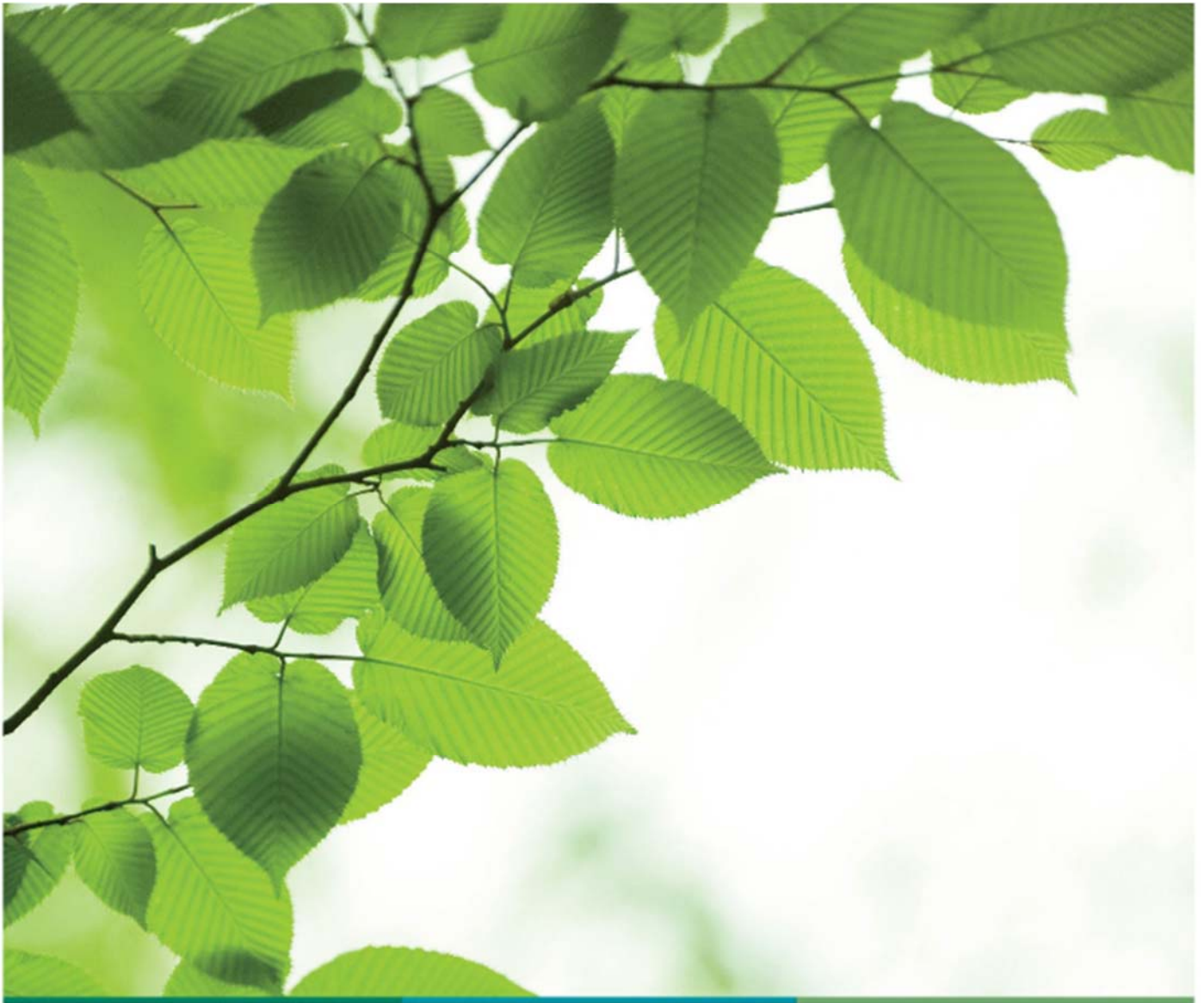




Drainage Strategy

Woodbine Cottage, Doncaster Road, Billingley S72 0JE

Presented to Mr Stephen Selway

Issued: September 2019

Delta-Simons Project No. 19-1049.02



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Report Details

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Report Title	Drainage Strategy
Site Address	Woodbine Cottage, Doncaster Road, Billingley, S72 0JE
Project No.	19-1049.02
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Quality Assurance

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
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About us

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Specialising in Environment, Health & Safety and Sustainability, Delta-Simons provide support and advice within the property development, asset management, corporate and industrial markets. Operating from ten locations - Lincoln, Birmingham, Bristol, Dublin, Leeds, London, Manchester, Newcastle, Norwich and Nottingham - we employ over 75 environmental professionals, bringing experience from across the private consultancy and public sector markets.

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Executive Summary

Appointment	Delta-Simons has been instructed by Mr Stephen Selway (the “Client”) to prepare a Drainage Strategy (DS) to inform a planning application for a proposed residential development on the greenfield land surrounding Woodbine Cottage, Doncaster Road, Billingley S72 0JE (the Site).
Existing and Proposed Site	The Site currently comprises an existing cottage and associated driveway occupying the northern extents. The remainder of the Site comprises the cottage’s garden with existing hedgerows denoting the eastern, southern and western boundaries. The proposed Site comprises five residential plots, eight associated garage units, courtyard and access. The existing cottage in the northern extent of the Site, and the associated driveway will remain as existing.
Drainage Strategy Summary	The proposed development will introduce impermeable drainage area in the form of dwellings, courtyards and access roads. In order to ensure no increase in flood risk elsewhere, surface water runoff from the development will be restricted and sustainable drainage systems used to accommodate storm events up to and including the 1 in 100 year plus 40% climate change event. Soakaway testing has been undertaken in accordance with the BRE365 specification in August 2019, which has identified a minimum viable infiltration rate of $9.7E^{-05}$ m/s. As such, it is proposed to utilise infiltration techniques (soakaways and permeable paving). Individual property soakaways are proposed to accommodate runoff from roofs (dwellings and garages) assuming the above infiltration rate. A permeable surface with an appropriately sized sub-grade is proposed for courtyards and the shared access. The proposed soakaways and sub-grade of the driveways / shared access road will be sized to accommodate storm events up to and including the 1 in 100 year plus 40% climate change event. Foul flows from the Site should be treated within a high specification package treatment plant located within the garden of the existing cottage. Treated water should be discharged to an appropriately sized soakaway.
Recommendations	Verify the attenuation volumes included in this report when undertaking detailed drainage design; Make provision for a soakaway system within the garden of each proposed residential unit, and within the garden of the existing cottage; Make provision for a high specification package treatment plant within the south eastern corner of the existing cottage garden; and The final location of the soakaways should consider all constraining factors including TPO’s and access.
This is intended as a summary only. Further detail and limitations of the assessment is provided within the main body of the Report.	

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1.0 Introduction

1.1 Appointment

- 1.1.1 Delta-Simons has been instructed by Mr Stephen Selway (the “Client”) to prepare a Drainage Strategy (DS) to inform a planning application for a proposed residential development on the land surrounding Woodbine Cottage, Doncaster Road, Billingley S72 0JE (the Site).

1.2 Project Understanding

- 1.2.1 From April 2015, Barnsley Metropolitan Borough Council as Lead Local Flood Authority (LLFA) is a statutory consultee for planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a Sustainable Drainage Strategy. The aim of the Sustainable Drainage Strategy is to identify water management measures, including Sustainable Drainage Systems (SuDS), to provide surface water runoff reduction and treatment.

1.3 Scope of Works

- 1.3.1 The scope of works has been as follows for this DS:
- ▲ Review existing conditions including sewer plans, British Geological Survey information and topographical information;
 - ▲ Review LLFA drainage policies;
 - ▲ Submit developer enquiry to LLFA;
 - ▲ Analyse existing and proposed impermeable areas;
 - ▲ Calculate existing runoff rates (excluding existing drainage system modelling);
 - ▲ Assess method of surface water runoff disposal (soakaway/watercourse/sewer);
 - ▲ Establish surface water discharge rate in consultation with the LLFA / sewerage undertaker;
 - ▲ Estimate required attenuation volume using MicroDrainage or similar;
 - ▲ Assess and Advise on suitable forms of SuDS;
 - ▲ Advise on drainage system maintenance measures;
 - ▲ Advise on surface water treatment methods;
 - ▲ Establish method of foul water drainage;
 - ▲ Prepare concept drainage sketch (where development plan is available as dwg. format); and
 - ▲ Prepare Drainage Strategy report.
- 1.3.2 This report takes into account the following national and local policies and guidance:
- ▲ CIRIA Guidance: The SuDS Manual (C753) (2017)¹; and
 - ▲ Barnsley Local Plan Adopted January 2019².

1.4 Sources of Information

- 1.4.1 The following sources of information have been reviewed and assessed for the purpose of this DS:
- ▲ British Geological Society (BGS) Interactive Map³; and

1 https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

2 <https://www.barnsley.gov.uk/media/9924/local-plan-adopted.pdf>

3 <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

▲ MAGIC Interactive Map⁴.

1.5 Project Limitations

1.5.1 The wider Delta-Simons limitations are contained within Appendix A.

⁴ <http://www.magic.gov.uk/>

2.0 Site Description

2.1.1 The aim of this section of the report is to outline key environmental information associated with the baseline conditions.



Source: Bing maps 2019®

Illustrative Site Layout Plan

Co-ordinates	Centred approximately at National Grid Reference: 444040, 404081	Elevation	High	29.0m AOD
			Low	26.5m AOD
		Area	Approx. 0.304 ha.	
Site Location	The Site is located adjacent to the A635 (Doncaster Road), and approximately 500m south of the Village of Billingley. The Site is bound to the north by Doncaster Road, to the east and south by agricultural fields, and to the west by a pair of semi-detached cottages with associated soft landscaping.			
Existing land use	The Site currently comprises an existing cottage and associated driveway occupying the northern extents. The remainder of the Site comprises the cottage's garden with existing			

	hedgerows denoting the eastern, southern and western boundaries. The existing hardstanding is approximately 206.71m ² and represents 6.8% of the existing Site.
Topography	Topographic levels to metres Above Ordnance Datum (m AOD) have been derived from a 2m resolution Environment Agency (EA) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A review of LiDAR data shows that the Site slopes from approximately 26.5m AOD in the west to 29.0m AOD in the north east of the Site.
Existing Drainage	Public sewer records have been obtained from the Client and are included in Appendix D. The public sewer records show that there are no public sewers within the direct vicinity of the Site. The nearest public combined sewer is located over 500m to the east of the Site adjacent to Carr Dike and Highgate farm. There are no public surface water or foul water sewers within the vicinity of the Site. It is understood from anecdotal information provided by the Client that surface water runoff currently drains to soakaway systems on Site. Foul water is drained via a septic tank to the north west of the Site and will be made redundant by the proposed development. The existing soakaway systems will not be utilised to serve the proposed development.
Hydrology	The nearest surface water feature is indicated to be a pond situated approximately 60m south-west of the Site boundary. The Nearest EA Main River (responsibility of the EA to maintain) is the River Dearne, located approximately 1.85km west of the Site boundary. The nearest Ordinary Watercourse (responsibility of the LLFA to maintain) is Carr Dike, located approximately 360m east of the Site boundary, flowing in a north to south direction before joining the River Dearne at its confluence 1.9km south of the Site.
Geology	Online Mapping British Geological Survey (BGS) online mapping [accessed 28/08/2019] indicates that the Site is underlain by bedrock of the Pennine Middle Coal Measures, comprising Carboniferous sandstone, mudstone and siltstone to the south, and predominantly sandstone to the north. No superficial deposits are mapped overlaying bedrock at the Site. The geological mapping is only available at a scale of 1:50,000 and therefore may not be a true reflection of the underlying ground conditions. Identified Geology [Delta-Simons Soakaway Testing 15-16/08/2019] Delta-Simons undertook soakaway testing to identify infiltration potential at the Site on the 15th and 16th August 2019. The Soakaway testing included the excavation of four surface water trial pits (SA101 to SA104) up to a maximum depth of 3.0 m, and three foul drainage percolation tests (FD 101 and FD103) up to a maximum depth of 0.8m bgl. Trial pit locations are available Appendix C and soakaway test results in Appendix E. A separate Delta-Simons Soakaway and Foul Drainage Testing Report has been issued to the Client under project number 19-1049.01. The underlying natural soils were observed as variable in composition and depth across the Site. Natural strata generally comprised slightly clayey gravelly sand, slightly sandy gravelly clay, and sandstone, underlain by mudstone and siltstone. The Soakaway testing report states: <i>"The natural soils and underlying bedrock lithologies are considered to be variable across the Site. Typically, weathered sandstone, weathered siltstone and weathered mudstone are present in the north-east, central and western parts of the Site respectively".</i>

