RCD

Residential Development
Nova
Primrose Road
Clitheroe
BB7 1DR

Drainage Strategy Report

14th July 2023

Rev	Date	Purpose/Status	Document Ref.	QA
A	14.03.2023	For approval	First issue	RAC/STC
B				
C				
D				
E				

Disclaimer

This report is for the use of the Client only and is not for the use of any other parties without the express permission of the Client. All calculations and related quantified assumptions are indicative for planning purposes only and are based solely on the available design proposals and must be reassessed during detailed design with the appropriate compliance methodology.

Table of Contents

Executive Summary

RCD Consultants Ltd has been appointed by Roman Summer Associates Ltd to design the surface water and foul water drainage aspects of the proposed development at Nova, Primrose Road, Clitheroe, BB7 1DR.

The report outlines the strategy for the surface water drainage for the proposed development with reference to Ciria 753, the SUDS manual, the NPPF, the National Planning Policy Framework and the Local Flood Risk Management Strategy for Lancashire 2021-2027.

The site area is 0.18Ha and is and elevated part of Primrose House gardens. The site is covered with trees and shrubs and is 100% permeable.

Infiltration testing completed on 25th May 2023 confirmed worst case infiltration rates of $1.67x10^{-5}$m/s.

The proposed development consists of the construction of a single storey dwelling with a roof area of 520m^2 and a permeable drive area with an area of 147m^2.

It is proposed that surface water from the roof will discharge to a cellular storage tank soakaway.

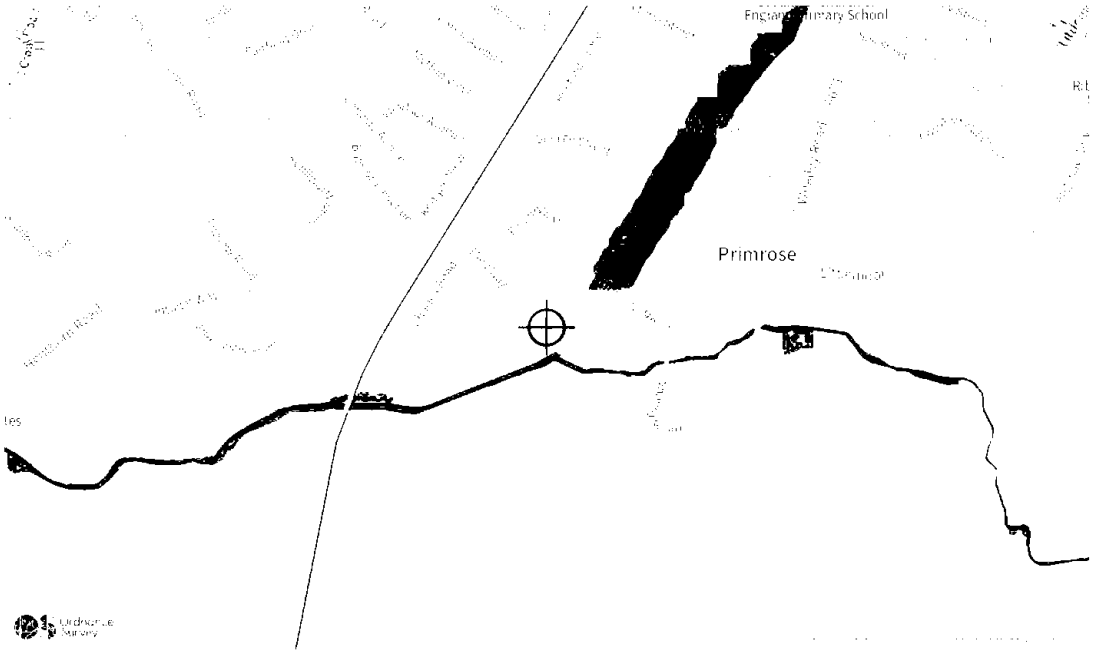
Foul drainage will discharge under gravity to the public foul sewer running though the site.

The flood warning information services website confirms that the site is in Flood Zone 1 and that there is no risk of surface water flooding. The mapping shows that the garden of Primrose house is in flood zone 3 and that there is a risk of flooding but the proposed site is in an elevated position some 7.0m higher than the garden.

