

Surface Water Strategy

For the Approved new dwellings on land at
**28 South View Road, Hoyland,
Barnsley, S74 9EB**

Prepared by

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Scope

Note: this report can only be assessed under the scope it is intended for as set out below:

Town and Country Planning Act 1990

The scope of this report includes the provision of supplementary information in relation to a planning application set under the provision of this Act and is intended to meet the requirements for “particulars” under Section 62; (3) & (4 A) of same.

The Town and Country Planning (Development Management Procedure) (England) Order 2015

The scope of this report includes the provision of supplementary information in relation to any related planning Condition set under the provision of this Order and is intended to meet the requirements for “particulars” under Section 27(b) of same.

Building Act 1984

Building Regulations 2010 and Statute control

This report **is not** provided in support of any application made under the Building Act 1984 or related Regulations.

Statement of conformity

While this report cannot therefore be lawfully assessed by any persons, in any capacity, for compliance with the above Building Regulations all drainage on this private site, both foul and SW will be subject to full compliance with Part H of the Building Regulations 2010 (as amended 2013).

Hence all construction details, SW runs, pipe diameters etc. as detailed in this report are designed to comply in full with the “Adequate provision” Requirement of Part H and are to be checked, inspected, tested and approved by the Building Control Body of the clients choice at the time of detailed design and construction.

SuDS design additional standards

All SuDS (Sustainable drainage system) on site will also be designed and installed in accordance with CIRIA 753 & CIRIA 768, para 169 of the NPPF, its supporting technical guidance and the DEFRA Non-Statutory Technical standards for sustainable drainage systems (2015).

1 Executive Summary

- A All surface water arising can be managed on site.
- B All surface water arising from new roofed areas is controlled by direct infiltration through soakaways.
- C Water butts will reduce potable water demand provide additional SuDS on site.
- D All areas of hard standing on the site will be constructed using a permeable medium.
- E There is no design exceedance outfall away from the site.
- F All SuDS on site will be installed with full consideration to long term maintenance.
- G The use of SuDS techniques on site will mitigate and treat the run-off volumes.

2 Introduction

2.1 Site location

The approved development is at 28 South View Road, Hoyland, Barnsley, S74 9EB, (see Figure 1).

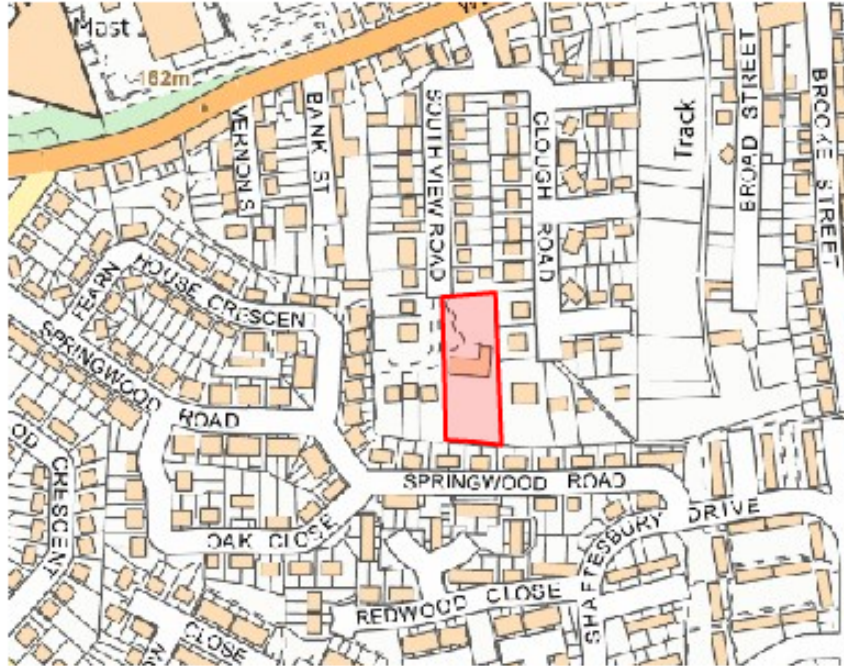


Figure 1: Site location, is indicated

2.2 Development description

The Approval (TA/2021/2055) is for the “Demolition of existing bungalow, erection of 5 no detached dwellings and associated works”.

All plans as per those approved.

2.2.1 Planning Condition 4

“No development shall take place until:

- (a) Full foul and surface water drainage details, including Yorkshire Water permission to discharge, have been submitted to and approved in writing by the Local Planning Authority;
- (b) Porosity tests are carried out in accordance with BRE 365, to demonstrate that the subsoil is suitable for soakaways;
- (c) Calculations based on the results of these porosity tests to prove that adequate land area is available for the construction of the soakaways;

Thereafter no part of the development shall be occupied or brought into use until the approved scheme has been fully implemented. The scheme shall be retained throughout the life of the development.”

2.3 Geology

BGS mapping indicates Pennine Middle Coal Measures Formation - Mudstone, siltstone and sandstone.

2.4 Infiltration rates

Infiltration rates for the site based on infiltration testing undertaken on site by the client, is found to be $7.6 \times 10^{-4} \text{ ms}^{-1}$ in the worst case at soakaway depth and $3.2 \times 10^{-4} \text{ ms}^{-1}$ in the worst case at driveway sub-base formation depth.

Refer to data at Appendix A.

2.4.1 Water table

Ground water was not encountered in the trial holes.

2.5 Existing surface water drainage

The site currently drains surface water to a network drain. The site does not utilise SuDS.

The curtilage of the entire site encloses an area of approximately 3154m^2 of which, pre-development, 0m^2 is classed as being impermeable. The new development increases the impermeable area from 0m^2 to 615m^2 (615m^2 roof area).

However, for the purposes of this assessment the area covered by the development is considered greenfield with all rainwater draining via natural process.

2.6 Greenfield estimation of peak rate of run-off

2.6.1 Methodology

The following greenfield run-off rate calculations have been carried out in accordance with the IH Report 124 'Flood estimation for small catchments'^[1]. The pro rata method on the size of catchment has been used.

2.6.2 Formula

For catchments less than 50ha:

$$Q_{BAR50ha} = 1.08 (50/100)^{0.89} * SAAR^{1.17} * SPR^{2.17} \quad (1)$$

$$Q_{BAR} = Q_{BAR50ha} * \frac{A}{50} \quad (2)$$

$$Q_{1yr} = Q_{BAR} * 0.85 \quad (3)$$

$$Q_{100yr} = Q_{BAR} * GC_{100} \quad (4)$$

2.6.3 Variables

Qbar/Qmed =0.85

SAAR = 682mm

Hydrological Region 3

Growth curve factors: 30 yr = 1.75; 100 yr = 2.08

SPR = 0.47

Note: Area reflects positively drained areas only. I.e. Whole site area minus areas of significant open space.

2.6.4 Calculations

$$\begin{aligned} Q_{BAR50ha} &= 1.08 * 0.5^{0.89} * 682^{1.17} * 0.47^{2.17} \\ &= 0.58 * 2067.89 * 0.19 \\ &= 234.15 \end{aligned}$$

Using Equation 2:

$$\begin{aligned} Q_{BAR} &= \frac{234.15 * 0.32}{50} \\ &= 1.48 l s^{-1} \end{aligned}$$

Using Equation 3:

$$\begin{aligned}Q_1 &= 1.48 * 0.85 \\&= 1.26 \text{ l s}^{-1}\end{aligned}$$

Using Equation 4:

$$\begin{aligned}Q_{100} &= 1.48 * 2.08 \\&= 3.07 \text{ l s}^{-1}\end{aligned}$$

2.6.5 Peak green field run-off rates

For the 1 year Return Period event the peak runoff calculates to 1.26 l s^{-1}

For the 30 year Return Period event the peak runoff calculates to 2.58 l s^{-1}

For the 100 year Return Period event the peak runoff calculates to 3.07 l s^{-1}

3 SuDS Principles

In line with the SuDS management train, the following hierarchy has been considered in applying the use of SuDS into the proposed development scheme.

3.1 SuDS design philosophy

The CIRIA SuDS^[2] manual provides the design philosophy:

“SuDS design should, as much as possible, be based around the following:

- using surface water runoff as a resource
- managing rainwater close to where it falls
- managing runoff at the surface
- allowing rainwater to soak into the ground
- promoting evapotranspiration
- slowing and storing run-off to mimic natural runoff characteristics
- reducing contamination of runoff through pollution prevention and controlling the runoff at source
- treating runoff to reduce the risk of urban contaminants causing environmental pollution.”

3.2 Source control

- Sedum roofing.
- Infiltration devices. Typically soakaways.
- Rainwater harvesting.
- Bio-retention planting, rain gardens.
- Permeable paving, porous asphalt. These provide both infiltration and short term storage volumes thus reducing overall un-mitigated run-off volumes.

3.3 “End of pipe” solutions

To be considered only after implementation of the above options.

- Retention tanks with outfall controlled by hydraulic means to limiting discharge rates and volumes to discharge to existing SW flow pathways.

Sections 4.2 to 4.7 consider the viability of a range of these SuDS devices.

4 Appraisal of SuDS options

The primary aim is to meet the requirements of the Local Plan core policies and the SuDS hierarchy so as to manage SW on site.

4.1 Site constraints impacting on SuDS

- Approved site layout.
- Approved pitched roof design.
- No access to a watercourse.

4.2 Infiltration devices

With reference to Section 3.1, soakaways promote the following SuDS design criteria:

- manages rainwater close to where it falls
- allows rainwater to soak into the ground
- slows and stores run-off to mimic natural run-off characteristics
- treats run-off to reduce the risk of urban contaminants causing environmental pollution.

Given the infiltration rates calculated on site infiltration devices appear suited for this site and can be designed to accommodate design rainfall events (designed in line with BRE365 and Part H of the Building Regulations and at least 5m away from any structure).

4.3 Expansive planting

With reference to Section 3.1, expansive planting promotes the following SuDS design criteria:

- manages rainwater close to where it falls
- slows and stores run-off to mimic natural run-off characteristics
- treats run-off to reduce the risk of urban contaminants causing environmental pollution.

4.4 Permeable hard standing

With reference to Section 3.1, permeable paving promotes the following SuDS design criteria:

- manages rainwater close to where it falls
- manages runoff at the surface
- allows rainwater to soak into the ground
- slows and stores run-off to mimic natural runoff characteristics
- treats runoff to reduce the risk of urban contaminants causing environmental pollution.

