9 Elsfield Way
Oxford
OX2 8EW

Drainage Strategy

Prepared for: Hugh Goodwin

Project No: TC23001
Date: February 2023

Contents

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Appendices

Revision	Amendments	By	Date
P01	Preliminary issue	Graham Taylor (IEng MICE)	07.02.23

1.0 Introduction

1.1 Taylor Consulting Engineers have been commissioned to undertake a Drainage Strategy to support the planning application for the construction of a new residential building to the rear of 9 Elsfield Way, Oxford.

2.0 Development Site Details

2.1 Description & Location

The site is located at grid reference SP 50508 10262. The site is located to the north of Oxford within Cutteslowe with the A40 to the south of the site and a new large residential development (Cannon Court) immediately east of the site.

The site comprises an existing residential garden north of 9 Elsfield Way.

Figure 1 – Location Plan

3.0 Existing Surface Water

There are public surface water sewers located in Elsfield Way to the south and within Harefields to the north.

It is understood that the existing roof drainage from No 9 discharges to the south and into the public sewer system.

The BGS maps indicate Oxford clay bedrock with sands and gravels above.

Investigation work carried out on the site immediately to the east indicates 1m of the made ground over Oxford Clay

Groundwater was encountered within trial pits 0.7m below ground level.

The drained area of the proposed site is 0.032 Hectares and using the HR Wallingford Greenfield runoff rate the QBAR greenfield runoff rate has been calculated.

Return Period (Years)	Flow Rate (litres/sec)
QBAR	0.13
1	0
30	0
100	0

The survey information and site investigation information are included in Appendix A.

4.0 Existing Foul Water

There is an existing public foul sewer located on Elsfield Way.

The existing foul drainage from No 9 is connected via gravity to the public foul sewer and the proposed development has an agreement to connect to the drainage associated with No 9 Elsfield Way.

5.0 Proposed Surface Water Drainage Strategy

5.1 Drainage Hierarchy

Developments should utilise SuDS sustainable drainage systems unless there are practical reasons for not doing so, and should aim to achieve greenfield runoff rates and ensure that surface water runoff is managed as close to its source as possible in line with the following drainage hierarchy:

- **Store rainwater for reuse:**
  Water butts will be installed where practicable for reuse in garden watering.

- **Use infiltration techniques such as swales, rain gardens and soakaways:**
  Infiltration is not viable on the site and has been proved by infiltration testing carried out on the adjacent site. The ground conditions are made ground over Oxford Clay with a relatively high water table.

- **Attenuate rainwater in ponds or open water features for gradual release into watercourses:**
  N/A.

- **Attenuate rainwater in tanks or sealed water features for gradual release into watercourses:**
  N/A.

- **Store rainwater for reuse:**
  Water butts will be utilised where practical and the green roof will reuse water

- **Attenuate rainwater in ponds or open water features for gradual release into the sewer/drain:**
  Green roofs will be utilised where possible to provide attenuation before discharge into the surface water system.

- **Attenuate rainwater in tanks or sealed water features for gradual release into the sewer/drain:**
  The surface water from the development will be attenuated using green roofs, and porous paving systems before a controlled discharge via new pump chamber into the existing surface water system.

5.2 Surface Water Destination

Site Investigation works carried out on the adjacent site confirm that infiltration is not viable as a means of surface water disposal.

Surface water from the green roof will be connected to a new drainage system and tanked porous paving before a controlled discharge via a new pump chamber into the existing surface water system for No 9 Elsfield Way which discharges into the public sewer system.

5.3 Peak Flow Control

The proposed surface water drainage system will discharge into the existing sewer system at a controlled rate using a pump chamber with duplex duty/standby pumps.

Flow rates from the building for each storm for the 6-hour rainfall event are indicated in the table below:

Return Period (Years)	Flow Rate (litres/sec)
1	2
30	2
100	2
100 + 40% climate change	2

Due to the control mechanism being a pumped system a lower flow rate is not achievable.

5.4 Volume Control

Attenuation will be provided by SuDS features including:

Green roof 40mm depression storage = 10m^3

Porous paving (0.30 void ratio) = 2.6m^3

The runoff volume discharged for the 6-hour rainfall event from the drained area for all storms up to and including 100 year, without attenuation or flow controls is:

Return Period (Years)	Volume (m^3)
1	5.3
30	15.0
100	19.9
100 + 40% climate change	27.0

5.5 Flood Risk

The new sewer system has been designed in accordance with the CIRIA SuDS manual with no flooding in the 30-year event and no flood water leaving the site for the 100-year + 40% climate change critical storm event.

5.6 Exceedance Events

In storm events exceeding the designed event of 100 year + 40% climate change, the flow of water would run towards the northwest towards Harefields following the existing flow path.

There will be no change to the flow path route from the existing.

5.7 Structural Integrity and construction

The surface water system will be designed and constructed using approved materials in line with Building Regulations and current British Standards appropriate for the location and proposed use.

The pumped system will use a duplex duty/standby pump system with telemetry and a generator socket on the control panel to ensure the system is robust and any issues could be rectified.

5.8 Maintenance and Operation

The drainage system will be inspected on completion to ensure that the system is fully operational and maintenance schedules provided for the owner to maintain the drainage system.

Maintenance schedules have been provided in Appendix F for the SuDS elements.

The owner of the property will be responsible for maintaining the drainage system on site including the pumps which will be maintained on an annual basis by a pump specialist.

6.0 Proposed Foul Drainage

The proposed foul drainage will be pumped to the existing private sewer from No 9 Elsfield to the existing public foul sewer system. The pump chamber will be designed to provide 24-hour storage in line with Building Regulations.

7.0 Surface Water Quality Management

7.1 Surface Water Quality

The surface water system has been designed to not affect the water quality of the receiving sewer system and watercourse.

The proposed roof drainage will be collected into a below ground drainage system via green roofs where practical. The hard paved areas will be constructed using a tanked porous paved system with a collector drain linked to the pump chamber.

7.2 Pollution Mitigation

CIRIA SuDS Manual assigns pollution hazard indices for different land use types and SuDS mitigation index for every SuDS component depending on whether the discharge destination is surface or groundwater.

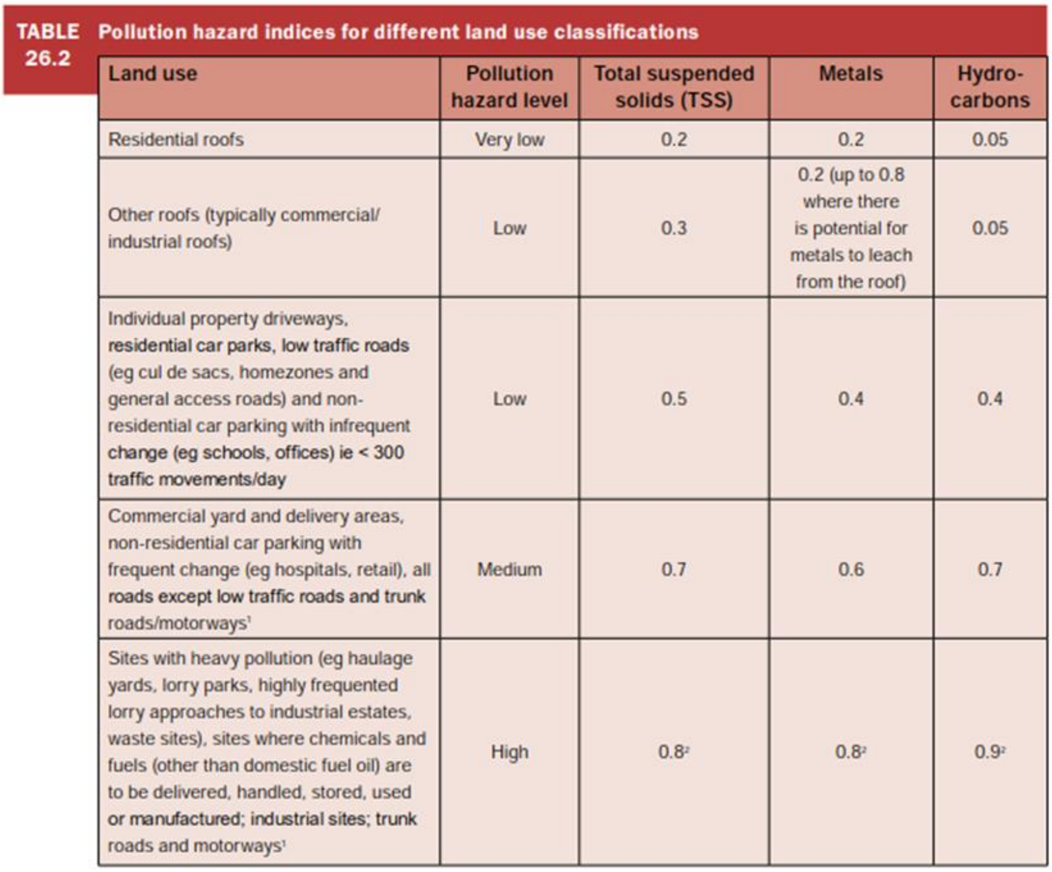


TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Figure 2 – CIRIA Pollution Hazards