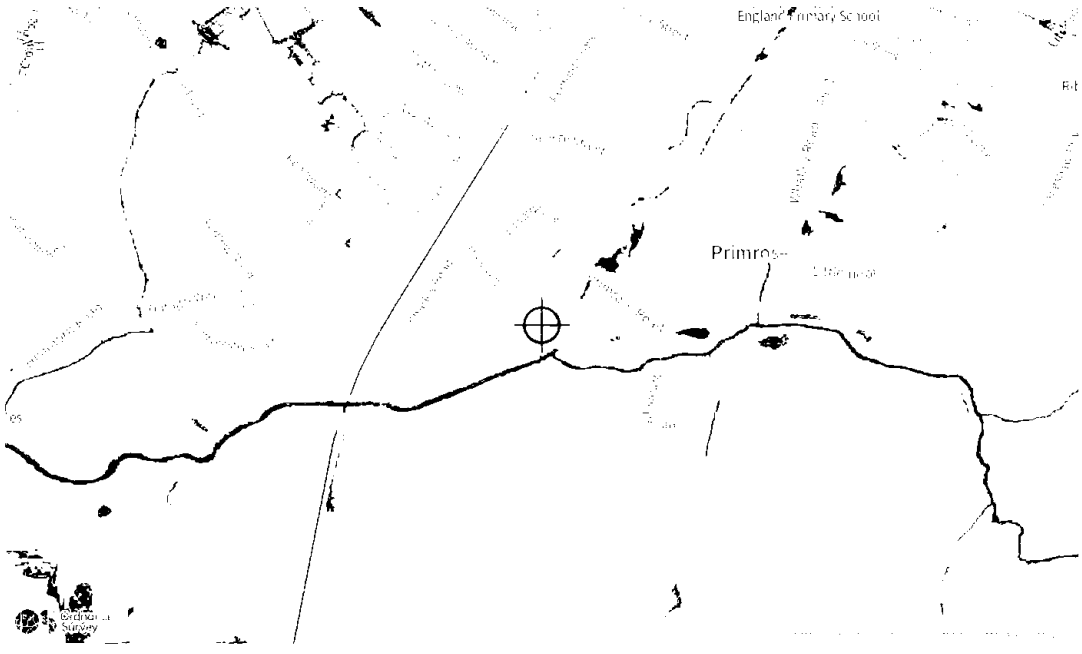
Construction will commence shortly after planning has been granted and it is expected that all construction, including SUDs features will be completed within three years.

1.0 Fluvial and pluvial flooding

The flood warning information services website confirms that the site is in Flood Zone 1 and that there is no risk of surface water flooding. The mapping shows that the garden of Primrose house is in flood zone 3 and that there is a risk of flooding but the proposed site is in an elevated position some 7.0m higher than the garden.



Extent of flooding from rivers or the sea



Extent of flooding from surface water

2.0 Existing Drainage/geology

The site area is 0.18Ha and is and elevated part of Primrose House gardens. The site is covered with trees and shrubs and is 100% permeable.

A copy of the existing site is shown in Appendix A.

There are surface water and foul water sewers crossing the site.

The nearest watercourse is the Pendleton Brook that is 90m due south of the site.

The Greenfield discharge rates are shown in Appendix B.

The British Geological Survey website indicates that the site is underlain by Alluvium superficial deposits over bedrock of the Clitheroe Limestone Formation and Hodder Mudstone Formation.

Infiltration testing completed on 25th May 2023 confirmed worst case infiltration rates of 1.67×10^{-5}m/s.

A copy of the infiltration testing results are shown in Appendix C.

3.0 Proposed Drainage Strategy

The proposed development consists of the construction of a single storey dwelling with a roof area of 520m^2 and a permeable drive area with an area of 147m^2.

It is proposed that surface water from the roof will discharge to a cellular storage tank soakaway.

The Drainage Layout 1165-2301-CIV-10 is shown in Appendix D.

3.1 Surface Water Drainage

In accordance with Ciria 753, SUDS Manual, flooding is permitted above ground during the 1 in 100 year storm event + 40% climate change allowance but all flood water is to be contained within the site boundaries. No flooding is permitted during the 1 in 30 year storm event.

1, 30 and 100 year surface water calculations are shown in Appendix F and 1 in 100 year surface water calculations with a 20% climate change allowance are shown in Appendix E.

The 1 in 100 year + 40% climate change calculations show that a small volume of flooding occurred. This will flow onto the soft landscaped area an infiltrate in a similar way to current Greenfield conditions.

SUDS techniques will be included where local ground conditions permit. In conjunction with the surface water management requirements, consideration of green roofs, infiltration devices, and rainwater harvesting techniques will be made. These methods are further detailed in Section 6.

3.1.1 Proposed Infrastructure

It is proposed that surface water from the roof will discharge to a cellular storage tank soakaway.

The drive will be constructed in permeable materials to mimic existing Greenfield conditions.

3.1.2 Standards

The performance of the surface water drainage system will be designed to BS EN 752 Parts 3 and 4, and the most current issue of Part H of the Building Regulations.

In accordance with the Local Water Authority guidance a flood exceedance plan shown in Appendix F indicates the routes water will take in the unlikely event of SUDS failure.

