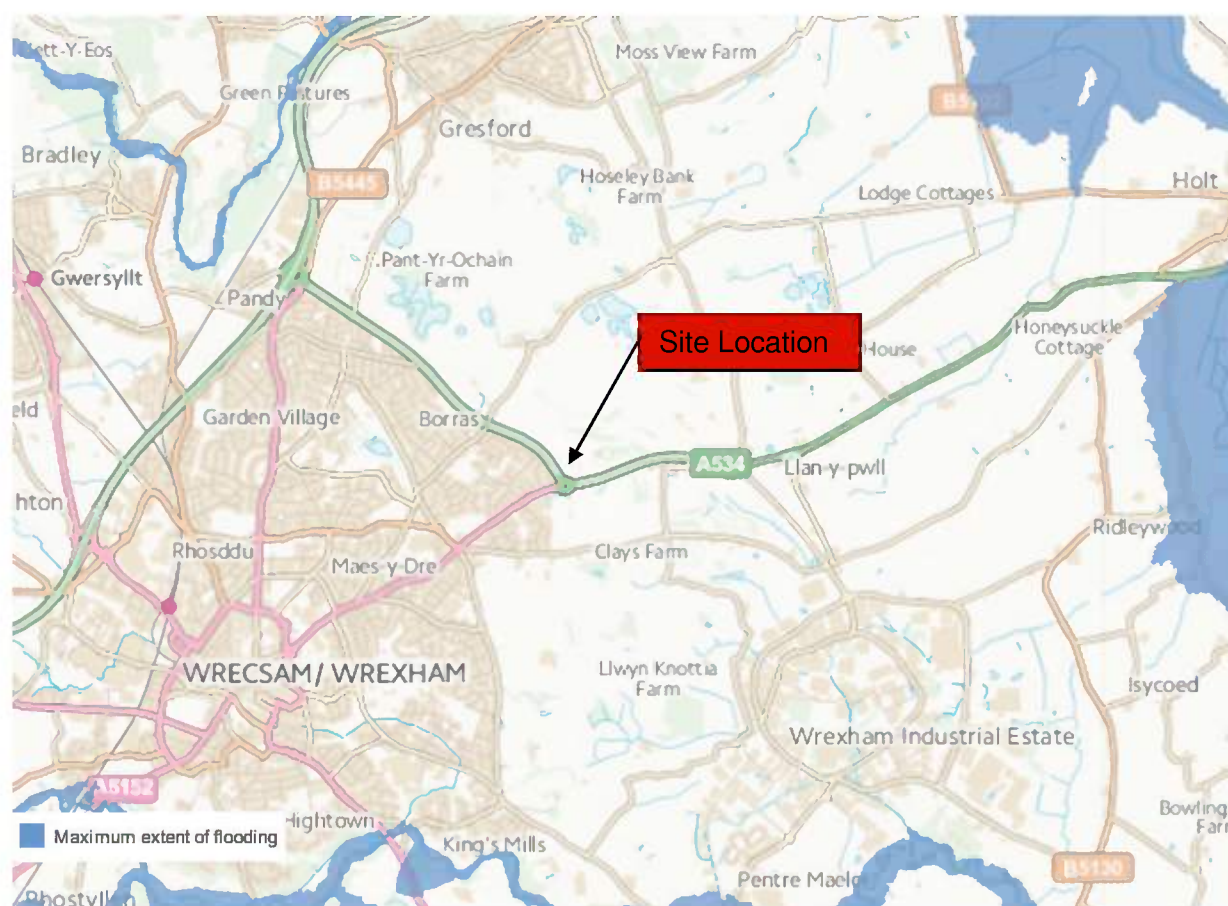


Figure 4: NRW Reservoir Flood Map

- 6.11 There are no canals in the immediate surrounding area, therefore, the development is not considered to be at risk of flooding from this source.

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- 6.12 It is anticipated that flooding associated with burst water mains would follow a similar pattern to overland surface water flood routes identified in *Figure 3*, therefore the site is not considered to be at risk from this source.

7. JUSTIFYING THE LOCATION OF THE DEVELOPMENT

- 7.1 The WAG Development Advice Map in *Appendix C* shows the site to be located in Flood Zone A, which is deemed to be an area at little or no risk of fluvial or tidal / coastal flooding. TAN15 advises that it is suitable for all forms of development to take place within flood zone A and that there is no need to consider flood risk from fluvial or tidal / coastal further.

8. MANAGING THE RISK OF FLOODING

- 8.1 Section 6 of this report established that the site is at low risk of flooding from all sources. However, new development has the potential to generate large volumes of surface water runoff, which can increase the risk of surface water flooding both on site and elsewhere in the catchment.
- 8.2 The following section of this report considers a strategy for the management of surface water runoff using Sustainable Urban Drainage Systems (SUDS) to ensure the development does not increase the risk of surface water flooding.

9. SURFACE WATER MANAGEMENT & DRAINAGE STRATEGY

Standard S1 - Surface Water Runoff Destination

- 9.1 The suggested procedures for managing surface water runoff from new developments in Wales are set out in the February 2015 Welsh Government Consultation Document “*Interim non-statutory standards for sustainable drainage (SUDS) in Wales – designing, constructing, operating and maintaining surface water drainage systems*”.
- 9.2 Standard S1 of the Consultation Document sets out a hierarchy for the disposal of surface water runoff. The methods of disposal are summarised in *Table 1* below with an assessment of each methods suitability also provided.

Table 1: Surface Water Runoff Destination Assessment

Surface Water Runoff Destination	Assessment
Level 1: Consider collection of surface water runoff for re-use	Given the proposed development uses it is considered that rainwater harvesting would not significantly contribute to a reduction in surface water runoff volumes or peak water demand. Therefore, the collection of surface water runoff for re-use is not considered to be an appropriate surface water runoff destination.
Level 2: Consider disposal of surface water runoff to ground by infiltration.	The underlying soils are considered suitable for disposal of surface water runoff to ground by infiltration with 2 No. soakaway tests establishing infiltration rates to vary from 3.7

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	$\times 10^{-05}$ m/s to 6.3×10^{-05} m/s. The soakaway test results are included in <i>Appendix E</i> .
Level 3: Consider discharge of surface water runoff to a surface water body.	It has been established that it would be appropriate to discharge surface water runoff to ground by infiltration, therefore, it is not necessary to consider the discharge of surface water runoff to a surface water body.
Level 4: Consider discharge of surface water runoff to a surface water sewer, highway drain, or another drainage system.	It has been established that it would be appropriate to discharge surface water runoff to ground by infiltration, therefore, it is not necessary to consider the discharge of surface water runoff to a surface water sewer, highway drain, or another drainage system.
Level 5: Consider discharge of surface water runoff to a combined sewer.	It has been established that it would be appropriate to discharge surface water runoff to ground by infiltration, therefore it is not necessary to consider the discharge of surface water runoff to a combined sewer.

Standard S2 - Surface water runoff hydraulic control

- 9.3 Standard S2 of the Consultation Document advises that consideration should be given to the use of Sustainable Urban Drainage Systems (SUDS) for the interception of surface water runoff to prevent any discharge from new development for rainfall events less than 5mm in depth and prevent runoff from the first 5mm of rainfall for larger events. The SUDS considered to achieve this requirement are listed in *Table 2* below with an assessment of each methods suitability also provided.

Table 2: Assessment of SUDS Methods considered to prevent any discharge of surface water for rainfall events less than 5mm in depth and prevent runoff from the first 5mm of rainfall for larger events.

System	Assessment
Green Roofs	Buildings are likely to have pitched roof profiles, therefore the use of green roofs is not considered appropriate for the management of surface water runoff.
Rainwater Harvesting	Given the proposed development uses it is considered that rainwater harvesting would not significantly contribute to a reduction in surface water runoff volumes or peak water demand. Therefore, the collection of surface water runoff for re-use is not considered to be an appropriate surface water runoff destination.
Soakaway / Infiltration Systems	The underlying soils are considered suitable for disposal of surface water runoff to ground by infiltration, therefore soakaways / and other infiltrations systems including infiltration trenches, swales, permeable pavements, infiltration basins are considered appropriate for the interception of surface water runoff.

- 9.4 Based on the assessment in *Table 2*, a surface water drainage scheme has been developed for the site and is shown on the proposed drainage layout drawing included in *Appendix F* with a description of the proposals provided below.

- Pub Restaurant: Roof water is shown to discharge via a system of underground pipework to a geocellular storage crate soakaway located in the pub garden while car park runoff is shown to be drained via permeable paving.

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- Access Road: Surface water runoff is shown to discharge via road gullies to a gravel filled filter drain, which in turn discharges to an infiltration basin located in an area of soft landscaping along the sites south-eastern boundary.
- Drive Thru: Roof water is shown to discharge via a system of underground pipework to an infiltration basin located in an area of soft landscaping along the western boundary. Car park runoff is also shown to discharge to the infiltration basin via road gullies and a gravel filled filter drain.
- Petrol Filling Station: Roof water is shown to discharge via a system of underground pipework to an infiltration basin located in an area of soft landscaping along the north-western boundary. Car park runoff is also shown to discharge to the infiltration basin via road gullies and a gravel filled filter drain.
- Lorry Rest Area: Surface water runoff is shown to discharge via road gullies to a gravel filled filter drain, which in turn discharges to an infiltration basin located in an area of soft landscaping along the eastern boundary.

- 9.5 The SUDS described above and shown on the proposed drainage layout have been designed in accordance with the flood protection requirements of the Consultation Document with sufficient capacity to store and attenuate excess surface water runoff associated with rainfall events exceeding the natural infiltration rate of the underlying soils for up to and including a 1 in 100 year event with 30% allowance for climate change.
- 9.6 The SUDS have been designed using the source control facility in the MicroDrainage software Package by XP Solutions based on a worst case infiltration rate of 3.7×10^{-05} m/s (0.13m/hr). Design results the 1 in 100 year event with 30% allowance for climate change for all SUDS identified on the proposed drainage layout are included in *Appendix G*.
- 9.7 In the event that the capacity of the surface water drainage network was exceeded, surface water would be channelled off-site along the developments access roads and car park circulation aisles following the routes of contours identified on the finished level contour layout in *Appendix H*, which closely match the sites existing falls. The finished floor level of the proposed buildings are raised above surrounding car park levels so there would no risk of buildings being affected by such overland flows.

Standard S3 - Water Quality

- 9.8 Standard S3 of the Consultation Document advises that where surface water is likely to be contaminated, effective management is required to reduce contaminant loads and concentrations in the runoff to acceptable levels, in order minimise the risk of pollution of receiving waterbodies and/or protect receiving sewers.
- 9.9 The proposed drainage layout drawing included in *Appendix F* shows surface water runoff from the development to be discharged to ground using a variety of SUDS providing relevant treatment stages complying with the standard with a description of the proposals provided below.
- Pub Restaurant: Roof water is shown to discharge via a system of underground pipework to a geocellular storage crate soakaway including a gravel filled filter trench for stage 1 treatment. Car park runoff is shown to be drained via permeable paving,

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which would provide both stage 1 and stage 2 treatment prior to allowing surface water runoff to infiltrate into the underlying soils.

- Access Road: Surface water runoff is shown to discharge via trapped road gullies to a gravel filled filter drain, which would provide stage 1 treatment. The filter drain in turn discharges to an infiltration basin located in an area of soft landscaping along the sites south-eastern boundary, which would provide stage 2 treatment prior to allowing surface water runoff to infiltrate into the underlying soils.
- Drive Thru: Roof water is shown to discharge via a system of underground pipework to an infiltration basin located in an area of soft landscaping along the western boundary for stage 1 treatment. Car park runoff is shown to discharge via trapped road gullies to a gravel filled filter drain, which would provide stage 1 treatment. The filter drain in turn discharges to the infiltration basin, which would provide stage 2 treatment prior to allowing surface water runoff to infiltrate into the underlying soils.
- Petrol Filling Station: Roof water is shown to discharge via a system of underground pipework to an infiltration basin located in an area of soft landscaping along the western boundary for stage 1 treatment. Car park runoff is shown to discharge via trapped road gullies to a gravel filled filter drain, which would provide stage 1 treatment. The filter drain in turn discharges to the infiltration basin, which would provide stage 2 treatment prior to allowing surface water runoff to infiltrate into the underlying soils. The fueling area is shown to be covered with a roof to prevent surface water from being contaminated and as a further precaution the perimeter of the fueling area and tank filling area is shown to be surrounded with linear drainage channels, which would be connected to the foul drainage system.
- Lorry Rest Area: Surface water runoff is shown to discharge via trapped road gullies to a gravel filled filter drain, which would provide stage 1 treatment. The filter drain in turn discharges to an infiltration basin located in an area of soft landscaping along the sites eastern boundary, which would provide stage 2 treatment prior to allowing surface water runoff to infiltrate into the underlying soils.

Standard S4 & S5 – Amenity & Biodiversity

- 9.10 Standard S4 of the Consultation Document advises that the design of the surface water management system should maximise amenity benefits, while Standard S5 requires the design of the surface water management system to maximise biodiversity benefits.
- 9.11 The proposed drainage layout drawing included in *Appendix F* shows a number of infiltration basins, which would help to maximise opportunity for amenity and biodiversity benefits on the site.

Standard S6 – Design of drainage for Construction, Operation and Maintenance

- 9.12 Standard S6 sets out requirements for surface water drainage systems so that they can be easily and safely constructed, maintained and operated, taking account of the need to minimise negative impacts on the environment and natural resources.
- 9.13 The following sections of this report set out measures to be implemented during construction of the scheme to ensure the site and areas downstream are protected from surface water runoff during construction of the development. Details of a maintenance

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plan for the surface water drainage network are also provided, which would help to prevent a reduction in the performance of the surface water drainage system over the lifetime of the development.

Implementation Plan

- 9.14 The proposed drainage outfalls and infiltration basins will be constructed at an early stage of the programme as this will assist in managing construction runoff and help settle out the high volumes of sediments created by construction activities.
- 9.15 Topsoil and seeding of the infiltration basins should not take place until site works have been completed. During the construction period, the surface of the infiltration basins should be lined with a sacrificial geotextile filter fabric, which will help to trap silt and prevent it from contaminating soils beneath.
- 9.16 The use of porous paving systems in the car park will require changes to conventional construction practices and procedures used in the construction of traditional car parking and other paved areas, which during the initial stages of the development are often used as access roads and storage areas. Together with runoff from the construction site, which can be heavily laden with silt, such activities are likely to block the porous paving systems, therefore, the following measures should be implemented to address this issue.
- Porous paving should be carried out at the end of the development programme, when most construction activities are complete, thus minimising the risk of clogging.
 - Should it be necessary to construct areas of porous paving at an early stage in the construction programme, an impermeable layer of Dense Bitumen Macadam (DBM) should be laid beneath the surfacing materials to act as a temporary road surface. When most construction activities are complete, holes will be punched through the impermeable layer with final surfacing then laid.
- 9.17 It is not always possible to ensure that new impermeable areas are immediately connected to the drainage system. Therefore, the following additional measures should be implemented to ensure construction runoff is appropriately managed:
- A straw barrier or silt fence should be placed along the sites boundary to prevent sediment such as soil and mud from washing downstream.
 - Protective coverings should be used to help prevent runoff stripping material stockpiles.
 - Plant and wheel washing should take place in a designated location. The area should be tanked and not allowed to discharge into the surface water drainage system or infiltrate into the ground. Effluent should be treated as contaminated waste and disposed off-site by a licensed waste management operator.
 - Surfaces used as access roads and storage areas during construction should be swept and vacuumed regularly to prevent the accumulation of dust and mud.
 - Should groundwater be encountered in excavations such water should not be discharged into the surface water drainage system until the amount of suspended

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solids has been reduced through the controlled use of skips or tanks, which would act as stilling basins.

- To prevent contamination associated with the use of oils and hydrocarbons during construction, the Contractor should ensure that the following precautionary measures are employed during construction:
 - Regular maintenance of machinery and plant.
 - Use of drip trays.
 - Regular checking of machinery and plant for oil leaks.
 - Use of correct storage facilities.
 - Regular checks for signs of wear and tear on tanks.
 - Specific procedures are followed when refuelling.
 - Use of a designated area for refuelling.
 - Emergency spill kit to be located near refuelling area.
 - Regular emptying of bunds.
 - Tanks will be located in secure areas to stop vandalism.
- Upon completion all underground pipework should be jet cleaned and CCTV surveyed, areas of porous paving should be swept and cleaned and silt / debris present in the infiltration basins should be removed.

Management & Maintenance Plan

- 9.18 Following handover of the drainage system to the Operations Team, it is recommended that the surface water drainage system is maintained in accordance with the SUDS Maintenance Plan included in *Appendix I*.

10. FOUL WATER DRAINAGE STRATEGY

- 10.1 The proposed drainage layout drawing included in *Appendix F* shows foul water to be discharged via a system of underground pipework to a new pumping station located in the south-east corner of the site. The pumping station is identified to in turn discharge to a foul water sewer located in Holt Road to the west of the site via a rising main.
- 10.2 Welsh Water have confirmed that the existing foul sewer system is able to accommodate flows from the development with relevant correspondence included in *Appendix D*.
- 10.3 The main foul water drainage network beneath the access road and the pump station would be offered for adoption to Welsh Water to be managed and maintained at their expense.
- 10.4 Property owners would be responsible for the maintenance of the private foul water drainage system serving their individual properties up to the connection with the foul water drainage network in the access road.

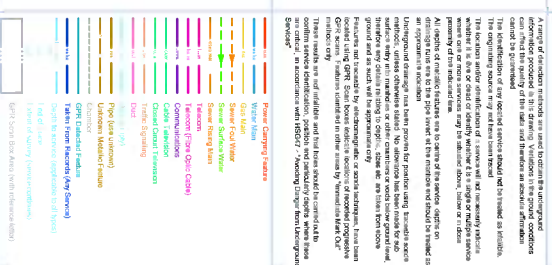
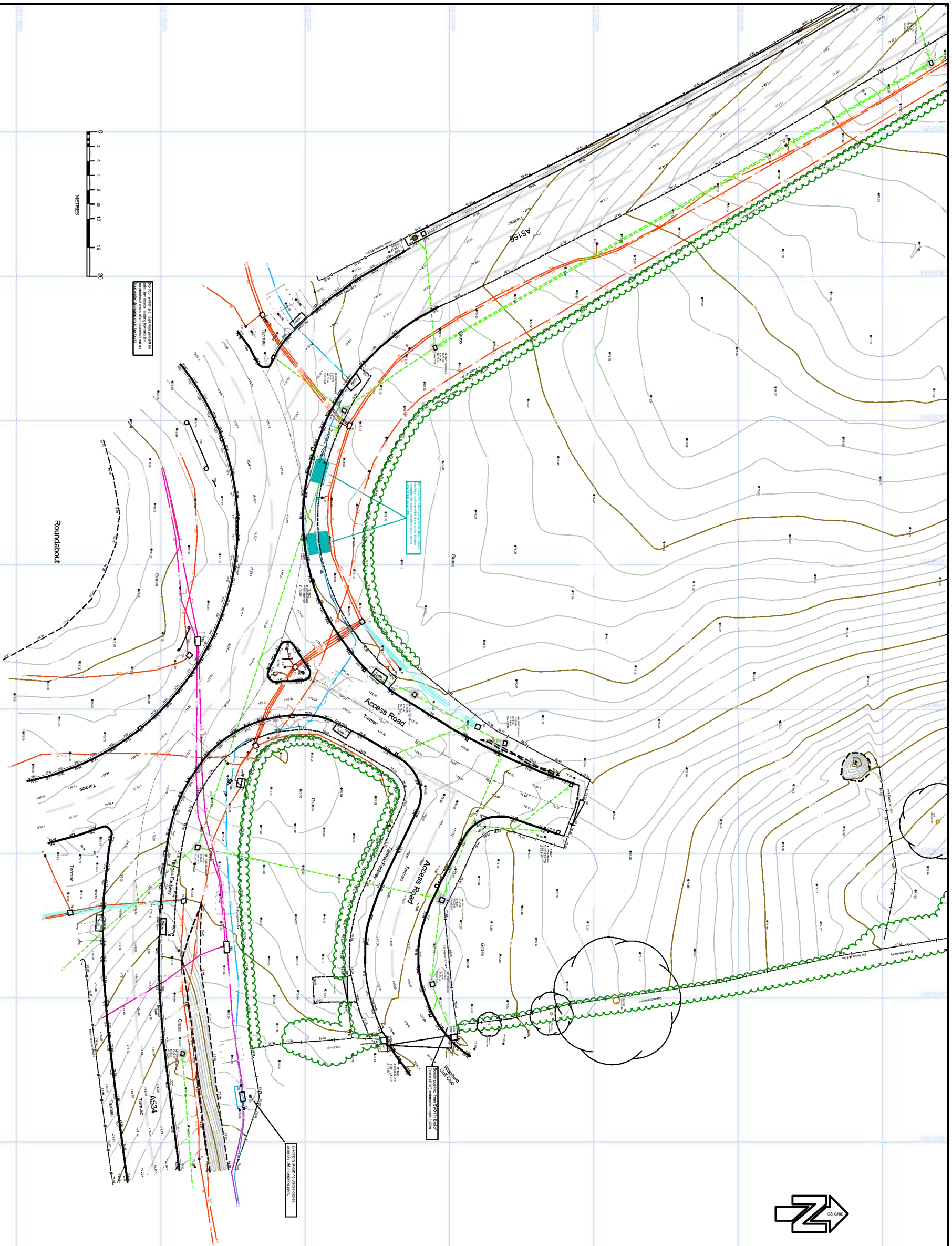
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11. CONCLUSIONS

- 11.1 It has been established that the site is located in the Flood Zone A and is not influenced by Tidal or fluvial flooding. This is confirmed by the flood mapping obtained from the WAG's website. The site has also been determined to be at low risk of flooding from surface water, groundwater, sewer and artificial sources.
- 11.2 New development can increase the volume and rate at which surface water runoff is discharged from a site when compared to the existing situation, which can cause an increase in flood risk both on the site and elsewhere within the catchment. Therefore, a surface water drainage scheme has been prepared for the development that will allow for surface water runoff to infiltrate into the ground using Sustainable Urban Drainage Systems (SUDS) in the form of soakaways, permeable paving and infiltration basins. The drainage strategy will ensure excess surface water runoff from the development is stored and attenuated up to a 1 in 100 year plus 30% climate change event.
- 11.3 Foul water runoff from the development can be discharged to a foul water sewer located in Holt Road to the west of the site via a new pumping station located in the south-east corner of the site.
- 11.4 It is concluded that the development can be occupied and operated safely and that there will be no increase in the level of flood risk to the site or neighbouring sites as a result of the development. Therefore the development can be considered acceptable in terms of flood risk.

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APPENDIX A
TOPOGRAPHICAL SURVEY



STN	East	North	Level	Type
STN1	32076.524	951513.725	75.45	Ind
STN2	320540.460	951772.322	75.05	Ind
STN3	320630.914	951773.016	75.577	Ind

No.	Description	Rate	Quantity
FINAL Drawing Sheet			
Topographical & Utilities Survey			
Client			
Marston's Inn & Taverns			
Site			
Land Adjacent to Wrexham Golf Course			
Wrexham			
North Wales			
Drawing No.			
3650/10/001			
Scale			
1:200			
Approx. 10'			
Sheet			
1 of 2			
Issue			
25.08.14			
Survey			
G.S			
Drawn			
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Notes

1. Drawing is to be used for the proposed development only.
2. The drawing is to be used for the proposed development only.
3. The drawing is to be used for the proposed development only.

Control		North		Level		Type	
11001	11001	11001	11001	11001	11001	11001	11001
11002	11002	11002	11002	11002	11002	11002	11002

Sheet Layout



General

- 1. The drawing is to be used for the proposed development only.
- 2. The drawing is to be used for the proposed development only.
- 3. The drawing is to be used for the proposed development only.

Legend

Feature Abbreviations		Description	
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3	3	3	3
4	4	4	4
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90	90	90	90
91	91	91	91
92	92	92	92
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99	99	99	99
100	100	100	100

Client: 3650/10/002

Client: 3650/10/002

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Client: 3650/10/002

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Client: 3650/10/002

Client: 3650/10/002

APPENDIX B
SITE LAYOUT PLAN



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Y	03.05.16	Final layout	Pump station location altered	ACR
X	07.04.16	Final layout	Planting shading altered	ACR
W	07.04.16	Road Layout altered		ACR
V	07.04.16	Road Layout altered		ACR
U	05.02.16	Layout altered		ACR
T	2.11.15	Layout updated		ACR
S	7.10.15	Title updated		ACR
R	24.8.15	Scheme layout altered		ACR
Q	10.04.15	150 cover pub shown		ACR
P	26.3.15	SE Garden to pub restaurant increased		ACR
O	23.3.15	REVISED ROADSIDE SERVICES SCHEME SHOWN		ACR
N	03.15	REVISED ROADSIDE SERVICES SCHEME SHOWN		ACR
M	11.2.15	ROADSIDE SERVICES SCHEME SHOWN		ACR
L	6.1.15	Supermarket indicatively shown		ACR
K	5.1.15	Layout updated to show drainage outfall scheme		ACR
G	23.12.14	Road realigned and layout redrawn		ACR
F	22.12.14	Drainage field shown		ACR
E	12.9.14	Hotel shown & Layout altered		ACR
D	12.9.14	CAR PARK LAYOUT ALTERED		ACR
C	12.9.14	REDRAWN		ACR
B	5.9.14	Survey shown and trees on site indicated		ACR
Rev	Date	Description		ACR

Brooklands Yard
Southover Hall Street
Lewes
East Sussex
BN7 1HU

Tel. 01273 479269
www.axiomarchitects.co.uk

Client
LIBERTY PROPERTIES DEVELOPMENTS LTD

Project
PROPOSED ROADSIDE SERVICES
HOLT ROAD
WREXHAM

Drawing
SITE LAYOUT

Scale	Status	Date	Drawn	Checked
1:500 @ A2	Preliminary	22.9.14	ACR	

Drawing No.	Revision
-------------	----------

3621/P104 Y

APPENDIX C
TAN15 DEVELOPMENT ADVICE MAP



APPENDIX D
WELSH WATER SEWER RECORDS & CORRESPONDENCE



LAND AT HOLT ROAD



LEGEND/Representative of most common features)

- [illegible]

Notes:

[illegible][illegible]

Services clients are not generally shown but their presence should be anticipated.

**EXACT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.**

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Map scale: 1:1,750
Printed by: CH
Printed on: 17.07.2014





**Dŵr Cymru
Welsh Water**

Developer Services
PO Box 3146
Cardiff
CF30 0EH

Tel: +44 (0)800 917 2652
Fax: +44 (0)2920 740472
E.mail: developer.services@dwrcymru.com

Gwasanaethau Datblygu
Blwch Post 3146
Caerdydd
CF30 0EH

Ffôn: +44 (0)800 917 2652
Ffacs: +44 (0)2920 740472
E.bost: developer.services@dwrcymru.com

Mrs Diana Sales
Simpson Associates
8 Friday Street
Henley On Thames
Oxfordshire
RG9 1AH



Date: 02/04/2015
Our Ref: PPA0000906

Dear Mrs Sales

Grid Ref: SJ3592251885 335922 351885

Site: Development at Holt Road Wrexham

Development: Development of site for a public house, budget hotel, drive thru' Costa Coffee & petrol station

We refer to the pre-planning enquiry relating to the above site, and we can provide the following comments in respect to the proposed development.

SEWERAGE

In relation to capacity to accept sewage flows from the proposed development we would confirm the following:

We would anticipate that a foul connection could be accommodated at manhole SJ35513450.

Alternatively if a direct connection is proposed into the Holt Road Sewage Pumping Station Welsh Water will need to undertake further investigation in order to assess the impact such a connection would have.

In relation to the surface water flows from the proposed development, these will have to be disposed of separately by other means, such as using soakaways or discharging directly to a watercourse.