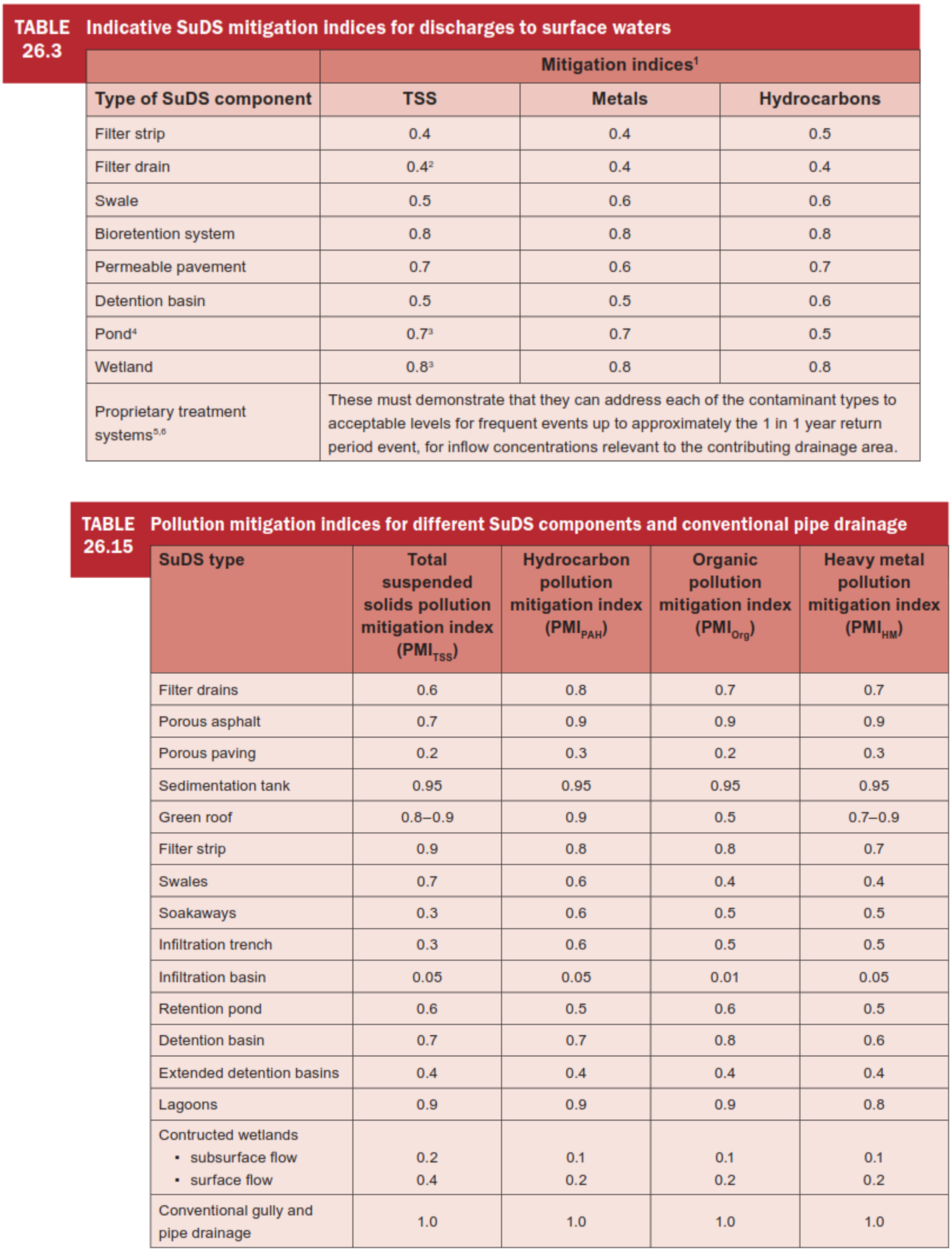


TABLE 26.3 **Indicative SuDS mitigation indices for discharges to surface waters**

Type of SuDS component	Mitigation indices[1]		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

TABLE 26.15 **Pollution mitigation indices for different SuDS components and conventional pipe drainage**

SuDS type	Total suspended solids pollution mitigation index (PMI_{TSS})	Hydrocarbon pollution mitigation index (PMI_{PAH})	Organic pollution mitigation index (PMI_{Org})	Heavy metal pollution mitigation index (PMI_{HM})
Filter drains	0.6	0.8	0.7	0.7
Porous asphalt	0.7	0.9	0.9	0.9
Porous paving	0.2	0.3	0.2	0.3
Sedimentation tank	0.95	0.95	0.95	0.95
Green roof	0.8–0.9	0.9	0.5	0.7–0.9
Filter strip	0.9	0.8	0.8	0.7
Swales	0.7	0.6	0.4	0.4
Soakaways	0.3	0.6	0.5	0.5
Infiltration trench	0.3	0.6	0.5	0.5
Infiltration basin	0.05	0.05	0.01	0.05
Retention pond	0.6	0.5	0.6	0.5
Detention basin	0.7	0.7	0.8	0.6
Extended detention basins	0.4	0.4	0.4	0.4
Lagoons	0.9	0.9	0.9	0.8
Contructed wetlands ▪ subsurface flow ▪ surface flow	 0.2 0.4	 0.1 0.2	 0.1 0.2	 0.1 0.2
Conventional gully and pipe drainage	1.0	1.0	1.0	1.0

Figure 3 – CIRIA SuDS Mitigation

7.3 SuDS Mitigation

CIRIA SuDS Manual states that ‘To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index that equals or exceeds the pollution hazard index’

Pollution indices for the site:

Land Use	Pollution Hazard Level	TSS	Metals	Hydrocarbons
Roof	Low	0.3	0.2	0.05
Paved area	Low	0.5	0.4	0.4

SuDS mitigation indices are determined by the type of SuDS utilised on-site.

The following indices have been used for the green roof and porous paving.

Catch pit chambers will be located upstream of the pump to provide additional protection.

SuDS Mitigation Indices for the site:

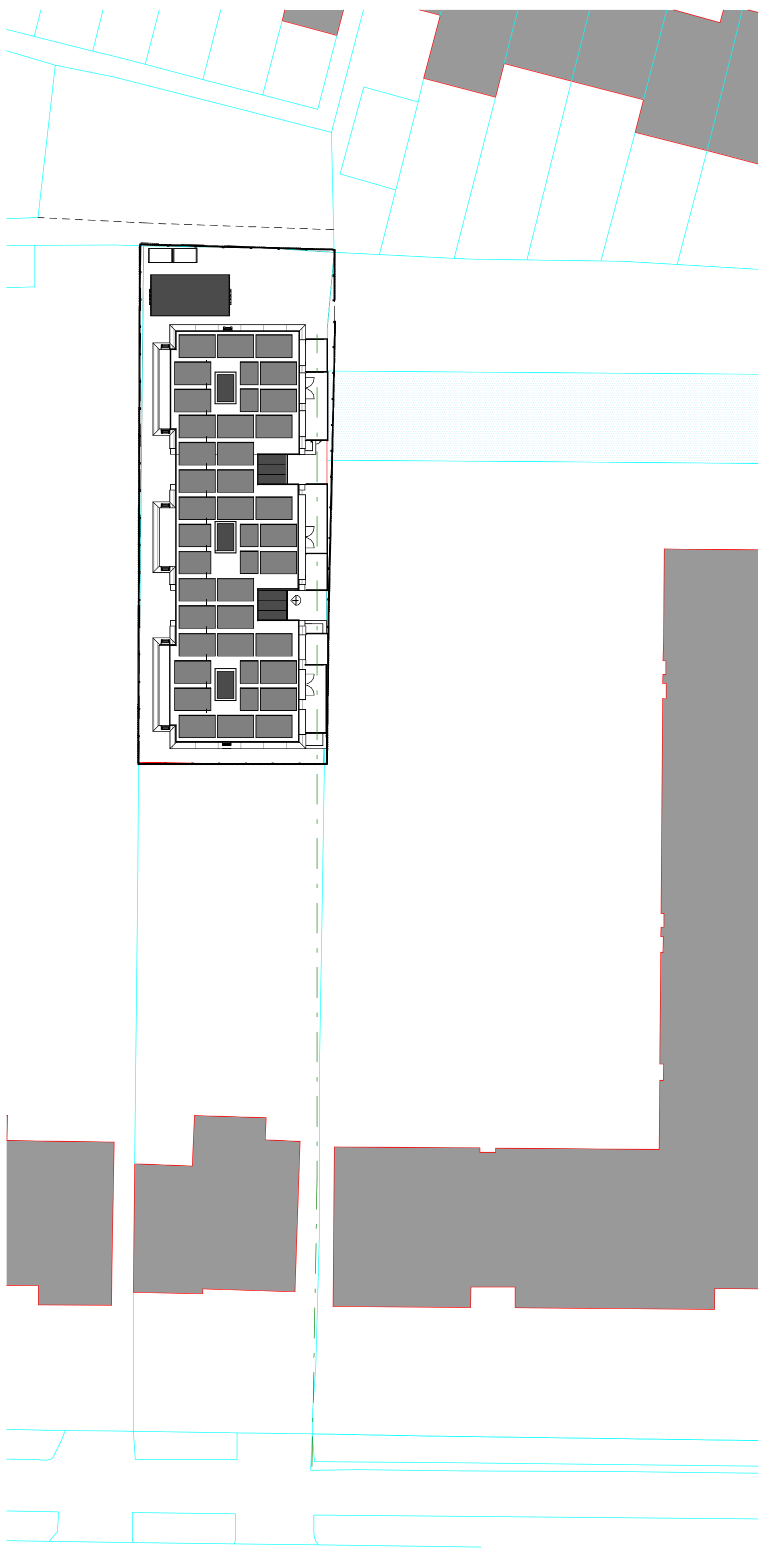
SuDS Type	TSS	Metals	Hydrocarbons
Green Roof	0.8	0.7	0.9
Porous Paving	0.7	0.6	0.7

