TECHNICAL NOTE – 9154/01
SURFACE WATER DRAINAGE DESIGN

Proposed Commercial Redevelopment, Penventon Farm Nursery, Lanner, Cornwall on Behalf of Warrior Warehouses Limited

Project Title:	Proposed Commercial Redevelopment, Penventon Farm Nursery, Lanner, Cornwall, TR16 6AS				
Client:	Warrior Warehouses Limited				
Project No.:	9154	Date:	September 2023	Issue No.:	1
Title:	Surface Water Drainage Design				
Written By:	B. Thornton BSc (Hons)	Checked By:	J. Pockett MEng (Hons)	Authorised By:	D. Frosoni CEng MICE MCIWEM

1.0 Introduction

1.1 This *Technical Note* has been prepared in relation to surface water drainage Planning Condition 4 (*Cornwall Council Application Reference: PA20/08877)* associated with the proposed construction of one commercial building with landscaping, access and parking at Penventon Farm Nursery, Lanner, Cornwall, TR16 6AS. Refer to enclosed CE Figure 9154/500 Figure 1 [*Site Location Plan*]. The proposal comprises the demolition of existing greenhouses on site, with one existing building to be retained, and the construction of a new warehouse. Refer to Drawing No. 07976-TDA-DR-PL-0006 [*Block Plan and Site Location Plan*] (by Trewin Design Architects) enclosed with this *Technical Note*.

1.2 This study advises on an appropriate surface water drainage scheme based on Sustainable Drainage Systems (SuDS) for the development site in line with national guidance, namely *National Planning Policy Framework (NPPF)* and its accompanying *Planning Practice Guidance (PPG)* and Cornwall Council (CC) Lead Local Flood Authority's (LLFA) requirements in relation to Planning Condition 4 below:

Condition 4:
The proposed surface water drainage systems shall be in accordance with the principles set out in Trewin Design Architects Flood Risk Assessment and Drainage Strategy. No development approved by this permission shall be commenced until details of a scheme for the provision of surface water management has been submitted to and approved by the LPA. The details shall include:

- *Details of the final drainage schemes including calculations and layout*
- *A Construction Surface Water Management Plan*
- *A Construction Quality Plan*
- *A timetable of construction*
- *Confirmation of who will maintain the drainage systems and a plan for the future management and maintenance, including responsibilities for the drainage systems and overland flow routes. The plan must include a drawing which clearly indicates the management responsibility for each drainage element, and schedule of maintenance. The developer must inform the LPA of any variation from the details provided and agree these in writing before such variations are undertaken. The surface water drainage systems shall fully manage surface water flows resulting from the development site up to the 1 in 100 year peak rainfall*

event plus a minimum allowance of 40% for the impacts of climate change. The approved scheme shall be implemented in accordance with the timetable so agreed and the scheme shall be managed and maintained in accordance with the approved details for the lifetime of the development.

1.3 This Report excludes the following elements of Condition 4 These elements will be provided by the Applicant separately: -

- *A Construction Quality Plan*
- *A timetable of construction*
- *Confirmation of who will maintain the drainage systems*

2.0 Existing Site

2.1 The site currently comprises an existing garden centre, Penventon Nursery, including car parking in the east and greenhouses to the west of the site. Access to the site is taken from the A393 to the north of the site. The site area is approximately 0.6908ha.

2.2 The site is immediately bound to the north by an existing residential building “Oakwood House B&B and Campsite” with Penventon Nursery Garden Centre and the A393 beyond. To the east, south and west the site is bound by undeveloped greenfield land. Land use in the vicinity of the site is a mixture of commercial and agricultural.

Existing Topography

2.3 The topographical survey for the site indicates that the site falls from south west to north east. Existing ground levels across the site vary from 84.596mAOD in the south west of the site to 79.425mAOD in the north east of the site.

Nearby Watercourses/Drainage Features

2.4 There is an unnamed water course that runs alongside the site’s eastern boundary. At its closest point the watercourse is located approximately 39.60m to the east of the site.

3.0 Proposed Construction Surface Water Management Plan

3.1 It is proposed that runoff during the construction period will discharge to a settlement lagoon. The silty water within this settlement lagoon would then be pumped to a siltbuster that would remove the sediment. The siltbuster system would then discharge clean runoff to a temporary infiltration system to the north of the site. Refer to CE Drawing 9154/502 [*Proposed Surface Water Drainage Layout*] enclosed.

4.0 Surface Water Drainage Proposals

Refer to CE Drawings 9154/502 [*Proposed Surface Water Drainage Layout*] and 9154/503 [*Proposed Surface Water Drainage Construction Details*] enclosed.

4.1 The drainage proposals for the site have been prepared in accordance with the following national and local guidance:

- *National Planning Policy Framework (July 2021);*
- *Planning Practice Guidance – Flood Risk and Coastal Change (August 2022);*
- *Flood risk assessments: climate change allowances (May 2022);*
- *C753 The SuDS Manual (CIRIA, November 2015);*
- *Non-Statutory Technical Standards for SuDS (March 2015); and*
- *Building Regulations 2010 – Approved Document H (Drainage and Waste Disposal).*

Drainage Hierarchy

4.2 The drainage proposals for the site have been developed in line with the national and local guidance, SuDS principles and Building Regulations guidelines following the drainage hierarchy as discussed below and as summarised in Table 4.1:

- *Rainwater re-use;*
- *Infiltration to the maximum extent that is practical;*
- *Discharge to surface waters (watercourses);*
- *Discharge to a surface water sewer, highway drain or another drainage system; or*
- *Discharge to combined sewer.*

Table 4.1: Review of SuDS Components in accordance with the Drainage Hierarchy

SuDS Techniques	Proposed	Not proposed	Reason
Store rainwater for re-use		X	Rainwater butts will not be incorporated in the development.
Use infiltration techniques	X		Infiltration techniques have been shown to be feasible, therefore an infiltration strategy has been proposed.
Attenuate rainwater in ponds or open water features		X	The site comprises an existing car park which will remain operational; space is therefore not available for open SuDS.
Attenuate rainwater in sealed tanks		X	Infiltration is possible therefore an attenuation strategy is not being proposed.
Discharge direct to a watercourse		X	No connection is sought to the existing watercourse to the east of the site.
Discharge to a surface water drain		X	No connection sought to a surface water sewer.
Discharge to a combined sewer		X	No connection sought to a combined sewer.

Infiltration Potential

4.3 An intrusive site investigation was undertaken in February 2021 by Wheal Jane Consultancy. The results of this intrusive site investigation indicated that infiltration was possible on site. The lowest infiltration rate found on site was 2.54×10^{-5}m/s this rate has been used in the design of SUDS features on site. In accordance with the

Drainage Hierarchy, it is proposed that an infiltration-based strategy will be utilised on site. The results of the intrusive site investigation are enclosed within this technical note.

Proposed Sustainable Drainage Systems (SuDS)

Permeable Surfacing

4.4 Runoff from the proposed warehouse roof area will discharge directly into a permeable surfacing structure located throughout the proposed hardstanding area. This permeable surfacing structure will consist of interlocking permeable paving blocks. Runoff from the proposed hardstanding area will percolate through the permeable surfacing, into the storage medium below and discharge into the underlaying strata.

4.5 Proposed finished levels vary across the permeable surfacing, therefore, vertical restraints will be required to minimise the overall required excavation of the paving subbase. The proposed hardstanding area will be subdivided into three areas across the site for this reason.

4.6 Preliminary calculations indicate that a volume of 147.4m³ needs to be accommodated to drain surface water runoff from the site at the above-mentioned infiltration rate. This can be provided within three areas of permeable surfacing as set out in Table 4.2 below. Refer also to network design calculations enclosed within this *Technical Note*.

Table 4.2: Permeable Pavement Summary (1:100 year + 45% Storm)

Permeable Pavement Area	Area (m^2)	Sub- base Depth (m)	Storage Provided (m^3)	Half Drain Time (mins)
1	620	0.35	29.5	88
2	378	0.35	35.1	116
3	1290	0.35	82.8	88

Design Exceedance

4.7 Should the drainage system fail due to extreme rainfall events or blockage, exceedance flow would follow the existing site topography and gravitate to the eastern boundary of the site, where it would flow naturally into the undeveloped greenfield land and existing watercourse in that area. Some exceedance flow would also head in a northernly direction, this would primarily enter an area of undeveloped land. However, there is an existing Bed and Breakfast beyond this land. Exceedance flows may impact on this site depending on existing ground levels within the undeveloped greenfield land. Exceedance flows would not negatively impact the proposed development. Exceedance flow routes are shown on CE Plan 9154/502 [*Proposed Surface Water Drainage Layout]* enclosed within this *Technical Note*.

Water Quality

4.8 Water quality has been assessed in line with the Simple Index approach from Chapter 26 of CIRIA *C753 The SuDS Manual:*

1) Step 1 – Allocate suitable pollution hazard indices for the proposed land use.

2) *Step 2 – Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index.*

4.9 The pollution hazard indices for the proposed land use are medium (commercial yard and delivery areas). The pollution hazard indices for the proposed land uses are shown in Table 4.3 below.

Table 4.3: Pollution Hazard Indices for different land uses (based on Table 26.2 of *CIRIA C753 The SuDS Manual*)

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Commercial yard and delivery area	Medium	0.7	0.6	0.7

4.10 The Pollution Mitigation Indices for permeable surfacing are equal to the Pollution Hazard Indices for Commercial yards and delivery areas. Refer to Table 4.4 below. Therefore, the proposed strategy will provide sufficient water quality treatment for the site prior to discharge.

Table 4.4: Pollution Mitigation Indices for Discharge to Groundwater from the Proposed Site (from Table 26.4 of CIRIA C753 The SuDS Manual)

SuDS Feature	Total suspended solids (TSS)	Metals	Hydrocarbons
Permeable Surfacing	0.7	0.6	0.7

Adoption and Maintenance

4.11 All on site surface water drainage systems will remain private, and will be the responsibility of the site owner or a private management company acting on behalf of the owner. A draft Maintenance Schedule is outlined below and summarised in Table 4.5.

Permeable Paving

4.12 Permeable surfaces need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. A brush and suction cleaner, which can be a lorry mounted device or a smaller precinct sweeper, should be used and the sweeping regime should be as follows:

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

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

- Lift surface layer and laying course
- Remove any geotextile filter layer
- Inspect sub-base and remove, wash and replace if required
- Renew any geotextile layer
- Renew laying course, jointing material and concrete block paving

4.14 Materials removed from the voids or the layers below the surface of the paving may contain hazardous substances such as heavy metals and hydrocarbons which may need to be disposed of as controlled waste.

Pipework and Catchpits

4.15 It is not envisaged that silt build up within the pipework systems will require a rigorous maintenance regime so long as silt is removed from upstream catch pits on a regular basis. Notwithstanding this, a suitable maintenance regime for the systems will comprise of routine inspection (every six months) and silt removal (as necessary).