Permissions to connect to a watercourse may need to be sought from the Land Drainage Authority and / or Environment Agency. Please note that no highway or land drainage run-off will be permitted to discharge directly or indirectly into the public sewerage system

With reference to the surface water flows from the proposed development, you are required to fully exhaust all technical options outlined under Sections 3.2 and 3.4 of Part H of the publication 'Building Regulations 2000; Disposal should be made through the hierarchical approach, preferring infiltration and, where infiltration is not possible, disposal to watercourses in liaison with the Land Drainage Authority



Welsh Water is owned by Glas Cymru – a 'not-for-profit' company.
Mae Dŵr Cymru yn eiddo i Glas Cymru – cwmni 'nid-er-elw'.

We welcome correspondence in
Welsh and English

Dŵr Cymru Cyf, a limited company registered in
Wales no 2366777. Registered office: Pentwyn Road,
Nelson, Treharris, Mid Glamorgan CF46 6LY

Rydym yn croesawu goheblaeth yn y
Gymraeg neu yn Saesneg

Dŵr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng
Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn
Nelson, Treharris, Morgannwg Ganol CF46 6LY.

and/or the Environment Agency. Discharge of surface water to the public sewer is only to be made as a last resort.

Other methods of SUDS must also be investigated. SUDS is an approach to managing surface water run-off which seeks to imitate natural drainage systems and retain water on or near the site as opposed to traditional drainage approaches which involve piping water off site as quickly as possible.

SUDS involve a range of techniques including green roofs, rainwater harvesting, permeable pavements, etc. SUDS offer significant advantages over conventional piped drainage systems in reducing flood risk by attenuating the rate and quantity of surface water run-off from a site, promoting groundwater recharge, and improving water quality and amenity.

The variety of SUDS techniques available means that virtually any development should be able to include a scheme based around these principles. Good justification would be required not to incorporate a SUDS scheme on the site.

Please note that no highway or land drainage run-off will be permitted to discharge directly or indirectly into the public sewerage system

ADVISORY

If any onsite or offsite sewers are to be offered for adoption they must be constructed to conform with the publication "Sewers for Adoption"- 7th Edition.

Please note that in order to make a connection to the public sewerage system, it may be necessary to cross third party land, for which you must first gain permission from all the relevant landowners. Should you encounter difficulties in gaining the permission to do so, it may be possible to requisition a new sewer under Sections 98 to 101 of the Water Industry Act 1991 from the boundary of the proposed development to the public sewerage system. Should you require further information please write to us at the address given above.

The Welsh Government have introduced new legislation that will make it mandatory for all developers who wish to communicate with the public sewerage system to obtain an adoption agreement for their sewerage with Dwr Cymru Welsh Water (DCWW). The Welsh Ministers Standards for the construction of sewerage apparatus and an agreement under Section 104 of the Water Industry Act (WIA) 1991 will need to be completed in advance of any authorisation to communicate with the public sewerage system under Section 106 WIA 1991 being granted by DCWW.



Welsh Water is owned by Glas Cymru – a 'not-for-profit' company.
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We welcome correspondence in
Welsh and English

Dŵr Cymru Cyf, a limited company registered in
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Nelson, Treharris, Mid Glamorgan CF46 6LY

Rydym yn croesawu gohebiaeth yn y
Gymraeg neu yn Saesneg

Dŵr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng
Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn
Nelson, Treharris, Morgannwg Ganol CF46 6LY.

Welsh Government introduced the Welsh Ministers Standards on the 1st October 2012 and we would welcome your support in informing applicants who wish to communicate with the public sewerage system to engage with us at the earliest opportunity. Further information on the Welsh Ministers Standards is available for viewing on our Developer Services Section of our website - www.dwrcymru.com or on the Welsh Government website - www.wales.gov.uk

Please note that some public sewers and lateral drains may not be recorded on our maps of public sewers because they were originally privately owned and were transferred into public ownership by nature of the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011. Should any drains or sewers be found that are not recorded on the public network plan please contact us to establish the location and status of the sewers as the presence of such assets may affect your proposal. Under the Water Industry Act 1991 Dwr Cymru Welsh Water has rights of access to its apparatus at all times.

If a connection is required to the public sewerage system, the developer is advised to contact us on Tel: 0800 917 2652.

SEWAGE TREATMENT

No problems are envisaged with the Waste Water Treatment Works for the treatment of domestic discharges from this site.

If you have any queries please contact Developer Services on 0800 917 2652 or via email at developer.services@dwrcymru.com

Please quote our reference number in all communications and correspondence.

Yours faithfully,



Henry Jones-Hughes
Development Control Officer
Developer Services

Demands upon the water and sewerage systems change continually; consequently the information given above should be regarded as reliable for a maximum period of 12 months from the date of this letter.



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Mae Dwr Cymru yn eiddo i Glas Cymru – cwmni 'nid-er-elw'.

We welcome correspondence in
Welsh and English

Dwr Cymru Cyf, a limited company registered in
Wales no 2366777. Registered office: Pentwyn Road,
Nelson, Treharris, Mid Glamorgan CF46 6LY

Rydym yn croesawu gohebiaeth yn y
Gymraeg neu yn Saesneg

Dwr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng
Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn
Nelson, Treharris, Morgannwg Ganol CF46 6LY.



LEGEND (Representative of most common features)

Waste network	
	Feed chamber
	Surface water sewer
	Combined sewer
	Sanitary sewer
	Storm overflow
	Manhole
	Gravity sewer
	Pressure sewer
	Private sewer
	Private sewer subject to SUDS
	Private sewer subject to SUDS agreement
	Private Sewer Transducer
	Lateral Drains
	Inspection Chamber

Notes:

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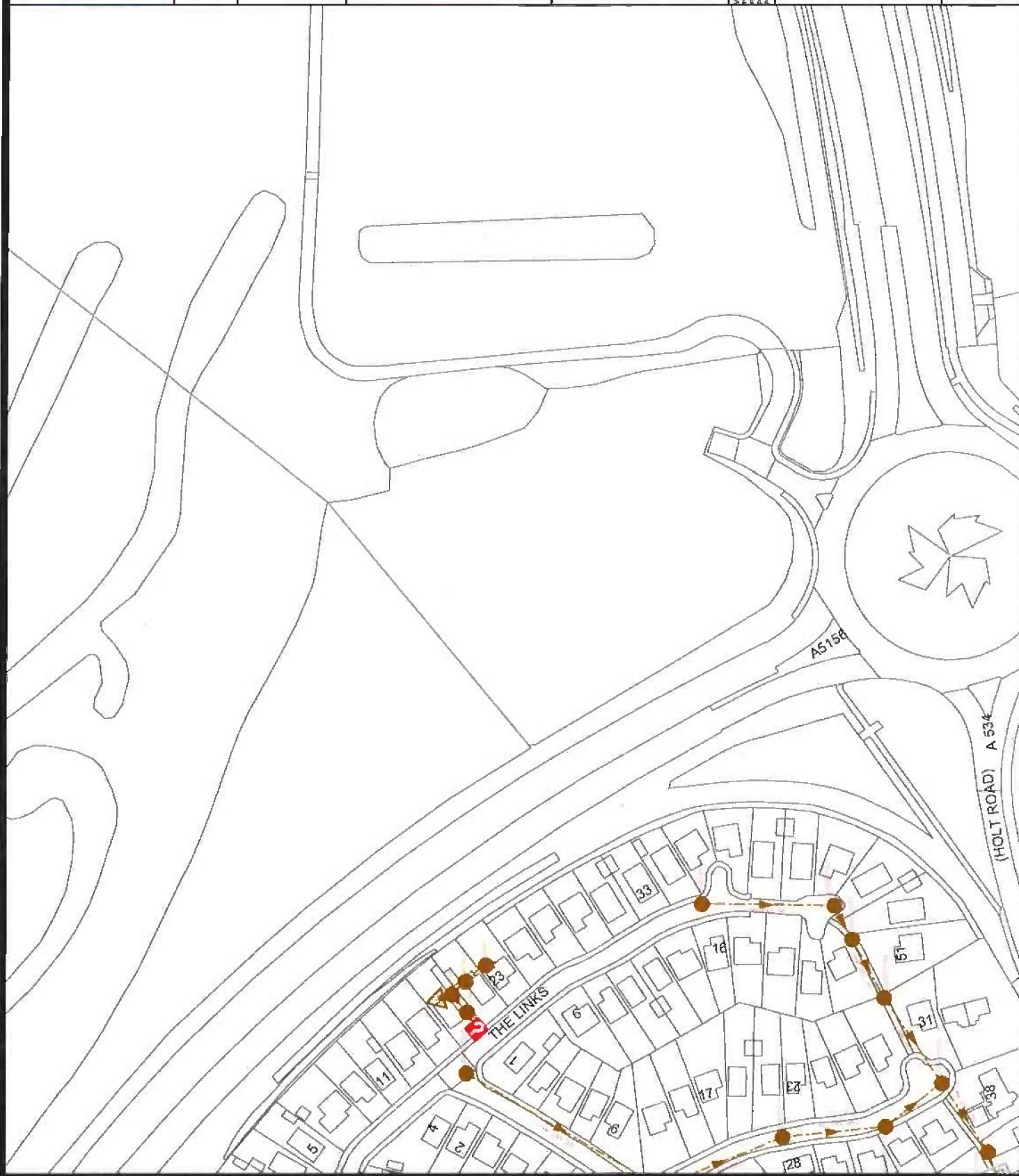
Dŵr Cymru Cŵl gives the information as to the position of the underground apparatus by way of a plan and no warranty is made as to the accuracy of the information. The information is provided on the basis that it is correct and complete at the time of publication. The information is provided on the basis that it is correct and complete at the time of publication. The information is provided on the basis that it is correct and complete at the time of publication.

Some of the information is not generally intended for publication and should be kept confidential.

**EXACT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.**

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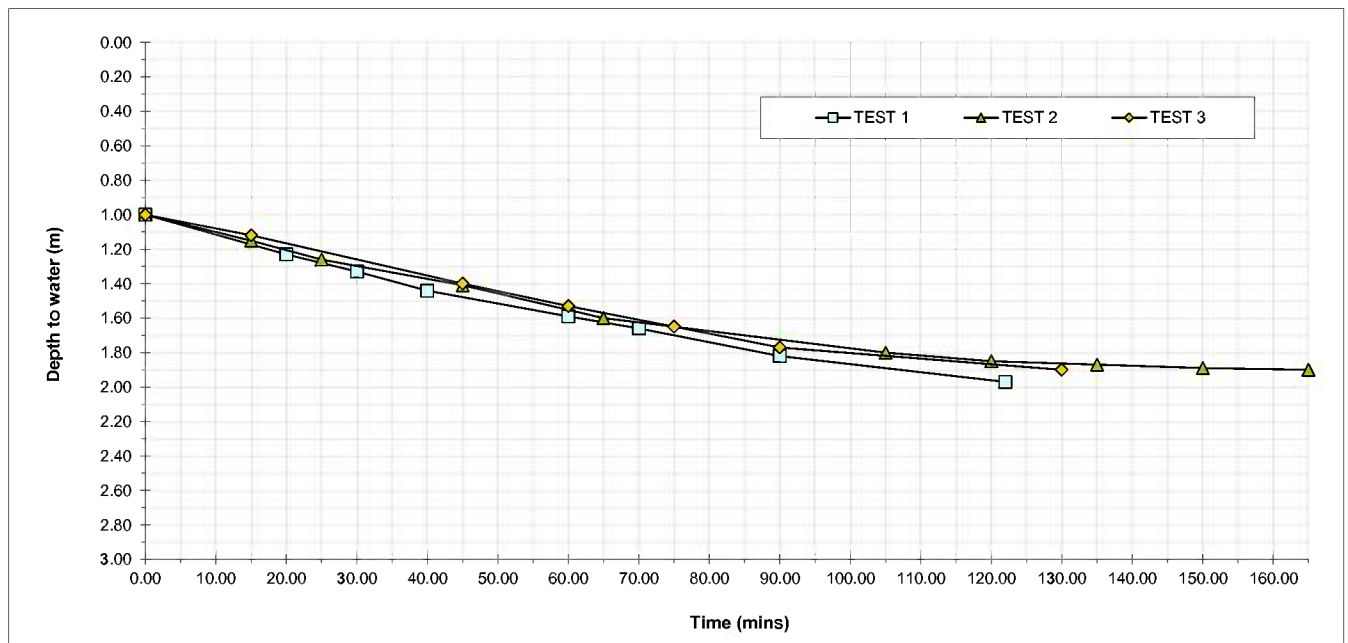
Map Ref: 335922 351885
Map scale: 1:1,750
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APPENDIX E
SOAKAWAY TEST RESULTS

		Site..... Wrexham Golf Club, Holt Road		Soakaway Number..... SA2		
		Job Number..... CRM.413.133		Length..... 3.00 m		
		Date of Test..... 09.03.15		Width..... 0.60 m		
				Depth..... 2.00 m		
		SOIL INFILTRATION RATE TEST		Groundwater Level..... Dry m		
		See B.R.E. Digest 365, 1991, Soakaway Design.				
Remarks - 0.00-0.40m: Grass over dark brown slightly sandy TOPSOIL. (Made Ground) 0.40-1.10m: Light to dark brown gravelly fine to coarse SAND with occasional fragments of tile. Gravel is angular and subangular fine to coarse flint, concrete and brick. (Made Ground) 1.10-2.00m: Light grey slightly clayey sandy angular and subangular fine to coarse mudstone, sandstone and flint.	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	1.00	0.0	1.00	0.0	1.00
	20.0	1.23	15.0	1.15	15.0	1.12
	30.0	1.33	25.0	1.26	45.0	1.40
	40.0	1.44	45.0	1.41	60.0	1.53
	60.0	1.59	65.0	1.60	75.0	1.65
	70.0	1.66	105.0	1.80	90.0	1.77
	90.0	1.82	120.0	1.85	130.0	1.90
	122.0	1.97	135.0	1.87	0.0	0.00
	0.0	0.00	150.0	1.89	0.0	0.00
	0.0	0.00	165.0	1.90	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	Effective Storage Depth	m	1.00	1.00	1.00	1.00
75% Effective Storage Depth	m	0.75	0.75	0.75	0.75	
(i.e. depth below GL)	m	1.25	1.25	1.25	1.25	
25% Effective Storage Depth	m	0.25	0.25	0.25	0.25	
(i.e. depth below GL)	m	1.75	1.75	1.75	1.75	
Effective Storage Depth 75%-25%	m	0.50	0.50	0.50	0.50	
Time to fall to 75% effective depth	mins	20.00	25.00	20.00	20.00	
Time to fall to 25% effective depth	mins	80.00	100.00	90.00	90.00	
V (75%-25%)	m3	0.90	0.90	0.90	0.90	
a (50%)	m2	5.40	5.40	5.40	5.40	
t (75%-25%)	mins	60.00	75.00	70.00	70.00	
SOIL INFILTRATION RATE	m/s	4.63E-05	3.70E-05	3.97E-05		

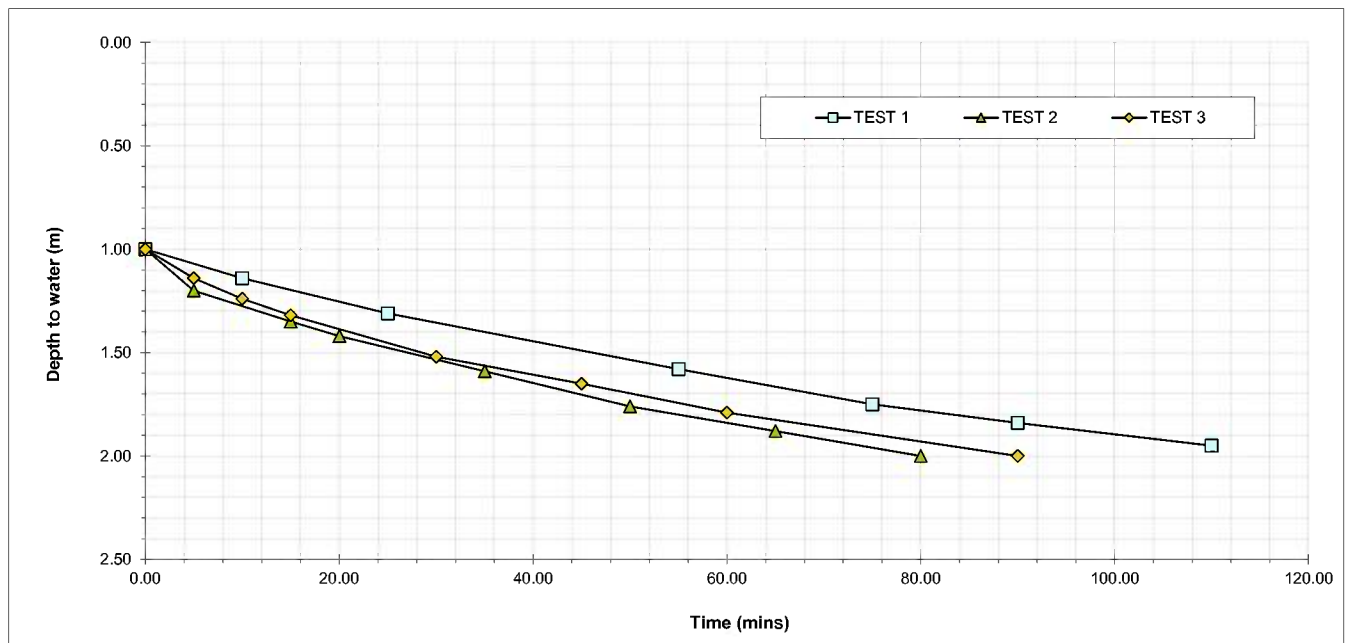
DESIGN SOIL INFILTRATION RATE, f	3.70E-05	m/s
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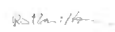
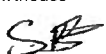


Compiled By:	Date:	Checked By:	Date:	Approved By:	Date:
M. Ward	12.03.15	R.Hamilton	12.03.15	S.Rhodes	12.03.15
					

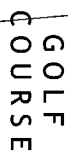
		Site..... Wrexham Golf Club, Holt Road		Soakaway Number..... SA3		
		Job Number..... CRM.413.133		Length..... 3.00 m		
		Date of Test..... 09.03.15		Width..... 0.60 m		
				Depth..... 2.00 m		
		SOIL INFILTRATION RATE TEST		Groundwater Level..... Dry m		
See B.R.E. Digest 365, 1991, Soakaway Design.						
Remarks - 0.00-0.40m: Grass over dark brown sandy TOPSOIL with frequent rootlets. (Made Ground) 0.40-1.10m: Light to dark brown gravelly file to coarse SAND with occasional angular and subangular concrete and flint cobbles and rare fragments of bones up to 150mm. Gravel is angular and subangular fine to coarse flint, concrete, tile and brick. 1.10-2.00m: Light grey slightly clayey sandy angular and subangular fine to coarse mudstone and sandstone and flint. .	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	1.00	0.0	1.00	0.0	1.00
	10.0	1.14	5.0	1.20	5.0	1.14
	25.0	1.31	15.0	1.35	10.0	1.24
	55.0	1.58	20.0	1.42	15.0	1.32
	75.0	1.75	35.0	1.59	30.0	1.52
	90.0	1.84	50.0	1.76	45.0	1.65
	110.0	1.95	65.0	1.88	60.0	1.79
	0.0	0.00	80.0	2.00	90.0	2.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	Effective Storage Depth	m	1.00	1.00	1.00	
75% Effective Storage Depth	m	0.75	0.75	0.75		
(i.e. depth below GL)	m	1.25	1.25	1.25		
25% Effective Storage Depth	m	0.25	0.25	0.25		
(i.e. depth below GL)	m	1.75	1.75	1.75		
Effective Storage Depth 75%-25%	m	0.50	0.50	0.50		
Time to fall to 75% effective depth	mins	20.00	6.00	10.00		
Time to fall to 25% effective depth	mins	75.00	50.00	60.00		
V (75%-25%)	m3	0.90	0.90	0.90		
a (50%)	m2	5.40	5.40	5.40		
t (75%-25%)	mins	55.00	44.00	50.00		
SOIL INFILTRATION RATE	m/s	5.05E-05	6.31E-05	5.56E-05		

DESIGN SOIL INFILTRATION RATE, f	5.05E-05	m/s
----------------------------------	----------	-----



Compiled By:	Date:	Checked By:	Date:	Approved By:	Date:
M. Ward	12.03.15	R.Hamilton	12.03.15	S.Rhodes	12.03.15
					

APPENDIX F
PROPOSED DRAINAGE LAYOUT

[illegible]

APPENDIX G
MICRODRAINAGE DESIGN RESULTS

Simpson Associates				Page 1	
1 Market Place Mews Henley-on-Thames RG9 2AH		Geocellular Soakaway A Roadside Services Holt Road, Wrexham			
Date 29.04.16 File Geocellular Storage Cra...		Designed by G.S.C Checked by G.S.C			
Micro Drainage		Source Control 2015.1			
Summary of Results for 100 year Return Period (+30%)					
Half Drain Time : 824 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	74.570	0.470	0.3	12.5	○ K
30 min Summer	74.730	0.630	0.3	16.8	○ K
60 min Summer	74.902	0.802	0.3	21.3	○ K
120 min Summer	75.074	0.974	0.4	25.9	○ K
180 min Summer	75.165	1.065	0.4	28.3	○ K
240 min Summer	75.218	1.118	0.4	29.7	○ K
360 min Summer	75.269	1.169	0.4	31.1	○ K
480 min Summer	75.291	1.191	0.4	31.7	○ K
600 min Summer	75.295	1.195	0.4	31.8	○ K
720 min Summer	75.293	1.193	0.4	31.7	○ K
960 min Summer	75.281	1.181	0.4	31.4	○ K
1440 min Summer	75.243	1.143	0.4	30.4	○ K
2160 min Summer	75.175	1.075	0.4	28.6	○ K
2880 min Summer	75.110	1.010	0.4	26.9	○ K
4320 min Summer	74.990	0.890	0.4	23.7	○ K
5760 min Summer	74.882	0.782	0.3	20.8	○ K
7200 min Summer	74.785	0.685	0.3	18.2	○ K
8640 min Summer	74.701	0.601	0.3	16.0	○ K
10080 min Summer	74.626	0.526	0.3	14.0	○ K
15 min Winter	74.627	0.527	0.3	14.0	○ K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	107.735	0.0	19		
30 min Summer	72.905	0.0	34		
60 min Summer	47.182	0.0	64		
120 min Summer	29.539	0.0	122		
180 min Summer	22.146	0.0	182		
240 min Summer	17.930	0.0	242		
360 min Summer	13.215	0.0	362		
480 min Summer	10.647	0.0	480		
600 min Summer	8.997	0.0	574		
720 min Summer	7.835	0.0	624		
960 min Summer	6.294	0.0	752		
1440 min Summer	4.613	0.0	1012		
2160 min Summer	3.374	0.0	1428		
2880 min Summer	2.698	0.0	1844		
4320 min Summer	1.966	0.0	2640		
5760 min Summer	1.568	0.0	3456		
7200 min Summer	1.315	0.0	4248		
8640 min Summer	1.139	0.0	5008		
10080 min Summer	1.009	0.0	5744		
15 min Winter	107.735	0.0	19		
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Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Geocellular Soakaway A Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Geocellular Storage Cra...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	74.808	0.708	0.3	18.8	○ K
60 min Winter	75.002	0.902	0.4	24.0	○ K
120 min Winter	75.199	1.099	0.4	29.2	○ K
180 min Winter	75.304	1.204	0.4	32.0	○ K
240 min Winter	75.367	1.267	0.4	33.7	○ K
360 min Winter	75.434	1.334	0.4	35.5	○ K
480 min Winter	75.467	1.367	0.4	36.4	○ K
600 min Winter	75.480	1.380	0.4	36.7	○ K
720 min Winter	75.480	1.380	0.4	36.7	○ K
960 min Winter	75.461	1.361	0.4	36.2	○ K
1440 min Winter	75.416	1.316	0.4	35.0	○ K
2160 min Winter	75.318	1.218	0.4	32.4	○ K
2880 min Winter	75.221	1.121	0.4	29.8	○ K
4320 min Winter	75.043	0.943	0.4	25.1	○ K
5760 min Winter	74.888	0.788	0.3	21.0	○ K
7200 min Winter	74.753	0.653	0.3	17.4	○ K
8640 min Winter	74.638	0.538	0.3	14.3	○ K
10080 min Winter	74.539	0.439	0.3	11.7	○ K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	72.905	0.0	33
60 min Winter	47.182	0.0	62
120 min Winter	29.539	0.0	120
180 min Winter	22.146	0.0	180
240 min Winter	17.930	0.0	238
360 min Winter	13.215	0.0	352
480 min Winter	10.647	0.0	464
600 min Winter	8.997	0.0	574
720 min Winter	7.835	0.0	680
960 min Winter	6.294	0.0	780
1440 min Winter	4.613	0.0	1082
2160 min Winter	3.374	0.0	1540
2880 min Winter	2.698	0.0	1992
4320 min Winter	1.966	0.0	2852
5760 min Winter	1.568	0.0	3688
7200 min Winter	1.315	0.0	4472
8640 min Winter	1.139	0.0	5272
10080 min Winter	1.009	0.0	6048

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Geocellular Soakaway A Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Geocellular Storage Cra...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.063

Time (mins)		Area
From:	To:	(ha)
0	4	0.063

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Geocellular Soakaway A Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Geocellular Storage Cra...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 76.100

Cellular Storage Structure

Invert Level (m) 74.100 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.13320 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.13320

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	28.0	28.0	1.600	0.0	61.0
1.500	28.0	61.0			