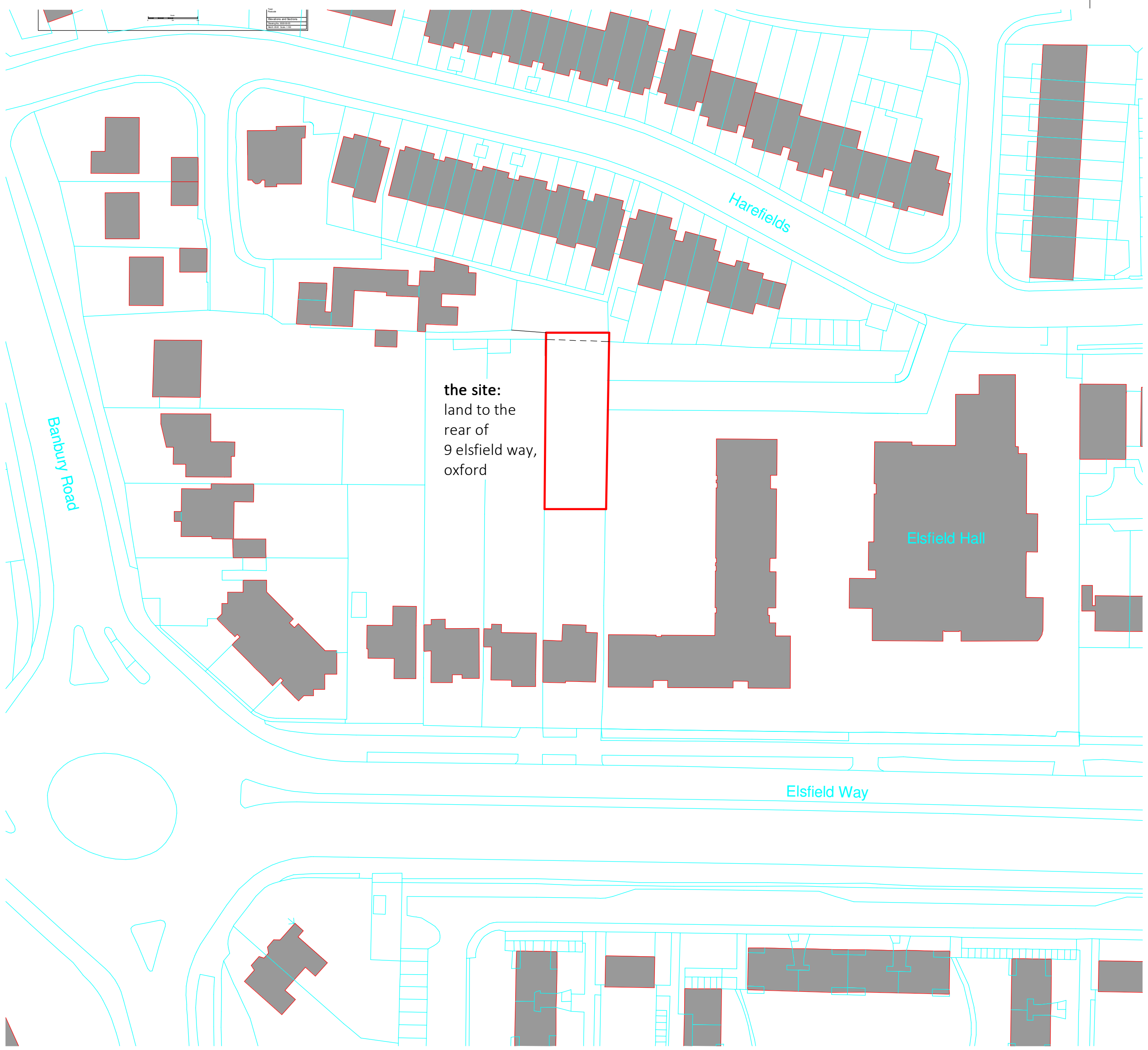
8.0 Conclusion

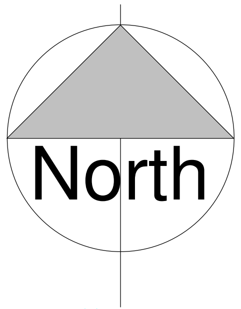
- The development is a new residential building.
- The site has been assessed and the drainage hierarchy followed for the surface water discharge.
- Infiltration is not viable due to the ground conditions and high-water table.
- Agreements are in place for drainage connections from the development to the existing drainage serving No 9 Elsfield Way.
- SuDS options have been used for the new surface water drainage in the form of green roof and porous paving.
- The new surface water system has been designed to attenuate all stormwater on site for storms up to and including the 100-year+ 40% climate change with a controlled discharge via a new pump chamber to the existing drainage system.
- The foul water from the site discharges via a new pumped system to the existing foul sewer at No 9 Elsfield Way.

Appendix A

Surveys







2
100
00.1 Block Plan - as proposed
1 : 500

0 10 20 30 40 50m
1:500 @ **a3**

1
100
00.0 Location Plan as existing
1 : 1250

0 100m
1:1250 @ **a3**

Notes

1. No deviation may be made from the details shown on this drawing without prior permission of the architects. Any discrepancy found between this drawing and any other document should be referred immediately to the architects. IF IN DOUBT ASK.
2. No dimensions should be scaled from this drawing.
3. This drawing is to be removed from currency immediately a revised version is issued.
4. The contractor must check the existing construction on the site prior to commencement of the works.
5. All rights described in chapter 1V of the Copyright, Designs and Patents Act of 1988 have been generally asserted.

Rev	Date	Description

Ifor Rhys Ltd

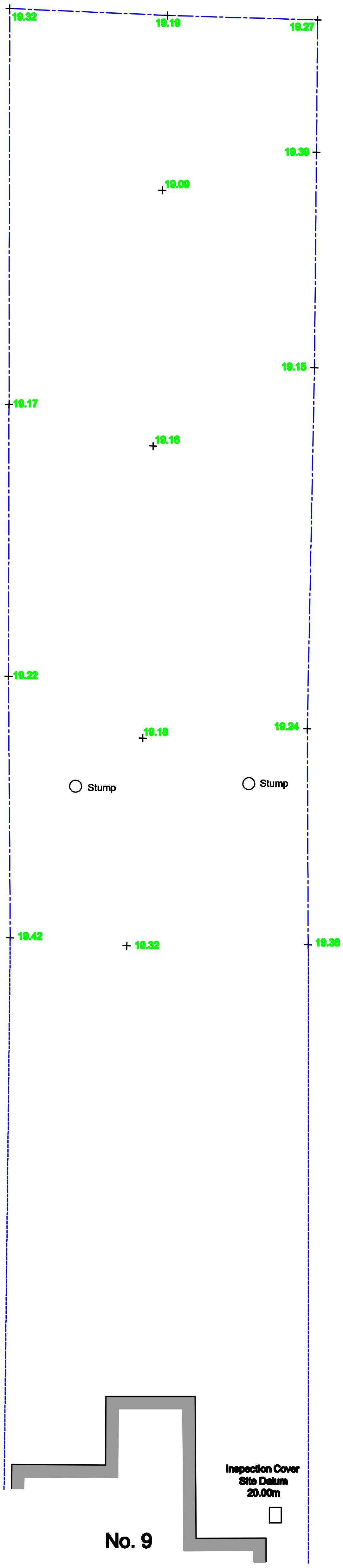
architects
environmental designers
landscape & interior designers

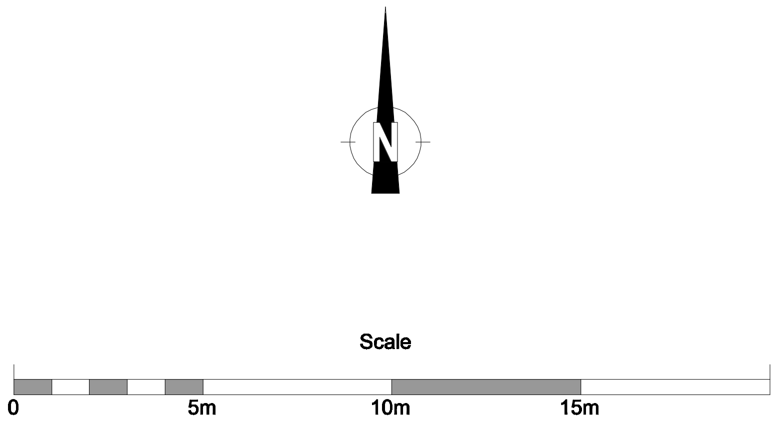
lower barn, 4 blenheim road,
horspath, oxford, ox33 1ry

t **01865 874112**
e iforrhys@iforrhys.com

client:	Hugh Goodwin
job:	Development on land to the rear of 9 Elsfield Way, Oxford
title:	Location & proposed block plan
status	preliminary for comment
scale:	As indicated
date:	november 2022
no:	2233 100

07/12/2022 11:45:09





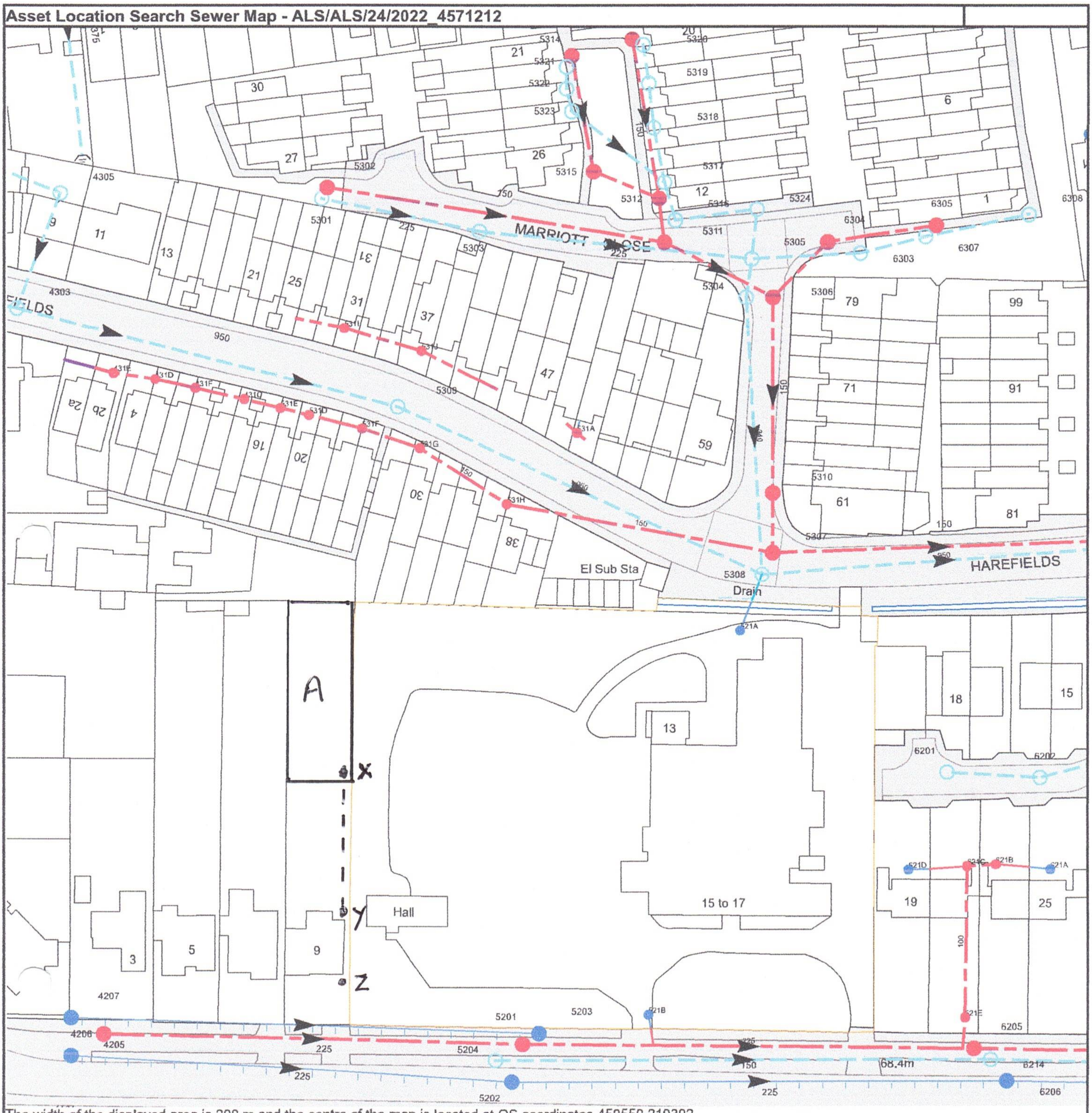
9 Elsfield Way
Cutteslowe
Oxford
OX2 8EW

Site Plan

Drawing No. 2022-81-01

September 2022 Scale 1:200

Asset Location Search Sewer Map - ALS/ALS/24/2022_4571212



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 450550,210302

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

However, Made Ground extends to depths of between 0.40m and 1.20m across the site.

