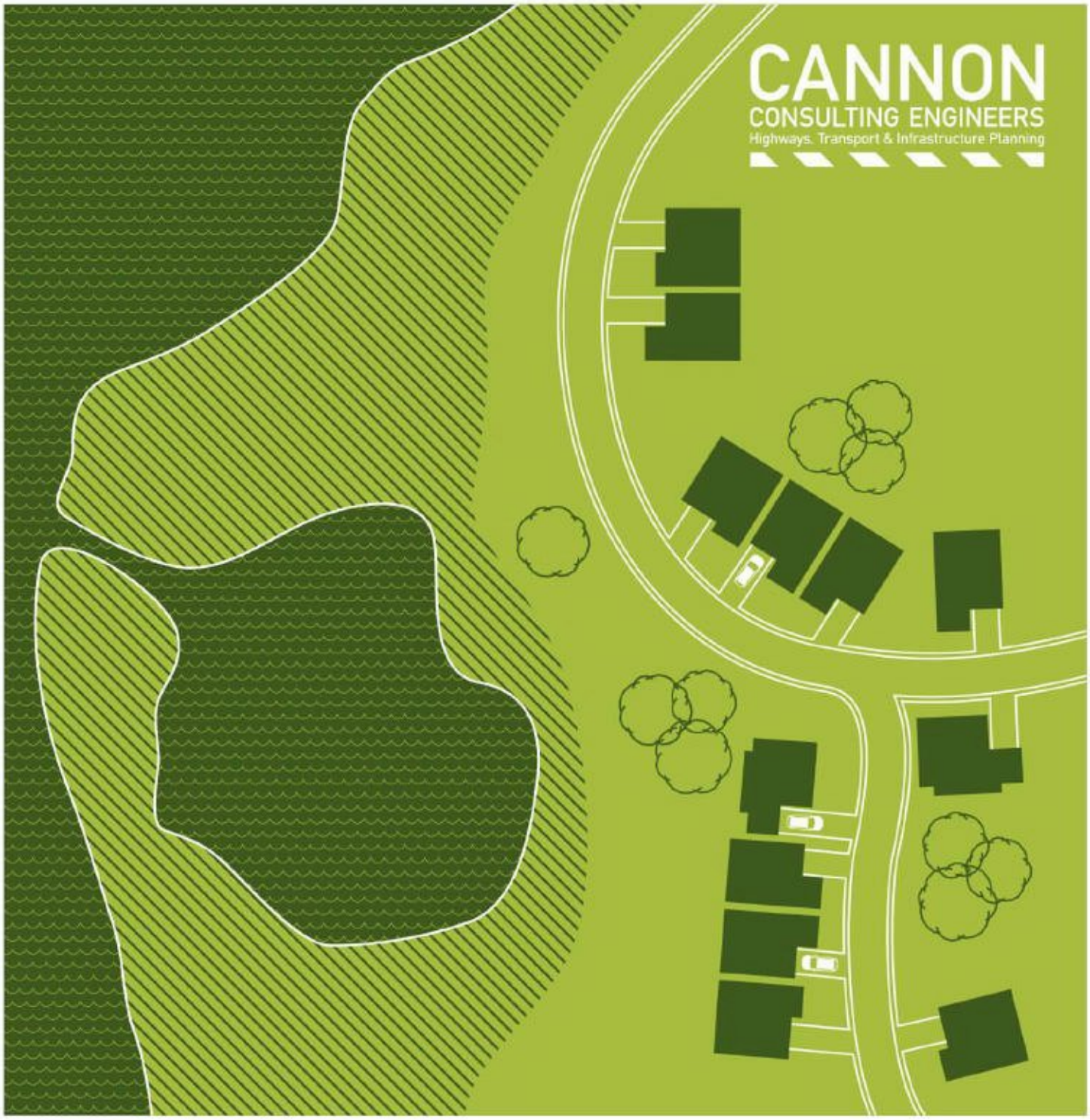

flood risk assessment

Land east of Henderson Road, Thorpe-le-Soken, Essex

CCE/S771/FRA2-01

July 2021

For M Scott Properties Ltd

Document Review Sheet:

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Reference	Date	Author	Checked
CCE/S771/FRA2-01	July 2021	JH	RT

Contents

Appendices

Summary Table

Site location	Land to the east of Henderson Road, Thorpe le-Soken, Essex. Grid reference – 618700, 222604
Planning application	Full
Existing site	Greenfield (agricultural)
Application area	Approximately 2.0 ha
Proposed development	Residential dwellings
Flood Zone	Flood Zone 1
Reservoir Inundation Zone	None
Surface water flooding	Shallow bands of primarily low risk
Surface water management	Greenfield discharge to the boundary ditch. On-site storage to manage the 1 in 100 annual probability storm plus 40 % climate change.

1.0 Introduction

1.1 This Flood Risk Assessment (FRA) has been prepared on behalf of M Scott Properties Ltd to support a planning application for residential development of land to the east of Henderson Road in Thorpe-le-Soken, Essex (see approximate site location below).

Approximate site location © Crown copyright and database rights 2021 Ordnance Survey 100047325

1.2 The development proposal comprises 28 residential dwellings (refer to the masterplan in Appendix B).

1.3 The report is based on findings of a site visit, discussions with the landowner and a review of the Tendring Strategic Flood Risk Assessment (SFRA) and SFRA addendum (2017), and the Essex County Council (ECC) flood risk and asset map.

1.4 This assessment takes account of the National Planning Policy Framework (NPPF) and the definitions of sources of flooding within the Flood and Water Management Act (FWMA) 2010.

1.5 The site is approximately centred on Ordnance Survey grid reference 618625,222605. The site is triangular (pointing northwards) and extends to approximately 2.0 ha. The current land use is agricultural.

1.6 The land to the north and east of the site is open agricultural land. The land to the west comprises recently constructed residential development. The land to the south is undeveloped grassland with residential development beyond.

1.7 The dominant slope of the site is from south to north. Levels fall from approximately 25.9 m AOD in the south to approximately 20.8 m AOD in the north (a topographical survey is included in Appendix A).

1.8 Part of western site boundary is marked by a drainage ditch. The ditch forms part of a wider network which (from Ordnance Survey mapping) flow northwards into Landermere Creek (a tidally influenced water body to the north of the site). The eastern boundary ditch is linked to the downstream network by a 150 mm diameter pipe.

1.9 The western boundary ditch receives flows from an Anglian Water surface water sewer network which serves the residential development to the south-west of the site (Rolph Close, Beldams Close etc). The sewer is shown on both the Anglian Water asset plans and topographical survey in Appendix A. There is also an "outgoing pipe" near to the outfall from the Anglian Water sewer (see headwall and 150 mm diameter pipe shown on the topographical survey) which is understood (from the landowner) to convey some of the flows from the sewer to an agricultural reservoir approximately 600 m to the east of the site. The route of the outgoing pipe will be realigned as part of the development of the site.

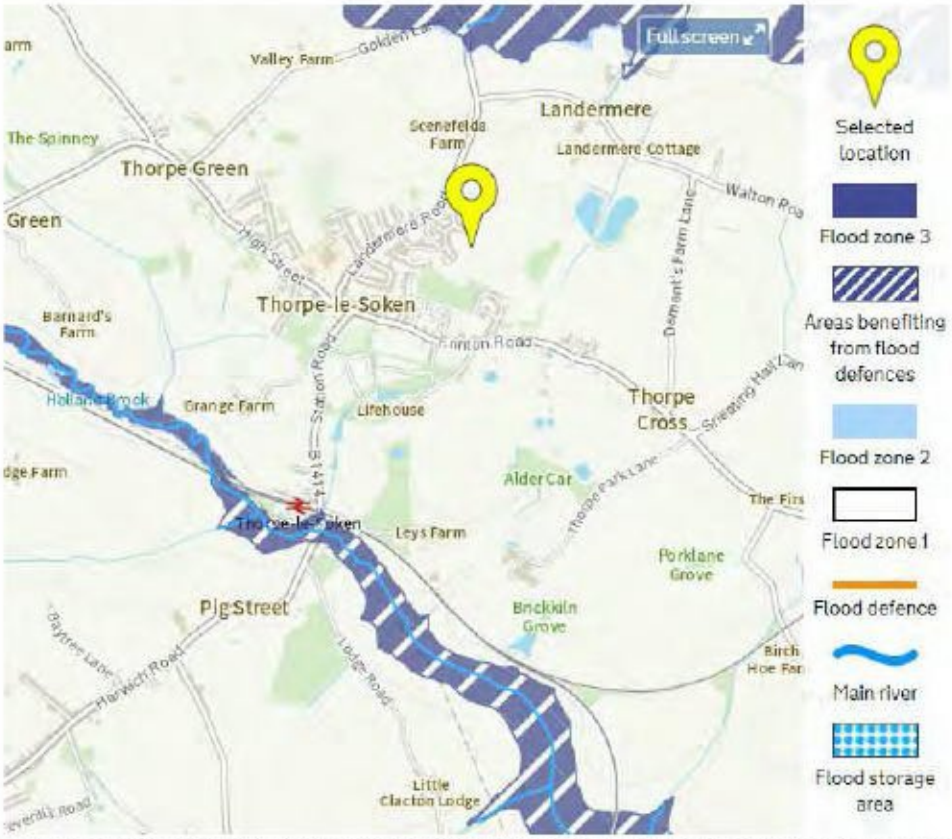
1.10 Geological mapping (refer to the Infiltration SuDS GeoReport in Appendix A) shows that the site is underlain by the silty clays of the Thames Group. The presence of clay beneath topsoil was confirmed during infiltration testing (refer to Appendix A for trial pit logs and test results).

1.11 Although wastewater does not form part of a FRA it is worth noting that the current proposal is to pump wastewater to the adopted wastewater network in the area. The layout includes an allowance for a pumping station (adjacent the site access).

2.0 Forms of Flooding

Watercourses

2.1 The site lies in Flood Zone 1 (see below) and is not therefore considered to be at risk of flooding from a main river or other watercourse with a significantly sized catchment.



Flood Map for Planning (21/07/2021) © Crown copyright and database rights 2021 Ordnance Survey 100047325

Surface Water

2.2 As discussed in Section 1, the surface water flood map (overleaf) shows bands of primarily low risk, sub 300 mm deep, surface water flooding crossing east-west through the site. The water is primarily the result of localised rural runoff from the field to the east of the site and is not considered to pose a notable threat to the site. In order to help direct any incoming rural flows northwards ground levels along the northern half of the eastern boundary of the site (the gardens of units 1 to 7) will be set slightly higher than existing (200 to 300 mm).

Surface water flood map (21/07/2021) © Crown copyright and database rights 2021 Ordnance Survey 100047325

Surface Water Sewers

2.3 A simple comparison of inlet and outlet diameters to and from the western boundary ditch suggests that the capacity of the Anglian Water surface water sewer feeding the ditch (at 400 mm diameter) may exceed the capacity of the outlets from the ditch (both at 150 mm diameter). However, in the event that eastern boundary ditch becomes overloaded, ground levels are such that overtopping would occur from the northern end of the ditch, with water flowing away from the site rather than presenting a risk to the proposed dwellings.

Groundwater

2.4 The Infiltration SuDS GeoReport (Appendix A) shows that groundwater may be between 3 and 5 m below ground level under the majority of the site, with levels being potentially closer to ground level in the north. These levels are not considered to present a notable threat to the proposed units. However were groundwater to reach a point where it emerged at the surface it would tend to flow northwards, around the proposed units rather than pooling around them.

Reservoirs

2.5 The site is not shown to lie within a reservoir inundation area.

3.0 Surface Water Management

3.1 Infiltration testing in the area was unsuccessful with all tests reported as failures (refer to the results in Appendix A). It is therefore proposed to discharge surface water runoff from the development to the boundary ditch. Flows will be limited to the 1 in 1 annual probability greenfield rate (the Q1 rate) calculated for the area.

3.2 Sufficient surface water storage will be provided in order to manage the 1 in 100 year storm including a 40 % allowance for climate change. Surface water runoff calculations, and a surface water management plan are included in Appendix B. The attenuation has been run with both the proposed approximate impermeable area. The scheme has also been tested with an additional allowance for creep (applied as a 10 % increase).

3.3 The 1 in 1 annual probability greenfield rate for the site is 3.1 l/s/ha. The approximate impermeable catchment area of the proposed development is 0.92 ha. This translates to a pro rata discharge rate of 2.85 l/s.

3.4 The proposed scheme relies on a single attenuation basin in the allocated space in the north of the site. The basin is 1.5 m deep with 1 in 3 side slopes with a maximum depth (during the 1 in 100 annual probability storm plus 40 % climate change and 10 % creep) of a little over 1.0 m. The depth in the basin for the 1 in 30 annual probability storm Is a little less than 0.5 m (i.e. less than half full). Flows will be restricted with an orifice control housed in a chamber with in-chamber protection (a perforated plate, tube etc). Additional protection for the control will be provided at the outlet from the basin (a gabion filter box) which will prevent debris from entering the chamber.

3.5 The short section of road in the north of the site will drain to a roadside planter/grassed filer drain (200 mm deep). The planter/filter drain will be connected to the basin by a perforated underdrain.

3.6 All proposals and rates are subject to detailed design and the approval of relevant parties.

Treatment

3.7 The C753 pollution hazard level for the development is low. The basin therefore provides sufficient treatment for the proposals.