Simpson Associates			Page 1																																																																																																																																																																																																																			
1 Market Place Mews Henley-on-Thames RG9 2AH		Permeable Paving (Area A1) Roadside Services Holt Road, Wrexham																																																																																																																																																																																																																				
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Summary of Results for 100 year Return Period (+30%) Half Drain Time : 87 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 Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>75.884</td><td>0.129</td><td>0.3</td><td>1.5</td><td>O K</td></tr><tr><td>30 min Summer</td><td>75.927</td><td>0.172</td><td>0.3</td><td>1.9</td><td>Flood Risk</td></tr><tr><td>60 min Summer</td><td>75.961</td><td>0.206</td><td>0.3</td><td>2.3</td><td>Flood Risk</td></tr><tr><td>120 min Summer</td><td>75.977</td><td>0.222</td><td>0.3</td><td>2.5</td><td>Flood Risk</td></tr><tr><td>180 min Summer</td><td>75.976</td><td>0.221</td><td>0.3</td><td>2.5</td><td>Flood Risk</td></tr><tr><td>240 min Summer</td><td>75.969</td><td>0.214</td><td>0.3</td><td>2.4</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>75.948</td><td>0.193</td><td>0.3</td><td>2.2</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>75.927</td><td>0.172</td><td>0.3</td><td>1.9</td><td>Flood Risk</td></tr><tr><td>600 min Summer</td><td>75.907</td><td>0.152</td><td>0.3</td><td>1.7</td><td>O K</td></tr><tr><td>720 min Summer</td><td>75.888</td><td>0.133</td><td>0.3</td><td>1.5</td><td>O K</td></tr><tr><td>960 min Summer</td><td>75.856</td><td>0.101</td><td>0.3</td><td>1.1</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>75.815</td><td>0.060</td><td>0.3</td><td>0.7</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>75.797</td><td>0.042</td><td>0.2</td><td>0.5</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>75.790</td><td>0.035</td><td>0.2</td><td>0.4</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>75.781</td><td>0.026</td><td>0.1</td><td>0.3</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>75.775</td><td>0.020</td><td>0.1</td><td>0.2</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>75.772</td><td>0.017</td><td>0.1</td><td>0.2</td><td>O K</td></tr><tr><td>8640 min 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min Summer</td><td>8.997</td><td>0.0</td><td>362</td></tr><tr><td>720 min Summer</td><td>7.835</td><td>0.0</td><td>422</td></tr><tr><td>960 min Summer</td><td>6.294</td><td>0.0</td><td>540</td></tr><tr><td>1440 min Summer</td><td>4.613</td><td>0.0</td><td>764</td></tr><tr><td>2160 min Summer</td><td>3.374</td><td>0.0</td><td>1104</td></tr><tr><td>2880 min Summer</td><td>2.698</td><td>0.0</td><td>1468</td></tr><tr><td>4320 min Summer</td><td>1.966</td><td>0.0</td><td>2200</td></tr><tr><td>5760 min Summer</td><td>1.568</td><td>0.0</td><td>2936</td></tr><tr><td>7200 min Summer</td><td>1.315</td><td>0.0</td><td>3656</td></tr><tr><td>8640 min Summer</td><td>1.139</td><td>0.0</td><td>4400</td></tr><tr><td>10080 min Summer</td><td>1.009</td><td>0.0</td><td>5032</td></tr><tr><td>15 min Winter</td><td>107.735</td><td>0.0</td><td>17</td></tr></tbody></table>					Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	75.884	0.129	0.3	1.5	O K	30 min Summer	75.927	0.172	0.3	1.9	Flood Risk	60 min Summer	75.961	0.206	0.3	2.3	Flood Risk	120 min Summer	75.977	0.222	0.3	2.5	Flood Risk	180 min Summer	75.976	0.221	0.3	2.5	Flood Risk	240 min Summer	75.969	0.214	0.3	2.4	Flood Risk	360 min Summer	75.948	0.193	0.3	2.2	Flood Risk	480 min Summer	75.927	0.172	0.3	1.9	Flood Risk	600 min Summer	75.907	0.152	0.3	1.7	O K	720 min Summer	75.888	0.133	0.3	1.5	O K	960 min Summer	75.856	0.101	0.3	1.1	O K	1440 min Summer	75.815	0.060	0.3	0.7	O K	2160 min Summer	75.797	0.042	0.2	0.5	O K	2880 min Summer	75.790	0.035	0.2	0.4	O K	4320 min Summer	75.781	0.026	0.1	0.3	O K	5760 min Summer	75.775	0.020	0.1	0.2	O K	7200 min Summer	75.772	0.017	0.1	0.2	O K	8640 min Summer	75.770	0.015	0.1	0.2	O K	10080 min Summer	75.768	0.013	0.1	0.1	O K	15 min Winter	75.903	0.148	0.3	1.7	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	107.735	0.0	17	30 min Summer	72.905	0.0	32	60 min Summer	47.182	0.0	60	120 min Summer	29.539	0.0	94	180 min 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Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area A1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area A...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.952	0.197	0.3	2.2	Flood Risk
60 min Winter	75.993	0.238	0.3	2.7	Flood Risk
120 min Winter	76.010	0.255	0.3	2.9	Flood Risk
180 min Winter	76.007	0.252	0.3	2.8	Flood Risk
240 min Winter	75.996	0.241	0.3	2.7	Flood Risk
360 min Winter	75.963	0.208	0.3	2.3	Flood Risk
480 min Winter	75.930	0.175	0.3	2.0	Flood Risk
600 min Winter	75.898	0.143	0.3	1.6	O K
720 min Winter	75.870	0.115	0.3	1.3	O K
960 min Winter	75.826	0.071	0.3	0.8	O K
1440 min Winter	75.798	0.043	0.2	0.5	O K
2160 min Winter	75.787	0.032	0.2	0.4	O K
2880 min Winter	75.780	0.025	0.1	0.3	O K
4320 min Winter	75.774	0.019	0.1	0.2	O K
5760 min Winter	75.770	0.015	0.1	0.2	O K
7200 min Winter	75.767	0.012	0.1	0.1	O K
8640 min Winter	75.766	0.011	0.1	0.1	O K
10080 min Winter	75.765	0.010	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	31
60 min Winter	47.182	0.0	60
120 min Winter	29.539	0.0	102
180 min Winter	22.146	0.0	138
240 min Winter	17.930	0.0	176
360 min Winter	13.215	0.0	250
480 min Winter	10.647	0.0	318
600 min Winter	8.997	0.0	384
720 min Winter	7.835	0.0	444
960 min Winter	6.294	0.0	550
1440 min Winter	4.613	0.0	752
2160 min Winter	3.374	0.0	1104
2880 min Winter	2.698	0.0	1476
4320 min Winter	1.966	0.0	2204
5760 min Winter	1.568	0.0	2936
7200 min Winter	1.315	0.0	3680
8640 min Winter	1.139	0.0	4280
10080 min Winter	1.009	0.0	5240

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area A1) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area A...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.009

Time (mins)	Area
From:	To: (ha)
0	4 0.009

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area A1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area A...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 76.210

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	7.5
Max Percolation (l/s)	10.4	Slope (1:X)	0.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.755	Cap Volume Depth (m)	0.255

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area A2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area A...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 87 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.699	0.129	0.3	1.5	O K
30 min Summer	75.742	0.172	0.3	1.9	Flood Risk
60 min Summer	75.776	0.206	0.3	2.3	Flood Risk
120 min Summer	75.792	0.222	0.3	2.5	Flood Risk
180 min Summer	75.791	0.221	0.3	2.5	Flood Risk
240 min Summer	75.784	0.214	0.3	2.4	Flood Risk
360 min Summer	75.763	0.193	0.3	2.2	Flood Risk
480 min Summer	75.742	0.172	0.3	1.9	Flood Risk
600 min Summer	75.722	0.152	0.3	1.7	O K
720 min Summer	75.703	0.133	0.3	1.5	O K
960 min Summer	75.671	0.101	0.3	1.1	O K
1440 min Summer	75.630	0.060	0.3	0.7	O K
2160 min Summer	75.612	0.042	0.2	0.5	O K
2880 min Summer	75.605	0.035	0.2	0.4	O K
4320 min Summer	75.596	0.026	0.1	0.3	O K
5760 min Summer	75.590	0.020	0.1	0.2	O K
7200 min Summer	75.587	0.017	0.1	0.2	O K
8640 min Summer	75.585	0.015	0.1	0.2	O K
10080 min Summer	75.583	0.013	0.1	0.1	O K
15 min Winter	75.718	0.148	0.3	1.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	17
30 min Summer	72.905	0.0	32
60 min Summer	47.182	0.0	60
120 min Summer	29.539	0.0	94
180 min Summer	22.146	0.0	128
240 min Summer	17.930	0.0	162
360 min Summer	13.215	0.0	230
480 min Summer	10.647	0.0	296
600 min Summer	8.997	0.0	362
720 min Summer	7.835	0.0	422
960 min Summer	6.294	0.0	540
1440 min Summer	4.613	0.0	764
2160 min Summer	3.374	0.0	1104
2880 min Summer	2.698	0.0	1468
4320 min Summer	1.966	0.0	2200
5760 min Summer	1.568	0.0	2936
7200 min Summer	1.315	0.0	3656
8640 min Summer	1.139	0.0	4400
10080 min Summer	1.009	0.0	5032
15 min Winter	107.735	0.0	17

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area A2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area A...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.767	0.197	0.3	2.2	Flood Risk
60 min Winter	75.808	0.238	0.3	2.7	Flood Risk
120 min Winter	75.825	0.255	0.3	2.9	Flood Risk
180 min Winter	75.822	0.252	0.3	2.8	Flood Risk
240 min Winter	75.811	0.241	0.3	2.7	Flood Risk
360 min Winter	75.778	0.208	0.3	2.3	Flood Risk
480 min Winter	75.745	0.175	0.3	2.0	Flood Risk
600 min Winter	75.713	0.143	0.3	1.6	O K
720 min Winter	75.685	0.115	0.3	1.3	O K
960 min Winter	75.641	0.071	0.3	0.8	O K
1440 min Winter	75.613	0.043	0.2	0.5	O K
2160 min Winter	75.602	0.032	0.2	0.4	O K
2880 min Winter	75.595	0.025	0.1	0.3	O K
4320 min Winter	75.589	0.019	0.1	0.2	O K
5760 min Winter	75.585	0.015	0.1	0.2	O K
7200 min Winter	75.582	0.012	0.1	0.1	O K
8640 min Winter	75.581	0.011	0.1	0.1	O K
10080 min Winter	75.580	0.010	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	31
60 min Winter	47.182	0.0	60
120 min Winter	29.539	0.0	102
180 min Winter	22.146	0.0	138
240 min Winter	17.930	0.0	176
360 min Winter	13.215	0.0	250
480 min Winter	10.647	0.0	318
600 min Winter	8.997	0.0	384
720 min Winter	7.835	0.0	444
960 min Winter	6.294	0.0	550
1440 min Winter	4.613	0.0	752
2160 min Winter	3.374	0.0	1104
2880 min Winter	2.698	0.0	1476
4320 min Winter	1.966	0.0	2204
5760 min Winter	1.568	0.0	2936
7200 min Winter	1.315	0.0	3680
8640 min Winter	1.139	0.0	4280
10080 min Winter	1.009	0.0	5240

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area A2) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area A...	Checked by G.S.C	
Micro Drainage		Source Control 2015.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.009

Time (mins)		Area
From:	To:	(ha)
0	4	0.009

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area A2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area A...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 76.025

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	7.5
Max Percolation (l/s)	10.4	Slope (1:X)	0.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.570	Cap Volume Depth (m)	0.255

Simpson Associates				Page 1	
1 Market Place Mews Henley-on-Thames RG9 2AH		Permeable Paving (Area B1) Roadside Services Holt Road, Wrexham			
Date 29.04.16 File Permeable Paving Area B...		Designed by G.S.C Checked by G.S.C			
Micro Drainage		Source Control 2015.1			
Summary of Results for 100 year Return Period (+30%)					
Half Drain Time : 31 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	76.123	0.101		0.6	1.2 Flood Risk
30 min Summer	76.138	0.116		0.7	1.6 Flood Risk
60 min Summer	76.147	0.125		0.7	1.9 Flood Risk
120 min Summer	76.149	0.127		0.7	1.9 Flood Risk
180 min Summer	76.145	0.123		0.7	1.8 Flood Risk
240 min Summer	76.139	0.117		0.7	1.7 Flood Risk
360 min Summer	76.129	0.107		0.6	1.4 Flood Risk
480 min Summer	76.119	0.097		0.6	1.1 O K
600 min Summer	76.112	0.090		0.5	1.0 O K
720 min Summer	76.105	0.083		0.5	0.8 O K
960 min Summer	76.094	0.072		0.4	0.6 O K
1440 min Summer	76.080	0.058		0.3	0.4 O K
2160 min Summer	76.070	0.048		0.3	0.3 O K
2880 min Summer	76.065	0.043		0.2	0.2 O K
4320 min Summer	76.059	0.037		0.2	0.2 O K
5760 min Summer	76.055	0.033		0.1	0.1 O K
7200 min Summer	76.052	0.030		0.1	0.1 O K
8640 min Summer	76.050	0.028		0.1	0.1 O K
10080 min Summer	76.048	0.026		0.1	0.1 O K
15 min Winter	76.132	0.110		0.6	1.4 Flood Risk
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	
15 min Summer		107.735	0.0	16	
30 min Summer		72.905	0.0	26	
60 min Summer		47.182	0.0	44	
120 min Summer		29.539	0.0	78	
180 min Summer		22.146	0.0	110	
240 min Summer		17.930	0.0	142	
360 min Summer		13.215	0.0	206	
480 min Summer		10.647	0.0	266	
600 min Summer		8.997	0.0	326	
720 min Summer		7.835	0.0	386	
960 min Summer		6.294	0.0	504	
1440 min Summer		4.613	0.0	738	
2160 min Summer		3.374	0.0	1100	
2880 min Summer		2.698	0.0	1468	
4320 min Summer		1.966	0.0	2192	
5760 min Summer		1.568	0.0	2928	
7200 min Summer		1.315	0.0	3600	
8640 min Summer		1.139	0.0	4408	
10080 min Summer		1.009	0.0	5096	
15 min Winter		107.735	0.0	16	
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Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area B...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	76.147	0.125	0.7	1.9	Flood Risk
60 min Winter	76.156	0.134	0.7	2.1	Flood Risk
120 min Winter	76.154	0.132	0.7	2.1	Flood Risk
180 min Winter	76.146	0.124	0.7	1.9	Flood Risk
240 min Winter	76.138	0.116	0.7	1.6	Flood Risk
360 min Winter	76.123	0.101	0.6	1.2	Flood Risk
480 min Winter	76.111	0.089	0.5	0.9	O K
600 min Winter	76.101	0.079	0.5	0.8	O K
720 min Winter	76.093	0.071	0.4	0.6	O K
960 min Winter	76.082	0.060	0.4	0.4	O K
1440 min Winter	76.070	0.048	0.3	0.3	O K
2160 min Winter	76.063	0.041	0.2	0.2	O K
2880 min Winter	76.058	0.036	0.2	0.2	O K
4320 min Winter	76.053	0.031	0.1	0.1	O K
5760 min Winter	76.050	0.028	0.1	0.1	O K
7200 min Winter	76.047	0.025	0.1	0.1	O K
8640 min Winter	76.045	0.023	0.1	0.1	O K
10080 min Winter	76.044	0.022	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	28
60 min Winter	47.182	0.0	46
120 min Winter	29.539	0.0	84
180 min Winter	22.146	0.0	118
240 min Winter	17.930	0.0	150
360 min Winter	13.215	0.0	214
480 min Winter	10.647	0.0	274
600 min Winter	8.997	0.0	334
720 min Winter	7.835	0.0	392
960 min Winter	6.294	0.0	510
1440 min Winter	4.613	0.0	734
2160 min Winter	3.374	0.0	1092
2880 min Winter	2.698	0.0	1468
4320 min Winter	1.966	0.0	2204
5760 min Winter	1.568	0.0	2936
7200 min Winter	1.315	0.0	3608
8640 min Winter	1.139	0.0	4360
10080 min Winter	1.009	0.0	5136

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B1) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area B...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.010

Time (mins)	Area
From:	To: (ha)
0	4 0.010

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B1) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area B...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 76.422

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	27.8	Slope (1:X)	40.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.022	Cap Volume Depth (m)	0.200

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area B...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 31 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	76.027	0.101	0.3	0.6	Flood Risk
30 min Summer	76.042	0.116	0.3	0.8	Flood Risk
60 min Summer	76.051	0.125	0.4	0.9	Flood Risk
120 min Summer	76.053	0.127	0.4	1.0	Flood Risk
180 min Summer	76.049	0.123	0.4	0.9	Flood Risk
240 min Summer	76.043	0.117	0.3	0.8	Flood Risk
360 min Summer	76.033	0.107	0.3	0.7	Flood Risk
480 min Summer	76.023	0.097	0.3	0.6	O K
600 min Summer	76.016	0.090	0.3	0.5	O K
720 min Summer	76.009	0.083	0.2	0.4	O K
960 min Summer	75.998	0.072	0.2	0.3	O K
1440 min Summer	75.984	0.058	0.2	0.2	O K
2160 min Summer	75.974	0.048	0.1	0.1	O K
2880 min Summer	75.969	0.043	0.1	0.1	O K
4320 min Summer	75.963	0.037	0.1	0.1	O K
5760 min Summer	75.959	0.033	0.1	0.1	O K
7200 min Summer	75.956	0.030	0.1	0.1	O K
8640 min Summer	75.954	0.028	0.0	0.0	O K
10080 min Summer	75.952	0.026	0.0	0.0	O K
15 min Winter	76.036	0.110	0.3	0.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	16
30 min Summer	72.905	0.0	26
60 min Summer	47.182	0.0	44
120 min Summer	29.539	0.0	78
180 min Summer	22.146	0.0	110
240 min Summer	17.930	0.0	142
360 min Summer	13.215	0.0	206
480 min Summer	10.647	0.0	266
600 min Summer	8.997	0.0	326
720 min Summer	7.835	0.0	386
960 min Summer	6.294	0.0	504
1440 min Summer	4.613	0.0	738
2160 min Summer	3.374	0.0	1100
2880 min Summer	2.698	0.0	1468
4320 min Summer	1.966	0.0	2192
5760 min Summer	1.568	0.0	2928
7200 min Summer	1.315	0.0	3600
8640 min Summer	1.139	0.0	4408
10080 min Summer	1.009	0.0	5096
15 min Winter	107.735	0.0	16

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area B...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	76.051	0.125	0.4	0.9	Flood Risk
60 min Winter	76.060	0.134	0.4	1.1	Flood Risk
120 min Winter	76.058	0.132	0.4	1.0	Flood Risk
180 min Winter	76.050	0.124	0.4	0.9	Flood Risk
240 min Winter	76.042	0.116	0.3	0.8	Flood Risk
360 min Winter	76.027	0.101	0.3	0.6	Flood Risk
480 min Winter	76.015	0.089	0.3	0.5	O K
600 min Winter	76.005	0.079	0.2	0.4	O K
720 min Winter	75.997	0.071	0.2	0.3	O K
960 min Winter	75.986	0.060	0.2	0.2	O K
1440 min Winter	75.974	0.048	0.1	0.1	O K
2160 min Winter	75.967	0.041	0.1	0.1	O K
2880 min Winter	75.962	0.036	0.1	0.1	O K
4320 min Winter	75.957	0.031	0.1	0.1	O K
5760 min Winter	75.954	0.028	0.0	0.0	O K
7200 min Winter	75.951	0.025	0.0	0.0	O K
8640 min Winter	75.949	0.023	0.0	0.0	O K
10080 min Winter	75.948	0.022	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	28
60 min Winter	47.182	0.0	46
120 min Winter	29.539	0.0	84
180 min Winter	22.146	0.0	118
240 min Winter	17.930	0.0	150
360 min Winter	13.215	0.0	214
480 min Winter	10.647	0.0	274
600 min Winter	8.997	0.0	334
720 min Winter	7.835	0.0	392
960 min Winter	6.294	0.0	510
1440 min Winter	4.613	0.0	734
2160 min Winter	3.374	0.0	1092
2880 min Winter	2.698	0.0	1468
4320 min Winter	1.966	0.0	2204
5760 min Winter	1.568	0.0	2936
7200 min Winter	1.315	0.0	3608
8640 min Winter	1.139	0.0	4360
10080 min Winter	1.009	0.0	5136

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B2) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area B...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.005

Time (mins)	Area
From:	To: (ha)
0	4 0.005

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area B...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 76.326

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	13.9	Slope (1:X)	40.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.926	Cap Volume Depth (m)	0.200

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B3) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area B...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 31 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.915	0.101	0.3	0.6	Flood Risk
30 min Summer	75.930	0.116	0.3	0.8	Flood Risk
60 min Summer	75.939	0.125	0.4	0.9	Flood Risk
120 min Summer	75.941	0.127	0.4	1.0	Flood Risk
180 min Summer	75.937	0.123	0.4	0.9	Flood Risk
240 min Summer	75.931	0.117	0.3	0.8	Flood Risk
360 min Summer	75.921	0.107	0.3	0.7	Flood Risk
480 min Summer	75.911	0.097	0.3	0.6	O K
600 min Summer	75.904	0.090	0.3	0.5	O K
720 min Summer	75.897	0.083	0.2	0.4	O K
960 min Summer	75.886	0.072	0.2	0.3	O K
1440 min Summer	75.872	0.058	0.2	0.2	O K
2160 min Summer	75.862	0.048	0.1	0.1	O K
2880 min Summer	75.857	0.043	0.1	0.1	O K
4320 min Summer	75.851	0.037	0.1	0.1	O K
5760 min Summer	75.847	0.033	0.1	0.1	O K
7200 min Summer	75.844	0.030	0.1	0.1	O K
8640 min Summer	75.842	0.028	0.0	0.0	O K
10080 min Summer	75.840	0.026	0.0	0.0	O K
15 min Winter	75.924	0.110	0.3	0.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	16
30 min Summer	72.905	0.0	26
60 min Summer	47.182	0.0	44
120 min Summer	29.539	0.0	78
180 min Summer	22.146	0.0	110
240 min Summer	17.930	0.0	142
360 min Summer	13.215	0.0	206
480 min Summer	10.647	0.0	266
600 min Summer	8.997	0.0	326
720 min Summer	7.835	0.0	386
960 min Summer	6.294	0.0	504
1440 min Summer	4.613	0.0	738
2160 min Summer	3.374	0.0	1100
2880 min Summer	2.698	0.0	1468
4320 min Summer	1.966	0.0	2192
5760 min Summer	1.568	0.0	2928
7200 min Summer	1.315	0.0	3600
8640 min Summer	1.139	0.0	4408
10080 min Summer	1.009	0.0	5096
15 min Winter	107.735	0.0	16

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B3) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area B...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.939	0.125	0.4	0.9	Flood Risk
60 min Winter	75.948	0.134	0.4	1.1	Flood Risk
120 min Winter	75.946	0.132	0.4	1.0	Flood Risk
180 min Winter	75.938	0.124	0.4	0.9	Flood Risk
240 min Winter	75.930	0.116	0.3	0.8	Flood Risk
360 min Winter	75.915	0.101	0.3	0.6	Flood Risk
480 min Winter	75.903	0.089	0.3	0.5	O K
600 min Winter	75.893	0.079	0.2	0.4	O K
720 min Winter	75.885	0.071	0.2	0.3	O K
960 min Winter	75.874	0.060	0.2	0.2	O K
1440 min Winter	75.862	0.048	0.1	0.1	O K
2160 min Winter	75.855	0.041	0.1	0.1	O K
2880 min Winter	75.850	0.036	0.1	0.1	O K
4320 min Winter	75.845	0.031	0.1	0.1	O K
5760 min Winter	75.842	0.028	0.0	0.0	O K
7200 min Winter	75.839	0.025	0.0	0.0	O K
8640 min Winter	75.837	0.023	0.0	0.0	O K
10080 min Winter	75.836	0.022	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	28
60 min Winter	47.182	0.0	46
120 min Winter	29.539	0.0	84
180 min Winter	22.146	0.0	118
240 min Winter	17.930	0.0	150
360 min Winter	13.215	0.0	214
480 min Winter	10.647	0.0	274
600 min Winter	8.997	0.0	334
720 min Winter	7.835	0.0	392
960 min Winter	6.294	0.0	510
1440 min Winter	4.613	0.0	734
2160 min Winter	3.374	0.0	1092
2880 min Winter	2.698	0.0	1468
4320 min Winter	1.966	0.0	2204
5760 min Winter	1.568	0.0	2936
7200 min Winter	1.315	0.0	3608
8640 min Winter	1.139	0.0	4360
10080 min Winter	1.009	0.0	5136

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B3) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area B...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.005

Time (mins)	Area
From:	To: (ha)
0	4 0.005

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B3) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area B...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 76.214

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	13.9	Slope (1:X)	40.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.814	Cap Volume Depth (m)	0.200

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B4) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area B...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 33 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.828	0.106	0.2	0.5	Flood Risk
30 min Summer	75.843	0.121	0.3	0.7	Flood Risk
60 min Summer	75.853	0.131	0.3	0.8	Flood Risk
120 min Summer	75.855	0.133	0.3	0.8	Flood Risk
180 min Summer	75.851	0.129	0.3	0.7	Flood Risk
240 min Summer	75.845	0.123	0.3	0.7	Flood Risk
360 min Summer	75.834	0.112	0.2	0.6	Flood Risk
480 min Summer	75.824	0.102	0.2	0.5	Flood Risk
600 min Summer	75.816	0.094	0.2	0.4	O K
720 min Summer	75.809	0.087	0.2	0.3	O K
960 min Summer	75.798	0.076	0.2	0.3	O K
1440 min Summer	75.783	0.061	0.1	0.2	O K
2160 min Summer	75.771	0.049	0.1	0.1	O K
2880 min Summer	75.766	0.044	0.1	0.1	O K
4320 min Summer	75.760	0.038	0.1	0.1	O K
5760 min Summer	75.756	0.034	0.1	0.1	O K
7200 min Summer	75.753	0.031	0.0	0.0	O K
8640 min Summer	75.751	0.029	0.0	0.0	O K
10080 min Summer	75.749	0.027	0.0	0.0	O K
15 min Winter	75.836	0.114	0.3	0.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	16
30 min Summer	72.905	0.0	27
60 min Summer	47.182	0.0	44
120 min Summer	29.539	0.0	78
180 min Summer	22.146	0.0	112
240 min Summer	17.930	0.0	144
360 min Summer	13.215	0.0	206
480 min Summer	10.647	0.0	266
600 min Summer	8.997	0.0	326
720 min Summer	7.835	0.0	388
960 min Summer	6.294	0.0	508
1440 min Summer	4.613	0.0	748
2160 min Summer	3.374	0.0	1100
2880 min Summer	2.698	0.0	1452
4320 min Summer	1.966	0.0	2184
5760 min Summer	1.568	0.0	2912
7200 min Summer	1.315	0.0	3592
8640 min Summer	1.139	0.0	4304
10080 min Summer	1.009	0.0	5008
15 min Winter	107.735	0.0	16

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B4) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area B...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.853	0.131	0.3	0.8	Flood Risk
60 min Winter	75.863	0.141	0.3	0.9	Flood Risk
120 min Winter	75.861	0.139	0.3	0.9	Flood Risk
180 min Winter	75.853	0.131	0.3	0.8	Flood Risk
240 min Winter	75.844	0.122	0.3	0.7	Flood Risk
360 min Winter	75.828	0.106	0.2	0.5	Flood Risk
480 min Winter	75.816	0.094	0.2	0.4	O K
600 min Winter	75.806	0.084	0.2	0.3	O K
720 min Winter	75.798	0.076	0.2	0.3	O K
960 min Winter	75.785	0.063	0.1	0.2	O K
1440 min Winter	75.771	0.049	0.1	0.1	O K
2160 min Winter	75.764	0.042	0.1	0.1	O K
2880 min Winter	75.760	0.038	0.1	0.1	O K
4320 min Winter	75.754	0.032	0.0	0.0	O K
5760 min Winter	75.751	0.029	0.0	0.0	O K
7200 min Winter	75.748	0.026	0.0	0.0	O K
8640 min Winter	75.746	0.024	0.0	0.0	O K
10080 min Winter	75.745	0.023	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	29
60 min Winter	47.182	0.0	48
120 min Winter	29.539	0.0	84
180 min Winter	22.146	0.0	118
240 min Winter	17.930	0.0	150
360 min Winter	13.215	0.0	214
480 min Winter	10.647	0.0	276
600 min Winter	8.997	0.0	336
720 min Winter	7.835	0.0	396
960 min Winter	6.294	0.0	512
1440 min Winter	4.613	0.0	728
2160 min Winter	3.374	0.0	1100
2880 min Winter	2.698	0.0	1468
4320 min Winter	1.966	0.0	2196
5760 min Winter	1.568	0.0	2944
7200 min Winter	1.315	0.0	3680
8640 min Winter	1.139	0.0	4456
10080 min Winter	1.009	0.0	5184

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B4) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area B...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.004

Time (mins)		Area
From:	To:	(ha)
0	4	0.004

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area B4) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area B...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 76.122

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	7.5
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	10.4	Slope (1:X)	40.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.722	Cap Volume Depth (m)	0.200

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area C1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area C...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 99 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.807	0.142	0.7	4.3	O K
30 min Summer	75.854	0.189	0.7	5.7	Flood Risk
60 min Summer	75.893	0.228	0.7	6.8	Flood Risk
120 min Summer	75.911	0.246	0.7	7.4	Flood Risk
180 min Summer	75.911	0.246	0.7	7.4	Flood Risk
240 min Summer	75.905	0.240	0.7	7.2	Flood Risk
360 min Summer	75.884	0.219	0.7	6.6	Flood Risk
480 min Summer	75.863	0.198	0.7	5.9	Flood Risk
600 min Summer	75.842	0.177	0.7	5.3	O K
720 min Summer	75.822	0.157	0.7	4.7	O K
960 min Summer	75.787	0.122	0.7	3.7	O K
1440 min Summer	75.737	0.072	0.7	2.2	O K
2160 min Summer	75.711	0.046	0.7	1.4	O K
2880 min Summer	75.702	0.037	0.6	1.1	O K
4320 min Summer	75.693	0.028	0.4	0.8	O K
5760 min Summer	75.687	0.022	0.3	0.7	O K
7200 min Summer	75.684	0.019	0.3	0.6	O K
8640 min Summer	75.681	0.016	0.2	0.5	O K
10080 min Summer	75.679	0.014	0.2	0.4	O K
15 min Winter	75.828	0.163	0.7	4.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	18
30 min Summer	72.905	0.0	32
60 min Summer	47.182	0.0	60
120 min Summer	29.539	0.0	98
180 min Summer	22.146	0.0	130
240 min Summer	17.930	0.0	164
360 min Summer	13.215	0.0	232
480 min Summer	10.647	0.0	300
600 min Summer	8.997	0.0	364
720 min Summer	7.835	0.0	428
960 min Summer	6.294	0.0	550
1440 min Summer	4.613	0.0	778
2160 min Summer	3.374	0.0	1104
2880 min Summer	2.698	0.0	1468
4320 min Summer	1.966	0.0	2200
5760 min Summer	1.568	0.0	2936
7200 min Summer	1.315	0.0	3616
8640 min Summer	1.139	0.0	4336
10080 min Summer	1.009	0.0	5000
15 min Winter	107.735	0.0	18