Access Roads on Made Ground

Deep Made Ground was encountered over the whole of the site. Pavement construction may be considered on this existing Made Ground by employing appropriate mitigation measures. Where deep Made Ground is encountered beneath the area of proposed pavement it is recommended that geogrids or similar soil reinforcement techniques be employed to provide a subgrade with a known CBR value. Reinforcement measures will also mitigate lateral and vertical displacement from traffic loadings and differential settlement over variable ground. Discussions should be held with a soil reinforcement company (such as Tensar) who would design a subgrade to a specified CBR value.

*As the Made Ground is likely to be frost susceptible the pavement thickness will need to accommodate this effect.

The following should also be taken into consideration:

- Inspection of the formation and removal of any surface areas of soft, organic or other unsuitable materials.
- 'Heavy' proof rolling of the resultant formation, to compact loose coarse materials and locate any soft spots at shallow depth beneath the formation for subsequent removal.
- Removal of intact or loose obstructions where noted at surface, or known based on the investigation, to a depth of at least 600mm beneath the formation to prevent the creation of hard spots or voiding.
- Backfilling of any excavation with well-compacted inert coarse material.
- Adopt a pavement design based upon an equilibrium CBR of less than 2%.

INFILTRATION MEASURES

Appropriately designed sustainable drainage systems (SuDS) are more sustainable than using piped drainage to local sewer systems. However, infiltration measures close to buildings may result in undermining of foundations and softening of soils leading to instability. Attenuation measures should be located at suitable distances from foundations and infrastructure and consideration given to the effects on slopes, flooding and mobilisation of contaminants.

Testing Results

Infiltration testing in accordance with BRE Digest 365, Soakaway Design was proposed. However, due to the presence of shallow groundwater encountered across the site no testing was undertaken.

Groundwater was encountered at depths of between 0.70m and 3.00m during the sitework and the groundwater was measured at depths of between 0.49m and 1.14m below existing ground levels in the existing groundwater installations from the previous investigation.

Given the above traditional soakaways are not considered possible at this site and an alternative sustainable drainage system should be adopted.

Key:

- ▚ Machine Excavated Trial Pits
- ⊕ Continuous Tube Sampler Borehole
- 🟥 Approximate Site Boundary

LISTERS GEO

Geotechnical and Geoenvironmental Consultants

Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060

Title:	Exploratory Hole Location Plan - Existing Site Layout
Site:	Elsfield Hall, Wolvercote, Oxford, OX2 8EP

Scale: NTS	Job No: 19.12.002	Drawn By: HC

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No.

TP 01

Project Location: Elsfield Hall, Wolvercote, Oxford, OX2 8EP

Co-ords: 450517E - 210269N

Level: 67.96 mAOD

Dates: 16/12/2019

Project Number: 19.12.002

Logged By: Matthew Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	(kPa)				
				0.10	67.86	▨	MADE GROUND Dark brown organic sandy slightly gravelly SILT. Gravel is fine to medium angular to sub-rounded flint
	0.20	D		0.30	67.66	▨	MADE GROUND Soft brown sandy silty gravelly CLAY with occasional brick cobbles
▼	0.50	D		0.90	67.06	▨	MADE GROUND (Loose to medium dense) black brown SAND and GRAVEL with brick and concrete cobbles. Gravel is fine to coarse angular coal, brick and concrete with occasional glass bottles and plates
	1.00	D				▥	OXFORD CLAY FORMATION Firm to stiff grey brown silty slightly sandy CLAY with occasional bands of fine orange sand
	1.50 1.50	D PP	 62			▥	
	2.00 2.00	D PP	 75			▥	
	2.50 2.50	D PP	 80			▥	
	3.00	D		3.00	64.96	▥	
				3.30	64.66	▥	OXFORD CLAY FORMATION Stiff dark grey silty CLAY
							End of Trial Pit at 3.30m

Method of excavation: JCB 3CX

Stability: Sides Stable

Groundwater: Perched inflows at 0.70m

Trial Pit Dimensions: 0.70m x 2.00m x 3.30m

Remarks:

QMS ISO 9001 REGISTERED FIRM

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Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No.
TP 02

Project Location: Elsfield Hall, Wolvercote, Oxford, OX2 8EP

Co-ords: 450528E - 210287N

Level: 67.90 mAOD

Dates: 16/12/2019

Project Number: 19.12.002

Logged By: Matthew Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing Depth (m)	Type	(kPa)	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	67.70	▨	MADE GROUND Dark brown organic slightly gravelly SAND and SILT with occasional limestone cobbles and brick. Gravel is fine to coarse angular limestone, flint and brick
	0.50	D				▨	MADE GROUND Dark brown clayey SAND, GRAVEL and COBBLES of limestone and occasional brick. Gravel is fine to coarse angular limestone, brick, pottery and concrete
▼				0.80	67.10		
	1.00	D				▨	POSSIBLE MADE GROUND Soft to firm light orange brown very sandy silty slightly gravelly CLAY. Gravel is fine to medium sub-angular limestone and flint
	1.20	PP	65	1.20	66.70		
						▤	OXFORD CLAY FORMATION Stiff light grey mottled orange slightly sandy silty CLAY with occasional bands of fine orange sand and abundant rootlets
	1.50	D					
	2.00 2.00	D PP	 92				
	2.50 2.50	D PP	 100				
	3.00 3.00	D PP	 105				
				3.30	64.60		End of Trial Pit at 3.30m

Method of excavation: JCB 3CX

Stability: Sides Stable

Groundwater: Groundwater seepage at 0.80m

Trial Pit Dimensions: 0.70m x 2.20m x 3.30m

Remarks:

QMS ISO 9001 REGISTERED FIRM

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Trial Pit Log

Trial Pit No.
TP 04

Project Location: Elsfield Hall, Wolvercote, Oxford, OX2 8EP

Co-ords: 450518E - 210247N

Level: 68.45 mAOD

Dates: 16/12/2019

Project Number: 19.12.002

Logged By: Matthew Johnston to BS 5930:2015

Water Strikes	**Sample and In Situ Testing**			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth (m)	Type	(kPa)					
				0.10	68.35	▨	MADE GROUND Dark brown organic sandy SILT with abundant fine roots	
				0.40	68.05	▨	MADE GROUND Black sandy GRAVEL with brick cobbles. Gravel is fine to coarse angular asphalt, coal and brick	
	0.50	D				▨	WOLVERCOTE SAND & GRAVEL MEMBER Soft to firm orange brown very sandy slightly gravelly CLAY. Gravel is fine to medium angular flint	
	1.00 1.00	D PP	 90	1.00	67.45	▨	OXFORD CLAY FORMATION Stiff light grey mottled orange silty slightly sandy CLAY	1
	1.50 1.50	D PP	 95					
	2.00 2.00	D PP	 110	2.00	66.45	▨	OXFORD CLAY FORMATION Stiff blue grey locally mottled orange silty CLAY with some decomposed roots and occasional pockets of fine orange sand	2
	2.50	D						
	3.00	D						3
				3.20	65.25		End of Trial Pit at 3.20m	
								4

Method of excavation: JCB 3CX

Stability: Sides Stable

Groundwater: None encountered

Trial Pit Dimensions: 0.70m x 2.00m x 3.20m

Remarks: Roots visible to 0.80m bgl

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ISO 9001
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Appendix B

Existing Calculations

Print | Close Report

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Graham Taylor
Site name:	9 Elsfield Wayy
Site location:	Oxford

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.78871° N
Longitude:	1.26913° W
Reference:	766615687
Date:	Feb 06 2023 11:25

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	620	620
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

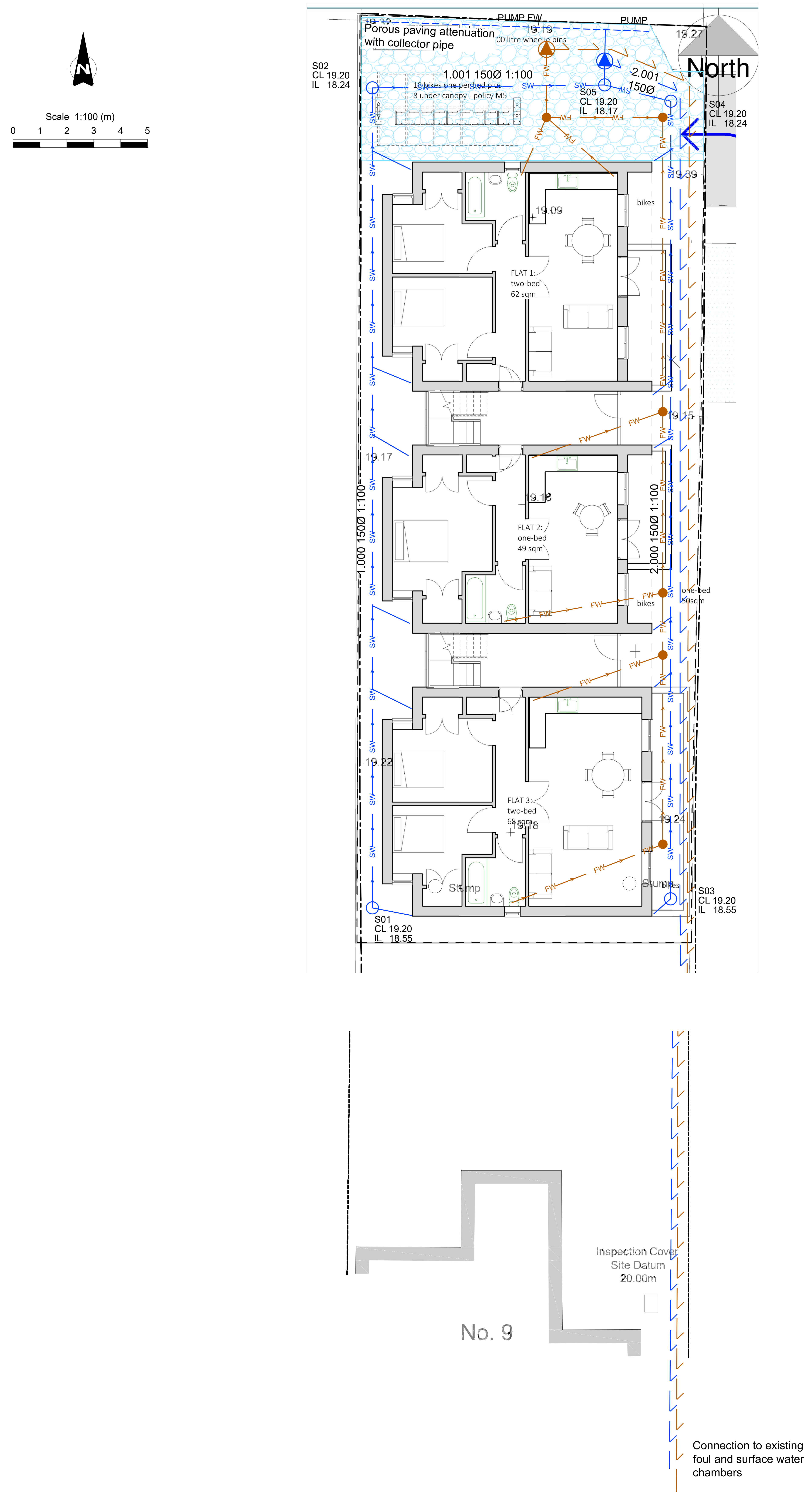
(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	0.42	0.42
1 in 1 year (l/s):	0.36	0.36
1 in 30 years (l/s):	0.96	0.96
1 in 100 year (l/s):	1.34	1.34
1 in 200 years (l/s):	1.57	1.57