Maintenance

3.8 All elements of the surface water management scheme will be offered to Anglian Water for adoption. If Anglian Water do not take on the scheme then it would be managed by a communally funded private management company

4.0 Conclusions

4.1 The proposed development is not considered to be liable to significant or unmanageable flooding from the sources identified in the Flood and Water Management Act 2010.

4.2 Surface water runoff from the proposed development will be discharged at the 1 in 1 annual probability greenfield rate of 3.1 l/s/ha to the local watercourse network.

4.3 Surface water management facilities will be sized to manage the 1 in 100 annual probability storm inclusive of 40 % climate change.

4.4 The proposed surface water management scheme includes sufficient treatment.

4.5 It is envisaged that maintenance of the surface water scheme will be undertaken by Anglian Water, or failing that a communally funded private management company.

A Existing Site

Topographical Survey
Anglian Water Sewer Plans
Infiltration SuDS GeoReport
Infiltration Tests

1. all elevations are in metres

2. elevations – OS datum translated from gps coordinates using OSGM02 as supplied by the OS.

3. survey grid – OS grid translated from gps coordinates using OSTN02 transformation as supplied by the OS.

4. control coordinates should be checked and verified on site prior to use. Any discrepancies must be reported to Surv-aid immediately

5. this drawing does not show or imply legal boundaries or rights of way

6. whilst every effort has been made to achieve accuracy on this plan, enlargements in scale and critical dimensions should be verified with site measurement

7. services and detail may not have been identified if obstructed or not visible at the time of survey

8. although this is a digital survey the accuracy is only commensurate with the graphical scale of mapping specified – care should be exercised when obtaining information from any electronic version of this drawing

9. vegetation shown identified to best of surveyors ability, seek confirmation if species critical (canopy and girth to scale)

10. kerb line levels are taken in channel unless shown otherwise

11. where boundary alignment lines are added to the survey drawing they are taken from legal documents or other information supplied and are done so within the constraints of drawing quality and scale. They are provided on the basis of opinion and do not imply legal contract

app	approximately	el	eaves level	rbol	removable bollard
av	average	elec	electricity	rl	ridge level
bit	bitumen	ep	electricity pole	re	rodding eye
bm	bench mark	et	EP & transformer	rs	road sign
bs	bench seat	fb	flower bed	rw	retaining wall
bl	bed level	fh	fire hydrant	srw	stone retaining wall
bh	bore hole	fl	floor level	sv	stop valve
bol	bollard	fw	foul water	sfl	soffit level
blwk	blockwork	g	gully	sps	stone paving slabs
bp	brick paviors	gv	gas valve	stn	survey station
bw	brick wall	h	height in metres	svp	soil vent pipe
bt	telecom	hc	hardcore	sw	surface water
conc	concrete	ic	inspection chamber	tl	traffic light
cb	control box	il	invert level	tc	traffic control
ctv	cable television	irf	iron railing fence	tcb	telephone call box
cbf	close boarded fence	iwf	interwoven fence	tp	trialpit
cl	cover level	ko	kerb gully/offlet	tpr	timber post & rail
clf	chain link fence	lp	lamp post	tp	telephone pole
cpf	concrete panel fence	ldc	drainage channel	tow	top of wall
cps	concrete paving slab	mh	man hole	utl	unable to lift
cw	concrete wall	mkr	marker	uk	unknown
d	depth/deep	no	number	ver	vertical
dpc	damp proof course	ol	outlet level	vp	vent pipe
dp	down pipe	oh	overhead	wpf	wooden panel fence
dk	drop kerb	pal	pallisade	wsv	water valve
dia	diameter	prf	post & rail fence	wl	water level
dc	drainage channel	pwf	post & wire fence	wc	window cill height
dh	door height	pst	post	wh	window head height

coniferous
deciduous
+(10.00) ceiling height
+ 10.00 floor level

Key to Underground Services

Foul Sewer
Foul Sewer from records/assumed
Surface water Sewer
Surface water Sewer from records/assumed
Pumped waste water
Pumped waste water from records/assumed
Telecommunication (BT)
Telecommunication (CATV)
Telecommunication (other)
Gas
Traffic control
Street lighting
Electric low voltage
Electric high voltage
Water
Oil/fuel
Unknown utility

Please note that not all buried pipes, cables and ducts can be detected and mapped in consideration of their depth, location, material type, geology and proximity to other utilities.

Location of utilities shown existing on or serving the surveyed property as determined by:
(a) Observed evidence.
(b) Observed evidence together with evidence from plans obtained from utility companies or provided by client, and markings by utility companies and other appropriate sources (with reference as to the source of information).
• Manholes, catch basins, valve vaults and other surface indications of subterranean uses;
• Wires and cables (including their function, if readily identifiable) crossing the surveyed property, and all poles on or near the surveyed property.
• Utility company installations on the surveyed property. Note – source information from plans and markings will be combined with observed evidence of utilities to develop a view of those underground utilities. However, lacking excavation, the exact location of underground features cannot be accurately, completely and reliably depicted. Where additional or more detailed information is required, the client is advised that excavation may be necessary.

approved	revision no	date	surveyed by	drawn by	checked	revisions

AUTOCAD

client
M. SCOTT PROPERTIES

project
LAND EAST OF
LANDERMERE ROAD
THORPE-LE-SOKEN C16 0NB

drawing title
SITE PLAN

surv-aid limited
Reality captured for design
T: 07747 608949 E: mail@surv-aid.co.uk

drawing number:
401/011/01

scale 1:500
date 01.03.16
surveyed IJM
drawn IJM

rev

A0 original sheet size

(c) Crown copyright and database rights 2016 Ordnance Survey 100022432 | Date: 25/02/16 | Scale: 1:1250 | Map Centre: 618679,222587 | Data updated: 04/12/15 | Our Ref: 176554 - 2 | Wastewater Plan A1

Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main (Colour denotes effluent type)
Private Sewer (Colour denotes effluent type)
Decommissioned Sewer (Colour denotes effluent type)

Outfall (Colour denotes effluent type)
Inlet (Colour denotes effluent type)
Manhole (Colour denotes effluent type)
Sewage Treatment Works
Pumping Station

[redacted]

S771

love every drop
anglianwater

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert
1500	618162	222845	F	-	-	-
2202	618078	222274	F	-	-	-
2301	618088	222354	F	-	-	-
2302	618098	222370	F	-	-	-
2401	618098	222452	F	-	-	-
2501	618020	222556	F	-	-	-
2601	618088	222630	F	-	-	-
3401	618084	222431	F	-	-	-
3402	618087	222434	F	-	-	-
3403	618042	222492	F	-	-	-
3404	618008	222412	F	-	-	-
3501	618088	222577	F	-	-	-
3502	618026	222500	F	-	-	-
3503	618007	222516	F	-	-	-
3601	618042	222626	F	-	-	-
3602	618026	222617	F	-	-	-
4401	618403	222470	F	-	-	-
4402	618438	222470	F	-	-	-
4501	618420	222526	F	-	-	-
4502	618448	222526	F	-	-	-
4503	618466	222517	F	-	-	-
4601	618466	222677	F	-	-	-
7301	618089	222338	F	-	-	-
8202	618028	222300	F	-	-	-
8203	618054	222296	F	-	-	-
8301	618051	222322	F	-	-	-
9201	618001	222278	F	-	-	-
2253	618014	222288	S	-	-	-
2255	618067	222274	S	-	-	-
2256	618019	222296	S	-	-	-
3451	618090	222498	S	-	-	-
3452	618088	222498	S	-	-	-
3453	618047	222496	S	-	-	-
3551	618089	222558	S	-	-	-
3552	618088	222580	S	-	-	-
3554	618022	222510	S	-	-	-
3555	618014	222517	S	-	-	-
4451	618403	222497	S	-	-	-
4452	618451	222496	S	-	-	-
4551	618444	222532	S	-	-	-
4552	618414	222526	S	-	-	-
5551	618675	222536	S	-	-	-
5552	618604	222500	S	-	-	-

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

GeoReports

James Howard
Cambridge House
Lanwades Business Park
Kentford
Newmarket
Suffolk
CB8 7PN

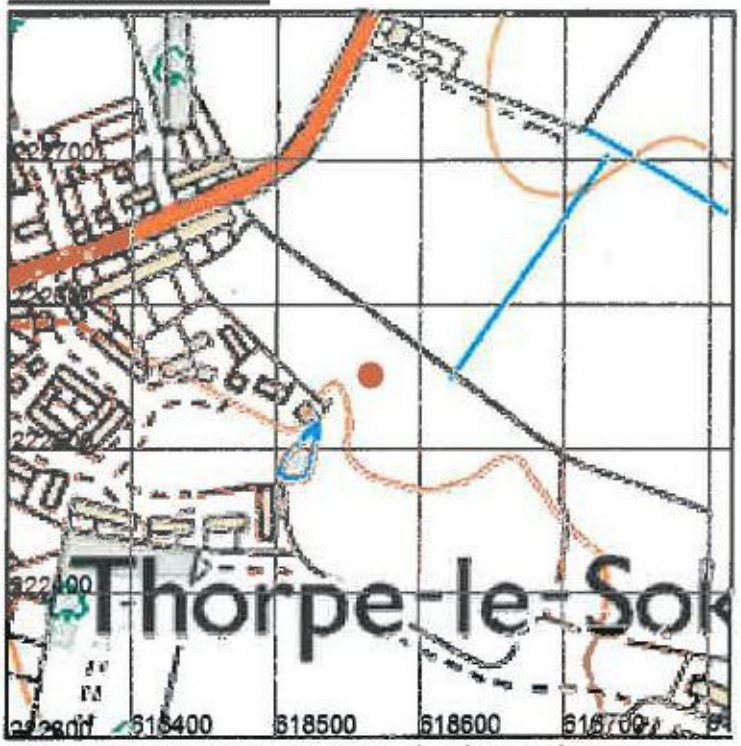
Infiltration SuDS GeoReport:

This report provides information on the suitability of the subsurface for the installation of infiltration sustainable drainage systems (SuDS). It provides information on the properties of the subsurface with respect to significant constraints, drainage, ground stability and groundwater quality protection.

Report Id: *GR_213283/1*

Client reference: S771 BGS JOH

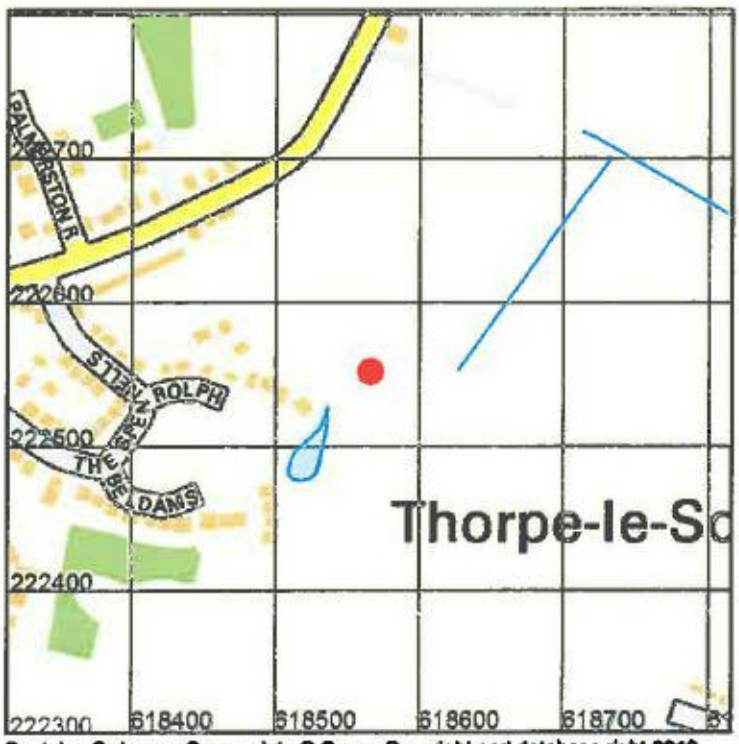
Search location



Point centred at:
618565,222552

Search location indicated in red

Scale: 1:5 000 (1cm = 50 m)



OS Street View: Scale: 1:5 000 (1cm = 50 m)

Assessment for an infiltration sustainable drainage system

Introduction

Sustainable drainage systems (SuDS) are drainage solutions that manage the volume and quality of surface water close to where it falls as rain. They aim to reduce flow rates to rivers, increase local water storage capacity and reduce the transport of pollutants to the water environment. There are four main types of SuDS, which are often designed to be used in sequence. They comprise:

- **source control:** systems that control the rate of runoff
- **pre-treatment:** systems that remove sediments and pollutants
- **retention:** systems that delay the discharge of water by providing surface storage
- **infiltration:** systems that mimic natural recharge to the ground.

This report focuses on infiltration SuDS. It provides subsurface information on the properties of the ground with respect to drainage, ground stability and groundwater quality protection. It is intended principally for those involved in the preliminary assessment of the suitability of the ground for infiltration SuDS, and those involved in assessing proposals from others for sustainable drainage, but it may also be useful to help house-holders judge whether or not further professional advice should be sought. If in doubt, users should consult a suitably-qualified professional about the results in this report before making any decisions based upon it.

This GeoReport is structured in two parts:

- **Part 1. Summary data.**

  Comprises three maps that summarise the data contained within Part 2.