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area C1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area C...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.882	0.217	0.7	6.5	Flood Risk
60 min Winter	75.928	0.263	0.7	7.9	Flood Risk
120 min Winter	75.950	0.285	0.7	8.5	Flood Risk
180 min Winter	75.948	0.283	0.7	8.5	Flood Risk
240 min Winter	75.937	0.272	0.7	8.2	Flood Risk
360 min Winter	75.905	0.240	0.7	7.2	Flood Risk
480 min Winter	75.871	0.206	0.7	6.2	Flood Risk
600 min Winter	75.838	0.173	0.7	5.2	O K
720 min Winter	75.807	0.142	0.7	4.3	O K
960 min Winter	75.756	0.091	0.7	2.7	O K
1440 min Winter	75.712	0.047	0.7	1.4	O K
2160 min Winter	75.699	0.034	0.5	1.0	O K
2880 min Winter	75.693	0.028	0.4	0.8	O K
4320 min Winter	75.685	0.020	0.3	0.6	O K
5760 min Winter	75.681	0.016	0.2	0.5	O K
7200 min Winter	75.679	0.014	0.2	0.4	O K
8640 min Winter	75.677	0.012	0.2	0.3	O K
10080 min Winter	75.675	0.010	0.2	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	32
60 min Winter	47.182	0.0	60
120 min Winter	29.539	0.0	112
180 min Winter	22.146	0.0	140
240 min Winter	17.930	0.0	180
360 min Winter	13.215	0.0	254
480 min Winter	10.647	0.0	324
600 min Winter	8.997	0.0	390
720 min Winter	7.835	0.0	454
960 min Winter	6.294	0.0	568
1440 min Winter	4.613	0.0	750
2160 min Winter	3.374	0.0	1120
2880 min Winter	2.698	0.0	1452
4320 min Winter	1.966	0.0	2172
5760 min Winter	1.568	0.0	2920
7200 min Winter	1.315	0.0	3648
8640 min Winter	1.139	0.0	4344
10080 min Winter	1.009	0.0	5080

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area C1) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area C...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.026

Time (mins)	Area
From:	To: (ha)
0	4 0.026

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area C1) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area C...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 76.150

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	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	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.665	Cap Volume Depth (m)	0.285

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area D1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area D...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 44 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.608	0.068	0.7	1.8	O K
30 min Summer	75.629	0.089	0.7	2.4	O K
60 min Summer	75.645	0.105	0.7	2.8	Flood Risk
120 min Summer	75.652	0.112	0.7	3.0	Flood Risk
180 min Summer	75.648	0.108	0.7	2.9	Flood Risk
240 min Summer	75.641	0.101	0.7	2.7	Flood Risk
360 min Summer	75.624	0.084	0.7	2.3	O K
480 min Summer	75.610	0.070	0.7	1.9	O K
600 min Summer	75.598	0.058	0.7	1.6	O K
720 min Summer	75.591	0.051	0.7	1.4	O K
960 min Summer	75.583	0.043	0.6	1.2	O K
1440 min Summer	75.573	0.033	0.4	0.9	O K
2160 min Summer	75.565	0.025	0.3	0.7	O K
2880 min Summer	75.561	0.021	0.3	0.6	O K
4320 min Summer	75.555	0.015	0.2	0.4	O K
5760 min Summer	75.552	0.012	0.2	0.3	O K
7200 min Summer	75.550	0.010	0.1	0.3	O K
8640 min Summer	75.549	0.009	0.1	0.2	O K
10080 min Summer	75.548	0.008	0.1	0.2	O K
15 min Winter	75.619	0.079	0.7	2.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	16
30 min Summer	72.905	0.0	30
60 min Summer	47.182	0.0	48
120 min Summer	29.539	0.0	82
180 min Summer	22.146	0.0	116
240 min Summer	17.930	0.0	150
360 min Summer	13.215	0.0	212
480 min Summer	10.647	0.0	272
600 min Summer	8.997	0.0	328
720 min Summer	7.835	0.0	384
960 min Summer	6.294	0.0	502
1440 min Summer	4.613	0.0	748
2160 min Summer	3.374	0.0	1104
2880 min Summer	2.698	0.0	1468
4320 min Summer	1.966	0.0	2204
5760 min Summer	1.568	0.0	2936
7200 min Summer	1.315	0.0	3584
8640 min Summer	1.139	0.0	4408
10080 min Summer	1.009	0.0	5136
15 min Winter	107.735	0.0	17

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area D1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area D...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.644	0.104	0.7	2.8	Flood Risk
60 min Winter	75.661	0.121	0.7	3.3	Flood Risk
120 min Winter	75.665	0.125	0.7	3.4	Flood Risk
180 min Winter	75.656	0.116	0.7	3.1	Flood Risk
240 min Winter	75.643	0.103	0.7	2.8	Flood Risk
360 min Winter	75.617	0.077	0.7	2.1	O K
480 min Winter	75.597	0.057	0.7	1.5	O K
600 min Winter	75.587	0.047	0.6	1.3	O K
720 min Winter	75.582	0.042	0.6	1.1	O K
960 min Winter	75.575	0.035	0.5	0.9	O K
1440 min Winter	75.566	0.026	0.3	0.7	O K
2160 min Winter	75.559	0.019	0.3	0.5	O K
2880 min Winter	75.555	0.015	0.2	0.4	O K
4320 min Winter	75.551	0.011	0.1	0.3	O K
5760 min Winter	75.549	0.009	0.1	0.2	O K
7200 min Winter	75.547	0.007	0.1	0.2	O K
8640 min Winter	75.546	0.006	0.1	0.2	O K
10080 min Winter	75.546	0.006	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	30
60 min Winter	47.182	0.0	52
120 min Winter	29.539	0.0	90
180 min Winter	22.146	0.0	126
240 min Winter	17.930	0.0	160
360 min Winter	13.215	0.0	224
480 min Winter	10.647	0.0	278
600 min Winter	8.997	0.0	330
720 min Winter	7.835	0.0	390
960 min Winter	6.294	0.0	510
1440 min Winter	4.613	0.0	750
2160 min Winter	3.374	0.0	1104
2880 min Winter	2.698	0.0	1468
4320 min Winter	1.966	0.0	2196
5760 min Winter	1.568	0.0	2936
7200 min Winter	1.315	0.0	3680
8640 min Winter	1.139	0.0	4416
10080 min Winter	1.009	0.0	5136

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area D1) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area D...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.013

Time (mins)	Area
From:	To: (ha)
0	4 0.013

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area D1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area D...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.940

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	18.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	25.0	Slope (1:X)	0.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.540	Cap Volume Depth (m)	0.200

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1 Market Place Mews Henley-on-Thames RG9 2AH		Pub Permeable Paving (Area D2) Roadside Services Holt Road, Wrexham																																																																																																																																																																																																																					
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Summer</td><td>75.454</td><td>0.078</td><td>0.2</td><td>0.8</td><td>O K</td></tr><tr><td>600 min Summer</td><td>75.441</td><td>0.065</td><td>0.2</td><td>0.6</td><td>O K</td></tr><tr><td>720 min Summer</td><td>75.432</td><td>0.056</td><td>0.2</td><td>0.5</td><td>O K</td></tr><tr><td>960 min Summer</td><td>75.422</td><td>0.046</td><td>0.2</td><td>0.4</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>75.412</td><td>0.036</td><td>0.2</td><td>0.3</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>75.403</td><td>0.027</td><td>0.1</td><td>0.3</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>75.398</td><td>0.022</td><td>0.1</td><td>0.2</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>75.392</td><td>0.016</td><td>0.1</td><td>0.2</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>75.389</td><td>0.013</td><td>0.1</td><td>0.1</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>75.387</td><td>0.011</td><td>0.1</td><td>0.1</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>75.386</td><td>0.010</td><td>0.0</td><td>0.1</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>75.385</td><td>0.009</td><td>0.0</td><td>0.1</td><td>O K</td></tr><tr><td>15 min Winter</td><td>75.462</td><td>0.086</td><td>0.2</td><td>0.8</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>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>107.735</td><td>0.0</td><td>17</td></tr><tr><td>30 min Summer</td><td>72.905</td><td>0.0</td><td>30</td></tr><tr><td>60 min Summer</td><td>47.182</td><td>0.0</td><td>48</td></tr><tr><td>120 min Summer</td><td>29.539</td><td>0.0</td><td>84</td></tr><tr><td>180 min Summer</td><td>22.146</td><td>0.0</td><td>118</td></tr><tr><td>240 min Summer</td><td>17.930</td><td>0.0</td><td>150</td></tr><tr><td>360 min Summer</td><td>13.215</td><td>0.0</td><td>216</td></tr><tr><td>480 min Summer</td><td>10.647</td><td>0.0</td><td>276</td></tr><tr><td>600 min Summer</td><td>8.997</td><td>0.0</td><td>332</td></tr><tr><td>720 min Summer</td><td>7.835</td><td>0.0</td><td>390</td></tr><tr><td>960 min Summer</td><td>6.294</td><td>0.0</td><td>502</td></tr><tr><td>1440 min Summer</td><td>4.613</td><td>0.0</td><td>740</td></tr><tr><td>2160 min Summer</td><td>3.374</td><td>0.0</td><td>1104</td></tr><tr><td>2880 min Summer</td><td>2.698</td><td>0.0</td><td>1468</td></tr><tr><td>4320 min Summer</td><td>1.966</td><td>0.0</td><td>2204</td></tr><tr><td>5760 min Summer</td><td>1.568</td><td>0.0</td><td>2904</td></tr><tr><td>7200 min Summer</td><td>1.315</td><td>0.0</td><td>3664</td></tr><tr><td>8640 min Summer</td><td>1.139</td><td>0.0</td><td>4360</td></tr><tr><td>10080 min Summer</td><td>1.009</td><td>0.0</td><td>5104</td></tr><tr><td>15 min Winter</td><td>107.735</td><td>0.0</td><td>17</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	75.450	0.074	0.2	0.7	O K	30 min Summer	75.474	0.098	0.2	0.9	O K	60 min Summer	75.491	0.115	0.2	1.1	Flood Risk	120 min Summer	75.499	0.123	0.2	1.2	Flood Risk	180 min Summer	75.495	0.119	0.2	1.2	Flood Risk	240 min Summer	75.487	0.111	0.2	1.1	Flood Risk	360 min Summer	75.470	0.094	0.2	0.9	O K	480 min Summer	75.454	0.078	0.2	0.8	O K	600 min Summer	75.441	0.065	0.2	0.6	O K	720 min Summer	75.432	0.056	0.2	0.5	O K	960 min Summer	75.422	0.046	0.2	0.4	O K	1440 min Summer	75.412	0.036	0.2	0.3	O K	2160 min Summer	75.403	0.027	0.1	0.3	O K	2880 min Summer	75.398	0.022	0.1	0.2	O K	4320 min Summer	75.392	0.016	0.1	0.2	O K	5760 min Summer	75.389	0.013	0.1	0.1	O K	7200 min Summer	75.387	0.011	0.1	0.1	O K	8640 min Summer	75.386	0.010	0.0	0.1	O K	10080 min Summer	75.385	0.009	0.0	0.1	O K	15 min Winter	75.462	0.086	0.2	0.8	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	107.735	0.0	17	30 min Summer	72.905	0.0	30	60 min Summer	47.182	0.0	48	120 min Summer	29.539	0.0	84	180 min Summer	22.146	0.0	118	240 min Summer	17.930	0.0	150	360 min Summer	13.215	0.0	216	480 min Summer	10.647	0.0	276	600 min Summer	8.997	0.0	332	720 min Summer	7.835	0.0	390	960 min Summer	6.294	0.0	502	1440 min Summer	4.613	0.0	740	2160 min Summer	3.374	0.0	1104	2880 min Summer	2.698	0.0	1468	4320 min Summer	1.966	0.0	2204	5760 min Summer	1.568	0.0	2904	7200 min Summer	1.315	0.0	3664	8640 min Summer	1.139	0.0	4360	10080 min Summer	1.009	0.0	5104	15 min Winter	107.735	0.0	17
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1 Market Place Mews Henley-on-Thames RG9 2AH	Pub Permeable Paving (Area D2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area D...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.489	0.113	0.2	1.1	Flood Risk
60 min Winter	75.508	0.132	0.2	1.3	Flood Risk
120 min Winter	75.514	0.138	0.2	1.3	Flood Risk
180 min Winter	75.505	0.129	0.2	1.3	Flood Risk
240 min Winter	75.492	0.116	0.2	1.1	Flood Risk
360 min Winter	75.464	0.088	0.2	0.9	O K
480 min Winter	75.441	0.065	0.2	0.6	O K
600 min Winter	75.427	0.051	0.2	0.5	O K
720 min Winter	75.421	0.045	0.2	0.4	O K
960 min Winter	75.413	0.037	0.2	0.4	O K
1440 min Winter	75.404	0.028	0.1	0.3	O K
2160 min Winter	75.396	0.020	0.1	0.2	O K
2880 min Winter	75.392	0.016	0.1	0.2	O K
4320 min Winter	75.388	0.012	0.1	0.1	O K
5760 min Winter	75.386	0.010	0.0	0.1	O K
7200 min Winter	75.384	0.008	0.0	0.1	O K
8640 min Winter	75.383	0.007	0.0	0.1	O K
10080 min Winter	75.382	0.006	0.0	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	30
60 min Winter	47.182	0.0	56
120 min Winter	29.539	0.0	90
180 min Winter	22.146	0.0	128
240 min Winter	17.930	0.0	162
360 min Winter	13.215	0.0	228
480 min Winter	10.647	0.0	284
600 min Winter	8.997	0.0	332
720 min Winter	7.835	0.0	390
960 min Winter	6.294	0.0	510
1440 min Winter	4.613	0.0	748
2160 min Winter	3.374	0.0	1108
2880 min Winter	2.698	0.0	1472
4320 min Winter	1.966	0.0	2208
5760 min Winter	1.568	0.0	2928
7200 min Winter	1.315	0.0	3680
8640 min Winter	1.139	0.0	4408
10080 min Winter	1.009	0.0	4960

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1 Market Place Mews Henley-on-Thames RG9 2AH	Pub Permeable Paving (Area D2) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area D...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.005

Time (mins)		Area
From:	To:	(ha)
0	4	0.005

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1 Market Place Mews Henley-on-Thames RG9 2AH	Pub Permeable Paving (Area D2) Roadside Services Holt Road, Wrexham	
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Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.776

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.4
Max Percolation (l/s)	9.0	Slope (1:X)	0.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.376	Cap Volume Depth (m)	0.200

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1 Market Place Mews Henley-on-Thames RG9 2AH		Pub Permeable Paving (Area D3) Roadside Services Holt Road, Wrexham			
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Micro Drainage		Source Control 2015.1			
Summary of Results for 100 year Return Period (+30%)					
Half Drain Time : 49 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.274	0.074		0.2 0.7	O K
30 min Summer	75.298	0.098		0.2 0.9	O K
60 min Summer	75.315	0.115		0.2 1.1	Flood Risk
120 min Summer	75.323	0.123		0.2 1.2	Flood Risk
180 min Summer	75.319	0.119		0.2 1.2	Flood Risk
240 min Summer	75.311	0.111		0.2 1.1	Flood Risk
360 min Summer	75.294	0.094		0.2 0.9	O K
480 min Summer	75.278	0.078		0.2 0.8	O K
600 min Summer	75.265	0.065		0.2 0.6	O K
720 min Summer	75.256	0.056		0.2 0.5	O K
960 min Summer	75.246	0.046		0.2 0.4	O K
1440 min Summer	75.236	0.036		0.2 0.3	O K
2160 min Summer	75.227	0.027		0.1 0.3	O K
2880 min Summer	75.222	0.022		0.1 0.2	O K
4320 min Summer	75.216	0.016		0.1 0.2	O K
5760 min Summer	75.213	0.013		0.1 0.1	O K
7200 min Summer	75.211	0.011		0.1 0.1	O K
8640 min Summer	75.210	0.010		0.0 0.1	O K
10080 min Summer	75.209	0.009		0.0 0.1	O K
15 min Winter	75.286	0.086		0.2 0.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	107.735	0.0	17		
30 min Summer	72.905	0.0	30		
60 min Summer	47.182	0.0	48		
120 min Summer	29.539	0.0	84		
180 min Summer	22.146	0.0	118		
240 min Summer	17.930	0.0	150		
360 min Summer	13.215	0.0	216		
480 min Summer	10.647	0.0	276		
600 min Summer	8.997	0.0	332		
720 min Summer	7.835	0.0	390		
960 min Summer	6.294	0.0	502		
1440 min Summer	4.613	0.0	740		
2160 min Summer	3.374	0.0	1104		
2880 min Summer	2.698	0.0	1468		
4320 min Summer	1.966	0.0	2204		
5760 min Summer	1.568	0.0	2904		
7200 min Summer	1.315	0.0	3664		
8640 min Summer	1.139	0.0	4360		
10080 min Summer	1.009	0.0	5104		
15 min Winter	107.735	0.0	17		
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Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.313	0.113	0.2	1.1	Flood Risk
60 min Winter	75.332	0.132	0.2	1.3	Flood Risk
120 min Winter	75.338	0.138	0.2	1.3	Flood Risk
180 min Winter	75.329	0.129	0.2	1.3	Flood Risk
240 min Winter	75.316	0.116	0.2	1.1	Flood Risk
360 min Winter	75.288	0.088	0.2	0.9	O K
480 min Winter	75.265	0.065	0.2	0.6	O K
600 min Winter	75.251	0.051	0.2	0.5	O K
720 min Winter	75.245	0.045	0.2	0.4	O K
960 min Winter	75.237	0.037	0.2	0.4	O K
1440 min Winter	75.228	0.028	0.1	0.3	O K
2160 min Winter	75.220	0.020	0.1	0.2	O K
2880 min Winter	75.216	0.016	0.1	0.2	O K
4320 min Winter	75.212	0.012	0.1	0.1	O K
5760 min Winter	75.210	0.010	0.0	0.1	O K
7200 min Winter	75.208	0.008	0.0	0.1	O K
8640 min Winter	75.207	0.007	0.0	0.1	O K
10080 min Winter	75.206	0.006	0.0	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	30
60 min Winter	47.182	0.0	56
120 min Winter	29.539	0.0	90
180 min Winter	22.146	0.0	128
240 min Winter	17.930	0.0	162
360 min Winter	13.215	0.0	228
480 min Winter	10.647	0.0	284
600 min Winter	8.997	0.0	332
720 min Winter	7.835	0.0	390
960 min Winter	6.294	0.0	510
1440 min Winter	4.613	0.0	748
2160 min Winter	3.374	0.0	1108
2880 min Winter	2.698	0.0	1472
4320 min Winter	1.966	0.0	2208
5760 min Winter	1.568	0.0	2928
7200 min Winter	1.315	0.0	3680
8640 min Winter	1.139	0.0	4408
10080 min Winter	1.009	0.0	4960

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Pub Permeable Paving (Area D3) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area D...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.005

Time (mins)	Area
From:	To: (ha)
0	4 0.005

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Pub Permeable Paving (Area D3) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area D...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.600

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.4
Max Percolation (l/s)	9.0	Slope (1:X)	0.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.200	Cap Volume Depth (m)	0.200

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area E...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 194 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.020	0.252	0.6	5.7	O K
30 min Summer	75.105	0.337	0.6	7.6	O K
60 min Summer	75.184	0.416	0.6	9.4	O K
120 min Summer	75.238	0.470	0.6	10.6	Flood Risk
180 min Summer	75.246	0.478	0.6	10.8	Flood Risk
240 min Summer	75.242	0.474	0.6	10.7	Flood Risk
360 min Summer	75.223	0.455	0.6	10.2	O K
480 min Summer	75.201	0.433	0.6	9.8	O K
600 min Summer	75.179	0.411	0.6	9.2	O K
720 min Summer	75.155	0.387	0.6	8.7	O K
960 min Summer	75.109	0.341	0.6	7.7	O K
1440 min Summer	75.024	0.256	0.6	5.8	O K
2160 min Summer	74.922	0.154	0.6	3.5	O K
2880 min Summer	74.856	0.088	0.6	2.0	O K
4320 min Summer	74.814	0.046	0.5	1.0	O K
5760 min Summer	74.805	0.037	0.4	0.8	O K
7200 min Summer	74.799	0.031	0.3	0.7	O K
8640 min Summer	74.795	0.027	0.3	0.6	O K
10080 min Summer	74.792	0.024	0.3	0.5	O K
15 min Winter	75.054	0.286	0.6	6.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	18
30 min Summer	72.905	0.0	33
60 min Summer	47.182	0.0	62
120 min Summer	29.539	0.0	120
180 min Summer	22.146	0.0	162
240 min Summer	17.930	0.0	192
360 min Summer	13.215	0.0	256
480 min Summer	10.647	0.0	326
600 min Summer	8.997	0.0	394
720 min Summer	7.835	0.0	462
960 min Summer	6.294	0.0	596
1440 min Summer	4.613	0.0	852
2160 min Summer	3.374	0.0	1208
2880 min Summer	2.698	0.0	1528
4320 min Summer	1.966	0.0	2200
5760 min Summer	1.568	0.0	2928
7200 min Summer	1.315	0.0	3632
8640 min Summer	1.139	0.0	4344
10080 min Summer	1.009	0.0	5120
15 min Winter	107.735	0.0	18

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area E...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.151	0.383	0.6	8.6	O K
60 min Winter	75.243	0.475	0.6	10.7	Flood Risk
120 min Winter	75.313	0.545	0.6	12.3	Flood Risk
180 min Winter	75.330	0.562	0.6	12.6	Flood Risk
240 min Winter	75.323	0.555	0.6	12.5	Flood Risk
360 min Winter	75.296	0.528	0.6	11.9	Flood Risk
480 min Winter	75.264	0.496	0.6	11.2	Flood Risk
600 min Winter	75.228	0.460	0.6	10.4	O K
720 min Winter	75.191	0.423	0.6	9.5	O K
960 min Winter	75.119	0.351	0.6	7.9	O K
1440 min Winter	74.987	0.219	0.6	4.9	O K
2160 min Winter	74.849	0.081	0.6	1.8	O K
2880 min Winter	74.813	0.045	0.5	1.0	O K
4320 min Winter	74.801	0.033	0.4	0.7	O K
5760 min Winter	74.795	0.027	0.3	0.6	O K
7200 min Winter	74.790	0.022	0.2	0.5	O K
8640 min Winter	74.787	0.019	0.2	0.4	O K
10080 min Winter	74.785	0.017	0.2	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	32
60 min Winter	47.182	0.0	60
120 min Winter	29.539	0.0	118
180 min Winter	22.146	0.0	174
240 min Winter	17.930	0.0	224
360 min Winter	13.215	0.0	278
480 min Winter	10.647	0.0	354
600 min Winter	8.997	0.0	430
720 min Winter	7.835	0.0	504
960 min Winter	6.294	0.0	644
1440 min Winter	4.613	0.0	896
2160 min Winter	3.374	0.0	1212
2880 min Winter	2.698	0.0	1472
4320 min Winter	1.966	0.0	2168
5760 min Winter	1.568	0.0	2920
7200 min Winter	1.315	0.0	3648
8640 min Winter	1.139	0.0	4312
10080 min Winter	1.009	0.0	5064

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E1) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area E...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.032

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

0	4 0.032
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Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area E...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.529

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	15.0
Max Percolation (l/s)	20.8	Slope (1:X)	0.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	74.768	Cap Volume Depth (m)	0.561

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area E...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 38 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.554	0.139	0.2	0.5	Flood Risk
30 min Summer	75.576	0.161	0.2	0.7	Flood Risk
60 min Summer	75.589	0.174	0.2	0.8	Flood Risk
120 min Summer	75.595	0.180	0.2	0.9	Flood Risk
180 min Summer	75.592	0.177	0.2	0.8	Flood Risk
240 min Summer	75.587	0.172	0.2	0.8	Flood Risk
360 min Summer	75.575	0.160	0.2	0.7	Flood Risk
480 min Summer	75.564	0.149	0.2	0.6	Flood Risk
600 min Summer	75.554	0.139	0.2	0.5	Flood Risk
720 min Summer	75.546	0.131	0.2	0.5	Flood Risk
960 min Summer	75.531	0.116	0.2	0.4	Flood Risk
1440 min Summer	75.511	0.096	0.1	0.2	O K
2160 min Summer	75.491	0.076	0.1	0.2	O K
2880 min Summer	75.478	0.063	0.1	0.1	O K
4320 min Summer	75.464	0.049	0.1	0.1	O K
5760 min Summer	75.458	0.043	0.0	0.1	O K
7200 min Summer	75.455	0.040	0.0	0.0	O K
8640 min Summer	75.452	0.037	0.0	0.0	O K
10080 min Summer	75.450	0.035	0.0	0.0	O K
15 min Winter	75.566	0.151	0.2	0.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	17
30 min Summer	72.905	0.0	30
60 min Summer	47.182	0.0	46
120 min Summer	29.539	0.0	80
180 min Summer	22.146	0.0	114
240 min Summer	17.930	0.0	146
360 min Summer	13.215	0.0	212
480 min Summer	10.647	0.0	274
600 min Summer	8.997	0.0	336
720 min Summer	7.835	0.0	396
960 min Summer	6.294	0.0	518
1440 min Summer	4.613	0.0	752
2160 min Summer	3.374	0.0	1108
2880 min Summer	2.698	0.0	1472
4320 min Summer	1.966	0.0	2188
5760 min Summer	1.568	0.0	2936
7200 min Summer	1.315	0.0	3584
8640 min Summer	1.139	0.0	4280
10080 min Summer	1.009	0.0	5048
15 min Winter	107.735	0.0	17

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area E...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.588	0.173	0.2	0.8	Flood Risk
60 min Winter	75.601	0.186	0.2	0.9	Flood Risk
120 min Winter	75.604	0.189	0.3	1.0	Flood Risk
180 min Winter	75.598	0.183	0.2	0.9	Flood Risk
240 min Winter	75.590	0.175	0.2	0.8	Flood Risk
360 min Winter	75.572	0.157	0.2	0.7	Flood Risk
480 min Winter	75.557	0.142	0.2	0.5	Flood Risk
600 min Winter	75.544	0.129	0.2	0.4	Flood Risk
720 min Winter	75.533	0.118	0.2	0.4	Flood Risk
960 min Winter	75.516	0.101	0.1	0.3	Flood Risk
1440 min Winter	75.493	0.078	0.1	0.2	O K
2160 min Winter	75.473	0.058	0.1	0.1	O K
2880 min Winter	75.463	0.048	0.1	0.1	O K
4320 min Winter	75.456	0.041	0.0	0.0	O K
5760 min Winter	75.452	0.037	0.0	0.0	O K
7200 min Winter	75.449	0.034	0.0	0.0	O K
8640 min Winter	75.446	0.031	0.0	0.0	O K
10080 min Winter	75.444	0.029	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	30
60 min Winter	47.182	0.0	48
120 min Winter	29.539	0.0	86
180 min Winter	22.146	0.0	122
240 min Winter	17.930	0.0	156
360 min Winter	13.215	0.0	222
480 min Winter	10.647	0.0	286
600 min Winter	8.997	0.0	348
720 min Winter	7.835	0.0	406
960 min Winter	6.294	0.0	528
1440 min Winter	4.613	0.0	764
2160 min Winter	3.374	0.0	1108
2880 min Winter	2.698	0.0	1472
4320 min Winter	1.966	0.0	2180
5760 min Winter	1.568	0.0	2920
7200 min Winter	1.315	0.0	3576
8640 min Winter	1.139	0.0	4376
10080 min Winter	1.009	0.0	5136