Appendix C

Proposed Plans



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NOTES

1. All setting out to be in accordance with the Architects drawings. Any discrepancies between the Engineers and the Architects drawings to be referred to the Architect before proceeding. Dimensions must not be scaled.
2. All drainage to be installed in accordance with relevant Building Regulations documents and Current Sewers for Adoption where applicable.
3. Connections to Public sewers to be agreed and inspected by Water Authority.
4. Invert level, size and cover levels to existing manholes and sewers to be checked prior to any construction. Any discrepancies to be reported immediately.
5. Invert to base of soil stack bends to be 450mm below lowest branch connection for up to 3 storeys buildings. For buildings up to 5 storeys the invert to base of soil stack bends should be not less than 750mm.
6. All RWP and Foul Water drain point setting out is to be confirmed by Architect.
7. All RWP & SVP sizes & setting out by Architect / M&E Engineer. All below ground connections to match above ground outlet size, Min 100/110mm diameter.
8. Foul drains to project 100mm above finished floor level.
9. All internal Manholes and Inspection Chambers to have double sealed recessed covers to suit floor finishes by Architect.
10. All external covers in footpaths and roads in non tarmac areas to have recessed trays to suit the paving material.
11. All pipework to be 100/110Ø UNO. Refer to note 7 connection sizes.
12. All foul and surface water drainage stacks to have above ground rodding access, refer to above ground drainage layout by others.
13. This drawing has been produced in colour and should be reproduced in colour for clarity.
14. A CCTV Survey and report in WINCAN format for all new drainage will be required before the "As Built" drawings will be issued.

Key

Proposed Drainage

○ Storm Inspection Chamber

● Foul Inspection Chamber

→ FW— New Foul Sewer
→ SW— New Surface Water Sewer. Unperforated Pipe
– – – – New Surface Water Sewer. Perforated Pipe
New Surface Water Sewer. Rising Main

▲ New Pumping Chamber

P01	Preliminary	GT	07.02.23
Rev.	Amendment	By	Date

taylor
Consulting Engineers

tel: 01491 202544
e-mail: contact@taylorcivils.com
web: www.taylorcivils.com

Client **Hugh Goodwin**

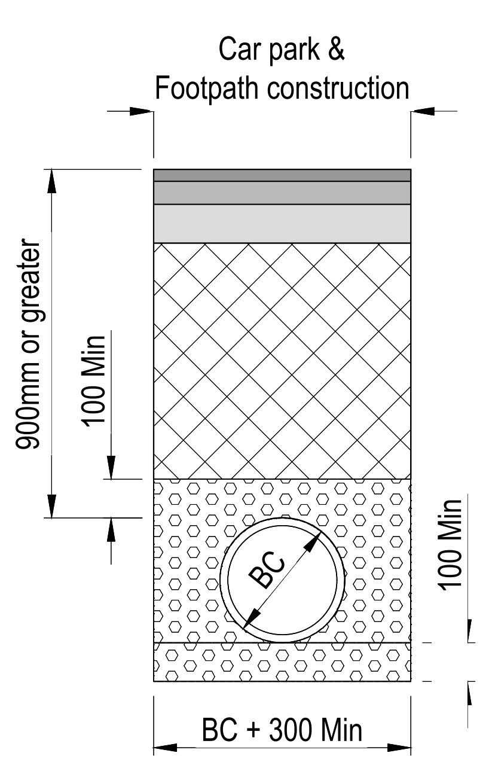
Project

9 Elsfield Way

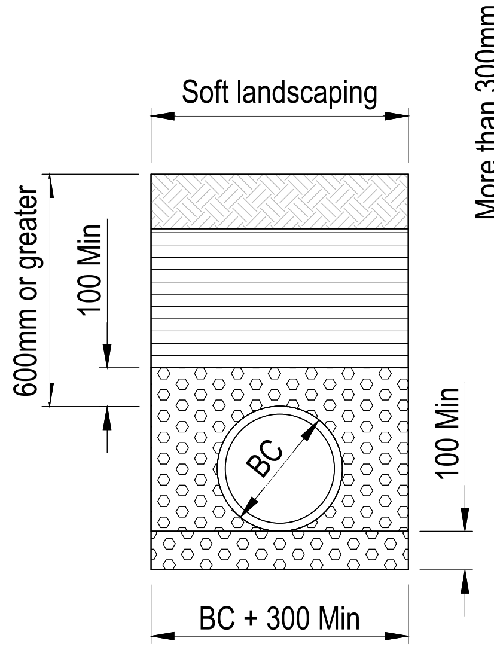
Title

Drainage Layout

Scale - A1 **1:100** Project No. **TC23001**
Project Ref.**ELW** Drg No. **300** Rev **P01**



CLASS "P"
BEDDING DETAIL



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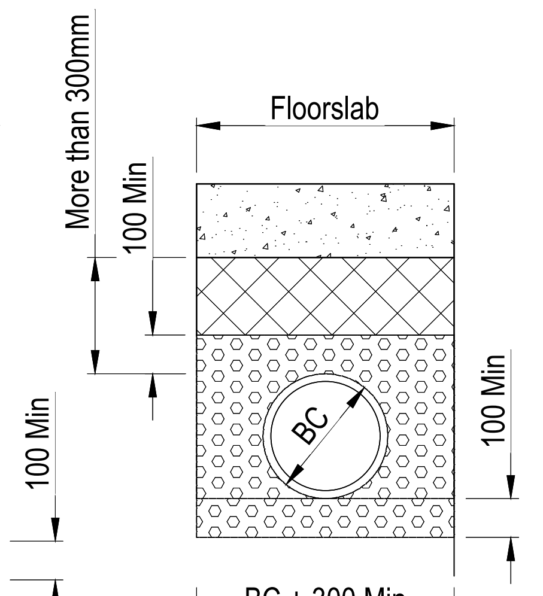
BEDDING DETAIL



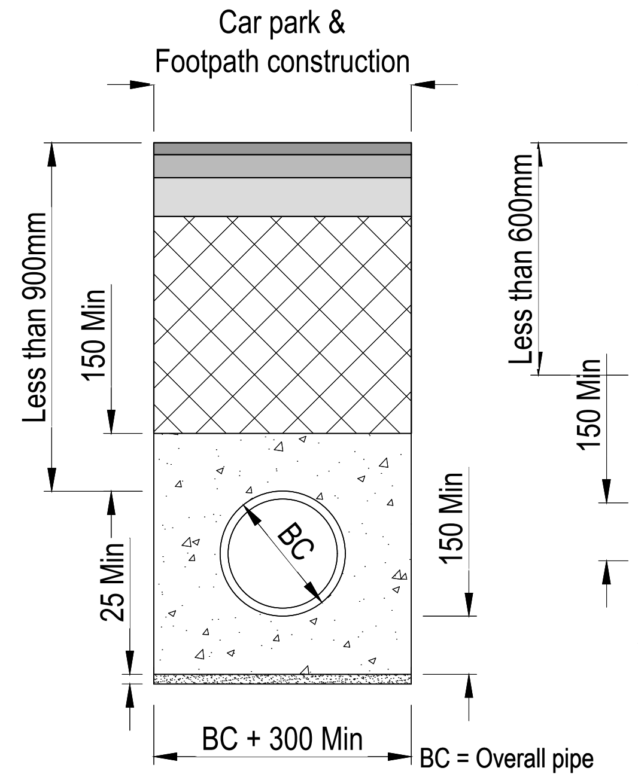
CLASS "W"
BEDDING
DETAIL

⬡	Granular Bedding and Sidefill
▨	GEN3 Concrete
☒	DOT Type 1 granular fill backfill well compacted in 150mm layers
☰	Material excavated from trench compacted in layers not exceeding 300mm thick. do not use heavy compactors before there is 600mm of material over pipes.