- **Part 2. Detailed data.**

  Comprises a further 24 maps in four thematic sections:

  - **Very significant constraints.** Maps highlight areas where infiltration may result in adverse impacts due to factors including: ground instability (soluble rocks, non-coal shallow mining and landslide hazards); persistent shallow groundwater, or the presence of made ground, which may represent a ground stability or contamination hazard.
  - **Drainage potential.** Maps indicate the drainage potential of the ground, by considering subsurface permeability, depth to groundwater and the presence of floodplain deposits.
  - **Ground stability.** Maps indicate the presence of hazards that have the potential to cause ground instability resulting in damage to some buildings and structures, if water is infiltrated to the ground.
  - **Groundwater protection.** Maps provide key indicators to help determine whether the groundwater may be susceptible to deterioration in quality as a result of infiltration.

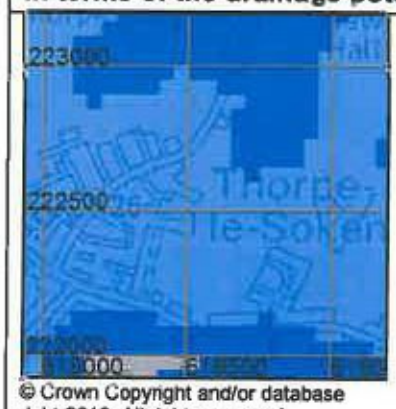
This report considers the suitability of the subsurface for the installation of infiltration SuDS, such as soakaways, infiltration basins or permeable pavements. It provides subsurface data to indicate whether, and which type of infiltration system may be appropriate. It does not state that infiltration SuDS are, or are not, appropriate as this is highly dependent on the design of the individual system. This report therefore describes the subsurface conditions at the site, allowing the reader to determine the suitability of the site for infiltration SuDS.

The map and text data in this report is similar to that provided in the '*Infiltration SuDS Map: Detailed*' national map product. For further information about the data, consult the '***User Guide for the Infiltration SuDS Map: Detailed***', available from http://nora.nerc.ac.uk/16618/.

PART 1: SUMMARY DATA

This section provides a summary of the data on the following pages.

In terms of the drainage potential, is the ground suitable for infiltration SuDS?



- Highly compatible for infiltration SuDS.
  The subsurface is likely to be suitable for free-draining infiltration SuDS.
- Probably compatible for infiltration SuDS.
  The subsurface is probably suitable although the design may be influenced by the ground conditions.
- Opportunities for bespoke infiltration SuDS.
  The subsurface is potentially suitable although the design will be influenced by the ground conditions.
- Very significant constraints are indicated.
  There is a very significant potential for one or more hazards associated with infiltration.

Is ground instability likely to be a problem?

- Increased infiltration is very unlikely to result in ground instability.
- Ground instability problems may be present or anticipated, but increased infiltration is unlikely to result in ground instability
- Ground instability problems are probably present. Increased infiltration may result in ground instability.
- There is a very significant potential for one or more geohazards associated with infiltration.

Is the groundwater susceptible to deterioration in quality?

- The groundwater is not expected to be especially vulnerable to contamination.
- The groundwater may be vulnerable to contamination.
- The groundwater is likely to be vulnerable to contaminants.
- Made ground is present at the surface. Infiltration may increase the possibility of remobilising pollutants.

PART 2: DETAILED DATA

This section provides further information about the properties of the ground and will help assess the suitability of the ground for infiltration SuDS.

Section 1. Very significant constraints

Where maps are overlain by grey polygons, geological or hydrogeological hazards may exist that could be made worse by infiltration. The following hazards are considered:

- soluble rocks
- landslides
- shallow mining
- shallow groundwater
- made ground

For more information read 'Explanation of terms' at the end of this report.

Soluble rock hazard

☐ Very significant soluble rock hazard.

Soluble rocks are present with a very significant possibility of localised subsidence that could be initiated or made worse by infiltration. The site investigation should consider whether the potential for or the consequences of subsidence as a result of infiltration are significant.

☐ Very significant soluble rock hazards are not present; however this hazard may still need to be considered. See Part 3.

Landslide hazard

☐ Very significant landslide hazard.

Slope instability problems are almost certainly present and may be active. An increase in moisture content as a result of infiltration may cause the slope to fail. The site investigation should consider whether the potential for or the consequences of landslide as a result of infiltration are significant.

☐ Very significant landslide hazards are not present; however this hazard may still need to be considered. See Part 3.

Shallow mining hazard

■ Very significant mining hazard.

Shallow mining is likely to be present with a very significant possibility of localised subsidence that could be initiated or made worse by increased infiltration. Also, infiltration may increase the possibility of remobilising pollutants. The site investigation should consider whether the potential for or consequences of subsidence and/or remobilisation of pollutants as a result of infiltration are significant.

☐ Very significant mining hazards are not present; however this hazard may still need to be considered. See Part 3.

Persistent shallow groundwater

■ Very high likelihood of persistent or seasonally shallow groundwater.

Persistent or seasonally shallow groundwater is likely to be present. Infiltration may increase the likelihood of soakaway inundation, or groundwater emergence at the surface. The site investigation should consider whether the potential for or the consequences of groundwater level rise as a result of infiltration are significant.

☐ See Part 2 for the likely depth to water table.

Made ground

■ Made ground present.

Made ground is present at the surface. Infiltration may affect ground stability or increase the possibility of remobilising pollutants. The site investigation should consider whether the potential for or consequences of ground instability and/or pollutant leaching as a result of infiltration are significant.

☐ None recorded

Section 2. Drainage potential

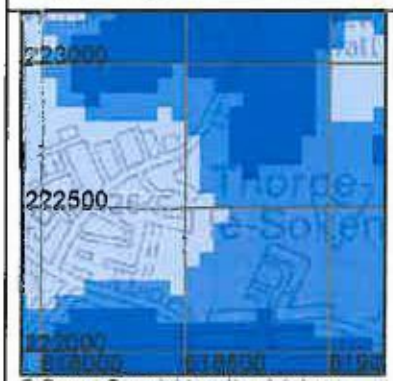
The following pages contain maps that will help you assess the drainage potential of the ground by considering the:

- depth to water table
- permeability of the superficial deposits
- thickness of the superficial deposits
- permeability of the bedrock
- presence of floodplains

Superficial deposits are not present everywhere and therefore some areas of the *superficial deposit permeability* map may not be coloured. Where this is the case, the *bedrock permeability* map shows the likely permeability of the ground. Superficial deposits in some places are very thin and hence in these places you may wish to consider both the permeability of the superficial deposits and the permeability of the bedrock. The *superficial thickness* map will tell you whether the superficial deposits are thin (< 3 m thick) or thick (>3 m). Where they are over 3 m thick, the permeability of the bedrock may not be relevant.

For more information read 'Explanation of terms' at the end of this report.

Depth to groundwater table



	Groundwater is likely to be **more than 5 m** below the ground surface throughout the year.
	Groundwater is likely to be between **3 and 5 m** below the ground surface for at least part of the year.
	Groundwater is likely to be **less than 3 m** below the ground surface for at least part of the year.

Superficial deposit permeability

Superficial deposits are likely to be **free-draining**.

The superficial deposit permeability is **spatially variable**, but likely to permit moderate infiltration.

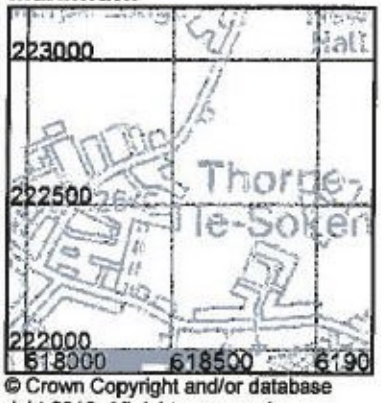
Superficial deposits are likely to be **poorly draining**.

These maps show the permeability range that is summarised above.

- Very Low
- Low
- Moderate
- High
- Very High

Minimum

Maximum

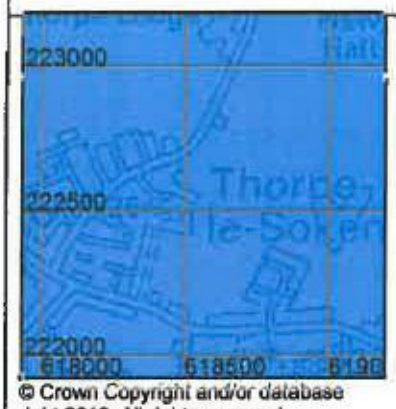


Superficial deposit thickness

The thickness of superficial deposits is **< 3 m** and hence the permeability of the ground may be dependent on both the superficial deposits (where present) and underlying bedrock (see below).

The thickness of superficial deposits is **> 3 m** and hence the permeability of the superficial deposits is likely to determine the permeability of the ground.

Bedrock permeability



Bedrock deposits are likely to be **free-draining**.

The bedrock permeability is **spatially variable**, but likely to permit moderate infiltration.

Bedrock deposits are likely to be **poorly draining**.

These maps show the permeability range that is summarised above.

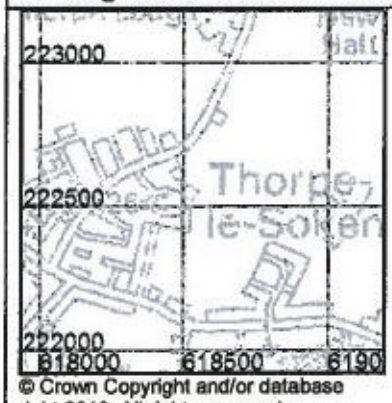
Key

- Very Low
- Low
- Moderate
- High
- Very High

Minimum

Maximum

Geological indicators of flooding



Superficial floodplain deposits or low-lying coastal areas have been identified. Groundwater levels may rise in response to high river or tide levels, potentially causing inundation of subsurface infiltration SuDS.

Section 3. Ground stability

The following pages contain maps that will help you assess whether infiltration may impact the stability of the ground. They consider hazards associated with:

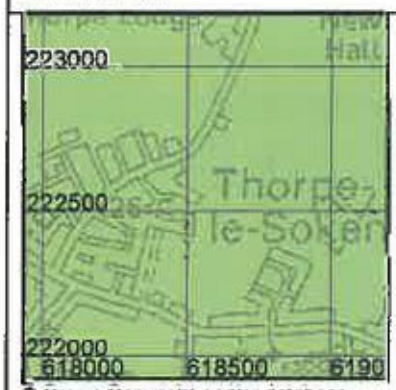
- soluble rocks
- landslides
- shallow mining
- running sands
- swelling clays
- compressible ground, and
- collapsible ground

In the following maps, geohazards that are identified in green are unlikely to prevent infiltration SuDS from being installed, but they should be considered during design. For more information read 'Explanation of terms' at the end of this report.

Soluble rocks

	Increased infiltration is unlikely to result in subsidence.
	Increased infiltration is unlikely to cause localised subsidence, but potential impacts should be considered.
	Increased infiltration may result in localised subsidence. The potential for or the consequences of subsidence associated with soluble rocks should be **considered.**
	Very significant possibility of localised subsidence that could be initiated or made worse by infiltration.

Landslides



- Increased infiltration is unlikely to lead to slope instability.
- Slope instability problems may be present or anticipated, but increased infiltration is unlikely to cause instability
- Slope instability problems are probably present or have occurred in the past, and increased infiltration may result in slope instability.
- Slope instability problems are almost certainly present and may be active. An increase in moisture content as a result of infiltration may cause the slope to fail.

Shallow mining

- Increased infiltration is unlikely to lead to subsidence.
- Shallow mining is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Shallow mining could be present with a significant possibility that localised subsidence could be initiated or made worse by increased infiltration.
- Shallow mining is likely to be present, with a very significant possibility that localised subsidence may be initiated or made worse by increased infiltration.

Running sand

- Increased infiltration is unlikely to cause ground collapse associated with running sands.
- Running sand is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Significant possibility for running sand problems. Increased infiltration may result in a geohazard.

Swelling clays

- Increased infiltration is unlikely to cause shrink-swell ground movement.
- Ground is susceptible to shrink-swell ground movement. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Ground is susceptible to shrink-swell ground movement. Increased infiltration may result in a geohazard.

Compressible ground

- Increased infiltration is unlikely to lead to ground compression.
- Compressibility and uneven settlement hazards are probably present. Increased infiltration may result in a geohazard.

Collapsible ground

- Increased infiltration is unlikely to result in subsidence.
- Deposits with potential to collapse when loaded and saturated are possibly present in places. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Deposits with potential to collapse when loaded and saturated are probably present in places. Increased infiltration may result in a geohazard.

Section 4. Groundwater quality protection

The following pages contain maps showing some of the information required to ensure the protection of groundwater quality. Data presented includes:

- groundwater source protection zones (Environment Agency data)
- predominant flow mechanism
- made ground

For more information read 'Explanation of terms' at the end of this report.

Groundwater source protection zones

- Groundwater is not within a source protection zone.
- Source protection zone IV
- Source protection zone III
- Source protection zone II
- Source protection zone I.

Predominant flow mechanism

- Water is likely to percolate through the unsaturated zone to the groundwater through either the pore space in granular media or through porespace and fractures; these processes have some potential for contaminant removal and breakdown.
- Water is likely to percolate through the unsaturated zone to the groundwater through fractures, a process which has little potential for contaminant removal and breakdown.