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E2) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area E...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.004

Time (mins)		Area
From:	To:	(ha)
0	4	0.004

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E2) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area E...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.815

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	7.5
Max Percolation (l/s)	10.4	Slope (1:X)	36.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.415	Cap Volume Depth (m)	0.200

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E3) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area E...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 38 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.360	0.139	0.2	0.5	Flood Risk
30 min Summer	75.382	0.161	0.2	0.7	Flood Risk
60 min Summer	75.395	0.174	0.2	0.8	Flood Risk
120 min Summer	75.401	0.180	0.2	0.9	Flood Risk
180 min Summer	75.398	0.177	0.2	0.8	Flood Risk
240 min Summer	75.393	0.172	0.2	0.8	Flood Risk
360 min Summer	75.381	0.160	0.2	0.7	Flood Risk
480 min Summer	75.370	0.149	0.2	0.6	Flood Risk
600 min Summer	75.360	0.139	0.2	0.5	Flood Risk
720 min Summer	75.352	0.131	0.2	0.5	Flood Risk
960 min Summer	75.337	0.116	0.2	0.4	Flood Risk
1440 min Summer	75.317	0.096	0.1	0.2	O K
2160 min Summer	75.297	0.076	0.1	0.2	O K
2880 min Summer	75.284	0.063	0.1	0.1	O K
4320 min Summer	75.270	0.049	0.1	0.1	O K
5760 min Summer	75.264	0.043	0.0	0.1	O K
7200 min Summer	75.261	0.040	0.0	0.0	O K
8640 min Summer	75.258	0.037	0.0	0.0	O K
10080 min Summer	75.256	0.035	0.0	0.0	O K
15 min Winter	75.372	0.151	0.2	0.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	17
30 min Summer	72.905	0.0	30
60 min Summer	47.182	0.0	46
120 min Summer	29.539	0.0	80
180 min Summer	22.146	0.0	114
240 min Summer	17.930	0.0	146
360 min Summer	13.215	0.0	212
480 min Summer	10.647	0.0	274
600 min Summer	8.997	0.0	336
720 min Summer	7.835	0.0	396
960 min Summer	6.294	0.0	518
1440 min Summer	4.613	0.0	752
2160 min Summer	3.374	0.0	1108
2880 min Summer	2.698	0.0	1472
4320 min Summer	1.966	0.0	2188
5760 min Summer	1.568	0.0	2936
7200 min Summer	1.315	0.0	3584
8640 min Summer	1.139	0.0	4280
10080 min Summer	1.009	0.0	5048
15 min Winter	107.735	0.0	17

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E3) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area E...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.394	0.173	0.2	0.8	Flood Risk
60 min Winter	75.407	0.186	0.2	0.9	Flood Risk
120 min Winter	75.410	0.189	0.3	1.0	Flood Risk
180 min Winter	75.404	0.183	0.2	0.9	Flood Risk
240 min Winter	75.396	0.175	0.2	0.8	Flood Risk
360 min Winter	75.378	0.157	0.2	0.7	Flood Risk
480 min Winter	75.363	0.142	0.2	0.5	Flood Risk
600 min Winter	75.350	0.129	0.2	0.4	Flood Risk
720 min Winter	75.339	0.118	0.2	0.4	Flood Risk
960 min Winter	75.322	0.101	0.1	0.3	Flood Risk
1440 min Winter	75.299	0.078	0.1	0.2	O K
2160 min Winter	75.279	0.058	0.1	0.1	O K
2880 min Winter	75.269	0.048	0.1	0.1	O K
4320 min Winter	75.262	0.041	0.0	0.0	O K
5760 min Winter	75.258	0.037	0.0	0.0	O K
7200 min Winter	75.255	0.034	0.0	0.0	O K
8640 min Winter	75.252	0.031	0.0	0.0	O K
10080 min Winter	75.250	0.029	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	30
60 min Winter	47.182	0.0	48
120 min Winter	29.539	0.0	86
180 min Winter	22.146	0.0	122
240 min Winter	17.930	0.0	156
360 min Winter	13.215	0.0	222
480 min Winter	10.647	0.0	286
600 min Winter	8.997	0.0	348
720 min Winter	7.835	0.0	406
960 min Winter	6.294	0.0	528
1440 min Winter	4.613	0.0	764
2160 min Winter	3.374	0.0	1108
2880 min Winter	2.698	0.0	1472
4320 min Winter	1.966	0.0	2180
5760 min Winter	1.568	0.0	2920
7200 min Winter	1.315	0.0	3576
8640 min Winter	1.139	0.0	4376
10080 min Winter	1.009	0.0	5136

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E3) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area E...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.004

Time (mins)		Area
From:	To:	(ha)
0	4	0.004

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E3) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area E...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.621

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	7.5
Max Percolation (l/s)	10.4	Slope (1:X)	36.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.221	Cap Volume Depth (m)	0.200

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E4) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area E...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 38 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.182	0.139	0.2	0.5	Flood Risk
30 min Summer	75.204	0.161	0.2	0.7	Flood Risk
60 min Summer	75.217	0.174	0.2	0.8	Flood Risk
120 min Summer	75.223	0.180	0.2	0.9	Flood Risk
180 min Summer	75.220	0.177	0.2	0.8	Flood Risk
240 min Summer	75.215	0.172	0.2	0.8	Flood Risk
360 min Summer	75.203	0.160	0.2	0.7	Flood Risk
480 min Summer	75.192	0.149	0.2	0.6	Flood Risk
600 min Summer	75.182	0.139	0.2	0.5	Flood Risk
720 min Summer	75.174	0.131	0.2	0.5	Flood Risk
960 min Summer	75.159	0.116	0.2	0.4	Flood Risk
1440 min Summer	75.139	0.096	0.1	0.2	O K
2160 min Summer	75.119	0.076	0.1	0.2	O K
2880 min Summer	75.106	0.063	0.1	0.1	O K
4320 min Summer	75.092	0.049	0.1	0.1	O K
5760 min Summer	75.086	0.043	0.0	0.1	O K
7200 min Summer	75.083	0.040	0.0	0.0	O K
8640 min Summer	75.080	0.037	0.0	0.0	O K
10080 min Summer	75.078	0.035	0.0	0.0	O K
15 min Winter	75.194	0.151	0.2	0.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	17
30 min Summer	72.905	0.0	30
60 min Summer	47.182	0.0	46
120 min Summer	29.539	0.0	80
180 min Summer	22.146	0.0	114
240 min Summer	17.930	0.0	146
360 min Summer	13.215	0.0	212
480 min Summer	10.647	0.0	274
600 min Summer	8.997	0.0	336
720 min Summer	7.835	0.0	396
960 min Summer	6.294	0.0	518
1440 min Summer	4.613	0.0	752
2160 min Summer	3.374	0.0	1108
2880 min Summer	2.698	0.0	1472
4320 min Summer	1.966	0.0	2188
5760 min Summer	1.568	0.0	2936
7200 min Summer	1.315	0.0	3584
8640 min Summer	1.139	0.0	4280
10080 min Summer	1.009	0.0	5048
15 min Winter	107.735	0.0	17

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1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E4) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area E...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.216	0.173	0.2	0.8	Flood Risk
60 min Winter	75.229	0.186	0.2	0.9	Flood Risk
120 min Winter	75.232	0.189	0.3	1.0	Flood Risk
180 min Winter	75.226	0.183	0.2	0.9	Flood Risk
240 min Winter	75.218	0.175	0.2	0.8	Flood Risk
360 min Winter	75.200	0.157	0.2	0.7	Flood Risk
480 min Winter	75.185	0.142	0.2	0.5	Flood Risk
600 min Winter	75.172	0.129	0.2	0.4	Flood Risk
720 min Winter	75.161	0.118	0.2	0.4	Flood Risk
960 min Winter	75.144	0.101	0.1	0.3	Flood Risk
1440 min Winter	75.121	0.078	0.1	0.2	O K
2160 min Winter	75.101	0.058	0.1	0.1	O K
2880 min Winter	75.091	0.048	0.1	0.1	O K
4320 min Winter	75.084	0.041	0.0	0.0	O K
5760 min Winter	75.080	0.037	0.0	0.0	O K
7200 min Winter	75.077	0.034	0.0	0.0	O K
8640 min Winter	75.074	0.031	0.0	0.0	O K
10080 min Winter	75.072	0.029	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	30
60 min Winter	47.182	0.0	48
120 min Winter	29.539	0.0	86
180 min Winter	22.146	0.0	122
240 min Winter	17.930	0.0	156
360 min Winter	13.215	0.0	222
480 min Winter	10.647	0.0	286
600 min Winter	8.997	0.0	348
720 min Winter	7.835	0.0	406
960 min Winter	6.294	0.0	528
1440 min Winter	4.613	0.0	764
2160 min Winter	3.374	0.0	1108
2880 min Winter	2.698	0.0	1472
4320 min Winter	1.966	0.0	2180
5760 min Winter	1.568	0.0	2920
7200 min Winter	1.315	0.0	3576
8640 min Winter	1.139	0.0	4376
10080 min Winter	1.009	0.0	5136

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1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E4) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area E...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.004

Time (mins)	Area
From:	To: (ha)
0	4 0.004

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1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area E4) Roadside Services Holt Road, Wrexham	
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Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.443

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	7.5
Max Percolation (l/s)	10.4	Slope (1:X)	36.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.043	Cap Volume Depth (m)	0.200

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<u>Summary of Results for 100 year Return Period (+30%)</u> Half Drain Time : 46 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 Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>75.667</td><td>0.162</td><td>0.2</td><td>0.7</td><td>Flood Risk</td></tr><tr><td>30 min Summer</td><td>75.691</td><td>0.186</td><td>0.2</td><td>0.9</td><td>Flood Risk</td></tr><tr><td>60 min Summer</td><td>75.706</td><td>0.201</td><td>0.3</td><td>1.1</td><td>Flood Risk</td></tr><tr><td>120 min Summer</td><td>75.712</td><td>0.207</td><td>0.3</td><td>1.2</td><td>Flood Risk</td></tr><tr><td>180 min Summer</td><td>75.710</td><td>0.205</td><td>0.3</td><td>1.1</td><td>Flood Risk</td></tr><tr><td>240 min Summer</td><td>75.704</td><td>0.199</td><td>0.3</td><td>1.1</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>75.691</td><td>0.186</td><td>0.2</td><td>0.9</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>75.680</td><td>0.175</td><td>0.2</td><td>0.8</td><td>Flood Risk</td></tr><tr><td>600 min Summer</td><td>75.669</td><td>0.164</td><td>0.2</td><td>0.7</td><td>Flood Risk</td></tr><tr><td>720 min Summer</td><td>75.660</td><td>0.155</td><td>0.2</td><td>0.6</td><td>Flood Risk</td></tr><tr><td>960 min Summer</td><td>75.644</td><td>0.139</td><td>0.2</td><td>0.5</td><td>Flood Risk</td></tr><tr><td>1440 min Summer</td><td>75.621</td><td>0.116</td><td>0.2</td><td>0.4</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>75.598</td><td>0.093</td><td>0.1</td><td>0.2</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>75.583</td><td>0.078</td><td>0.1</td><td>0.2</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>75.564</td><td>0.059</td><td>0.1</td><td>0.1</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>75.554</td><td>0.049</td><td>0.1</td><td>0.1</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>75.550</td><td>0.045</td><td>0.1</td><td>0.1</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>75.546</td><td>0.041</td><td>0.0</td><td>0.0</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>75.544</td><td>0.039</td><td>0.0</td><td>0.0</td><td>O K</td></tr><tr><td>15 min Winter</td><td>75.679</td><td>0.174</td><td>0.2</td><td>0.8</td><td>Flood Risk</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>107.735</td><td>0.0</td><td>17</td></tr><tr><td>30 min Summer</td><td>72.905</td><td>0.0</td><td>30</td></tr><tr><td>60 min Summer</td><td>47.182</td><td>0.0</td><td>46</td></tr><tr><td>120 min Summer</td><td>29.539</td><td>0.0</td><td>80</td></tr><tr><td>180 min Summer</td><td>22.146</td><td>0.0</td><td>116</td></tr><tr><td>240 min Summer</td><td>17.930</td><td>0.0</td><td>148</td></tr><tr><td>360 min Summer</td><td>13.215</td><td>0.0</td><td>214</td></tr><tr><td>480 min Summer</td><td>10.647</td><td>0.0</td><td>278</td></tr><tr><td>600 min Summer</td><td>8.997</td><td>0.0</td><td>338</td></tr><tr><td>720 min Summer</td><td>7.835</td><td>0.0</td><td>400</td></tr><tr><td>960 min Summer</td><td>6.294</td><td>0.0</td><td>520</td></tr><tr><td>1440 min Summer</td><td>4.613</td><td>0.0</td><td>764</td></tr><tr><td>2160 min Summer</td><td>3.374</td><td>0.0</td><td>1120</td></tr><tr><td>2880 min Summer</td><td>2.698</td><td>0.0</td><td>1472</td></tr><tr><td>4320 min Summer</td><td>1.966</td><td>0.0</td><td>2204</td></tr><tr><td>5760 min Summer</td><td>1.568</td><td>0.0</td><td>2936</td></tr><tr><td>7200 min Summer</td><td>1.315</td><td>0.0</td><td>3656</td></tr><tr><td>8640 min Summer</td><td>1.139</td><td>0.0</td><td>4392</td></tr><tr><td>10080 min Summer</td><td>1.009</td><td>0.0</td><td>5120</td></tr><tr><td>15 min Winter</td><td>107.735</td><td>0.0</td><td>17</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max 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Summer	107.735	0.0	17	30 min Summer	72.905	0.0	30	60 min Summer	47.182	0.0	46	120 min Summer	29.539	0.0	80	180 min Summer	22.146	0.0	116	240 min Summer	17.930	0.0	148	360 min Summer	13.215	0.0	214	480 min Summer	10.647	0.0	278	600 min Summer	8.997	0.0	338	720 min Summer	7.835	0.0	400	960 min Summer	6.294	0.0	520	1440 min Summer	4.613	0.0	764	2160 min Summer	3.374	0.0	1120	2880 min Summer	2.698	0.0	1472	4320 min Summer	1.966	0.0	2204	5760 min Summer	1.568	0.0	2936	7200 min Summer	1.315	0.0	3656	8640 min Summer	1.139	0.0	4392	10080 min Summer	1.009	0.0	5120	15 min Winter	107.735	0.0	17
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Date 29.04.16 File Permeable Paving Area F...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.705	0.200	0.3	1.1	Flood Risk
60 min Winter	75.720	0.215	0.3	1.2	Flood Risk
120 min Winter	75.724	0.219	0.3	1.3	Flood Risk
180 min Winter	75.718	0.213	0.3	1.2	Flood Risk
240 min Winter	75.709	0.204	0.3	1.1	Flood Risk
360 min Winter	75.690	0.185	0.2	0.9	Flood Risk
480 min Winter	75.674	0.169	0.2	0.8	Flood Risk
600 min Winter	75.660	0.155	0.2	0.6	Flood Risk
720 min Winter	75.648	0.143	0.2	0.6	Flood Risk
960 min Winter	75.628	0.123	0.2	0.4	Flood Risk
1440 min Winter	75.601	0.096	0.1	0.2	O K
2160 min Winter	75.577	0.072	0.1	0.1	O K
2880 min Winter	75.563	0.058	0.1	0.1	O K
4320 min Winter	75.551	0.046	0.1	0.1	O K
5760 min Winter	75.546	0.041	0.0	0.0	O K
7200 min Winter	75.543	0.038	0.0	0.0	O K
8640 min Winter	75.540	0.035	0.0	0.0	O K
10080 min Winter	75.538	0.033	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	30
60 min Winter	47.182	0.0	50
120 min Winter	29.539	0.0	88
180 min Winter	22.146	0.0	124
240 min Winter	17.930	0.0	158
360 min Winter	13.215	0.0	226
480 min Winter	10.647	0.0	290
600 min Winter	8.997	0.0	352
720 min Winter	7.835	0.0	414
960 min Winter	6.294	0.0	532
1440 min Winter	4.613	0.0	766
2160 min Winter	3.374	0.0	1124
2880 min Winter	2.698	0.0	1472
4320 min Winter	1.966	0.0	2200
5760 min Winter	1.568	0.0	2848
7200 min Winter	1.315	0.0	3584
8640 min Winter	1.139	0.0	4384
10080 min Winter	1.009	0.0	5088

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F1) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area F...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.005

Time (mins)	Area
From:	To: (ha)
0	4 0.005

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area F...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.924

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	7.5
Max Percolation (l/s)	10.4	Slope (1:X)	36.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.505	Cap Volume Depth (m)	0.219

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area F...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 69 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.442	0.200	0.3	1.1	Flood Risk
30 min Summer	75.472	0.230	0.3	1.4	Flood Risk
60 min Summer	75.495	0.253	0.3	1.7	Flood Risk
120 min Summer	75.507	0.265	0.3	1.8	Flood Risk
180 min Summer	75.505	0.263	0.3	1.8	Flood Risk
240 min Summer	75.499	0.257	0.3	1.7	Flood Risk
360 min Summer	75.482	0.240	0.3	1.5	Flood Risk
480 min Summer	75.466	0.224	0.3	1.3	Flood Risk
600 min Summer	75.452	0.210	0.3	1.2	Flood Risk
720 min Summer	75.442	0.200	0.3	1.1	Flood Risk
960 min Summer	75.424	0.182	0.2	0.9	O K
1440 min Summer	75.396	0.154	0.2	0.6	O K
2160 min Summer	75.367	0.125	0.2	0.4	O K
2880 min Summer	75.347	0.105	0.1	0.3	O K
4320 min Summer	75.323	0.081	0.1	0.2	O K
5760 min Summer	75.308	0.066	0.1	0.1	O K
7200 min Summer	75.297	0.055	0.1	0.1	O K
8640 min Summer	75.291	0.049	0.1	0.1	O K
10080 min Summer	75.288	0.046	0.1	0.1	O K
15 min Winter	75.456	0.214	0.3	1.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	17
30 min Summer	72.905	0.0	31
60 min Summer	47.182	0.0	54
120 min Summer	29.539	0.0	86
180 min Summer	22.146	0.0	122
240 min Summer	17.930	0.0	156
360 min Summer	13.215	0.0	222
480 min Summer	10.647	0.0	286
600 min Summer	8.997	0.0	346
720 min Summer	7.835	0.0	406
960 min Summer	6.294	0.0	530
1440 min Summer	4.613	0.0	766
2160 min Summer	3.374	0.0	1124
2880 min Summer	2.698	0.0	1476
4320 min Summer	1.966	0.0	2204
5760 min Summer	1.568	0.0	2936
7200 min Summer	1.315	0.0	3672
8640 min Summer	1.139	0.0	4352
10080 min Summer	1.009	0.0	5136
15 min Winter	107.735	0.0	17

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area F...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.492	0.250	0.3	1.6	Flood Risk
60 min Winter	75.519	0.277	0.3	1.9	Flood Risk
120 min Winter	75.530	0.288	0.3	2.1	Flood Risk
180 min Winter	75.525	0.283	0.3	2.0	Flood Risk
240 min Winter	75.514	0.272	0.3	1.9	Flood Risk
360 min Winter	75.487	0.245	0.3	1.6	Flood Risk
480 min Winter	75.463	0.221	0.3	1.3	Flood Risk
600 min Winter	75.445	0.203	0.3	1.1	Flood Risk
720 min Winter	75.431	0.189	0.3	1.0	Flood Risk
960 min Winter	75.407	0.165	0.2	0.7	O K
1440 min Winter	75.373	0.131	0.2	0.5	O K
2160 min Winter	75.342	0.100	0.1	0.3	O K
2880 min Winter	75.324	0.082	0.1	0.2	O K
4320 min Winter	75.302	0.060	0.1	0.1	O K
5760 min Winter	75.291	0.049	0.1	0.1	O K
7200 min Winter	75.287	0.045	0.1	0.1	O K
8640 min Winter	75.284	0.042	0.0	0.0	O K
10080 min Winter	75.281	0.039	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	31
60 min Winter	47.182	0.0	58
120 min Winter	29.539	0.0	94
180 min Winter	22.146	0.0	132
240 min Winter	17.930	0.0	168
360 min Winter	13.215	0.0	238
480 min Winter	10.647	0.0	300
600 min Winter	8.997	0.0	362
720 min Winter	7.835	0.0	424
960 min Winter	6.294	0.0	546
1440 min Winter	4.613	0.0	780
2160 min Winter	3.374	0.0	1128
2880 min Winter	2.698	0.0	1488
4320 min Winter	1.966	0.0	2204
5760 min Winter	1.568	0.0	2936
7200 min Winter	1.315	0.0	3608
8640 min Winter	1.139	0.0	4352
10080 min Winter	1.009	0.0	5144

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F2) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area F...	Checked by G.S.C	
Micro Drainage		Source Control 2015.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.007

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

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F2) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area F...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.730

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	7.5
Max Percolation (l/s)	10.4	Slope (1:X)	36.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.242	Cap Volume Depth (m)	0.288

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F3) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area F...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 119 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	75.161	0.269	0.3	1.9	O K
30 min Summer	75.215	0.323	0.3	2.5	O K
60 min Summer	75.262	0.370	0.3	3.0	Flood Risk
120 min Summer	75.288	0.396	0.3	3.3	Flood Risk
180 min Summer	75.291	0.399	0.3	3.3	Flood Risk
240 min Summer	75.286	0.394	0.3	3.3	Flood Risk
360 min Summer	75.268	0.376	0.3	3.1	Flood Risk
480 min Summer	75.248	0.356	0.3	2.8	Flood Risk
600 min Summer	75.228	0.336	0.3	2.6	O K
720 min Summer	75.208	0.316	0.3	2.4	O K
960 min Summer	75.172	0.280	0.3	2.0	O K
1440 min Summer	75.118	0.226	0.3	1.4	O K
2160 min Summer	75.077	0.185	0.2	0.9	O K
2880 min Summer	75.051	0.159	0.2	0.7	O K
4320 min Summer	75.016	0.124	0.2	0.4	O K
5760 min Summer	74.994	0.102	0.1	0.3	O K
7200 min Summer	74.979	0.087	0.1	0.2	O K
8640 min Summer	74.968	0.076	0.1	0.2	O K
10080 min Summer	74.959	0.067	0.1	0.1	O K
15 min Winter	75.184	0.292	0.3	2.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	18
30 min Summer	72.905	0.0	32
60 min Summer	47.182	0.0	60
120 min Summer	29.539	0.0	104
180 min Summer	22.146	0.0	136
240 min Summer	17.930	0.0	168
360 min Summer	13.215	0.0	238
480 min Summer	10.647	0.0	306
600 min Summer	8.997	0.0	372
720 min Summer	7.835	0.0	436
960 min Summer	6.294	0.0	560
1440 min Summer	4.613	0.0	794
2160 min Summer	3.374	0.0	1144
2880 min Summer	2.698	0.0	1500
4320 min Summer	1.966	0.0	2208
5760 min Summer	1.568	0.0	2936
7200 min Summer	1.315	0.0	3672
8640 min Summer	1.139	0.0	4400
10080 min Summer	1.009	0.0	5120
15 min Winter	107.735	0.0	18

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F3) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area F...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.247	0.355	0.3	2.8	Flood Risk
60 min Winter	75.302	0.410	0.3	3.4	Flood Risk
120 min Winter	75.335	0.443	0.3	3.8	Flood Risk
180 min Winter	75.336	0.444	0.3	3.8	Flood Risk
240 min Winter	75.328	0.436	0.3	3.7	Flood Risk
360 min Winter	75.300	0.408	0.3	3.4	Flood Risk
480 min Winter	75.269	0.377	0.3	3.1	Flood Risk
600 min Winter	75.236	0.344	0.3	2.7	Flood Risk
720 min Winter	75.206	0.314	0.3	2.4	O K
960 min Winter	75.152	0.260	0.3	1.8	O K
1440 min Winter	75.089	0.197	0.3	1.0	O K
2160 min Winter	75.046	0.154	0.2	0.6	O K
2880 min Winter	75.019	0.127	0.2	0.4	O K
4320 min Winter	74.986	0.094	0.1	0.2	O K
5760 min Winter	74.967	0.075	0.1	0.2	O K
7200 min Winter	74.955	0.063	0.1	0.1	O K
8640 min Winter	74.947	0.055	0.1	0.1	O K
10080 min Winter	74.941	0.049	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	32
60 min Winter	47.182	0.0	60
120 min Winter	29.539	0.0	114
180 min Winter	22.146	0.0	146
240 min Winter	17.930	0.0	184
360 min Winter	13.215	0.0	258
480 min Winter	10.647	0.0	332
600 min Winter	8.997	0.0	400
720 min Winter	7.835	0.0	466
960 min Winter	6.294	0.0	588
1440 min Winter	4.613	0.0	806
2160 min Winter	3.374	0.0	1164
2880 min Winter	2.698	0.0	1500
4320 min Winter	1.966	0.0	2208
5760 min Winter	1.568	0.0	2936
7200 min Winter	1.315	0.0	3672
8640 min Winter	1.139	0.0	4368
10080 min Winter	1.009	0.0	5040

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F3) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area F...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.011

Time (mins)		Area
From:	To:	(ha)
0	4	0.011

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F3) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area F...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.536

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	7.5
Max Percolation (l/s)	10.4	Slope (1:X)	36.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	74.892	Cap Volume Depth (m)	0.444

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F4) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area F...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 81 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	74.982	0.217	0.3	1.3	O K
30 min Summer	75.018	0.253	0.3	1.7	Flood Risk
60 min Summer	75.046	0.281	0.3	2.0	Flood Risk
120 min Summer	75.061	0.296	0.3	2.2	Flood Risk
180 min Summer	75.061	0.296	0.3	2.2	Flood Risk
240 min Summer	75.055	0.290	0.3	2.1	Flood Risk
360 min Summer	75.037	0.272	0.3	1.9	Flood Risk
480 min Summer	75.019	0.254	0.3	1.7	Flood Risk
600 min Summer	75.002	0.237	0.3	1.5	Flood Risk
720 min Summer	74.988	0.223	0.3	1.3	O K
960 min Summer	74.966	0.201	0.3	1.1	O K
1440 min Summer	74.937	0.172	0.2	0.8	O K
2160 min Summer	74.906	0.141	0.2	0.5	O K
2880 min Summer	74.884	0.119	0.2	0.4	O K
4320 min Summer	74.857	0.092	0.1	0.2	O K
5760 min Summer	74.840	0.075	0.1	0.2	O K
7200 min Summer	74.828	0.063	0.1	0.1	O K
8640 min Summer	74.820	0.055	0.1	0.1	O K
10080 min Summer	74.814	0.049	0.1	0.1	O K
15 min Winter	74.998	0.233	0.3	1.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	17
30 min Summer	72.905	0.0	31
60 min Summer	47.182	0.0	58
120 min Summer	29.539	0.0	90
180 min Summer	22.146	0.0	124
240 min Summer	17.930	0.0	158
360 min Summer	13.215	0.0	226
480 min Summer	10.647	0.0	290
600 min Summer	8.997	0.0	354
720 min Summer	7.835	0.0	414
960 min Summer	6.294	0.0	530
1440 min Summer	4.613	0.0	776
2160 min Summer	3.374	0.0	1128
2880 min Summer	2.698	0.0	1496
4320 min Summer	1.966	0.0	2204
5760 min Summer	1.568	0.0	2936
7200 min Summer	1.315	0.0	3672
8640 min Summer	1.139	0.0	4400
10080 min Summer	1.009	0.0	5136
15 min Winter	107.735	0.0	17