Table 4.5: Draft Maintenance Schedule for Proposed Drainage Infrastructure

Drainage Element	Schedule	Maintenance Requirement	Frequency
Permeable surfacing	Regular	• Remove litter and debris	• Monthly
		• Mow grass at margins	• Monthly, or as required
		• Brushing and vacuuming over whole surface	• Mid-summer, after autumn leaf fall and end of winter
	Occasional	• Removal of weeds	• As required
	Remedial	• Remedial work to any depressions or damage considered a hazard to end users or detrimental to performance • Rehabilitation of surface and upper sub-structure by remedial sweeping	• As require • Every 10-15 years or as required
	Monitoring	• Initial inspection • Inspect for evidence of weed growth or poor operation • Inspect silt accumulation rates • Monitor inspection chambers	• Monthly for 3 months after installation • Three monthly, 48 hours after large storm in first six months • Annually • Annually
Pipework & Catchpits	Regular	• Inspect for accumulation of silt • Inspect inlets, outlets and overflows for blockages • Inspect for debris and litter	• Every six months
	Occasional	• Remove debris and litter • Remove silt	• As required

Note: In addition to the above maintenance requirements, it is recommended that all drainage elements are inspected:

- Following the first storm event
- Monthly for the first 3 months following commissioning

Cole Easdon Consultants Limited
September 2023

Enclosures

CE Drawing 9154/500	Site Location Plan
CE Drawing 9154/502	Proposed Surface Water Drainage Layout
CE Drawing 9154/503	Proposed Surface Water Drainage Construction Details
Drawing No. 07976-TDA-DR-PL-0006	Block plan and site location plan (by Trewin Design Architects)

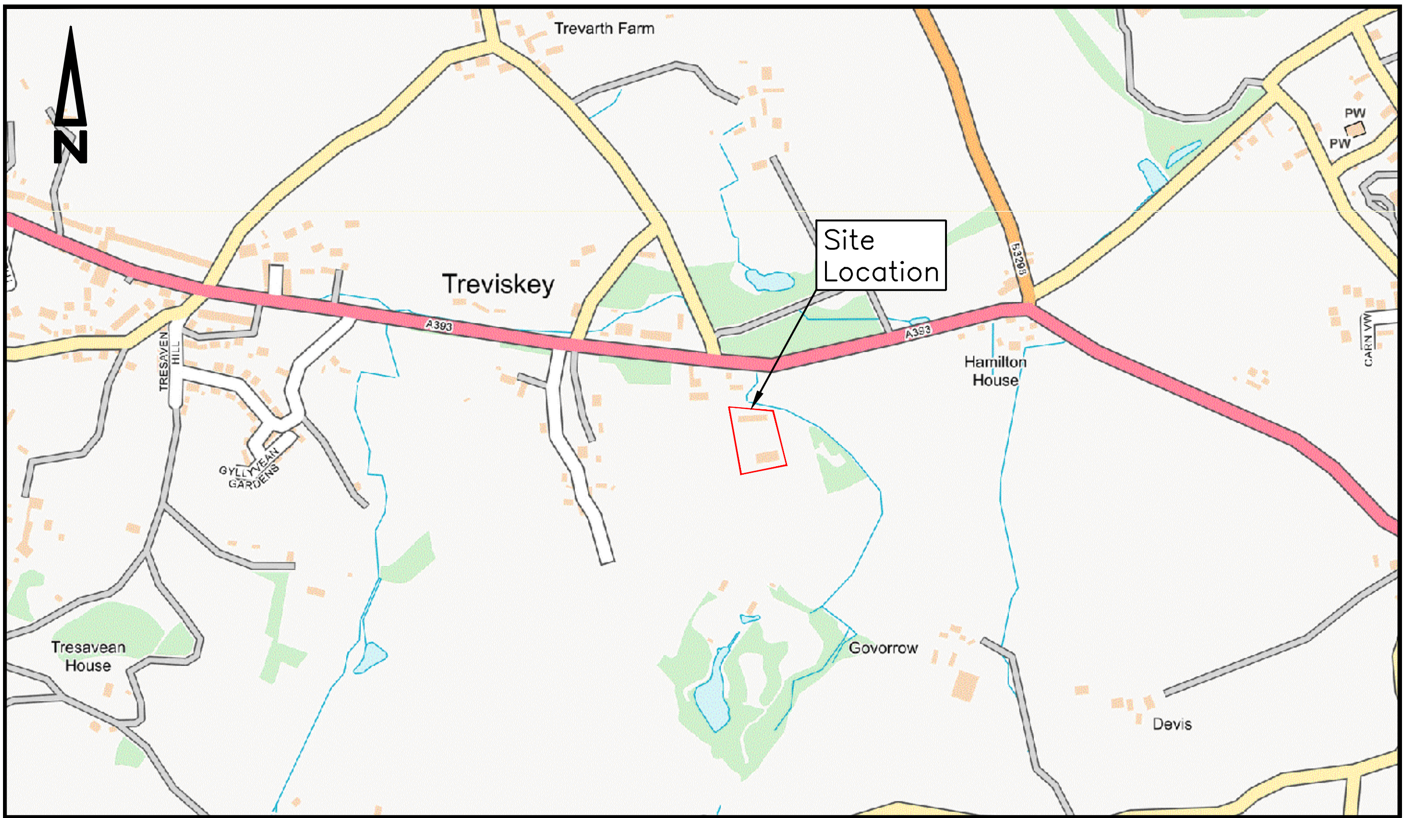
9154 Permeable Surfacing Section One Network Design

9154 Permeable Surfacing Section Two Network Design

9154 Permeable Surfacing Section Three Network Design

Soakaway Letter Report – Penventon Nursery 20468

Enclosures



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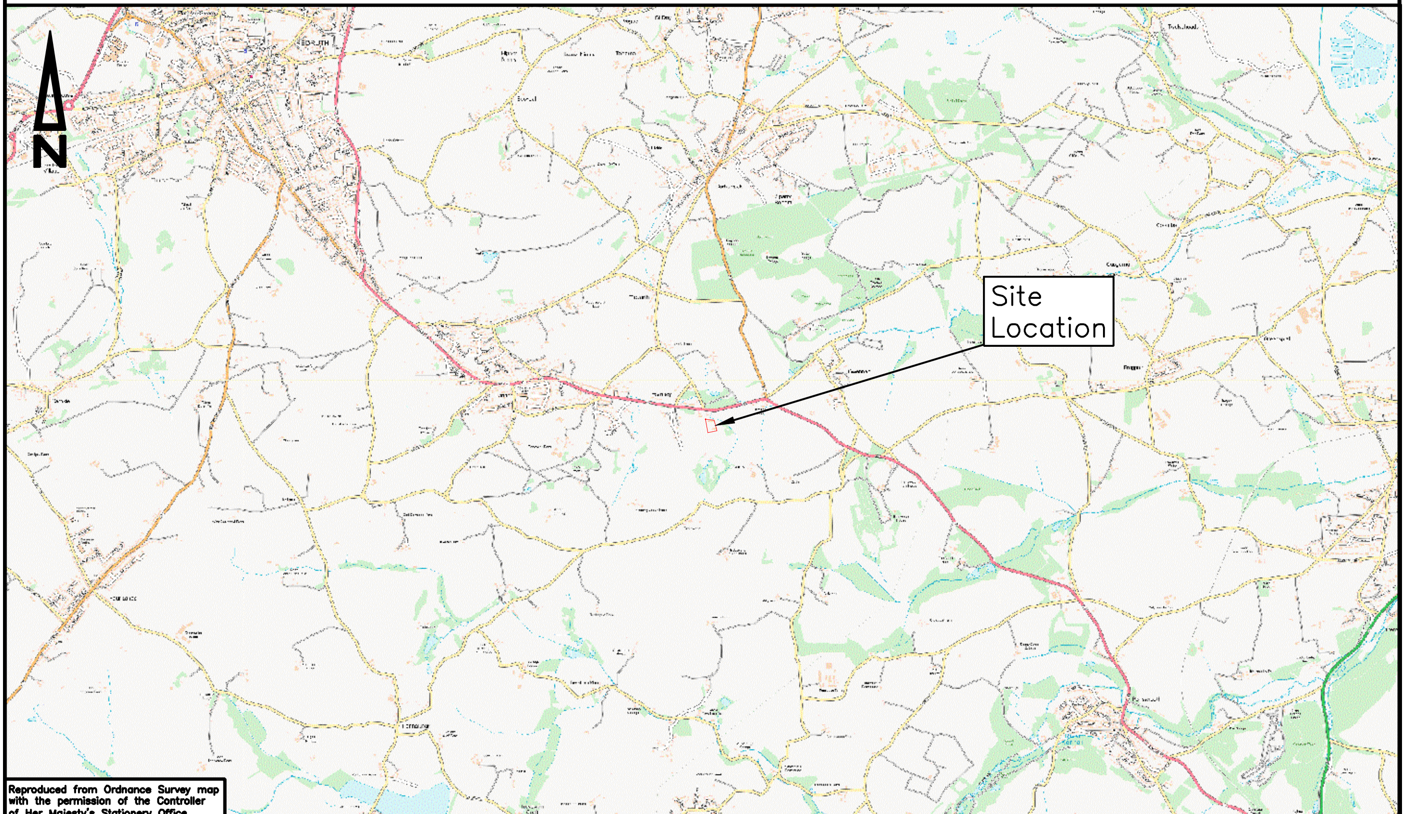

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Cole Easdon

01793 619 965 | cec@ColeEasdon.com | www.ColeEasdon.com

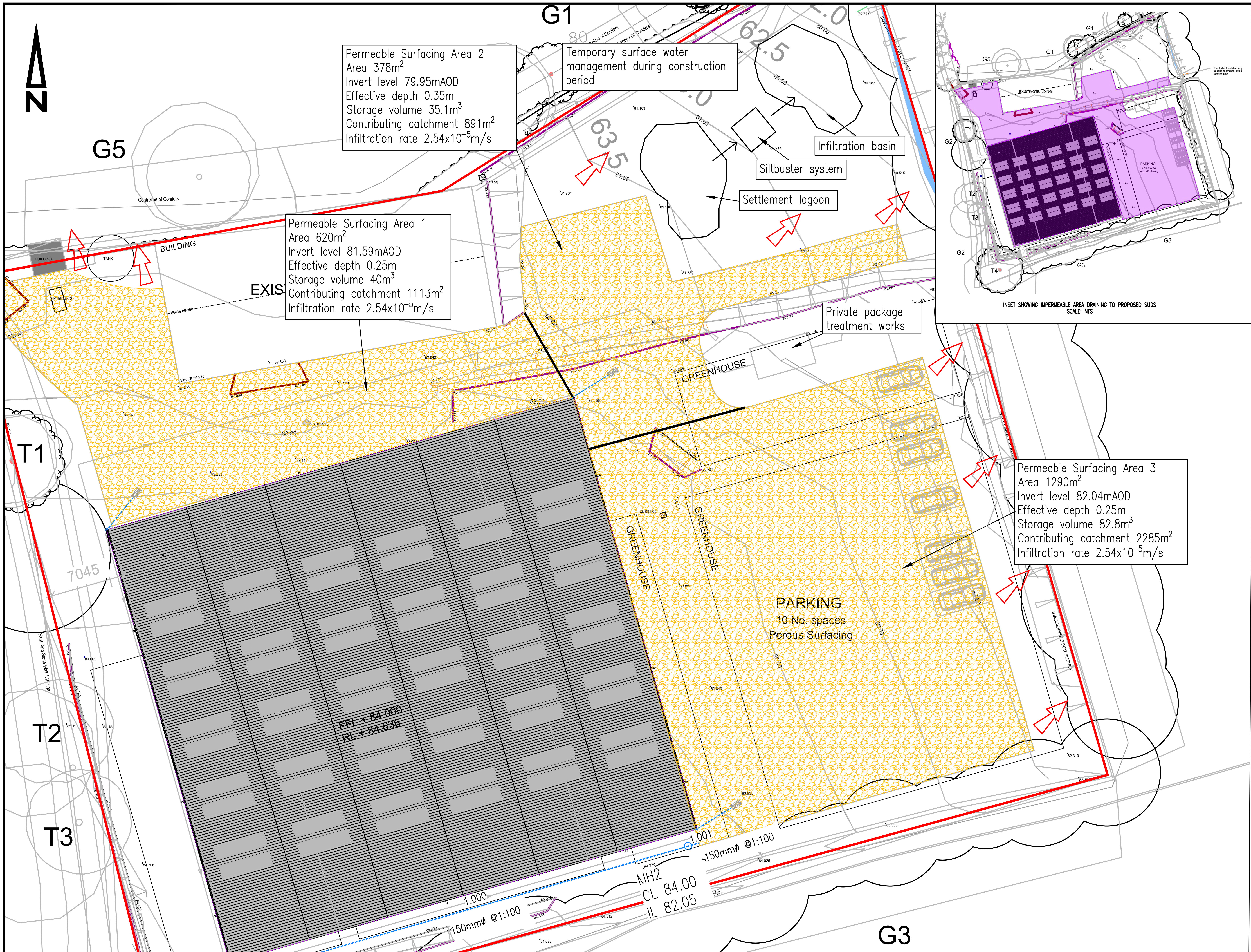
Job Title:
Proposed Warehouse
Penventon Farm Nursery
Lanner
TR16 6AS