4.4.1 Permeable paving

A 30% void ratio is assumed through a 350mm sub-base. This is appropriate for a DOT Type 3 Sub-base hence the storage capacity equates to circa 105mm per 1m² therefore based on a M6 100hr + cc storm of 70mm rainfall the paving offers, without any allowance for infiltration, a circa 1:1.5 drained volume:storage volume capacity. Hence there is no anticipated exceedance flow from the areas of permeable paving.

Mitigation indices = TSS 0.7, Metals 0.6, Hydrocarbons 0.7 = suitable for trafficked areas

All permeable paving offers sufficient storage volume to accommodate the 5mm event.

4.5 Rainwater harvesting

With reference to Section 3.1, Rainwater harvesting promotes the following SuDS design criteria:

- uses surface water runoff as a resource
- manages rainwater close to where it falls

and:

- stores rainwater for later use

4.5.1 For external use

Rain water harvesting / water butts: These provide additional, “off line”¹ SuDS, and are deemed a suitable SuDS component for small plots^[2], extract at Figure 2. The image shows a water butt in “off-line” configuration using a standard diverter.



Figure 2: Use of water butts as provided in the SuDS manual

The collection and re-use of water can reduce run off volumes arising from roofs. The collected water, via readily available diverters (e.g. Web link: [Standard diverter example](#), as per Figure 3), being used for external uses.

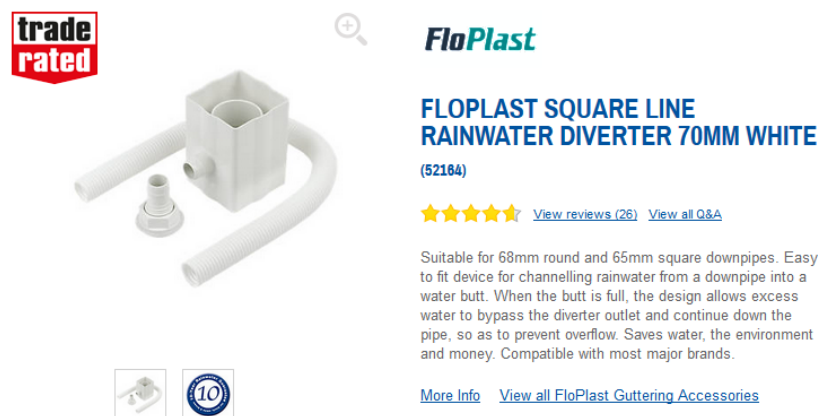


Figure 3: Standard rainwater diverter

Rainwater butts can, in part, accommodate the 5mm event dependent on manual drawdown and evaporation.

¹The term “off-line” refers to the fact that a water butt is a harvesting device that is not “in-line” in the same manner that a pipe is in-line. Water is collected (harvested) until the water butt is full. When full, the rainwater continues down the rainwater pipe. Outflow from the tank is not “automatic” since this would negate the reason to harvest rainwater. Instead, manual drawdown occurs with the harvested water being used for external uses. Since a water butt may be full, the useful volume is not accounted for in storage and run-off calculations.

4.6 Sedum/green roofs.

Not required.

4.7 “End of pipe” solutions

Not required.

5 Proposed surface water disposal strategy

The following sections consider the strategy for water arising from the roof areas, driveways and hard standing and areas of landscaping.

5.1 Soakaways

With Reference to Table 26.2 of the SuDS Manual, pollution hazard indices for:

Domestic Roofs are 0.2 (TSS), 0.2 Metals & 0.05 Hydrocarbons.

5.1.1 Plot 1

All surface water arising from the area of new roofing is controlled by direct infiltration through a soakaway. Notes:

- For this report the drained area to the soakaway(s) arises from the area of new roofing plus a 1.1 allowance for urban creep.
- The soakaway is designed for all events up to and including the M100 6hr event.
- An allowance of x1.4 is made for climate change in line with current best practice.

Designed to BRE365, and to accommodate all surface water arising from a drained area of 155m² requires 1 , 95% void ratio soakaway 2m wide x 2.1m long with a 0.8m effective depth. See Table 1.

Permeability	7.60E-04	ms ⁻¹
Urban Creep	1.1	
Drained area	155	m ²
Designed drained area	170.5	m ²
Return Period	100	yr
% voids	95	%
Climate change	1.4	

Design Width, m	2
Design Depth _{eff} , m	0.8
Design Qty	1

Duration, mins	5	10	15	30	60	120	240	360	600	1440
Rainfall, mm	16.3	25.1	31.2	43.1	56.7	71.8	87.5	97.9	112.1	140.1
Volume in, m ³	2.8	4.3	5.3	7.3	9.7	12.2	14.9	16.7	19.1	23.9
Length req'd, m	1.4	1.9	2.0	2.0	1.4	0.6	0.0	0.0	0.0	0.0

Crit Length, m	2.1
Crit Duration, mins	19
Empty to 50%, hrs	0.18

Table 1: BRE 365 Calculation results

The minimum design length with respect to the critical storm duration is shown in Figure 4.

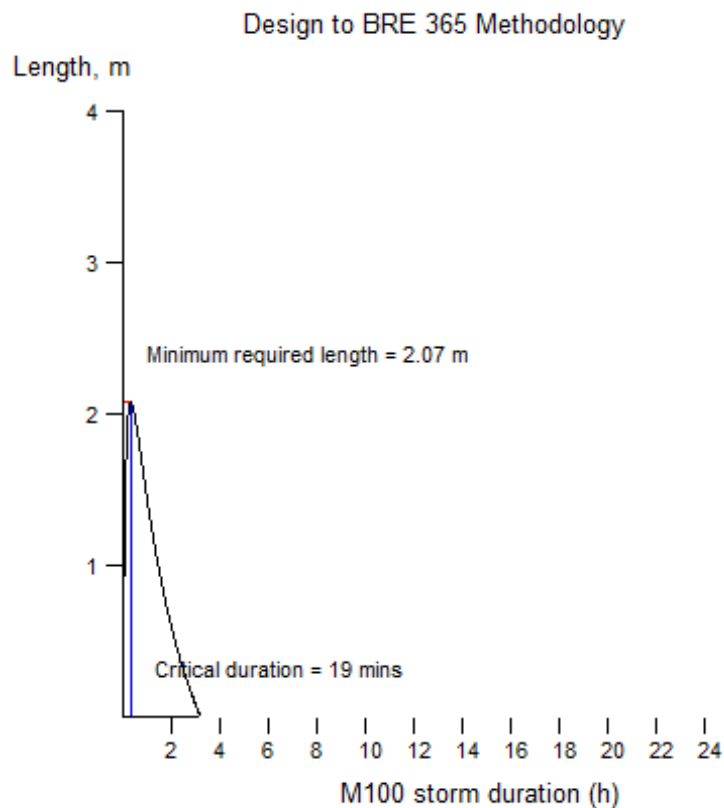


Figure 4: Critical storm duration and soakaway length

5.1.2 Sedimentation risk

Generally, roofing carries a very low sediment loading. Worst case $216 \text{ kg} \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$ - so for this site that equates to circa $13.3 \text{ kg} \cdot \text{yr}^{-1}$ in the worst case. Generally this would reduce the attenuation capacity by circa 2% over 50yrs (all data from the SuDS manual). The design allows for this amount with extra capacity provided to a 100yr design life. The BRE 365 method acknowledges this sedimentation and hence the base area is not considered in the sizing calculations.

5.1.3 Minimising sedimentation risk

The developer will fit accessible sumped rainwater gulleys at the base of all RWP's so as to reduce the amount of any sediment entering the soakaway.

The developer will also fit clip-in leaf guards to all roof gutters so as to remove gross solids.

5.1.4 Soakaway detail

The soakaway is designed to use open crates offering a circa 95% void ratio, encased within a geotextile membrane and provided with circa 400mm minimum cover. A typical detail is shown in Figure 7.

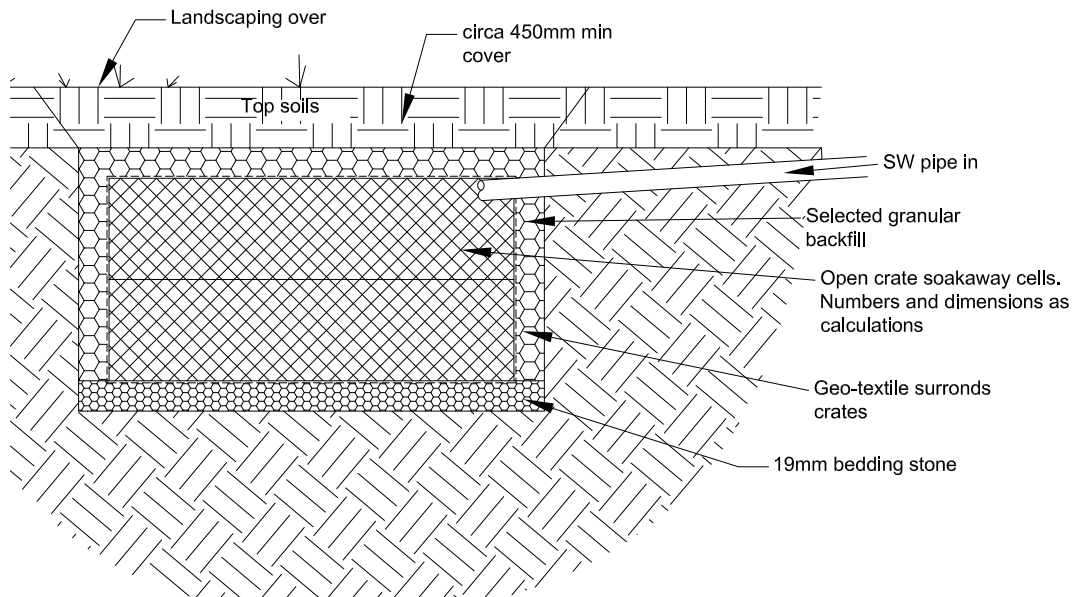


Figure 5: Typical soakaway details

5.1.5 Plots 2 - 5

All surface water arising from the area of new roofing is controlled by direct infiltration through a soakaway. Notes:

- For this report the drained area to the soakaway(s) arises from the area of new roofing plus a 1.1 allowance for urban creep.
- The soakaway is designed for all events up to and including the M100 6hr event.
- An allowance of x1.4 is made for climate change in line with current best practice.

Designed to BRE365, and to accommodate all surface water arising from a drained area of 115m² requires 1 , 95% void ratio soakaway 2m wide x 1.4m long with a 0.8m effective depth. See Table 2.