Hydrogeology	The Magic Map [accessed 28/08/2019] identifies the superficial strata of the Site to be unproductive, defined as low permeability strata with negligible significance for water supply or river base flow The bedrock strata are considered a Secondary A aquifer, defined as permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers. The Delta-Simons Soakaway and Foul Drainage Testing Report did not note groundwater up to the maximum trial pit depth of 3m bgl. The Site is not located within a Source Protection Zone (SPZ) or a Groundwater Protection Zone (GPZ).
Proposed Site conditions	The proposed Site comprises five residential plots, eight associated garage units, courtyard and access upon the existing greenfield land. The existing cottage in the northern extent of the Site, and the associated driveway will remain as existing. The proposed development will result in an increase in hardstanding areas. The proposed development will introduce approximately 929.08m² of additional hardstanding to the site comprising approximately 536.1m² in the form of new residential units and attached garages and 392.98m² in the form of the proposed courtyards and access. A proposed Site layout is available in Appendix B, produced by Peter Dimberline Chartered Architect, dated March 2019, drawing number: 2019/08/02.

3.0 Relevant Planning Policy and Guidance

3.1 Local Policy

- 3.1.1 The Barnsley Metropolitan Borough Council Local Plan (adopted January 2019) contains the following policies in relation to drainage:

Policy CC3 Flood Risk

- 3.1.2 “The extent and impact of flooding will be reduced by:”

- ▲ *“Expecting all development proposals on brownfield sites to reduce surface water run-off by at least 30% and development on greenfield sites to maintain or reduce existing run-off rates requiring development proposals to use Sustainable Drainage Systems (SuDS) in accordance with policy CC4”*

Policy CC4 Sustainable Drainage Systems (SuDS)

- 3.1.3 “All major development will be expected to use Sustainable Drainage Systems (SuDS) to manage surface water drainage, unless it can be demonstrated that all types of SuDS are inappropriate. The Council will also promote the use of SuDS on minor development. To enable the Council to determine the suitability of a proposed SuDS scheme:”
- ▲ *“Outline Planning applications must be supported by a conceptual drainage plan and SuDS design statement; and”*
 - ▲ *“Detailed Planning applications must be supported by a detailed drainage plan and SuDS design statement, which should contain information on how the SuDS will operate, be managed and maintained for the lifetime of the development”.*

4.0 Drainage Strategy

4.1 Introduction

- 4.1.1 The Site currently comprises an existing cottage and associated driveway occupying the northern extents. The remainder of the Site comprises greenfield land. The existing hardstanding is approximately 206.71m² and represents 6.8% of the existing Site. It is understood from anecdotal information provided by the Client that surface water runoff currently drains by soakaway.
- 4.1.2 The proposed Site comprises five residential plots, eight associated garage units, courtyard and access. The proposed development will introduce approximately 929.08m² of additional hardstanding to the site comprising approximately 536.1m² in the form of new residential units and attached garages and 392.98m² in the form of the proposed courtyards and access.
- 4.1.3 In order to ensure the proposed development will not increase flood risk elsewhere, surface water discharge from the site will be controlled. Sustainable Drainage Systems, (SuDS), are designed to maximise the various opportunities and benefits (ecological and Amenity etc) that can be secured from surface water management.

4.2 Surface Water Drainage Hierarchy

- 4.2.1 The recommended surface water drainage hierarchy is to utilise soakaway systems or other infiltration as the preferred surface water discharge option, followed by discharging to an appropriate watercourse. If this is not available, the final option is to discharge to public sewers.

Surface Water Discharge to Soakaway

- 4.2.2 The first consideration for the disposal of surface water is infiltration (soakaways and permeable surfaces). As described in Section 2.0, soakaway tests were carried out in August 2019 by Delta-Simons in accordance with the BRE365 specification (see Appendix C for trial pit location map and Appendix E for test results).
- 4.2.3 The underlying natural soils were variable in composition and depth across the Site. Natural strata generally comprised slightly clayey gravelly sand, slightly sandy gravelly clay, and sandstone, underlain by mudstone and siltstone. The soakaway tests identified infiltration rates to be viable for soakaway systems, with a minimum infiltration rate of 9.7E⁻⁰⁵ m/s, and a maximum rate of 1.3E⁻⁰⁴. The Site is not located within an SPZ or GPZ.
- 4.2.4 It can be concluded that soakaways are suitable for the discharge of surface water runoff.

Surface Water Discharge to Watercourse

- 4.2.5 Where soakaways are determined not to be suitable a connection to watercourse is the next consideration. The nearest watercourse is Carr Dike, located approximately 360m east of the Site boundary. This watercourse is separated by third-party land and therefore discharge to this watercourse is not considered feasible.

Surface Water Discharge to Sewer

- 4.2.6 Where disposal of surface water to watercourse is not possible, a connection to the public sewer system is the final consideration. There are no known public surface water sewers within 500m of the Site boundary. The nearest public combined sewer is located over 500m to the east of the Site adjacent to Carr Dike and Highgate farm. Furthermore, and as described above, discharge to soakaways is considered feasible and therefore a connection to the public sewer is not required.

4.3 Sustainable Drainage Systems

- 4.3.1 The introduction of the proposed hardstanding will result in an increase in surface water runoff rates and volumes. In order to ensure the proposed development will not increase flood risk elsewhere, sustainable drainage systems (SuDS) will be used to accommodate the 1 in 100 year plus 40% climate change (CC) storm event.

Soakaways

- 4.3.2 As described above, infiltration tests were undertaken in August 2019 and confirmed that soakaways are likely to be a suitable method for surface water drainage onsite, subject to appropriate sizing, design and location.
- 4.3.3 An average roof area has been used to calculate approximate soakaway volumes for the proposed residential units and garages. 5No. soakaways will be required to serve the proposed residential units and garages. The area of the existing cottage roof and driveway has been used to calculate an approximate soakaway size to serve this existing hardstanding. Permeable paving will be utilised for the proposed courtyard areas and access roads.
- 4.3.4 Indicative soakaway sizing calculations have been undertaken using MicroDrainage (see Appendix F). The soakaway calculations are based on the conservative measured infiltration rate of $9.7E^{-05}$ m/s, a cellular storage structure, a 1 in 100 year plus 40% climate change design storm event calculated using the ReFH2 software tool, and a soakaway depth of 1m. See Appendix G for on-Site runoff rates extracted from ReFH2. Table 1 below details the soakaway volumes and drain times.

Table 1: Pollution Hazard Indices

Plot	Drainage Area (m ²)	Soakaway Volume (m ³)	Half Drain Time (mins)
Average Residential Plot	110	4.5	58 mins
Existing Cottage Roof and Driveway	206.71	9.75	87

- 4.3.5 Soakaways should be located a minimum of 5m from buildings.

Swales, Detention Basins and Ponds

- 4.3.6 The site will be occupied by buildings, courtyard and private residential gardens and there is limited space to accommodate a number of above ground storage features such as ponds and basins. Furthermore, an open surface water attenuation feature such as a pond, basin or a swale in a residential area presents a safety risk to residents at the Site.

Rainwater Harvesting

- 4.3.7 The attenuation benefits provided through the use of rainwater harvesting are considered to be limited and would only be realised when the tanks were not full. However, rainwater harvesting techniques could be incorporated within the final design.

Green Roofs

- 4.3.8 Green roofs are not identified on development plans. Given the nature of the proposed development, the significant additional cost involved in installing and maintaining green roofs and the additional works required to allow for the additional loading on the building, green roofs are not considered a practical option. The benefits achieved through installing a green roof would be disproportionate to the significant ongoing maintenance and construction costs involved.

Porous/Permeable Paving

- 4.3.9 Permeable paving could be incorporated within the shared/private courtyards and access roads. Storage would be provided within the sub-grade material prior to controlled release to the ground. The amount of storage offered by permeable paving is subject to sub-grade depth and site gradient. The courtyard areas considered suitable for permeable paving cover approximately 206.71m². A permeable paved area of 206.71m² with a subgrade depth of 300mm and a void ratio of 30% (applicable to stone aggregate) would provide approximately 18.60 m³ of attenuation storage (assuming a level sub-grade). Should additional attenuation be required the subgrade depth could be increased.
- 4.3.10 The provision of storage within the sub-grade material would only be feasible in areas with a proposed gradient of greater than 1 in 20 as detailed within CIRIA RP992/28 (Design Assessment Checklists for Permeable/Porous Pavement). Site gradients should be confirmed at the detailed design stage.

Underground Attenuation Tanks

- 4.3.11 Storage could be provided within underground attenuation tanks or within oversized pipes. Sufficient space for an underground tank is provided within the proposed shared courtyard to the west of the Site. However, given the lack of an appropriate outfall, underground attenuation tanks or oversized pipes are not considered appropriate for this site.

Concept Surface Water Drainage Scheme

- 4.3.12 Soakaways and permeable paving will be used where practical. Sufficient space for soakaways is provided within the gardens of the proposed residential units and within the garden of the existing cottage.

4.4 Exceedance Event

- 4.4.1 Storage will be provided for the 1 in 100 year + 40% CC event. Storm events in excess of the 1 in 100 year + 40% CC event should be permitted to produce temporary shallow depth flooding within the courtyard areas or private gardens. Finished floor levels will be set at a minimum of 150mm above surrounding ground levels ensuring exceedance flooding will not affect the buildings.

4.5 Surface Water Treatment

- 4.5.1 In accordance with the CIRIA C753 publication 'The SuDS Manual' (2015), residential roofs have a 'very low' pollution hazard level and low traffic roads are classified as having a 'low' pollution hazard level. Table 1 below reproduces the pollution hazard indices for each land use.

Table 1: Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Low Traffic Roads	Low	0.5	0.4	0.4

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2

* Indices values range from 0-1.

- 4.5.2 Where practical, runoff from roofs and roads will be directed to permeable paving and soakaways. Table 2 overleaf demonstrates that soakaways provide sufficient treatment. Table 3 overleaf demonstrates that a pond, basin or permeable paving also provide sufficient treatment.

Table 2: Soakaway Treatment Levels

SuDS Group	Technique	Water Quality Treatment Potential					Hydraulic Control			
		Total suspended solids removal	Total suspended solids removal	Nutrient (phosphorus, nitrogen removal)	bacteria removal	capacity to treat fine suspended sediments and dissolved pollutants	Runoff volume reduction	Suitability for flow rate control (probability)		
								0.5 (1/2 yr)	0.1-0.3 (10/30yr)	0.01 (100 yr)
Infiltration	Soakaway	H	H	H	M	H	H	H	H	L

H = High; M = Medium; L = Low

Table extract taken from the CIRIA C697 publication 'The SuDS Manual' – Table 26.3

Table 3: SuDS Mitigation indices

Type of SuDS	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Pond	0.7	0.7	0.5
Permeable pavement	0.7	0.6	0.7

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.3

- 4.5.3 It can be concluded that the inclusion of soakaways and permeable paving will provide sufficient treatment. Where attenuation is provided in a below ground system (tank storage), treatment will need to be provided by a suitably sized separator. A sediment trap may be placed upstream of each soakaway for ease of sediment removal.

