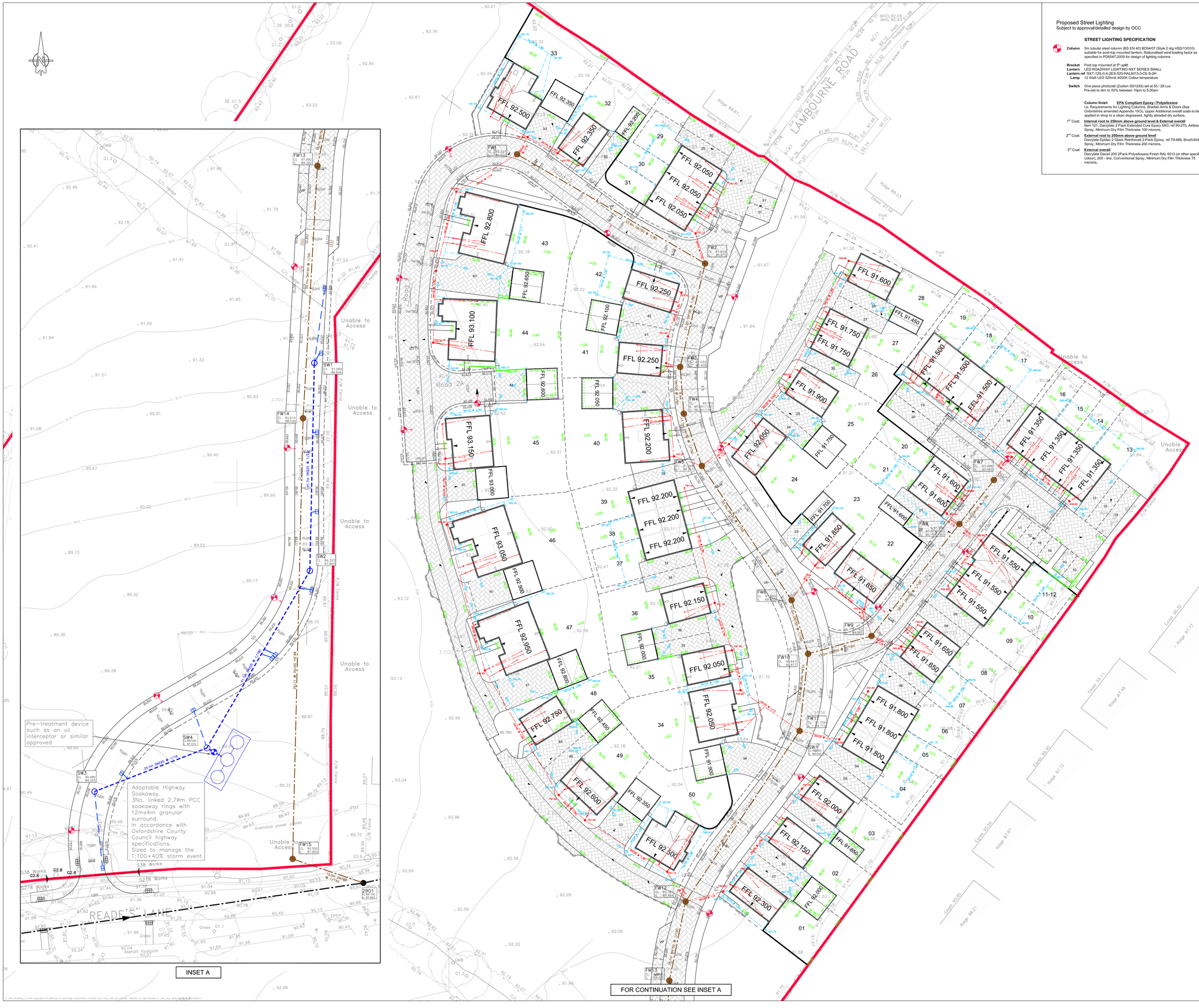


Construction Notes:

1. Do not scale from this drawing.
2. All dimensions in metres.
3. All levels relate to ordnance datum.
4. This drawing is based on the latest Architectural planning layout and shall be read in conjunction with all other relevant longitudinal sections and construction drawings.
5. Any discrepancies with any of the drawings shall be reported to MJA Consulting Engineer.
6. The level and location of all existing services shall be verified on site by the Contractor before commencing any construction work.
7. Contractor must comply with all current legislation relating to CDM, Health and Safety and COSHH.
8. All material in excess of 20kg (i.e. kerbs, manhole units cover etc.) shall be mechanically lifted and laid where possible at all times.
9. Manholes, sewers, headwalls and other structures intended to convey surface water or sewerage are to be constructed in accordance with the Water Authorities Association specification "Sewers for Adoption" 6th edition and to Thames Water specification and addendum.
10. Gullies, gully connections, drains, manholes, catchpits, soakaways, headwalls and other drainage structures intended to convey highway water are to be constructed in accordance with the specification issued by Oxfordshire County Council.
11. All foul and storm water drains which are not to be adopted as public sewers under a section 104 agreement shall be constructed using uPVC pipes or similar approved, bedded and backfilled in accordance with the manufacturers instructions and to the Building Regulations Part H, BS EN 752 & B.R.E. SD1.
12. All building drainage to be 100mm dia. laid at a minimum gradient of 1 in 40 where serving less than 1 WC, 1 in 80 otherwise (FW) and 1 in 80 (SW) unless otherwise shown.
13. Sewers and drains of different diameters should be laid soffit to soffit
14. Inspection chambers on private drains shall be non-access preformed polypropylene.
Depth to invert — Minimum size
< 0.6m — DN300
> 0.6m — DN475
In accordance with the Building Regulations Part H & BS EN 752.
15. Position of soil pipes, stubstacks, WC outlets rainwater downpipes etc positions shall be checked against architects house type drawings to ensure compatibility.
16. Where back inlet gullies are used they should be roddable.
17. All stub stacks to be fitted with air admittance valve where branch drain exceeds 12m except at head of run.
18. Rainwater downpipes to be connected directly to drains via removable adapter to permit access for rodding.
19. Positions of yard and house gullies are nominal and may be adjusted on site, aco drains to be installed at the end of all drives falling towards the public highway. All gully gratings in drives and parking areas should be of sufficient strength to withstand vehicular loading.
20. Lintels or sleeves are to be provided for drains passing through foundation brickwork.
21. All gully connections to be 150 dia. uPVC ultrarib or similar.
22. All gully connections other than at manholes to be 'Y' junctions
23. All drain runs are to be flushed through and building materials removed where necessary at the time of final test by Building Inspector and prior to occupation.
24. All soakaways to be positioned a minimum of 5.0m from buildings (where utilised)
25. All finished floor levels are shown on the drawing for guidance only and may need to be adjusted on site. However there is to be no deviation without prior approval
26. All drives are to have a crossfall or gradient of 1:40 minimum. Maximum drive gradient on down slope to be 1 in 10 and 1 in 8 on up slopes.
27. Continuous edging to be laid at rear of service margin.

PRELIMINARY

REV. No.	DATE	DESCRIPTION	INITIALS
B	23.02.18	Garage working drawings added, engineering amended to suit.	INITIALS
A	06.02.18	Drawing updated to suit latest working drawings.	INITIALS

Client: Linden HOMES

Project: Reade's Lane, Sonning Common

Title: Engineering Layout

MJA CONSULTING
CIVIL AND STRUCTURAL ENGINEERS
Monarch House, Barton Lane, Abingdon, Oxon, OX14 3NB
Tel: 01235 555173
Fax: 01235 523226

Scale: 1:250@A0 | Date: May '17 | Drawing No.: 5176:01 | Rev: B
Checked: AMc | Drawn: WSR

PROPOSED RESIDENTIAL DEVELOPMENT
LAND OFF READE'S LANE
SONNING COMMON
OXFORDSHIRE

FLOOD RISK ASSESSMENT & DEVELOPMENT DRAINAGE STRATEGY

LINDEN HOMES

Linden HOMES

Rev A

Ref: 15/0955/5176

DOCUMENT CONTROL RECORD

Document Issue:

Rev	Date	Issue Status	Prepared by	Checked by
-	04.11.15	First Issue for comment	C.Pendle	A.McShane
A	04.12.15	Site layout updated, drainage strategy amended to suit.	C.Pendle	A.McShane

CONTENTS

APPENDICES

REFERENCES

Environment Agency Flood Map Information © and database right www.environment_agency.gov.uk

Technical Guidance to the National Planning Policy Framework - NPPF (2012)
Department for Communities and Local Government ISBN: 978-1-4098-3410-6

Contains British Geological Survey materials © NERC (2014)

South Oxfordshire & Vale of White Horse District Council SFRA – JBA Consulting (July 2013)

Oxfordshire County Council Preliminary Flood Risk Assessment – JBA Consulting (June 2011)

1 Executive Summary

SITE INFORMATION	CLIENT	Linden Homes
	SITE NAME	Reade's Lane, Sonning Common, Oxfordshire
	SITE LOCATION	SU 70228 80218
	SITE AREA CURRENT LAND USE PROPOSED LAND USE	7.715 ha Undeveloped arable grazing farmland 50No. Residential Dwellings
	SITE GEOLOGY - Superficial SITE GEOLOGY - Bedrock	Winter Hill Gravel - Sand and Gravel Upper Chalk - Newhaven Chalk Formation
	SOIL INFILTRATION RATE	Averaged rate of 2.5x10-5 m/s
	GROUNDWATER LEVELS	Circa 15-40mBGL
	GROUNDWATER SPZ / AQUIFER	SPZ 3/ Secondary A Aquifer (Superficial Soils) Principle Aquifer (Upper Chalk)
	GROUND CONTAMINATION	None identified
FLOOD RISK	ENVIRONMENT AGENCY FLOOD ZONE	Flood Zone 1 - Lowest Risk < 0.1% (<1:1000)
	FLUVIAL (RIVERS & WATERCOURSES)	Not a risk
	PLUVIAL (SURFACE WATER)	Minor risk – can be mitigated through development
	GROUNDWATER	Not a risk
	EXISTING/PROPOSED SEWERS & MAINS	Not a risk
	ARTIFICIAL	Not a risk
	TIDAL	Not a risk
FOUL & SURFACE	SURFACE WATER STRATEGY	Infiltration
	PROPOSED SUDS TYPE	Soakaways Permeable surfacing with sub-base storage
	EXISTING SW PEAK FLOW RATE PROPOSED SW PEAK FLOW RATE	Greenfield QBar – 1.0 l/s N/A
	FOUL WATER STRATEGY	Gravity sewer to Thames Water foul network
	EXISTING FW PEAK FLOW RATE PROPOSED FW PEAK FLOW RATE	N/A 2.3 l/s
MISC	FURTHER INVESTIGATIONS	Additional infiltration testing within the northern area of site both in the Sand & Gravel and the Chalk strata. Thames water to confirm foul sewer capacity.

2 Introduction

2.1 Scope

Linden Homes are seeking planning permission for the construction of 50No. residential dwellings with associated access roads, parking areas, domestic gardens and areas of public open space.
The 77 150 m² (7.715ha) site is located off Reade's Lane on the western outskirts of the village of Sonning Common, in South Oxfordshire.

2.2 MJA Consulting have been appointed by Linden Homes to undertake a Flood Risk Assessment and Development Drainage Strategy to determine the potential flood risks associated with the site and to provide a suitable strategy for the disposal of surface and foul water from the proposed development.

2.3 Report Structure

The National Planning Policy Framework (NPPF) and the Flood Risk and Coastal Planning Practice Guidance (PPG) is the current guidance on development and flood risk in England and Wales.
The Flood Risk technical guidance for the National Planning Policy Framework requires a Flood Risk Assessment (FRA) to be carried out on sites over 1ha to consider all potential forms of flooding including that from river, sea, estuarial, land drainage, groundwater, overland flow, surface water run-off, sewer systems, and artificial water bodies (lakes, reservoirs, canals etc.).
A Flood Risk Assessment is required to consider the impact of all these potential forms of flooding to both the development site and to offsite parties and land.

2.4 This report will take the structure of a 'Flood Risk Assessment' in accordance with the National Planning Policy Framework, the Flood Risk and Coastal Planning Practice Guidance, Environment Agency's Flood Risk Assessment Guidance and CIRIA Report 624 'Development and Flood Risk.

2.5 The objective of this report is:

- To confirm that the proposed development will not be effected by current or future flooding from all potential sources for the lifetime of the site.
- To confirm that this development will not increase the risk of flooding to any offsite parties and land or increase the population within a floodplain.
- To undertake calculations to establish the existing foul and surface water runoff from the site and to assess the potential foul and surface water runoff from the proposed development.
- To detail a suitable strategy for the management of surface and foul water generated from the proposed development, in line with the mandatory Code for Sustainable Home criteria- SUR1.
- To satisfy the planning authority that the most sustainable foul and surface water drainage solutions have been considered, in line with Environment Agency guidance, The Building Regulations (Document H 2002) and government legislation such as the Flood and Water Management Act 2010 (Defra) and The National Planning Policy Framework (NPPF & PPG).

3 The Development Site

3.1 Site Location and Description

The application site is located to the north of Reade's Lane, in Sonning Common, Oxfordshire.
The site is centred on National Grid Reference SU 70228 80218.