Client:
Warrior Warehouses Ltd

Drawing Status:

CONSTRUCTION AT CLIENT AND/OR CONTRACTOR RISK	FOR COMMENT	
	FOR PLANNING	X
	FOR TENDER	
	FOR APPROVAL	
	FOR CONSTRUCTION	
	AS BUILT	

Drawing Title:	Drawn By	Date Drawn	Scale
Site Location Plan	BT	August 2023	As Shown (A4)
	Checked By	**Drawing No.**	**Revision**
	JP	9154/500 Figure 1	



REFERENCE DRAWINGS:

Drawing No.	Drawing Title	Revision	Date	Company
07976-TDA-DR-PL-0006	Block Plan and Site Location Plan	A03	Sept 2020	Trewin Design Architects

Key:

- Site boundary
- Proposed impermeable area Area: 0.4289 ha
- Proposed surface water drain and inspection chamber
- Proposed tanked permeable surfacing
- Proposed permavoid distribution tank (outlet to permeable paving systems)
- Proposed vertical restraints
- Design excedence route
- 81.887+ Existing ground level

NOTES

1. All levels are in metres above Ordnance datum
2. Surface water drainage systems designed to accommodate the 1 in 100 year critical storm including a 45% allowance for climate change

Cole Easdon
01793 619 965 | cec@ColeEasdon.com | www.ColeEasdon.com

Client
Warrior Warehouses Ltd

Job Title
Proposed Warehouse
Penventon Farm Nursery
Lanner
TR16 6AS

Drawing Title
Proposed Surface Water Drainage Layout

Drawing Status:

FOR COMMENT	FOR PLANNING	FOR TENDER	FOR APPROVAL	FOR CONSTRUCTION	AS BUILT
	X				

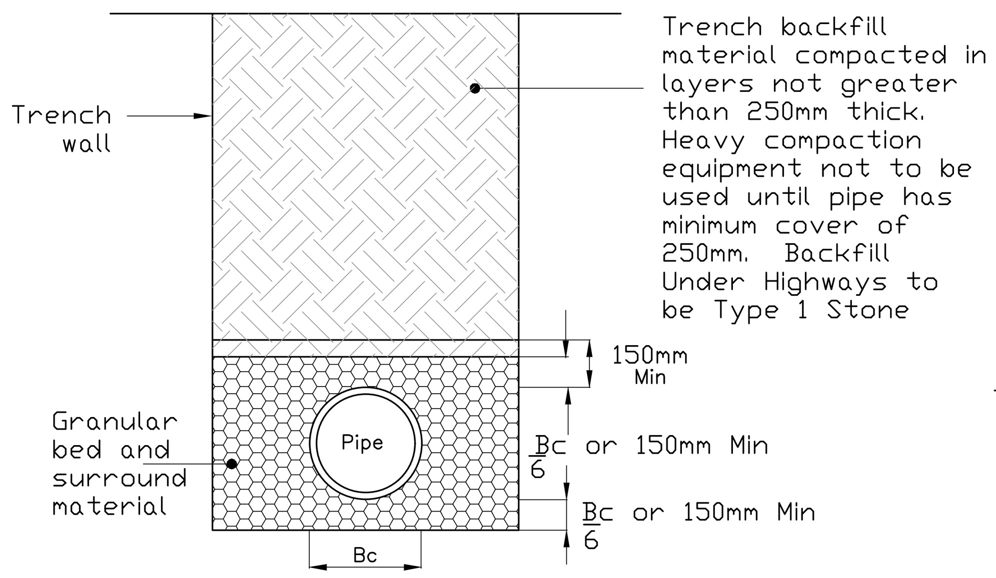
CONSTRUCTION AT CLIENT / CONTRACTOR RISK

Designed by:	Drawn by:	Checked by:
BT	BT	JP

Date	Scale
September 2023	1:200 @ A2

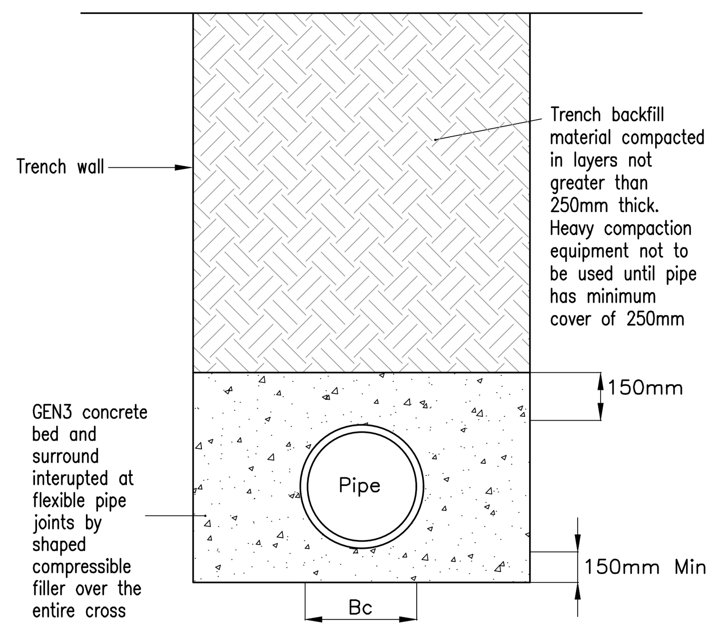
Drg. No.	Rev.
9154/502	

SITED IN SOFT LANDSCAPED AREAS



Pipe Bedding Detail

Scale NTS



Concrete Surround

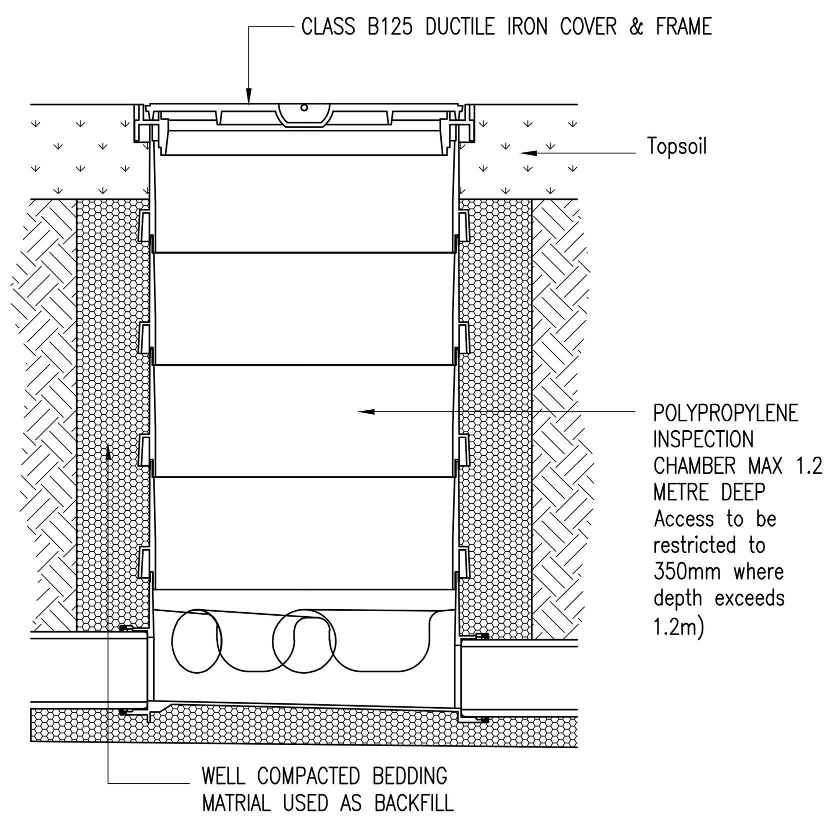
Bedding and Sidefill Material

Bedding, sidefill and surround materials shall comply with Water Industry Specification No. 4–08–02. Bedding and sidefill material may be selected as–dug granular material or processed granular material complying with Tables 1 and 2 for rigid and flexible pipes respectively. Material excavated from trenches dug through land contaminated with domestic, building or industrial waste should not be used as bedding and sidefill material. Selected excavated material should be readily compactable and be free from organic matter and combustible materials. Frozen soil should not be used. During selection, soil containing clay lumps larger than 75mm and stones larger than those permitted in Tables 1 or 2 as appropriate should be discarded. All selected as–dug granular bedding and sidefill material should be evaluated using the Compaction Fraction Test detailed in Appendix B of the WIs No. 4–08–02. Materials are suitable if the values obtained do not exceed those given in Table 1 and 2 as appropriate.

Trench Backfill Material

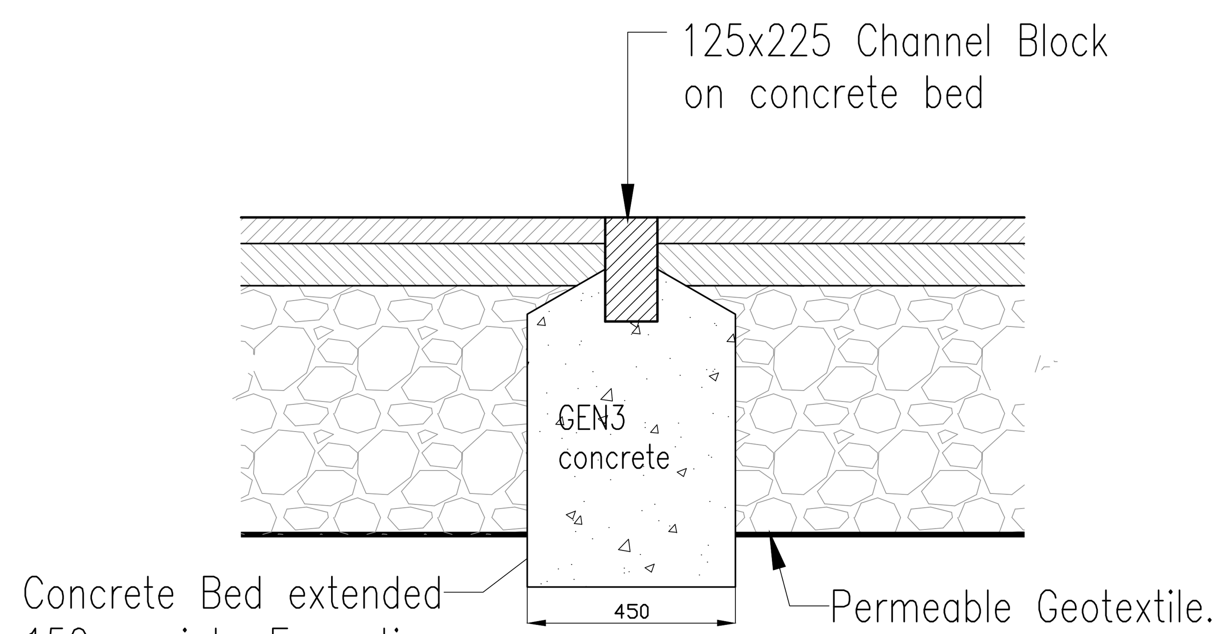
Where pipe trenches lie beneath road, footway and parking areas trench backfill material shall be type 1 up to formation level.