4.6 Maintenance

- 4.6.1 Maintenance of communal drainage features such as the shared permeable paved courtyard and access road will be the responsibility of the site owner. Maintenance of shared surface water drainage systems can be arranged through appointment of a site management company.
- 4.6.2 Maintenance of individual property soakaways will be the responsibility of the property owner(s).
- 4.6.3 Maintenance schedules for permeable paving and soakaways are included in Appendix H.

4.7 Foul Drainage

- 4.7.1 The options for foul water drainage are:

- 1) **Drain to a nearby sewer** – However the nearest combined sewer is 645m to the east, making this option impractical.

- 2) Pass foul water through a **high specification Package Treatment Plant (PTP) and Discharge to a nearby surface watercourse** that contains flowing water 24/7 - There is a drainage ditch to the south although this necessitates crossing third-party land so is unlikely to provide a viable solution.
 - 3) Pass foul water through a **high specification PTP and Discharge to soakaways that are normally used for surface water drainage** – probably the most viable option and requires design by the PTP supplier and the project's civil/drainage engineer.
 - 4) Pass foul water through a **low specification PTP and Discharge to the ground via a drainage field** – a viable option, but drainage fields are not permitted to be built over, nor trafficked, even by foot (as such can risk compacting the soils and over time could adversely reduce drainage rates. This would mean sterilising such parts of the site. In discussion with the local authority, it may however be permitted to employ say geotextile grids above the drainage field to reduce/remove the compaction by foot and therefore bring such areas back into say garden use.
- 4.7.2 Individual proprietries could have their own PTPs to make responsibility and costs for maintenance, clearer. Or there could be one PTP serving the whole site, which should be cheaper, but would require each homeowner to enter into a maintenance (and cost) agreement.
- 4.7.3 PTPs require routine maintainance, the intervals for which vary significantly depending on the specification for the PTP, i.e. high specification plants require less frequent cleaning vs lower specifications plants. PTPs must be located where tankers can reach such to empty them.
- 4.7.4 Importantly, the client must note that drainage fields do eventually silt up and require excavating and rebuilding.
- 4.7.5 Given all of the above, Option (3) remains the most viable option. The most appropriate location for the PTP is considered to be the south east corner of the existing cottage garden. If the Client wishes to consider Option (4) then Delta-Simons can provide an outline design, but such would only duplicate the specification for drainage fields given in BS6297 and Building Regulations Approved Document H (e.g. the drainage field pipes being laid to a 1:200 slope, no shallower than 0.2m bgl and >1.2m above the shallowest seasonal groundwater level.
- 4.7.6 A Concept Drainage Sketch is available in Appendix I highlighting the proposed surface water and foul water drainage strategy detailed above. The final location of the soakaways should consider all constraining factors including TPO's and access.

5.0 Conclusions and Recommendations

5.1 Conclusions

- 5.1.1 The proposed development comprises five residential plots, eight associated garage units and hardstanding courtyard. The existing cottage to the north of the Site, and the associated hardstanding driveway will remain as existing.
- 5.1.2 The proposed development will introduce impermeable drainage area in the form of dwellings, courtyards and access roads. In order to ensure no increase in flood risk elsewhere, surface water runoff from the development will be restricted and sustainable drainage systems used to accommodate storm events up to and including the 1 in 100 year plus 40% climate change event.
- 5.1.3 All surface water discharge options have been assessed. There are no surface water bodies (watercourse) or surface water sewers in the vicinity of the site. As such, it is proposed to utilise infiltration techniques (soakaways and permeable paving).
- 5.1.4 Soakaway testing has been undertaken in accordance with the BRE365 specification in August 2019, which has identified a minimum viable infiltration rate of $9.7E^{-05}$ m/s.
- 5.1.5 Individual property soakaways are proposed to accommodate runoff from roofs (dwellings and garages) assuming the above infiltration rate. A permeable surface with an appropriately sized sub-grade is proposed for courtyards and the shared access. The proposed soakaways and sub-grade of the driveways / shared access road will be sized to accommodate storm events up to and including the 1 in 100 year plus 40% climate change event.
- 5.1.6 Foul flows from the Site should be treated within a high specification package treatment plant located within the garden of the existing cottage. Treated water should be discharged to soakaway.

5.2 Recommendations

- ▲ Verify the attenuation volumes included in this report when undertaking detailed drainage design;
- ▲ Make provision for a soakaway system within the garden of each proposed residential unit, and within the garden of the existing cottage;
- ▲ Make provision for a high specification package treatment plant within the south eastern corner of the existing cottage garden; and
- ▲ The final location of the soakaways should consider all constraining factors including TPO's and access.

Appendix A – Limitations

Limitations

The recommendations contained in this Report represent Delta-Simons professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons conclusions, opinions and recommendations has been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Appendix B – Proposed Site Layout

- 1) This drawing and the design and details depicted thereon are the copyright of Peter Dimberline Chartered Architect.
- 2) All dimensions on this drawing are to be checked by the Contractor and any discrepancies are to be reported to the Architect.
- 3) Do not scale critical dimensions off this drawing.
- 4) Contractor to ensure that all Health & Safety requirements (CDM Regulations) in relation to this project will be complied with.



proposed site layout at 1:200

The concept behind the proposal, takes a lead from the idea of a converted former farmstead reflecting a logical architectural hierarchy.

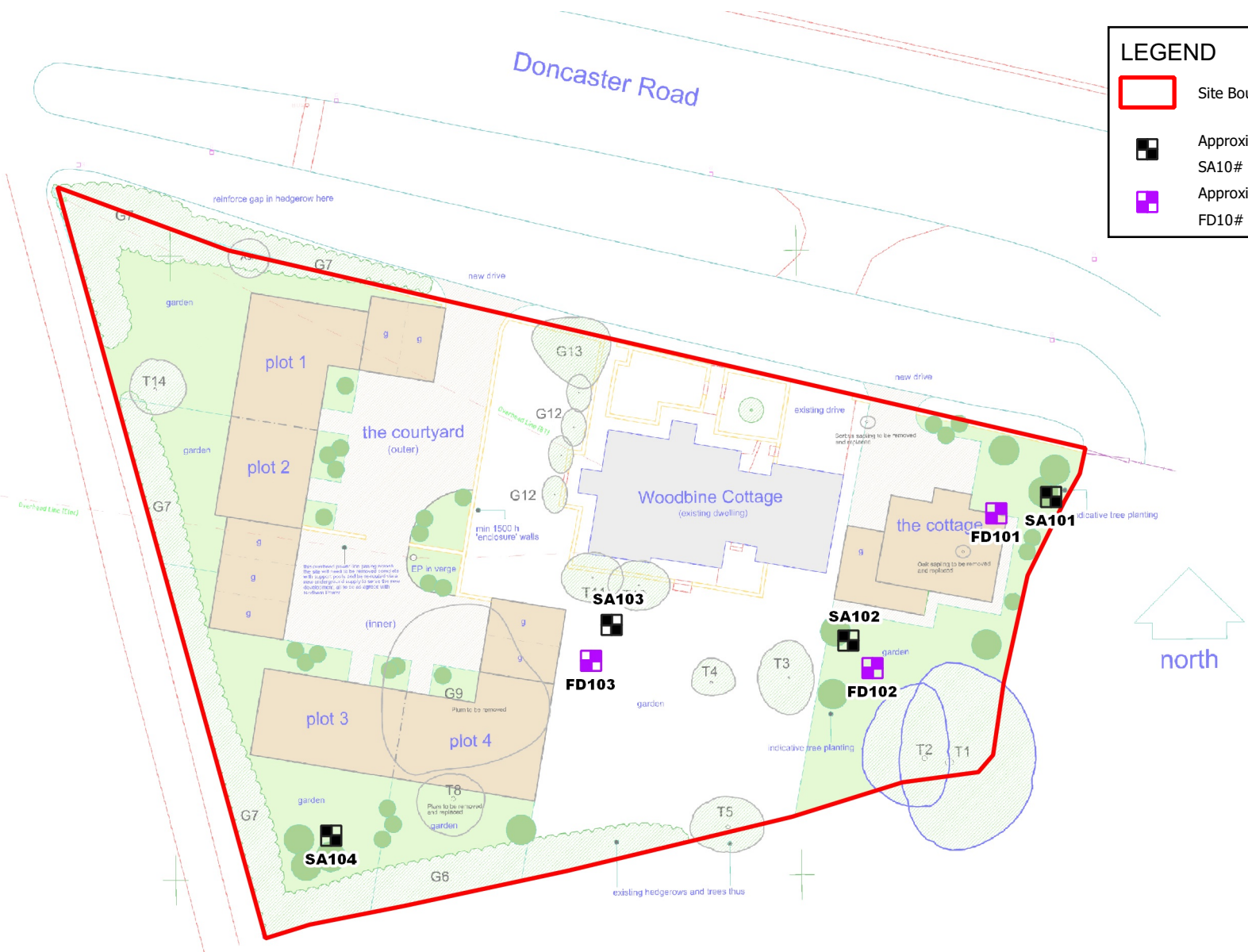
Woodbine Cottage being the 'main two storey farmhouse' (first tier).

The cottage alongside having more modest architectural embellishment, (the second tier).

The "courtyard" a group of two storey and single storey buildings, (third tier).

REVISIONS	
PETER DIMBERLINE Dip Arch, RIBA CHARTERED ARCHITECT 2 TIPSEY COURT, STAINCROSS BARNSELEY, S75 6F tel/fax (01226) 390947 email: pdimberline@tiscali.co.uk	
CLIENT Stephen and Jayne Selway	
PROJECT Proposed residential development of 5 no dwellings	
LOCATION Woodbine Cottage, Doncaster Road, Billingley, Barnsley S72 0JE	
DRAWING Proposed site layout	
SCALES 1:200	DATE Mar 19
DRWG No. 2019/08/02	DRAWN BY PD

Appendix C – Exploratory Hole Location Plan



 Site Boundary

 Approximate Soakaway Test Pit Location
SA10#

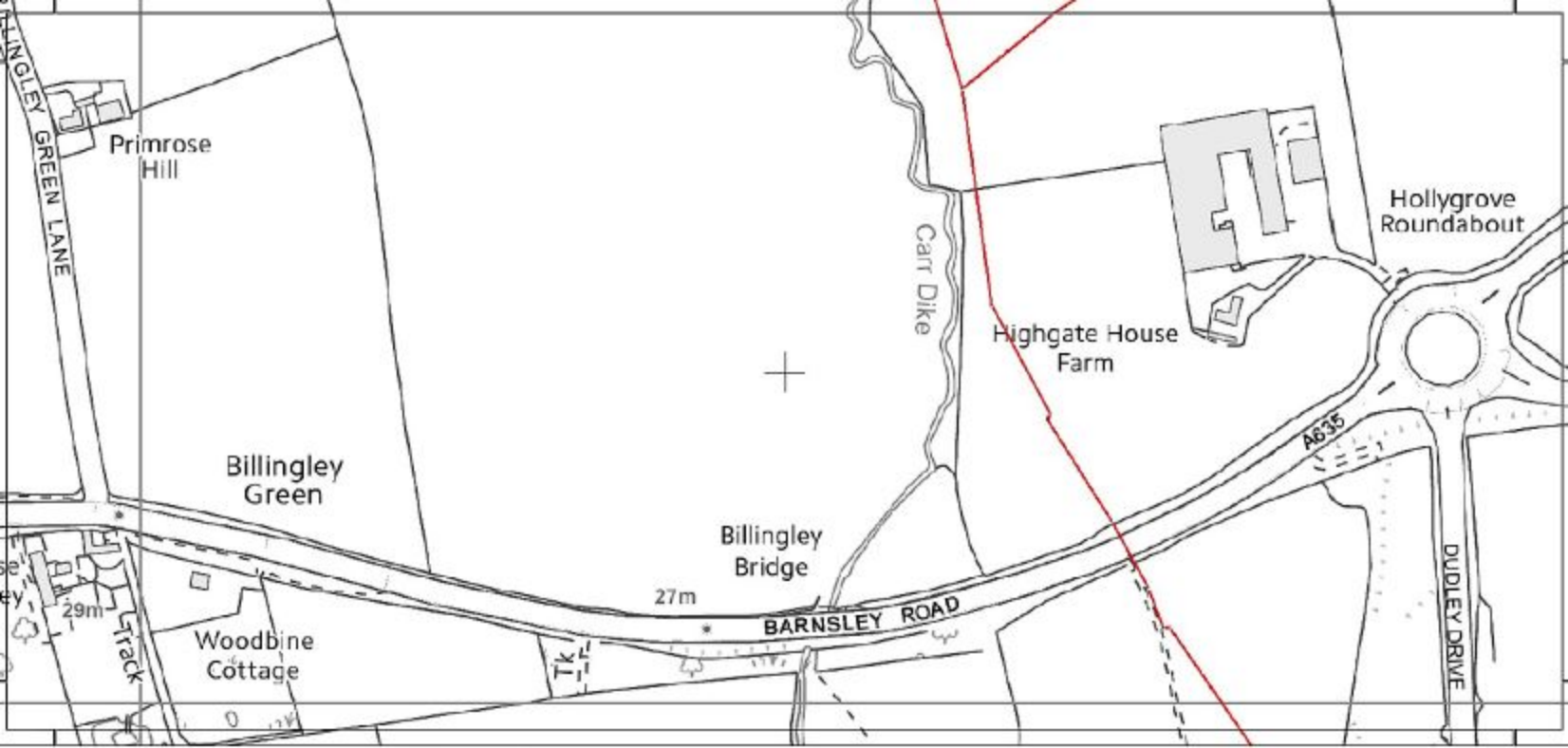
 Approximate Foul Drainage Test Pit Location
FD10#