3.2 The 77 150m² (7.715ha) parcel of land comprises of two agricultural fields associated with Bishopswood Farm.
The site is bound to the north and east by existing residential developments, to the south by Reade's Lane and by Bishopswood Farm to the west.

3.3 Linden Homes are seeking planning permission for the construction of 50No. residential dwellings (Class C3a) within the northern portion of the site.
Vehicle access to the development will be off Reade's Lane to the south, with access for emergency vehicles provided from Lambourne Road to the north.

Figure 1: Regional site location

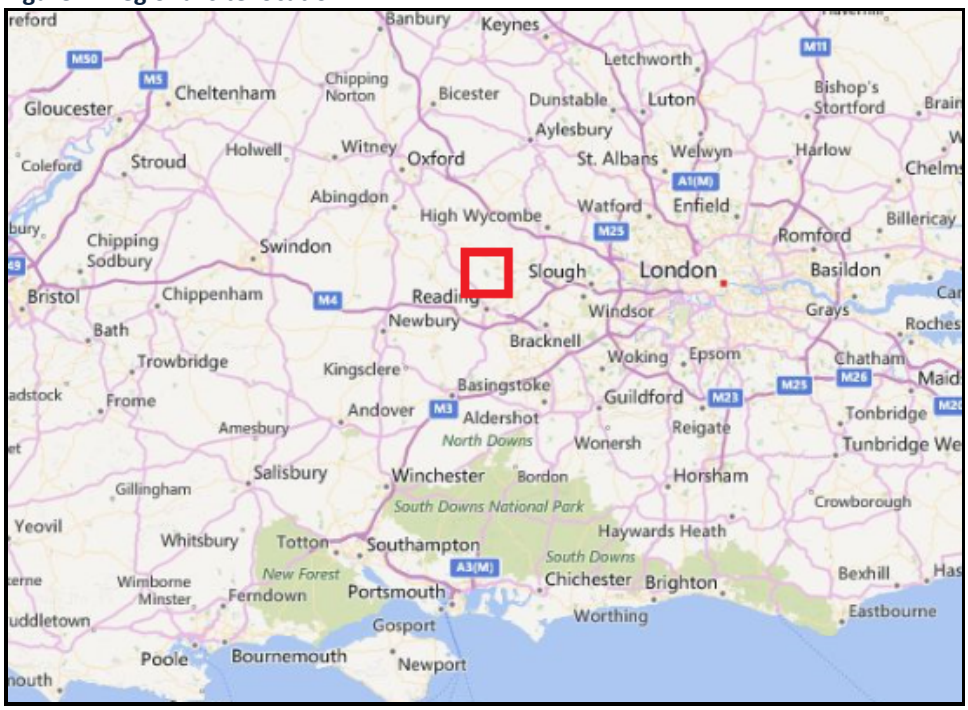


Figure 2: Local site location

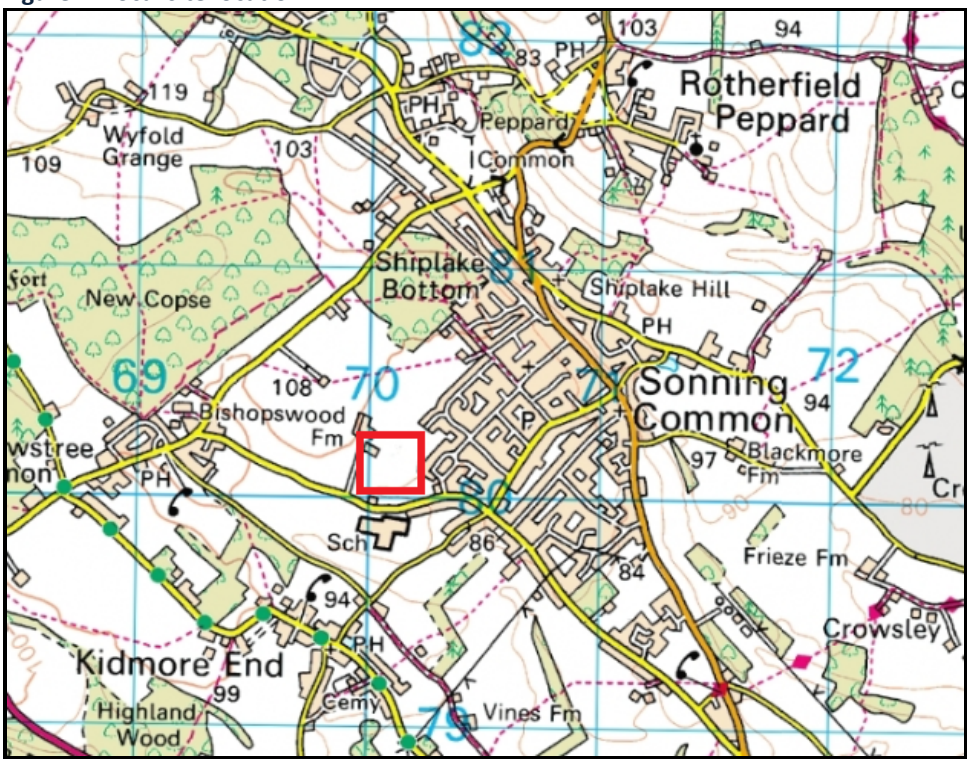


Image courtesy of: @2015 Microsoft Corporation Image courtesy of Ordnance Survey

Figure 3: Development site boundary

Image courtesy of: Imagery @ 2015 Digital Globe, Getmapping plc, Infoterra Ltd & Bluesky, Map data @2014 Google

3.4 Topography

A topographical survey of the site undertaken by Healer Surveys Ltd in June 2014 indicates a general fall from west to east across the site with levels ranging from 95.50m-88.70mAOD (metres above Ordnance Datum).
Refer to Appendix B for the Topographical Survey of the existing site.

3.5 Geology

Information published by the British Geological Society (BGS) indicates the underlying site geology as:
Bedrock: Upper Chalk - Newhaven Chalk Formation.
Superficial: Winter Hill Gravel - Sand and Gravel.

3.6 The geology observed during intrusive investigations undertaken at the site (to a maximum depth of 4m BGL) generally concurs with the anticipated published information.
The superficial geology is typically very sandy gravelly clays to a depth of 3.0 to 4.0mBGL, representative of the Winter Hill Gravel formation.
Beneath the Winter Hill Gravel lies the Seaford and Newhaven Chalk Formation encountered at 3.0 to 4.0m+ BGL.
This was recorded as a structureless chalk (Grade Dm) containing gravel of flint and chert.

3.7 The presence of sinkholes, cavities and solution features are known to exist within Sonning Common associated with the underlying chalk geology.
Although there are no such features recorded within the site, it is recommended that a robust assessment of the chalk formation for the presence of solution features is carried out.
On the basis of the current understanding of site conditions it is recommended that soakaways be site a minimum of 10m away from any structural foundation.
If solution feature are discovered then soakaways should be sited at least 20m away from any foundations.

3.8 Soil Permeability

Infiltration testing was carried out within the southern portion of the site (land to be transferred to the Parish) by Hydrock Consultants in August 2015.
These tests were carried out at depths required to encounter the chalk strata at each location.

Table 1 – Summary of Hydrock August 2015 Infiltration testing

Location	Fill No	Depth (m)	Infiltration Rate (m/s)
SA101	1	4.1	$1.76x10^{-5}$
	2	4.0	$1.75x10^{-5}$
	3	4.0	$1.59x10^{-5}$
SA102	1	3.9	$3.62x10^{-6}$
	2	3.8	$4.36x10^{-6}$
	3	3.8	$6.25x10^{-6}$
SA103	1	3.6	$5.75x10^{-5}$
	2	3.6	$5.93x10^{-5}$
	3	3.7	$5.57x10^{-5}$

3.9 Additional infiltration testing has been carried out within the northern portion (proposed residential) by Eastwood & Partners Consulting Engineers in November 2015.
These tests were carried out within the Winter Hill Gravel Formation at each location to depths between 1 – 2mBGL.
Refer to Appendix D for test locations.

Table 2 – Summary of Eastwood & Partners November 2015 Infiltration testing

Location	Fill No	Depth (m)	Infiltration Rate (m/s)
SK1	1	1.1	4.9×10^{-6}
SK2	1	2.05	3.0×10^{-5}
	2	2.05	2.1×10^{-5}
	3	2.05	6.6×10^{-6}
SK3	1	1.5	3.9×10^{-6}
SK4	1	1.1	1.0×10^{-6}
SK5	1	1.6	8.6×10^{-7}
SK6	1	1.7	1.3×10^{-5}
	2	1.7	1.2×10^{-5}

3.10 These tests confirm that infiltration within both the Winter Hill Gravel - Sand and Gravel and Upper Chalk - Newhaven Chalk Formation is feasible.
For preliminary design purposes all SuDS have been indicatively designed on the worst case infiltration rate (SK5) of 8.6 x10-7m/s.

3.11 Hydrogeology

The Environment Agency's mapping website (www.maps.environmentagency.gov.uk) has classified the northern portion of the site as located within a Groundwater Source Protection Zone 3 (Total Catchment) for groundwater abstractions.
This is defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source.
The southern portion of the site is not within a groundwater source protection zone.

3.12 Under the Environment Agency's classification system, the bedrock (Newhaven Chalk Formation) is classified as a 'Principle' aquifer.
These are layers of rock that have high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage.
They may support water supply and/or river base flow on a strategic scale.

3.13 The superficial soils (Winter Hill Gravel) are classified as a 'Secondary A' Aquifer'.
These are permeable layers capable of supporting water supplies at a local scale, and in some cases form an important source of base flow to rivers.

3.14 Groundwater

During the site investigations groundwater was not encountered within any of the excavations to a maximum depth of 4.2mBGL.
Historic borehole records held by the BGS indicted that the groundwater levels in Sonning Common are expected to be in excess of 15-40m below the site.
Therefore while groundwater levels may vary from those at the time of the investigation in response to seasonal fluctuations, it is not anticipated to be encountered during the development.

3.15 Ground Contamination

Detailed soil analysis will be carried out as part of the intrusive geological investigation to determine the presence of any contamination.
No visual or olfactory evidence of soil contamination was identified during the excavations carried out for the infiltration testing.
The available environment data does not indicate the presence of any significant sources of contamination risk on site
Due to the undeveloped historical land use, the potential for ground contamination is considered to be very low.

3.16 As the site lies above an aquifer and within a groundwater source protection zone (SPZ 3), given the sensitivity of the site in respect of groundwater resources all runoff will pass through a comprehensive and robust pollution treatment train in accordance with Environment Agency pollution prevention guidance and 'policy GP3' prior to discharge to ground via soakaways.
This will be supported by a detailed maintenance and management plan for the site including a risk assessment demonstrating that no polluted discharge to ground water will take place.

3.17 Existing site drainage characteristics

The site is undeveloped agricultural land.
There are no natural or manmade drainage features within site.
A drainage ditch runs along the northern side of Reade's Lane along the southern boundary of the site.

3.18 Rainfall that lands on this site primarily infiltrates directly at source into the upper superficial soils and into the permeable chalk strata below.
Due to the topography of the site, which falls from west to east at a gradient of approximately 1:60, the natural drainage pathways (above and below ground) is towards the eastern boundary of the site.

3.19 A small pond feature is located 100m beyond the western boundary of the site at Bishopswood Farm.

4 Flood Risk Assessment

4.1 A Flood Risk Assessment requires that an evaluation of all potential forms of flood risk to the site is considered.
In accordance with the Environment Agency's Flood Risk Assessment Guidance, NPPF, PPG and CIRIA Report 624, sources of flooding to be assessed include tidal, fluvial (rivers, streams and watercourses), pluvial (overland rainfall runoff), groundwater, artificial sources (canals and reservoirs) and existing / proposed sewerage and water mains infrastructure.

4.2 History of Flooding

During the data collection process it is important to consider the information which already exists for the site location with respect to flood risk.
Assessing previous recorded events of flooding is an important process in a flood risk assessment, in particular comparing predicted flooding information against actual recorded data.

4.3 The main sources of data for flood risk and recorded incidents of flooding for this site has been the *South Oxfordshire & Vale of White Horse District Council Strategic Flood Risk Assessment (JBA 2013).*
Additional information has been obtained from The Environment Agency (historic flood extents maps and the 2007 Flood Review), British Society Chronology of Extreme Hydrological Events and local news and media outlets.

4.4 Within the SFRA, consultation was carried out with all appropriate authorities and organisations including the Environment Agency, Thames Water, South Oxfordshire District Council, Sonning Common Parish Council and local community stakeholders to identify known and/or perceived problem areas with respect to flooding.

4.5 The SFRA has concluded that at the development site, there are no current or potential issues of flooding from sources including rivers and watercourse (fluvial), groundwater, existing sewer / water main networks or any other artificial source.

4.6 The SFRA does highlight the potential risk of minor surface water flow paths and ponding occurring within the site boundary, however no actual flooding from surface water has been recorded at the site.
This is discussed in more detail within paragraph 4.28 - Pluvial flooding.