Trench backfill material, whether selected from locally excavated material or imported, shall consist of uniform, readily compactable material, free from vegetable matter, building rubbish and frozen material, or materials susceptible to spontaneous combustion, and excluding clay of liquid limit greater than 80 and/or plastic limit greater than 55 and materials of excessively high moisture content. Clay lumps and stones shall be retained on 75mm and 37.5mm sieves



POLYPROPYLENE INSPECTION CHAMBER INSTALLATION DETAIL

Not To Scale



FULL DEPTH RESTRAINT DETAIL

NTS

DOMESTIC DRAINAGE NOTES

All Domestic Drainage to comply with the British Standard BS EN 752:2008 'Drain and Sewer Systems Outside Buildings' and Part H of the Building Regulations 2000.

Underground drainage components shall be one of the following: i) Wavin Osma ii) Hepworth clay or iii) Polypipe and installed in accordance with the manufacturers recommendations.

Domestic drainage to be 100mm dia. laid at a minimum gradient of 1 in 80 unless stated otherwise on the drawings. All spur connections to be laid at 1 in 80 unless otherwise stated on the drawings. Minimum cover to be 350mm (600mm for UpVC) unless concrete bed and surround is provided.

Pipe bedding as specified by the drainage manufacturer. All pipes that pass under buildings to have a minimum 100mm granular surround. Where drains pass through external walls the pipe is to be lintelled over with a minimum 50mm clear space around the pipe. Rigid pipes to be fixed to the wall externally and internally to prevent movement within the granular material.

Types of access to be as follows :–

1. 0 to 0.6m deep: – Type A Inspection Chamber
2. 0.6m to 1m deep: – Type B Inspection Chamber
3. 1m to 1.8m deep:– Type C Inspection Chamber

Where required, Step Irons to be built into the inspection chamber in accordance with the requirements of the aforementioned British Standard and Building Regulations. The top step iron shall be fixed not more than 750mm below the surface and the lowest step to be fixed not more than 300mm above the benching.

Manhole Covers and Frames to comply with BS EN 124.

Class D400 for areas with frequent vehicular usage such as roads.
Class C250 for areas with light vehicular usage such as car parks.
Class B125 for pavements and pedestrian areas.
Class A15 for areas inaccessible to motor vehicles.

Notes:

(a) All levels are in meters above Ordnance Datum

(b) All dimensions are in millimeters unless specified otherwise

TABLE 1: PROCESSED AND AS–DUG GRANULAR BEDDING AND SIDEFILL MATERIALS FOR RIGID PIPES

Pipe nominal size (DN)	Nominal maximum particle size (mm) See note (c)	Class of bedding See note (d)	Suitable Materials: EITHER: Maximum CF value for acceptability See note (b)	Suitable Materials: OR: Materials specified in British Standards See note (a)
100	10	S B F	0.15 0.30 0.15	10mm nominal single–size
		N	0.30	Fine aggregate
Over 100 to 150	16	S B F	0.15 0.30 0.15	10mm or 14mm nominal single–size or 14mm to 5mm graded
		N	0.30	Fine aggregate
Over 150 to 300	20	S B F	0.15 0.30 0.15	10, 14 or 20mm nominal single–size or 14mm to 5mm graded or 20 to 5mm graded
		N	0.30	All–in aggregate or fine aggregate
Over 300 to 550	20	S B F	0.15 0.30 0.15	14mm or 20mm nominal single–size or 14mm to 5mm graded or 20 to 5mm graded
		N	0.30	All–in aggregate or fine aggregate
Over 550	40	S B F	0.15 0.30 0.15	14, 20 or 40mm nominal single–size crushed rock or 14mm to 5mm, 20 to 5mm or 40 to 5mm graded
		N	0.30	All–in aggregate or fine aggregate

Notes:

(a) Processed granular materials to include aggregates to BS EN 13242.

(b) Compaction Fraction value (CF), see Appendix B of WIs IGN No. 4–08–02.

(c) The nominal maximum particle sizes apply both to processed and as–dug materials (see Section 4 of IGN No. 4–08–01–Issue 4 and No.4–08–01 Amendment [Nov 2008]).

(d) Bedding classes are defined in:–
BS EN 1295–1:1997 Structural Design of Buried Pipelines under various conditions of loading.
TRRL – Simplified Table of External Loads on Buried Pipelines.

(e) The sulphate content of bedding and sidefill materials for use with cementitious pipe should not be greater than 0.3% as sulphur trioxide.

TABLE 2: PROCESSED GRANULAR BEDDING AND SIDEFILL MATERIALS FOR FLEXIBLE PIPES

Pipe nominal bore (mm) (See note (d)	Nominal maximum particle size (mm)	Suitable Materials: EITHER: Maximum CF value for acceptability See note (b): Non–pressure pipe	Pressure pipe	OR: Materials specified in British Standards See note (a)
100	10	0.15	0.30	10mm nominal single–size
Over 100 to 150	16	0.15	0.30	10 or 14mm nominal single–size or 14mm to 5mm graded
Over 150 to 300	20	0.15	0.30	10, 14 or 20mm nominal single–size or 14mm to 5mm graded or 20mm to 5mm graded
Over 300 to 550	20	0.15	0.30	14mm or 20mm nominal single–size or 14mm to 5mm graded or 20 to 5mm graded
Over 550	40	0.15	0.30	14, 20 or 40mm single–size or 14mm to 5mm graded or 20mm to 5mm graded or 40 to 5mm graded.

Notes:

(a) Processed granular materials to include aggregates to BS EN 13242.

(b) Compaction Fraction value (CF), see Appendix B of WIs IGN No. 4–08–02.

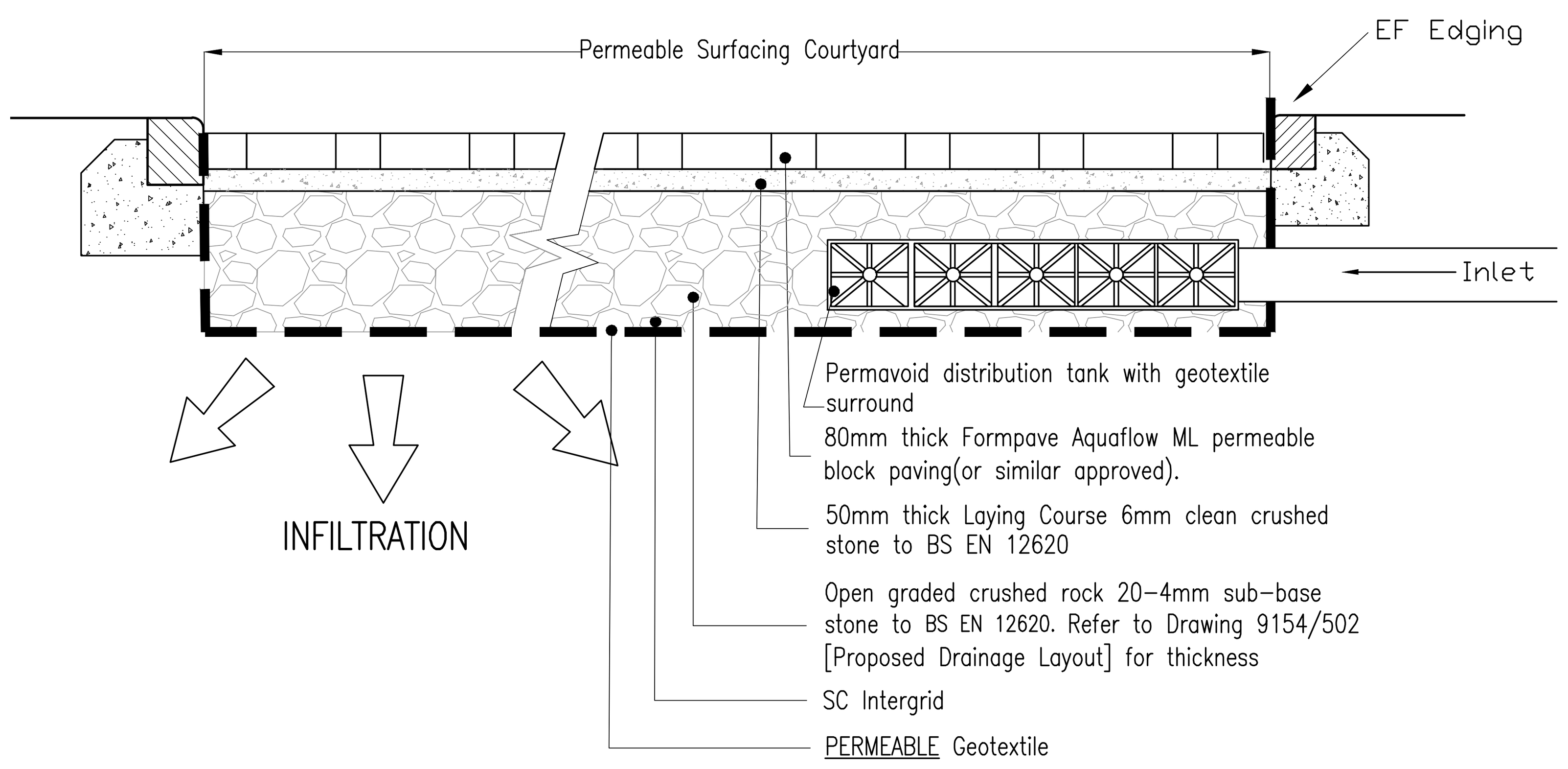
(c) For the purpose of this table, PE pipes of 630mm OD can be regarded as having nominal bores of over 550mm, irrespective of wall thickness.

(d) Nominal bore is used in preference to DN because of the different nominal size classification for flexible pipes.

(e) For PE80 and PE100 polyethene pipe complying with current relevant Water Industry Specifications, the maximum sidefill particle size may be increased to 10% of the pipe nominal size.

(f) For E' values for processed granular materials reference should be made to Table A.3 of WIs IGN No. 4–08–02 where specific site tests have not been performed.

(g) For ferrous cementitious pipeline materials, the sulphate content of bedding and sidefill materials should not be greater than 0.3% as sulphur trioxide.