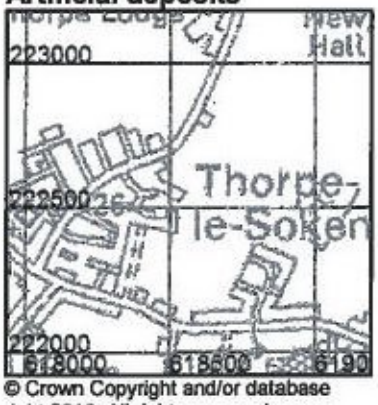
Made ground

Made ground is present at the surface. Infiltration may increase the possibility of remobilising pollutants.

Section 5. Geological Maps

The following maps show the artificial, superficial and bedrock geology within the area of interest.

Artificial deposits



Superficial deposits

Bedrock

Fault

Coal, ironstone or mineral vein

Note: Faults and Coals, ironstone & mineral veins are shown for illustration and to aid interpretation of the map. Not all such features are shown and their absence on the map face does not necessarily mean that none are present

Key to Artificial deposits:
No deposits recorded by BGS in the search area

Key to Superficial deposits:

Map colour	Computer Code	Rock name	Rock type
	KGCA-XSV	KESGRAVE CATCHMENT SUBGROUP	SAND AND GRAVEL [UNLITHIFIED DEPOSITS CODING SCHEME]

Key to Bedrock geology:

Map colour	Computer Code	Rock name	Rock type
	THAM-SICL	THAMES GROUP	CLAY, SILTY

Limitations of this report:

- This report is concerned with the potential for infiltration-to-the-ground to be used as a SuDS technique at the site described. It only considers the subsurface beneath the search area and does NOT consider potential surface or subsurface impacts outside of that area.
- This report is NOT an alternative for an on-site investigation or soakaway test, which might reach a different conclusion.
- This report must NOT be used to justify disposal of foul waste or grey water.
- This report is based on and limited to an interpretation of the records held by the British Geological Survey (BGS) at the time the search is performed. The datasets used (with the exception of that showing depth to water table) are based on 1:50 000 digital geological maps and not site-specific data.
- Other more specific and detailed ground instability information for the site may be held by BGS, and an assessment of this could result in a modified assessment.
- To interpret the maps correctly, the report must be viewed and printed in colour.
- The search does NOT consider the suitability of sites with regard to:
    - previous land use,
    - potential for, or presence of contaminated land
    - presence of perched water tables
    - shallow mining hazards relating to coal mining. Searches of coal mining should be carried out via The Coal Authority Mine Reports Service: www.coalminingreports.co.uk.
    - made ground, where not recorded
    - proximity to landfill sites (searches for landfill sites or contaminated land should be carried out through consultation with local authorities/Environment Agency)
    - zones around private water supply boreholes that are susceptible to groundwater contamination.
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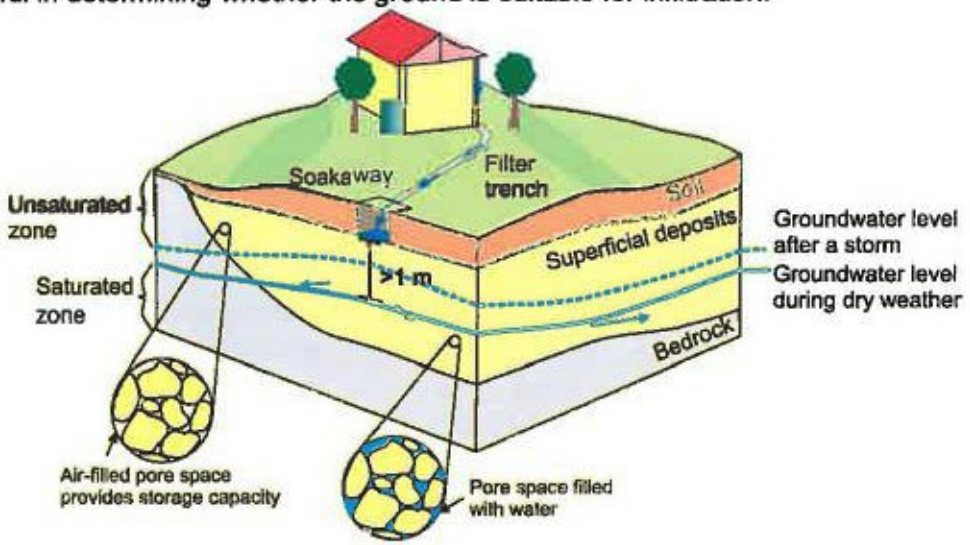
Explanation of terms

Depth to groundwater

In the shallow subsurface, the ground is commonly unsaturated with respect to water. Air fills the spaces within the soil and the underlying superficial deposits and bedrock. At some depth below the ground surface, there is a level below which these spaces are full of water. This level is known as the groundwater level, and the water below it is termed the groundwater. When water is infiltrated, the groundwater level may rise temporarily. To ensure that there is space in the unsaturated zone to accommodate this, there should be a minimum thickness of 1 m between the base of the infiltration system and the water table. An estimate of the *depth to groundwater* is therefore useful in determining whether the ground is suitable for infiltration.



Groundwater flooding

Groundwater flooding occurs when a rise in groundwater level results in very shallow groundwater or the emergence of groundwater at the surface. If infiltration systems are installed in areas that are susceptible to groundwater flooding, it is possible that the system could become inundated. The susceptibility map seeks to identify areas where the geological conditions and water tables indicate that groundwater level rise could occur under certain circumstances. A high susceptibility to groundwater flooding classification does not mean that groundwater flooding has ever occurred in the past, or will do so in the future as the susceptibility maps do not contain information on how often flooding may occur. The susceptibility maps are designed for planning; identifying areas where groundwater flooding might be an issue that needs to be taken into account.

Geological indicators of flooding

In floodplain deposits, groundwater level can be influenced by the water level in the adjacent river. Groundwater level may increase during periods of fluvial flood and therefore this should be taken into account when designing infiltration systems on such deposits. The *geological indicators of flooding* dataset shows where there is geological evidence (floodplain deposits) that flooding has occurred in the past.

For further information on flood-risk, the likely frequency of its recurrence in relation to any proposed development of the site, and the status of any flood prevention measures in place, you are advised to contact the local office of the Environment Agency (England and Wales) at www.environment-agency.gov.uk/ or the Scottish Environment Protection Agency (Scotland) at www.sepa.org.uk.

Artificial ground

Artificial ground comprises deposits and excavations that have been created or modified by human activity. It includes ground that is worked (quarries and road cuttings), infilled (back-filled quarries), landscaped (surface re-shaping), disturbed (near surface mineral workings) or classified as made ground (embankments and spoil heaps). The composition and properties of artificial ground are often unknown. In particular, the permeability and chemical composition of the artificial ground should be determined to ensure that the ground will drain and that any contaminants present will not be remobilised.

Superficial permeability

Superficial deposits are those geological deposits that were formed during the most recent period of geological time (as old as 2.6 million years before present). They generally comprise relatively thin deposits of gravel, sand, silt and clay and are present beneath the pedological soil in patches or larger spreads over much of Britain. The ease with which water can percolate through these deposits is controlled by their permeability and varies widely depending on their composition. Those deposits comprising clays and silts are less permeable and thus infiltration is likely to be slow, such that water may pool on the surface. In comparison, deposits comprising sands and gravels are more permeable allowing water to percolate freely.

Bedrock permeability

Bedrock forms the main mass of rock forming the Earth. It is present everywhere, commonly beneath superficial deposits. Where the superficial deposits are thin or absent, the ease with which water will percolate into the ground depends on the permeability of the bedrock.

Natural ground instability

Natural ground instability refers to the propensity for upward, lateral or downward movement of the ground that can be caused by a number of natural geological hazards (e.g. ground dissolution/compressible ground). Some movements associated with particular hazards may be gradual and of millimetre or centimetre scale, whilst others may be sudden and of metre or tens of metres scale. Significant natural ground instability has the potential to cause damage to buildings and structures, especially when the drainage characteristics of a site are altered. It should be noted, however, that many buildings, particularly more modern ones, are built to such a standard that they can remain unaffected in areas of significant ground movement.

Shrink-swell

A shrinking and swelling clay changes volume significantly according to how much water it contains. All clay deposits change volume as their water content varies, typically swelling in winter and shrinking in summer, but some do so to a greater extent than others. Contributory circumstances could include drought, leaking service pipes, tree roots drying-out the ground or changes to local drainage patterns, such as the creation of soakaways. Shrinkage may remove support from the foundations of buildings and structures, whereas clay expansion may lead to uplift (heave) or lateral stress on part or all of a structure; any such movements may cause cracking and distortion.

Landslides (slope stability)

A landslide is a relatively rapid outward and downward movement of a mass of ground on a slope, due to the force of gravity. A slope is under stress from gravity but will not move if its strength is greater than this stress. If the balance is altered so that the stress exceeds the strength, then movement will occur. The stability of a slope can be reduced by removing ground at the base of the slope, by placing material on the slope, especially at the top, or by increasing the water content of the materials forming the slope. Increase in subsurface water content beneath a soakaway could increase susceptibility to landslide hazards. The assessment of landslide hazard refers to the stability of the present land surface. It does not encompass a consideration of the stability of excavations.

Soluble rocks (dissolution)

Some rocks are soluble in water and can be progressively removed by the flow of water through the ground. This process tends to create cavities, potentially leading to the collapse of overlying materials and possibly subsidence at the surface. The release of water into the subsurface from infiltration systems may increase the dissolution of rock or destabilise material above or within a cavity. Dissolution cavities may create a pathway for rapid transport of contaminated water to an aquifer or water course.

Compressible ground
Many ground materials contain water-filled pores (the spaces between solid particles). Ground is compressible if a building (or other load) can cause the water in the pore space to be squeezed out, causing the ground to decrease in thickness. If ground is extremely compressible the building may sink. If the ground is not uniformly compressible, different parts of the building may sink by different amounts, possibly causing tilting, cracking or distortion. The compressibility of the ground may alter as a result of changes in subsurface water content caused by the release of water from soakaways.

Collapsible deposits
Collapsible ground comprises certain fine-grained materials with large pore spaces (the spaces between solid particles). It can collapse when it becomes saturated by water and/or a building (or other structure) places too great a load on it. If the material below a building collapses it may cause the building to sink. If the collapsible ground is variable in thickness or distribution, different parts of the building may sink by different amounts, possibly causing tilting, cracking or distortion. The subsurface underlying a soakaway will experience an increase in water content that may affect the stability of the ground. This hazard is most likely to be encountered only in parts of southern England.

Running sand
Running sand conditions occur when loosely-packed sand, saturated with water, flows into an excavation, borehole or other type of void. The pressure of the water filling the spaces between the sand grains reduces the contact between the grains and they are carried along by the flow. This can lead to subsidence of the surrounding ground. Running sand is potentially hazardous during the drainage system installation. During installation, excavation of the ground may create a space into which sand can flow, potentially causing subsidence of surrounding ground.

Shallow mining hazards (non coal)
Current or past underground mining for coal or for other commodities can give rise to cavities at shallow or intermediate depths, which may cause fracturing, general settlement, or the formation of crown-holes in the ground above. Spoil from mineral workings may also present a pollution hazard. The release of water into the subsurface from soakaways may destabilise material above or within a cavity. Cavities arising as a consequence of mining may also create a pathway for rapid transport of contaminated water to an aquifer or watercourse. The mining hazards map is derived from the geological map and considers the potential for subsidence associated with mining on the basis of geology type. Therefore if mining is known to occur within a certain rock, the map will highlight the potential for a hazard within the area covered by that geology.

For more information regarding underground and opencast **coal mining**, the location of mine entries (shafts and adits) and matters relating to subsidence or other ground movement induced by **coal mining** please contact the Coal Authority, Mining Reports, 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG; telephone 0845 762 6848 or at www.coal.gov.uk. For more information regarding other types of mining (i.e. non-coal), please contact the British Geological Survey.