The materials specification for the scheme will be in accordance with the Highways Agency Specification for Highway Works. For the purposes of the indicative design, the following material types have been assumed:

- Drainage pipes up to 300mm diameter – Vitrified clayware, plastic pipes will be permitted subject to ground conditions.
- Manholes and chambers - Precast concrete with concrete surround or PPIC
- Chamber covers – Class D400 infill type in hard paved areas.
- Pipe bedding - Imported granular material.
- Pipe Trench backfill - Selected as dug or imported material.
- Manholes should be located at every change of alignment or gradient; at the head of all sewers; at every junction of a public sewer.

The drainage shall be designed utilizing the following criteria:

- Minimum flow velocity 1.0m/s for self-cleansing
- Standard pipe roughness “Ks” of 0.6.

3.2 Foul Water Drainage

3.2.1 Proposed Infrastructure

Foul drainage from the building will be collected via pipes and discharge to the existing public foul sewer running through the site.

In accordance with sewers for adoption the average flow rate will be 0.05l/s.

3.2.2 Standards

The performance of the foul drainage system has been designed to Sewers for Adoption current Edition, BS EN 752 Parts 3 and 4, and the most current issue of Part H of the Building Regulations. The main criteria used are as follows.

- Drainage pipes up to 100mm diameter – Vitrified clayware, plastic pipes will be permitted subject to ground conditions.
- Manholes and chambers - Precast concrete with concrete surround or PPIC
- Chamber covers – Class D400 infill type in higher quality paved areas.
- Class D400 standard type in all other road / parking areas
- Class C250 standard type in all footpath areas
- Pipe bedding - Imported granular material.
- Pipe Trench backfill - Selected as dug or imported material.
- Manholes should be located at every change of alignment or gradient; at the head of all sewers; at every junction of a public sewer.

The drainage shall be designed utilizing the following criteria:

- Minimum flow velocity 0.75m/s for self-cleansing
- Standard pipe roughness “Ks” of 1.5.

4.0 Surface Water Flows

4.1 Existing and proposed site run-off flows

There are surface water and foul water sewers crossing the site.

The pre-development site is a field where rainfall infiltrates to the ground below.

Infiltration testing results shown in Appendix C confirm that a soakaway will be the preferred method of disposal of surface water runoff from the roof. The permeable drive will mimic existing Greenfield conditions.

The pre-development surface water calculations are shown in Appendix B and the post-development surface water calculations are shown in Appendix D.

As we are disposing of surface water via infiltration flow rate and water volume tables are not shown as we are not increasing the volume of rainfall landing on the site.

The 1 in 100 year + 40% climate change calculations confirm that a small volume of flooding occurs, and should this storm ever occur then such flood water will flow down the embankment towards the Pendleton Brook.

The flood exceedance plan shown in Appendix E shows the route flood water will take in the unlikely event of SUDs failure.

5.0 Attenuation

It is proposed that Sustainable Urban Drainage Systems (SUDS) will be the primary consideration for surface water management. There are several different methods that may be used to provide sufficient attenuation of the surface water described in Section 6 below.

Attenuation should be positioned as close to the outfall as possible and would control the surface water discharge from the site. Implementation of one or all of the SUDS methods outlined in Section 6 of this report is highly recommended to reduce the requirement for below ground storage.

The proposed drainage design includes a suitably sized cellular storage tank soakaway.

The drive will be constructed using permeable materials to mimic existing Greenfield conditions.

6.0 Sustainable Urban Drainage Systems (SUDS)

The objective of SUDS is to minimise the impacts of the development on the quantity and quality of site runoff and maximise amenity and biodiversity opportunities. Surface water SUDS will be designed and installed in accordance with NPPF and associated technical guidance March 2012 and associated CIRIA documents.

The mix of SUDS to be used is determined by the conditions on site, in this case a development with areas of external space which can be utilised for SUDS. The methodology of surface water control is to slow the entry of the surface water into the system by using flow control devices (in this instance infiltration), then retain the runoff which will release surface water into the existing groundwater table or aquifer below and preventing flooding within and beyond the site boundaries.

6.1 Infiltration Devices

Infiltration devices drain water directly into the ground. Infiltration trenches and soakaways are more practicable for urban sites with limited space available. Infiltration devices can be integrated into and form part of the landscaped areas.

Infiltration trenches are completely below ground, and water should not occur on the surface.

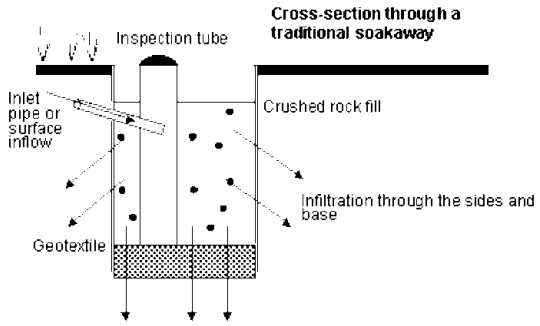


Figure 1 – Typical cross section through infiltration trench

Advantages – Reduces the volume of runoff, effective at pollutant removal, contributes to ground water recharge, simple and cost effective.