north



DRAWN BY: RB	SCALE (@A4): 1:500	PROJECT NO: 19-1049.02
CHECKED BY: JK	REVISION: -	
DATE: 30 August 2019		FIGURE NO: C

Appendix D – Sewer Plans



Appendix E – Soakaway Test Results

	units	Infill 1	Infill 2	Infill 3
Length	m		2.20	
Width	m		0.60	
Depth	m		2.30	
Gravel type			Standard	
Voids ratio			0.35	
Resting groundwater level at time of testing	m		DRY	
Depth of first reading	m	1.90	1.80	1.80
Depth of final reading	m	2.30	2.30	2.30
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		Yes	Yes	Yes
Depth at 75% full/effective depth	m	2.00	1.93	1.93
Depth at 25% full/effective depth	m	2.20	2.18	2.18
Time at 75% full/effective depth	mins	0.67	0.82	1.37
Time at 25% full/effective depth	mins	5.67	8.12	8.33
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m ³	0.09	0.12	0.12
Mean surface area for outflow (50% full/effective depth)	m ²	2.44	2.72	2.72
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	5.00	7.30	6.97
Soil infiltration rate, f =	m/s	0.00012623	0.00009690	0.00010159
or	m/s	1.3E-04	9.7E-05	1.0E-04

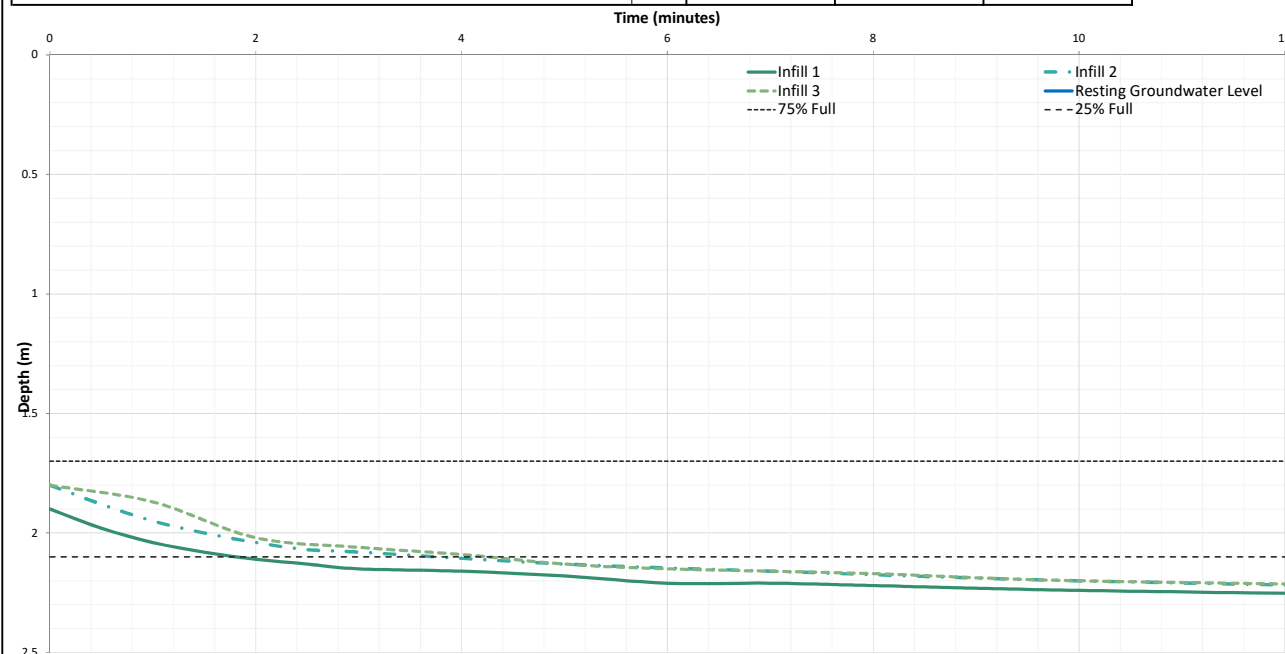
Recommended soil infiltration rate

9.7E-05

m/s

Note:

Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.



LOG

BACKFILL

DEPTH (m)	Arisings	DEPTH (m)
Dark brown slightly sandy gravelly CLAY. 0.0		0.0
Dark brown slightly sandy gravelly CLAY. 0.2		
Brown slightly clayey sandy GRAVEL. 0.4		
Light brown slightly sandy gravelly CLAY. 0.7		
Light brown slightly clayey gravelly SAND. 1.0		
Light brown slightly clayey very sandy GRAVEL of sandstone. 1.5	Gravel	1.5
		2.3



TITLE: Soakaway Test Results
Woodbine Cottage, Billingley

In accordance with BRE Digest 365 (2016)

DRAWN BY: JK
CHECKED BY: DJ
DATE: 15/08/2019

SCALE: Not to Scale
REVISION: 1

PROJECT NUMBER: 19-1049.02
SOAKAWAY NUMBER: SA101

	units	Infill 1	Infill 2	Infill 3
Length	m		2.20	
Width	m		0.60	
Depth	m		2.00	
Gravel type			Standard	
Voids ratio			0.35	
Resting groundwater level at time of testing	m		DRY	
Depth of first reading	m	1.51	1.43	1.41
Depth of final reading	m	2.00	2.00	2.00
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		Yes	Yes	Yes
Depth at 75% full/effective depth	m	1.63	1.57	1.56
Depth at 25% full/effective depth	m	1.88	1.86	1.85
Time at 75% full/effective depth	mins	0.88	0.79	0.87
Time at 25% full/effective depth	mins	3.96	4.94	6.06
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m ³	0.11	0.13	0.14
Mean surface area for outflow (50% full/effective depth)	m ²	2.69	2.92	2.97
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	3.08	4.15	5.19
Soil infiltration rate, f =	m/s	0.00022728	0.00018152	0.00014713
or	m/s	2.3E-04	1.8E-04	1.5E-04

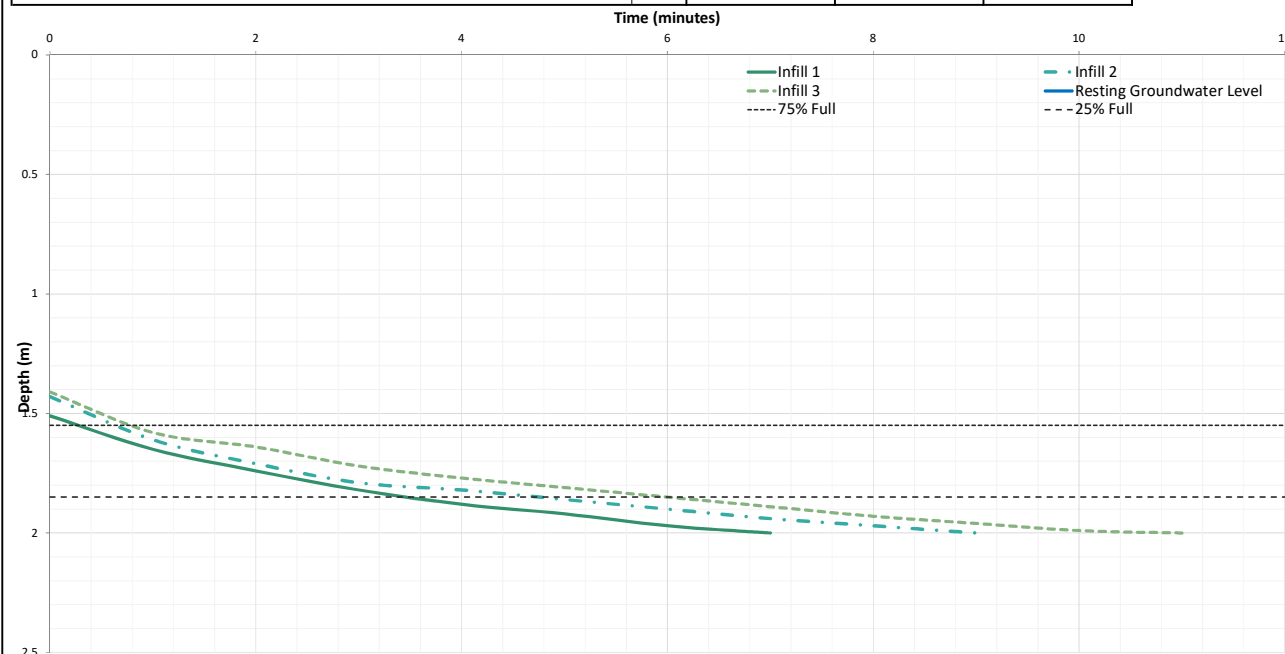
Recommended soil infiltration rate

1.5E-04

m/s

Note:

Where water level reaches nearly empty (5% full), soil infiltration based on '**Full**' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on '**Effective**' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a '**Failed**' test.