Groundwater source protection zones

In England and Wales, the Environment Agency has defined areas around wells, boreholes and springs that are used for the abstraction of public drinking water as source protection zones. In conjunction with Groundwater Protection Policy the zones are used to restrict activities that may impact groundwater quality, thereby preventing pollution of underlying aquifers, such that drinking water quality is upheld. The Environment Agency can provide advice on the location and implications of source protection zones in your area (www.environment-agency.gov.uk/)

Contact Details

Keyworth (KW) Office
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Environmental Science Centre
Nicker Hill
Keyworth
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NG12 5GG
Tel: 0115 9363143
Fax: 0115 9363276
Email: enquiries@bgs.ac.uk

Wallingford (WL) Office
British Geological Survey
Maclean Building
Wallingford
Oxford
OX10 8BB
Tel: 01491 838800
Fax: 01491 692345
Email: hydroenq@bgs.ac.uk

Murchison House (MH) Office
British Geological Survey
Murchison House
West Mains Road
Edinburgh
EH9 3LA
Tel: 0131 650 0207
Fax: 0131 650 0252
Email: enquiry@bgs.ac.uk

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- The data, information and related records supplied in this Report by BGS can only be indicative and should not be taken as a substitute for specialist interpretations, professional advice and/or detailed site investigations. You must seek professional advice before making technical interpretations on the basis of the materials provided.
- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.
- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.
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- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
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- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
- Note that for some sites, the latest available records may be quite historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

Report issued by
BGS Enquiry Service

geosphere environmental ltd Investigate design resolve

LEGEND:

Site boundary

Trial pit location

N

geosphere environmental ltd
Brightwell Barn, Ipswich Road, Brightwell, Suffolk, IP10 0BJ
[redacted]

SITE	TITLE	PROJECT NO.	DRAWING NO.	DATE
Landermere Road, Thorpe-le-Soken, CO16 0LW	Exploratory Hole Location Plan	1696,EC,AR,DS,SK	002 / Rev 0	March 2016
	CLIENT: Scott Properties Ltd	DRAWN BY: PC	CHECKED	SCALE: Not to scale

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ
[redacted]

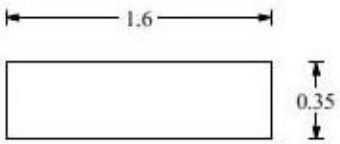
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP1**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.30	TOPSOIL (Brown very clayey sand with rootlets)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.30-1.50	Pale brown/yellow/grey mottled slightly silty CLAY				
					Trial pit completed at 1.5m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ

[redacted]

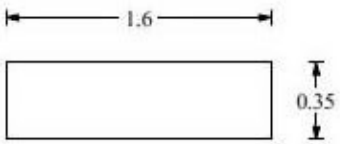
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP2**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.30	TOPSOIL (Brown very clayey sand with rootlets)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.30-1.00	Pale brown/yellow/grey/dark orange mottled slightly silty CLAY				
					Trial pit completed at 1.0m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ

[redacted]

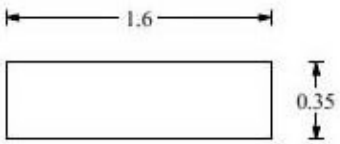
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP3**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.40	TOPSOIL (Very clayey sand)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.40-1.00	Pale brown/yellow/grey mottled CLAY				
					Trial pit completed at 1.0m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ

[redacted]

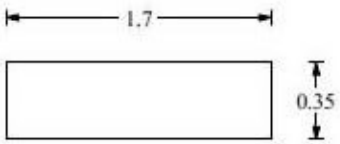
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP4**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.40	TOPSOIL (Very clayey sand)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.40-1.50	Pale brown CLAY				
					Trial pit completed at 1.5m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ

[redacted]

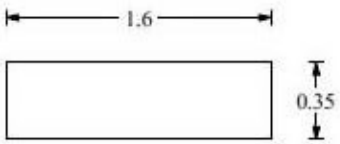
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP5**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.40	TOPSOIL (Very clayey sand)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.40-1.30	Pale brown CLAY				
					Trial pit completed at 1.3m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ
[redacted]

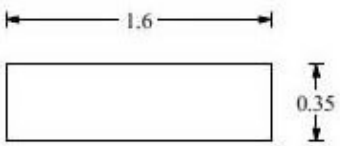
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP6**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.30	TOPSOIL (Very clayey sand)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.30-1.50	Pale brown CLAY				Trial pit completed at 1.5m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ

[redacted]

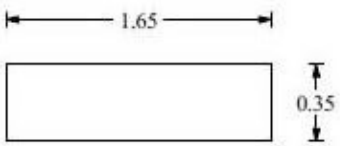
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP7**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.30	TOPSOIL (Very clayey sand)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.30-1.50	Pale brown CLAY				
					Trial pit completed at 1.5m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ

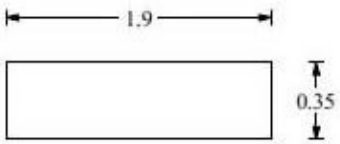
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP8**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.30	TOPSOIL (Very clayey sand)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.30-1.50	Pale brown CLAY				
					Trial pit completed at 1.5m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ

[redacted]

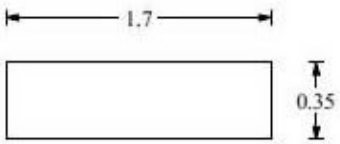
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP9**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.35	TOPSOIL (Dark grey clay with occasional gravel of fine flint)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.35-1.50	Orange brown slightly sandy CLAY with occasional dark orange brown/pale grey partings				
	1.20 Occasional partings of pale grey gravel of fine siltstone present with depth				
	1.30 Shear surface with pale blue grey staining on surface				
					Trial pit completed at 1.5m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ
[redacted]

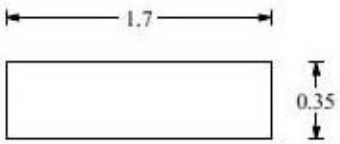
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP10**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.30	TOPSOIL (Very clayey sand)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.30-1.50	Pale brown CLAY				Trial pit completed at 1.5m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ
[redacted]

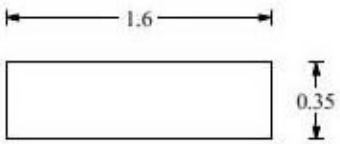
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP11**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.30	TOPSOIL (Very clayey sand)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.30-1.50	Pale brown CLAY				Trial pit completed at 1.5m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ

[redacted]

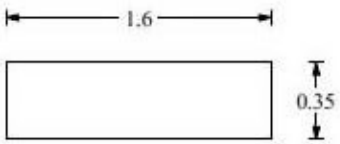
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Landermere Road, Thorpe-le-Soken	Scott Properties	**TP12**

Job No	Date	Ground Level (m)	Co-Ordinates ()
1696,EC,AR,DS,SK	12-03-16 12-03-16		

Fieldwork By	Logged By	Sheet
DRILLT	SG	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.30	TOPSOIL (Very clayey sand)				No groundwater encountered during excavation No collapse of sidewalls during excavation
0.30-1.50	Pale brown CLAY				
					Trial pit completed at 1.5m



Shoring/Support: None
Stability: Stable

All dimensions in metres Scale 1:14.1666666666667	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

geosphere environmental ltd
Geosphere Environmental Ltd, Brightwell Barns, Ipswich Road, Brightwell, Suffolk, IP10 0BJ
[redacted]

Pit Size [m]		
Length	Width	Depth
1.60	0.35	1.50

Time [min]	Depth to Water [mbgl]	
0.0	0.87	
0.5	0.87	
1.0	0.87	
2.0	0.87	
3.0	0.87	
4.0	0.87	
5.0	0.87	
10.0	0.87	
15.0	0.87	
20.0	0.87	
30.0	0.87	
45.0	0.87	
60.0	0.87	
120.0	0.87	
180.0	0.87	
240.0	0.87	
300.0	0.87	
360.0	0.87	
420.0	0.87	

Pit TP2 **Run** 1 of 1

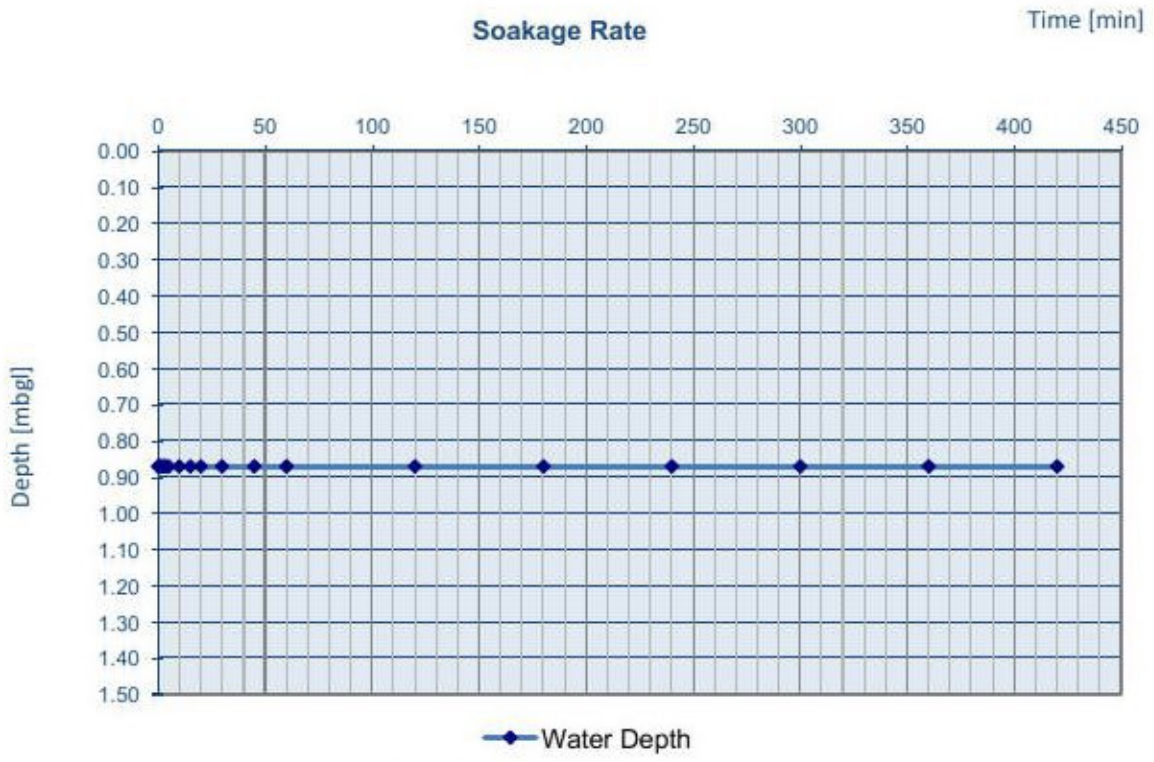
Test Date 12/03/2016

Groundwater Encountered at: n/a

Remarks:

It was not possible to undertake full-depth soakaway test. Maximum water depth achieved in the test = 0.87mbgl

Soakage Rate



mbgl - meters below ground level

SITE	CLIENT	REPORT NO	SITE SUPERVISION	CHECKED BY	DATE
Landermere Road, Thorpe-le-Soken	Scott Properties	1696,EC,AR,DS,SK	SG	SG	17 March 2016

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TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

geosphere environmental ltd
Geosphere Environmental Ltd, Brightwell Barns, Ipswich Road, Brightwell, Suffolk, IP10 0BJ
[redacted]

Pit Size [m]		
Length	Width	Depth
1.90	0.35	1.50

Time [min]	Depth to Water [mbgl]	
0.0	0.730	
0.5	0.730	
1.0	0.730	
2.0	0.730	
3.0	0.730	
4.0	0.735	
5.0	0.735	
10.0	0.735	
15.0	0.735	
20.0	0.735	
30.0	0.735	
45.0	0.735	
60.0	0.735	
120.0	0.735	
180.0	0.735	
240.0	0.735	
300.0	0.735	
360.0	0.735	
420.0	0.735	

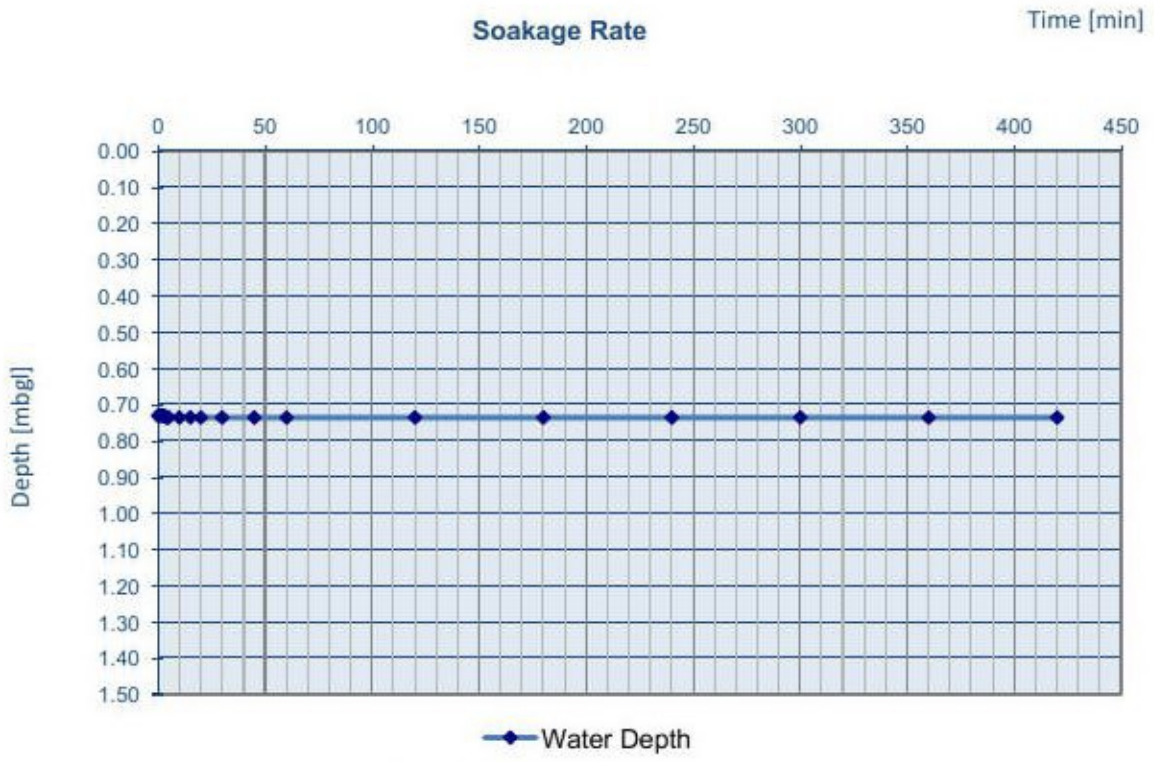
Pit TP8 **Run** 1 of 1

Test Date 12/03/2016

Groundwater Encountered at: n/a

Remarks:

It was not possible to undertake full-depth soakaway test. Maximum water depth achieved in the test = 0.735mbgl



mbgl - meters below ground level

SITE	CLIENT	REPORT NO	SITE SUPERVISION	CHECKED BY	DATE
Landermere Road, Thorpe-le-Soken	Scott Properties	1696,EC,AR,DS,SK	SG	SG	17 March 2016

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TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

geosphere environmental ltd
Geosphere Environmental Ltd, Brightwell Barns, Ipswich Road, Brightwell, Suffolk, IP10 0BJ
[redacted]

Pit Size [m]		
Length	Width	Depth
1.70	0.35	1.50

Time [min]	Depth to Water [mbgl]	
0.0	0.760	
0.5	0.760	
1.0	0.760	
2.0	0.760	
3.0	0.760	
4.0	0.760	
5.0	0.760	
10.0	0.760	
15.0	0.760	
20.0	0.760	
30.0	0.760	
45.0	0.760	
60.0	0.760	
120.0	0.760	
180.0	0.760	
240.0	0.760	
300.0	0.760	
360.0	0.760	
420.0	0.760	

Pit TP9 **Run** 1 of 1

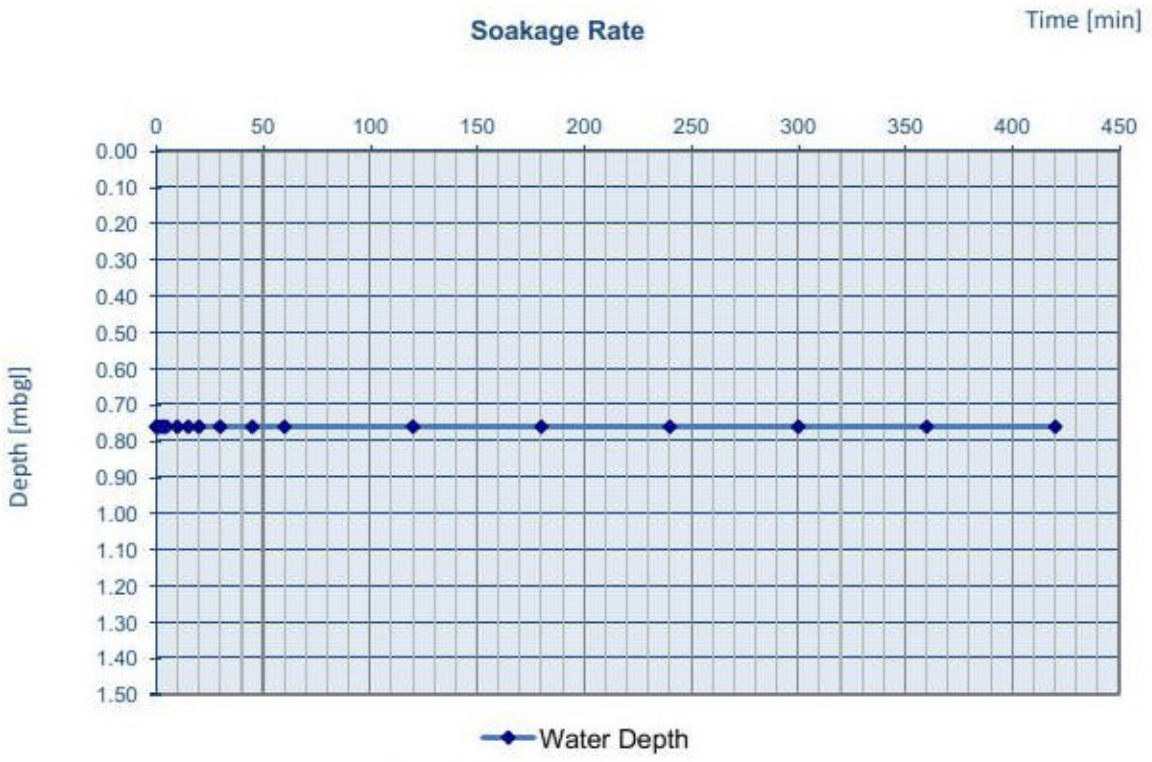
Test Date 12/03/2016

Groundwater Encountered at: n/a

Remarks:

It was not possible to undertake full-depth soakaway test. Maximum water depth achieved in the test = 0.76mbgl

Soakage Rate



mbgl - meters below ground level

SITE	CLIENT	REPORT NO	SITE SUPERVISION	CHECKED BY	DATE
Landermere Road, Thorpe-le-Soken	Scott Properties	1696,EC,AR,DS,SK	SG	SG	17 March 2016

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TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

geosphere environmental ltd
Geosphere Environmental Ltd, Brightwell Barns, Ipswich Road, Brightwell, Suffolk, IP10 0BJ
[redacted]

Pit Size [m]		
Length	Width	Depth
1.70	0.35	1.50

Time [min]	Depth to Water [mbgl]	
0.0	0.910	
0.5	0.910	
1.0	0.910	
2.0	0.910	
3.0	0.910	
4.0	0.910	
5.0	0.910	
10.0	0.910	
15.0	0.910	
20.0	0.910	
30.0	0.910	
45.0	0.910	
60.0	0.910	
120.0	0.910	
180.0	0.910	
240.0	0.910	
300.0	0.910	
360.0	0.910	
420.0	0.910	

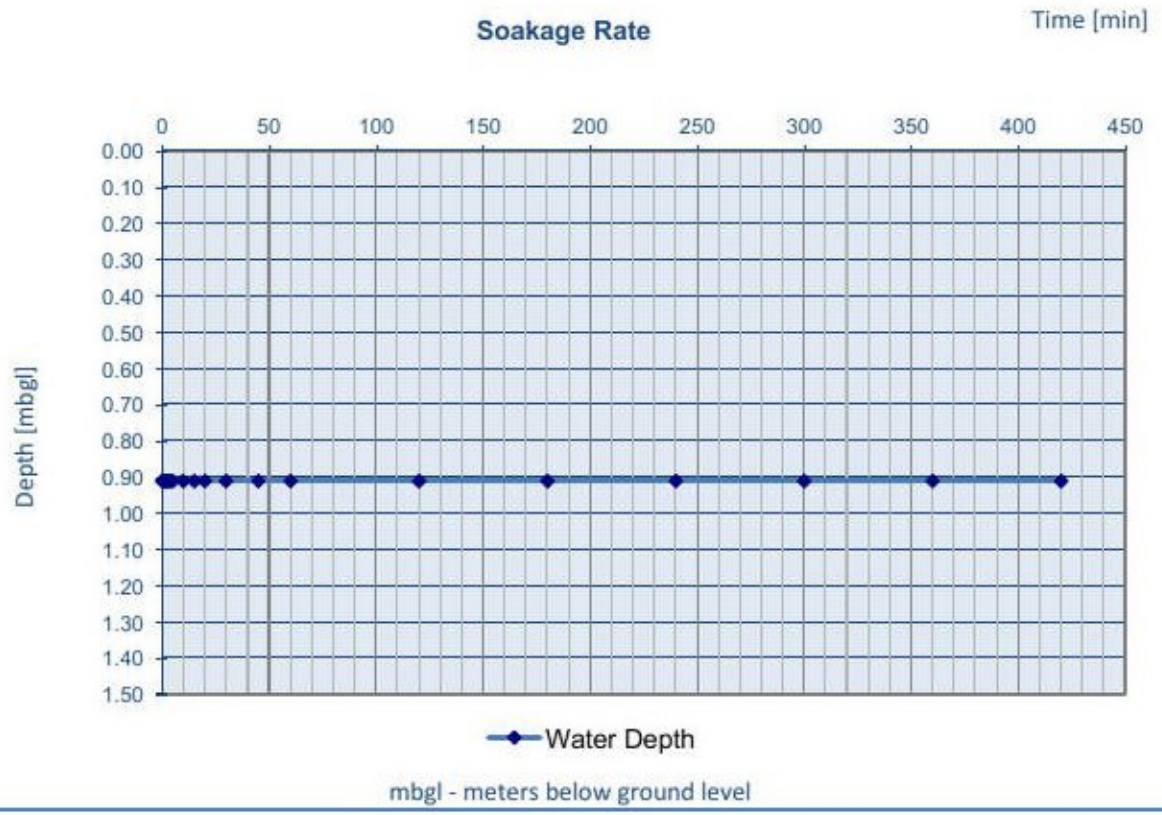
Pit TP10 **Run** 1 of 1

Test Date 12/03/2016

Groundwater Encountered at: n/a

Remarks:

It was not possible to undertake full-depth soakaway test. Maximum water depth achieved in the test = 0.91mbgl



mbgl - meters below ground level

SITE	CLIENT	REPORT NO	SITE SUPERVISION	CHECKED BY	DATE
Landermere Road, Thorpe-le-Soken	Scott Properties	1696,EC,AR,DS,SK	SG	SG	17 March 2016

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B Proposed Site

Masterplan
Surface Water Management Plan
Flow Calculations Maintenance
Schedules

0 5m 10m 15m 20m 25m
SCALE (1:500)

Surface Water Attenuation

Access to Field

Public Open Space

N

Indicative

Public Open Space

SCOTT PROPERTIES

PROPOSED DEVELOPMENT

LAND TO THE EAST OF
HENDERSON ROAD
THORPE-LE-SOKEN
ESSEX

SITE PLAN

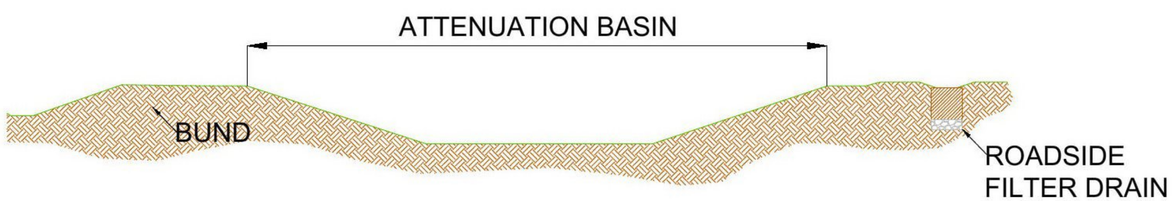
Tim Snow Architects
9A High Street, Brightlingsea
Colchester, Essex CO7 0AE
[redacted]

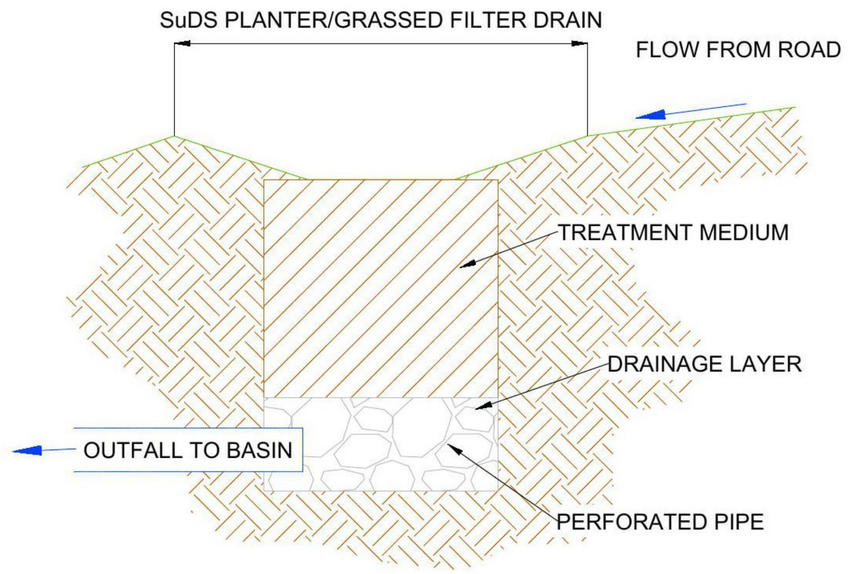
Scale: 1:500 @ A1
Date: JUNE 2021
Drawing No. 942/01 H

KEY

- ATTENUATION BASIN
- ROADSIDE FILTER DRAIN
- IMPERMEABLE CATCHMENT
- FLOW CONTROL
- GABION FILER BOX
- OVERLAND FLOW

NOTES





TYPICAL SECTION OF SuDS
PLANTER-GRASSED FILTER DRAIN

REV	DESCRIPTION	DE	DR	CH	DATE
P01	REVISED LAYOUT		JH		20/07/2021

DESIGNED BY	DRAWN BY	CHECKED BY
	DP	

SCALE @ A1 SIZE	DATE
D.N.S	20/12/2020

PROJECT TITLE
THORPE LE SOKEN

DRAWING TITLE
SURFACE WATER MANAGEMENT STRATEGY

CLIENT
SCOTT PROPERTIES LTD

CANNON
CONSULTING ENGINEERS
Highways, Transport & Infrastructure Planning
Peek House, 20 Eastcheap
London,
EC3M 1EB
Cambridge House, Lanwades
Business Park, Kentford,
Newmarket, CB8 7PN
[redacted]