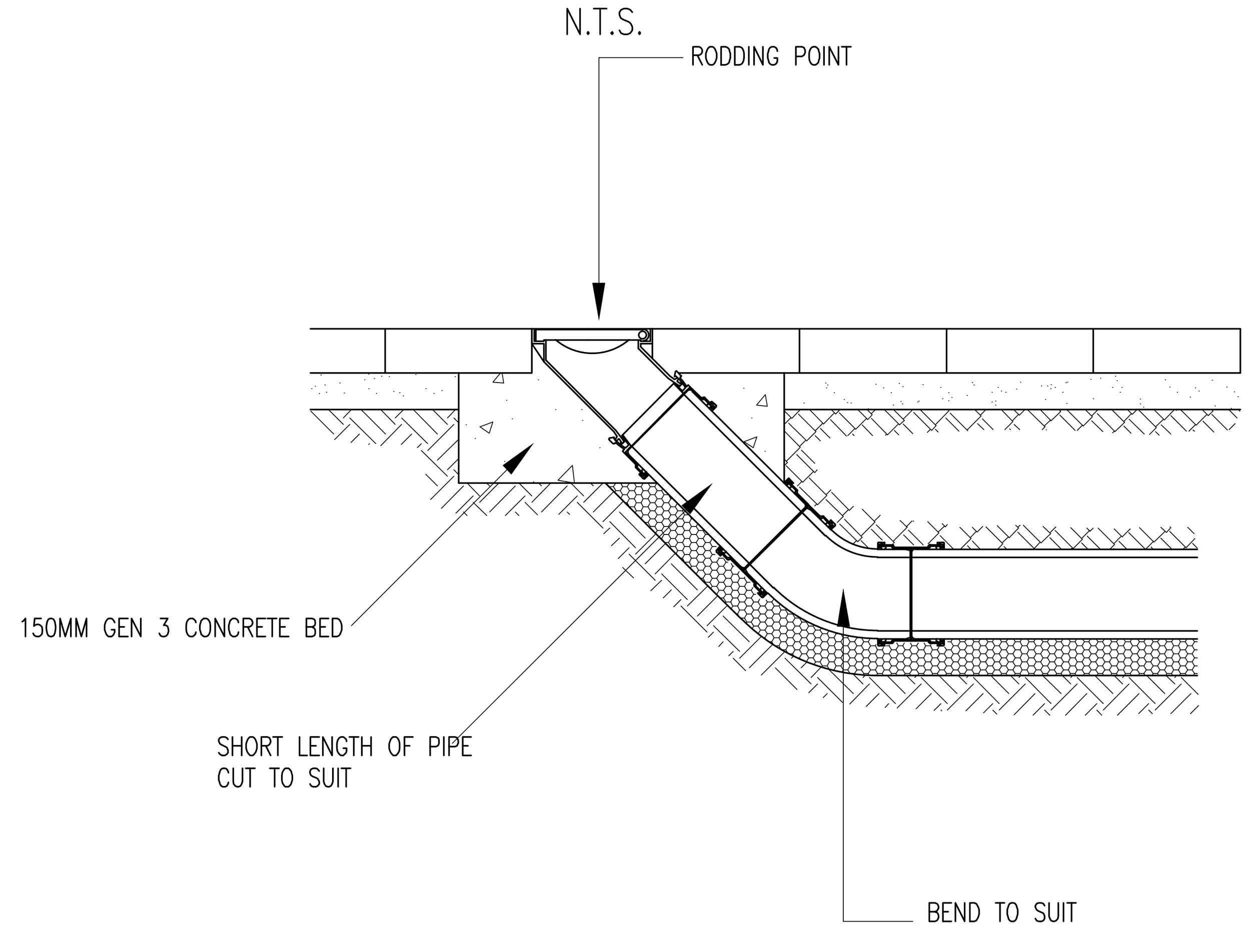


Permeable Surfacing Detail

NTS

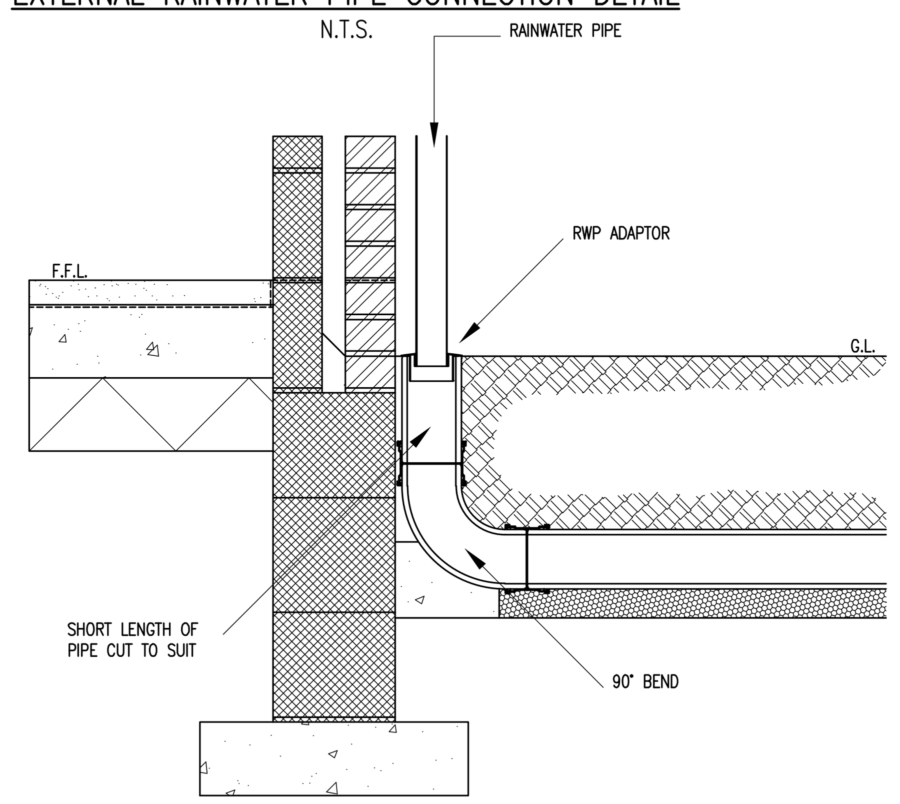
RODDING POINT INSTALLATION DETAIL

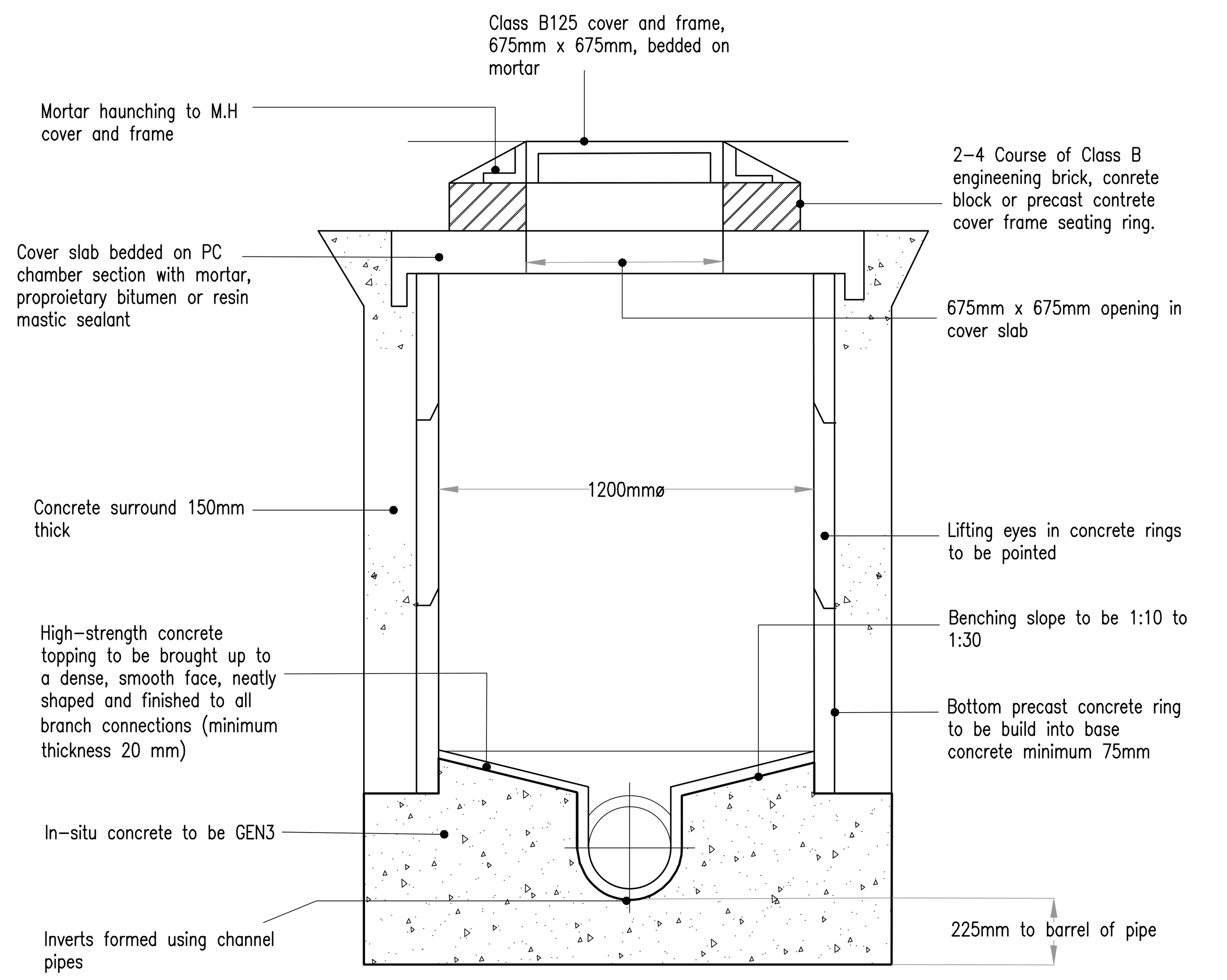
N.T.S.



EXTERNAL RAINWATER PIPE CONNECTION DETAIL

N.T.S.