Extract from Table A2 WIS 4-08-02

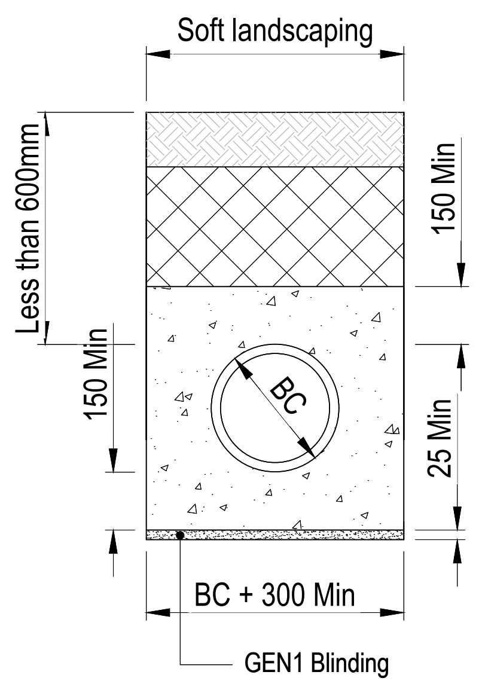
Processed granular bedding and sidefill materials for flexible pipes

Pipe nominal bore (mm)	Nominal maximum particle size (mm)	Materials specified in British Standards
100	10	10mm nominal single-size
Over 100 to 500	15	10 or 14mm nominal single-size or 14mm to 5mm graded
Over 150 to 300	20	10, 14 or 20mm nominal single-size or 14mm to 5mm graded or 20mm to 5mm graded
Over 300 to 550	20	14 or 20mm nominal single-size or 14mm to 5mm graded or 20mm to 5mm graded
Over 550	40	14, 20 or 40mm nominal single-size or 14mm to 5mm graded or 20mm to 5mm graded or 40mm to 5mm graded