Permeability	7.60E-04	ms ⁻¹
Urban Creep	1.1	
Drained area	115	m ²
Designed drained area	126.5	m ²
Return Period	100	yr
% voids	95	%
Climate change	1.4	

Design Width, m	2
Design Depth _{eff} , m	0.8
Design Qty	1

Duration, mins	5	10	15	30	60	120	240	360	600	1440
Rainfall, mm	16.3	25.1	31.2	43.1	56.7	71.8	87.5	97.9	112.1	140.1
Volume in, m ³	2.1	3.2	4.0	5.4	7.2	9.1	11.1	12.4	14.2	17.7
Length req'd, m	1.0	1.3	1.4	1.2	0.8	0.1	0.0	0.0	0.0	0.0

Crit Length, m	1.4
Crit Duration, mins	17
Empty to 50%, hrs	0.14

Table 2: BRE 365 Calculation results

The minimum design length with respect to the critical storm duration is shown in Figure 6.

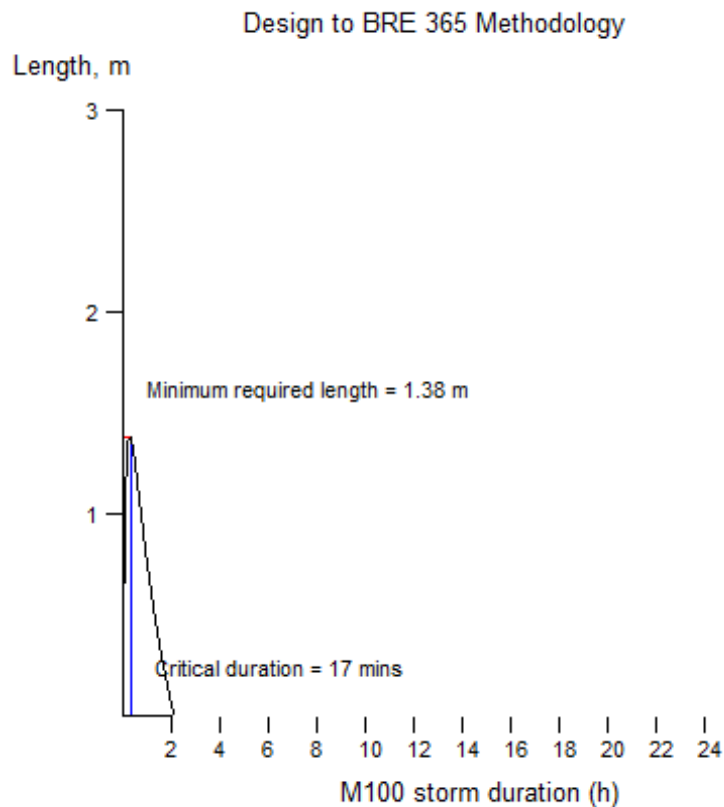


Figure 6: Critical storm duration and soakaway length

5.1.6 Sedimentation risk

Generally, roofing carries a very low sediment loading. Worst case $216 \text{ kg.ha}^{-1}\text{yr}^{-1}$ - so for this site that equates to circa 13.3kg.yr^{-1} in the worst case. Generally this would reduce the attenuation capacity by circa 2% over 50yrs (all data from the SuDS manual). The design allows for this amount with extra capacity provided to a 100yr design life. The BRE 365 method acknowledges this sedimentation and hence the base area is not considered in the sizing calculations.

5.1.7 Minimising sedimentation risk

The developer will fit accessible sumped rainwater gulleys at the base of all RWP's so as to reduce the amount of any sediment entering the soakaway.

The developer will also fit clip-in leaf guards to all roof gutters so as to remove gross solids.

5.1.8 Soakaway detail

The soakaway is designed to use open crates offering a circa 95% void ratio, encased within a geotextile membrane and provided with circa 400mm minimum cover. A typical detail is shown in Figure 7.

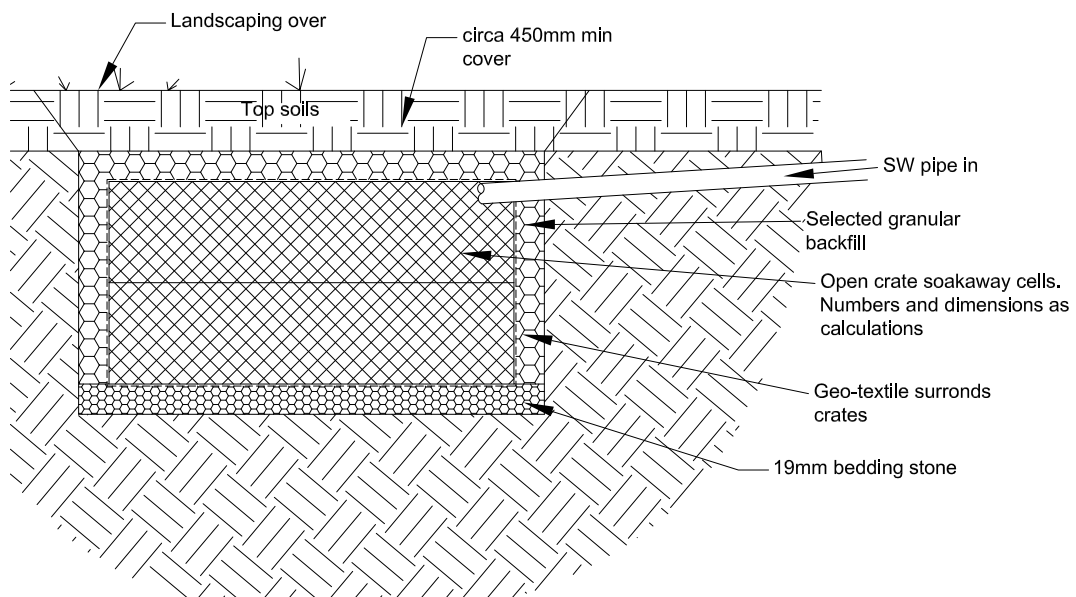


Figure 7: Typical soakaway details

5.1.9 Drainage run capacity check

Flow will be conveyed to the soakaway via 100mm diameter drainage runs laid at no less than 1:80 falls giving a maximum design capacity of 6.6ls^{-1} (Part H design chart, Figure 8).

1 in 100yr max mean intensity storm = 131mmhr^{-1}

Drained area to one pipe = 155m^2

Required pipe capacity = $155 \times 0.131 / 3.6 = 5.6\text{ls}^{-1}$

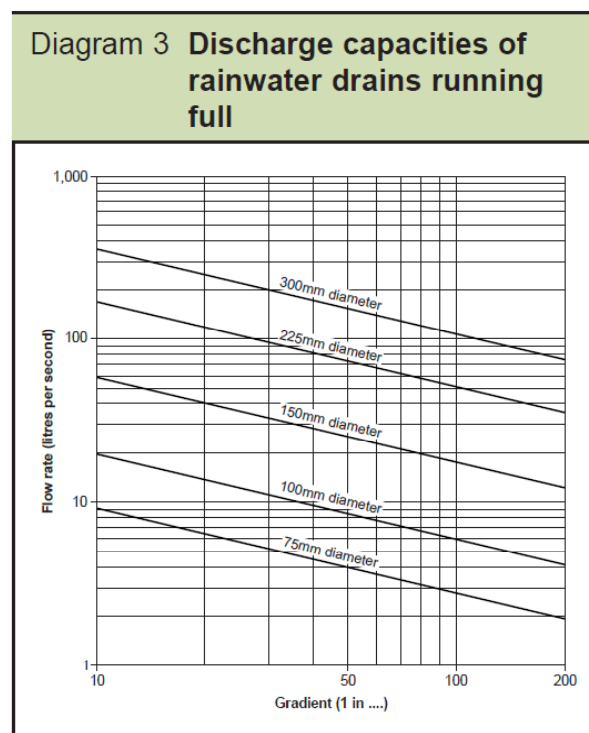


Figure 8: Part H drainage design chart

5.2 Rainwater Harvesting

The project team have detailed a “off line” rainwater butts to collect water for external use primarily to reduce potable water demand. These also serve as an additional SuDS feature. Since these are in off-line configuration any exceedance flows are automatically directed back to the downpipes.

5.3 Hard standing

All new areas of hard standing on the site will be constructed using a permeable medium on a DOT/MOT 3 sub-base of a minimum 350mm depth (refer to Section 4.4).

Note: The depth requirement above satisfies hydraulic criteria only. Structural loading may require greater hardcore depths.

The perimeter of these areas will be considered for expansive planting to accommodate any exceedance flows.

For a check on the capacity of the permeable paving to function an infiltration rate of 10mm.hr^{-1} has been used below. Infiltration rates on the site have been found to be $3.2 \times 10^{-4} \text{ ms}^{-1}$ (in the worst case) which equals circa 1152mm.hr^{-1} . Applying a factor of safety of 10 on this reduces the infiltration rate to 115mm.hr^{-1} hence a design value of 10mm.hr^{-1} is considered very conservative. A nominal 100m^2 is checked here (so as to provide meaningful results per unit area) but the results can be scaled up or down pro rata.

Over 100m^2 plan area, 10mm.hr^{-1} equates to a total outflow rate of 0.27ls^{-1}

Designed to accommodate all surface water arising from a design drained area of 100m^2 requires a minimum attenuation volume of 5 m^3 . This can be achieved using an overall storage volume of 35.0 m^3 formed within a $100\text{m}^2 \times 0.35\text{m}$ deep 30% void ratio sub-base. See Table 3.