Typical Private Manhole Detail

Depth from cover level to soffit of pipe >1.2m

Not To Scale

No.	By	Date	Revision Details

Cole Easdon

01793 619 965 | cec@ColeEasdon.com | www.ColeEasdon.com

Client

Warrior Warehouses Ltd

Job Title

Proposed Warehouse
Penventon Farm Nursery
Lanner
TR16 6AS

Drawing Title

Proposed Surface Water Drainage Construction Details

Drawing Status:

FOR COMMENT	FOR PLANNING	FOR TENDER	FOR APPROVAL	FOR CONSTRUCTION	AS BUILT
	X				

CONSTRUCTION AT CLIENT / CONTRACTOR RISK

Designed by:	Drawn by:	Checked by:
BT	BT	JP

Date	Scale
August	NTS

Drg. No.	Rev.
9154/503	

Key: To be read in conjunction with Arboricultural and Net Gain report

- Site boundary
- Tree protection fencing
- Category B trees
- Category C trees
- Grassland - other natural grassland (species-rich wildflower grassland on bank)
- Newly planted species rich hedge associated with bank or ditch
- Heathland and scrub - mixed scrub

Bat box information

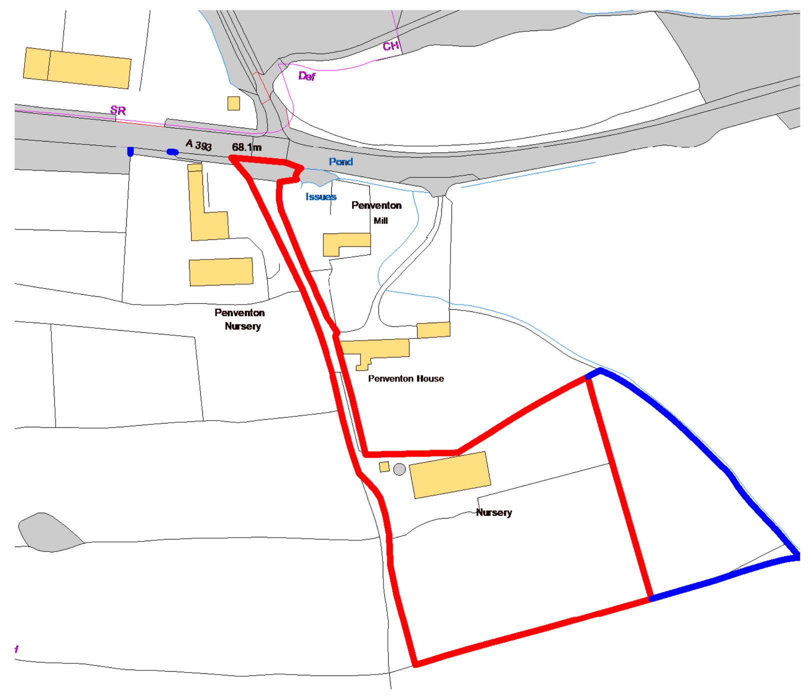
Bat boxes to be mounted onto the existing building or large trees on the cormish hedgebank at the southwest perimeter.

Bird box information

Pre-fabricated bird boxes to be mounted onto the large tress at the site perimeters or incorporating them into the existing building.

Block Plan

1 : 500   0   10m



Site Location Plan

1 : 2500   0   50m

N

TREWIN DESIGN ARCHITECTS

1 Stanhope Square Holsworthy Devon EX22 6DR - 01409253013
www.trewin-design.co.uk - create@trewin-design.co.uk

Drawing title

Block Plan and Site Location Plan

Job title

New Warehouse
Penventon Farm Nursery
Lanner

Client

Warrior Warehouses Ltd

Stage	PL - Detailed Design	**Issued for**	Client/Stage Approved
Scale @ A1	As indicated	**Date**	15/09/2020
Drawn by	SD	**Checked by**	JT

Drawing number	**Revision**
07976-TDA-DR-PL-0006	A03

Revision	Description	Date	Initials
02	Planning Application	17.09.20	SMD

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.268	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	1.000	0.010	100.0	0.111	1.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	1.000	0.010	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	1.02	81.590	0.111	0.0	0.0	0.0	1.00	17.8	15.0
S1.001	50.00	1.03	81.580	0.111	0.0	0.0	0.0	1.00	17.8	15.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diam (m
SPermeable Surfacing	82.050	0.460	Open Manhole	1200	S1.000	81.590	150			
SDummy Pump	82.050	0.470	Open Manhole	1200	S1.001	81.580	150	S1.000	81.580	
S	82.050	0.480	Open Manhole	0		OUTFALL		S1.001	81.570	

No coordinates have been specified, layout information cannot be produced.

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.001	S	82.050	81.570	0.000	0	0

Online Controls for Storm

Pump Manhole: SDummy Pump, DS/PN: S1.001, Volume (m^3): 0.5

Invert Level (m) 81.580

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.900	0.0000	1.700	0.0000	2.500	0.0000
0.200	0.0000	1.000	0.0000	1.800	0.0000	2.600	0.0000
0.300	0.0000	1.100	0.0000	1.900	0.0000	2.700	0.0000
0.400	0.0000	1.200	0.0000	2.000	0.0000	2.800	0.0000
0.500	0.0000	1.300	0.0000	2.100	0.0000	2.900	0.0000
0.600	0.0000	1.400	0.0000	2.200	0.0000	3.000	0.0000
0.700	0.0000	1.500	0.0000	2.300	0.0000		
0.800	0.0000	1.600	0.0000	2.400	0.0000		

Storage Structures for Storm

Porous Car Park Manhole: SPermeable Surfacing, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.09144	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	31.0
Max Percolation (l/s)	172.2	Slope (1:X)	1000.0
Safety Factor	3.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	81.590	Cap Volume Depth (m)	0.250

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.268
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S1.000	SPermeable Surfacing	120 Winter	100	+45%	100/30 Winter		
S1.001	SDummy Pump	180 Winter	100	+45%	100/30 Summer		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
S1.000	SPermeable Surfacing		81.805	0.065	0.000	0.02		88
S1.001	SDummy Pump		81.910	0.180	0.000	0.00		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SPermeable Surfacing	0.2	FLOOD RISK	
S1.001	SDummy Pump	0.0	FLOOD RISK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.268	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	1.000	0.010	100.0	0.089	1.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	1.000	0.010	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	1.02	79.950	0.089	0.0	0.0	0.0	1.00	17.8	12.1
S1.001	50.00	1.03	79.940	0.089	0.0	0.0	0.0	1.00	17.8	12.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diam (m
SPermeable Surfacing	80.500	0.550	Open Manhole	1200	S1.000	79.950	150			
SDummy Pump	80.500	0.560	Open Manhole	1200	S1.001	79.940	150	S1.000	79.940	
S	82.050	2.120	Open Manhole	0		OUTFALL		S1.001	79.930	

No coordinates have been specified, layout information cannot be produced.

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.001	S	82.050	79.930	0.000	0	0

Online Controls for Storm

Pump Manhole: SDummy Pump, DS/PN: S1.001, Volume (m^3): 0.6

Invert Level (m) 79.940

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.900	0.0000	1.700	0.0000	2.500	0.0000
0.200	0.0000	1.000	0.0000	1.800	0.0000	2.600	0.0000
0.300	0.0000	1.100	0.0000	1.900	0.0000	2.700	0.0000
0.400	0.0000	1.200	0.0000	2.000	0.0000	2.800	0.0000
0.500	0.0000	1.300	0.0000	2.100	0.0000	2.900	0.0000
0.600	0.0000	1.400	0.0000	2.200	0.0000	3.000	0.0000
0.700	0.0000	1.500	0.0000	2.300	0.0000		
0.800	0.0000	1.600	0.0000	2.400	0.0000		

Storage Structures for Storm

Porous Car Park Manhole: SPermeable Surfacing, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.09144	Width (m)	12.0
Membrane Percolation (mm/hr)	1000	Length (m)	31.5
Max Percolation (l/s)	105.0	Slope (1:X)	1000.0
Safety Factor	3.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	79.950	Cap Volume Depth (m)	0.350

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.268
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood
S1.000	SPermeable Surfacing	120 Winter	100	+45%	100/15 Winter	
S1.001	SDummy Pump	180 Winter	100	+45%	100/15 Summer	100/360 Winter

PN	US/MH Name	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.000	SPermeable Surfacing			80.260	0.160	0.000	0.02	
S1.001	SDummy Pump			80.402	0.312	0.000	0.00	

PN	US/MH Name	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SPermeable Surfacing	116	0.2	FLOOD RISK	
S1.001	SDummy Pump		0.0	FLOOD RISK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.268	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	44.420	0.444	100.0	0.049	1.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	1.090	0.011	99.1	0.049	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	1.000	0.010	100.0	0.131	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	1.000	0.000	0.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	1.74	82.350	0.049	0.0	0.0	0.0	1.00	17.8	6.6
S1.001	50.00	1.75	82.050	0.098	0.0	0.0	0.0	1.01	17.8	13.3
S1.002	50.00	1.77	82.040	0.229	0.0	0.0	0.0	1.00	17.8«	31.0
S1.003	50.00	1.95	82.030	0.229	0.0	0.0	0.0	0.09	1.6«	31.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diamete (mm)
SManhole 1	84.000	1.650	Open Manhole	1200	S1.000	82.350	150			
SManhole 2	84.000	2.094	Open Manhole	1200	S1.001	82.050	150	S1.000	81.906	15
SPermeable Paving	82.500	0.461	Open Manhole	1200	S1.002	82.040	150	S1.001	82.039	15
SDummy Pump	82.500	0.470	Open Manhole	1200	S1.003	82.030	150	S1.002	82.030	15
S	82.500	0.470	Open Manhole	0		OUTFALL		S1.003	82.030	15

No coordinates have been specified, layout information cannot be produced.

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	82.500	82.030	0.000	0	0

Online Controls for Storm

Pump Manhole: SDummy Pump, DS/PN: S1.003, Volume (m^3): 0.5

Invert Level (m) 82.030

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.900	0.0000	1.700	0.0000	2.500	0.0000
0.200	0.0000	1.000	0.0000	1.800	0.0000	2.600	0.0000
0.300	0.0000	1.100	0.0000	1.900	0.0000	2.700	0.0000
0.400	0.0000	1.200	0.0000	2.000	0.0000	2.800	0.0000
0.500	0.0000	1.300	0.0000	2.100	0.0000	2.900	0.0000
0.600	0.0000	1.400	0.0000	2.200	0.0000	3.000	0.0000
0.700	0.0000	1.500	0.0000	2.300	0.0000		
0.800	0.0000	1.600	0.0000	2.400	0.0000		

Storage Structures for Storm

Porous Car Park Manhole: SPermeable Paving, DS/PN: S1.002

Infiltration Coefficient Base (m/hr)	0.09144	Width (m)	30.0
Membrane Percolation (mm/hr)	1000	Length (m)	43.0
Max Percolation (l/s)	358.3	Slope (1:X)	1000.0
Safety Factor	3.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	82.040	Cap Volume Depth (m)	0.350

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.268
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S1.000	SManhole 1	15 Summer	100	+45%	100/15 Summer		
S1.001	SManhole 2	15 Summer	100	+45%	100/15 Summer		
S1.002	SPermeable Paving	120 Winter	100	+45%	100/30 Winter		
S1.003	SDummy Pump	180 Winter	100	+45%	100/30 Summer		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
S1.000	SManhole 1		83.589	1.089	0.000	1.30		
S1.001	SManhole 2		82.805	0.605	0.000	4.48		
S1.002	SPermeable Paving		82.255	0.065	0.000	0.03		88
S1.003	SDummy Pump		82.364	0.184	0.000	0.00		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SManhole 1	22.4	SURCHARGED	
S1.001	SManhole 2	48.6	SURCHARGED	
S1.002	SPermeable Paving	0.4	FLOOD RISK	
S1.003	SDummy Pump	0.0	FLOOD RISK	

Soakaway Investigation

Letter Report

In line with BRE Digest 365

Site Name: Penventon Nursery

Job Number: 20468

Client: Mr S Keverne

Date: 26 February 2021

Introduction

- Wheal Jane Consultancy (WJC) was commissioned by Mr S Parker on behalf of Mr S Keverne, to undertake a Soakaway Investigation at the site known as "Penventon Nursery."
- This report has been prepared by Wheal Jane Consultancy solely for the benefit of the client. It shall not be relied upon or transferred to any third party without the prior written authorisation of WJC.
- The aim of this investigation is to assess the site's drainage characteristic by completing soakaway tests in line with BRE 365.