Disadvantages – Potentially high failure rates, comprehensive ground investigations required, offset from foundations (min. 5m away), risk of ground water pollution, reduced performance during prolonged wet periods.

Suitable for use – Yes, infiltration testing results confirmed that soakaways will work for soakaways.

6.2 Brown/Green Roofs

Green roofs comprise a multi-layered system that covers the roof of a building or podium structure with vegetation cover/landscaping over a drainage layer. They are designed to intercept and retain precipitation, increasing the time of concentration and reducing the volume of runoff and attenuation peak flows. Green roofs can be anything from a thin growing layer of sedums and mosses to plants, shrubs and large trees.

These roofs vary in specification and can be designed to attract bird and invertebrate species. Referring to CIRIA document C644, green and brown roofs also participate in attenuating rainwater. This would reduce the requirement for below ground storage attenuation on the site.

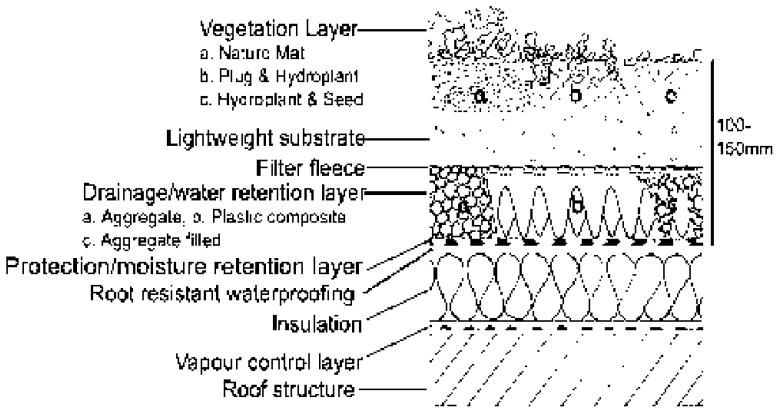


Figure 2 – Typical section through green roof build up

Advantages – Mimic greenfield state of building footprint, good removal of pollutants, ecological and amenity benefits, improve air quality, insulates building.

Disadvantages – Costs, increased structural loading, roof height, design, maintenance and exposure may preclude use.

Suitable for use – No, the types of property proposed have pitched roofs that are not suitable to support Green Roofs.

6.3 Rainwater Harvesting

These tanks act as mini-storage chambers for surface water, reducing the extent of underground storage required. They provide a source of water for plant irrigation, washing machines and for flushing toilets.

Harvested rainwater is stored below ground and pumped to provide a substitute for potable mains water reducing both the site discharge and water consumption.

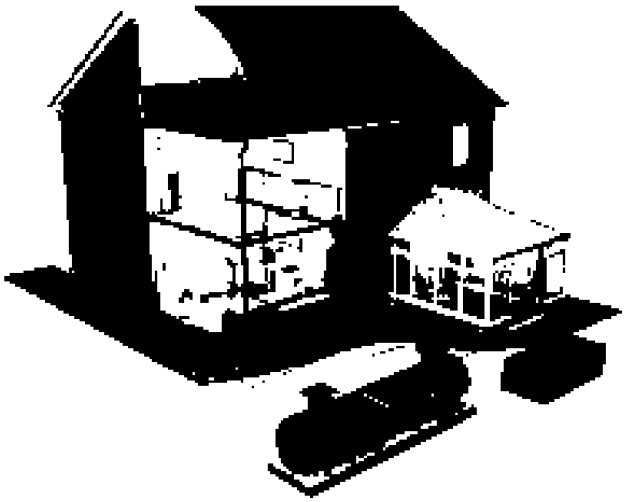


Figure 4 – Rainwater Harvesting

Advantages – Provided source control of storm water runoff, reduces demand on mains water.

Disadvantages – Costs, Risk to public health, use dependant on demand requirements and seasonal rainfall characteristics, maintenance of pumps & control systems.

Suitable for use – No, there is no space available and the cost of installing is not viable for a project of this type.

6.4 Porous Paving

Porous pavement is an alternative to conventional paving in which water permeates through the paved structure rather than draining off it. The surface water will be held in a reservoir structure (high void content sub-base) under the pavement for subsequent delayed discharge or infiltration into the sub-strata below.

The porous paving can be materials such as gravel, grasscrete, porous (no fines) concrete, concrete blocks or porous asphalt. Pollutant removal rates have been shown to be high, as the majority of the removal occurs as a result of the filtration of the water through the aggregate sub-base.