Drained area	100m ²	
Urban Creep	1	
Designed drained area	100m ²	
Return periods considered	1yr, 30yr, 100yr	
Storm profiles used	50% Summer	75% Winter
Storm coeffs	a = 0.1, b = 0.815	a = 0.06, b = 1.026
Storm range, storm increments	From 5 minutes duration in further 2 min. intervals until critical storm reached	
M5-60	20mm	
r	0.3	
Rainfall model	FSR	
Critical design storm	157 mins, Summer	
Climate change	1.4	
Storm mean intensity	21.2mm.hr ⁻¹	
Design mean intensity	29.7mm.hr ⁻¹	
Storm peak intensity	106.8mm.hr ⁻¹	
Design peak intensity	149.6mm.hr ⁻¹	
Design maximum head	0.25m	
Calculated maximum head	0.17m	
Minimum attenuation volume required	5.00m ³	
Void ratio	30%	
Design attenuation volume	8m ³	(0.3 x 100m ² x 0.25m)
Provided attenuation volume	11m ³	(0.3 x 100m ² x 0.35m)
Factor of Safety	1.40	
1 in 1yr maximum outfall rate	0.3ls ⁻¹	(See Figure 9.)
1 in 30yr maximum outfall rate	0.3ls ⁻¹	(See Figure 10.)
1 in 100yr maximum outfall rate	0.3ls ⁻¹	(See Figure 11.)
1 in 100yr Time to peak	138 mins	
1 in 100yr Max head: Time to drop to 50%	2.50 hrs	
Outfall control method	Nominal GF outflow	

Table 3: Storage volume design summary

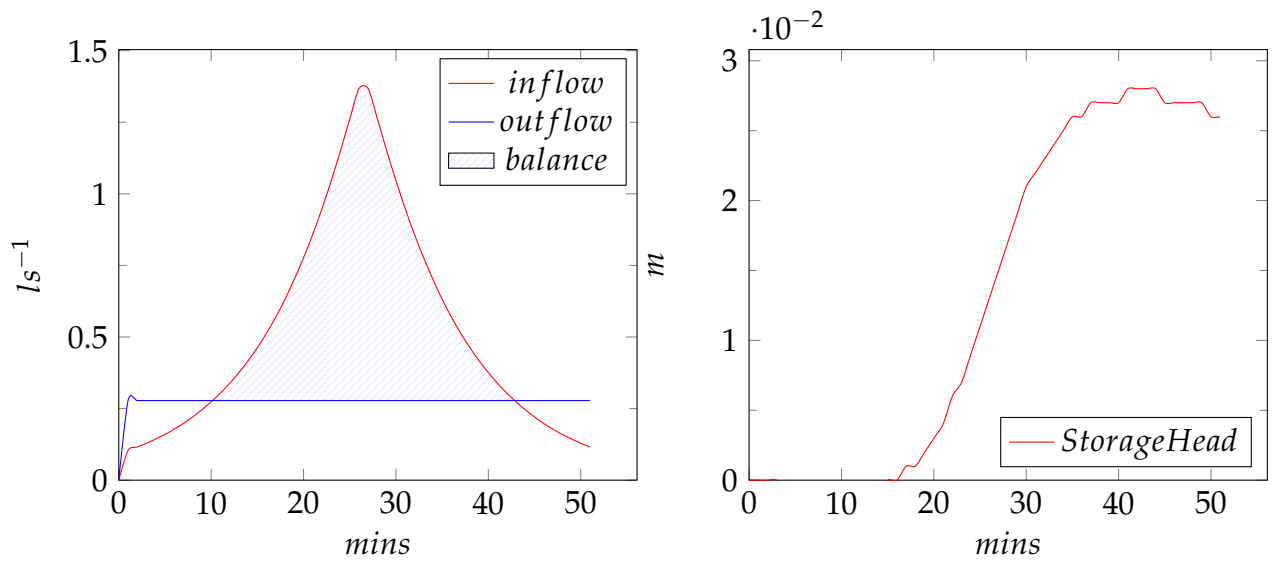


Figure 9: 1 in 1 year critical storm event

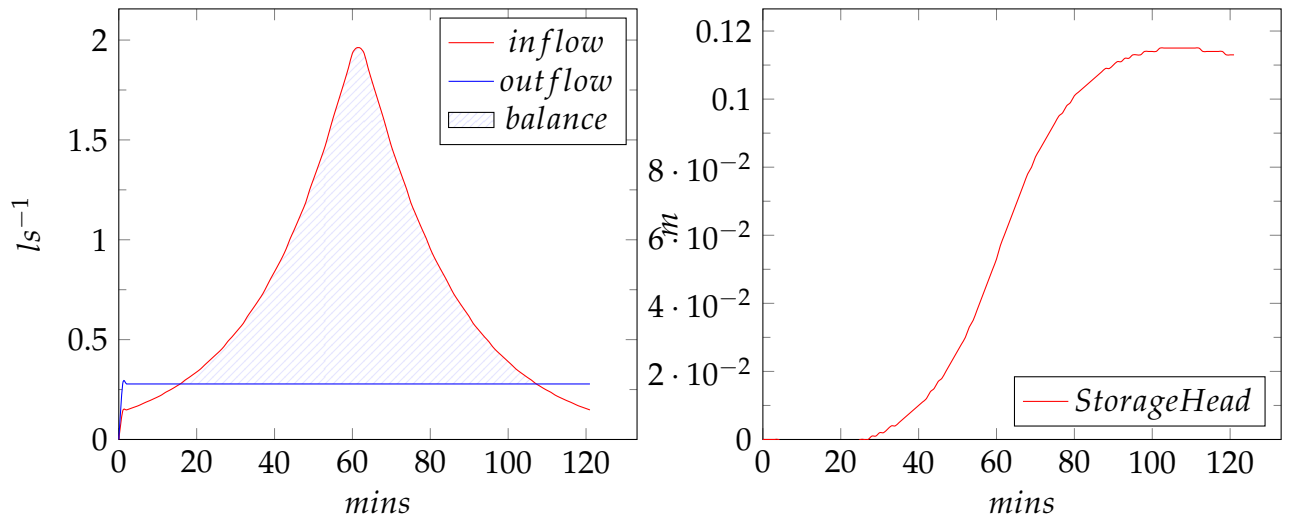


Figure 10: 1 in 30 year critical storm event

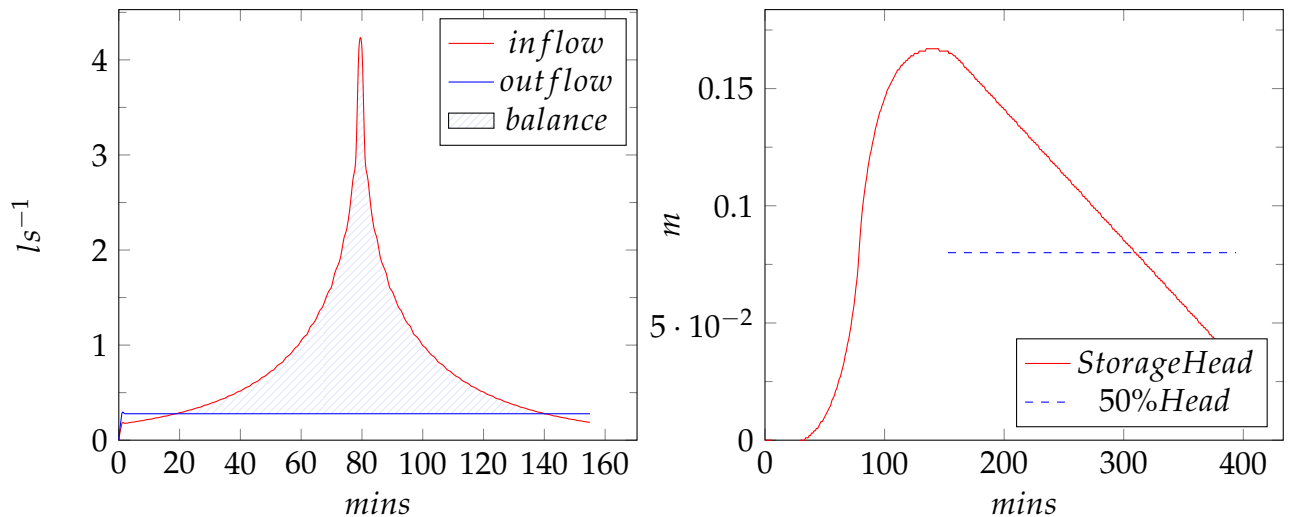


Figure 11: 1 in 100 year critical storm event

The areas of permeable paving are primarily disconnected from the proposed SW network on site, i.e. they are not primarily designed to drain to the soakaways. Surface water retained in the sub-base matrix is lost through evaporation and infiltration at or greater than $3.2 \times 10^{-4} \text{ ms}^{-1}$, at shallow depths, into the surrounding naturally fissured sub-soils (due to action of freeze-thaw, roots, earthworms and the proposed local re-grading following any site clearance). In doing so it mimics as close as possible the natural hydrological process of water falling onto the ground and finding natural flow paths for dispersion.

A suitable option is provided at Appendix B.

Noting the gradients on site, sub-base baffles will be required as per the general detail in Figure 12.

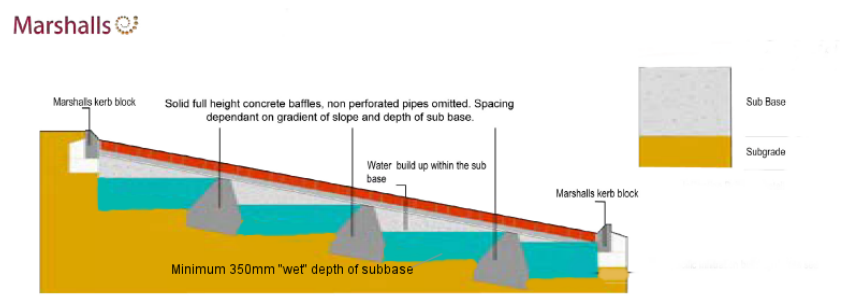


Figure 12: Sub-base baffles for use on sloping site

5.4 Landscaped areas

Typical domestic planting.

5.5 Drainage layout

Please refer to the drainage layout showing SuDS features at Appendix C.

5.6 Timetable for implementation

5.6.1 Demolition phase

During the demolition phase, rainwater will be managed in line with the requirements under the CDM regulations using existing SW gullies with measures in place to prevent contaminants entering the network (sand bag bunding).

5.6.2 Construction phase

Soakaways will be installed early in the project under the remit of the ground-works operations.

Areas of landscaping and boundary planting will be undertaken as the project nears completion.

Any permeable paving will only be installed when all construction activities are either complete, or near completion so as to minimise blockage of the surface.

5.6.3 Post construction phase

Water butts will be installed prior to final completion as part of the final landscaping. Inspection chambers pumped and cleaned out.

5.7 Foul drainage

Beyond the scope of this report.

6 Maintenance of SuDS

Ultimate responsibility for the long term maintenance with SuDS in this environment lay with the owner of each dwelling (as yet unknown).

The site SW drainage will remain private.