4.7 Anecdotal statements from local residents have identified a reoccurring issue of surface water highway flooding at the junction of Reade's Lane and Ashford Avenue, beyond the south eastern boundary of the site.
This may be related to blockages of the road ditches, gullies and soakaways that serve the highway causing surface water to runoff the carriage onto private land.
This issue should be resolved by clearance / maintenance works carried out by Oxfordshire Highways.
It should be noted that no amount of surface water runoff the development of this site will runoff the site onto Reade's Lane or enter the existing highway drainage system along Reade's Lane and the development of this site will not exacerbate any existing flooding issue.

4.8 Nevertheless, the new development as a whole must not exacerbate existing flood risk elsewhere and in particular the properties that bound the development and along Reade's Lane.
During the design of the proposed development careful consideration has been given to the most sustainable method of surface water disposal and strict controls have been imposed to limit the peak rate and volume of runoff generated from the developed site.

4.9 All surface water runoff from impermeable areas on the proposed development will be attenuated and safely disposed at a controlled rate to mimic the existing natural runoff regime for the undeveloped greenfield site.
This will ensure that the risk of flooding to properties and land downstream of the site will not increase as a result of this proposed outfall.

4.10 Thames Water will be consulted with to ensure adequate capacity and determine a suitable point of connection with the existing foul sewer network.
If required, upgrading works will be carried to the existing network to enable the proposed connection.
This will ensure that the proposed development has a 'no detriment' impact on the foul sewer system within Harwell and does not create a flood risk.

4.11 Tidal

Oxfordshire and its local river networks do not encounter a risk from tidal flooding as confirmed by the SFRA and the EA.

4.12 Fluvial

There are no main rivers or watercourses within Sonning Common and therefore is not at risk from fluvial flooding.
As confirmed by the VOWH & SODC SFRA and the Environment Agency's historic flood outlines, the site has not been affected by fluvial flooding from any main rivers or ordinary watercourse.

4.13 The Environment Agency Flood Map shows the whole site to be located within the lowest risk category - Flood Zone 1.
This is land assessed as having a less than 1 in 1000 (<0.1%AEP) annual probability of flooding from a main river in any year and is not within an area of the greatest recorded historical event.

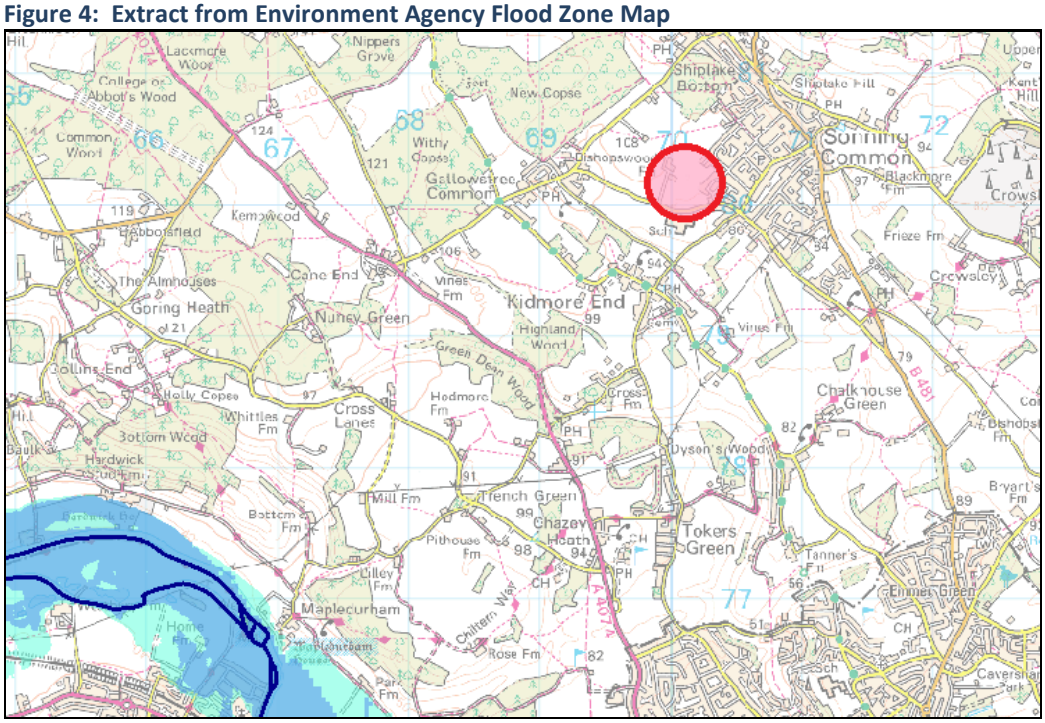
4.14 The River Thames is located over 4km north east of the development and has no direct influence on flood risk to this site.

4.15 Under the development proposals strict controls will be imposed on the site surface water drainage system to limit the peak rate and volume of runoff discharging into existing local watercourses.
Surface water flow rates from the site will be restricted to a maximum of the existing 'greenfield' site conditions including a level of betterment, ensuring that the existing risk of fluvial flooding to downstream properties and land will not increase as a result of this development.

4.16 It is demonstrated that safe access and egress at the site is achievable to a publically accessible location outside the 1:100 year (plus climate change) flood event extent, in accordance with DEFRA Report FD2320/TR2 - 'Flood Risk Assessment Guidance for New Developments'.

4.17 Flood Zone Map

Figure 4: Extract from Environment Agency Flood Zone Map



Contains Environment Agency information © Environment Agency 2014

Key:

Main Rivers

Dark Blue : (Flood Zone 3)
Shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded: from the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening each year, or from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.

Light Blue : (Flood Zone 2)
Shows the additional extent of an extreme flood from rivers or the sea.
These outlying areas are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.
These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

Clear : (Flood Zone 1)
Shows the area where flooding from rivers and the sea is very unlikely.
There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year.

4.18 The flood risk technical Guidance to the National Planning Policy Framework Table 2: Flood Risk Vulnerability classification, classifies residential developments as 'More Vulnerable'. Table 2 & 3 would indicate that 'more vulnerable' developments located within Flood Zone 1 are considered appropriate under the National Planning Policy Framework.

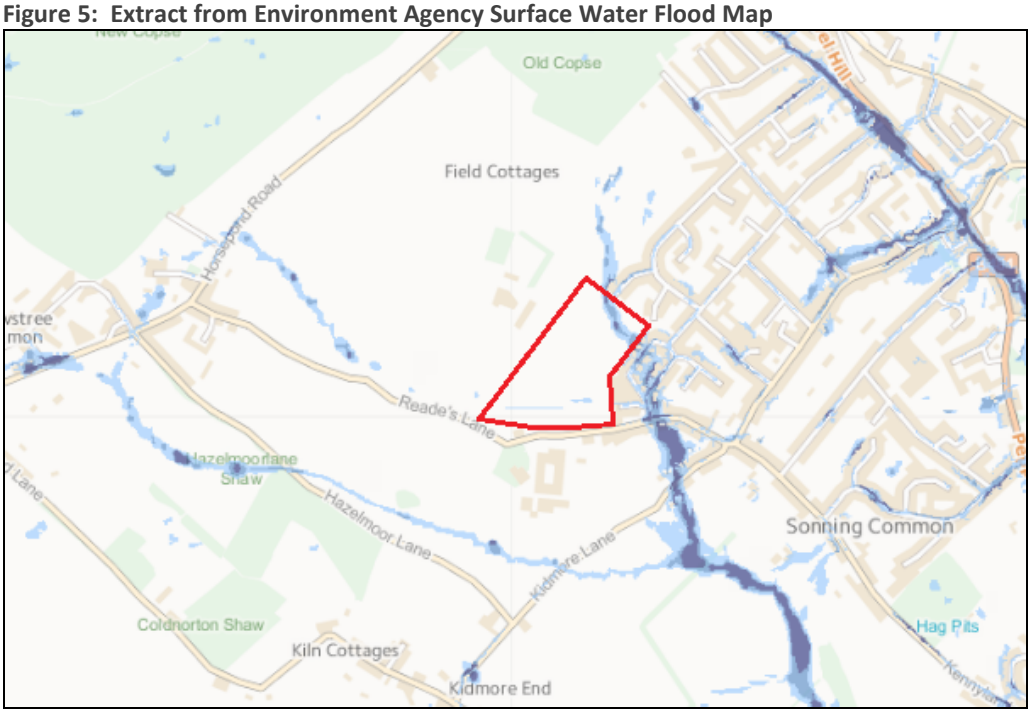
4.19 Surface Water (Pluvial)

With reference to the South Oxfordshire SFRA, there have been no recorded incidents of flooding from surface water runoff within the site boundary.

4.20 The '*Flood Map for Surface Water'* (FMfSW) produced for the SFRA and the Environment Agency's *'Risk of Flooding from Surface Water Flood Map'* indicate areas that are susceptible to surface water flooding across the county.
These maps are theoretical assessments of potential overland flow paths, ground levels and drainage systems within the area using information from Lead Local Flood Authorities where available.

4.21 Surface Water Flood Zone Map

Figure 5: Extract from Environment Agency Surface Water Flood Map



Contains Environment Agency information © Environment Agency 2015

Key:

- High (Greater than 1:30(3.3%) chance of flooding)
- Medium (Between 1:100(1%) and 1:30(3.3%) chance of flooding)
- Low (Between 1:1000 (0.1%) and 1:100 (1%) chance of flooding)
- Very Low (Less than 1:1000 (0.1%) chance of flooding)

4.22 This map indicates that the majority of the existing site has a 'very low' (less than a 1 in 1000 or 0.1% Annual Exceedance Probability) risk of flooding from surface water runoff.
There are areas of the greenfield site identified as having a 'Low' (1:100 to 1:1000 AEP) and 'Medium' (1:30 to 1:100AEP) risk of flooding from surface water runoff at the northern and southern extents of the site.

4.23 This risk of potential overland surface water flooding has been highlighted due to the topography of the site and surrounding land where runoff could potentially flow from the higher ground to the north west including Lambourne Road and towards the north eastern lower lying areas of the site where minor ponding could occur.
These areas of potential flooding have been assessed as generating maximum water depths of below 300mm.
Any resulting ponding on the existing greenfield site would be temporary, before draining through to the underlying soils.

4.24 This existing risk of surface water flooding to the new houses will be mitigated by the development of this site.
The provision of a positive drainage system incorporating the use of SuDS to collect and dispose of runoff will provide a level of betterment over current conditions by preventing overland surface water runoff and ponding.

4.25 To protect the proposed development from offsite surface water flows, a cut off infiltration trench will be constructed within the open space along the western and northern boundaries of the site.
This stone filled trench will intercept any sheet runoff that flows from the higher land beyond the site boundary and infiltrate this runoff into the underlying soils before it can reach the development.
The trench will be taken down into suitably permeable soils or connect to a soakaway that communicates with the deeper chalk strata.

4.26 The implementation of a robust SUDS scheme with consideration of overland 'flood flow routes' to safely direct and contain runoff to low risk areas of the site during an extreme rainfall event or failure of the drainage system will prevent an increase in surface water flood risk to both the development site and offsite third parties.

4.27 Any residual risk of surface water flooding is to be mitigated by the provision of raised property slab levels a minimum of 150mm above surrounding ground level.

4.28 Groundwater

With reference to the South Oxfordshire SFRA and the Environment Agency, there have been no recorded incidents of flooding from groundwater emergence within Sonning Common.
During the site investigations groundwater was not encountered within any of the excavations to a maximum depth of 4.2mBGL.
Historic borehole records held by the BGS indicted that the groundwater levels in Sonning Common are expected to be in excess of 15-40m below the site.
Therefore while groundwater levels may vary from those at the time of the investigation in response to seasonal fluctuations, it is not anticipated to be encountered during the construction of the development.

4.29 The AStGWF map within the SFRA suggests that the potential risk of groundwater emergence at the site is <25%.

4.30 To mitigate the effects of any residual groundwater flooding to houses on the development, the proposed properties will not include basements and the level of finished plot slab and entry thresholds will be set a minimum of 150mm above finished ground level.
Raised pavement levels will also provide safe and dry pedestrian access to and from the development in the event of groundwater emergence.

4.31 In summary, the available sources of information generally indicate the likelihood of flooding on the proposed development site from groundwater very low and that the development proposals will not increase the risk of groundwater flooding to any offsite parties or land.

4.32 Existing Sewers & Water Mains

With reference to the SFRA and the Thames Water flooding incidents register, there are no properties recorded as flooded from surcharged from all public foul and surface water sewers or burst water mains within Sonning Common.

4.33 There are no existing foul, surface or combined sewers or potable water infrastructure within the site boundary that pose a flood risk from the development of this site.

4.34 Anecdotal statements from local residents have identified a reoccurring issue of surface water highway flooding at the junction of Reade's Lane and Ashford Avenue, beyond the south eastern boundary of the site.
This may be related to blockages of the road ditches, gullies and soakaways that serve the highway causing surface water to runoff the carriage onto private land.
This issue should be resolved by clearance / maintenance works carried out by Oxfordshire Highways.
It should be noted that no amount of surface water runoff the development of this site will runoff the site onto Reade's Lane or enter the existing highway drainage system along Reade's Lane and the development of this site will not exacerbate any existing flooding issue.