DRAWING NUMBER	REV.
S771-PL-SK-350	P01

M:\S771 Landermere Road, Thorpe Le Soken, ESSEX\DRAWINGS\AUTOCAD\CURRENT DRGS\S771 - PL - SK - 350 - SW STRATEGY PHASE 2 P01

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	0.950	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	500.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SW1	0.092	5.00	25.750	1500	1.850
SW2	0.092	5.00	25.600	1500	1.850
SW3	0.092	5.00	25.000	1900	2.350
SW4	0.092	5.00	24.700	1900	2.350
SW5	0.092	5.00	24.150	1900	2.350
SW6	0.092	5.00	23.750	1900	2.350
SW7	0.092	5.00	22.800	1900	2.050
SW8	0.092	5.00	25.650	1500	1.760
SW9	0.092	5.00	25.500	1500	1.860
BASIN	0.092		22.000	1900	1.306

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1	SW1	SW2	35.000	0.030	23.900	23.750	0.150	233.3	500	5.32	146.1
2	SW2	SW3	70.000	0.030	23.750	23.150	0.600	116.7	500	5.77	141.7
3	SW3	SW4	37.000	0.030	22.650	22.350	0.300	123.3	600	5.99	139.6
4	SW4	SW5	39.000	0.030	22.350	21.800	0.550	70.9	600	6.17	138.1
5	SW5	SW6	33.000	0.030	21.800	21.400	0.400	82.5	600	6.32	136.7
6	SW6	SW7	33.000	0.030	21.400	21.334	0.066	500.0	600	6.73	133.2
7	SW7	BASIN	28.000	0.030	20.750	20.694	0.056	500.0	600	7.08	130.3
8	SW8	SW9	21.000	0.030	23.890	23.740	0.150	140.0	500	5.15	147.9
9	SW9	SW3	42.000	0.030	23.640	23.050	0.590	71.2	600	5.33	146.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1	1.800	353.4	64.6	1.350	1.350	0.092	0.0
2	2.594	509.3	125.3	1.350	1.350	0.184	0.0
3	2.821	797.7	308.6	1.750	1.750	0.460	0.0
4	3.767	1065.0	366.3	1.750	1.750	0.552	0.0
5	3.481	984.2	423.2	1.750	1.750	0.644	0.0
6	1.346	380.7	471.1	1.750	0.866	0.736	0.0
7	1.346	380.7	518.5	1.450	0.706	0.828	0.0
8	2.357	462.8	65.4	1.260	1.260	0.092	0.0
9	3.759	1062.8	129.2	1.260	1.350	0.184	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1	35.000	233.3	500	Box 1.5 by 2.4	25.750	23.900	1.350	25.600	23.750	1.350
2	70.000	116.7	500	Box 1.5 by 2.4	25.600	23.750	1.350	25.000	23.150	1.350
3	37.000	123.3	600	Box 1.5 by 2.4	25.000	22.650	1.750	24.700	22.350	1.750
4	39.000	70.9	600	Box 1.5 by 2.4	24.700	22.350	1.750	24.150	21.800	1.750
5	33.000	82.5	600	Box 1.5 by 2.4	24.150	21.800	1.750	23.750	21.400	1.750
6	33.000	500.0	600	Box 1.5 by 2.4	23.750	21.400	1.750	22.800	21.334	0.866
7	28.000	500.0	600	Box 1.5 by 2.4	22.800	20.750	1.450	22.000	20.694	0.706
8	21.000	140.0	500	Box 1.5 by 2.4	25.650	23.890	1.260	25.500	23.740	1.260
9	42.000	71.2	600	Box 1.5 by 2.4	25.500	23.640	1.260	25.000	23.050	1.350

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1	SW1	1500	Manhole	Adoptable	SW2	1500	Manhole	Adoptable
2	SW2	1500	Manhole	Adoptable	SW3	1900	Manhole	Adoptable
3	SW3	1900	Manhole	Adoptable	SW4	1900	Manhole	Adoptable
4	SW4	1900	Manhole	Adoptable	SW5	1900	Manhole	Adoptable
5	SW5	1900	Manhole	Adoptable	SW6	1900	Manhole	Adoptable
6	SW6	1900	Manhole	Adoptable	SW7	1900	Manhole	Adoptable
7	SW7	1900	Manhole	Adoptable	BASIN	1900	Manhole	Adoptable
8	SW8	1500	Manhole	Adoptable	SW9	1500	Manhole	Adoptable
9	SW9	1500	Manhole	Adoptable	SW3	1900	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SW1	25.750	1.850	1500		0	1	23.900	500
SW2	25.600	1.850	1500		1	1	23.750	500
					0	2	23.750	500
SW3	25.000	2.350	1900		1	9	23.050	600
					2	2	23.150	500
					0	3	22.650	600
SW4	24.700	2.350	1900		1	3	22.350	600
					0	4	22.350	600
SW5	24.150	2.350	1900		1	4	21.800	600
					0	5	21.800	600
SW6	23.750	2.350	1900		1	5	21.400	600
					0	6	21.400	600

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW7	22.800	2.050	1900	1	6	21.334	600
				0	7	20.750	600
SW8	25.650	1.760	1500				
				0	8	23.890	500
SW9	25.500	1.860	1500	1	8	23.740	500
				0	9	23.640	600
BASIN	22.000	1.306	1900	1	7	20.694	600

Simulation Settings

Rainfall Methodology	FEH-13	Skip Steady State	x	1 year (l/s)	3.1
Summer CV	0.950	Drain Down Time (mins)	240	30 year (l/s)	7.1
Winter CV	0.950	Additional Storage (m³/ha)	20.0	100 year (l/s)	9.0
Analysis Speed	Detailed	Check Discharge Rate(s)	✓	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0
100	40	10	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 years	1.95
Greenfield Method	IH124	Growth Factor 100 years	2.48
Positively Drained Area (ha)	1.000	Betterment (%)	0
SAAR (mm)	550	QBar	3.6
Soil Index	4	Q 1 year (l/s)	3.1
SPR	0.47	Q 30 year (l/s)	7.1
Region	1	Q 100 year (l/s)	9.0
Growth Factor 1 year	0.85		

Node BASIN Online Orifice Control

Flap Valve	x	Design Depth (m)	1.500	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	2.8		
Invert Level (m)	20.300	Diameter (m)	0.033		

Node BASIN Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	20.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	460.0	0.0	1.500	950.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	98.952	28.000
2 year 15 minute winter	69.440	28.000
2 year 30 minute summer	63.223	17.890
2 year 30 minute winter	44.367	17.890
2 year 60 minute summer	41.794	11.045
2 year 60 minute winter	27.767	11.045
2 year 120 minute summer	30.650	8.100
2 year 120 minute winter	20.363	8.100
2 year 180 minute summer	24.905	6.409
2 year 180 minute winter	16.189	6.409
2 year 240 minute summer	20.150	5.325
2 year 240 minute winter	13.387	5.325
2 year 360 minute summer	15.544	4.000
2 year 360 minute winter	10.104	4.000
2 year 480 minute summer	12.178	3.218
2 year 480 minute winter	8.091	3.218
2 year 600 minute summer	9.884	2.704
2 year 600 minute winter	6.754	2.704
2 year 720 minute summer	8.723	2.338
2 year 720 minute winter	5.863	2.338
2 year 960 minute summer	7.028	1.851
2 year 960 minute winter	4.656	1.851
2 year 1440 minute summer	4.964	1.330
2 year 1440 minute winter	3.336	1.330
2 year 2160 minute summer	3.482	0.962
2 year 2160 minute winter	2.400	0.962
2 year 2880 minute summer	2.877	0.771
2 year 2880 minute winter	1.933	0.771
2 year 4320 minute summer	2.203	0.576
2 year 4320 minute winter	1.450	0.576
2 year 5760 minute summer	1.857	0.475
2 year 5760 minute winter	1.202	0.475
2 year 7200 minute summer	1.624	0.414
2 year 7200 minute winter	1.048	0.414
2 year 8640 minute summer	1.463	0.373
2 year 8640 minute winter	0.944	0.373
2 year 10080 minute summer	1.347	0.344
2 year 10080 minute winter	0.869	0.344
30 year 15 minute summer	249.213	70.519
30 year 15 minute winter	174.886	70.519
30 year 30 minute summer	162.769	46.058
30 year 30 minute winter	114.224	46.058
30 year 60 minute summer	108.534	28.682

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 60 minute winter	72.107	28.682
30 year 120 minute summer	69.182	18.283
30 year 120 minute winter	45.963	18.283
30 year 180 minute summer	53.300	13.716
30 year 180 minute winter	34.646	13.716
30 year 240 minute summer	41.875	11.066
30 year 240 minute winter	27.820	11.066
30 year 360 minute summer	31.281	8.050
30 year 360 minute winter	20.334	8.050
30 year 480 minute summer	24.048	6.355
30 year 480 minute winter	15.977	6.355
30 year 600 minute summer	19.267	5.270
30 year 600 minute winter	13.165	5.270
30 year 720 minute summer	16.842	4.514
30 year 720 minute winter	11.319	4.514
30 year 960 minute summer	13.395	3.527
30 year 960 minute winter	8.873	3.527
30 year 1440 minute summer	9.265	2.483
30 year 1440 minute winter	6.227	2.483
30 year 2160 minute summer	6.349	1.755
30 year 2160 minute winter	4.375	1.755
30 year 2880 minute summer	5.145	1.379
30 year 2880 minute winter	3.458	1.379
30 year 4320 minute summer	3.807	0.995
30 year 4320 minute winter	2.507	0.995
30 year 5760 minute summer	3.121	0.799
30 year 5760 minute winter	2.020	0.799
30 year 7200 minute summer	2.665	0.680
30 year 7200 minute winter	1.720	0.680
30 year 8640 minute summer	2.352	0.600
30 year 8640 minute winter	1.518	0.600
30 year 10080 minute summer	2.126	0.542
30 year 10080 minute winter	1.372	0.542
100 year 15 minute summer	315.868	89.380
100 year 15 minute winter	221.662	89.380
100 year 30 minute summer	207.868	58.819
100 year 30 minute winter	145.872	58.819
100 year 60 minute summer	139.458	36.855
100 year 60 minute winter	92.653	36.855
100 year 120 minute summer	87.770	23.195
100 year 120 minute winter	58.312	23.195
100 year 180 minute summer	67.647	17.408
100 year 180 minute winter	43.972	17.408
100 year 240 minute summer	53.284	14.081
100 year 240 minute winter	35.400	14.081
100 year 360 minute summer	40.031	10.301
100 year 360 minute winter	26.021	10.301
100 year 480 minute summer	30.952	8.180
100 year 480 minute winter	20.564	8.180
100 year 600 minute summer	24.893	6.809
100 year 600 minute winter	17.008	6.809
100 year 720 minute summer	21.810	5.845

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 720 minute winter	14.658	5.845
100 year 960 minute summer	17.366	4.573
100 year 960 minute winter	11.504	4.573
100 year 1440 minute summer	11.986	3.213
100 year 1440 minute winter	8.056	3.212
100 year 2160 minute summer	8.131	2.247
100 year 2160 minute winter	5.602	2.247
100 year 2880 minute summer	6.517	1.747
100 year 2880 minute winter	4.380	1.747
100 year 4320 minute summer	4.718	1.234
100 year 4320 minute winter	3.107	1.234
100 year 5760 minute summer	3.795	0.971
100 year 5760 minute winter	2.456	0.971
100 year 7200 minute summer	3.192	0.814
100 year 7200 minute winter	2.060	0.814
100 year 8640 minute summer	2.780	0.709
100 year 8640 minute winter	1.794	0.709
100 year 10080 minute summer	2.486	0.634
100 year 10080 minute winter	1.604	0.634
100 year +40% CC 15 minute summer	442.216	125.132
100 year +40% CC 15 minute winter	310.327	125.132
100 year +40% CC 30 minute summer	291.015	82.347
100 year +40% CC 30 minute winter	204.221	82.347
100 year +40% CC 60 minute summer	195.241	51.596
100 year +40% CC 60 minute winter	129.714	51.596
100 year +40% CC 120 minute summer	122.878	32.473
100 year +40% CC 120 minute winter	81.637	32.473
100 year +40% CC 180 minute summer	94.705	24.371
100 year +40% CC 180 minute winter	61.561	24.371
100 year +40% CC 240 minute summer	74.597	19.714
100 year +40% CC 240 minute winter	49.561	19.714
100 year +40% CC 360 minute summer	56.043	14.422
100 year +40% CC 360 minute winter	36.429	14.422
100 year +40% CC 480 minute summer	43.333	11.452
100 year +40% CC 480 minute winter	28.790	11.452
100 year +40% CC 600 minute summer	34.850	9.532
100 year +40% CC 600 minute winter	23.812	9.532
100 year +40% CC 720 minute summer	30.535	8.184
100 year +40% CC 720 minute winter	20.521	8.184
100 year +40% CC 960 minute summer	24.313	6.402
100 year +40% CC 960 minute winter	16.105	6.402
100 year +40% CC 1440 minute summer	16.781	4.498
100 year +40% CC 1440 minute winter	11.278	4.498
100 year +40% CC 2160 minute summer	11.383	3.146
100 year +40% CC 2160 minute winter	7.843	3.146
100 year +40% CC 2880 minute summer	9.124	2.445
100 year +40% CC 2880 minute winter	6.132	2.445
100 year +40% CC 4320 minute summer	6.606	1.727
100 year +40% CC 4320 minute winter	4.350	1.727
100 year +40% CC 5760 minute summer	5.312	1.360
100 year +40% CC 5760 minute winter	3.438	1.360
100 year +40% CC 7200 minute summer	4.468	1.140