Site Works

- An intrusive site investigation was conducted on Thursday 18th February 2021. The investigation was overseen by a geotechnical engineer from Wheal Jane Consultancy.
- The site works can be summarised as follows;

Exploratory Hole Type	Exploratory Hole ID	Hole Depths (mBGL)
Trial Pit	TP01 – TP03	0.80 – 2.50

- Exploratory hole logs are included as Appendix A.
- Trial Pit Photographs are included as Appendix B.
- A plan showing the location of the exploratory holes is provided as Figure 3.1.

Ground Conditions

Strata	Depth Encountered (mBGL)		Typical Thickness (m)	Brief Description & Comments
	From	To		
Made Ground	0.00	0.40 – 0.90	0.6	Hardcore or Brown sandy gravelly CLAY with anthropogenic components of concrete, brick, metal, ceramic and timber.

Mylor Slate Formation	0.40 – 0.60	0.80 – 2.50	Unproven	Light orangish brown gravelly CLAY/Orangish brown sandy gravelly CLAY

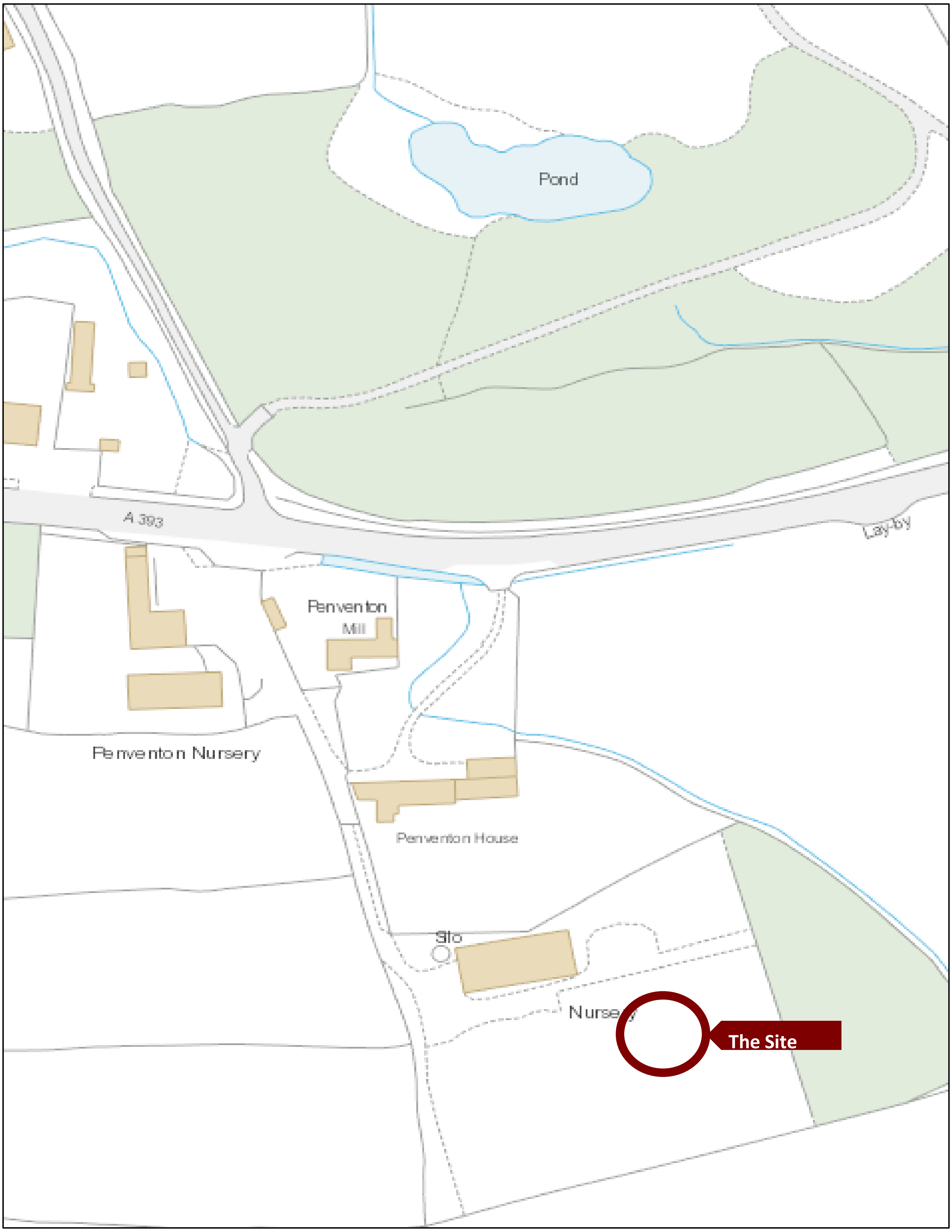
Made Ground:	• Material described as Made Ground was encountered across the site to depths of up to 0.90m. The unit varies in thickness, from 0.40m in TP02 in the east of the site to 0.90m in TP01 in the south east. The base of the Made Ground was not encountered in TP01. • The material is generally described as 'Hardcore or Brown sandy gravelly CLAY with anthropogenic components of concrete, brick, metal, ceramic and timber.'
Mylor Slate Formation:	• Material described as Weathered Mylor Slate Formation was encountered in TP02 and TP03 to a maximum depth of 2.50m in TP02 where the deep infiltration test was undertaken. • In general, the unit may be described as 'Light orangish brown gravelly CLAY/Orangish brown sandy gravelly CLAY.'

Soakaway Test Results

Exploratory Hole	Test 1	Test 2	Test 3	Average
TP01	5.58E-3	5.58E-3	5.58E-3	5.58E-3
TP02	4.48E-5	3.69E-5	2.54E-5	3.57E-5
TP03	Failed	-	-	-

- Soakaway records are contained as Appendix C.

FIGURES



Title: **Site Location Plan**

Project: **Penventon Nursery**

Client: **Mr S Keverne**

Report Title: **Drainage Investigation**

Date: **22/02/2021** Ref: **20468** Figure: **2.1**

WHEAL JANE CONSULTANCY
GEOTECHNICAL, ENVIRONMENTAL & MINING SERVICES

N

Legend:

WHEAL JANE CONSULTANCY
GEOTECHNICAL, ENVIRONMENTAL & MINING SERVICES

Title:

Current Site Layout

Project:

Penventon Nursery

20468

Client:

Mr S Keverne

Date:	22/02/2021
Scale:	NTS
Drawn by:	BH
Revision:	A
Figure:	2.2

N

Legend:

WHEAL JANE CONSULTANCY

GEOTECHNICAL, ENVIRONMENTAL & MINING SERVICES

Title:

Proposed Site Layout

Project:

Penventon Nursery

20468

Client:

Mr S Keverne

Date:	22/02/2021
Scale:	NTS
Drawn by:	BH
Revision:	A
Figure:	2.3

N

Legend:

Trial pit locations

WHEAL JANE CONSULTANCY
GEOTECHNICAL, ENVIRONMENTAL & MINING SERVICES

Title:

Exploratory Hole Location Plan

Project:

Penventon Nursery

20468

Client:

Mr S Keverne

Date:	22/02/2021
Scale:	NTS
Drawn by:	DJ
Revision:	A
Figure:	3.1

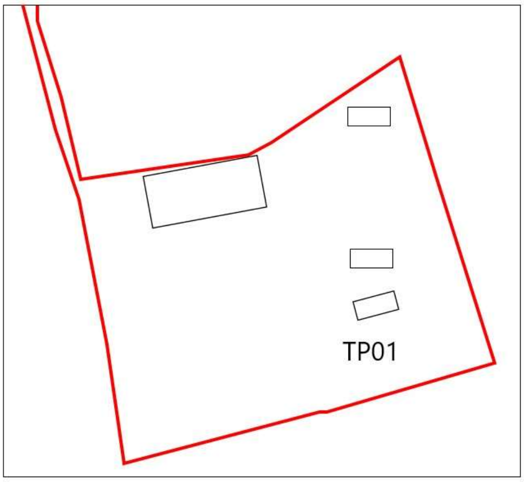
Appendix A

Exploratory Hole Logs

Wheal Jane Consultancy	Site: Penventon Nursery	Trial Pit Number: TP01

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine Excavated Trial Pit	Width: 1.70m Length: 2.50m	87.00	Mr S Keverne	20468
	Location Lanner	**Dates** 18/02/2021	**Engineer** Wheal Jane Consultancy	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.90)	MADE GROUND: Grey slightly clayey sandy angular, medium to coarse GRAVEL of Hardcore. Sand is medium to coarse.		
				86.10	0.90	Complete at 0.90m		



Remarks

No groundwater encountered.
Shallow infiltration testing undertaken to aid design of permeable paving.
Historic pipe encountered.
Sides of pit are slightly unstable.

North	Scale (approx)	Logged By	Figure No.
	1:20	BH	20468.TP01

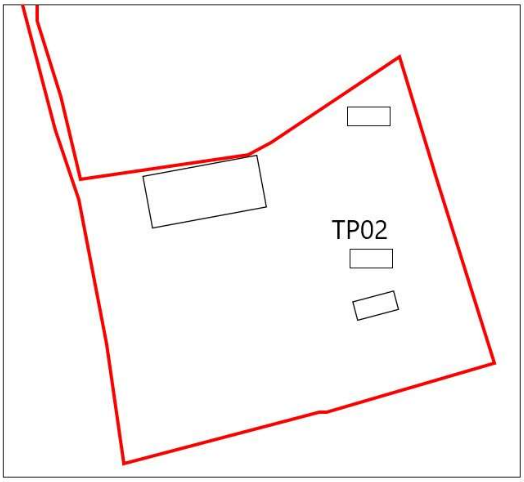
Wheal Jane Consultancy
Geotechnical, environmental & mining services

Wheal Jane Group

Site	Trial Pit Number
Penventon Nursery	TP02

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine Excavated Trial pit	Width: 1.00m Length: 2.60m	87.00	Mr S Keverne	20468
	Location	**Dates**	**Engineer**	**Sheet**
	Lanner	18/02/2021	Wheal Jane Consultancy	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	MADE GROUND: Grey slightly clayey sandy angular, medium to coarse GRAVEL of Hardcore. Sand is medium to coarse.		
				86.60	0.40			
					(1.60)	Dark brown gravelly CLAY. Gravel is angular to subangular, medium to coarse of Mudstone.		
				85.00	2.00			
					(0.50)	Orangish brown sandy gravelly CLAY. Gravel is angular to subangular, medium to coarse of Mudstone. Sand is fine to coarse.		
				84.50	2.50			
						Complete at 2.50m		



Remarks

Sides of pit are fairly stable.
No groundwater encountered.
Infiltration testing undertaken in line with BRE 365.