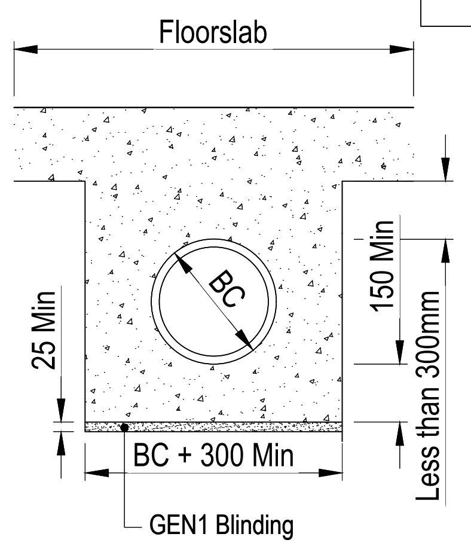


BC = Overall pipe diameter

CLASS "Z" BEDDING
DETAIL

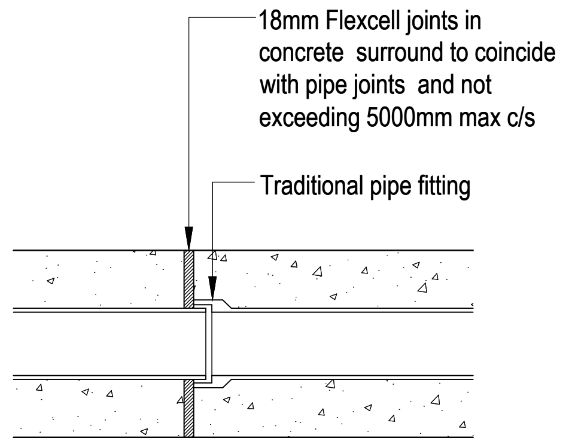


CLASS "Z" BEDDING
DETAIL

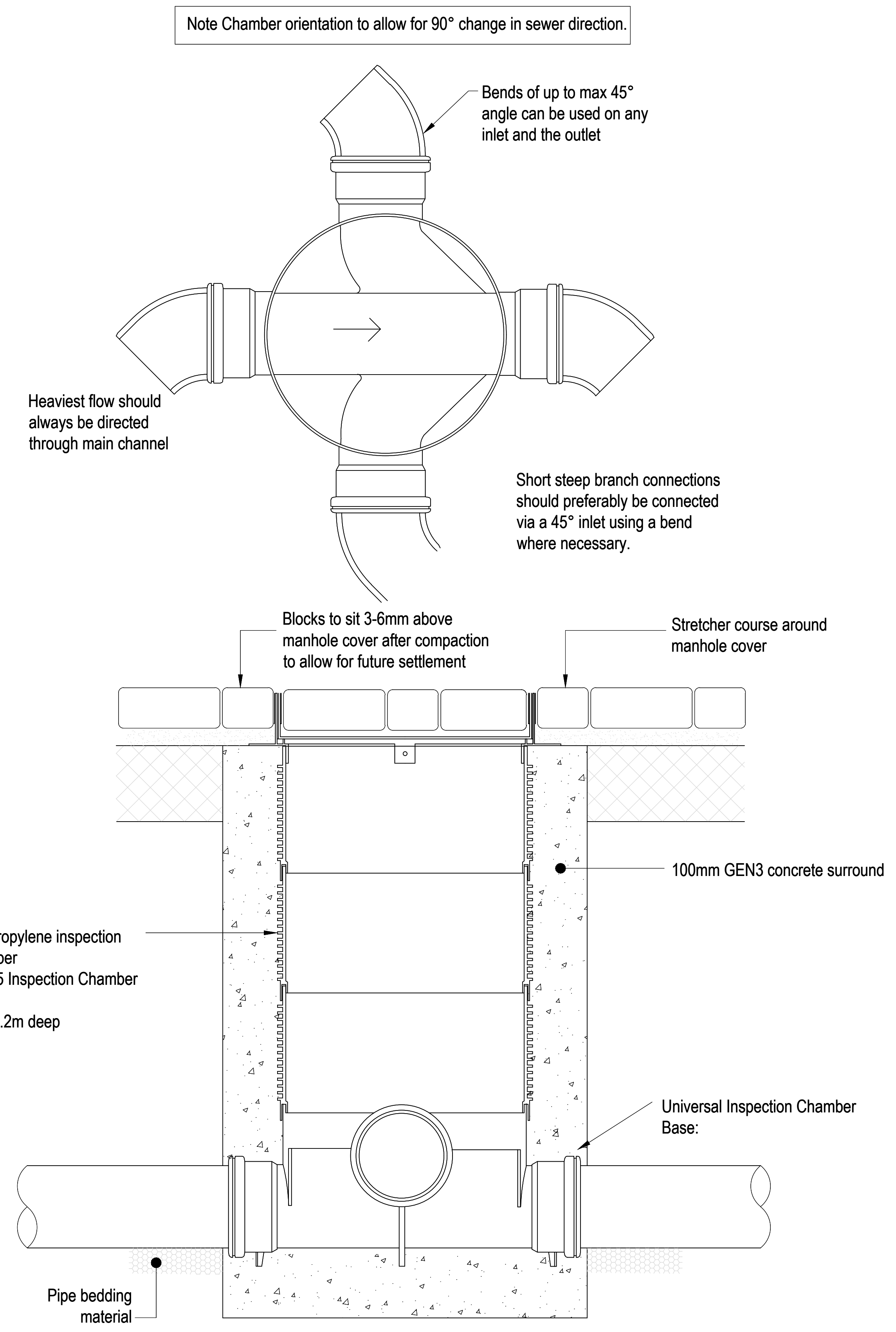


CLASS "Y" BEDDING DETAIL

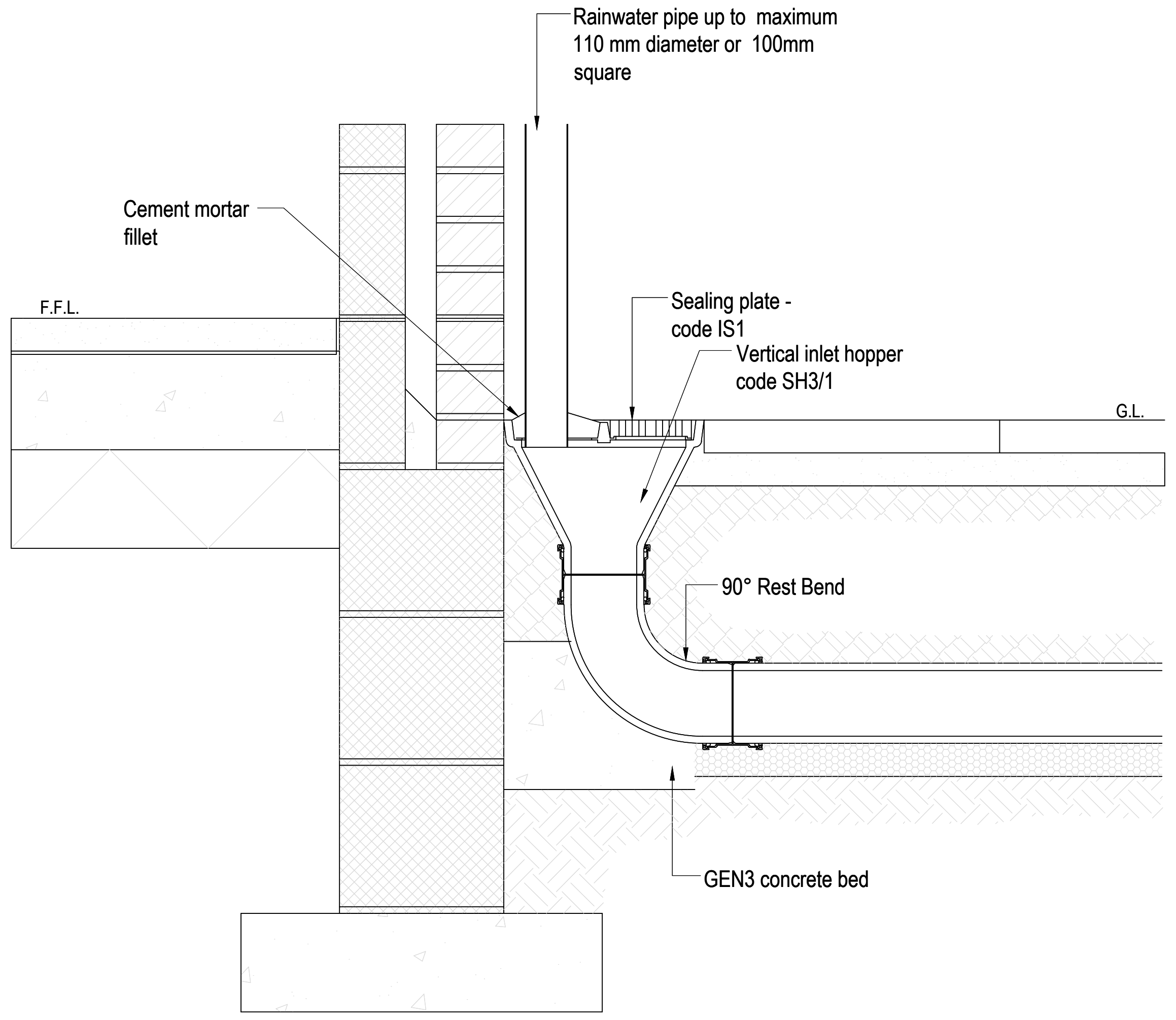
PLASTIC PIPES DETAIL



FLEXIBLE JOINTS
IN CLASS "Z" and "Y" CONCRETE SURROUND



POLYPROPYLENE INSPECTION CHAMBER



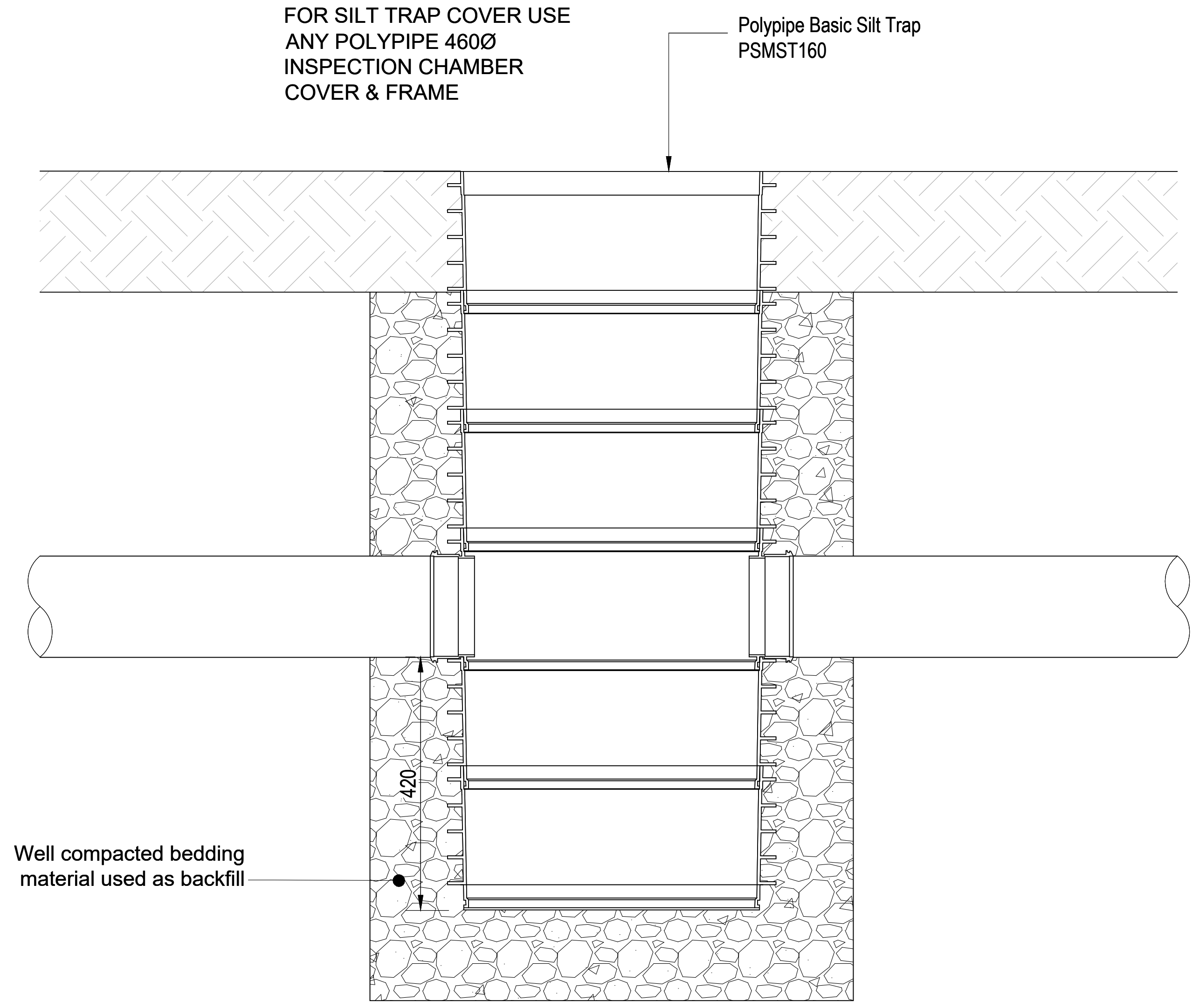
RWP DETAIL

NOTES

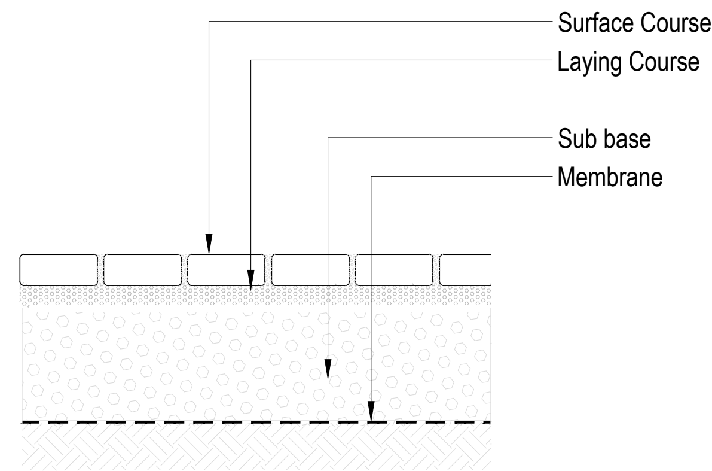
1. All setting out to be in accordance with the Architects drawings. Any discrepancies between the Engineers and the Architects drawings to be referred to the Architect before proceeding. Dimensions must not be scaled.
2. All drainage to be installed in accordance with relevant Building Regulations documents and Current Sewers for Adoption where applicable.

NOTE

FOR SILT TRAP COVER USE
ANY POLYPIPE 460Ø
INSPECTION CHAMBER
COVER & FRAME



PLASTIC CATCHPIT

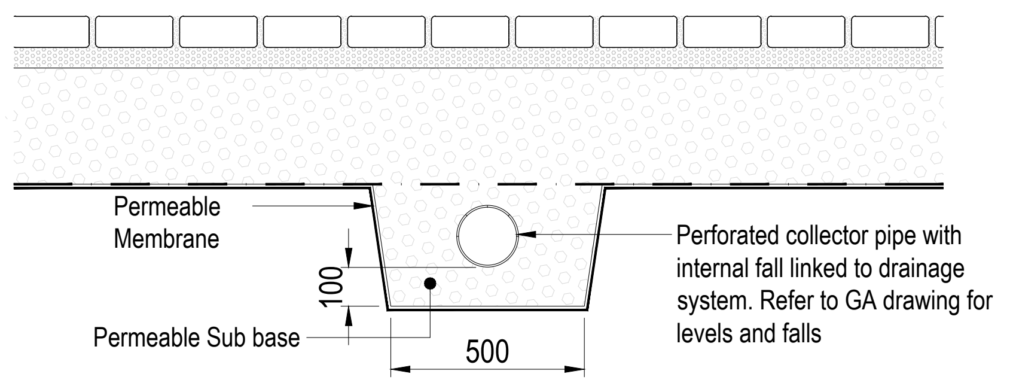


- Cutting Blocks; use a diamond bladed saw. Block splitters are NOT permitted
- Small slender cuts less than 25% NOT permitted.
- Joint space; blocks to be tightly butted
- Edge restraints shall be installed along the exposed perimeter and to drainage items and other penetrations within the pavement

PERMEABLE BLOCK PAVING PARTIAL INFILTRATION (Traffic Cat 4&3)
Pedestrian areas used by light commercial vehicles, emergency and maintenance vehicles. Small car park subject to cars only

Assumed CBR >3% (Subgrade to be proof rolled)

Layer	Thickness	Material
Surface Course	80mm	Permeable concrete block with interlocking nibs to Architects detail. Jointing material to block manufacturers specification. Allow for topping up of jointing material 3 months after completion.
Laying Course	50mm	Angular bedding material to BS EN 13242 and in accordance with the paving block manufacturer.
Sub base	250mm	Coarse graded aggregate (CGA) to comply with BS EN 13242 (BSI 2007 or BS 12620 (BSI 2008). Deemed to comply Type 3 sub base 0mm-40mm SHW Serier 800 or Coarse graded aggregate 4mm-20mm BS7533-13. Laid in maximum 150mm layer
Geogrid		Terram Geotextile



TYPICAL SECTION THROUGH COLLECTION PIPE

Rev.	Amendment	By	Date
P01	Preliminary	GT	28.11.22

taylor
Consulting Engineers

tel: 01491 202544
e-mail: contact@taylorcivils.com
web: www.taylorcivils.com

Client **Hugh Goodwin**

Project
9 Elsfield Way

Title
Drainage Layout

Scale - A1 **NTS** Project No. **TC23001**
Project Ref.**ELW** Drg No. **310** Rev **P01**

Appendix D

Proposed Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	30	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	1.000
Ratio-R	0.400	Preferred Cover Depth (m)	0.500
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.006	5.00	19.200	450	-223.871	51.624	0.650
2	0.010	5.00	19.200	450	-223.706	82.002	0.952
3	0.006	5.00	19.200	450	-212.604	51.071	0.650
4	0.008	5.00	19.200	450	-212.549	81.781	0.955
5	0.007	5.00	19.200	450	-216.360	81.836	1.025
PUMP			19.200	1500	-216.360	83.104	1.038

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)
1.000	1	2	30.378	0.600	18.550	18.248	0.302	100.6	150	5.51	50.0
1.001	2	5	7.348	0.600	18.248	18.175	0.073	100.7	150	5.63	50.0
2.000	3	4	30.710	0.600	18.550	18.245	0.305	100.7	150	5.51	50.0
2.001	4	5	3.811	0.600	18.245	18.175	0.070	54.4	150	5.56	50.0
1.002	5	PUMP	1.268	0.600	18.175	18.162	0.013	97.5	150	5.65	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.002	17.7	0.8	0.500	0.802	0.006	0.0	21	0.500
1.001	1.001	17.7	2.1	0.802	0.875	0.015	0.0	35	0.674
2.000	1.001	17.7	0.8	0.500	0.805	0.006	0.0	21	0.500
2.001	1.366	24.1	1.9	0.805	0.875	0.014	0.0	28	0.815
1.002	1.017	18.0	4.9	0.875	0.888	0.036	0.0	54	0.869

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)
1.000	30.378	100.6	150	Circular	19.200	18.550	0.500	19.200	18.248	0.802
1.001	7.348	100.7	150	Circular	19.200	18.248	0.802	19.200	18.175	0.875
2.000	30.710	100.7	150	Circular	19.200	18.550	0.500	19.200	18.245	0.805
2.001	3.811	54.4	150	Circular	19.200	18.245	0.805	19.200	18.175	0.875