4.35 To avoid the risk of flooding and to allow unrestricted access for any future maintenance and repairs, the required easements will be afforded to all existing sewers and water mains infrastructure within the vicinity of the site by the layout of the development.
All existing sewers and infrastructure outside of the site boundary will be suitably protected during all construction activities.

4.36 Thames Water will be instructed to carry out a foul water impact study to ensure adequate capacity and determine a suitable point of connection on the network to receive the development foul drainage.
If required, network upgrading works will be carried to the existing foul sewer system in the village to ensure that the proposed development has a 'no detriment' impact on the network and does not create an increase in flood risk within Sonning Common.

4.37 Proposed Site Drainage

A Flood Risk Assessment requires that an evaluation of all proposed artificial drainage systems and infrastructure within, or in close proximity to the site is carried out.
In the context of this development, the following systems are to be installed which need to be assessed in terms of potential flooding through the capacity of the systems being exceeded or the structural, hydraulic, mechanical or operational failure of the system occurring during the lifetime of the development:

- Piped foul and surface water sewers and manholes.
- SuDS for the collection and discharge of surface water runoff.

4.38 All foul and surface water drains, sewers and manholes will be designed and constructed to the latest *Sewers for Adoption 6th edition* and *The Building Regulations Part H*, ensuring adequate design capacity and robust structural integrity for the lifetime of the development. This will not only prevent the risk of flooding to both the development and offsite parties, but will avoid the potential contamination of groundwater by preventing the leaking of sewerage into the underlying soils.

4.39 Surface water sewers will be designed to the Sewers for Adoption requirement of 'no surcharge of pipes up to the 1 in 1 year storm' and 'no flooding up to the 1 in 30 year storm event'.
Any flooding as a result of the 1:100+30% year storm will not leave the development site.

4.40 All SuDS within the drainage system will be sized to manage the runoff from the exceptionally rare 1 in 100 storm event (1% chance of occurrence each year) plus an additional 30% allowance for predicted future climate change effects (in accordance with EA recommendations up to the year 2115).
This system will capture and discharge all runoff from the site at a controlled 'greenfield' rate, mimicking the existing natural runoff regime for the undeveloped site.

4.41 Overland Flood Flow / Exceedance

The occurrence of overland flooding at the site due to an extreme rainfall event exceeding the design capacity of the drainage system and SuDS structures or a failure of the associated flow controls have been considered both during the construction and operational phase of the development.

4.42 Any flood water that occurs as a result of surcharging within the piped drainage system will be contained within the highway limits by raised kerb edges and driveway entrance levels, where it will be temporarily stored until capacity returns within the drainage system.
To mitigate the residual risk of overland flooding the design levels of hard paved and landscaped areas will aim to contain and safely convey flood flows through areas of the site as to cause minimum flood risk to properties and residents such as parking areas and low lying open space.

4.43 All proposed attenuation features within the development are designed to manage the 1 in 100 year return storm (1% chance of occurrence each year) plus an extra allowance of 30% for the potential increase in peak rainfall predicted up to 2115.

4.44 Any residual risk of overland flooding to properties is to be mitigated by the provision of raised property slab levels a minimum of 150mm above surrounding ground level.

4.45 The described protection measures ensure that properties both within the proposed development and any offsite parties and land will not be affected by overland runoff in the event of a reasonably extreme rainfall event exceeding the design storm or a failure or a blockage of the SuDS structures within the system.

4.46 Artificial Sources

With reference to the SFRA there have been no recorded incidents of flooding from artificial sources within the vicinity of the site.
Artificial sources include sewerage works, canals, reservoirs and ponds.
The Environment Agency has assessed that Sonning Common is not at risk from reservoir flooding.

4.47 There is small a pond located 100m beyond the western boundary of the site within Bishopswood Farm.
This pond has no history of flooding however, due to the topography of the area any floodwaters would flow south east and away from the residential area of the proposed development.

4.48 Sequential Test

The flood risk technical Guidance to the National Planning Policy Framework Table 2: Flood Risk Vulnerability classification, classifies residential developments as 'More Vulnerable'.
Table 2 & 3 would indicate that 'more vulnerable' developments located within Flood Zone 1 are considered appropriate under the National Planning Policy Framework.

NPPF Table 3: Flood Risk Vulnerability and Flood Zone 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
× Development should not be permitted.

4.49 The National Planning Policy Framework Guidance states that Planning Authorities should complete a risk based 'Sequential Test' at all stages of the planning process, to steer new development to areas with the lowest probability of flooding.
Under the requirements of the 'sequential test' and as the proposed development is already located within flood zone 1 (lowest risk), there are no more suitable, developable and deliverable alternative sites, better located from a flood risk perspective, which would accommodate the proposed development.

5 Existing and Proposed Site Runoff

5.1 This section aims to calculate the estimated peak runoff rates and volumes of surface water leaving the site, for the pre and post development conditions.
These discharge rates can then be used for the preliminary design of the surface water drainage strategy for the proposed development.

5.2 Catchment Areas

The existing and indicative proposed permeable and impermeable areas are listed in the table below.
Of the total 7.715ha site, only 1.55ha is to be developed upon.
Therefore for the purpose of determining the allowable post-development discharge rate, the existing greenfield runoff rate will be calculated on the developed area of 1.55ha.

Catchment	Permeable	Impermeable	Total
Existing Site Area	77 150 m²	0 m²	77 150 m²
Proposed Site Area (Approx.)	61 650 m²	15 500 m²	20 000 m²

5.3 This development represents an approximate overall increase of 15 500m² (1.55ha) in impermeable area post development.

5.4 Existing Surface Water Runoff Peak Runoff Rate & Volume (Greenfield)

Greenfield runoff rates and volumes are calculated to determine the acceptable rate of discharge from the site post development and are used by the environmental regulator to set site-specific drainage constraints.

5.5 An assessment of the estimated current Greenfield runoff rate has been carried out using both the Institute of Hydrology Report 124 (QBar) and the FEH (QMed) methodology using Micro Drainage software.
Refer to Appendix D for a summary of results.

IH 124 (FSR) Greenfield Catchment: 1.55ha

1 in 1 year	0.6 l/s
1 in 100 year	2.2 l/s
QBar	**0.7 l/s**
Volume 100y 6hr	103 m³

FEH Greenfield Catchment: 1.55ha

QMed	**1.0 l/s**
Volume 100y 6hr	287 m³

5.6 The FSR method of assessing greenfield runoff yields a slightly lower greenfield runoff rate and volume from the existing site over the IH124 method.
Therefore the QBar rate of 0.7 l/s will be used as the existing site greenfield runoff rate for conservative design purposes.

5.7 Post Development Surface Water Runoff Peak Runoff Rate & Volume (Pre – Mitigation)

The estimated peak runoff rate from the proposed site (pre-mitigation) is based on 100% runoff from impermeable areas and 0% runoff from permeable areas, in accordance with CIRIA C697 The SuDS Manual & Preliminary rainfall runoff management for Developments (EA/DEFRA W5-074/A).

5.8 The National Planning Policy Framework requires that consideration is given to the effect of climate change on the flows generated by any new development.
For piped surface water drainage, an increase in 30% is considered as a likely increase in rainfall intensity due to long term climate change up to 2115.

NPPF Table 5: Recommended national precautionary sensitivity ranges for peak rainfall intensities:

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	*+5%*	*+10%*	*+20%*	*+30%*
Peak river flow	*+10%*	*+20%*		
Offshore wind speed	*+5%*		*+10%*	
Extreme wave height	*+5%*		*+10%*	

5.9 A suitable method for the estimation of peak flow from impermeable areas on the proposed development is the *Rational method:* ***Q = 2.78 CIA***

Where:
Q = flow (l/s)
I = rainfall intensity (mm/hr), return period equal to time of concentration (to include a 30% increase for predicted climate change)
A = Impermeable area (ha)
C = Runoff coefficient, assumed to be 1.0

Impermeable Catchment 1: 1.55ha

1 in 1 year	125 l/s
1 in 30 year	370 l/s
1 in 100 year	546 l/s
Volume 100y 6hr	1497 m^3

5.10 Proposed Development Surface Water Runoff Peak Runoff Rate & Volume (Post – Mitigation)

The procedure for surface water management in accordance within 'Rainfall runoff management for developments' (DEFRA/EA Report – SC030219 E, 2013) states;
"For the range of annual flow rate probabilities up to and including the one per cent annual exceedance probability (1 in 100 years) event, including an appropriate allowance for climate change (30% residential developments), the post-developed rate of run-off into a watercourse, sewer, or other receiving water body, should be no greater than the existing pre-developed rate of run-off for the same event".

5.11 It can be seen that as a result of this development and the increase in impermeable areas, the peak rate and volume at which surface water could potentially runoff the site if not effectively managed, will be much greater than in its greenfield state.
To mitigate this increase, it is proposed that all surface water runoff from impermeable areas on the proposed development will be discharged directly to the ground at source via infiltration.

5.12 This will ensure that the peak rate of surface water runoff from the site post development will be no greater than the existing greenfield runoff rate for all equivalent rainfall events, providing a level of betterment over existing conditions.

5.13 This achieves the mandatory criteria (2 credits) set within Code for Sustainable Homes (CFSH) Category 4: Surface water run-off (SUR 1) to reduce peak runoff and volume of water to pre-development volumes.

6 Surface Water Drainage Strategy

6.1 The National Planning Policy Framework (NPPF) requires that developments do not exacerbate flood risks both to the development site and to offsite parties and land, which means there is a need to control surface water drainage and overland runoff to ensure there are no increases in peak rates and volumes of runoff as a result of the development.

6.2 Environment Agency guidance and government legislation such as the Flood and Water Management Act (Defra 2010) requires surface water drainage strategies for new developments to be in accordance with the ideals of 'sustainable development' via the provision of Sustainable Drainage Systems (SuDS).

6.3 SuDS are more sustainable than conventional drainage methods because they can mitigate many of the adverse effects of urban stormwater runoff on the environment.
This can be achieved through reducing runoff rates and volumes to sewer networks and watercourses, reducing the risk of downstream flooding.
Where appropriate SuDS can reduce pollutant concentrations in stormwater, protecting the quality of the receiving water body.

6.4 The Building Regulations Document H (2002) details a hierarchy of potential methods for disposing of surface water from a development:

1. A soakaway or some other adequate infiltration system, or where that is not practicable;
2. A watercourse, or where that is not practicable;
3. A sewer.

6.5 Following a review of the site geology, soil permeability and potential groundwater levels, infiltration as a method of surface water disposal will be feasible.

6.6 Infiltration is a sustainable urban drainage system (SuDS) technique that enables storm water to be dealt with at source rather than discharging into an offsite sewer network or watercourse.
This method of disposal improves the quality of the storm water runoff whilst maintaining the existing natural drainage regime and the pre-development rates of runoff and volumes. It can is also be an important process of maintaining groundwater recharge.

6.7 Infiltration testing carried out within the southern portion of the site (land to be transferred to the Parish) yielded an average soakage rate of 2.5x10-5m/s.
These tests were carried out at depths required to encounter the chalk strata at each location.
Additional infiltration testing carried out within the northern portion (proposed residential) yielded an average soakage rate of 3.1.x10-6m/s.
These tests were carried out within the Winter Hill Gravel Formation at each location to depths between 1 – 2mBGL.
These tests confirm that infiltration within both the Winter Hill Gravel and the Newhaven Chalk Formation is feasible.
For preliminary design purposes all SuDS have been indicatively designed on the worst case infiltration test result (SK5 Eastward & Partners) of 8.6 x10-7m/s.
Refer to Appendix D for test locations.

6.8 The presence of sinkholes, cavities and solution features are known to exist within Sonning Common associated with the underlying chalk geology.
Although there are no such features recorded within the site, it is recommended that a robust assessment of the chalk formation for the presence of solution features is carried out.
On the basis of the current understanding of site conditions it is recommended that soakaways be site a minimum of 10m away from any structural foundation.
If solution feature are discovered then soakaways should be sited at least 20m away from any foundations.

6.9 Drainage Strategy

The surface water drainage strategy for the proposed development will utilise the following options:

Roof Runoff

Roof runoff will be collected by a conventional system of guttering and downpipes where it will be discharged into the stone sub base of permeable surfacing located within private driveways via cellular diffuser cells
Water Butts are to be provided per plot where feasible on a rainwater downpipe to collect roof runoff for grey water re-use.

Driveways, Parking courts & Development Road

Runoff from driveways and parking courts and the main access roads through the site will drain via a permeable surfaces.

Site Access Road

The main access road into the site will be of macadam finishing, draining via highway gullies into a piped carrier system.
This surface water system is to discharge via a precast concrete ringed soakaway located towards the low point of the site.

6.10 All SuDS systems will be sized to manage the 1 in 100year storm event, plus an extra allowance of 30% for the potential predicted increase in peak rainfall up to 2115.
The time for all structures to empty (drain-down time) so that it can accept further storm flow is considered, and will half empty from full within 24 hours so that it can receive runoff from subsequent storms.