LOG

BACKFILL

DEPTH (m)	DEPTH (m)
Dark brown slightly sandy slightly gravelly CLAY. 0.0	Arisings 0.0
Brown slightly sandy gravelly CLAY. 0.2	
Light brown gravelly SAND. 0.4	
Light brown very sandy GRAVEL of sandstone. 0.6	
Light brown sandy very clayey GRAVEL of siltstone & sandstone. 1.1	
Gravel 1.4	
Brown clayey sandy GRAVEL of siltstone. 1.7	
2.0	2.0



TITLE: Soakaway Test Results
Woodbine Cottage, Billingley

In accordance with BRE Digest 365 (2016)

DRAWN BY: JK
CHECKED BY: DJ
DATE: 15/08/2019

SCALE: Not to Scale
REVISION: 1

PROJECT NUMBER:
19-1049.02
SOAKAWAY NUMBER:
SA102

	units	Infill 1	Infill 2	Infill 3
Length	m		2.20	
Width	m		0.60	
Depth	m		2.60	
Gravel type			Standard	
Voids ratio			0.35	
Resting groundwater level at time of testing	m		DRY	
Depth of first reading	m	2.05	2.01	2.10
Depth of final reading	m	2.60	2.60	2.60
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		Yes	Yes	Yes
Depth at 75% full/effective depth	m	2.19	2.16	2.23
Depth at 25% full/effective depth	m	2.46	2.45	2.48
Time at 75% full/effective depth	mins	1.45	1.11	0.89
Time at 25% full/effective depth	mins	4.71	3.94	4.63
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m ³	0.13	0.14	0.12
Mean surface area for outflow (50% full/effective depth)	m ²	2.86	2.97	2.72
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	3.26	2.83	3.73
Soil infiltration rate, f =	m/s	0.00022723	0.00027004	0.00018963
or	m/s	2.3E-04	2.7E-04	1.9E-04

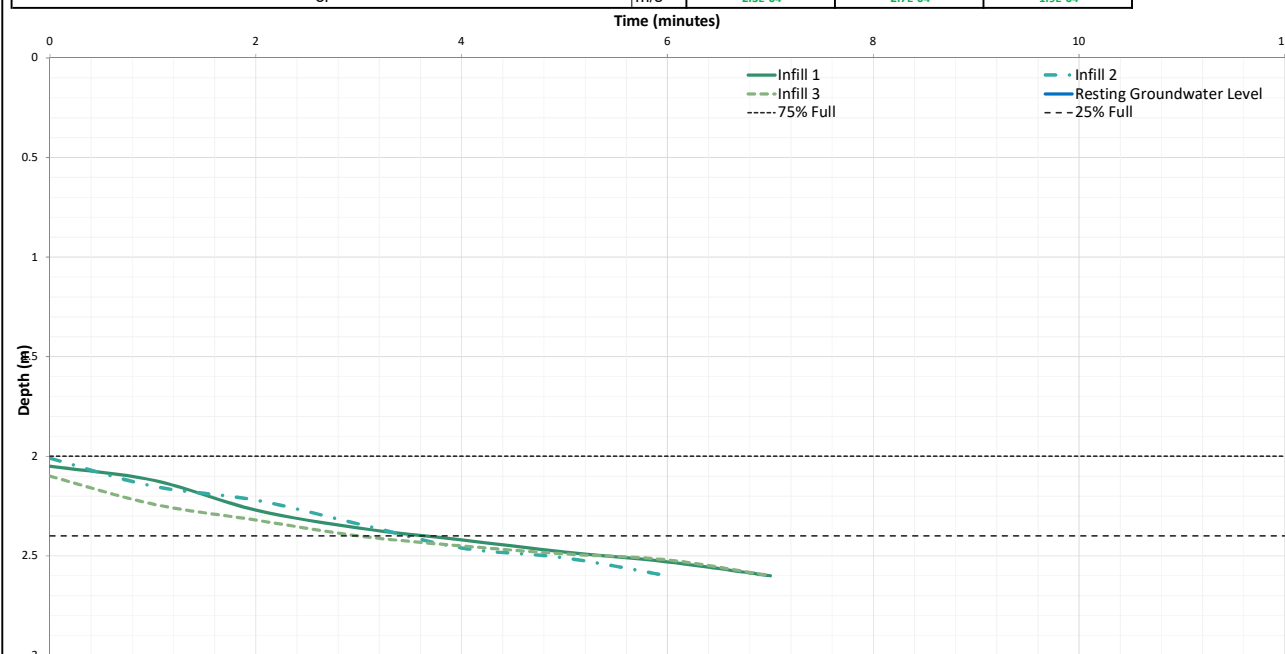
Recommended soil infiltration rate

1.9E-04

m/s

Note:

Where water level reaches nearly empty (5% full), soil infiltration based on '**Full**' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on '**Effective**' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a '**Failed**' test.



LOG

BACKFILL

DEPTH (m)	DEPTH (m)
Dark brown slightly sandy gravelly CLAY. 0.0	Arising 0.0
Brown sandy CLAY. 0.3	
Sandy slightly gravelly CLAY. 0.8	
Brown slightly clayey very sandy GRAVEL of siltstone. 1.4	
Brown slightly clayey very sandy GRAVEL of siltstone. 1.9	Gravel 1.8
	2.6



TITLE: Soakaway Test Results
Woodbine Cottage, Billingley

In accordance with BRE Digest 365 (2016)

DRAWN BY: JK
CHECKED BY: DJ
DATE: 15/08/2019

SCALE: Not to Scale
REVISION: 1

PROJECT NUMBER: 19-1049.02
SOAKAWAY NUMBER: SA103

	units	Infill 1	Infill 2	Infill 3
Length	m		2.20	
Width	m		0.60	
Depth	m		3.00	
Gravel type			Standard	
Voids ratio			0.35	
Resting groundwater level at time of testing	m		DRY	
Depth of first reading	m	2.59	2.57	2.50
Depth of final reading	m	3.00	3.00	3.00
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		Yes	Yes	Yes
Depth at 75% full/effective depth	m	2.69	2.68	2.63
Depth at 25% full/effective depth	m	2.90	2.89	2.88
Time at 75% full/effective depth	mins	0.93	1.59	1.39
Time at 25% full/effective depth	mins	4.92	5.85	6.83
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m ³	0.09	0.10	0.12
Mean surface area for outflow (50% full/effective depth)	m ²	2.47	2.52	2.72
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	3.98	4.26	5.44
Soil infiltration rate, f =	m/s	0.00016050	0.00015410	0.00012999
or	m/s	1.6E-04	1.5E-04	1.3E-04

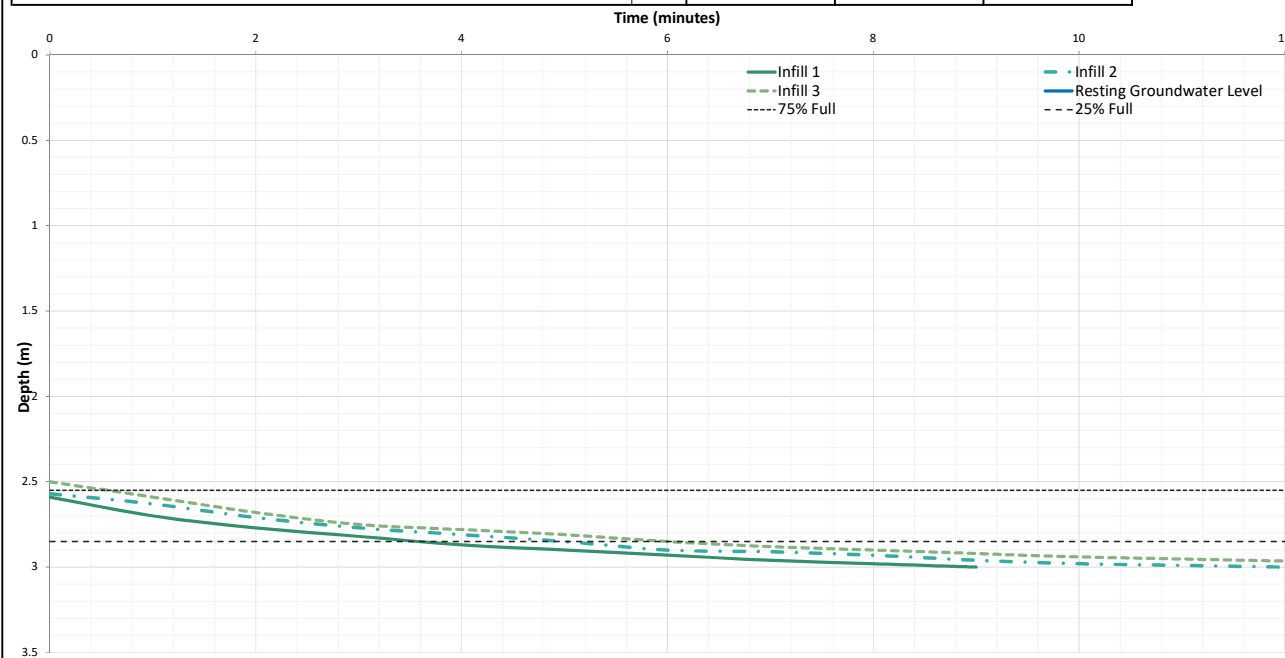
Recommended soil infiltration rate

1.3E-04

m/s

Note:

Where water level reaches nearly empty (5% full), soil infiltration based on '**Full**' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on '**Effective**' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a '**Failed**' test.



LOG

BACKFILL

DEPTH (m)	DEPTH (m)
Dark brown sandy slightly gravelly CLAY. 0.0	Arisings 0.0
Creamish grey sandy slightly gravelly CLAY. 0.7	
Light bluish grey sandy CLAY. 1.4	
Grey sandy CLAY. 2.2	
Gravel 2.4	
Grey clayey sandy GRAVEL of mudstone & siltstone. 2.7	
3.0	3.0



TITLE: Soakaway Test Results
Woodbine Cottage, Billingley

In accordance with BRE Digest 365 (2016)

DRAWN BY: JK
CHECKED BY: DJ
DATE: 15/08/2019

SCALE: Not to Scale
REVISION: 1

PROJECT NUMBER:
19-1049.02
SOAKAWAY NUMBER:
SA104

Appendix F – Micro-Drainage Soakaway Calculations

Waterco Ltd				Page 1																																																																																																																																																																	
Eden Court		12359-20746																																																																																																																																																																			
Lon Parcwr Business Park		Woodbine Cottage, Doncaster Rd																																																																																																																																																																			
Denbighshire LL15 1NJ		Soakaway 1 - 1in100 + 40% CC																																																																																																																																																																			
Date 30/08/2019		Designed by CM																																																																																																																																																																			
File Soakaway1_1 in 100 +40C...		Checked by AW																																																																																																																																																																			
XP Solutions		Source Control 2019.1																																																																																																																																																																			
Summary of Results for 100 year Return Period (+40%) Half Drain Time : 58 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>9.641</td><td>0.641</td><td>0.6</td><td>2.7</td><td>0 K</td></tr><tr><td>30 min Summer</td><td>9.777</td><td>0.777</td><td>0.7</td><td>3.3</td><td>Flood Risk</td></tr><tr><td>60 min Summer</td><td>9.864</td><td>0.864</td><td>0.8</td><td>3.7</td><td>Flood Risk</td></tr><tr><td>120 min Summer</td><td>9.880</td><td>0.880</td><td>0.8</td><td>3.8</td><td>Flood Risk</td></tr><tr><td>180 min Summer</td><td>9.859</td><td>0.859</td><td>0.8</td><td>3.7</td><td>Flood Risk</td></tr><tr><td>240 min Summer</td><td>9.827</td><td>0.827</td><td>0.7</td><td>3.5</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>9.756</td><td>0.756</td><td>0.7</td><td>3.2</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>9.692</td><td>0.692</td><td>0.6</td><td>3.0</td><td>0 K</td></tr><tr><td>600 min Summer</td><td>9.637</td><td>0.637</td><td>0.6</td><td>2.7</td><td>0 K</td></tr><tr><td>720 min Summer</td><td>9.590</td><td>0.590</td><td>0.5</td><td>2.5</td><td>0 K</td></tr><tr><td>960 min Summer</td><td>9.516</td><td>0.516</td><td>0.5</td><td>2.2</td><td>0 K</td></tr><tr><td>1440 min Summer</td><td>9.415</td><td>0.415</td><td>0.4</td><td>1.8</td><td>0 K</td></tr><tr><td>2160 min Summer</td><td>9.325</td><td>0.325</td><td>0.3</td><td>1.4</td><td>0 K</td></tr><tr><td>2880 min Summer</td><td>9.270</td><td>0.270</td><td>0.2</td><td>1.2</td><td>0 K</td></tr><tr><td>4320 min Summer</td><td>9.205</td><td>0.205</td><td>0.2</td><td>0.9</td><td>0 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>146.691</td><td>0.0</td><td>15</td></tr><tr><td>30 min Summer</td><td>96.880</td><td>0.0</td><td>30</td></tr><tr><td>60 min Summer</td><td>61.453</td><td>0.0</td><td>46</td></tr><tr><td>120 min Summer</td><td>36.790</td><td>0.0</td><td>80</td></tr><tr><td>180 min Summer</td><td>27.161</td><td>0.0</td><td>114</td></tr><tr><td>240 min Summer</td><td>21.844</td><td>0.0</td><td>146</td></tr><tr><td>360 min Summer</td><td>15.983</td><td>0.0</td><td>212</td></tr><tr><td>480 min Summer</td><td>12.749</td><td>0.0</td><td>276</td></tr><tr><td>600 min Summer</td><td>10.677</td><td>0.0</td><td>338</td></tr><tr><td>720 min Summer</td><td>9.227</td><td>0.0</td><td>402</td></tr><tr><td>960 min Summer</td><td>7.316</td><td>0.0</td><td>528</td></tr><tr><td>1440 min Summer</td><td>5.256</td><td>0.0</td><td>766</td></tr><tr><td>2160 min Summer</td><td>3.775</td><td>0.0</td><td>1128</td></tr><tr><td>2880 min Summer</td><td>2.990</td><td>0.0</td><td>1496</td></tr><tr><td>4320 min Summer</td><td>2.161</td><td>0.0</td><td>2208</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	9.641	0.641	0.6	2.7	0 K	30 min Summer	9.777	0.777	0.7	3.3	Flood Risk	60 min Summer	9.864	0.864	0.8	3.7	Flood Risk	120 min Summer	9.880	0.880	0.8	3.8	Flood Risk	180 min Summer	9.859	0.859	0.8	3.7	Flood Risk	240 min Summer	9.827	0.827	0.7	3.5	Flood Risk	360 min Summer	9.756	0.756	0.7	3.2	Flood Risk	480 min Summer	9.692	0.692	0.6	3.0	0 K	600 min Summer	9.637	0.637	0.6	2.7	0 K	720 min Summer	9.590	0.590	0.5	2.5	0 K	960 min Summer	9.516	0.516	0.5	2.2	0 K	1440 min Summer	9.415	0.415	0.4	1.8	0 K	2160 min Summer	9.325	0.325	0.3	1.4	0 K	2880 min Summer	9.270	0.270	0.2	1.2	0 K	4320 min Summer	9.205	0.205	0.2	0.9	0 K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	146.691	0.0	15	30 min Summer	96.880	0.0	30	60 min Summer	61.453	0.0	46	120 min Summer	36.790	0.0	80	180 min Summer	27.161	0.0	114	240 min Summer	21.844	0.0	146	360 min Summer	15.983	0.0	212	480 min Summer	12.749	0.0	276	600 min Summer	10.677	0.0	338	720 min Summer	9.227	0.0	402	960 min Summer	7.316	0.0	528	1440 min Summer	5.256	0.0	766	2160 min Summer	3.775	0.0	1128	2880 min Summer	2.990	0.0	1496	4320 min Summer	2.161	0.0	2208
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Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	12359-20746 Woodbine Cottage, Doncaster Rd Soakaway 1 - 1in100 + 40% CC	
Date 30/08/2019 File Soakaway1_1 in 100 +40C...	Designed by CM Checked by AW	
XP Solutions Source Control 2019.1		