All SuDS on site will be installed with full consideration to long term maintenance. The following guidance applies:

6.1 Soakaways (and pre treatment sediment sumps)

Figure 13^[2] provides details maintenance operations required for a soakaway system.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of 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 of 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

Figure 13: Maintenance operations for soakaway

6.2 Permeable pavements

The maintenance plan for permeable pavements will include:

- Monthly litter removal;
- Bi-Annual jet wash and sweeping.
- Annual inspection and repairs as/if required.

6.3 Water butts

A maintenance plan for water butts should include:

- Regular inspection of silt traps and filters.
- Removal of sediments and debris as required.

6.4 Vegetation expansion

The maintenance plan for any garden planting will include:

- Monthly inspections until vegetation is established;
- Six monthly inspections after the vegetation has become established;
- Monthly litter removal.

7 Summary

All surface water arising can be managed on site. All surface water arising from roofed areas is controlled by direct infiltration through a pair of soakaways. Water butts will reduce potable water demand provide additional SuDS on site. All new areas of hard standing on the site will be constructed using a permeable medium.

There is no design exceedance outfall away from the site. Exceedance flows and flows arising from system failure can be accommodated on site within areas of landscape planting, soakaway crates and the sub-base to the hard standing.

The use of SuDS techniques on site, as detailed above and when installed in line with best practice (I.e. CIRIA 753 & CIRIA 768), will reduce and treat the run-off volumes in line with the core policies.

Signed:



Dr Robin Saunders CEng, C. Build E, MCABE, BEng(Hons), PhD

Drainage and Building Engineer

Date: 10th May, 2023

References

- [1] DCW Marshall & AC Bayliss. Flood estimation for small catchments. Technical Report No. 124, Institute of Hydrology, June 1994.
- [2] CIRIA. The SUDS manual. Technical report, CIRIA, 2015.

A Site Investigation

Infiltration testing to BRE 365 was conducted on site in four locations.

Test holes 1 and 2 where undertaken at soakaway operational depth (0.8 to 1.2m b.g.l) and test holes 3 and 4 were undertaken and the driveway's sub-base formation level.

A.1 Test Hole 1

Permeability Test Data

Site details:

Trial Hole location or reference: TOP OF 306 / Plot 1

Trial Hole (actual test hole that is filled)

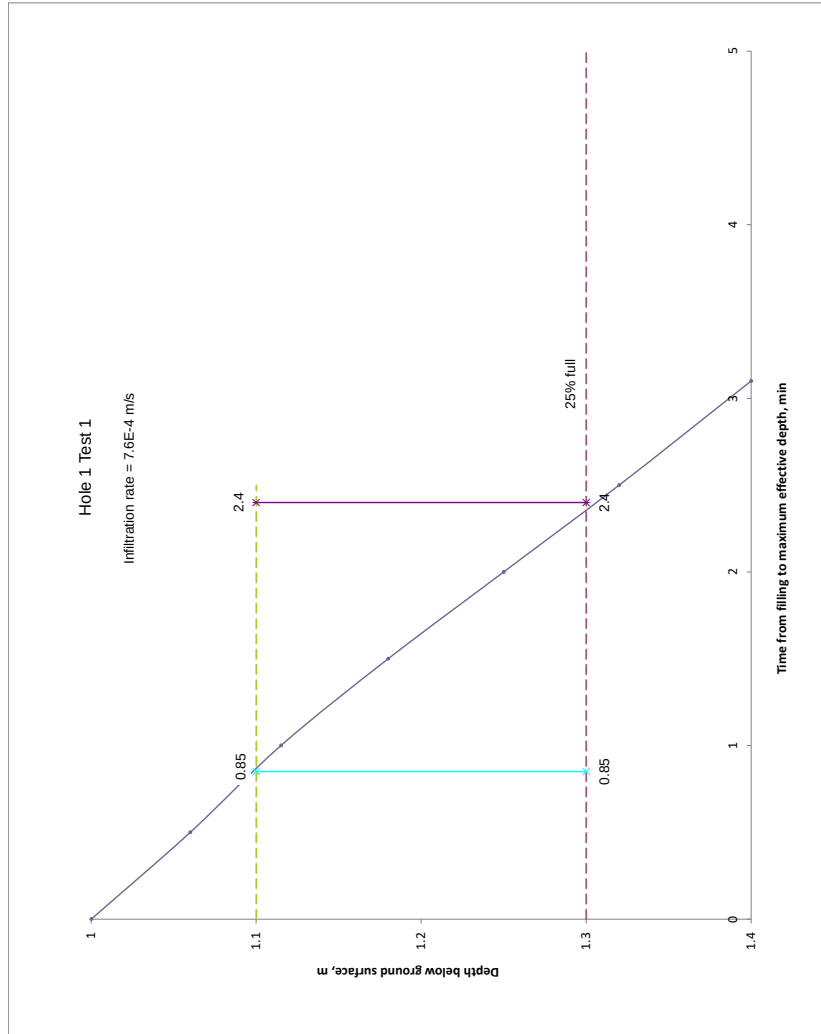
Width	mm	min 300mm
Length	mm	min 800mm
Depth b.g.l.	mm	min 1200mm
Depth of water	mm	min 400mm

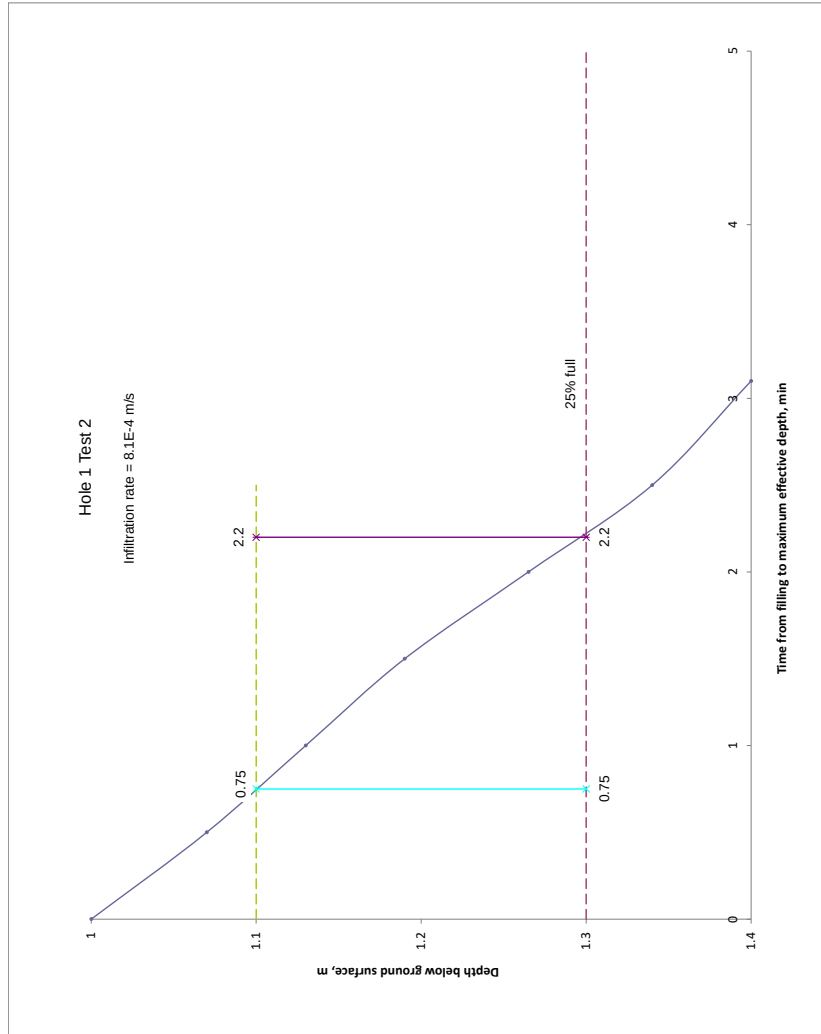
Start	Test 1		Test 2		Test 3		Example 11	
	Time	Depth of water	Time	Depth of water	Time	Depth of water	Time	depth
Reading 1	0	400 mm	0	400 mm	0	400 mm	10.00 AM	400
Reading 2	30 sec	340	30 sec	330	30 sec	330	10.05	350
Reading 3	60 sec	295	60 sec	270	60 sec	275	10.15	325
Reading 4	90 sec	220	90 sec	210	90 sec	210	10.28	290
Reading 5	120 sec	150	120 sec	135	120 sec	140	11.07	198
Reading 6	150 sec	80	150 sec	60	150 sec	70	12.22	150
Finish	190 sec		195 sec		190 sec		13.14	115
							14.45	85

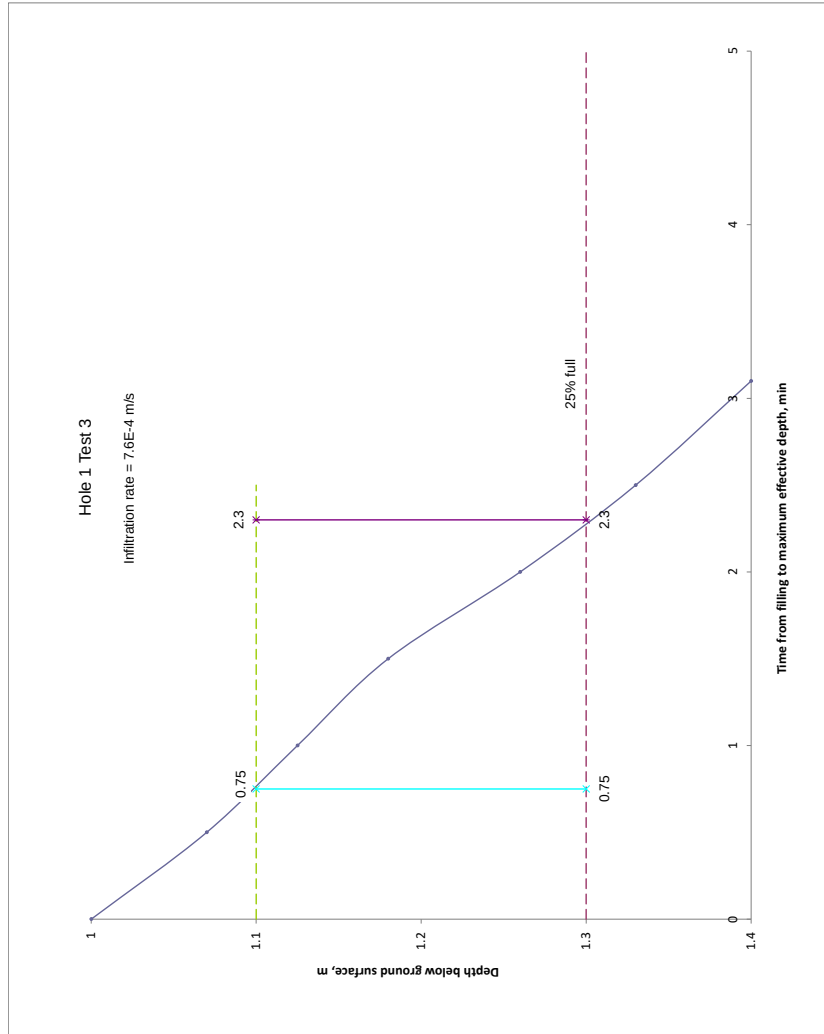
Notes: Use one sheet per test hole. Conduct three tests per hole. Email copy of completed sheet(s) to rob@innervision-design.co.uk