6.11 Pollution Prevention

As the site lies above an aquifer and within an groundwater source protection zone (SPZ 3), given the sensitivity of the site in respect of groundwater resources, all runoff will receive a suitable level of pollution treatment in accordance with Environment Agency pollution prevention guidance and '*policy GP3'* prior to discharge into the ground to protect the sensitive receiving waters.

This will be supported by a detailed maintenance and management plan for the SuDS systems at the site including a risk assessment demonstrating that no polluted discharge to ground water will take place.

6.12 All runoff from roofs will pass through a catchpit chamber to remove sediments prior to discharging to a soakaway or the sub-base of permeable surfacing.

All runoff from trafficked areas will pass through the permeable surfaced system which consists of a permeable construction that allow runoff to flow between the joints laid upon a stone sub-base, the base of which is lined with a permeable membrane to allow infiltration in the underlying soils whilst capturing hydrocarbon pollutants.

This system provides a high level of treatment to stormwater runoff prior to discharging to ground, protecting the groundwater.

6.13 The concrete ringed soakaway which drains runoff from the main access road into the site will be located outside of the groundwater source protection zone.

All runoff from this access road will pass through deep trapped highway gullies offering the first level of sediment and oil removal.

If required, a pre-treatment device such as an oil interceptor or other suitable system could be incorporated upstream of the soakaway.

The geotextile layers and granular surround within the soakaway offer additional trapping of stormwater particulates prior to discharge to the ground.

7 Foul water drainage strategy

7.1 The foul water flows from each property will drain via gravity through the private house drainage before out falling to a sewer located within the development road network. This sewer will convey flows via gravity to the south of the site connecting to the existing Thames Water DN150 foul sewer within Reade's Lane. The development foul drainage network will be offered to Thames Water for adoption under a Section 104 agreement of the Water Industry Act 1991.

7.2 The predicted peak foul sewer discharge from the site into the existing Thames Water foul system based on the Sewers for Adoption figure (4000 l/dwelling/day) for the 50 units will be 2.3/s.

7.3 Discussions have been held with Thames Water and a nil detriment scheme of offsite improvements appropriate to the scale of the development are currently being agreed. This will ensure that the proposed development does not create a flood risk to both the development and offsite properties and land within Sonning Common.

APPENDIX A
SITE LAYOUT

notes:
1. The red boundary line indicated does not represent the line of legal ownership; it is the client's responsibility to collaborate this with the title plans.

N

Farm

Pond

LAMBOURNE ROAD

LAMBOURNE ROAD

Emergency Access

shared surface

10m Landscape Buffer

Open Space

shared surface

new site access

raised table

private drive

Open Space

new site access

Land to be transferred to Parish for future community facility

7.5m Landscape Buffer

ASHFORD AVENUE

ASHFORD AVENUE

FARM CLOSE

READE'S LANE

LB

Kidmore End
War Memorial Hall

ED & Ward Bdy

EK

El
Sub Sta

Whitehill

rev:	date:	comment(s):	name:	check:
E	27 11 15	Shared surface width altered to 6m	JAF	JAF
D	26 11 15	Private paths/gates, service strips added.	JAF	JAF
C	25 11 15	Plot 36 / 37 altered via client	JAF	JAF
B	4 11 15	red line reviewed	JAF	JAF
A	2 11 15	access altered	JAF	JAF

ARCHITECTS.
URBAN DESIGNERS.
PLANNERS.
PROJECT MANAGERS.
WE ARE IDP.

status: PLANNING 3

client: Linden Homes Thames Valley

job: Sonning Common, South Oxfordshire

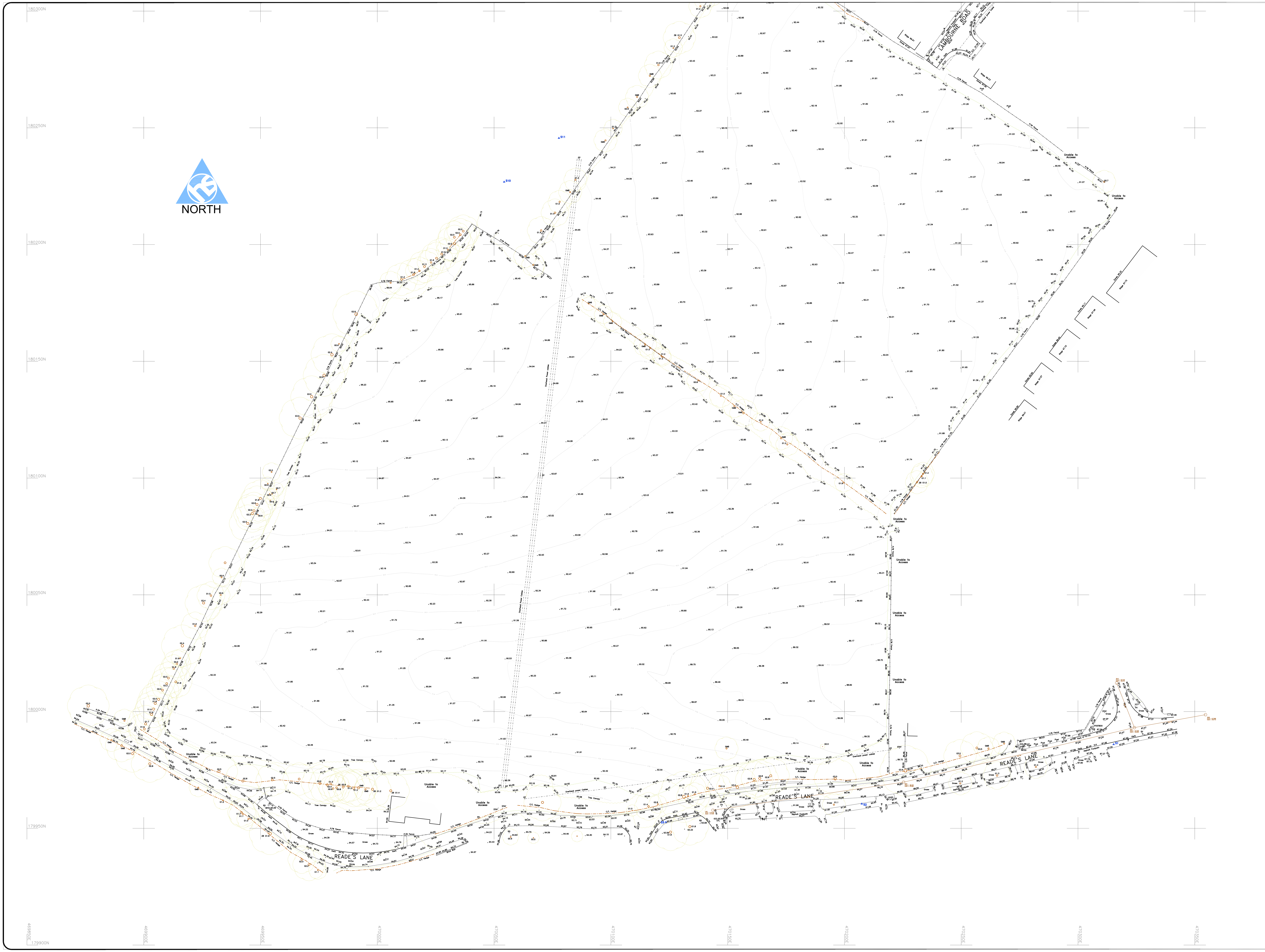
title: Overall Context Plan

drawn: JAF date: 24.09.15 scale @ a0: 1:1000

job no: C2120 drg no: P001 - Rev E

IDP GROUP 27 SPON STREET COVENTRY CV1 3BA
T: +44 (0)24 7652 7600 E:info@idpgroup.com
www.weareidp.com

APPENDIX B
TOPOGRAPHICAL SURVEY



Station Schedule:

S1	470315.267	179985.966	87.572
S2	470207.428	179960.493	91.161
S3	470123.551	179952.629	92.975
S10	470054.319	180226.848	95.867
S11	470077.758	180245.591	95.187

Notes:

GPS (OSGB36) Co-Ordinates & Levels Used.

Scale Factor Used :1.000

LEGEND:

Revisions:

A	
B	
C	
D	
E	

healer surveys
Land & Hydrographic Surveyors
8 Oldfield Road, Bocam Park, Pencoed, Bridgend, CF35 5LJ
tel. 01656 861000 fax. 01656 865575
12 The Croft, Buntsford Drive, Stoke Heath, Bromsgrove, B60 4JE
tel. 01527 575414 fax. 01527 578275

Client: Linden homes

Project: Reade's Lane, Sonning Common, Reading

Drawing: Site Survey

Scale: 1:500

Date: 11th June 2014

Surveyed / Drawn: J.A.E

Checked: R.E.

Dwg. No: P2252

Sheet No: 1 of 2

APPENDIX C
FOUL & SURFACE DRAINAGE STRATEGY LAYOUT

Key:

- Adoptable Foul sewer with MH
- Adoptable Foul I.C. & lateral/sewer
- Adoptable Highway Drain
- Private Surface Water Sewer
- Private Foul I.C & drain
- Permavoid Diffuser Cell (PV)
- Adoptbale Permeable Surface
- Private Permeable Surface
- Cellular Soakaway

Linear cut–off / infiltration trench to intercept any surface water runoff from higher offsite land to the north and west.
Trench to discharge runoff into sand and gravels or taken into a soakaway located within deeper chalk strata.

Diffuser Cells from RWP

Private Drives
Permeable surfacing with stone sub–base (4–20 OGCR)

Private Drives
Permeable surfacing with stone sub–base (4–20 OGCR)

Adoptable Highways
Permeable surfacing upon AC20 dence/HCM/HMB running coarse with core drilled holes with stone sub–base (4–20 OGCR)

Indicative highway gully location

Adoptable Highway Soakaway.
3No. linked 2.7øm PCC soakaway rings with 12mx4m granular surround.
In accordance with Oxfordshire County Council highway specifications.
Sized to manage the 1:100+30% storm event

Pre–treatment device such as an oil interceptor or similar approved

Development gravity foul water system to connect to existing Thames Water public foul network within Reade's Lane.
Subject to approval from Thames Water

Diffuser Cells
(Into private drives and parking spaces only)
Cellular polypropylene unit, Charcon 'Permavoid' or similar approved, wrapped in a permeable geotextile membrane laid within the stone sub–base of the permeable block paving

Typical surface water drainage

Typical foul water drainage

Development boundary

LAMBOURNE ROAD

READE'S LANE

Construction Notes:

Do not scale from this drawing.

All dimensions in metres unless noted otherwise.

All levels relate to ordnance datum.

This drawing is based on the latest Architectural planning layout and shall be read in conjunction with all other relevant longitudinal sections and construction drawings.

Any discrepancies with any of the drawings shall be reported to MJA Consulting Engineer.

The level and location of all existing services shall be verified on site by the Contractor before commencing any construction work.

Contractor must comply with all current legislation relating to CDM, Health and Safety and COSHH.

Manholes, sewers, headwalls, pumping stations and other structures intended to convey surface water or sewerage are to be constructed in accordance with the Water Authorities Association specification "Sewers for Adoption" 6th edition and to Thames Water specifications and addendums.

All finished floor levels are indicative only and are subject to change during detailed design.

REV. No.	DATE	DESCRIPTION	INITIALS
A	04.12.15	Site layout amended, drainage updated to suit	CP