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 444039 404077	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.011

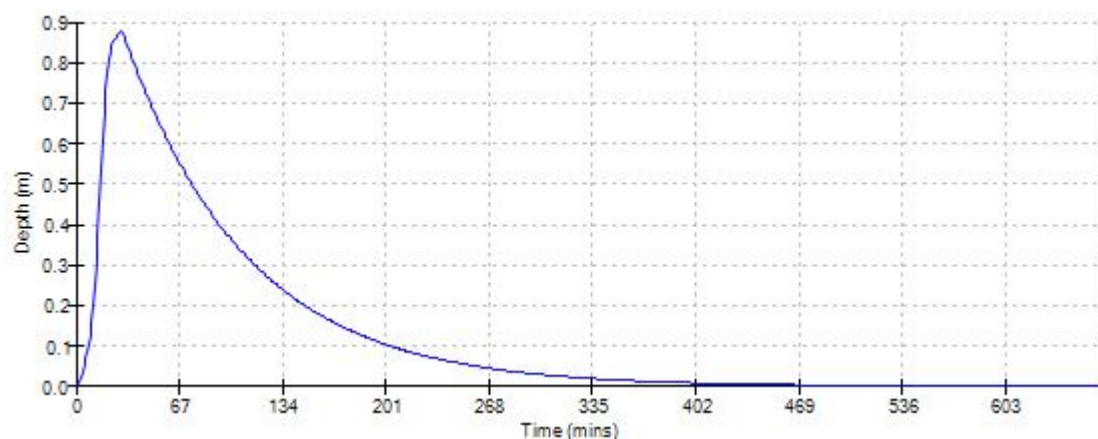
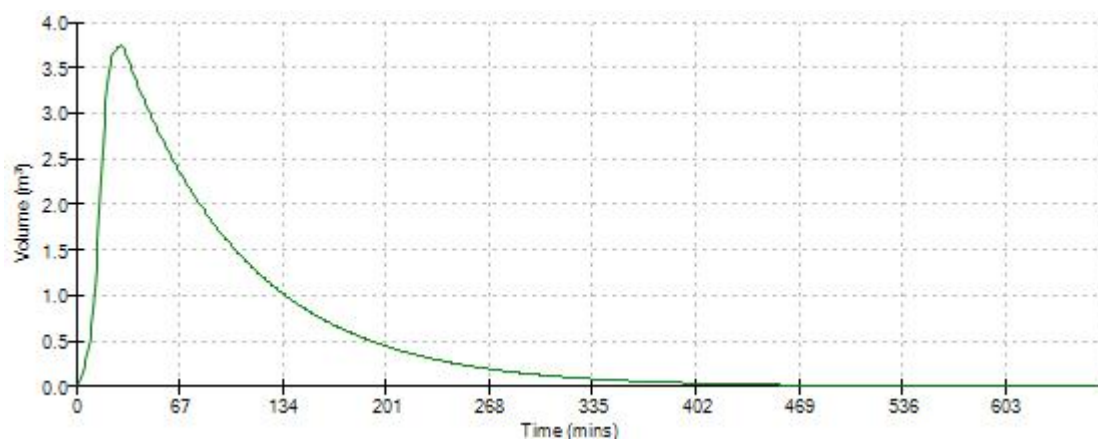
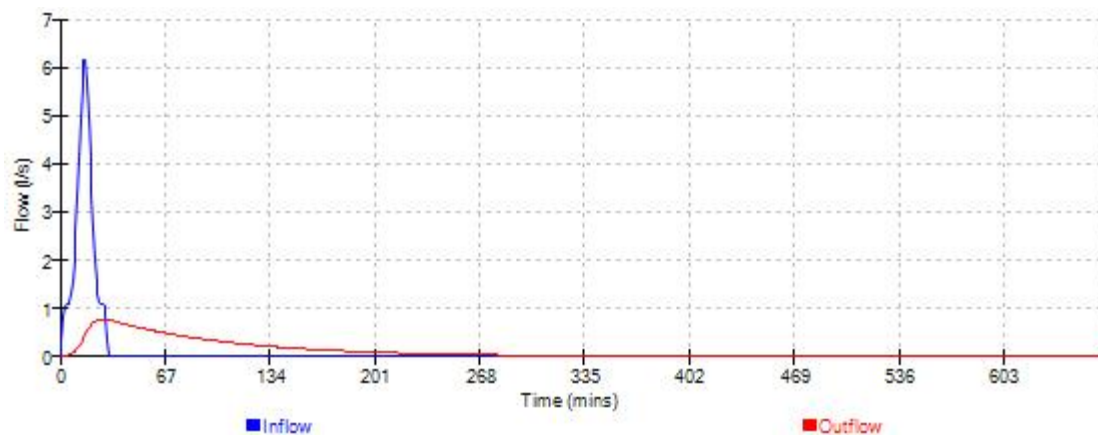
Time (mins)	Area
From:	To: (ha)
0	1 0.011

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Eden Court	12359-20746	
Lon Parcwr Business Park	Woodbine Cottage, Doncaster Rd	
Denbighshire LL15 1NJ	Soakaway 1 - 1in100 + 40% CC	
Date 30/08/2019	Designed by CM	
File Soakaway1_1 in 100 +40C...	Checked by AW	
XP Solutions		Source Control 2019.1
Model Details Storage is Online Cover Level (m) 10.000 Trench Soakaway Structure Infiltration Coefficient Base (m/hr) 0.00000 Infiltration Coefficient Side (m/hr) 0.34920 Safety Factor 1.2 Porosity 0.95 Invert Level (m) 9.000 Trench Width (m) 1.0 Trench Length (m) 4.5 Slope (1:X) 10000.0 Cap Volume Depth (m) 0.000 Cap Infiltration Depth (m) 0.000		
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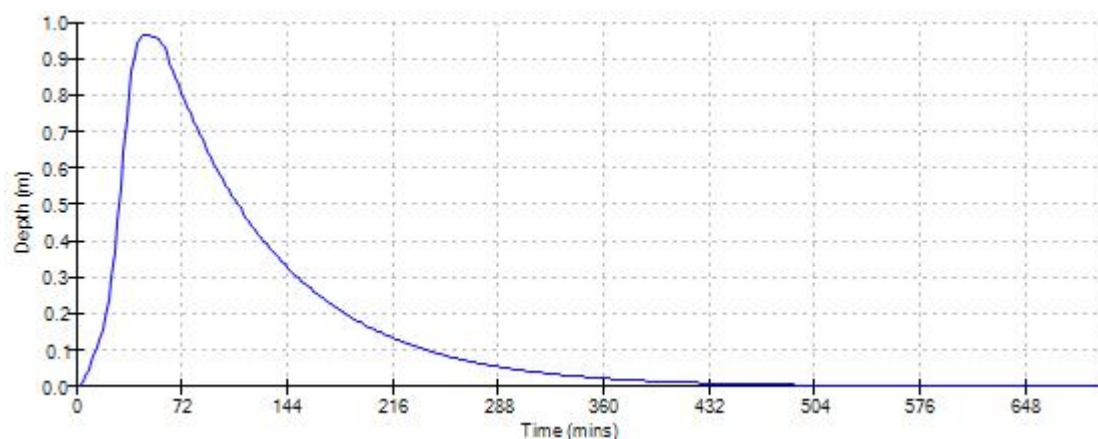
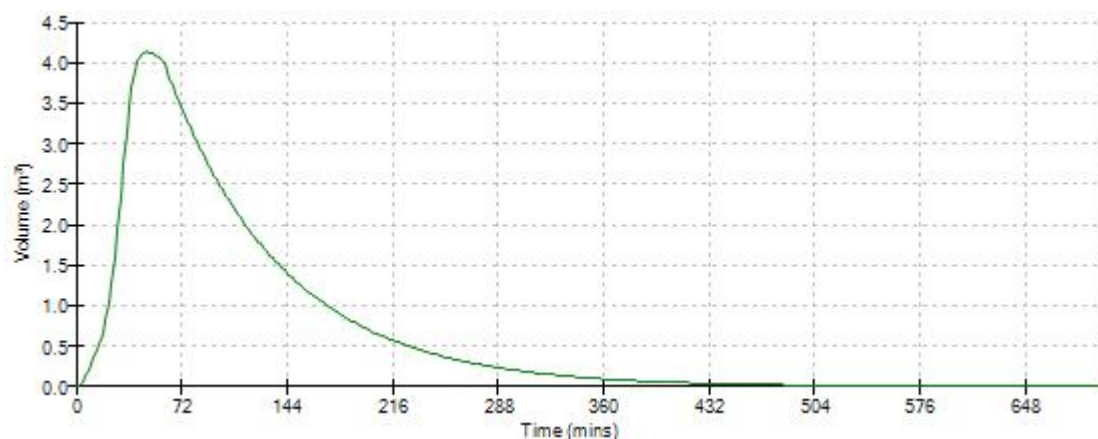
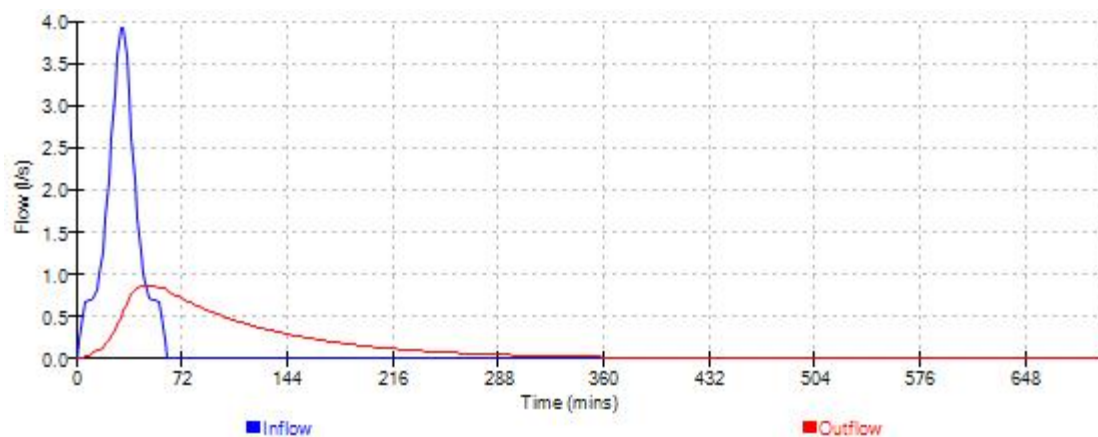
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File Soakaway1_1 in 100 +40C...	Checked by AW	
XP Solutions	Source Control 2019.1	