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F4) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area F...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	75.041	0.276	0.3	1.9	Flood Risk
60 min Winter	75.075	0.310	0.3	2.3	Flood Risk
120 min Winter	75.089	0.324	0.3	2.5	Flood Risk
180 min Winter	75.086	0.321	0.3	2.4	Flood Risk
240 min Winter	75.076	0.311	0.3	2.3	Flood Risk
360 min Winter	75.047	0.282	0.3	2.0	Flood Risk
480 min Winter	75.019	0.254	0.3	1.7	Flood Risk
600 min Winter	74.995	0.230	0.3	1.4	Flood Risk
720 min Winter	74.975	0.210	0.3	1.2	O K
960 min Winter	74.950	0.185	0.2	0.9	O K
1440 min Winter	74.913	0.148	0.2	0.6	O K
2160 min Winter	74.879	0.114	0.2	0.4	O K
2880 min Winter	74.858	0.093	0.1	0.2	O K
4320 min Winter	74.833	0.068	0.1	0.1	O K
5760 min Winter	74.820	0.055	0.1	0.1	O K
7200 min Winter	74.813	0.048	0.1	0.1	O K
8640 min Winter	74.810	0.045	0.1	0.1	O K
10080 min Winter	74.807	0.042	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	31
60 min Winter	47.182	0.0	58
120 min Winter	29.539	0.0	96
180 min Winter	22.146	0.0	136
240 min Winter	17.930	0.0	172
360 min Winter	13.215	0.0	244
480 min Winter	10.647	0.0	310
600 min Winter	8.997	0.0	372
720 min Winter	7.835	0.0	428
960 min Winter	6.294	0.0	550
1440 min Winter	4.613	0.0	792
2160 min Winter	3.374	0.0	1144
2880 min Winter	2.698	0.0	1500
4320 min Winter	1.966	0.0	2204
5760 min Winter	1.568	0.0	2936
7200 min Winter	1.315	0.0	3704
8640 min Winter	1.139	0.0	4392
10080 min Winter	1.009	0.0	5048

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F4) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area F...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.008

Time (mins)	Area
From:	To: (ha)
0	4 0.008

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area F4) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area F...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.289

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	7.5
Max Percolation (l/s)	10.4	Slope (1:X)	36.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	74.765	Cap Volume Depth (m)	0.324

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area G1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area G...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 177 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	74.635	0.235	0.4	3.9	O K
30 min Summer	74.713	0.313	0.4	5.2	O K
60 min Summer	74.785	0.385	0.4	6.4	O K
120 min Summer	74.833	0.433	0.4	7.1	Flood Risk
180 min Summer	74.839	0.439	0.4	7.2	Flood Risk
240 min Summer	74.834	0.434	0.4	7.2	Flood Risk
360 min Summer	74.815	0.415	0.4	6.8	Flood Risk
480 min Summer	74.793	0.393	0.4	6.5	O K
600 min Summer	74.771	0.371	0.4	6.1	O K
720 min Summer	74.748	0.348	0.4	5.7	O K
960 min Summer	74.702	0.302	0.4	5.0	O K
1440 min Summer	74.620	0.220	0.4	3.6	O K
2160 min Summer	74.526	0.126	0.4	2.1	O K
2880 min Summer	74.471	0.071	0.4	1.2	O K
4320 min Summer	74.443	0.043	0.3	0.7	O K
5760 min Summer	74.434	0.034	0.3	0.6	O K
7200 min Summer	74.429	0.029	0.2	0.5	O K
8640 min Summer	74.425	0.025	0.2	0.4	O K
10080 min Summer	74.422	0.022	0.2	0.4	O K
15 min Winter	74.667	0.267	0.4	4.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	18
30 min Summer	72.905	0.0	33
60 min Summer	47.182	0.0	62
120 min Summer	29.539	0.0	120
180 min Summer	22.146	0.0	156
240 min Summer	17.930	0.0	188
360 min Summer	13.215	0.0	252
480 min Summer	10.647	0.0	322
600 min Summer	8.997	0.0	388
720 min Summer	7.835	0.0	456
960 min Summer	6.294	0.0	588
1440 min Summer	4.613	0.0	838
2160 min Summer	3.374	0.0	1188
2880 min Summer	2.698	0.0	1504
4320 min Summer	1.966	0.0	2204
5760 min Summer	1.568	0.0	2936
7200 min Summer	1.315	0.0	3672
8640 min Summer	1.139	0.0	4400
10080 min Summer	1.009	0.0	5064
15 min Winter	107.735	0.0	18

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area G1) Roadside Services Holt Road, Wrexham	
Date 29.04.16 File Permeable Paving Area G...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	74.756	0.356	0.4	5.9	O K
60 min Winter	74.841	0.441	0.4	7.3	Flood Risk
120 min Winter	74.903	0.503	0.4	8.3	Flood Risk
180 min Winter	74.921	0.521	0.4	8.5	Flood Risk
240 min Winter	74.906	0.506	0.4	8.3	Flood Risk
360 min Winter	74.879	0.479	0.4	7.9	Flood Risk
480 min Winter	74.847	0.447	0.4	7.4	Flood Risk
600 min Winter	74.811	0.411	0.4	6.8	O K
720 min Winter	74.774	0.374	0.4	6.2	O K
960 min Winter	74.703	0.303	0.4	5.0	O K
1440 min Winter	74.578	0.178	0.4	2.9	O K
2160 min Winter	74.460	0.060	0.4	1.0	O K
2880 min Winter	74.443	0.043	0.3	0.7	O K
4320 min Winter	74.431	0.031	0.3	0.5	O K
5760 min Winter	74.425	0.025	0.2	0.4	O K
7200 min Winter	74.421	0.021	0.2	0.3	O K
8640 min Winter	74.418	0.018	0.1	0.3	O K
10080 min Winter	74.416	0.016	0.1	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	72.905	0.0	32
60 min Winter	47.182	0.0	60
120 min Winter	29.539	0.0	118
180 min Winter	22.146	0.0	172
240 min Winter	17.930	0.0	216
360 min Winter	13.215	0.0	274
480 min Winter	10.647	0.0	350
600 min Winter	8.997	0.0	424
720 min Winter	7.835	0.0	498
960 min Winter	6.294	0.0	634
1440 min Winter	4.613	0.0	880
2160 min Winter	3.374	0.0	1168
2880 min Winter	2.698	0.0	1472
4320 min Winter	1.966	0.0	2172
5760 min Winter	1.568	0.0	2936
7200 min Winter	1.315	0.0	3544
8640 min Winter	1.139	0.0	4408
10080 min Winter	1.009	0.0	5144

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area G1) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area G...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.022

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

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Permeable Paving (Area G1) Roadside Services Holt Road, Wrexham	
Date 29.04.16	Designed by G.S.C	
File Permeable Paving Area G...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 75.114

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.13320	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	11.0
Max Percolation (l/s)	15.3	Slope (1:X)	0.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	74.400	Cap Volume Depth (m)	0.514

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain A Roadside Services Holt Road, Wrexham	
Date 05.05.16 File Infiltration Basin A Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Filter Drain A.srcx

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
8640 min Summer	73.868	0.118	0.0	0.2	0.2	0.1	O K
10080 min Summer	73.867	0.117	0.0	0.2	0.2	0.1	O K
15 min Winter	74.015	0.265	0.0	11.5	11.5	0.5	O K
30 min Winter	73.986	0.236	0.0	8.8	8.8	0.4	O K
60 min Winter	73.956	0.206	0.0	6.0	6.0	0.3	O K
120 min Winter	73.931	0.181	0.0	3.8	3.8	0.2	O K
180 min Winter	73.922	0.172	0.0	2.9	2.9	0.2	O K
240 min Winter	73.915	0.165	0.0	2.3	2.3	0.2	O K
360 min Winter	73.905	0.155	0.0	1.7	1.7	0.2	O K
480 min Winter	73.899	0.149	0.0	1.4	1.4	0.2	O K
600 min Winter	73.895	0.145	0.0	1.2	1.2	0.2	O K
720 min Winter	73.892	0.142	0.0	1.0	1.0	0.2	O K
960 min Winter	73.887	0.137	0.0	0.8	0.8	0.1	O K
1440 min Winter	73.882	0.132	0.0	0.6	0.6	0.1	O K
2160 min Winter	73.877	0.127	0.0	0.4	0.4	0.1	O K
2880 min Winter	73.874	0.124	0.0	0.4	0.4	0.1	O K
4320 min Winter	73.870	0.120	0.0	0.3	0.3	0.1	O K
5760 min Winter	73.868	0.118	0.0	0.2	0.2	0.1	O K
7200 min Winter	73.866	0.116	0.0	0.2	0.2	0.1	O K
8640 min Winter	73.865	0.115	0.0	0.2	0.2	0.1	O K
10080 min Winter	73.864	0.114	0.0	0.1	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	27.0	4384
10080 min Summer	1.009	0.0	27.9	5008
15 min Winter	107.735	0.0	4.9	10
30 min Winter	72.905	0.0	6.7	18
60 min Winter	47.182	0.0	8.6	32
120 min Winter	29.539	0.0	10.8	64
180 min Winter	22.146	0.0	12.2	92
240 min Winter	17.930	0.0	13.2	122
360 min Winter	13.215	0.0	14.6	186
480 min Winter	10.647	0.0	15.7	240
600 min Winter	8.997	0.0	16.6	302
720 min Winter	7.835	0.0	17.3	364
960 min Winter	6.294	0.0	18.5	486
1440 min Winter	4.613	0.0	20.4	728
2160 min Winter	3.374	0.0	22.4	1104
2880 min Winter	2.698	0.0	23.9	1436
4320 min Winter	1.966	0.0	26.1	2188
5760 min Winter	1.568	0.0	27.7	2880
7200 min Winter	1.315	0.0	29.1	3568
8640 min Winter	1.139	0.0	30.2	4360
10080 min Winter	1.009	0.0	31.3	4928

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain A Roadside Services Holt Road, Wrexham	
Date 05.05.16 File Infiltration Basin A Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain A.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.022

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

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain A Roadside Services Holt Road, Wrexham	
Date 05.05.16	Designed by G.S.C	
File Infiltration Basin A Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Filter Drain A.srcx

Storage is Online Cover Level (m) 75.100

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	16.9
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	100.0
Invert Level (m)	73.750	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	100.0	Coefficient of Contraction	0.600
Length (m)	3.000	Upstream Invert Level (m)	73.850
Roughness k (mm)	0.600		

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain B Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin A Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Filter Drain B.srcx

**Upstream
Structures**

Outflow To

Overflow To

(None) Infiltration Basin A.srcx

(None)

Half Drain Time : 1 minutes.

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
15 min Summer	74.348	0.598	0.0	30.6	30.6	3.0	O K
30 min Summer	74.302	0.552	0.0	28.8	28.8	2.6	O K
60 min Summer	74.177	0.427	0.0	23.6	23.6	1.6	O K
120 min Summer	74.067	0.317	0.0	16.9	16.9	0.9	O K
180 min Summer	74.030	0.280	0.0	13.2	13.2	0.7	O K
240 min Summer	74.011	0.261	0.0	10.9	10.9	0.6	O K
360 min Summer	73.979	0.229	0.0	8.1	8.1	0.4	O K
480 min Summer	73.963	0.213	0.0	6.5	6.5	0.4	O K
600 min Summer	73.950	0.200	0.0	5.5	5.5	0.3	O K
720 min Summer	73.941	0.191	0.0	4.8	4.8	0.3	O K
960 min Summer	73.932	0.182	0.0	3.9	3.9	0.2	O K
1440 min Summer	73.922	0.172	0.0	2.9	2.9	0.2	O K
2160 min Summer	73.911	0.161	0.0	2.1	2.1	0.2	O K
2880 min Summer	73.904	0.154	0.0	1.7	1.7	0.2	O K
4320 min Summer	73.896	0.146	0.0	1.2	1.2	0.2	O K
5760 min Summer	73.891	0.141	0.0	1.0	1.0	0.1	O K
7200 min Summer	73.887	0.137	0.0	0.8	0.8	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	15.1	11
30 min Summer	72.905	0.0	20.4	19
60 min Summer	47.182	0.0	26.5	34
120 min Summer	29.539	0.0	33.2	64
180 min Summer	22.146	0.0	37.3	92
240 min Summer	17.930	0.0	40.3	122
360 min Summer	13.215	0.0	44.5	182
480 min Summer	10.647	0.0	47.8	244
600 min Summer	8.997	0.0	50.5	306
720 min Summer	7.835	0.0	52.8	364
960 min Summer	6.294	0.0	56.6	486
1440 min Summer	4.613	0.0	62.2	728
2160 min Summer	3.374	0.0	68.2	1076
2880 min Summer	2.698	0.0	72.8	1440
4320 min Summer	1.966	0.0	79.5	2168
5760 min Summer	1.568	0.0	84.6	2848
7200 min Summer	1.315	0.0	88.7	3576

Simpson Associates

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1 Market Place Mews
Henley-on-Thames
RG9 2AH

Date 06.05.16
File Infiltration Basin A Ca...

Filter Drain B
Roadside Services
Holt Road, Wrexham

Designed by G.S.C
Checked by G.S.C

Micro Drainage

Source Control 2015.1

Cascade Summary of Results for Filter Drain B.srcx

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
8640 min Summer	73.885	0.135	0.0	0.7	0.7	0.1	O K
10080 min Summer	73.883	0.133	0.0	0.6	0.6	0.1	O K
15 min Winter	74.365	0.615	0.0	31.1	31.1	3.1	O K
30 min Winter	74.258	0.508	0.0	27.1	27.1	2.3	O K
60 min Winter	74.106	0.356	0.0	20.0	20.0	1.1	O K
120 min Winter	74.027	0.277	0.0	13.0	13.0	0.6	O K
180 min Winter	74.004	0.254	0.0	9.9	9.9	0.5	O K
240 min Winter	73.978	0.228	0.0	7.9	7.9	0.4	O K
360 min Winter	73.954	0.204	0.0	5.8	5.8	0.3	O K
480 min Winter	73.940	0.190	0.0	4.7	4.7	0.3	O K
600 min Winter	73.933	0.183	0.0	4.0	4.0	0.3	O K
720 min Winter	73.928	0.178	0.0	3.5	3.5	0.2	O K
960 min Winter	73.921	0.171	0.0	2.8	2.8	0.2	O K
1440 min Winter	73.910	0.160	0.0	2.1	2.1	0.2	O K
2160 min Winter	73.901	0.151	0.0	1.5	1.5	0.2	O K
2880 min Winter	73.896	0.146	0.0	1.2	1.2	0.2	O K
4320 min Winter	73.889	0.139	0.0	0.9	0.9	0.1	O K
5760 min Winter	73.884	0.134	0.0	0.7	0.7	0.1	O K
7200 min Winter	73.882	0.132	0.0	0.6	0.6	0.1	O K
8640 min Winter	73.880	0.130	0.0	0.5	0.5	0.1	O K
10080 min Winter	73.877	0.127	0.0	0.4	0.4	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	92.2	4304
10080 min Summer	1.009	0.0	95.3	5136
15 min Winter	107.735	0.0	16.9	11
30 min Winter	72.905	0.0	22.9	19
60 min Winter	47.182	0.0	29.6	34
120 min Winter	29.539	0.0	37.1	62
180 min Winter	22.146	0.0	41.8	92
240 min Winter	17.930	0.0	45.1	122
360 min Winter	13.215	0.0	49.9	184
480 min Winter	10.647	0.0	53.6	240
600 min Winter	8.997	0.0	56.6	308
720 min Winter	7.835	0.0	59.2	366
960 min Winter	6.294	0.0	63.4	472
1440 min Winter	4.613	0.0	69.7	710
2160 min Winter	3.374	0.0	76.4	1048
2880 min Winter	2.698	0.0	81.5	1468
4320 min Winter	1.966	0.0	89.1	2184
5760 min Winter	1.568	0.0	94.7	2832
7200 min Winter	1.315	0.0	99.3	3544
8640 min Winter	1.139	0.0	103.2	4296
10080 min Winter	1.009	0.0	106.7	5216

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1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain B Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin A Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain B.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.075

Time (mins)		Area
From:	To:	(ha)
0	4	0.075

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain B Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin A Ca...	Checked by G.S.C	
Micro Drainage		Source Control 2015.1

Cascade Model Details for Filter Drain B.srcx

Storage is Online Cover Level (m) 75.100

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	45.5
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	100.0
Invert Level (m)	73.750	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	100.0	Coefficient of Contraction	0.600
Length (m)	3.000	Upstream Invert Level (m)	73.850
Roughness k (mm)	0.600		

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin A Roadside Services Holt Road, Wrexham	
Date 05.05.16 File Infiltration Basin A Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Infiltration Basin A.srcx

Upstream Outflow To Overflow To
Structures

Filter Drain B.srcx (None) (None)
Filter Drain A.srcx

Half Drain Time : 184 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	73.936	0.136	1.5	18.4	Flood Risk
30 min Summer	73.972	0.172	1.7	24.2	Flood Risk
60 min Summer	74.003	0.203	1.9	29.7	Flood Risk
120 min Summer	74.023	0.223	2.0	33.4	Flood Risk
180 min Summer	74.028	0.228	2.0	34.4	Flood Risk
240 min Summer	74.029	0.229	2.0	34.6	Flood Risk
360 min Summer	74.026	0.226	2.0	34.1	Flood Risk
480 min Summer	74.021	0.221	2.0	33.1	Flood Risk
600 min Summer	74.015	0.215	2.0	31.9	Flood Risk
720 min Summer	74.009	0.209	1.9	30.7	Flood Risk
960 min Summer	73.995	0.195	1.8	28.3	Flood Risk
1440 min Summer	73.971	0.171	1.7	24.0	Flood Risk
2160 min Summer	73.940	0.140	1.6	18.9	Flood Risk
2880 min Summer	73.915	0.115	1.4	15.1	Flood Risk
4320 min Summer	73.880	0.080	1.2	9.9	Flood Risk
5760 min Summer	73.857	0.057	1.1	6.9	Flood Risk
7200 min Summer	73.847	0.047	1.0	5.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	107.735	0.0	19
30 min Summer	72.905	0.0	33
60 min Summer	47.182	0.0	62
120 min Summer	29.539	0.0	120
180 min Summer	22.146	0.0	148
240 min Summer	17.930	0.0	180
360 min Summer	13.215	0.0	248
480 min Summer	10.647	0.0	316
600 min Summer	8.997	0.0	386
720 min Summer	7.835	0.0	454
960 min Summer	6.294	0.0	588
1440 min Summer	4.613	0.0	850
2160 min Summer	3.374	0.0	1216
2880 min Summer	2.698	0.0	1588
4320 min Summer	1.966	0.0	2292
5760 min Summer	1.568	0.0	2992
7200 min Summer	1.315	0.0	3672

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin A Roadside Services Holt Road, Wrexham	
Date 05.05.16 File Infiltration Basin A Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Infiltration Basin A.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
8640 min Summer	73.842	0.042	0.9	4.9	Flood Risk
10080 min Summer	73.838	0.038	0.8	4.4	Flood Risk
15 min Winter	73.951	0.151	1.6	20.7	Flood Risk
30 min Winter	73.990	0.190	1.8	27.3	Flood Risk
60 min Winter	74.024	0.224	2.0	33.6	Flood Risk
120 min Winter	74.047	0.247	2.1	38.2	Flood Risk
180 min Winter	74.052	0.252	2.2	39.2	Flood Risk
240 min Winter	74.053	0.253	2.2	39.3	Flood Risk
360 min Winter	74.048	0.248	2.1	38.3	Flood Risk
480 min Winter	74.040	0.240	2.1	36.7	Flood Risk
600 min Winter	74.031	0.231	2.0	34.9	Flood Risk
720 min Winter	74.021	0.221	2.0	33.1	Flood Risk
960 min Winter	74.002	0.202	1.9	29.5	Flood Risk
1440 min Winter	73.967	0.167	1.7	23.4	Flood Risk
2160 min Winter	73.925	0.125	1.5	16.5	Flood Risk
2880 min Winter	73.893	0.093	1.3	11.7	Flood Risk
4320 min Winter	73.852	0.052	1.1	6.2	Flood Risk
5760 min Winter	73.842	0.042	0.9	5.0	Flood Risk
7200 min Winter	73.836	0.036	0.7	4.2	Flood Risk
8640 min Winter	73.832	0.032	0.7	3.7	Flood Risk
10080 min Winter	73.828	0.028	0.6	3.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	4408
10080 min Summer	1.009	0.0	5128
15 min Winter	107.735	0.0	19
30 min Winter	72.905	0.0	33
60 min Winter	47.182	0.0	62
120 min Winter	29.539	0.0	118
180 min Winter	22.146	0.0	166
240 min Winter	17.930	0.0	190
360 min Winter	13.215	0.0	266
480 min Winter	10.647	0.0	342
600 min Winter	8.997	0.0	416
720 min Winter	7.835	0.0	488
960 min Winter	6.294	0.0	628
1440 min Winter	4.613	0.0	896
2160 min Winter	3.374	0.0	1276
2880 min Winter	2.698	0.0	1640
4320 min Winter	1.966	0.0	2284
5760 min Winter	1.568	0.0	2944
7200 min Winter	1.315	0.0	3680
8640 min Winter	1.139	0.0	4384
10080 min Winter	1.009	0.0	5144

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin A Roadside Services Holt Road, Wrexham	
Date 05.05.16 File Infiltration Basin A Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Infiltration Basin A.srcx

Storage is Online Cover Level (m) 74.100

Infiltration Basin Structure

Invert Level (m) 73.800 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.13320 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.13320

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	110.8	0.700	0.0	1.400	0.0	2.100	0.0
0.100	146.1	0.800	0.0	1.500	0.0	2.200	0.0
0.200	181.7	0.900	0.0	1.600	0.0	2.300	0.0
0.300	217.8	1.000	0.0	1.700	0.0	2.400	0.0
0.400	0.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	0.0	1.200	0.0	1.900	0.0		
0.600	0.0	1.300	0.0	2.000	0.0		

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain C Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin B Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Filter Drain C.srcx

**Upstream
Structures**

Outflow To

Overflow To

(None) Infiltration Basin B.srcx

(None)

Half Drain Time : 1 minutes.

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
15 min Summer	75.894	0.444	0.0	20.9	20.9	1.3	O K
30 min Summer	75.859	0.409	0.0	19.3	19.3	1.2	O K
60 min Summer	75.790	0.340	0.0	14.8	14.8	0.9	O K
120 min Summer	75.748	0.298	0.0	10.1	10.1	0.7	O K
180 min Summer	75.726	0.276	0.0	7.8	7.8	0.6	O K
240 min Summer	75.711	0.261	0.0	6.4	6.4	0.5	O K
360 min Summer	75.690	0.240	0.0	4.7	4.7	0.5	O K
480 min Summer	75.681	0.231	0.0	3.9	3.9	0.4	O K
600 min Summer	75.675	0.225	0.0	3.2	3.2	0.4	O K
720 min Summer	75.671	0.221	0.0	2.8	2.8	0.4	O K
960 min Summer	75.664	0.214	0.0	2.3	2.3	0.4	O K
1440 min Summer	75.654	0.204	0.0	1.7	1.7	0.3	O K
2160 min Summer	75.646	0.196	0.0	1.2	1.2	0.3	O K
2880 min Summer	75.641	0.191	0.0	1.0	1.0	0.3	O K
4320 min Summer	75.635	0.185	0.0	0.7	0.7	0.3	O K
5760 min Summer	75.632	0.182	0.0	0.6	0.6	0.2	O K
7200 min Summer	75.628	0.178	0.0	0.5	0.5	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	8.7	10
30 min Summer	72.905	0.0	11.9	18
60 min Summer	47.182	0.0	15.4	32
120 min Summer	29.539	0.0	19.3	62
180 min Summer	22.146	0.0	21.8	92
240 min Summer	17.930	0.0	23.5	122
360 min Summer	13.215	0.0	26.0	182
480 min Summer	10.647	0.0	27.9	242
600 min Summer	8.997	0.0	29.5	300
720 min Summer	7.835	0.0	30.9	366
960 min Summer	6.294	0.0	33.1	476
1440 min Summer	4.613	0.0	36.4	734
2160 min Summer	3.374	0.0	39.9	1088
2880 min Summer	2.698	0.0	42.6	1432
4320 min Summer	1.966	0.0	46.5	2168
5760 min Summer	1.568	0.0	49.5	2832
7200 min Summer	1.315	0.0	51.9	3672

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain C Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin B Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Filter Drain C.srcx

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
8640 min Summer	75.626	0.176	0.0	0.4	0.4	0.2	O K
10080 min Summer	75.625	0.175	0.0	0.4	0.4	0.2	O K
15 min Winter	75.898	0.448	0.0	21.1	21.1	1.3	O K
30 min Winter	75.820	0.370	0.0	17.3	17.3	1.0	O K
60 min Winter	75.764	0.314	0.0	11.9	11.9	0.8	O K
120 min Winter	75.725	0.275	0.0	7.6	7.6	0.6	O K
180 min Winter	75.703	0.253	0.0	5.8	5.8	0.5	O K
240 min Winter	75.689	0.239	0.0	4.7	4.7	0.4	O K
360 min Winter	75.677	0.227	0.0	3.4	3.4	0.4	O K
480 min Winter	75.671	0.221	0.0	2.8	2.8	0.4	O K
600 min Winter	75.665	0.215	0.0	2.3	2.3	0.4	O K
720 min Winter	75.660	0.210	0.0	2.0	2.0	0.3	O K
960 min Winter	75.653	0.203	0.0	1.6	1.6	0.3	O K
1440 min Winter	75.646	0.196	0.0	1.2	1.2	0.3	O K
2160 min Winter	75.639	0.189	0.0	0.9	0.9	0.3	O K
2880 min Winter	75.635	0.185	0.0	0.7	0.7	0.3	O K
4320 min Winter	75.630	0.180	0.0	0.5	0.5	0.2	O K
5760 min Winter	75.626	0.176	0.0	0.4	0.4	0.2	O K
7200 min Winter	75.624	0.174	0.0	0.4	0.4	0.2	O K
8640 min Winter	75.622	0.172	0.0	0.3	0.3	0.2	O K
10080 min Winter	75.621	0.171	0.0	0.3	0.3	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	54.0	4248
10080 min Summer	1.009	0.0	55.8	4960
15 min Winter	107.735	0.0	9.8	11
30 min Winter	72.905	0.0	13.3	18
60 min Winter	47.182	0.0	17.3	32
120 min Winter	29.539	0.0	21.7	62
180 min Winter	22.146	0.0	24.4	92
240 min Winter	17.930	0.0	26.3	124
360 min Winter	13.215	0.0	29.1	182
480 min Winter	10.647	0.0	31.3	242
600 min Winter	8.997	0.0	33.1	302
720 min Winter	7.835	0.0	34.6	360
960 min Winter	6.294	0.0	37.1	490
1440 min Winter	4.613	0.0	40.8	724
2160 min Winter	3.374	0.0	44.7	1100
2880 min Winter	2.698	0.0	47.7	1428
4320 min Winter	1.966	0.0	52.1	2160
5760 min Winter	1.568	0.0	55.5	2840
7200 min Winter	1.315	0.0	58.1	3568
8640 min Winter	1.139	0.0	60.4	4240
10080 min Winter	1.009	0.0	62.5	4992

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain C Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin B Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain C.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.044

Time (mins)		Area
From:	To:	(ha)
0	4	0.044

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain C Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin B Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Filter Drain C.srcx

Storage is Online Cover Level (m) 76.800

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	20.5
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	100.0
Invert Level (m)	75.450	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	100.0	Coefficient of Contraction	0.600
Length (m)	9.600	Upstream Invert Level (m)	75.600
Roughness k (mm)	0.600		

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain D Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin B Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Filter Drain D.srcx