Client: Linden HOMES

Project: Reade's Lane
Sonning Common

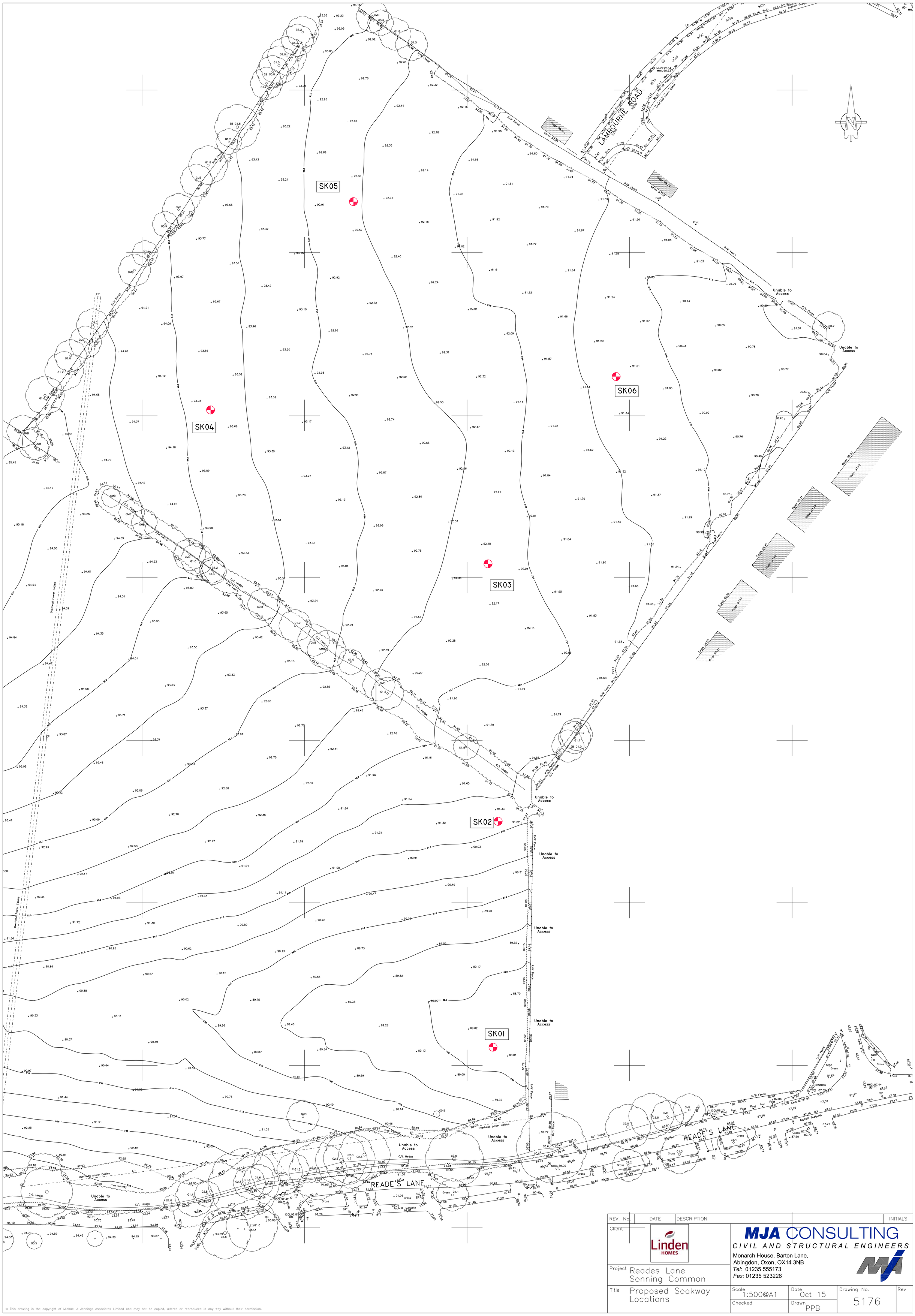
Title: Foul and Surface Water Drainage Strategy Layout

MJA CONSULTING
CIVIL AND STRUCTURAL ENGINEERS
Monarch House, Barton Lane,
Abingdon, Oxon, OX14 3NB
Tel: 01235 555173
Fax: 01235 523226

Scale	Date	Drawing No.	Rev
1:500@A1	Nov 15	5176:01P	A
Checked	Drawn CP		

PRELIMINARY FOR PLANNING PURPOSES ONLY

APPENDIX D
INFILTRATION TEST LOCATIONS



REV. No.	DATE	DESCRIPTION	INITIALS

Client: Linden HOMES

Project: Reades Lane
Sonning Common

Title: Proposed Soakway Locations

MJA CONSULTING
CIVIL AND STRUCTURAL ENGINEERS
Monarch House, Barton Lane,
Abingdon, Oxon, OX14 3NB
Tel: 01235 555173
Fax: 01235 523226

Scale	Date	Drawing No.	Rev
1:500@A1	Oct 15	5176	
Checked	Drawn PPB		

EASTWOOD & PARTNERS **Sheet 1 of 2**
(Consulting Engineers) Ltd

PROJECT:	Reade's Lane, Sonning Common	Job No. 39118	Date 16.11.15
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared DES	Checked CAT

Test No. **SK01**

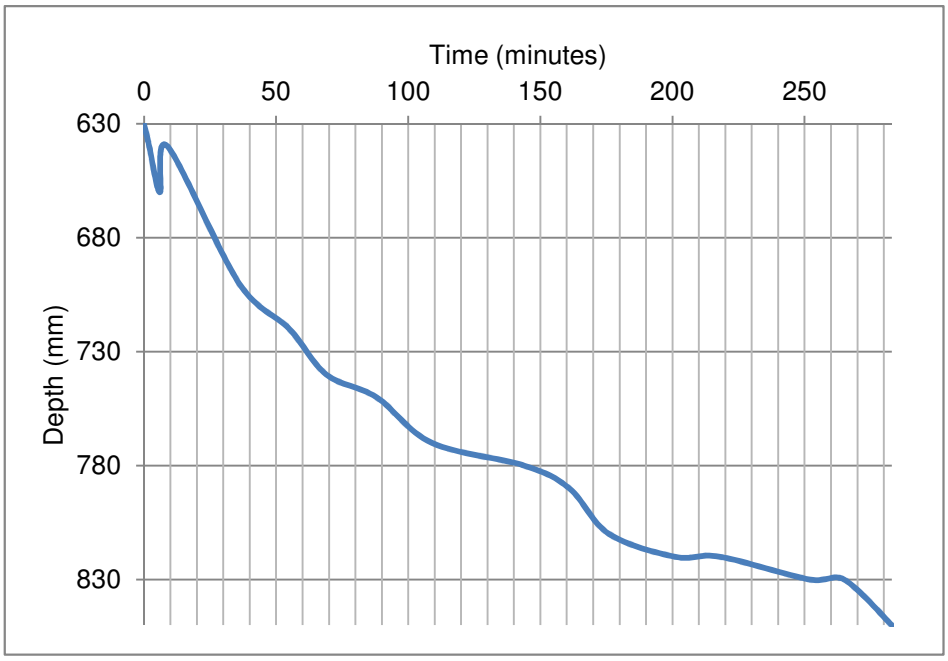
Test Pit Dimensions

Length = **1600** mm
Width = **600** mm
Depth = **1100** mm (Total depth)

Plan area = **0.96** m²

Approximate time to discharge water into the hole: **180** Seconds
Depth to water after completion of pumping: **630** mm

Time (min)	Depth (mm)
0	**630**
2	**640**
6	**660**
9	**640**
36	**700**
55	**720**
69	**740**
88	**750**
109	**770**
144	**780**
161	**790**
176	**810**
201	**820**
218	**820**
252	**830**
265	**830**
283	**850**



Test Pit Log

Depth (m)	Description
0.0 - 0.6	Grass over TOPSOIL: Brown gravelly sand. Gravel is of rounded mixed lithologies.
0.6 - 0.8	Red to brown gravelly CLAY. Gravel is coarse angular of flint.
0.8 - 1.1	Red to brown very clayey gravelly CLAY. Gravel is coarse angular of flint.

PROJECT:	Reade's Lane, Sonning Common	Job No. 39118	Date 16.11.15
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared	Checked CAT

Test No. SK01

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} x t_{p75-25}}$$

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water =	**640**	mm	Average water depth:	**365** mm
Start time =	**9**	min		
			Change in water depth:	**190** mm
Final parameters				
Depth to water =	**930**	mm	Time interval:	**243** min
End time =	**252**	min		

Effective Storage Volume of Water in the Trial Pit	=	**0.4512**	m³
75% Effective Depth	=	**748**	mm from ground level
25% Effective Depth	=	**983**	mm from ground level
Time at 75% Effective Depth	=	**80**	minutes
Time at 25% Effective Depth	=	**N/A**	minutes

V_{p75-25} = **0.23** m³

a_{p50} = **1.99** m²

t_{p75-25} = **-4800** sec

Soil Infiltration Rate = **-2.4E-05 m/sec**

Average Soakaway Rate	=	**1.3E-05**	m³/sec
Average soakaway area	=	**2.57**	m² (sides + base)

Average Infiltration Rate = **4.9E-06 m/sec**

PROJECT:	Reade's Lane, Sonning Common	Job No. 39118	Date 16.11.15
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared DES	Checked CAT

Test No. **SK02 Test 1**

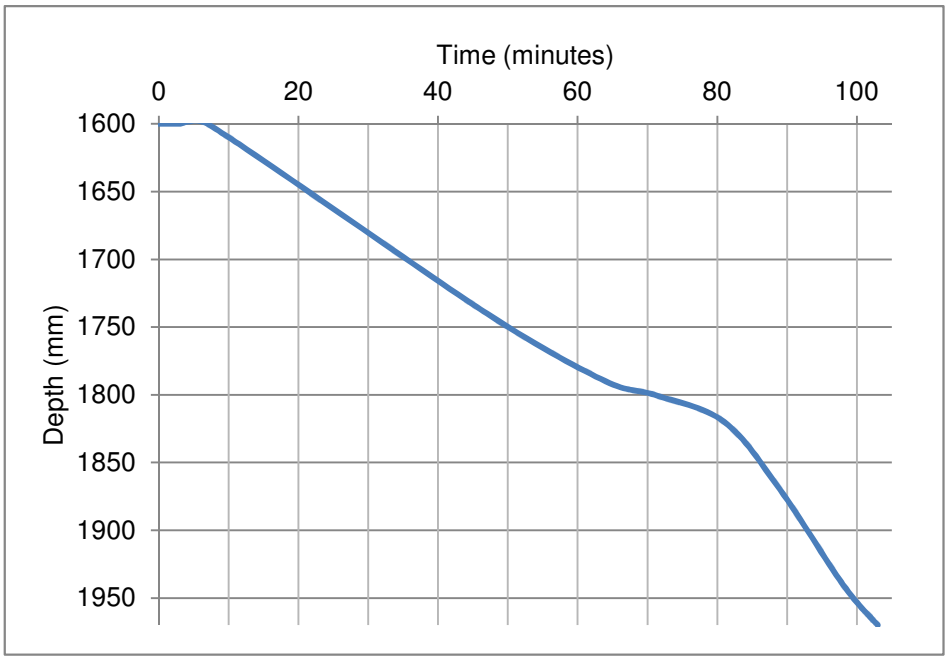
Test Pit Dimensions

Length = **1650** mm
Width = **650** mm
Depth = **2050** mm (Total depth)

Plan area = **1.0725** m²

Approximate time to discharge water into the hole: **120** Seconds
Depth to water after completion of pumping: **1600** mm

Time (min)	Depth (mm)
0	**1600**
3	**1600**
7	**1600**
47	**1740**
64	**1790**
71	**1800**
81	**1820**
89	**1870**
98	**1940**
103	**1970**



Test Pit Log

Depth (m)	Description
0.0 - 0.3	Grass over TOPSOIL: Brown gravelly sand. Gravel is of rounded mixed lithologies.
0.3 - 1.6	Brown gravelly sandy silty CLAY. Gravel is coarse angular of flint.
1.6 - 2.05	Brown gravelly sandy silty CLAY with a weathered chalk feature in the centre (CLAY).

PROJECT:	**Reade's Lane, Sonning Common**	**Job No. 39118**	**Date 16.11.15**
SUBJECT:	**Infiltration Test Results and Calculation of Infiltration Rates**	**Prepared DES**	**Checked CAT**

Test No. SK02 Test 1

Soil Infiltration Rate in Accordance with BR365

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

$$f = \frac{V_{p75-25}}{a_{p50} x t_{p75-25}}$$

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters
Depth to water = **1600** mm
Start time = **7** min

Final parameters
Depth to water = **1970** mm
End time = **103** min

Average water depth: **265** mm
Change in water depth: **370** mm
Time interval: **96** min

Effective Storage Volume of Water in the Trial Pit = **0.482625** m³
75% Effective Depth = **1713** mm from ground level
25% Effective Depth = **1938** mm from ground level
Time at 75% Effective Depth = **40** minutes
Time at 25% Effective Depth = **96** minutes

= **0.24** m³

= **2.11** m²

= **3360** sec

= **3.4E-05 m/sec**

Average Soakaway Rate = **6.9E-05** m³/sec
Average soakaway area = **2.29** m² (sides + base)

V_{p75-25} **Soil Infiltration Rate = 3.4E-05 m/sec**
Average Infiltration Rate = 3.0E-05 m/sec
a_{p50}

t_{p75-25}

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Test No. **SK02 Test 2**

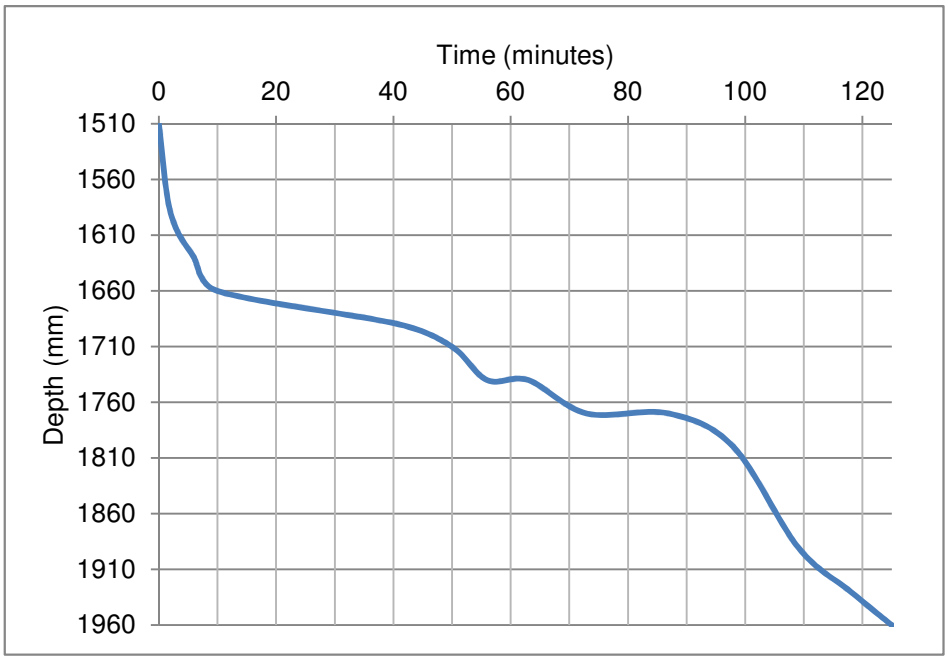
Test Pit Dimensions

Length = **1650** mm
Width = **650** mm
Depth = **2050** mm (Total depth)

Plan area = **1.0725** m²

Approximate time to discharge water into the hole: **120** Seconds
Depth to water after completion of pumping: **1510** mm

Time (min)	Depth (mm)
0	**1510**
2	**1590**
6	**1630**
10	**1660**
41	**1690**
50	**1710**
56	**1740**
63	**1740**
73	**1770**
87	**1770**
98	**1800**
109	**1890**
118	**1930**
125	**1960**



Test Pit Log

Depth (m)	Description
0.0 - 0.3	Grass over TOPSOIL: Brown gravelly sand. Gravel is of rounded mixed lithologies.
0.3 - 1.6	Brown gravelly sandy silty CLAY. Gravel is coarse angular of flint.
1.6 - 2.05	Brown gravelly sandy silty CLAY with a weathered chalk feature in the centre (CLAY).