North	Scale (approx)	Logged By	Figure No.
	1:20	BH	20468.TP02

Wheal Jane Consultancy
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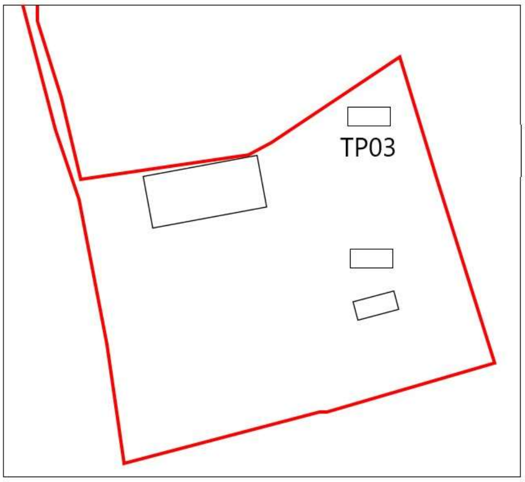
Site	Trial Pit Number
Penventon Nursery	TP03

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine Excavated Trial Pit	Width: 1.10m Length: 1.85m	82.00	Mr S Keverne	20468
	Location	**Dates**	**Engineer**	**Sheet**
	Lanner	18/02/2021	Wheal Jane Consultancy	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.60)	MADE GROUND: Brown sandy gravelly CLAY. Gravel is angular, medium to coarse of mudstone, concrete, brick, metal , ceramic and timber. Sand is medium to corase.		
				81.40	0.60 (0.20)	Light orangish brown gravelly CLAY. Gravel is angular to subangular, medium to coarse of Mudstone.		
				81.20	0.80	Complete at 0.80m		



Remarks

Shallow infiltration testing undertaken to aid design of permeable paving.
No groundwater encountered.
Sides of pit are fairly stable.

North	Scale (approx)	Logged By	Figure No.
	1:20	BH	20468.TP03

Appendix B

Trial Pit Photographs

Trial Pit:	TP01

Penventon Nursery	20468
Drainage Investigation	Trial Pit Photographs
Mr S Keverne	February 2021

Trial Pit:	TP01

Penventon Nursery	20468
Drainage Investigation	Trial Pit Photographs
Mr S Keverne	February 2021

Trial Pit:	TP02

Penventon Nursery	20468
Drainage Investigation	Trial Pit Photographs
Mr S Keverne	February 2021

Trial Pit:	TP02

Penventon Nursery	20468
Drainage Investigation	Trial Pit Photographs
Mr S Keverne	February 2021

Trial Pit:	TP03

Penventon Nursery	20468
Drainage Investigation	Trial Pit Photographs
Mr S Keverne	February 2021

Trial Pit:	TP03

Penventon Nursery	20468
Drainage Investigation	Trial Pit Photographs
Mr S Keverne	February 2021

Appendix C

Soakaway Records

Soakaway Test (BRE Digest 365)

Wheal Jane Consultancy

Site : Penventon Nursery

Client : Mr S Keverne

Engineer: Wheal Jane Consultancy

Job Number 20468

Sheet 1 / 1

Location	Date	Level	Location
TP01	18/02/2021	87.00	Lanner

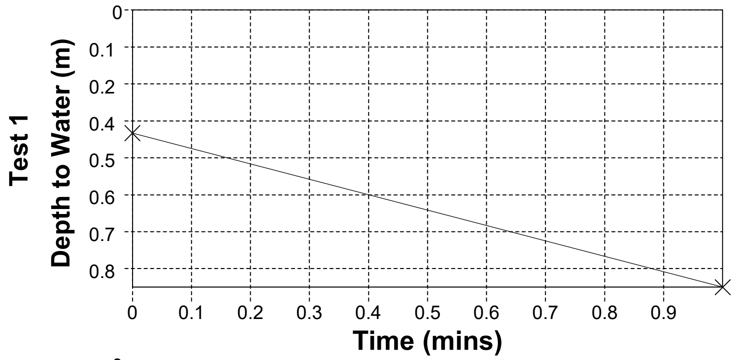
Pit Width (m)	1.70
Pit Depth (m)	0.90
Pit Length (m)	2.50

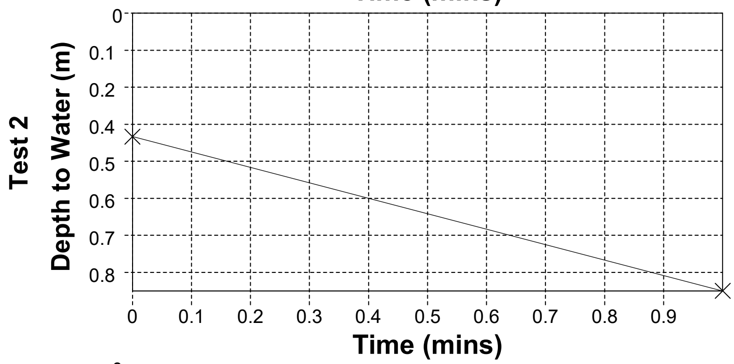
Soil type at test level	MADE GROUND: Hardcore
Groundwater	None
Drain discharge depth	N/A
Sidewall stability	Slightly unstable
Stone filled or open pit	Open pit

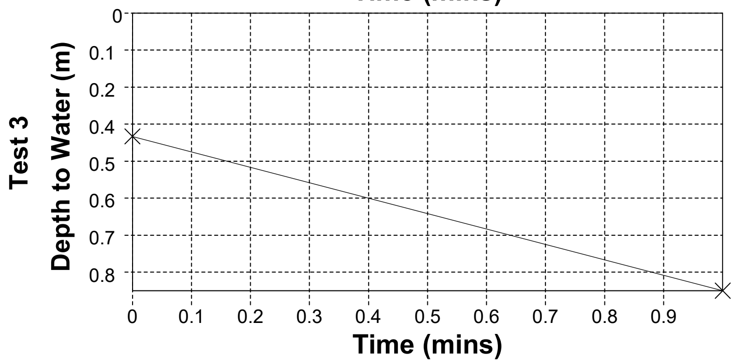
	1	2	3
Effective depth (m)	0.50	0.50	0.50
Volume outflowing between 75% & 25% (m3)	1.06	1.06	1.06
Mean surface area through which outflow occurs (m2)	6.35	6.35	6.35
Time for outflow between 75% & 25% (min)	0.50	0.50	0.50
SOIL INFILTRATION RATE (ms-1), f	5.58E-3	5.58E-3	5.58E-3

Remarks

Elapsed time (mins)	Depth to Water Test 1	Depth to Water Test 2	Depth to Water Test 3
0	0.40	0.40	0.40
1	0.90	0.90	0.90







Wheal Jane Consultancy

Soakaway Test (BRE Digest 365)

Site	: Penventon Nursery	**Job Number**	20468
Client	: Mr S Keverne	**Sheet**	1 / 1
Engineer	: Wheal Jane Consultancy		

Location	Date	Level	Location
TP02	18/02/2021	87.00	Lanner

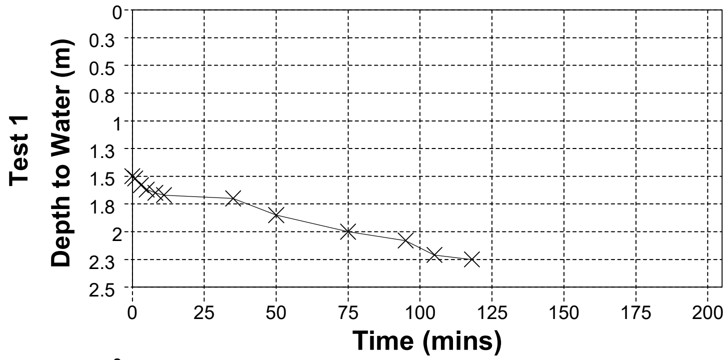
Pit Width (m)	1.00
Pit Depth (m)	2.50
Pit Length (m)	2.60

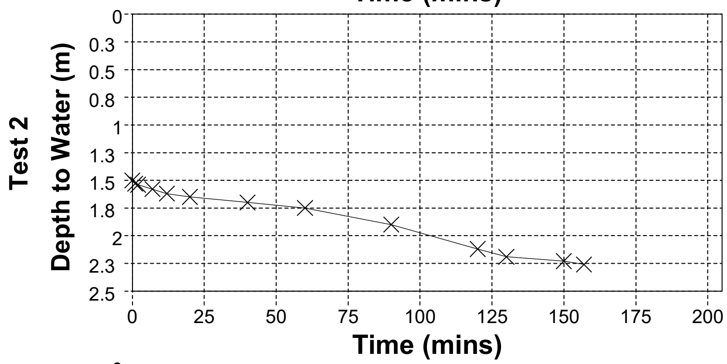
Soil type at test level	Orangish brown sandy gravelly CLAY
Groundwater	None
Drain discharge depth	N/A
Sidewall stability	Fairly Stable
Stone filled or open pit	Open pit

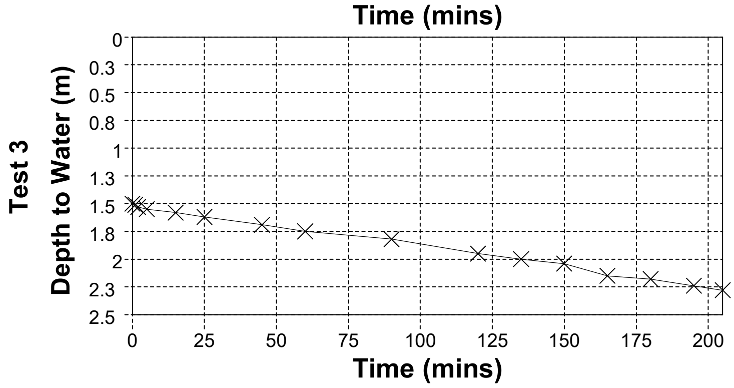
	1	2	3
Effective depth (m)	1.00	1.00	1.00
Volume outflowing between 75% & 25% (m3)	1.30	1.30	1.30
Mean surface area through which outflow occurs (m2)	6.20	6.20	6.20
Time for outflow between 75% & 25% (min)	78.00	94.67	137.50
SOIL INFILTRATION RATE (ms-1), f	4.48E-5	3.69E-5	2.54E-5

Remarks

Elapsed time (mins)	Depth to Water Test 1	Depth to Water Test 2	Depth to Water Test 3
0	1.50	1.50	1.50
1	1.52	1.53	1.51
2		1.54	1.53
3	1.58		
5	1.62		1.55
7		1.58	
8	1.65		
11	1.67		
12		1.62	
15			1.58
20		1.65	
25			1.62
35	1.70		
40		1.70	
45			1.69
50	1.85		
60		1.75	1.75
75	2.00		
90		1.90	1.82
95	2.08		
105	2.21		
118	2.25		
120		2.12	1.95
130		2.19	
135			2.00
150		2.23	2.04
157		2.26	
165			2.15
180			2.18
195			2.24
205			2.28







Wheal Jane Consultancy

Geotechnical, environmental & mining services

Wheal Jane Group

Soakaway Test (BRE Digest 365)

Site : Penventon Nursery

Client : Mr S Keverne

Engineer: Wheal Jane Consultancy

Job Number 20468

Sheet 1 / 1

Location	Date	Level	Location
TP03	18/02/2021	82.00	Lanner

Pit Width (m)	1.10
Pit Depth (m)	0.80
Pit Length (m)	1.85

Soil type at test level	Light orangish brown gravelly CLAY
Groundwater	None
Drain discharge depth	N/A
Sidewall stability	Fairly Stable
Stone filled or open pit	Open pit

	1
Effective depth (m)	0.40
Volume outflowing between 75% & 25% (m3)	
Mean surface area through which outflow occurs (m2)	
Time for outflow between 75% & 25% (min)	
SOIL INFILTRATION RATE (ms-1), f	Test Failed

Remarks

Elapsed time (mins)	Depth to Water Test 1
0	0.40
60	0.40
120	0.40
180	0.40
240	0.40
300	0.40
360	0.40