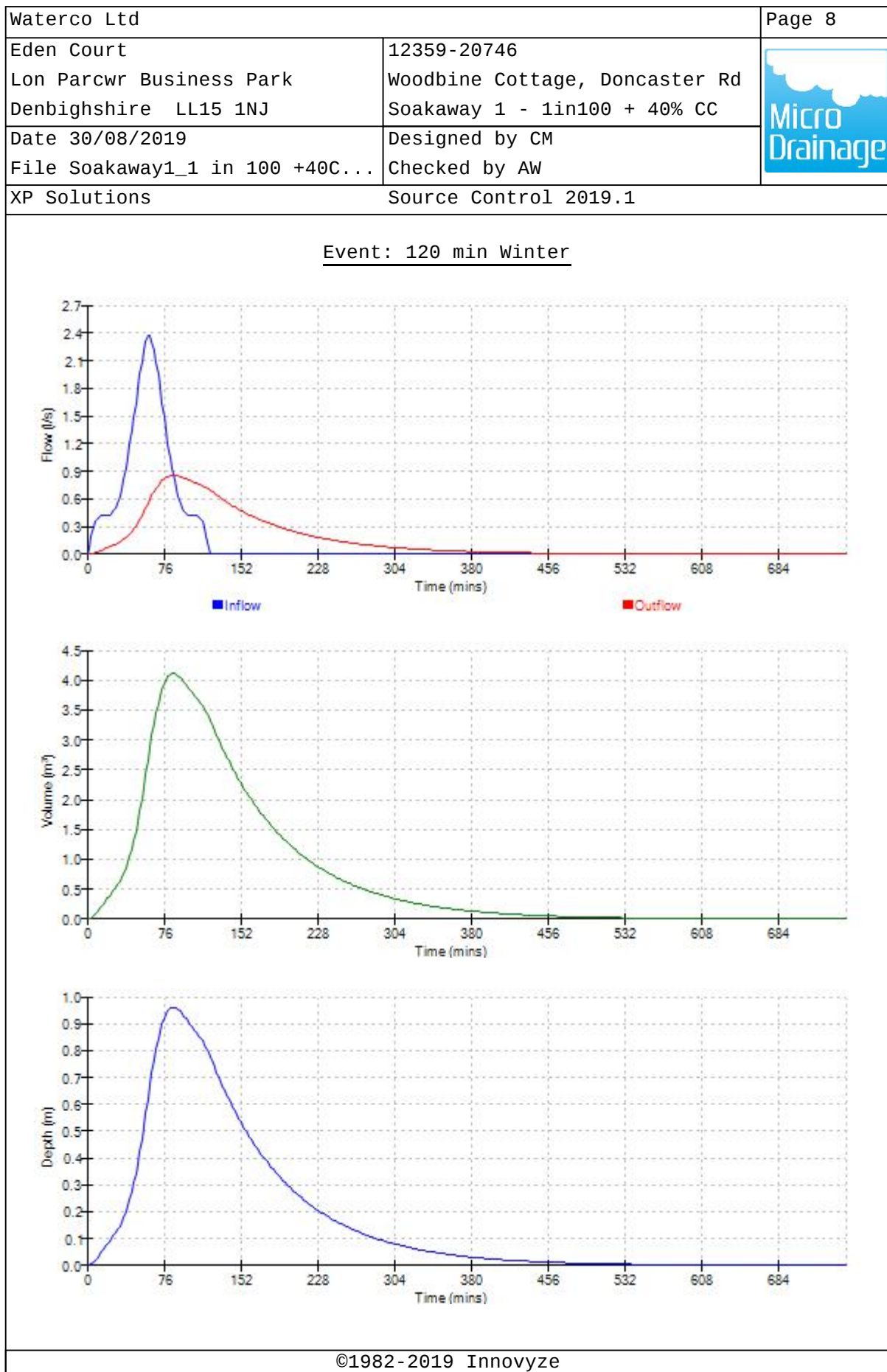
Event: 30 min Winter



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Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	12359-20746	
	Woodbine Cottage, Doncaster Rd Soakaway 1 - 1in100 + 40% CC	
Date 30/08/2019	Designed by CM	
File Soakaway1_1 in 100 +40C...	Checked by AW	
XP Solutions	Source Control 2019.1	

Event: 60 min Winter





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Waterco Ltd		Page 4
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	12359-20746 Woodbine Cottage, Doncaster Rd Soakaway 2 - 1in100 + 40% CC	
Date 30/08/2019 File Soakaway2_1 in 100 +40C...	Designed by CM Checked by AW	
XP Solutions Source Control 2019.1		

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 444039 404077	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.021

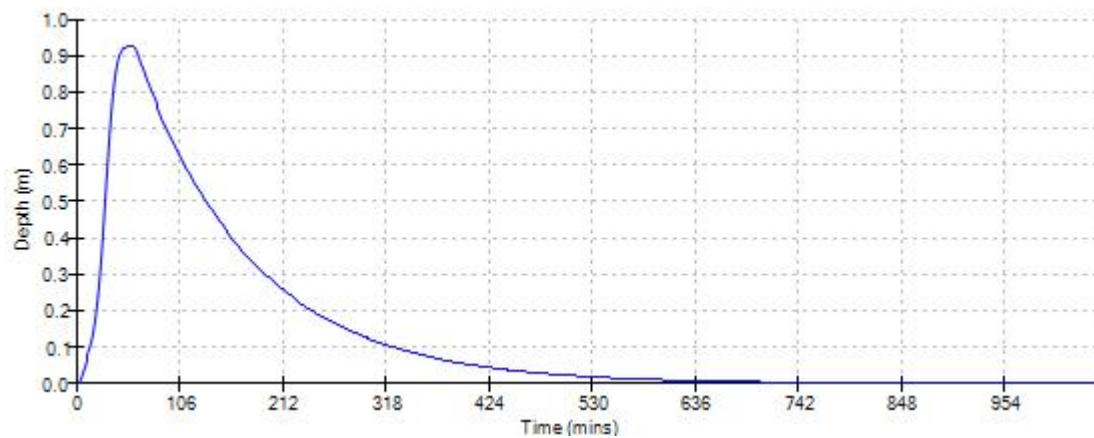
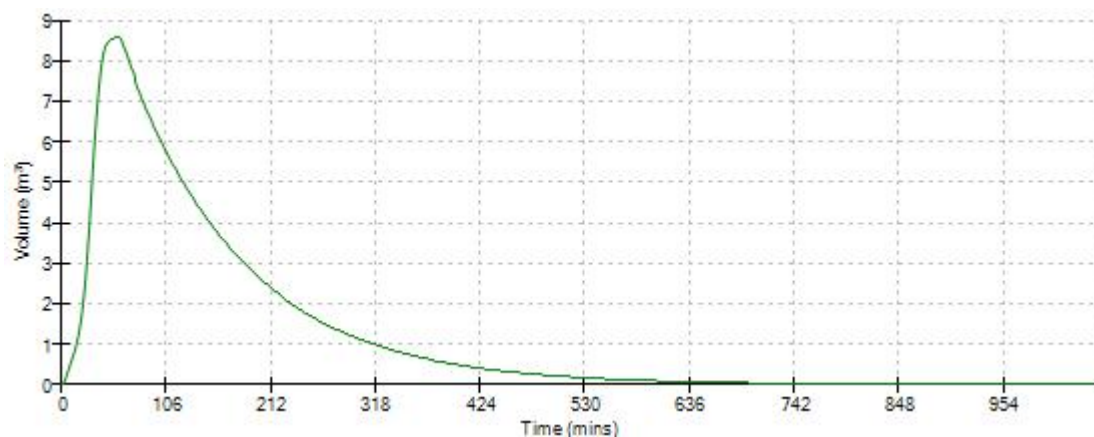
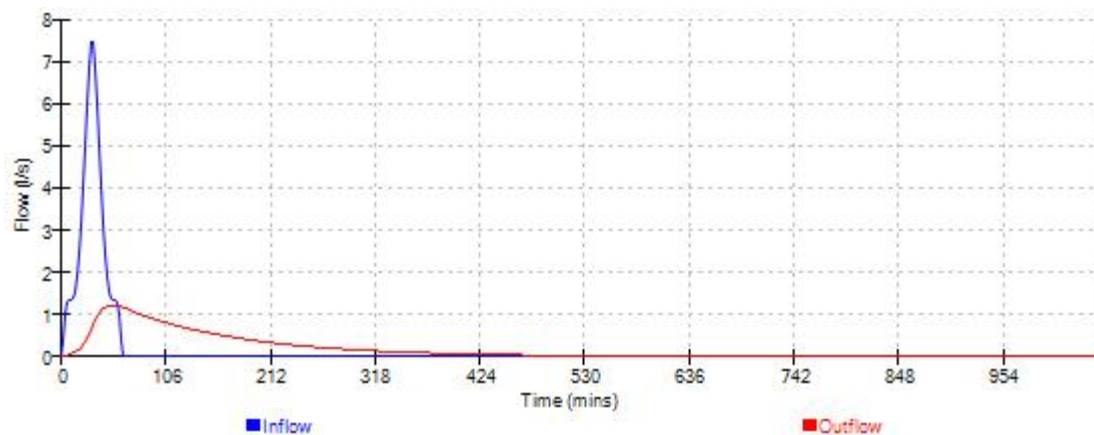
Time (mins)	Area
From:	To: (ha)
0	1 0.021

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Waterco Ltd		Page 5
Eden Court	12359-20746	
Lon Parcwr Business Park	Woodbine Cottage, Doncaster Rd	
Denbighshire LL15 1NJ	Soakaway 2 - 1in100 + 40% CC	
Date 30/08/2019	Designed by CM	
File Soakaway2_1 in 100 +40C...	Checked by AW	
XP Solutions	Source Control 2019.1	
Model Details Storage is Online Cover Level (m) 10.000 Trench Soakaway Structure Infiltration Coefficient Base (m/hr) 0.00000 Infiltration Coefficient Side (m/hr) 0.34920 Safety Factor 1.2 Porosity 0.95 Invert Level (m) 9.000 Trench Width (m) 1.5 Trench Length (m) 6.5 Slope (1:X) 10000.0 Cap Volume Depth (m) 0.000 Cap Infiltration Depth (m) 0.000		
©1982-2019 Innovyze		