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
8640 min Summer	75.638	0.188	0.0	0.9	0.9	1.3	O K
10080 min Summer	75.636	0.186	0.0	0.8	0.8	1.3	O K
15 min Winter	76.239	0.789	0.0	32.7	32.7	7.6	O K
30 min Winter	76.142	0.692	0.0	29.9	29.9	6.7	O K
60 min Winter	75.943	0.493	0.0	23.0	23.0	4.8	O K
120 min Winter	75.797	0.347	0.0	15.6	15.6	3.5	O K
180 min Winter	75.763	0.313	0.0	11.8	11.8	3.0	O K
240 min Winter	75.743	0.293	0.0	9.6	9.6	2.7	O K
360 min Winter	75.720	0.270	0.0	7.1	7.1	2.4	O K
480 min Winter	75.703	0.253	0.0	5.7	5.7	2.1	O K
600 min Winter	75.692	0.242	0.0	4.9	4.9	2.0	O K
720 min Winter	75.685	0.235	0.0	4.2	4.2	1.9	O K
960 min Winter	75.677	0.227	0.0	3.4	3.4	1.8	O K
1440 min Winter	75.667	0.217	0.0	2.5	2.5	1.6	O K
2160 min Winter	75.656	0.206	0.0	1.8	1.8	1.5	O K
2880 min Winter	75.650	0.200	0.0	1.5	1.5	1.4	O K
4320 min Winter	75.643	0.193	0.0	1.1	1.1	1.3	O K
5760 min Winter	75.638	0.188	0.0	0.8	0.8	1.3	O K
7200 min Winter	75.635	0.185	0.0	0.7	0.7	1.3	O K
8640 min Winter	75.633	0.183	0.0	0.6	0.6	1.2	O K
10080 min Winter	75.631	0.181	0.0	0.6	0.6	1.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	111.0	4376
10080 min Summer	1.009	0.0	114.8	4968
15 min Winter	107.735	0.0	19.7	12
30 min Winter	72.905	0.0	26.9	20
60 min Winter	47.182	0.0	35.1	34
120 min Winter	29.539	0.0	44.2	64
180 min Winter	22.146	0.0	49.9	94
240 min Winter	17.930	0.0	53.9	124
360 min Winter	13.215	0.0	59.7	184
480 min Winter	10.647	0.0	64.2	246
600 min Winter	8.997	0.0	67.8	304
720 min Winter	7.835	0.0	70.9	368
960 min Winter	6.294	0.0	76.1	488
1440 min Winter	4.613	0.0	83.7	728
2160 min Winter	3.374	0.0	91.9	1084
2880 min Winter	2.698	0.0	98.1	1468
4320 min Winter	1.966	0.0	107.2	2192
5760 min Winter	1.568	0.0	114.1	2928
7200 min Winter	1.315	0.0	119.7	3584
8640 min Winter	1.139	0.0	124.4	4392
10080 min Winter	1.009	0.0	128.7	5096

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain D Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin B Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain D.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.091

Time (mins)		Area
From:	To:	(ha)
0	4	0.091

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain D Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin B Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Filter Drain D.srcx

Storage is Online Cover Level (m) 76.800

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	61.5
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	615.0
Invert Level (m)	75.450	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	100.0	Coefficient of Contraction	0.600
Length (m)	9.600	Upstream Invert Level (m)	75.600
Roughness k (mm)	0.600		

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin B Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin B Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Infiltration Basin B.srcx

**Upstream Outflow To Overflow To
Structures**

Filter Drain D.srcx (None) (None)
Filter Drain C.srcx

Half Drain Time : 510 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	76.034	0.534	0.9	29.8	O K
30 min Summer	76.165	0.665	1.1	40.5	O K
60 min Summer	76.285	0.785	1.2	51.9	O K
120 min Summer	76.389	0.889	1.4	62.8	O K
180 min Summer	76.435	0.935	1.5	68.0	O K
240 min Summer	76.459	0.959	1.5	70.7	O K
360 min Summer	76.475	0.975	1.5	72.6	O K
480 min Summer	76.482	0.982	1.5	73.4	O K
600 min Summer	76.485	0.985	1.5	73.8	O K
720 min Summer	76.485	0.985	1.5	73.8	O K
960 min Summer	76.480	0.980	1.5	73.2	O K
1440 min Summer	76.457	0.957	1.5	70.5	O K
2160 min Summer	76.413	0.913	1.4	65.4	O K
2880 min Summer	76.367	0.867	1.4	60.4	O K
4320 min Summer	76.285	0.785	1.2	51.9	O K
5760 min Summer	76.216	0.716	1.1	45.2	O K
7200 min Summer	76.156	0.656	1.0	39.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	25
30 min Summer	72.905	0.0	38
60 min Summer	47.182	0.0	66
120 min Summer	29.539	0.0	124
180 min Summer	22.146	0.0	184
240 min Summer	17.930	0.0	242
360 min Summer	13.215	0.0	342
480 min Summer	10.647	0.0	398
600 min Summer	8.997	0.0	460
720 min Summer	7.835	0.0	522
960 min Summer	6.294	0.0	660
1440 min Summer	4.613	0.0	938
2160 min Summer	3.374	0.0	1344
2880 min Summer	2.698	0.0	1756
4320 min Summer	1.966	0.0	2520
5760 min Summer	1.568	0.0	3288
7200 min Summer	1.315	0.0	4040

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin B Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin B Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Infiltration Basin B.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
8640 min Summer	76.104	0.604	1.0	35.4	O K
10080 min Summer	76.059	0.559	0.9	31.7	O K
15 min Winter	76.082	0.582	0.9	33.6	O K
30 min Winter	76.221	0.721	1.1	45.7	O K
60 min Winter	76.349	0.849	1.3	58.5	O K
120 min Winter	76.460	0.960	1.5	70.9	O K
180 min Winter	76.511	1.011	1.6	77.1	O K
240 min Winter	76.538	1.038	1.6	80.4	O K
360 min Winter	76.559	1.059	1.7	83.0	Flood Risk
480 min Winter	76.563	1.063	1.7	83.6	Flood Risk
600 min Winter	76.565	1.065	1.7	83.7	Flood Risk
720 min Winter	76.563	1.063	1.7	83.6	Flood Risk
960 min Winter	76.553	1.053	1.7	82.3	Flood Risk
1440 min Winter	76.518	1.018	1.6	77.9	O K
2160 min Winter	76.454	0.954	1.5	70.2	O K
2880 min Winter	76.391	0.891	1.4	63.0	O K
4320 min Winter	76.278	0.778	1.2	51.2	O K
5760 min Winter	76.185	0.685	1.1	42.4	O K
7200 min Winter	76.107	0.607	1.0	35.6	O K
8640 min Winter	76.042	0.542	0.9	30.4	O K
10080 min Winter	75.986	0.486	0.8	26.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	4760
10080 min Summer	1.009	0.0	5520
15 min Winter	107.735	0.0	25
30 min Winter	72.905	0.0	37
60 min Winter	47.182	0.0	64
120 min Winter	29.539	0.0	122
180 min Winter	22.146	0.0	180
240 min Winter	17.930	0.0	236
360 min Winter	13.215	0.0	346
480 min Winter	10.647	0.0	446
600 min Winter	8.997	0.0	478
720 min Winter	7.835	0.0	554
960 min Winter	6.294	0.0	708
1440 min Winter	4.613	0.0	1010
2160 min Winter	3.374	0.0	1448
2880 min Winter	2.698	0.0	1860
4320 min Winter	1.966	0.0	2676
5760 min Winter	1.568	0.0	3456
7200 min Winter	1.315	0.0	4184
8640 min Winter	1.139	0.0	4936
10080 min Winter	1.009	0.0	5656

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin B Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin B Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Infiltration Basin B.srcx

Storage is Online Cover Level (m) 76.850

Infiltration Basin Structure

Invert Level (m) 75.500 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.13320 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.13320

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	36.8	0.700	91.7	1.400	0.0	2.100	0.0
0.100	43.3	0.800	101.3	1.500	0.0	2.200	0.0
0.200	50.3	0.900	111.3	1.600	0.0	2.300	0.0
0.300	57.7	1.000	121.7	1.700	0.0	2.400	0.0
0.400	65.6	1.100	132.6	1.800	0.0	2.500	0.0
0.500	73.9	1.200	143.9	1.900	0.0		
0.600	82.6	1.300	155.6	2.000	0.0		

Simpson Associates

1 Market Place Mews
Henley-on-Thames
RG9 2AH

Date 06.05.16
File Infiltration Basin C Ca...

Micro Drainage

Filter Drain E
Roadside Services
Holt Road, Wrexham

Designed by G.S.C
Checked by G.S.C

Source Control 2015.1

Page 2



Cascade Summary of Results for Filter Drain E.srcx

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
8640 min Summer	76.552	0.182	0.0	0.6	0.6	0.2	O K
10080 min Summer	76.550	0.180	0.0	0.5	0.5	0.2	O K
15 min Winter	77.139	0.769	0.0	31.9	31.9	1.0	O K
30 min Winter	76.925	0.555	0.0	24.7	24.7	0.7	O K
60 min Winter	76.753	0.383	0.0	16.9	16.9	0.5	O K
120 min Winter	76.674	0.304	0.0	10.7	10.7	0.4	O K
180 min Winter	76.650	0.280	0.0	8.1	8.1	0.4	O K
240 min Winter	76.634	0.264	0.0	6.6	6.6	0.4	O K
360 min Winter	76.612	0.242	0.0	4.9	4.9	0.3	O K
480 min Winter	76.602	0.232	0.0	4.0	4.0	0.3	O K
600 min Winter	76.596	0.226	0.0	3.3	3.3	0.3	O K
720 min Winter	76.592	0.222	0.0	2.9	2.9	0.3	O K
960 min Winter	76.584	0.214	0.0	2.3	2.3	0.3	O K
1440 min Winter	76.574	0.204	0.0	1.7	1.7	0.2	O K
2160 min Winter	76.567	0.197	0.0	1.3	1.3	0.2	O K
2880 min Winter	76.561	0.191	0.0	1.0	1.0	0.2	O K
4320 min Winter	76.555	0.185	0.0	0.7	0.7	0.2	O K
5760 min Winter	76.552	0.182	0.0	0.6	0.6	0.2	O K
7200 min Winter	76.549	0.179	0.0	0.5	0.5	0.2	O K
8640 min Winter	76.547	0.177	0.0	0.4	0.4	0.2	O K
10080 min Winter	76.545	0.175	0.0	0.4	0.4	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	76.1	4392
10080 min Summer	1.009	0.0	78.7	5088
15 min Winter	107.735	0.0	13.9	10
30 min Winter	72.905	0.0	18.8	17
60 min Winter	47.182	0.0	24.4	32
120 min Winter	29.539	0.0	30.6	62
180 min Winter	22.146	0.0	34.4	94
240 min Winter	17.930	0.0	37.2	122
360 min Winter	13.215	0.0	41.1	180
480 min Winter	10.647	0.0	44.2	240
600 min Winter	8.997	0.0	46.7	302
720 min Winter	7.835	0.0	48.8	362
960 min Winter	6.294	0.0	52.3	480
1440 min Winter	4.613	0.0	57.5	714
2160 min Winter	3.374	0.0	63.1	1072
2880 min Winter	2.698	0.0	67.3	1468
4320 min Winter	1.966	0.0	73.5	2156
5760 min Winter	1.568	0.0	78.2	2784
7200 min Winter	1.315	0.0	82.0	3568
8640 min Winter	1.139	0.0	85.2	4344
10080 min Winter	1.009	0.0	88.1	5056

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Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain E Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin C Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain E.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.062

Time (mins)		Area
From:	To:	(ha)
0	4	0.062

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain E Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin C Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Filter Drain E.srcx

Storage is Online Cover Level (m) 77.600

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	7.5
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	615.0
Invert Level (m)	76.370	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	130.0	Coefficient of Contraction	0.600
Length (m)	9.071	Upstream Invert Level (m)	76.520
Roughness k (mm)	0.600		

Simpson Associates		Page 1	
1 Market Place Mews Henley-on-Thames RG9 2AH		Filter Drain E Roadside Services Holt Road, Wrexham	
Date 06.05.16		Designed by G.S.C	
File Infiltration Basin C Ca...		Checked by G.S.C	
Micro Drainage		Source Control 2015.1	

Cascade Summary of Results for Filter Drain E.srcx

Upstream Structures

(None)

Outflow To

Filter Drain F.srcx

Overflow To

(None)

Half Drain Time : 0 minutes.

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
15 min Summer	77.138	0.768	0.0	31.9	31.9	0.9	O K
30 min Summer	77.021	0.651	0.0	28.2	28.2	0.8	O K
60 min Summer	76.839	0.469	0.0	21.2	21.2	0.6	O K
120 min Summer	76.711	0.341	0.0	14.4	14.4	0.5	O K
180 min Summer	76.677	0.307	0.0	11.1	11.1	0.4	O K
240 min Summer	76.659	0.289	0.0	9.1	9.1	0.4	O K
360 min Summer	76.635	0.265	0.0	6.7	6.7	0.4	O K
480 min Summer	76.619	0.249	0.0	5.4	5.4	0.3	O K
600 min Summer	76.609	0.239	0.0	4.6	4.6	0.3	O K
720 min Summer	76.603	0.233	0.0	4.0	4.0	0.3	O K
960 min Summer	76.595	0.225	0.0	3.2	3.2	0.3	O K
1440 min Summer	76.585	0.215	0.0	2.3	2.3	0.3	O K
2160 min Summer	76.575	0.205	0.0	1.7	1.7	0.2	O K
2880 min Summer	76.569	0.199	0.0	1.4	1.4	0.2	O K
4320 min Summer	76.562	0.192	0.0	1.0	1.0	0.2	O K
5760 min Summer	76.557	0.187	0.0	0.8	0.8	0.2	O K
7200 min Summer	76.554	0.184	0.0	0.7	0.7	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	107.735	0.0	12.4	10
30 min Summer	72.905	0.0	16.8	18
60 min Summer	47.182	0.0	21.8	32
120 min Summer	29.539	0.0	27.3	62
180 min Summer	22.146	0.0	30.7	92
240 min Summer	17.930	0.0	33.2	122
360 min Summer	13.215	0.0	36.7	182
480 min Summer	10.647	0.0	39.4	242
600 min Summer	8.997	0.0	41.7	304
720 min Summer	7.835	0.0	43.6	360
960 min Summer	6.294	0.0	46.7	488
1440 min Summer	4.613	0.0	51.3	728
2160 min Summer	3.374	0.0	56.3	1076
2880 min Summer	2.698	0.0	60.1	1460
4320 min Summer	1.966	0.0	65.6	2176
5760 min Summer	1.568	0.0	69.8	2920
7200 min Summer	1.315	0.0	73.2	3576

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1 Market Place Mews
Henley-on-Thames
RG9 2AH

Date 06.05.16
File Infiltration Basin C Ca...

Micro Drainage

Filter Drain E
Roadside Services
Holt Road, Wrexham

Designed by G.S.C
Checked by G.S.C

Source Control 2015.1

Page 2



Cascade Summary of Results for Filter Drain E.srcx

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
8640 min Summer	76.552	0.182	0.0	0.6	0.6	0.2	O K
10080 min Summer	76.550	0.180	0.0	0.5	0.5	0.2	O K
15 min Winter	77.139	0.769	0.0	31.9	31.9	1.0	O K
30 min Winter	76.925	0.555	0.0	24.7	24.7	0.7	O K
60 min Winter	76.753	0.383	0.0	16.9	16.9	0.5	O K
120 min Winter	76.674	0.304	0.0	10.7	10.7	0.4	O K
180 min Winter	76.650	0.280	0.0	8.1	8.1	0.4	O K
240 min Winter	76.634	0.264	0.0	6.6	6.6	0.4	O K
360 min Winter	76.612	0.242	0.0	4.9	4.9	0.3	O K
480 min Winter	76.602	0.232	0.0	4.0	4.0	0.3	O K
600 min Winter	76.596	0.226	0.0	3.3	3.3	0.3	O K
720 min Winter	76.592	0.222	0.0	2.9	2.9	0.3	O K
960 min Winter	76.584	0.214	0.0	2.3	2.3	0.3	O K
1440 min Winter	76.574	0.204	0.0	1.7	1.7	0.2	O K
2160 min Winter	76.567	0.197	0.0	1.3	1.3	0.2	O K
2880 min Winter	76.561	0.191	0.0	1.0	1.0	0.2	O K
4320 min Winter	76.555	0.185	0.0	0.7	0.7	0.2	O K
5760 min Winter	76.552	0.182	0.0	0.6	0.6	0.2	O K
7200 min Winter	76.549	0.179	0.0	0.5	0.5	0.2	O K
8640 min Winter	76.547	0.177	0.0	0.4	0.4	0.2	O K
10080 min Winter	76.545	0.175	0.0	0.4	0.4	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	76.1	4392
10080 min Summer	1.009	0.0	78.7	5088
15 min Winter	107.735	0.0	13.9	10
30 min Winter	72.905	0.0	18.8	17
60 min Winter	47.182	0.0	24.4	32
120 min Winter	29.539	0.0	30.6	62
180 min Winter	22.146	0.0	34.4	94
240 min Winter	17.930	0.0	37.2	122
360 min Winter	13.215	0.0	41.1	180
480 min Winter	10.647	0.0	44.2	240
600 min Winter	8.997	0.0	46.7	302
720 min Winter	7.835	0.0	48.8	362
960 min Winter	6.294	0.0	52.3	480
1440 min Winter	4.613	0.0	57.5	714
2160 min Winter	3.374	0.0	63.1	1072
2880 min Winter	2.698	0.0	67.3	1468
4320 min Winter	1.966	0.0	73.5	2156
5760 min Winter	1.568	0.0	78.2	2784
7200 min Winter	1.315	0.0	82.0	3568
8640 min Winter	1.139	0.0	85.2	4344
10080 min Winter	1.009	0.0	88.1	5056

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Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain E Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin C Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain E.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.062

Time (mins)		Area
From:	To:	(ha)
0	4	0.062

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain E Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin C Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Filter Drain E.srcx

Storage is Online Cover Level (m) 77.600

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	7.5
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	615.0
Invert Level (m)	76.370	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	130.0	Coefficient of Contraction	0.600
Length (m)	9.071	Upstream Invert Level (m)	76.520
Roughness k (mm)	0.600		

Simpson Associates			Page 2				
1 Market Place Mews Henley-on-Thames RG9 2AH		Filter Drain F Roadside Services Holt Road, Wrexham					
Date 06.05.16 File Infiltration Basin C Ca...		Designed by G.S.C Checked by G.S.C					
Micro Drainage		Source Control 2015.1					
<u>Cascade Summary of Results for Filter Drain F.srcx</u>							
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
8640 min Summer	76.441	0.191	0.0	1.0	1.0	1.0	O K
10080 min Summer	76.438	0.188	0.0	0.9	0.9	1.0	O K
15 min Winter	77.282	1.032	0.0	42.2	42.2	6.2	Flood Risk
30 min Winter	77.100	0.850	0.0	37.1	37.1	5.2	O K
60 min Winter	76.822	0.572	0.0	27.4	27.4	3.6	O K
120 min Winter	76.642	0.392	0.0	17.9	17.9	2.6	O K
180 min Winter	76.585	0.335	0.0	13.5	13.5	2.2	O K
240 min Winter	76.559	0.309	0.0	11.0	11.0	2.1	O K
360 min Winter	76.529	0.279	0.0	8.1	8.1	1.8	O K
480 min Winter	76.513	0.263	0.0	6.5	6.5	1.7	O K
600 min Winter	76.500	0.250	0.0	5.5	5.5	1.5	O K
720 min Winter	76.491	0.241	0.0	4.8	4.8	1.4	O K
960 min Winter	76.482	0.232	0.0	3.9	3.9	1.3	O K
1440 min Winter	76.472	0.222	0.0	2.9	2.9	1.3	O K
2160 min Winter	76.461	0.211	0.0	2.1	2.1	1.2	O K
2880 min Winter	76.454	0.204	0.0	1.7	1.7	1.1	O K
4320 min Winter	76.446	0.196	0.0	1.2	1.2	1.0	O K
5760 min Winter	76.441	0.191	0.0	1.0	1.0	1.0	O K
7200 min Winter	76.437	0.187	0.0	0.8	0.8	1.0	O K
8640 min Winter	76.435	0.185	0.0	0.7	0.7	0.9	O K
10080 min Winter	76.433	0.183	0.0	0.6	0.6	0.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
8640 min Summer	1.139	0.0	127.0	4384			
10080 min Summer	1.009	0.0	131.4	5000			
15 min Winter	107.735	0.0	22.6	12			
30 min Winter	72.905	0.0	31.0	19			
60 min Winter	47.182	0.0	40.3	34			
120 min Winter	29.539	0.0	50.7	64			
180 min Winter	22.146	0.0	57.2	92			
240 min Winter	17.930	0.0	61.8	124			
360 min Winter	13.215	0.0	68.4	184			
480 min Winter	10.647	0.0	73.5	244			
600 min Winter	8.997	0.0	77.7	304			
720 min Winter	7.835	0.0	81.3	364			
960 min Winter	6.294	0.0	87.1	482			
1440 min Winter	4.613	0.0	95.8	732			
2160 min Winter	3.374	0.0	105.2	1088			
2880 min Winter	2.698	0.0	112.3	1448			
4320 min Winter	1.966	0.0	122.7	2144			
5760 min Winter	1.568	0.0	130.6	2928			
7200 min Winter	1.315	0.0	136.9	3488			
8640 min Winter	1.139	0.0	142.4	4408			
10080 min Winter	1.009	0.0	147.2	5048			
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Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain F Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin C Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain F.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.042

Time (mins)		Area
From:	To:	(ha)
0	4	0.042

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain F Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin C Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Filter Drain F.srcx

Storage is Online Cover Level (m) 77.500

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	38.2
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	764.0
Invert Level (m)	76.250	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	130.0	Coefficient of Contraction	0.600
Length (m)	5.539	Upstream Invert Level (m)	76.400
Roughness k (mm)	0.600		

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain G Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin C Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain G.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.005

Time (mins)		Area
From:	To:	(ha)
0	4	0.005

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain G Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin C Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Filter Drain G.srcx

Storage is Online Cover Level (m) 77.500

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	13.4
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	268.0
Invert Level (m)	76.250	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	130.0	Coefficient of Contraction	0.600
Length (m)	5.539	Upstream Invert Level (m)	76.400
Roughness k (mm)	0.600		

Simpson Associates		Page 1
1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin C Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin C Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Infiltration Basin C.srcx

Upstream Outflow To Overflow To
Structures

Filter Drain F.srcx (None) (None)
Filter Drain E.srcx
Filter Drain G.srcx

Half Drain Time : 512 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	76.813	0.463	1.0	33.9	O K
30 min Summer	76.932	0.582	1.2	45.9	O K
60 min Summer	77.044	0.694	1.4	58.5	O K
120 min Summer	77.142	0.792	1.6	70.7	Flood Risk
180 min Summer	77.186	0.836	1.6	76.6	Flood Risk
240 min Summer	77.208	0.858	1.7	79.5	Flood Risk
360 min Summer	77.222	0.872	1.7	81.5	Flood Risk
480 min Summer	77.228	0.878	1.7	82.3	Flood Risk
600 min Summer	77.230	0.880	1.7	82.6	Flood Risk
720 min Summer	77.230	0.880	1.7	82.5	Flood Risk
960 min Summer	77.223	0.873	1.7	81.6	Flood Risk
1440 min Summer	77.199	0.849	1.7	78.3	Flood Risk
2160 min Summer	77.154	0.804	1.6	72.3	Flood Risk
2880 min Summer	77.110	0.760	1.5	66.6	Flood Risk
4320 min Summer	77.031	0.681	1.4	56.9	O K
5760 min Summer	76.963	0.613	1.3	49.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	107.735	0.0	23
30 min Summer	72.905	0.0	36
60 min Summer	47.182	0.0	66
120 min Summer	29.539	0.0	124
180 min Summer	22.146	0.0	182
240 min Summer	17.930	0.0	242
360 min Summer	13.215	0.0	346
480 min Summer	10.647	0.0	398
600 min Summer	8.997	0.0	462
720 min Summer	7.835	0.0	524
960 min Summer	6.294	0.0	662
1440 min Summer	4.613	0.0	938
2160 min Summer	3.374	0.0	1344
2880 min Summer	2.698	0.0	1756
4320 min Summer	1.966	0.0	2548
5760 min Summer	1.568	0.0	3288

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1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin C Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin C Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Infiltration Basin C.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Summer	76.905	0.555	1.2	43.1	O K
8640 min Summer	76.855	0.505	1.1	38.0	O K
10080 min Summer	76.811	0.461	1.0	33.7	O K
15 min Winter	76.857	0.507	1.1	38.1	O K
30 min Winter	76.985	0.635	1.3	51.7	O K
60 min Winter	77.105	0.755	1.5	66.0	Flood Risk
120 min Winter	77.211	0.861	1.7	79.9	Flood Risk
180 min Winter	77.259	0.909	1.8	86.8	Flood Risk
240 min Winter	77.285	0.935	1.8	90.4	Flood Risk
360 min Winter	77.305	0.955	1.9	93.4	Flood Risk
480 min Winter	77.309	0.959	1.9	94.0	Flood Risk
600 min Winter	77.309	0.959	1.9	94.0	Flood Risk
720 min Winter	77.307	0.957	1.9	93.7	Flood Risk
960 min Winter	77.296	0.946	1.8	92.1	Flood Risk
1440 min Winter	77.260	0.910	1.8	86.9	Flood Risk
2160 min Winter	77.196	0.846	1.7	77.9	Flood Risk
2880 min Winter	77.134	0.784	1.5	69.6	Flood Risk
4320 min Winter	77.025	0.675	1.4	56.2	O K
5760 min Winter	76.934	0.584	1.2	46.1	O K
7200 min Winter	76.858	0.508	1.1	38.3	O K
8640 min Winter	76.794	0.444	1.0	32.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Summer	1.315	0.0	4040
8640 min Summer	1.139	0.0	4760
10080 min Summer	1.009	0.0	5544
15 min Winter	107.735	0.0	23
30 min Winter	72.905	0.0	36
60 min Winter	47.182	0.0	64
120 min Winter	29.539	0.0	122
180 min Winter	22.146	0.0	180
240 min Winter	17.930	0.0	236
360 min Winter	13.215	0.0	346
480 min Winter	10.647	0.0	448
600 min Winter	8.997	0.0	480
720 min Winter	7.835	0.0	554
960 min Winter	6.294	0.0	710
1440 min Winter	4.613	0.0	1012
2160 min Winter	3.374	0.0	1448
2880 min Winter	2.698	0.0	1872
4320 min Winter	1.966	0.0	2680
5760 min Winter	1.568	0.0	3456
7200 min Winter	1.315	0.0	4192
8640 min Winter	1.139	0.0	4936

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1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin C Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin C Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Infiltration Basin C.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	76.740	0.390	0.9	27.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	1.009	0.0	5656

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin C Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin C Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Infiltration Basin C.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.070

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

0	4 0.070
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Simpson Associates		Page 5
1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin C Roadside Services Holt Road, Wrexham	
Date 06.05.16	Designed by G.S.C	
File Infiltration Basin C Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Infiltration Basin C.srcx

Storage is Online Cover Level (m) 77.400

Infiltration Basin Structure

Invert Level (m) 76.350 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.13320 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.13320

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	53.2	0.700	119.6	1.400	0.0	2.100	0.0
0.100	61.4	0.800	130.8	1.500	0.0	2.200	0.0
0.200	70.0	0.900	142.4	1.600	0.0	2.300	0.0
0.300	79.1	1.000	154.4	1.700	0.0	2.400	0.0
0.400	88.6	1.100	166.9	1.800	0.0	2.500	0.0
0.500	98.5	1.200	0.0	1.900	0.0		
0.600	108.8	1.300	0.0	2.000	0.0		

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1 Market Place Mews
Henley-on-Thames
RG9 2AH

Date 06.05.16
File Infiltration Basin D Ca...