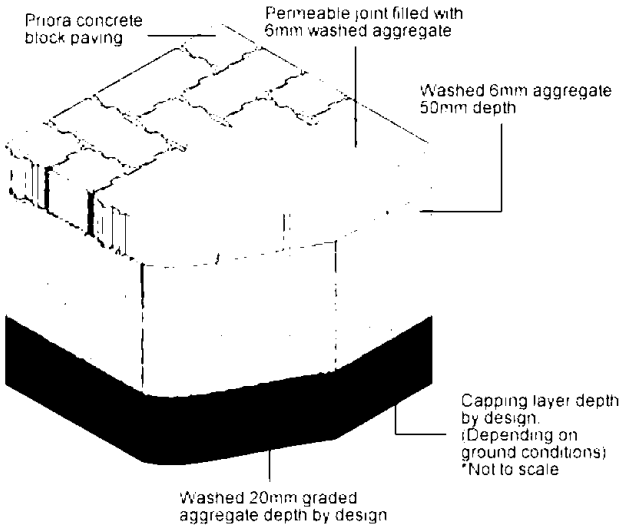


Figure 3 – Typical section through porous paving

Advantages – Effective in removing pollutants, lined systems can be used to avoid infiltration, reduces volume and rate of surface water runoff, suitable for high density developments. Mimics existing Greenfield conditions by filtering into the surrounding soft landscaped areas.

Disadvantages – Costs, used for low traffic volumes, low axel loads and speeds, risk of long term clogging due to poor maintenance.

Suitable for use – **Yes**, a permeable drive is proposed to mimic existing Greenfield conditions.

6.5 Below Ground Attenuation

Attenuation involves the storing of surface water within pipework or underground tanks prior to controlled discharge into the public system. Attenuation tanks can also provide off-line storage.

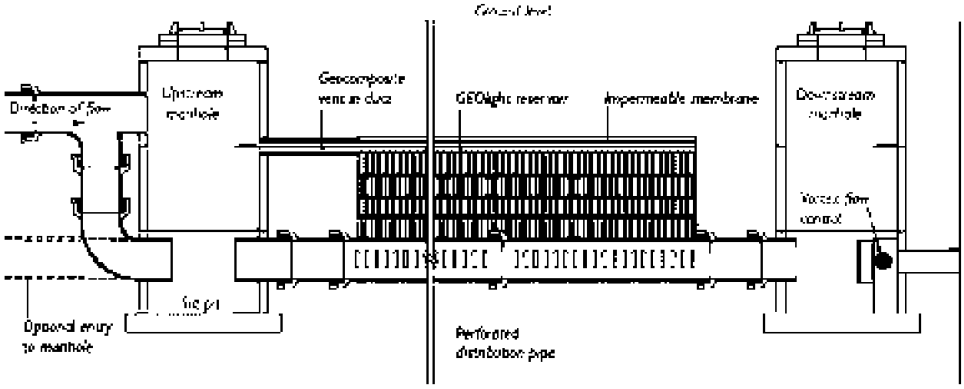


Figure 5 – Typical section through below ground attenuation chamber (cellular storage)

Advantages – Effective storage of surface water, can be used below trafficked areas, can be used below public open areas, minimum maintenance.

Disadvantages – No water quality treatment.

Suitable for use – Yes, a cellular storage tank soakaway is proposed.

6.6 Wetlands

Wetlands provide both stormwater attenuation and treatment. They comprise shallow ponds and marshy areas, covered in aquatic vegetation. Wetlands provide settlement of sediment and remove contaminants.

Advantages – Effective storage of surface water, good pollutant removal, ecological and amenity benefits.

Disadvantages – Requires large surface area. Health & Safety issues associated with large bodies of water.

Suitable for use – No, there is no space available.

6.7 Swales

Swales are vegetated drainage structures up to 500mm deep and used to provide flow control through attenuation. They can be used for infiltration, where possible.

Advantages – Can be incorporated into landscaping, good removal of contaminants, reduces discharge rates. Low costs.

Disadvantages – Requires large surface area. Limits extent of trees used in landscaping. Health & Safety issues associated with large bodies of water following heavy rainfall.

Suitable for use – **No,** there is no space available.

6.8 Ponds/Rain gardens

Ponds or rain gardens are irregular shaped vegetated drainage structures used to provide flow control through attenuation. They can be used for infiltration, where possible.

Advantages – Can be incorporated into landscaping, good removal of contaminants, reduces discharge rates. Low costs.

Disadvantages – Requires large surface area. Limits extent of trees used in landscaping. Health & Safety issues associated with large bodies of water following heavy rainfall.

Suitable for use – Yes, an above ground water collection feature is proposed, however this is not included in the design drawing.

7.0 Proposed SUDS solution

It is advised that a combination of Sustainable Drainage Systems (SUDS) is used to increase the time of concentration of the water before it discharges from the development.

This can be achieved by using a soakaway and a permeable drive.