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Test No. SK02 Test 2

Soil Infiltration Rate in Accordance with BR365

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

$$f = \frac{V_{p75-25}}{a_{p50} x t_{p75-25}}$$

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters
Depth to water = **1660** mm
Start time = **10** min

Final parameters
Depth to water = **1960** mm
End time = **125** min

Average water depth: **240** mm
Change in water depth: **300** mm
Time interval: **115** min

Effective Storage Volume of Water in the Trial Pit = **0.57915** m³
75% Effective Depth = **1645** mm from ground level
25% Effective Depth = **1915** mm from ground level
Time at 75% Effective Depth = **8** minutes
Time at 25% Effective Depth = **110** minutes

V_{p75-25} = **0.29** m³

a_{p50} = **2.31** m²

t_{p75-25} = **6120** sec

5 Soil Infiltration Rate = = **2.0E-05 m/sec**

Average Infiltration Rate = **2.1E-05 m/sec**

Average Soakaway Rate = **4.7E-05** m³/sec
Average soakaway area = **2.18** m² (sides + base)

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Test No. **SK02 Test 3**

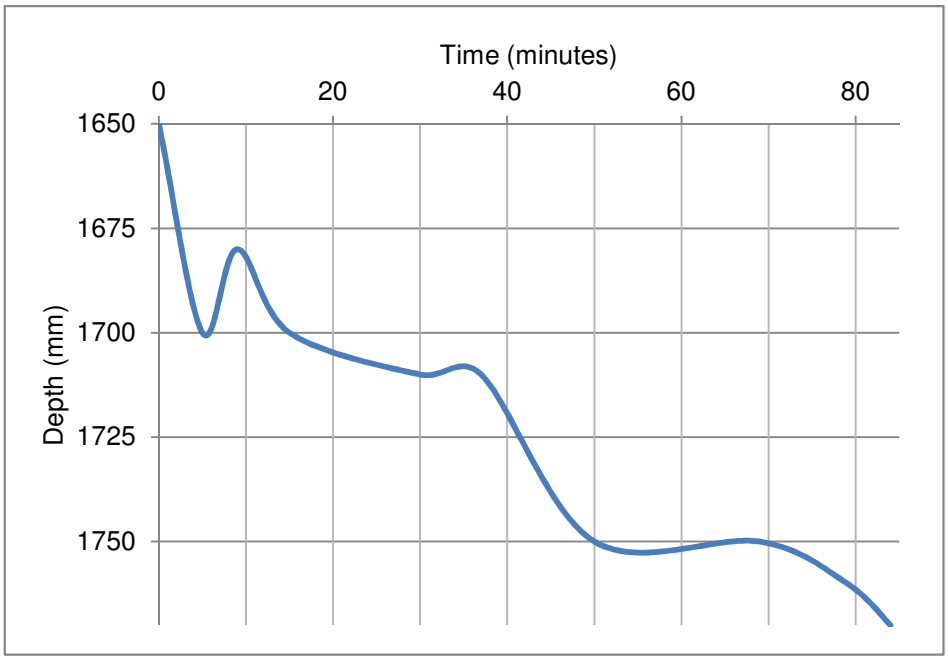
Test Pit Dimensions

Length = **1650** mm
Width = **650** mm
Depth = **2050** mm (Total depth)

Plan area = **1.0725** m²

Approximate time to discharge water into the hole: **120** Seconds
Depth to water after completion of pumping: **1650** mm

Time (min)	Depth (mm)
0	**1650**
5	**1700**
9	**1680**
15	**1700**
30	**1710**
37	**1710**
50	**1750**
69	**1750**
79	**1760**
84	**1770**



Test Pit Log

Depth (m)	Description
0.0 - 0.3	Grass over TOPSOIL: Brown gravelly sand. Gravel is of rounded mixed lithologies.
0.3 - 1.6	Brown gravelly sandy silty CLAY. Gravel is coarse angular of flint.
1.6 - 2.05	Brown gravelly sandy silty CLAY with a weathered chalk feature in the centre (CLAY).

PROJECT:	Reade's Lane, Sonning Common	Job No. 39118	Date 16.11.15
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Test No. SK02 Test 3

Soil Infiltration Rate in Accordance with BR365

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

$$f = \frac{V_{p75-25}}{a_{p50} x t_{p75-25}}$$

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1700** mm
Start time = **15** min

Final parameters

Depth to water = **1760** mm
End time = **79** min

Average water depth: **320** mm
Change in water depth: **60** mm
Time interval: **64** min

Effective Storage Volume of Water in the Trial Pit	=	**0.429**	m³
75% Effective Depth	=	**1750**	mm from ground level
25% Effective Depth	=	**1950**	mm from ground level
Time at 75% Effective Depth	=	**50**	minutes
Time at 25% Effective Depth	=	**N/A**	minutes

V_{p75-25} = **0.21** m³

a_{p50} = **1.99** m²

t_{p75-25} = **-3000** sec

Soil Infiltration Rate = **-3.6E-05 m/sec**

Average Soakaway Rate = **1.7E-05** m³/sec
Average soakaway area = **2.54** m² (sides + base)

Average Infiltration Rate = 6.6E-06 m/sec

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Test No. **SK03**

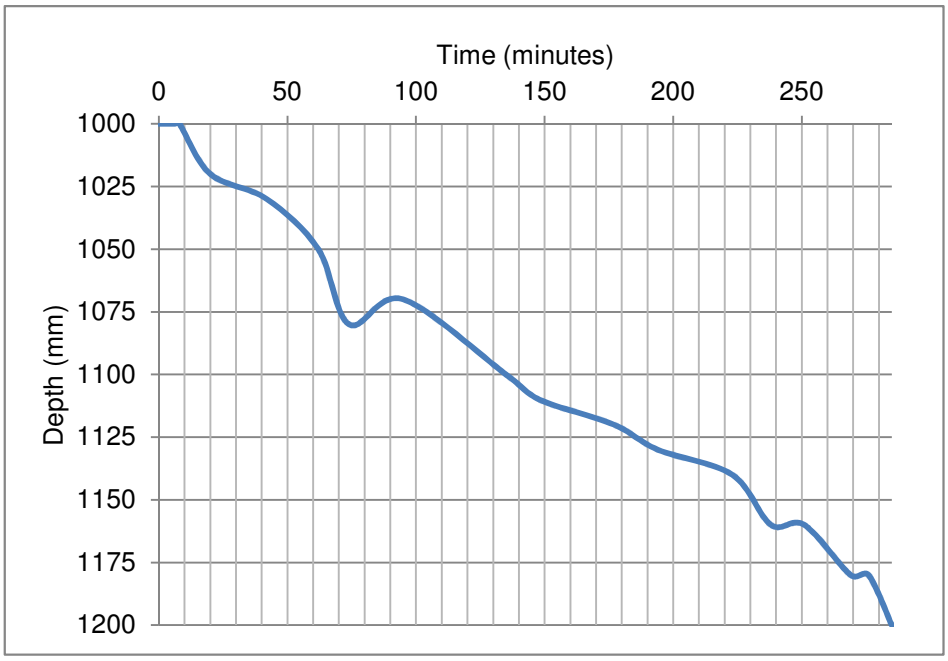
Test Pit Dimensions

Length = **1600** mm
Width = **650** mm
Depth = **1500** mm (Total depth)

Plan area = **1.04** m²

Approximate time to discharge water into the hole: **180** Seconds
Depth to water after completion of pumping: **1000** mm

Time (min)	Depth (mm)
0	**1000**
6	**1000**
8	**1000**
20	**1020**
42	**1030**
62	**1050**
74	**1080**
95	**1070**
135	**1100**
148	**1110**
177	**1120**
194	**1130**
223	**1140**
238	**1160**
251	**1160**
269	**1180**
276	**1180**
285	**1200**



Test Pit Log

Depth (m)	Description
0.0 - 0.2	Grass over TOPSOIL: Brown gravelly sand. Gravel is of rounded mixed lithologies.
0.2 - 0.55	Orange gravelly SAND. Gravel is coarse subrounded to subangular gravel of flint and mixed lithologies.
0.55 - 1.50	Coarse angular GRAVEL AND COBBLES of flint in orange clay.

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Test No. SK03

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} x t_{p75-25}}$$

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1020** mm
Start time = **20** min

Final parameters

Depth to water = **1180** mm
End time = **269** min

Average water depth: **400** mm

Change in water depth: **160** mm

Time interval: **249** min

Effective Storage Volume of Water in the Trial Pit = **0.52** m³
75% Effective Depth = **1125** mm from ground level
25% Effective Depth = **1375** mm from ground level
Time at 75% Effective Depth = **180** minutes
Time at 25% Effective Depth = **N/A** minutes

V_{p75-25} = **0.26** m³

a_{p50} = **2.17** m²

t_{p75-25} = **-10800** sec

Soil Infiltration Rate = **-1.1E-05 m/sec**

Average Soakaway Rate = **1.1E-05** m³/sec
Average soakaway area = **2.84** m² (sides + base)

Average Infiltration Rate = 3.9E-06 m/sec

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Test No. **SK04**

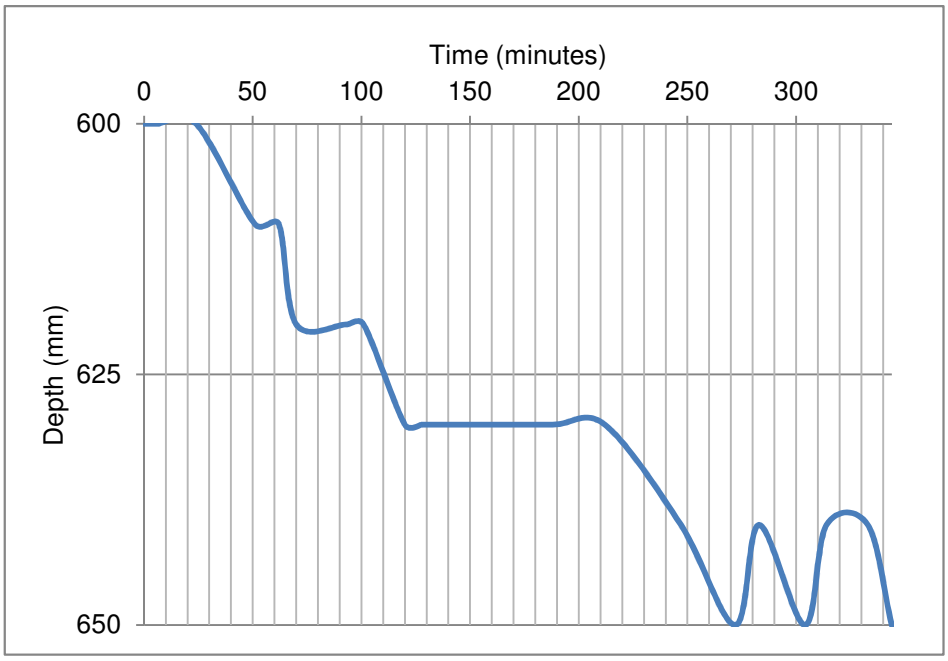
Test Pit Dimensions

Length = **1600** mm
Width = **600** mm
Depth = **1100** mm (Total depth)

Plan area = **0.96** m²

Approximate time to discharge water into the hole: **180** Seconds
Depth to water after completion of pumping: **600** mm

Time (min)	Depth (mm)
0	**600**
3	**600**
6	**600**
24	**600**
51	**610**
62	**610**
70	**620**
93	**620**
101	**620**
120	**630**
128	**630**
141	**630**
152	**630**
188	**630**
212	**630**
247	**640**
272	**650**
283	**640**
304	**650**
314	**640**
333	**640**
344	**650**



Test Pit Log

Depth (m)	Description
0.0 - 0.3	Grass over TOPSOIL: Brown slightly gravelly sand. Gravel is of rounded mixed lithologies.
0.3 - 0.9	Orange very sandy CLAY.
0.9 - 1.1	Orange very clayey SAND.