Micro Drainage

Filter Drain H
Roadside Services
Holt Road, Wrexham

Designed by G.S.C
Checked by G.S.C

Source Control 2015.1

Micro Drainage

Cascade Summary of Results for Filter Drain H.srcx

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
8640 min Summer	76.519	0.019	0.0	0.2	0.2	0.0	O K
10080 min Summer	76.517	0.017	0.0	0.2	0.2	0.0	O K
15 min Winter	76.656	0.156	0.0	11.0	11.0	0.2	O K
30 min Winter	76.633	0.133	0.0	8.5	8.5	0.1	O K
60 min Winter	76.603	0.103	0.0	5.7	5.7	0.1	O K
120 min Winter	76.579	0.079	0.0	3.7	3.7	0.0	O K
180 min Winter	76.571	0.071	0.0	2.8	2.8	0.0	O K
240 min Winter	76.563	0.063	0.0	2.3	2.3	0.0	O K
360 min Winter	76.553	0.053	0.0	1.6	1.6	0.0	O K
480 min Winter	76.548	0.048	0.0	1.3	1.3	0.0	O K
600 min Winter	76.544	0.044	0.0	1.1	1.1	0.0	O K
720 min Winter	76.541	0.041	0.0	1.0	1.0	0.0	O K
960 min Winter	76.536	0.036	0.0	0.8	0.8	0.0	O K
1440 min Winter	76.532	0.032	0.0	0.6	0.6	0.0	O K
2160 min Winter	76.527	0.027	0.0	0.4	0.4	0.0	O K
2880 min Winter	76.525	0.025	0.0	0.4	0.4	0.0	O K
4320 min Winter	76.520	0.020	0.0	0.2	0.2	0.0	O K
5760 min Winter	76.518	0.018	0.0	0.2	0.2	0.0	O K
7200 min Winter	76.517	0.017	0.0	0.2	0.2	0.0	O K
8640 min Winter	76.515	0.015	0.0	0.2	0.2	0.0	O K
10080 min Winter	76.516	0.016	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	25.8	4416
10080 min Summer	1.009	0.0	26.7	5016
15 min Winter	107.735	0.0	4.8	10
30 min Winter	72.905	0.0	6.4	17
60 min Winter	47.182	0.0	8.3	32
120 min Winter	29.539	0.0	10.4	62
180 min Winter	22.146	0.0	11.7	90
240 min Winter	17.930	0.0	12.7	120
360 min Winter	13.215	0.0	14.0	182
480 min Winter	10.647	0.0	15.0	234
600 min Winter	8.997	0.0	15.9	298
720 min Winter	7.835	0.0	16.6	372
960 min Winter	6.294	0.0	17.8	472
1440 min Winter	4.613	0.0	19.5	718
2160 min Winter	3.374	0.0	21.4	1160
2880 min Winter	2.698	0.0	22.8	1388
4320 min Winter	1.966	0.0	25.0	2176
5760 min Winter	1.568	0.0	26.5	2768
7200 min Winter	1.315	0.0	27.8	3448
8640 min Winter	1.139	0.0	28.8	4728
10080 min Winter	1.009	0.0	29.9	5624

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Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain H Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin D Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain H.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.021

Time (mins)		Area
From:	To:	(ha)
0	4	0.021

Simpson Associates		Page 4
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain H Roadside Services Holt Road, Wrexham	
Date 06.05.16 File Infiltration Basin D Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Filter Drain H.srcx

Storage is Online Cover Level (m) 77.650

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	15.8
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	100.0
Invert Level (m)	76.500	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	58.0	Coefficient of Contraction	0.600
Length (m)	20.821	Upstream Invert Level (m)	76.500
Roughness k (mm)	0.600		

Simpson Associates

1 Market Place Mews
Henley-on-Thames
RG9 2AH

Date 11.05.16
File Infiltration Basin D Ca...

Micro Drainage

Filter Drain I
Roadside Services
Holt Road, Wrexham

Designed by G.S.C
Checked by G.S.C

Source Control 2015.1

Page 2



Cascade Summary of Results for Filter Drain I.srcx

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
8640 min Summer	74.539	0.039	0.0	0.9	0.9	0.0	O K
10080 min Summer	74.537	0.037	0.0	0.8	0.8	0.0	O K
15 min Winter	75.477	0.977	0.0	44.6	44.6	1.3	Flood Risk
30 min Winter	75.187	0.687	0.0	36.7	36.7	0.7	O K
60 min Winter	74.864	0.364	0.0	25.3	25.3	0.2	O K
120 min Winter	74.702	0.202	0.0	16.1	16.1	0.1	O K
180 min Winter	74.666	0.166	0.0	12.1	12.1	0.0	O K
240 min Winter	74.646	0.146	0.0	9.9	9.9	0.0	O K
360 min Winter	74.622	0.122	0.0	7.3	7.3	0.0	O K
480 min Winter	74.605	0.105	0.0	5.9	5.9	0.0	O K
600 min Winter	74.594	0.094	0.0	5.0	5.0	0.0	O K
720 min Winter	74.587	0.087	0.0	4.5	4.5	0.0	O K
960 min Winter	74.579	0.079	0.0	3.7	3.7	0.0	O K
1440 min Winter	74.569	0.069	0.0	2.6	2.6	0.0	O K
2160 min Winter	74.558	0.058	0.0	1.9	1.9	0.0	O K
2880 min Winter	74.552	0.052	0.0	1.6	1.6	0.0	O K
4320 min Winter	74.544	0.044	0.0	1.1	1.1	0.0	O K
5760 min Winter	74.539	0.039	0.0	0.9	0.9	0.0	O K
7200 min Winter	74.536	0.036	0.0	0.8	0.8	0.0	O K
8640 min Winter	74.533	0.033	0.0	0.7	0.7	0.0	O K
10080 min Winter	74.532	0.032	0.0	0.6	0.6	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	114.1	4288
10080 min Summer	1.009	0.0	118.0	4952
15 min Winter	107.735	0.0	21.0	11
30 min Winter	72.905	0.0	28.5	18
60 min Winter	47.182	0.0	36.9	32
120 min Winter	29.539	0.0	46.2	62
180 min Winter	22.146	0.0	51.9	90
240 min Winter	17.930	0.0	56.0	120
360 min Winter	13.215	0.0	61.9	184
480 min Winter	10.647	0.0	66.5	246
600 min Winter	8.997	0.0	70.3	300
720 min Winter	7.835	0.0	73.5	378
960 min Winter	6.294	0.0	78.7	488
1440 min Winter	4.613	0.0	86.5	696
2160 min Winter	3.374	0.0	94.9	1096
2880 min Winter	2.698	0.0	101.1	1532
4320 min Winter	1.966	0.0	110.5	2384
5760 min Winter	1.568	0.0	117.3	2584
7200 min Winter	1.315	0.0	123.0	3592
8640 min Winter	1.139	0.0	127.8	4696
10080 min Winter	1.009	0.0	132.2	5128

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Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain I Roadside Services Holt Road, Wrexham	
Date 11.05.16 File Infiltration Basin D Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain I.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.072

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

0	4 0.072
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1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain I Roadside Services Holt Road, Wrexham	
Date 11.05.16 File Infiltration Basin D Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Filter Drain I.srcx

Storage is Online Cover Level (m) 75.650

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	26.6
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	16.0
Invert Level (m)	74.500	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	22.0	Coefficient of Contraction	0.600
Length (m)	10.759	Upstream Invert Level (m)	74.500
Roughness k (mm)	0.600		

Simpson Associates		Page 2
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain J Roadside Services Holt Road, Wrexham	
Date 11.05.16 File Infiltration Basin D Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Filter Drain J.srcx

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
8640 min Summer	74.675	0.025	0.0	0.4	0.4	0.0	O K
10080 min Summer	74.673	0.023	0.0	0.3	0.3	0.0	O K
15 min Winter	74.903	0.253	0.0	19.8	19.8	0.1	O K
30 min Winter	74.845	0.195	0.0	15.4	15.4	0.1	O K
60 min Winter	74.801	0.151	0.0	10.5	10.5	0.0	O K
120 min Winter	74.764	0.114	0.0	6.6	6.6	0.0	O K
180 min Winter	74.745	0.095	0.0	5.1	5.1	0.0	O K
240 min Winter	74.733	0.083	0.0	4.1	4.1	0.0	O K
360 min Winter	74.723	0.073	0.0	3.0	3.0	0.0	O K
480 min Winter	74.716	0.066	0.0	2.4	2.4	0.0	O K
600 min Winter	74.711	0.061	0.0	2.1	2.1	0.0	O K
720 min Winter	74.705	0.055	0.0	1.8	1.8	0.0	O K
960 min Winter	74.700	0.050	0.0	1.5	1.5	0.0	O K
1440 min Winter	74.693	0.043	0.0	1.1	1.1	0.0	O K
2160 min Winter	74.688	0.038	0.0	0.8	0.8	0.0	O K
2880 min Winter	74.683	0.033	0.0	0.7	0.7	0.0	O K
4320 min Winter	74.679	0.029	0.0	0.5	0.5	0.0	O K
5760 min Winter	74.675	0.025	0.0	0.4	0.4	0.0	O K
7200 min Winter	74.673	0.023	0.0	0.3	0.3	0.0	O K
8640 min Winter	74.671	0.021	0.0	0.3	0.3	0.0	O K
10080 min Winter	74.671	0.021	0.0	0.3	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.139	0.0	46.7	4160
10080 min Summer	1.009	0.0	48.2	5144
15 min Winter	107.735	0.0	8.6	10
30 min Winter	72.905	0.0	11.6	17
60 min Winter	47.182	0.0	15.1	32
120 min Winter	29.539	0.0	18.9	62
180 min Winter	22.146	0.0	21.2	94
240 min Winter	17.930	0.0	22.9	126
360 min Winter	13.215	0.0	25.3	180
480 min Winter	10.647	0.0	27.2	234
600 min Winter	8.997	0.0	28.7	288
720 min Winter	7.835	0.0	30.0	356
960 min Winter	6.294	0.0	32.1	484
1440 min Winter	4.613	0.0	35.3	718
2160 min Winter	3.374	0.0	38.7	1072
2880 min Winter	2.698	0.0	41.3	1476
4320 min Winter	1.966	0.0	45.1	2116
5760 min Winter	1.568	0.0	47.9	2736
7200 min Winter	1.315	0.0	50.2	3560
8640 min Winter	1.139	0.0	52.2	4080
10080 min Winter	1.009	0.0	53.9	5160

Simpson Associates		Page 3
1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain J Roadside Services Holt Road, Wrexham	
Date 11.05.16 File Infiltration Basin D Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Rainfall Details for Filter Drain J.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.338	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.038

Time (mins)		Area
From:	To:	(ha)
0	4	0.038

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1 Market Place Mews Henley-on-Thames RG9 2AH	Filter Drain J Roadside Services Holt Road, Wrexham	
Date 11.05.16 File Infiltration Basin D Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Filter Drain J.srcx

Storage is Online Cover Level (m) 75.800

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	32.4
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.150
Safety Factor	5.0	Pipe Depth above Invert (m)	0.150
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	74.650	Cap Volume Depth (m)	1.200
Trench Width (m)	0.5	Cap Infiltration Depth (m)	1.200

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	15.0	Coefficient of Contraction	0.600
Length (m)	10.068	Upstream Invert Level (m)	74.650
Roughness k (mm)	0.600		

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1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin D Roadside Services Holt Road, Wrexham	
Date 11.05.16 File Infiltration Basin D Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Infiltration Basin D.srcx

Upstream Outflow To Overflow To
Structures

Filter Drain J.srcx (None) (None)
Filter Drain I.srcx
Filter Drain H.srcx

Half Drain Time : 313 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	74.406	0.406	1.2	25.7	O K
30 min Summer	74.487	0.487	1.4	34.1	O K
60 min Summer	74.559	0.559	1.6	42.6	Flood Risk
120 min Summer	74.616	0.616	1.8	49.9	Flood Risk
180 min Summer	74.636	0.636	1.8	52.7	Flood Risk
240 min Summer	74.643	0.643	1.8	53.6	Flood Risk
360 min Summer	74.646	0.646	1.9	54.1	Flood Risk
480 min Summer	74.646	0.646	1.9	54.1	Flood Risk
600 min Summer	74.643	0.643	1.8	53.6	Flood Risk
720 min Summer	74.637	0.637	1.8	52.9	Flood Risk
960 min Summer	74.624	0.624	1.8	51.0	Flood Risk
1440 min Summer	74.592	0.592	1.7	46.8	Flood Risk
2160 min Summer	74.547	0.547	1.6	41.1	Flood Risk
2880 min Summer	74.506	0.506	1.5	36.3	Flood Risk
4320 min Summer	74.439	0.439	1.3	29.0	O K
5760 min Summer	74.386	0.386	1.2	23.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	107.735	0.0	19
30 min Summer	72.905	0.0	33
60 min Summer	47.182	0.0	62
120 min Summer	29.539	0.0	122
180 min Summer	22.146	0.0	180
240 min Summer	17.930	0.0	216
360 min Summer	13.215	0.0	276
480 min Summer	10.647	0.0	340
600 min Summer	8.997	0.0	410
720 min Summer	7.835	0.0	478
960 min Summer	6.294	0.0	616
1440 min Summer	4.613	0.0	884
2160 min Summer	3.374	0.0	1280
2880 min Summer	2.698	0.0	1672
4320 min Summer	1.966	0.0	2420
5760 min Summer	1.568	0.0	3168

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1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin D Roadside Services Holt Road, Wrexham	
Date 11.05.16 File Infiltration Basin D Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Infiltration Basin D.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Summer	74.343	0.343	1.1	19.9	O K
8640 min Summer	74.308	0.308	1.0	17.0	O K
10080 min Summer	74.278	0.278	0.9	14.6	O K
15 min Winter	74.437	0.437	1.3	28.8	O K
30 min Winter	74.524	0.524	1.5	38.3	Flood Risk
60 min Winter	74.601	0.601	1.7	48.0	Flood Risk
120 min Winter	74.664	0.664	1.9	56.5	Flood Risk
180 min Winter	74.687	0.687	2.0	60.0	Flood Risk
240 min Winter	74.696	0.696	2.0	61.2	Flood Risk
360 min Winter	74.697	0.697	2.0	61.4	Flood Risk
480 min Winter	74.695	0.695	2.0	61.1	Flood Risk
600 min Winter	74.689	0.689	2.0	60.2	Flood Risk
720 min Winter	74.680	0.680	2.0	58.9	Flood Risk
960 min Winter	74.659	0.659	1.9	56.0	Flood Risk
1440 min Winter	74.614	0.614	1.8	49.7	Flood Risk
2160 min Winter	74.550	0.550	1.6	41.4	Flood Risk
2880 min Winter	74.494	0.494	1.5	34.9	O K
4320 min Winter	74.406	0.406	1.2	25.6	O K
5760 min Winter	74.339	0.339	1.0	19.5	O K
7200 min Winter	74.288	0.288	0.9	15.4	O K
8640 min Winter	74.247	0.247	0.8	12.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Summer	1.315	0.0	3888
8640 min Summer	1.139	0.0	4584
10080 min Summer	1.009	0.0	5344
15 min Winter	107.735	0.0	18
30 min Winter	72.905	0.0	33
60 min Winter	47.182	0.0	62
120 min Winter	29.539	0.0	118
180 min Winter	22.146	0.0	174
240 min Winter	17.930	0.0	228
360 min Winter	13.215	0.0	288
480 min Winter	10.647	0.0	364
600 min Winter	8.997	0.0	440
720 min Winter	7.835	0.0	516
960 min Winter	6.294	0.0	664
1440 min Winter	4.613	0.0	952
2160 min Winter	3.374	0.0	1360
2880 min Winter	2.698	0.0	1756
4320 min Winter	1.966	0.0	2508
5760 min Winter	1.568	0.0	3232
7200 min Winter	1.315	0.0	3960
8640 min Winter	1.139	0.0	4672

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1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin D Roadside Services Holt Road, Wrexham	
Date 11.05.16 File Infiltration Basin D Ca...	Designed by G.S.C Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Summary of Results for Infiltration Basin D.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
10080 min Winter	74.215	0.215	0.7	10.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
10080 min Winter	1.009	0.0	5352

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1 Market Place Mews Henley-on-Thames RG9 2AH	Infiltration Basin D Roadside Services Holt Road, Wrexham	
Date 11.05.16	Designed by G.S.C	
File Infiltration Basin D Ca...	Checked by G.S.C	
Micro Drainage	Source Control 2015.1	

Cascade Model Details for Infiltration Basin D.srcx

Storage is Online Cover Level (m) 74.800

Infiltration Basin Structure

Invert Level (m) 74.000 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.13320 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.13320

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	30.5	0.700	149.7	1.400	0.0	2.100	0.0
0.100	46.4	0.800	168.3	1.500	0.0	2.200	0.0
0.200	62.6	0.900	0.0	1.600	0.0	2.300	0.0
0.300	79.2	1.000	0.0	1.700	0.0	2.400	0.0
0.400	96.3	1.100	0.0	1.800	0.0	2.500	0.0
0.500	113.7	1.200	0.0	1.900	0.0		
0.600	131.5	1.300	0.0	2.000	0.0		

APPENDIX H
FINISHED LEVEL CONTOUR LAYOUT



LEGEND

-  SITE BOUNDARY
 FINISHED FLOOR LEVEL
[FFL 76.40]
 FINISHED LEVEL CONTOUR AT 0.1m INTERVAL
 FINISHED LEVEL CONTOUR AT 0.5m INTERVAL
 FINISHED LEVEL CONTOUR AT 1 IN 3 (3%) SLOPE

A	MILLINSON BURNS KNOX.	S.S.C.	18.09
MR	REYERSON	BY	C.A.

PRELIMINARY

DRAWING TITLE

SITE WIDE FINISHED
LEVEL CONTOUR LAYOUT

PROJECT	Project Number
	13

**PROPOSED ROADSIDE
SERVICES HOLT ROAD
WREXHAM**



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INFORMATION

13136/SK100	A
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APPENDIX I
SUDS MAINTENANCE PLAN

SUDS MAINTENANCE PLAN
FOR
PROPOSED ROADSIDE SERVICES DEVELOPMENT
AT
HOLT ROAD WREXHAM

PREPARED FOR:

Liberty Properties Developments

DS/13136/GC
20 MAY 2016

A Member Firm of the
Association for Consultancy
and Engineering



DOCUMENT HISTORY

Revision	Description	Date

CONTENTS

1. INTRODUCTION	3
2. MANAGEMENT & MAINTENANCE PLAN.....	4

APPENDICES

APPENDIX A: PROPOSED DRAINAGE LAYOUT

Reference	Revision	Client	Date
DS/13136/GC	-	Liberty Property Developments	20 May 2016

1. INTRODUCTION

- 1.1 This report has been prepared by Simpson Associates, on behalf of Liberty Properties Developments to provide details of the operation and maintenance requirements for the SUDS identified on the proposed drainage layout drawing (ref: 13136/SK105) included in *Appendix A*.
- 1.2 On occupation of the development, this maintenance and management plan should be incorporated into the sites "*Operation and Maintenance Manual*" with the as-built drainage system operated and maintained in accordance with the requirements set out in the following section of this report to prevent a reduction in the performance of the drainage system over the lifetime of the development.
- 1.3 The Site Manager should ensure that the Maintenance Contractor tasked with carrying out any maintenance works provides a risk assessment and method statement that adopts best practice health and safety policies for maintenance personnel throughout the duration of any maintenance works. Measures may include:
- Ensure the use of safe systems of work and procedures are followed.
 - Certificated operatives only to be used for all confined space entry.
 - Ensure appropriate ppe is worn at all times including the use of safety goggles, ear defenders and other relevant equipment when using high pressure jetting.
 - Do not work in weather conditions where flooding or surging is likely.
 - Erect barriers where appropriate and provide adequate lighting.
 - No operations to be carried out by operatives working alone.
 - Time maintenance to not conflict with other on-site activities.
 - Method statement to be prepared and approved prior to entry into confined space.

Reference	Revision	Client	Date
DS/13136/GC	-	Liberty Property Developments	20 May 2016

2. MANAGEMENT & MAINTENANCE PLAN

- 2.1 On occupation of the development, it is recommended that each element of the as-built drainage system is maintained in accordance with the regime set out in the tables below.

Table 1: Below Ground Drainage System - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove all litter and debris from external hard landscaped areas and adjacent landscaping, which may pose a risk to the performance of the system.	Monthly.
	Remove build-up of sediment / silt in catch-pits and dispose of oils / petrol residues using safe standard practices.	
	Stabilise and mow adjacent landscaped areas and remove weeds.	
Remedial actions	Repair or rehabilitate inlet and outlets to ensure they are in good condition and operating as designed.	As required.
	Remediate any landscaping, which has raised to within 50mm of the level of adjacent hard landscaping.	
Monitoring	Check of all inlets / outlets for blockages or evidence of physical damage with any necessary remedial action or clearance carried out if required.	On a monthly basis for the first 3 months of operation, thereafter every 6 months & following severe rainfall events.
	Inspect all surfaces for ponding, or silt accumulation. Record areas where water is ponding for more than 48 hours and carry out any remedial work deemed necessary.	After severe storms.

Reference	Revision	Client	Date	Author
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Table 2: Permeable Paving - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove all litter and debris from drained surfaces areas and adjacent hard / soft landscaping, which may pose a risk to the performance of the system.	Monthly.
	Sweep permeable paved areas. If necessary use jet wash or suction sweeper. Any jointing aggregate lost from the joints must be replaced as necessary with 2/6.3mm single sized aggregate, brushed into joints.	Three times a year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging.
	Stabilise and mow adjacent landscaped areas and remove weeds.	
Remedial actions	Remediate any landscaping, which has raised to within 50mm of the level of adjacent hard landscaping.	As required.
	Carry out remedial work to any depressions, rutting and cracked or broken paving blocks within the permeable paved areas that are considered detrimental to the structural performance or a hazard to users.	
	Carry out repair / rehabilitation works to inlets, outlets, overflows and vents.	
Monitoring	Inspect silt accumulation rates within the permeable paved areas and establish appropriate brushing frequencies.	Annually.
	Check of all inlets, outlets, overflows and vents for blockages or evidence of physical damage with any necessary remedial action or clearance carried out if required.	On a monthly basis for the first 3 months of operation, thereafter every 6 months & following severe rainfall events.
	Inspect and identify any areas that are not operating correctly	On a monthly basis for the first 3 months of operation, thereafter every 6 months & following severe rainfall events.

Reference	Revision	Client	Date	Author
DS/13136/GC	-	Liberty Property Developments	20 May 2016	GSC

Table 3: Gravel Filter Drains - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal from trench surface, access chambers and pre-treatment devices.	Monthly (or as required).
	Removal and washing of exposed stones on the trench surface.	Annual (bi-annual the first year) or when silt is evident on the surface.
	Trimming of any roots that may be causing blockages.	Annually (semi-annual the first year).
	Remove weeds on the trench surface.	Monthly (at start, then as required)
Occasional Maintenance	Removal of sediment from pre-treatment devices.	Every 6 months.
	Remove tree roots or trees that grow close to the trench.	As required.
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace filter media.	Every 5 years.
Remedial actions	Clear perforated pipework of blockages.	As required.
	Rehabilitate infiltration or filtration surfaces.	
	Excavate trench walls to expose clean soils if infiltration performance reduces to unacceptable levels.	
	Replace geotextiles and clean and replace filter media, if clogging occurs.	Monthly
	Inspect inlets, outlets and inspection points for blockages, clogging, standing water and structural damage.	
Monitoring	Inspect pre-treatment systems, inlets, trench surfaces and perforated pipework for silt accumulation. Establish appropriate silt removal frequencies.	Every 6 months.

Reference	Revision	Client	Date	Author
DS/13136/GC	-	Liberty Property Developments	20 May 2016	GSC

Table 4: Geocellular Storage Soakaways - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for first 3 months of operation, then every 6 months.
	Debris removal from catchment surface (where may cause risks to performance).	Monthly.
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly / after severe storms.
	Remove sediment from pre-treatment structures.	Annually, or as required.
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents.	As required.
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually and after large storms.

Reference	Revision	Client	Date	Author
DS/13136/GC	-	Liberty Property Developments	20 May 2016	GSC

Table 5: Infiltration Basin - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter, debris and trash removal.	Monthly.
	Grass cutting – for landscaped areas and access routes.	Monthly during growing season, or as required.
	Grass cutting – meadow grass in and around basin.	Half yearly (spring – before nesting season, and autumn).
	Manage other vegetation and remove nuisance plants.	Monthly (at start, then as required).
Occasional Maintenance	Re-seed areas of poor vegetation growth.	Annually, or as required.
	Prune and trim trees and remove cuttings.	
	Remove sediment from pre-treatment system when 50% full.	
Remedial actions	Repair of erosion or other damage by re-seeding or re-turfing.	As required.
	Realignment of rip-rap.	
	Repair/rehabilitation of inlets, outlets and overflows.	
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates.	
	Re-level uneven surfaces and reinstate design levels.	
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly.
	Inspect banksides, structures, pipework, etc for evidence of physical damage.	
	Inspect infiltration surfaces for compaction and ponding.	
	Inspect inlets and pre-treatment systems for silt accumulation.	Every 6 months.
	Establish appropriate silt removal frequencies.	

Reference	Revision	Client	Date	Author
DS/13136/GC	-	Liberty Property Developments	20 May 2016	GSC

Table 6: Detention Pond - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal.	Monthly.
	Grass cutting for spillways and access routes.	Monthly (during growing season), or as required.
	Grass cutting of meadow grass in and around basin.	Every 6 months (spring - before nesting season, and autumn).
	Manage other vegetation and remove nuisance plants.	Monthly (at start, then as required).
	Tidy all dead growth before start of growing season.	Annually.
	Manage wetland plants in outlet pool – where provided.	
	Remove sediment from inlets, outlet and forebay.	
Occasional Maintenance	Re-seed areas of poor vegetation growth.	Annually or as required.
	Prune and trim trees and remove cuttings.	Every 2 years or as required.
	Remove sediment from forebay, when 50% full and from micropools if volume reduced by > 25%.	3 – 10 years (or as required).
Remedial actions	Repair of erosion or other damage by re-seeding or re-turfing.	As required.
	Realignment of rip-rap.	
	Repair/rehabilitation of inlets, outlets and overflows.	
	Re-level uneven surfaces and reinstate design levels.	
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly/after severe storms.
	Inspect banksides, structures, pipework, etc for evidence of physical damage.	
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Every 6 months.
	Check penstocks and other mechanical devices.	

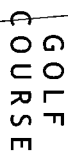
Reference	Revision	Client	Date	Author
DS/13136/GC	-	Liberty Property Developments	20 May 2016	GSC

Table 7: Wet Pond - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal.	Monthly.
	Grass cutting for spillways and access routes.	Monthly (during growing season), or as required.
	Grass cutting of meadow grass in and around basin.	Every 6 months (spring - before nesting season, and autumn).
	Inspect vegetation to pond edge and remove nuisance plants (for first 3 years).	Monthly (at start, then as required).
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1 m above pond base; include max 25% of pond surface).	Annually.
	Remove 25% of bank vegetation from waters edge to a minimum of 1 m above water level.	
	Tidy all dead growth before start of growing season.	
	Remove sediment from forebay.	1–5 years, or as required.
	Remove sediment from one quadrant of the main body of ponds without sediment forebays.	2–10 years.
Occasional Maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%.	>25 years (usually).
Remedial actions	Repair of erosion or other damage.	As required.
	Aerate pond when signs of eutrophication are detected.	
	Realignment of rip-rap or other damage.	
	Repair/rehabilitation of inlets, outlets and overflows.	
Monitoring	Inspect structures for evidence of poor operation.	Monthly/after severe storms.
	Inspect banksides, structures, pipework etc for evidence of physical damage.	Monthly/after severe storms.
	Inspect water body for signs of eutrophication.	Monthly (May–October).
	Inspect silt accumulation rates and establish appropriate removal; frequencies.	Every 6 months.
	Check penstocks and other mechanical devices.	

Reference	Revision	Client	Date	Author
DS/13136/GC	-	Liberty Property Developments	20 May 2016	GSC

APPENDIX A
PROPOSED DRAINAGE LAYOUT



NO.	DATE	BY	CHECK
DRAWING TITLE PREFABRICATED SITE WIDE DRAINAGE LAYOUT			
PROJECT NAME PROPOSED ROADSIDE SERVICES HOT T ROAD WREXHAM			
PROJECT NUMBER 13136/SK105			



simpson
strong-tie

2 Field Street
Oshkosh WI 54901
1-800-552-2022



Labels: 1/2" = 1'-0" (Horizontal)
 1/4" = 1'-0" (Vertical)
 1/8" = 1'-0" (Diagonal)

DATE

13136/SK105

REVISION