The last reading MUST be below 25% of start depth (e.g. less than 100mm in a 400mm test hole)

Site Notes:







A.2 Test Hole 2

Site details:

Trial Hole location or reference: mid to bottom of Job/ Between plot 3 & 4

Permeability Test Data

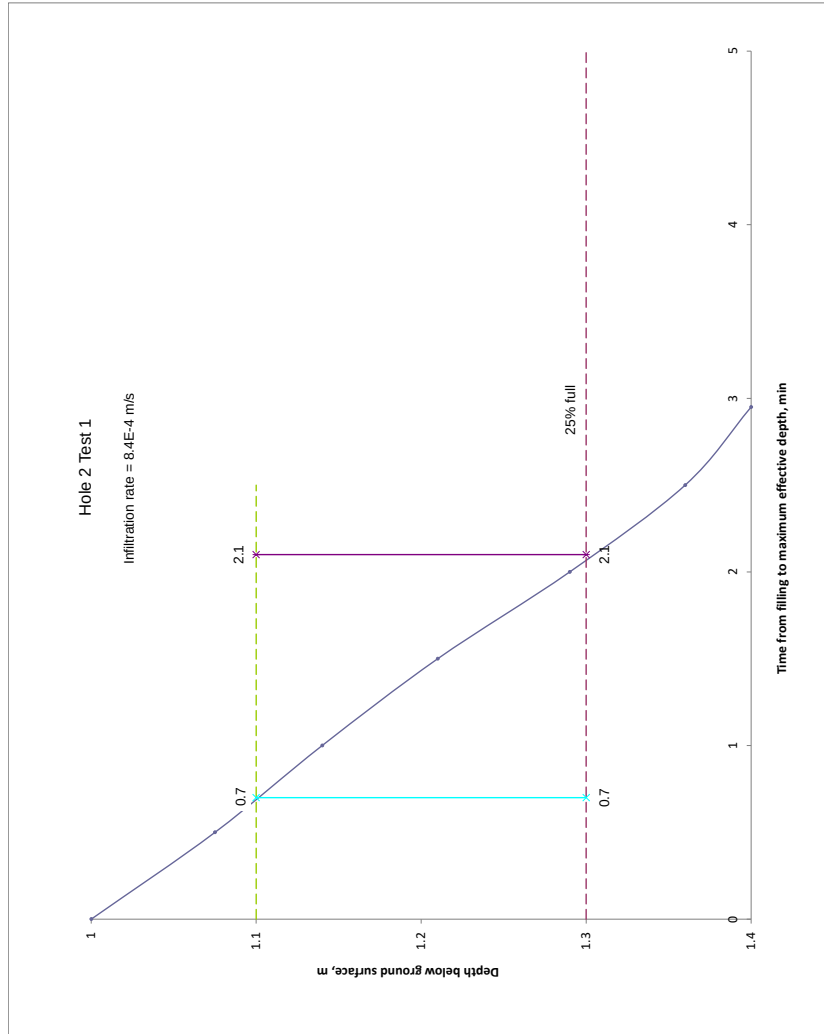
Trial Hole (actual test hole that is filled)			
Width	mm	min 300mm	
Length	mm	min 800mm	
Depth b.g.l.	mm	min 1200mm	
Depth of water	mm	min 400mm	

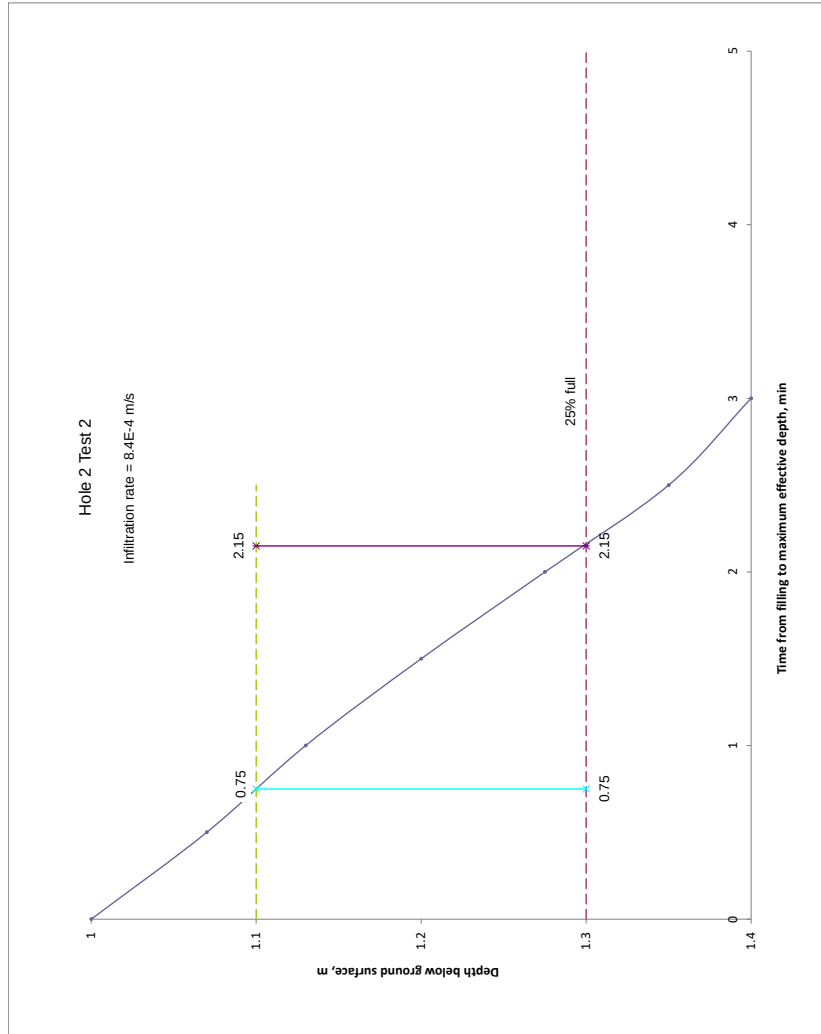
	Test 1		Test 2		Test 3		Example!!	
	Time	Depth of water	Time	Depth of water	Time	Depth of water	Time	depth
Start							10.00AM	400
Reading 1	0	400 mm	0	400 mm	0	400 mm	10.05	350
Reading 2	30 sec	325	30	320	30	320	10.15	325
Reading 3	60 sec	260	60	270	60	265	10.28	290
Reading 4	90 sec	190	90	200	90	195	11.07	199
Reading 5	120 sec	110	120	125	120	130	12.22	130
Reading 6	150 sec	40	150	50	150	45	13.14	115
Finish	170 sec		170	50	170	45	14.45	85

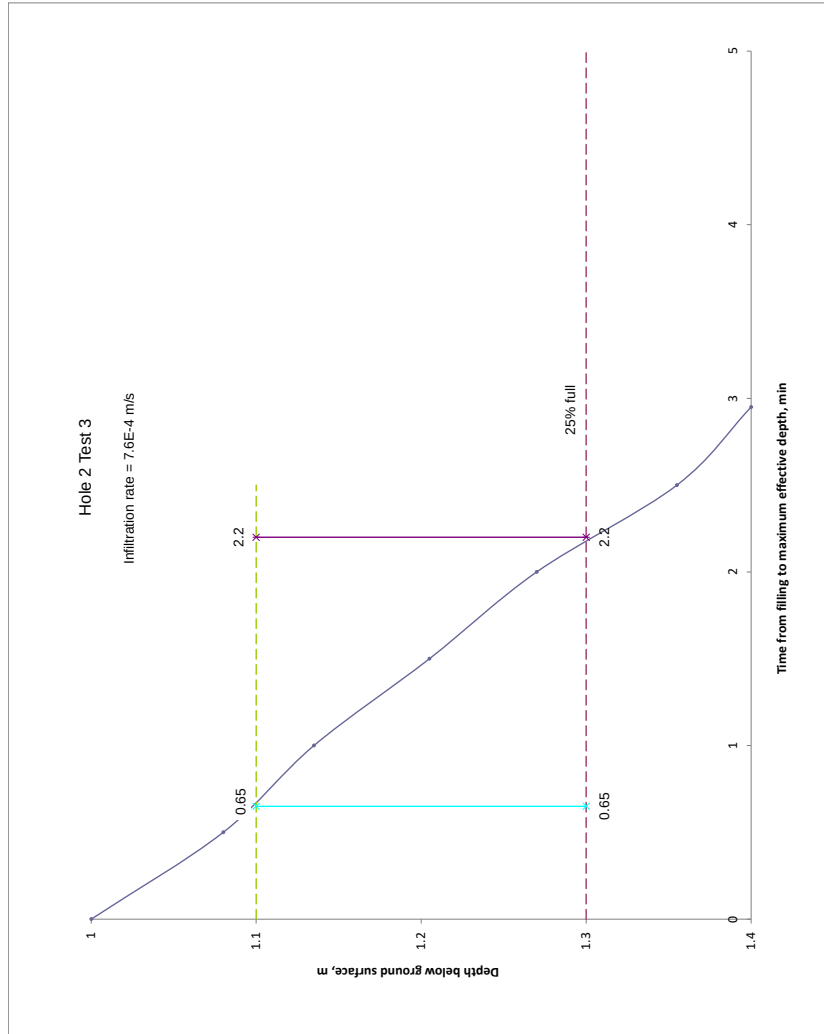
Notes: Use one sheet per test hole. Conduct three tests per hole. Email copy of completed sheet(s) to rob@innervision-design.co.uk

The last reading MUST be below 25% of start depth (e.g. less than 100mm in a 400mm test hole)

Site Notes:







A.3 Test Hole 3

Permeability Test Data

Site details:

Trial Hole location or reference:

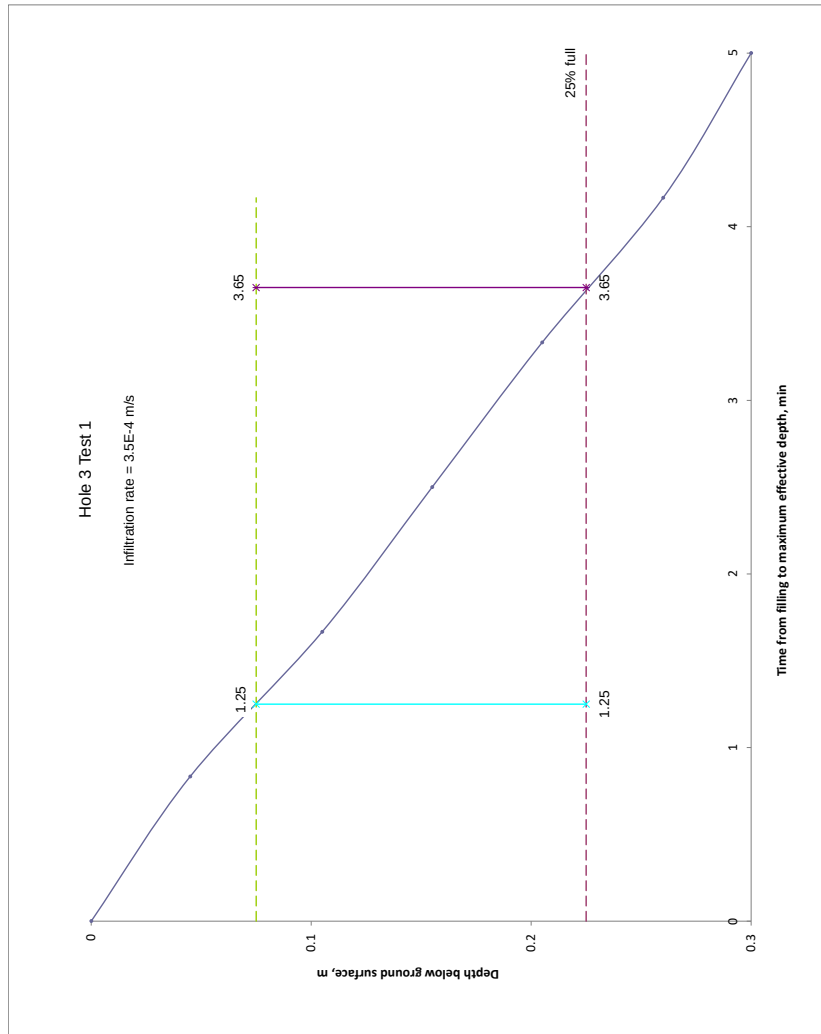
Trial Hole (actual test hole that is filled)		
Width	mm	min 300mm
Length	mm	min 300mm
Depth b.g.l.	mm	min 1500mm
Depth of water	mm	min 400mm

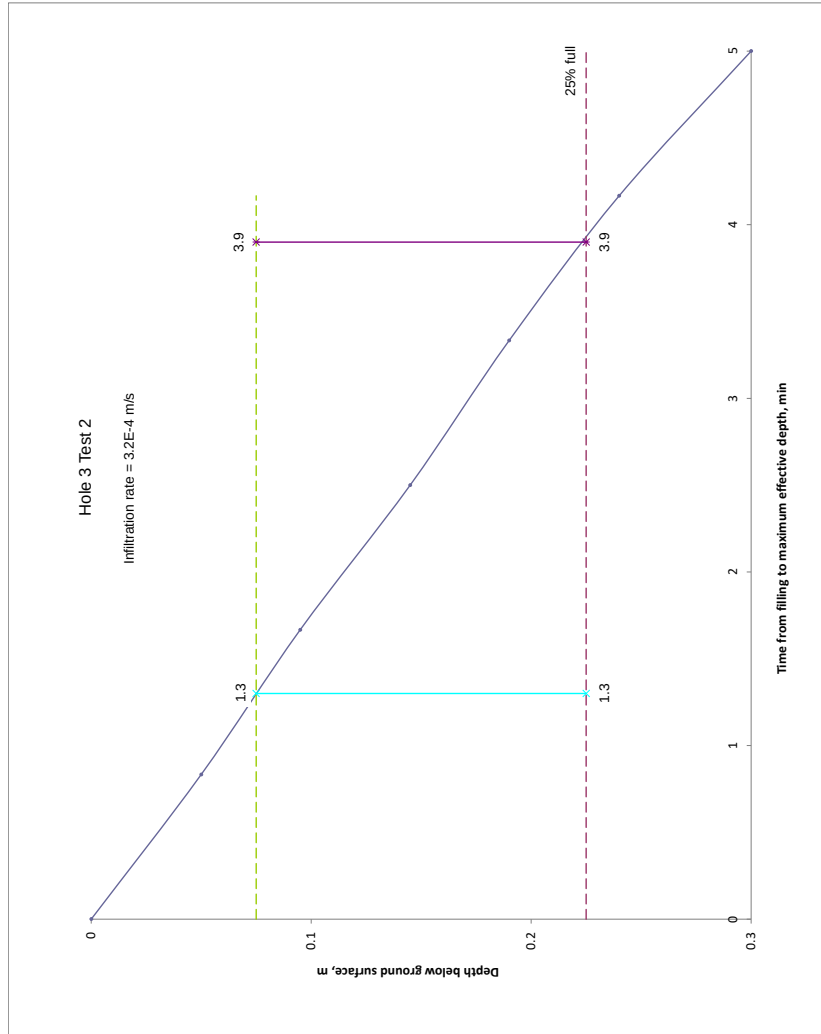
300 mm
300 mm
300 mm

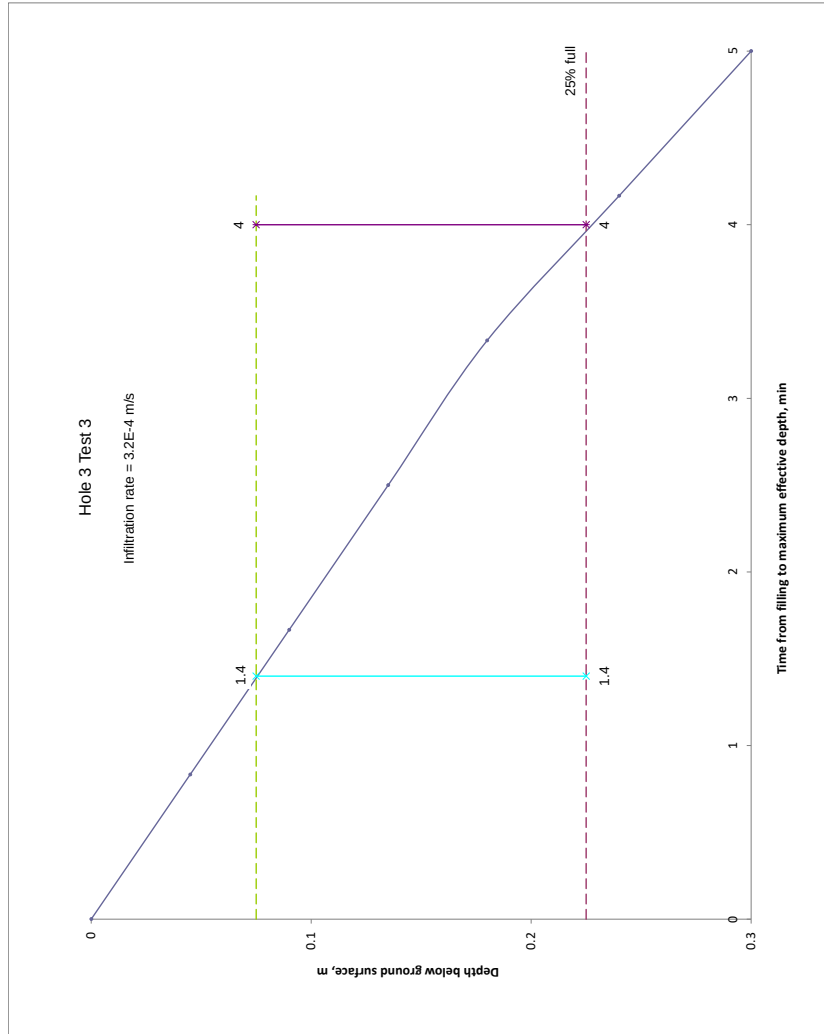
	Test 1		Test 2		Test 3		Example!! Time depth 10.00AM 400
	Time	Depth of water	Time	Depth of water	Time	Depth of water	
Start							
Reading 1	0	300	0	300	0	300	10.05 350
Reading 2	50	255	50	250	50	255	10.15 325
Reading 3	100	195	100	205	100	210	10.28 290
Reading 4	150	145	150	155	150	165	11.07 198
Reading 5	200	95	200	110	200	120	12.22 130
Reading 6	250	40	250	60	250	60	13.14 115
Finish	300	0	300	0	300	0	14.45 85

Notes: Use one sheet per test hole. Conduct three tests per hole. Email copy of completed sheet(s) to rob@innervision-design.co.uk
The last reading MUST be below 25% of start depth (e.g. less than 100mm in a 400mm test hole)

Site Notes:







A.4 Test Hole 4

Permeability Test Data

Site details:

Trial Hole location or reference:

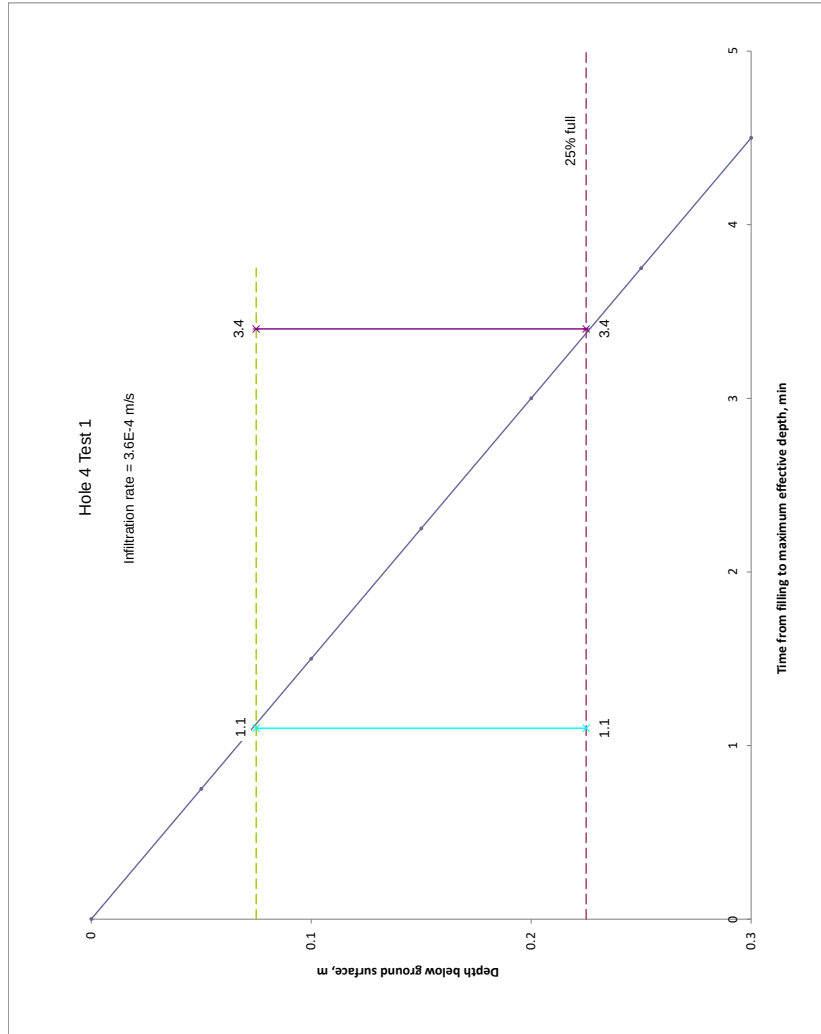
Trial Hole (actual test hole that is filled)			
Width	mm	min	300mm
Length	mm	min	300mm
Depth b.g.l.	mm	min	300mm
Depth of water	mm	min	400mm

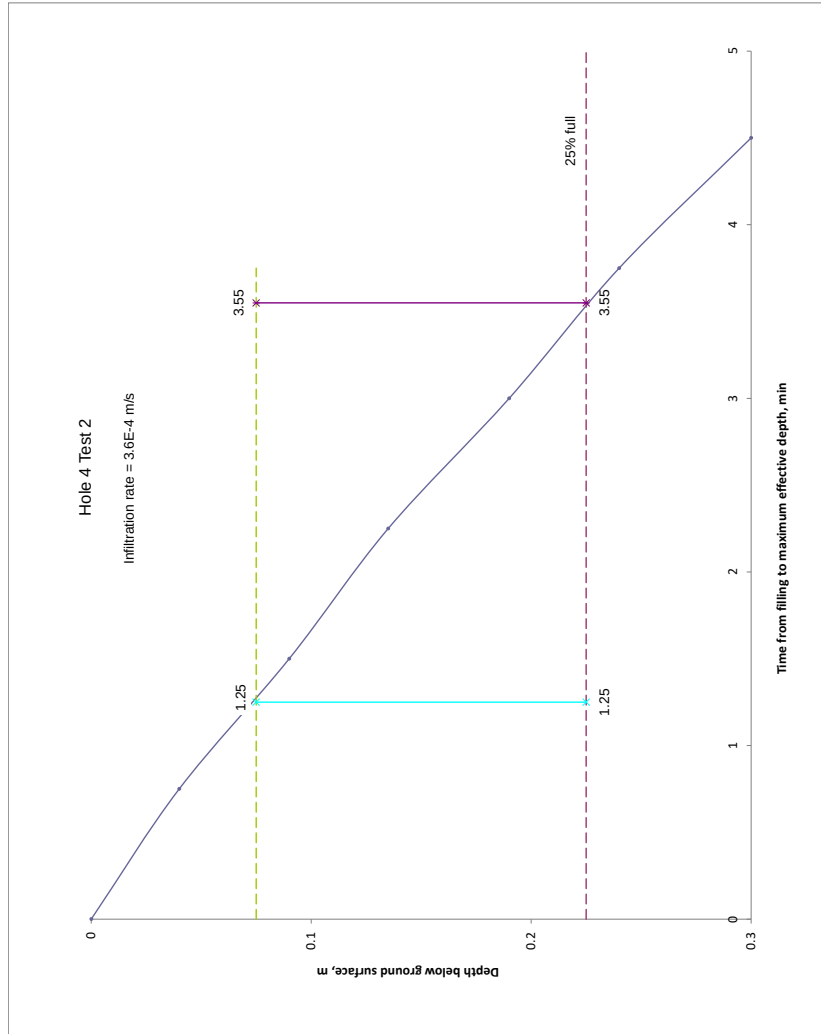
300mm
300mm
300mm

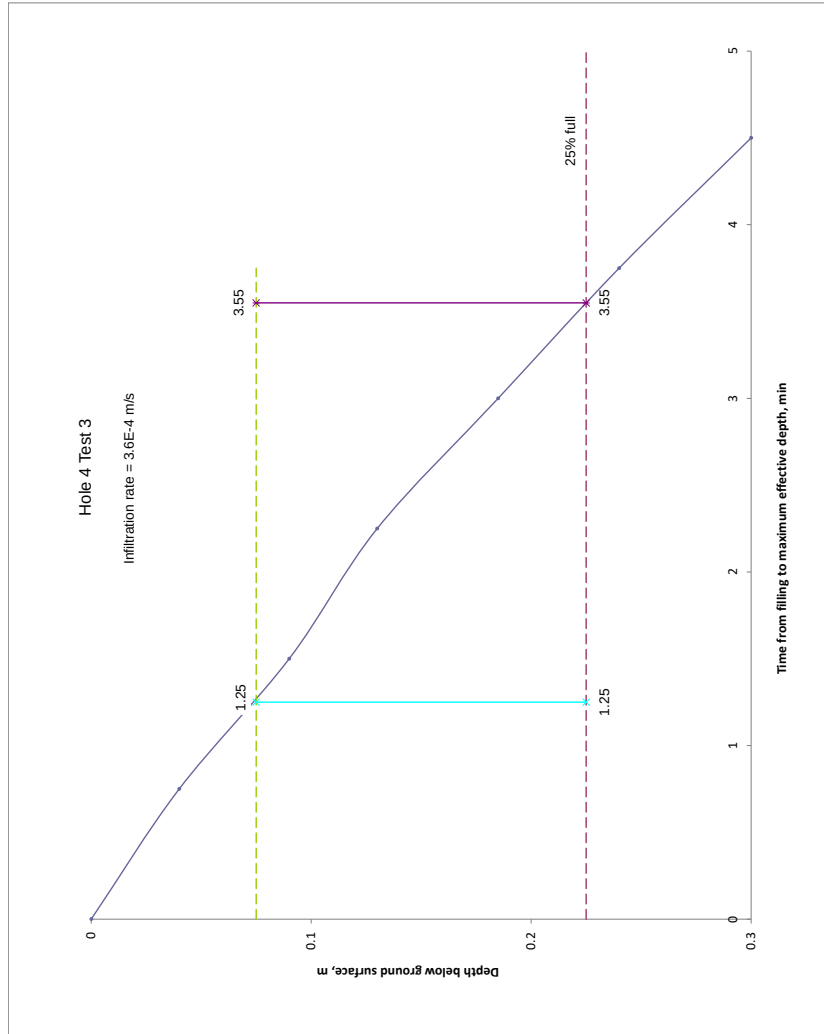
	Test 1		Test 2		Test 3		Example!!	
	Time	Depth of water	Time	Depth of water	Time	Depth of water	Time	depth
Start							10.00AM	400
Reading 1	0	300	0	300	0	300	10.05	350
Reading 2	45	250	45	260	45	260	10.15	325
Reading 3	90	200	90	210	90	210	10.28	290
Reading 4	135	150	135	165	135	170	11.07	198
Reading 5	180	100	180	110	180	115	12.22	130
Reading 6	225	50	225	60	225	60	13.14	115
Finish	270	0	270	0	270	0	14.45	85

Notes: Use one sheet per test hole. Conduct three tests per hole. Email copy of completed sheet(s) to rob@innervision-design.co.uk
The last reading MUST be below 25% of start depth (e.g. less than 100mm in a 400mm test hole)

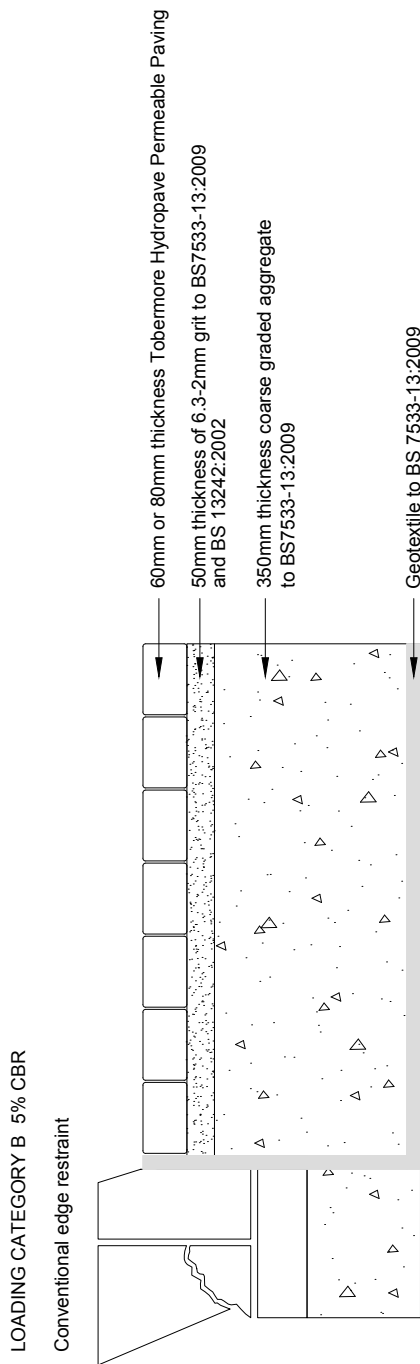
Site Notes:







B Pervious surface option



Disclaimer:

- These design cross-sections and suggested build-ups are provided for illustration only and are intended to depict an idealised situation.
- In all instances, local design solutions are preferred and should be checked to ensure suitability with ground conditions and planned traffic usage.
- Refer to BS 7533 Part 13 for depths of capping layers.
- All references are to latest edition of BS 7533. Tobermore can provide a project specific solution if required.

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