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +40% CC 7200 minute winter	2.884	1.140
100 year +40% CC 8640 minute summer	3.892	0.993
100 year +40% CC 8640 minute winter	2.512	0.993
100 year +40% CC 10080 minute summer	3.480	0.888
100 year +40% CC 10080 minute winter	2.246	0.888
100 year +40% CC +10% A 15 minute summer	442.216	125.132
100 year +40% CC +10% A 15 minute winter	310.327	125.132
100 year +40% CC +10% A 30 minute summer	291.015	82.347
100 year +40% CC +10% A 30 minute winter	204.221	82.347
100 year +40% CC +10% A 60 minute summer	195.241	51.596
100 year +40% CC +10% A 60 minute winter	129.714	51.596
100 year +40% CC +10% A 120 minute summer	122.878	32.473
100 year +40% CC +10% A 120 minute winter	81.637	32.473
100 year +40% CC +10% A 180 minute summer	94.705	24.371
100 year +40% CC +10% A 180 minute winter	61.561	24.371
100 year +40% CC +10% A 240 minute summer	74.597	19.714
100 year +40% CC +10% A 240 minute winter	49.561	19.714
100 year +40% CC +10% A 360 minute summer	56.043	14.422
100 year +40% CC +10% A 360 minute winter	36.429	14.422
100 year +40% CC +10% A 480 minute summer	43.333	11.452
100 year +40% CC +10% A 480 minute winter	28.790	11.452
100 year +40% CC +10% A 600 minute summer	34.850	9.532
100 year +40% CC +10% A 600 minute winter	23.812	9.532
100 year +40% CC +10% A 720 minute summer	30.535	8.184
100 year +40% CC +10% A 720 minute winter	20.521	8.184
100 year +40% CC +10% A 960 minute summer	24.313	6.402
100 year +40% CC +10% A 960 minute winter	16.105	6.402
100 year +40% CC +10% A 1440 minute summer	16.781	4.498
100 year +40% CC +10% A 1440 minute winter	11.278	4.498
100 year +40% CC +10% A 2160 minute summer	11.383	3.146
100 year +40% CC +10% A 2160 minute winter	7.843	3.146
100 year +40% CC +10% A 2880 minute summer	9.124	2.445
100 year +40% CC +10% A 2880 minute winter	6.132	2.445
100 year +40% CC +10% A 4320 minute summer	6.606	1.727
100 year +40% CC +10% A 4320 minute winter	4.350	1.727
100 year +40% CC +10% A 5760 minute summer	5.312	1.360
100 year +40% CC +10% A 5760 minute winter	3.438	1.360
100 year +40% CC +10% A 7200 minute summer	4.468	1.140
100 year +40% CC +10% A 7200 minute winter	2.884	1.140
100 year +40% CC +10% A 8640 minute summer	3.892	0.993
100 year +40% CC +10% A 8640 minute winter	2.512	0.993
100 year +40% CC +10% A 10080 minute summer	3.480	0.888
100 year +40% CC +10% A 10080 minute winter	2.246	0.888

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	10	23.961	0.061	14.1	0.1695	0.0000	OK
15 minute summer	SW2	11	23.822	0.072	28.1	0.1977	0.0000	OK
15 minute summer	SW3	11	22.764	0.114	68.8	0.4116	0.0000	OK
15 minute summer	SW4	11	22.456	0.106	82.7	0.3820	0.0000	OK
15 minute summer	SW5	11	21.918	0.118	96.6	0.4272	0.0000	OK
15 minute summer	SW6	11	21.611	0.211	110.6	0.7621	0.0000	OK
15 minute summer	SW7	11	20.975	0.225	123.4	0.8413	0.0000	OK
15 minute summer	SW8	10	23.946	0.056	14.1	0.1582	0.0000	OK
15 minute summer	SW9	10	23.702	0.062	28.0	0.1697	0.0000	OK
600 minute winter	BASIN	600	20.862	0.168	16.0	188.8043	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW1	1	SW2	14.0	0.920	0.040	0.5343	
15 minute summer	SW2	2	SW3	27.7	1.654	0.054	1.1715	
15 minute summer	SW3	3	SW4	69.2	1.968	0.087	1.3009	
15 minute summer	SW4	4	SW5	83.1	2.300	0.078	1.4106	
15 minute summer	SW5	5	SW6	97.1	1.553	0.099	2.1000	
15 minute summer	SW6	6	SW7	109.9	1.371	0.289	2.6766	
15 minute summer	SW7	7	BASIN	123.0	1.404	0.323	2.4684	
15 minute summer	SW8	8	SW9	13.9	1.224	0.030	0.2395	
15 minute summer	SW9	9	SW3	27.6	1.899	0.026	0.6138	
600 minute winter	BASIN	Orifice		1.7				71.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	10	24.000	0.100	35.6	0.2772	0.0000	OK
15 minute summer	SW2	10	23.865	0.115	70.9	0.3189	0.0000	OK
15 minute summer	SW3	10	22.842	0.192	174.5	0.6944	0.0000	OK
15 minute summer	SW4	10	22.526	0.176	208.9	0.6359	0.0000	OK
15 minute summer	SW5	11	22.019	0.219	244.6	0.7913	0.0000	OK
15 minute summer	SW6	11	21.761	0.361	280.7	1.3078	0.0000	OK
600 minute winter	SW7	600	21.190	0.440	28.8	1.6437	0.0000	OK
15 minute summer	SW8	10	23.982	0.092	35.6	0.2574	0.0000	OK
15 minute summer	SW9	10	23.739	0.099	70.8	0.2733	0.0000	OK
600 minute winter	BASIN	600	21.190	0.496	31.5	397.7379	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW1	1	SW2	35.3	1.139	0.100	1.0858	
15 minute summer	SW2	2	SW3	70.2	2.146	0.138	2.2907	
15 minute summer	SW3	3	SW4	174.8	2.411	0.219	2.7063	
15 minute summer	SW4	4	SW5	210.7	2.635	0.198	3.1449	
15 minute summer	SW5	5	SW6	246.8	1.829	0.251	4.4582	
15 minute summer	SW6	6	SW7	281.5	1.737	0.739	5.3580	
15 minute summer	SW7	7	BASIN	314.6	1.779	0.826	4.9630	
15 minute summer	SW8	8	SW9	35.2	1.565	0.076	0.4734	
15 minute summer	SW9	9	SW3	70.1	2.455	0.066	1.2052	
600 minute winter	BASIN	Orifice		2.1				86.9

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	10	24.015	0.115	45.1	0.3166	0.0000	OK
15 minute summer	SW2	10	23.881	0.131	89.8	0.3630	0.0000	OK
15 minute summer	SW3	10	22.871	0.221	221.7	0.8006	0.0000	OK
15 minute summer	SW4	10	22.553	0.203	265.6	0.7356	0.0000	OK
15 minute summer	SW5	11	22.062	0.262	310.1	0.9494	0.0000	OK
15 minute summer	SW6	11	21.821	0.421	356.0	1.5248	0.0000	OK
960 minute summer	SW7	975	21.370	0.620	37.8	2.3132	0.0000	SURCHARGED
15 minute summer	SW8	10	23.994	0.104	45.1	0.2928	0.0000	OK
15 minute summer	SW9	10	23.753	0.113	89.7	0.3102	0.0000	OK
960 minute summer	BASIN	975	21.370	0.676	41.3	526.6974	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW1	1	SW2	44.7	1.198	0.127	1.3082	
15 minute summer	SW2	2	SW3	89.0	2.286	0.175	2.7265	
15 minute summer	SW3	3	SW4	221.6	2.519	0.278	3.2990	
15 minute summer	SW4	4	SW5	267.1	2.689	0.251	3.9360	
15 minute summer	SW5	5	SW6	313.0	1.887	0.318	5.4443	
15 minute summer	SW6	6	SW7	357.1	1.838	0.938	6.4072	
15 minute summer	SW7	7	BASIN	398.7	1.876	1.047	5.9698	
15 minute summer	SW8	8	SW9	44.6	1.662	0.096	0.5651	
15 minute summer	SW9	9	SW3	89.0	2.612	0.084	1.4373	
960 minute summer	BASIN	Orifice		2.3				132.3

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	10	24.039	0.139	63.1	0.3847	0.0000	OK
15 minute summer	SW2	10	23.909	0.159	125.7	0.4380	0.0000	OK
15 minute summer	SW3	10	22.923	0.273	311.1	0.9889	0.0000	OK
15 minute summer	SW4	10	22.604	0.254	372.9	0.9198	0.0000	OK
15 minute summer	SW5	10	22.143	0.343	434.3	1.2416	0.0000	OK
15 minute summer	SW6	11	21.973	0.573	499.1	2.0733	0.0000	OK
960 minute summer	SW7	975	21.685	0.935	53.1	3.4909	0.0000	SURCHARGED
15 minute summer	SW8	10	24.016	0.126	63.1	0.3532	0.0000	OK
15 minute summer	SW9	10	23.775	0.135	125.6	0.3726	0.0000	OK
960 minute summer	BASIN	975	21.671	0.977	63.3	767.0258	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW1	1	SW2	62.6	1.283	0.177	1.7101	
15 minute summer	SW2	2	SW3	124.6	2.496	0.245	3.5075	
15 minute summer	SW3	3	SW4	310.0	2.660	0.389	4.4121	
15 minute summer	SW4	4	SW5	374.1	2.716	0.351	5.4633	
15 minute summer	SW5	5	SW6	439.0	1.934	0.446	7.2830	
15 minute summer	SW6	6	SW7	499.4	1.938	1.312	8.4251	
15 minute summer	SW7	7	BASIN	559.8	2.039	1.470	7.3800	
15 minute summer	SW8	8	SW9	62.5	1.807	0.135	0.7278	
15 minute summer	SW9	9	SW3	124.7	2.847	0.117	1.8463	
960 minute summer	BASIN	Orifice		2.6				148.3

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	10	24.047	0.147	69.4	0.4218	0.0000	OK
15 minute summer	SW2	10	23.917	0.167	138.2	0.4789	0.0000	OK
15 minute summer	SW3	10	22.941	0.291	342.4	1.0757	0.0000	OK
15 minute summer	SW4	10	22.622	0.272	410.3	1.0055	0.0000	OK
15 minute summer	SW5	11	22.165	0.365	477.5	1.3488	0.0000	OK
15 minute summer	SW6	11	22.025	0.625	547.3	2.3106	0.0000	SURCHARGED
960 minute winter	SW7	945	21.776	1.026	51.4	3.9228	0.0000	SURCHARGED
15 minute summer	SW8	10	24.023	0.133	69.4	0.3866	0.0000	OK
15 minute summer	SW9	10	23.783	0.143	138.1	0.4072	0.0000	OK
960 minute winter	BASIN	945	21.764	1.070	69.0	846.9742	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW1	1	SW2	68.9	1.308	0.195	1.8465	
15 minute summer	SW2	2	SW3	137.1	2.557	0.269	3.7697	
15 minute summer	SW3	3	SW4	341.0	2.694	0.427	4.8019	
15 minute summer	SW4	4	SW5	411.3	2.751	0.386	5.8930	
15 minute summer	SW5	5	SW6	481.1	1.946	0.489	7.6068	
15 minute summer	SW6	6	SW7	549.8	2.021	1.444	8.6674	
15 minute summer	SW7	7	BASIN	617.6	2.208	1.622	7.5127	
15 minute summer	SW8	8	SW9	68.7	1.850	0.149	0.7822	
15 minute summer	SW9	9	SW3	137.2	2.917	0.129	1.9838	
960 minute winter	BASIN	Orifice		2.7				153.2

Basin Maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Removal of litter and debris	Monthly
	Cut grass	Half yearly
	Manage other vegetation	Monthly then as required
	Inspect and clear inlets, outlets, overflows etc	Monthly
	Inspect and repair banks, pipes, headwalls etc	Monthly
	Inspect inlets and basin for silt accumulation	Monthly until able to establish the required silt removal frequency, then in accordance with established frequency
	Manage vegetation in wetter areas (micro-pools etc)	Annually or as established by ecologist/landscape architect
	Tidy dead growth	Annually (as per growing season)
	Remove sediment from traps, forebays etc	Annually
Occasional maintenance	Reseed	As required.
	Prune adjacent trees	Every 2 years, or as otherwise advised
	Silt removal	Every 5 years (depending on the requirement for regular maintenance)
Remedial actions	Repair erosion or other damage	As required
	Repair inlets, outlets and overflows	As required

(Based on advice in CIRIA C753)

Filter Drain Maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal	Monthly, as required
	Inspect surface, inlet and outlets and controls for waterlogging/pooling, silt build up/clogs, and damage	Monthly
	Inspect pre-treatment systems, inlets, perforated pipes for silt (to establish the required silt removal regime)	6 monthly
	Remove silt	6 monthly or as required (see above)
Remedial actions	Remove/control tree roots should they threaten the filter drain	As required.
	Replace and/or clean geotextiles, stone filter layer from areas which demonstrate high pollution loads	Five yearly, or as required (established via inspection).
	Clear perforated pipes of any blockages	As required.

(Based on advice in CIRIA C753)