8.0 Management and Maintenance of SUDS

The owner will complete routine maintenance of the development including all SUDs elements.

The manholes and catchpits are to be inspected and cleaned out on an annual basis.

The soakaway chamber shall be inspected annually and all silt removed.

The porous paving shall be swept clean and weeded every month.

Every twenty-five years or at a period recommended by the manufacturer the porous paving shall be lifted and the laying course cleaned or replaced to ensure that the paving operates correctly.

9.0 Implementation of SUDS

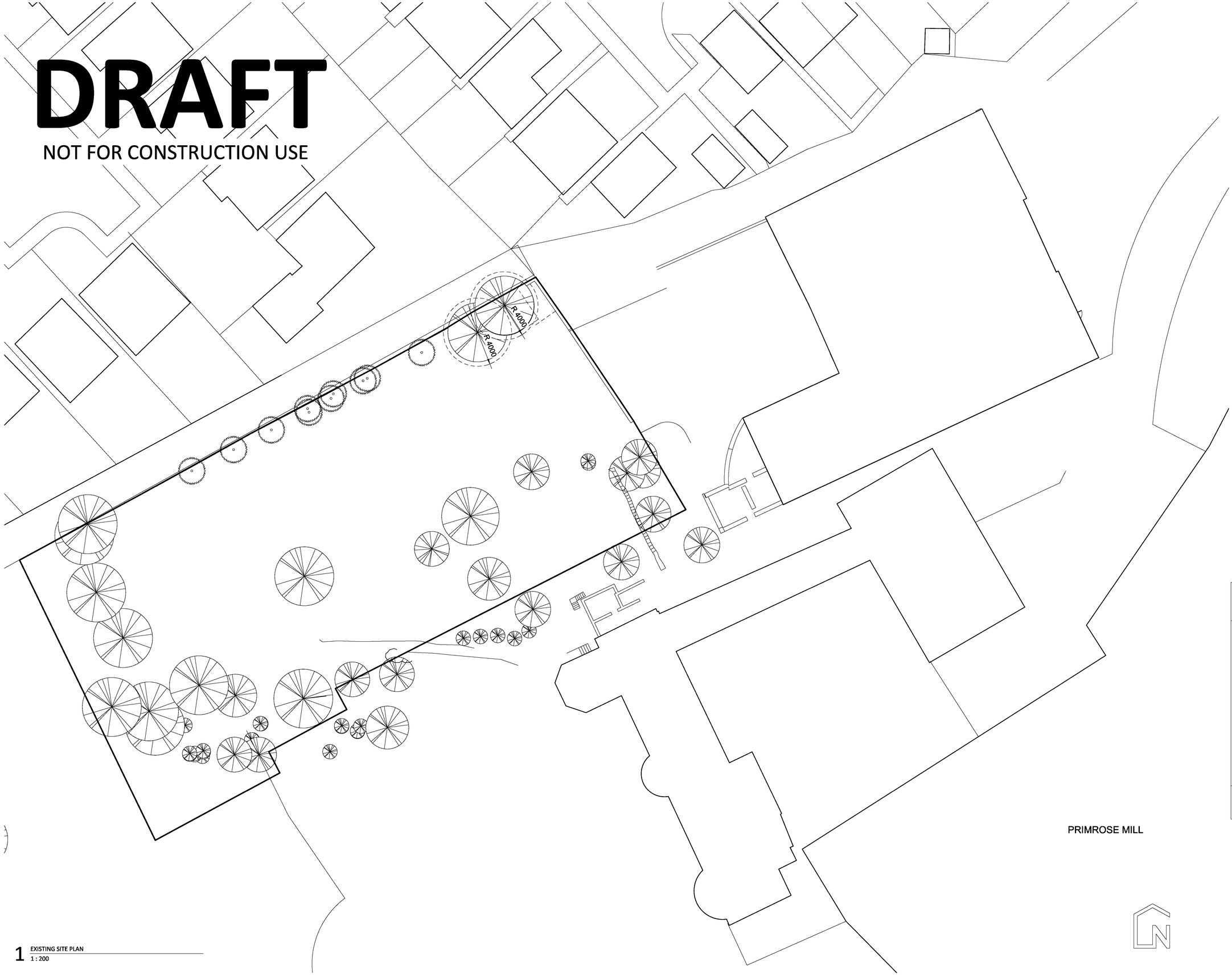
Construction will commence shortly after planning has been granted and it is expected that all construction, including SUDs features will be completed within one year.