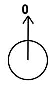
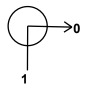
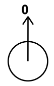
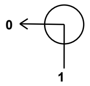
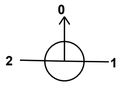
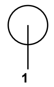
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	450	Manhole	Adoptable	2	450	Manhole	Adoptable
1.001	2	450	Manhole	Adoptable	5	450	Manhole	Adoptable
2.000	3	450	Manhole	Adoptable	4	450	Manhole	Adoptable
2.001	4	450	Manhole	Adoptable	5	450	Manhole	Adoptable

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)
1.002	1.268	97.5	150	Circular	19.200	18.175	0.875	19.200	18.162	0.888

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.002	5	450	Manhole	Adoptable	PUMP	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
1	-223.871	51.624	19.200	0.650	450		0	1.000	18.550	150
2	-223.706	82.002	19.200	0.952	450		1	1.000	18.248	150
							0	1.001	18.248	150
3	-212.604	51.071	19.200	0.650	450		0	2.000	18.550	150
4	-212.549	81.781	19.200	0.955	450		1	2.000	18.245	150
							0	2.001	18.245	150
5	-216.360	81.836	19.200	1.025	450		1	2.001	18.175	150
							2	1.001	18.175	150
							0	1.002	18.175	150
PUMP	-216.360	83.104	19.200	1.038	1500		1	1.002	18.162	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	**Climate Change (CC %)**	**Additional Area (A %)**	**Additional Flow (Q %)**
1	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node PUMP Online Pump Control

Flap Valve	x	Invert Level (m)	17.000	Switch off depth (m)	0.300
Replaces Downstream Link	✓	Switch on depth (m)	0.400		

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.300	2.000	2.000	2.000

Node 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	18.800	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	50	Depth (m)	0.250
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	0.250
Porosity	0.30	Length (m)	3.500		

Results for 1 year Critical Storm Duration. Lowest mass balance: 50.64%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	18.572	0.022	0.8	0.0073	0.0000	OK
15 minute winter	2	11	18.283	0.035	2.2	0.0126	0.0000	OK
15 minute winter	3	11	18.572	0.022	0.8	0.0073	0.0000	OK
15 minute winter	4	11	18.274	0.029	2.0	0.0095	0.0000	OK
15 minute winter	5	11	18.238	0.063	5.0	0.0186	0.0000	OK
15 minute winter	PUMP	15	18.194	0.032	5.0	0.0580	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 winter	1	1.000	2	0.8	0.345	0.045	0.0711	
15 minute winter	2	1.001	5	2.1	0.424	0.120	0.0373	
15 minute winter	3	2.000	4	0.8	0.410	0.045	0.0599	
15 minute winter	4	2.001	5	1.9	0.425	0.080	0.0179	
15 minute winter	5	1.002	PUMP	5.0	0.784	0.277	0.0081	
15 minute summer	PUMP	Pump		2.0				1.1

Results for 30 year Critical Storm Duration. Lowest mass balance: 50.64%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	27	18.625	0.075	1.6	0.0253	0.0000	OK
30 minute winter	2	28	18.624	0.376	4.2	0.1356	0.0000	SURCHARGED
30 minute winter	3	27	18.625	0.075	1.5	0.0252	0.0000	OK
30 minute winter	4	28	18.624	0.379	4.8	0.1254	0.0000	SURCHARGED
30 minute winter	5	26	18.624	0.449	7.6	0.1319	0.0000	SURCHARGED
30 minute winter	PUMP	28	18.624	0.462	7.3	0.8171	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 winter	1	1.000	2	1.9	0.439	0.110	0.3248	
15 minute winter	2	1.001	5	4.5	0.512	0.257	0.1294	
15 minute winter	3	2.000	4	1.9	0.518	0.110	0.3273	
15 minute winter	4	2.001	5	4.2	0.515	0.174	0.0671	
15 minute winter	5	1.002	PUMP	10.6	0.950	0.589	0.0223	
15 minute summer	PUMP	Pump		2.0				4.0

Results for 100 year Critical Storm Duration. Lowest mass balance: 50.64%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	29	18.837	0.287	2.6	0.0973	0.0000	SURCHARGED
30 minute winter	2	30	18.837	0.589	5.3	0.2128	0.0000	SURCHARGED
30 minute winter	3	28	18.837	0.287	2.6	0.0965	0.0000	SURCHARGED
30 minute winter	4	30	18.837	0.592	4.8	0.1961	0.0000	SURCHARGED
30 minute winter	5	30	18.837	0.662	8.4	0.5517	0.0000	SURCHARGED
30 minute winter	PUMP	30	18.837	0.675	7.6	1.1936	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 winter	1	1.000	2	2.6	0.446	0.144	0.5348	
15 minute summer	2	1.001	5	5.7	0.512	0.321	0.1294	
15 minute winter	3	2.000	4	2.5	0.517	0.142	0.5406	
15 minute summer	4	2.001	5	5.1	0.507	0.211	0.0671	
15 minute winter	5	1.002	PUMP	10.7	0.951	0.594	0.0223	
15 minute summer	PUMP	Pump		2.0				5.6

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 50.64%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	1	57	19.145	0.595	3.7	0.2018	0.0000	FLOOD RISK
60 minute winter	2	57	19.145	0.897	5.0	0.3238	0.0000	FLOOD RISK
60 minute winter	3	57	19.145	0.595	3.7	0.2000	0.0000	FLOOD RISK
60 minute winter	4	57	19.145	0.900	4.5	0.2980	0.0000	FLOOD RISK
60 minute winter	5	56	19.145	0.970	10.4	2.8790	0.0000	FLOOD RISK
60 minute winter	PUMP	57	19.145	0.983	5.7	1.7375	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)
30 minute summer	1	1.000	2	-3.9	0.417	-0.218	0.5348	
30 minute winter	2	1.001	5	6.3	0.472	0.359	0.1294	
30 minute summer	3	2.000	4	-4.1	0.492	-0.233	0.5406	
30 minute winter	4	2.001	5	6.0	0.470	0.247	0.0671	
15 minute summer	5	1.002	PUMP	13.3	1.002	0.739	0.0223	
15 minute summer	PUMP	Pump		2.0				8.2

Appendix E

SuDS Maintenance Schedule

Green Roofs Operation & Maintenance Requirements

Extensive green roofs should normally only require bi-annual or annual visits to remove litter, check fire breaks and drains and, in some cases, remove unwanted colonizing plants. The most maintenance is generally required in the first three years, and usually this should be made the responsibility of the green roof provider.

Intensive green roofs will require regular maintenance. Lawns will require mowing weekly or fortnightly, plant beds may require weeding on a weekly or fortnightly basis during the growing season, and wildflower meadows may require annual mowing with the cuttings removed.

Operation and maintenance requirements for green roofs are described below.

Green roof operation and maintenance requirements

	Extensive green roof	**Intensive green roof**
Access	Not usually accessible	Accessible as public space or garden
Growing medium	Thin growing medium 20 to 150mm	Deeper growing medium
Irrigation	Only during plant establishment	Occasional to frequent
Maintenance	Minimal to none	Low to high
	Advantages • Lightweight • Suitable for roofs with slope of up to one in three • Little or no need for irrigation and specialized drainage systems • Often suitable for retrofits • Little management of vegetation • Relatively inexpensive • Attractive to pioneer species colonization, which can lead to a more biodiverse long-term ecosystem • Can support arrested pioneer communities, which are important for nature conservation **Disadvantages** • More stressful conditions for plants, leading to lower potential diversity and associated biodiversity • Limited insulation provision • Limited surface water retention benefits • Limited aesthetic benefits	**Advantages** • More favorable conditions for plants, leading to greater potential diversity of plants and habitats • Good contribution to thermal performance of the building • Can be made very attractive • Often accessible, with opportunities for recreation and amenity benefits • Good surface ware retention capacity **Disadvantages** • Greater loading on roof structures • Need for irrigation and drainage systems requiring energy, water, materials • Higher capital and maintenance costs

If mechanical systems are located on the roof, then spill prevention measures must be exercised to ensure that roof runoff is not contaminated. The mechanical system area should be bundled and provided with separate drainage.

Training and guidance information on operating and maintaining the roof should be provided to property owners. Safety fastenings will be required for personnel working on the roof.

Access routes to the roof should be designed and maintained to be safe and efficient and walkways should always be kept clear of obstructions.

Maintenance activities should be detailed in the Health and Safety Plan and a risk assessment should be undertaken.

Permeable Paving Operation & Maintenance Requirements

Regular inspection and maintenance is important for the effective operation of pervious pavements. The facility should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious surfaces need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. Manufacturers' recommendations should always be followed.

A brush cleaner, which can be a lorry-mounted device or a smaller precinct sweeper, should be used and the sweeping regime should be as follows:

1. End of winter (April) – to collect winter debris.
2. Mid-summer (July/August) – to collect dust, flower and grass-type deposits.
3. After autumn leaf fall (November).

Care should be taken in using vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced.

If reconstruction is necessary, the following procedure should be followed:

1. Lift surface layer and laying course.
2. Remove any geo-textile filter layer.
3. Inspect sub-base and remove, and replace if required.
4. Renew any geo-textile layers.
5. Renew laying course, jointing material and concrete block paving.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Pervious pavement operation and maintenance requirements

Maintenance schedule	**Required action**	**Frequency**
Regular maintenance	Brushing	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilize and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosphate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements

Maintenance schedule	**Required action**	**Frequency**
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting, and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every ten to fifteen years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48hrs after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Maintenance activities should be detailed in the Health and Safety Plan and a risk assessment should be undertaken.

Water Butts Operation & Maintenance Requirements

Water butts are low maintenance devices. The operation and maintenance requirements for water butts are described below.

Water butts operation and maintenance requirements

Maintenance schedule	**Required action**	**Frequency**
Regular maintenance	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris.	Annually (or following poor performance).
Occasional maintenance	Replacement of any filters.	As required.
Remedial actions	Repair of erosion damage, or damage to tank.	As required.
Monitoring	Inspection of the tank for debris and sediment build up.	Annually (or following poor performance).
	Inspection of inlets, outlets and withdrawal devices.	Annually (or following poor performance).
	Inspection of areas receiving overflow, for evidence of erosion.	After extreme storms.
	Inspection of roof drain filters.	Annually (or following poor performance).