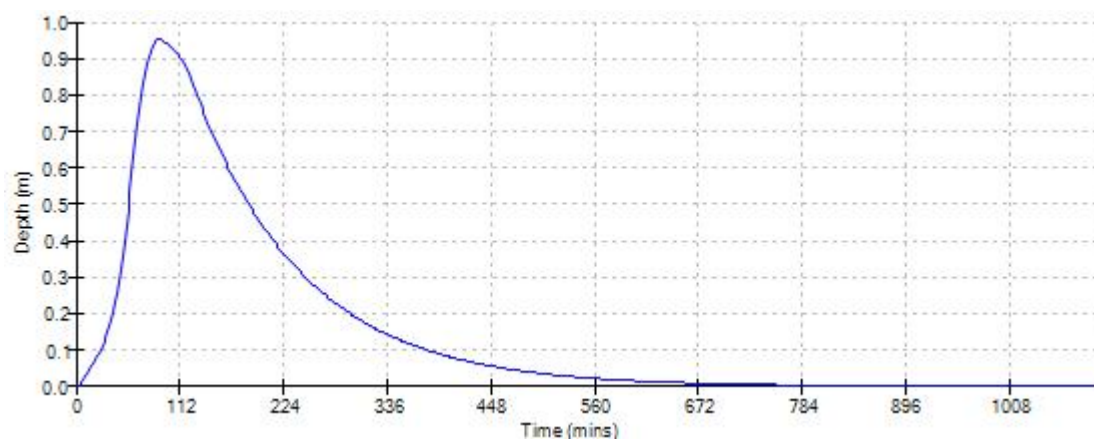
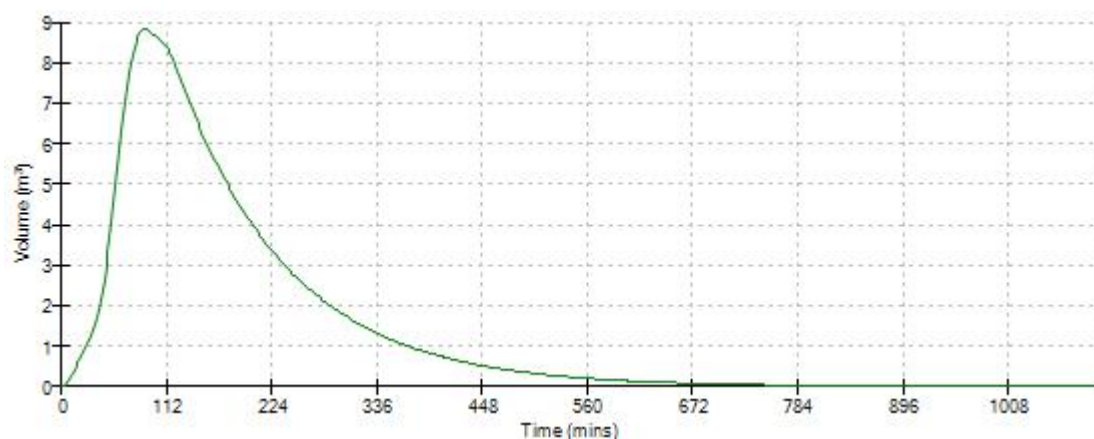
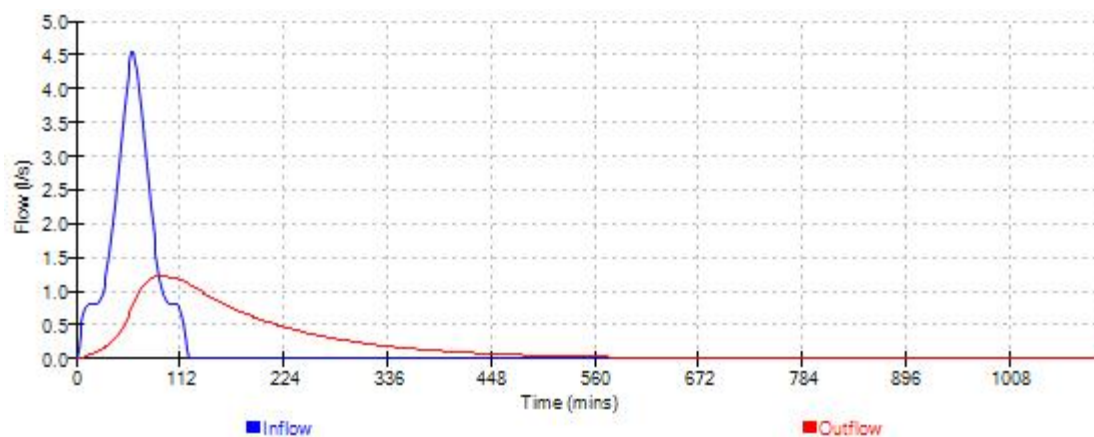
Waterco Ltd		Page 6
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	12359-20746	
	Woodbine Cottage, Doncaster Rd Soakaway 2 - 1in100 + 40% CC	
Date 30/08/2019	Designed by CM	
File Soakaway2_1 in 100 +40C...	Checked by AW	
XP Solutions		Source Control 2019.1

Event: 60 min Winter



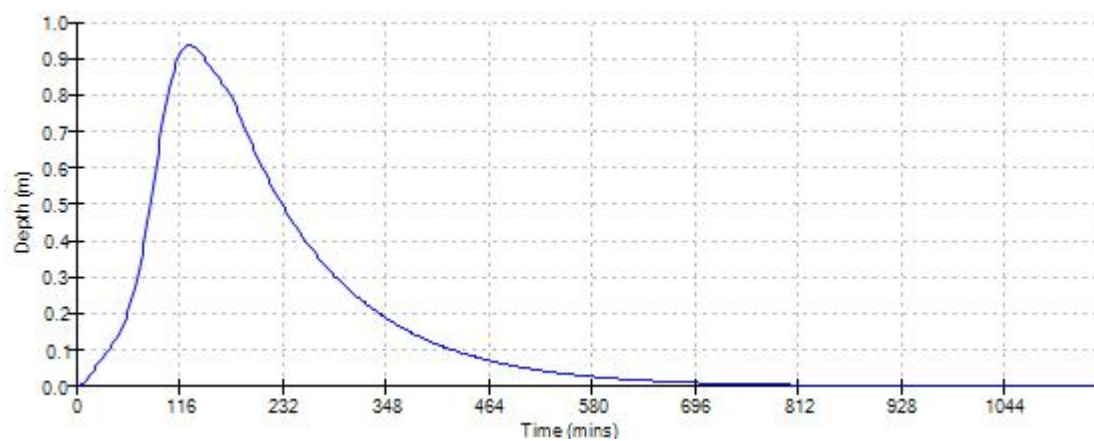
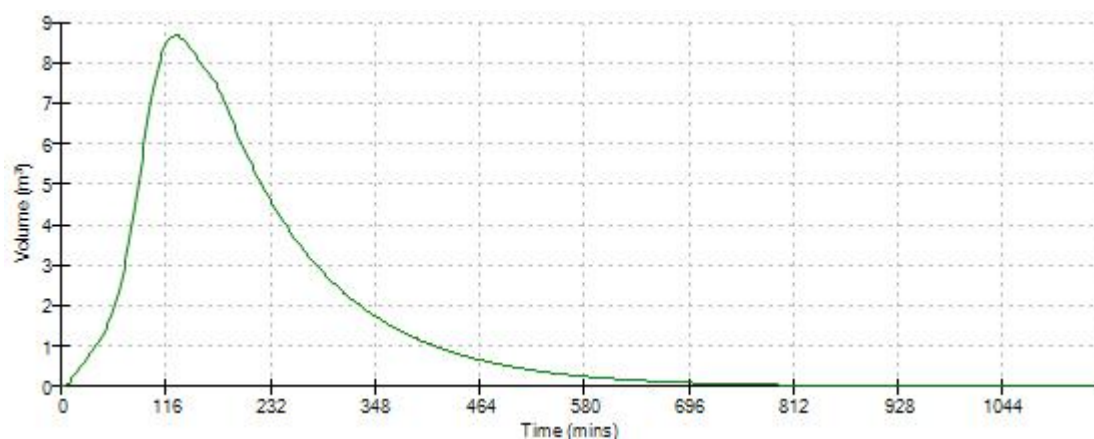
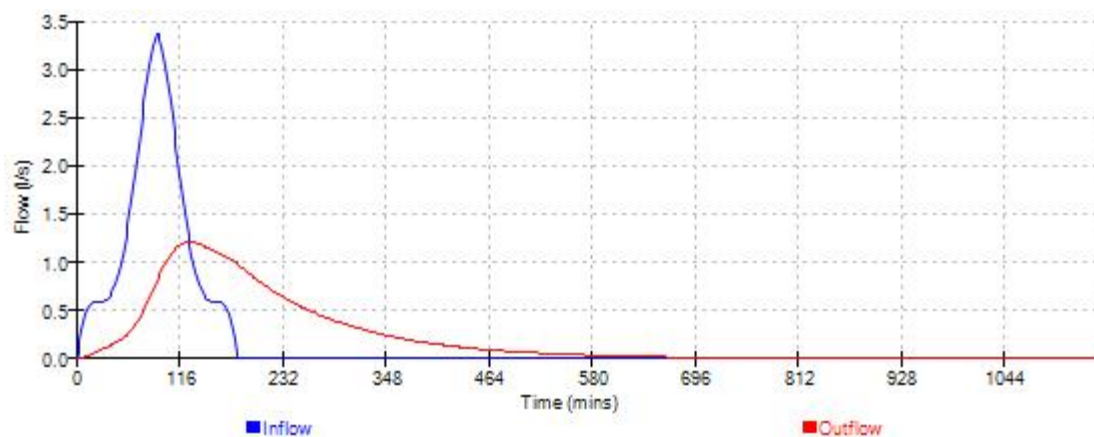
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Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	12359-20746	
	Woodbine Cottage, Doncaster Rd Soakaway 2 - 1in100 + 40% CC	
Date 30/08/2019	Designed by CM	
File Soakaway2_1 in 100 +40C...	Checked by AW	
XP Solutions	Source Control 2019.1	

Event: 120 min Winter



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Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	12359-20746	
	Woodbine Cottage, Doncaster Rd Soakaway 2 - 1in100 + 40% CC	
Date 30/08/2019	Designed by CM	
File Soakaway2_1 in 100 +40C...	Checked by AW	
XP Solutions	Source Control 2019.1	

Event: 180 min Winter



Appendix G – ReFH2 Runoff Rates

Inputs	
Site Area	0.304 Ha
Proposed Hardstanding	0.09 Ha
BFI Host	0.507

ReFH2 RUNOFF RATES*	
Return Period (Years)	As-rural Peak Flow (l/s)
1	0.67
2	0.76
5	1.07
10	1.31
30	1.76
50	2.02
75	2.27
100	2.47
200	3.04
1000	4.80

*Runoff Rates printed from the ReFH Flood Modelling software package

Appendix H – Soakaway and Permeable Paving Maintenance Schedules

Soakaway Maintenance Schedule

Maintenance Schedule	Required Action	Typical Frequency
Regular	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor inspection tube or chamber and inside of concrete manhole rings.	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs.	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation.	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Ref. Table 20.15 CIRIA C753 'The SuDS Manual'

Permeable Paving Maintenance Schedule

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season), or as required
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage, and / or physical damage.	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options.	Half yearly
	Check any mechanical devices e.g. penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level	Annually
	Remove sediment from any forebay	Every 1 – 5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g. 25-50 years
Remedial actions	Repair erosion or other damage	As required
	Replant where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required

	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate of Inlets, outlets and overflows	As required

Ref. Table 23.1 CIRIA C753 'The SuDS Manual'

Appendix I – Concept Drainage Sketch



3. THIS DRAWING PROVIDES A DRAINAGE CONCEPT ONLY AND IS NOT INTENDED FOR DETAILED DRAINAGE DESIGN.

	SURFACE WATER SOAKAWAY Soakaways positioned with a 5m buffer from infrastructure
	PROSPECTIVE LOCATION AREA FOR PTP Prospective location based upon 5m buffer from existing/ proposed infrastructure

DRAWN BY: AC	SCALE: Not to Scale	PROJECT NO: 19-1049.02
CHECKED BY: JR	REVISION: 1	
DATE: 02/09/2019		FIGURE NO: H