Appendix A

Existing Site plan

DRAFT

NOT FOR CONSTRUCTION USE



1 EXISTING SITE PLAN
1 : 200

TEL: 07950 754564
EMAIL: info@studio-perfectus.co.uk
WEB: www.studio-perfectus.co.uk

PROJECT:

PRIMROSE MILL

CLIENT:

DOCUMENT DATE:

DOCUMENT STAGE:

DRAWN BY:

CHECKED BY:

REV.	REMARK	DATE

EXISTING SITE PLAN

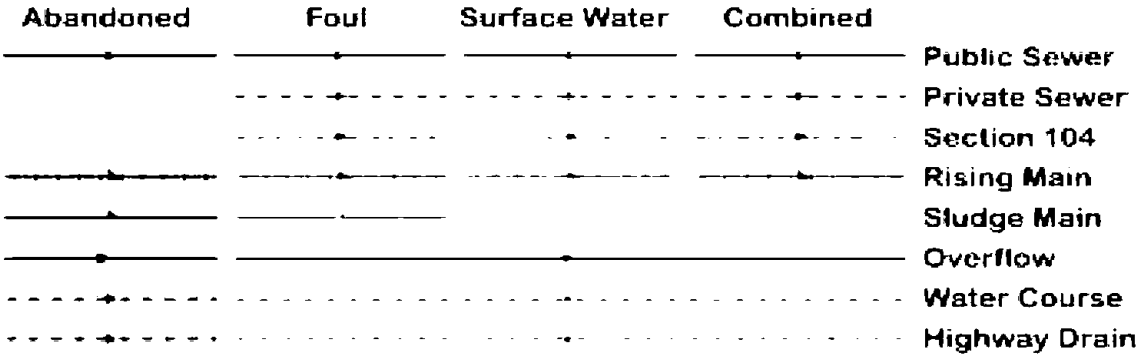
A1.1

Sheet size A1

United Utilities

Water for the North West

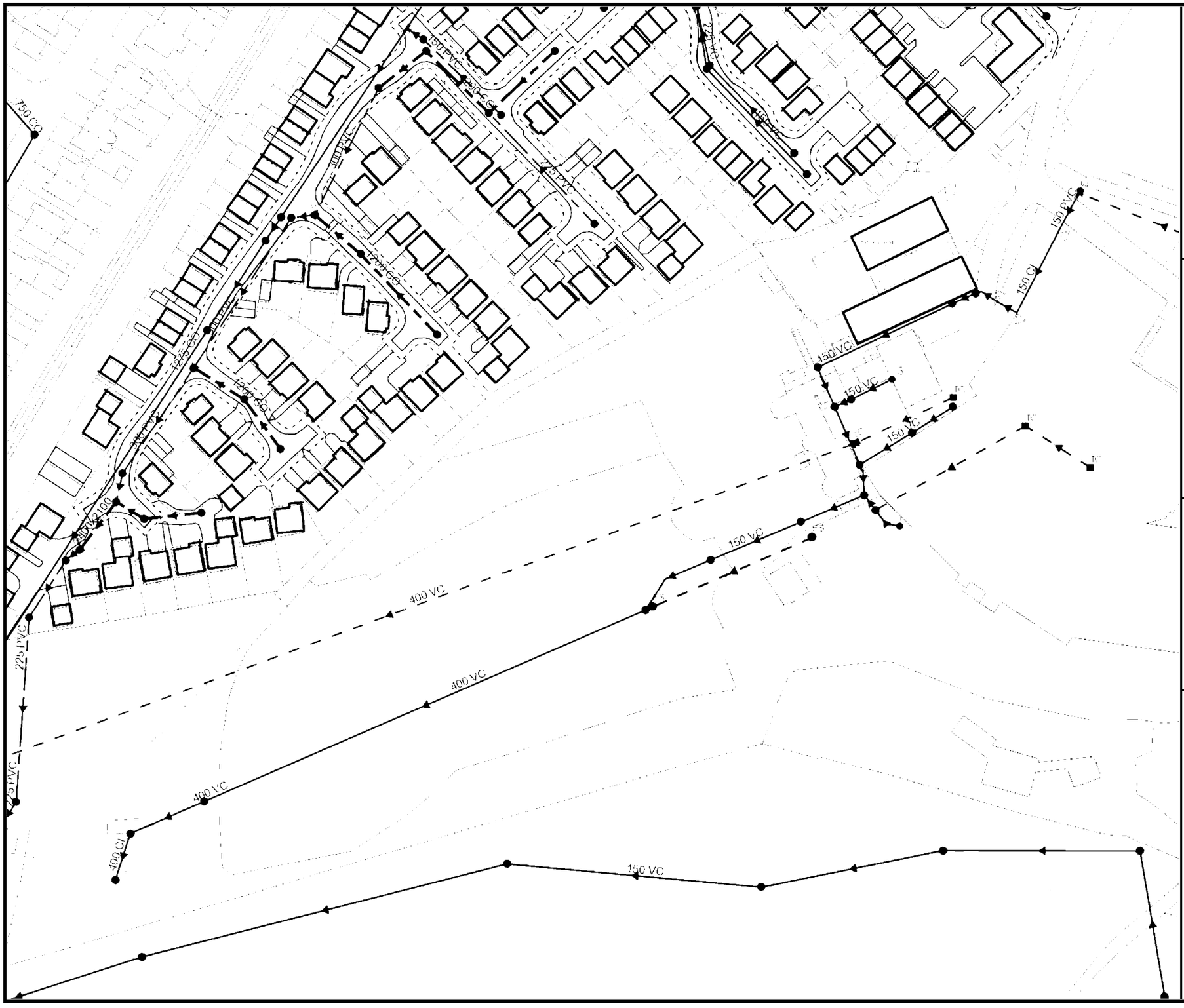
Wastewater Symbology



All point assets follow the standard colour convention:	red – combined	brown - foul
	blue – surface water	purple - overflow

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Valve
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk

Change of Characteristic



United Utilities

Water for the North West

SEWER RECORDS

Address or Site Reference

PRIMROSE HOUSE PRIMROSE ROAD,
CLITHEROE,
BB7 1DR

Scale: 1:1250
Date: 26/05/2023

Printed by: Property Searches

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

Appendix B

Pre-development surface water flow calculations

hrwallingford

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by: [redacted]

Site name: Nova

Site location: Primrose Road, Clitheroe

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: 53.86208° N

Longitude: 2.40185° W

Reference: 2117536317

Date: Jul 14 2023 20:48

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.18

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):	1183	1183
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

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):	1.61	1.61
1 in 1 year (l/s):	1.4	1.4
1 in 30 years (l/s):	2.73	2.73
1 in 100 year (l/s):	3.34	3.34
1 in 200 years (l/s):	3.81	3.81

Appendix C

Infiltration Testing results

Ground Drainage test

Primrose Hill

Test date 26th May 2023 (19.00 hrs) & 27th May 2023 (14.00 hrs)

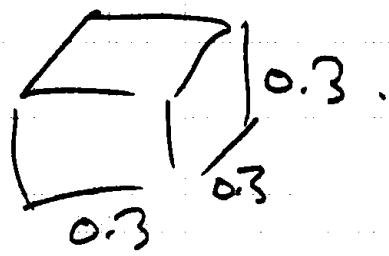
Tester: RS