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Test No. SK04

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} x t_{p75-25}}$$

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **610** mm
Start time = **62** min

Final parameters

Depth to water = **650** mm
End time = **272** min

Average water depth: **470** mm

Change in water depth: **40** mm

Time interval: **210** min

Effective Storage Volume of Water in the Trial Pit = **0.48** m³
75% Effective Depth = **725** mm from ground level
25% Effective Depth = **975** mm from ground level
Time at 75% Effective Depth = **N/A** minutes
Time at 25% Effective Depth = **N/A** minutes

V_{p75-25} = **0.24** m³

a_{p50} = **2.06** m²

t_{p75-25} = **0** sec

Soil Infiltration Rate = **#DIV/0! m/sec**

Average Soakaway Rate = **3.0E-06** m³/sec
Average soakaway area = **3.03** m² (sides + base)

Average Infiltration Rate = 1.0E-06 m/sec

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Test No. **SK05**

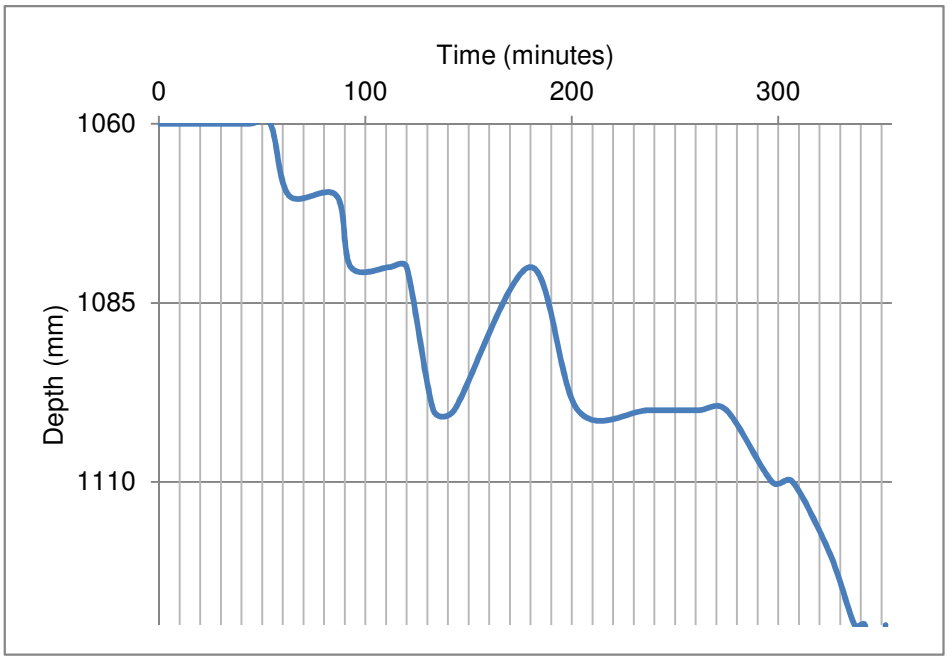
Test Pit Dimensions

Length = **1700** mm
Width = **600** mm
Depth = **1600** mm (Total depth)

Plan area = **1.02** m²

Approximate time to discharge water into the hole: **120** Seconds
Depth to water after completion of pumping: **1060** mm

Time (min)	Depth (mm)
0	**1060**
3	**1060**
7	**1060**
16	**1060**
43	**1060**
54	**1060**
63	**1070**
86	**1070**
93	**1080**
112	**1080**
120	**1080**
133	**1100**
143	**1100**
180	**1080**
203	**1100**
237	**1100**
261	**1100**
275	**1100**
297	**1110**
307	**1110**
325	**1120**
337	**1130**
342	**1130**
347	**1140**
352	**1130**



Test Pit Log

Depth (m)	Description
0.0 - 0.3	Grass over TOPSOIL: Brown slightly gravelly sand. Gravel is of rounded mixed lithologies.
0.3 - 1.0	Friable orange brown sandy CLAY.
1.0 - 1.2	Friable reddish orange sandy cobbly CLAY.
1.2 - 1.6	Orange clayey gravelly SAND with some clay lumps.

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Test No. SK05

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} x t_{p75-25}}$$

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1070** mm
Start time = **63** min

Final parameters

Depth to water = **1110** mm
End time = **297** min

Average water depth: **510** mm

Change in water depth: **40** mm

Time interval: **234** min

Effective Storage Volume of Water in the Trial Pit = **0.5508** m³
75% Effective Depth = **1195** mm from ground level
25% Effective Depth = **1465** mm from ground level
Time at 75% Effective Depth = **N/A** minutes
Time at 25% Effective Depth = **N/A** minutes

V_{p75-25} = **0.28** m³

a_{p50} = **2.26** m²

t_{p75-25} = **0** sec

Soil Infiltration Rate = **#DIV/0! m/sec**

Average Soakaway Rate = **2.9E-06** m³/sec
Average soakaway area = **3.37** m² (sides + base)

Average Infiltration Rate = 8.6E-07 m/sec

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Test No. **SK06 Test 1**

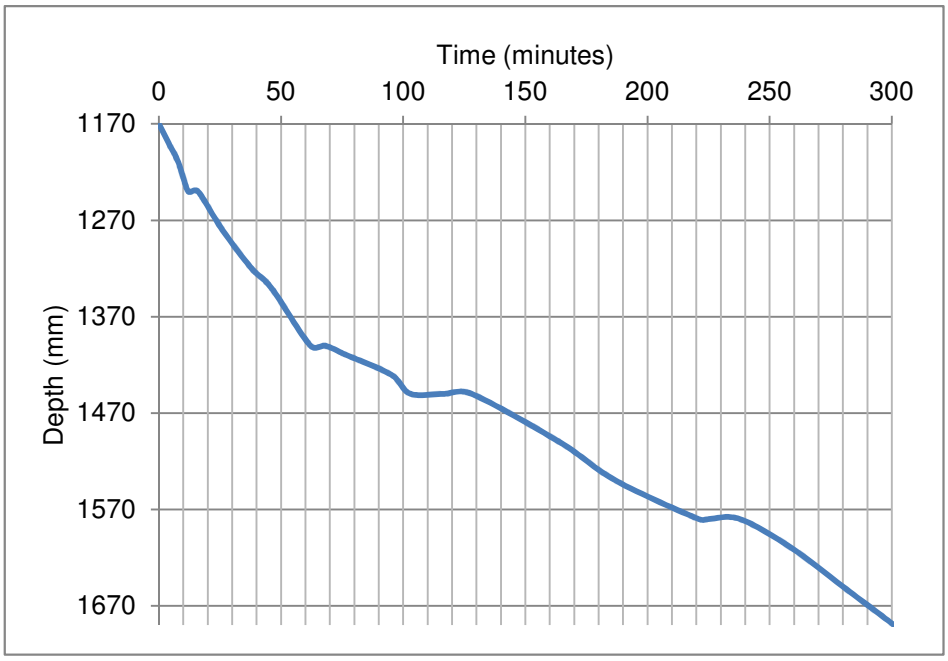
Test Pit Dimensions

Length = **1700** mm
Width = **650** mm
Depth = **1700** mm (Total depth)

Plan area = **1.105** m²

Approximate time to discharge water into the hole: **60** Seconds
Depth to water after completion of pumping: **1170** mm

Time (min)	Depth (mm)
0	**1170**
4	**1190**
8	**1210**
12	**1240**
16	**1240**
26	**1280**
38	**1320**
46	**1340**
62	**1400**
68	**1400**
77	**1410**
95	**1430**
103	**1450**
117	**1450**
128	**1450**
164	**1500**
187	**1540**
221	**1580**
225	**1580**
238	**1580**
259	**1610**
280	**1650**
301	**1690**



Test Pit Log

Depth (m)	Description
0.0 - 0.3	Grass over TOPSOIL: Brown slightly gravelly sand. Gravel is of rounded mixed lithologies.
0.3 - 1.4	Orange to brown sandy cobbly CLAY. Cobbles are of flint, loose in sides where they have fallen out.
1.4 - 1.7	Orange to brown sandy cobbly CLAY. Cobbles are of flint; loose in sides where they have fallen out. Weathered chalk feature to west of pit (CLAY).

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Test No. SK06 Test 1

Soil Infiltration Rate in Accordance with BR365

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

$$f = \frac{V_{p75-25}}{a_{p50} x t_{p75-25}}$$

Initial parameters
Depth to water = **1240** mm
Start time = **16** min

Final parameters
Depth to water = **1690** mm
End time = **301** min

Average water depth: **235** mm
Change in water depth: **450** mm
Time interval: **285** min

Effective Storage Volume of Water in the Trial Pit = **0.58565** m³
75% Effective Depth = **1303** mm from ground level
25% Effective Depth = **1568** mm from ground level
Time at 75% Effective Depth = **30** minutes
Time at 25% Effective Depth = **210** minutes

V_{p75-25} = **0.29** m³

a_{p50} = **2.35** m²

t_{p75-25} = **10800** sec

Soil Infiltration Rate = = **1.2E-05 m/sec**

Average Soakaway Rate = **2.9E-05** m³/sec
Average soakaway area = **2.21** m² (sides + base)

Average Infiltration Rate = **1.3E-05 m/sec**

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Test No. **SK06 Test 2**

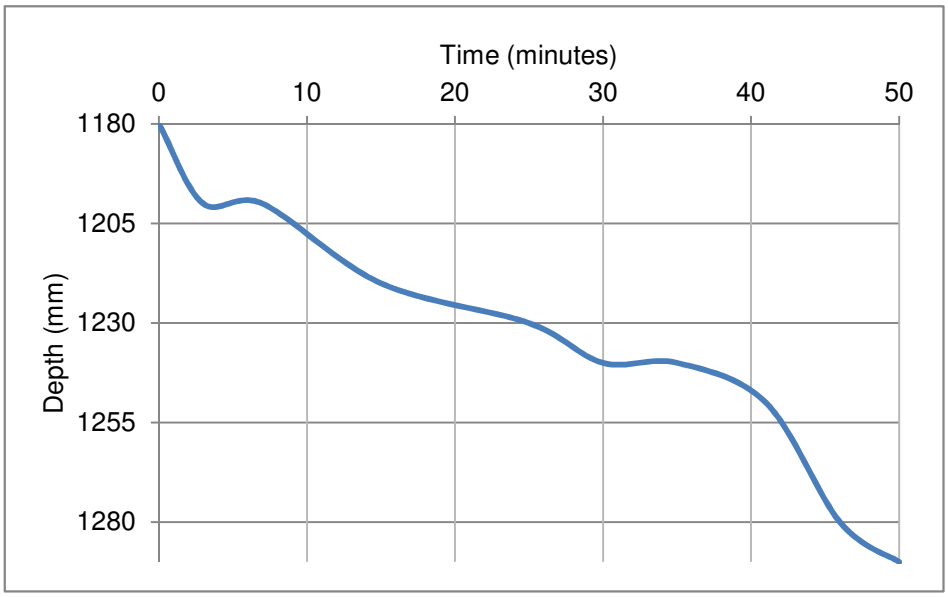
Test Pit Dimensions

Length = **1700** mm
Width = **650** mm
Depth = **1700** mm (Total depth)

Plan area = **1.105** m²

Approximate time to discharge water into the hole: **120** Seconds
Depth to water after completion of pumping: **1180** mm

Time (min)	Depth (mm)
0	**1180**
3	**1200**
7	**1200**
15	**1220**
25	**1230**
30	**1240**
35	**1240**
41	**1250**
46	**1280**
50	**1290**



Test Pit Log

Depth (m)	Description
0.0 - 0.3	Grass over TOPSOIL: Brown slightly gravelly sand. Gravel is of rounded mixed lithologies.
0.3 - 1.4	Orange to brown sandy cobbly CLAY. Cobbles are of flint, loose in sides where they have fallen out.
1.4 - 1.7	Orange to brown sandy cobbly CLAY. Cobbles are of flint; loose in sides where they have fallen out. Weathered chalk feature to west of pit (CLAY).

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Test No. SK06 Test 2

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} x t_{p75-25}}$$

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1200** mm
Start time = **7** min

Average water depth: **460** mm

Change in water depth: **80** mm

Final parameters

Depth to water = **1280** mm
End time = **46** min

Time interval: **39** min

Effective Storage Volume of Water in the Trial Pit = **0.5746** m³
75% Effective Depth = **1310** mm from ground level
25% Effective Depth = **1570** mm from ground level
Time at 75% Effective Depth = **N/A** minutes
Time at 25% Effective Depth = **N/A** minutes

V_{p75-25} = **0.29** m³

a_{p50} = **2.33** m²

t_{p75-25} = **0** sec

f = **#DIV/0! m/sec**

Average Soakaway Rate = **3.8E-05** m³/sec
Average soakaway area = **3.27** m² (sides + base)

BR365 Soil Infiltration Rate = #DIV/0! m/sec
Average Infiltration Rate = 1.2E-05 m/sec

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