The instructions required 2 holes 300 x 300 x 500 deep. Water was filled to 300mm mark in each hole and the elapsed time measured at the 200mm, 100mm and 0mm marks. Given the delta between Hole 1 and Hole 2 and third hold was dug and tested. Hole 1 and 3 are considered representative of the site.
(Hole 2 is likely to be an anomaly as seems to have been the location of an old collapsed culvert.)

Results

Level	Hole 1 -Elapsed Time	Hole 2 Elapsed Time	Hole 3 Elapsed Time
30 cm	0	0	0
20 cm	08:19	03:17	09:05
10 cm	20:44	05:15	22:01
0 cm	27:26	07:11	29:02
Total Time	56:30	15:44	1:00:08

1165-2301, NOVA, PRIMROSE ROAD, CLITHEROE.



$$V = 0.3^3 = 0.027 m^3$$

$$A = 5 \times 0.3^2 = 0.45 m^2$$

WORST TIME = 1 HOUR = 3600 SECONDS

$$F = \frac{V}{\Delta T} = \frac{0.027}{0.45 \times 3600}$$

$$= 1.67 \times 10^{-5} m/s$$

$$= 0.06 m/hr.$$

Appendix D

Drainage Layout

NOTES

CONTRACTORS MUST VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK ON SHOP DRAWINGS

DO NOT SCALE FROM THIS DRAWING

NOTES

1. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.

2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERING DRAWINGS AND CALCULATIONS ASSOCIATED WITH THIS PROJECT.

3. ALL COMPONENTS AND MATERIALS ARE TO BE MANUFACTURED AND SUPPLIED IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS, AND LAID AND BACKFILLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND THE RELEVANT BRITISH STANDARDS.

4. THE CONTRACTOR SHALL, BEFORE COMMENCING THE WORKS, VERIFY ALL SITE AND SETTING OUT DIMENSIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE TRUE AND PROPER SETTING OUT OF THE WORKS AND FOR THE CORRECTNESS OF THE POSITION, LEVELS, DIMENSIONS, AND ALIGNMENT OF ALL PARTS OF THE WORKS.

5. ALL BUILDING DRAINAGE TO BE INSTALLED AND TESTED IN COMPLIANCE WITH THE BUILDING REGULATIONS 2000 DRAINAGE AND WASTE DISPOSAL APPROVED DOCUMENT H 2002 EDITION.

6. SMALL LIGHTWEIGHT ACCESS COVERS SHOULD BE SECURED (FOR EXAMPLE WITH SCREWS) TO DETER UNAUTHORISED ACCESS.

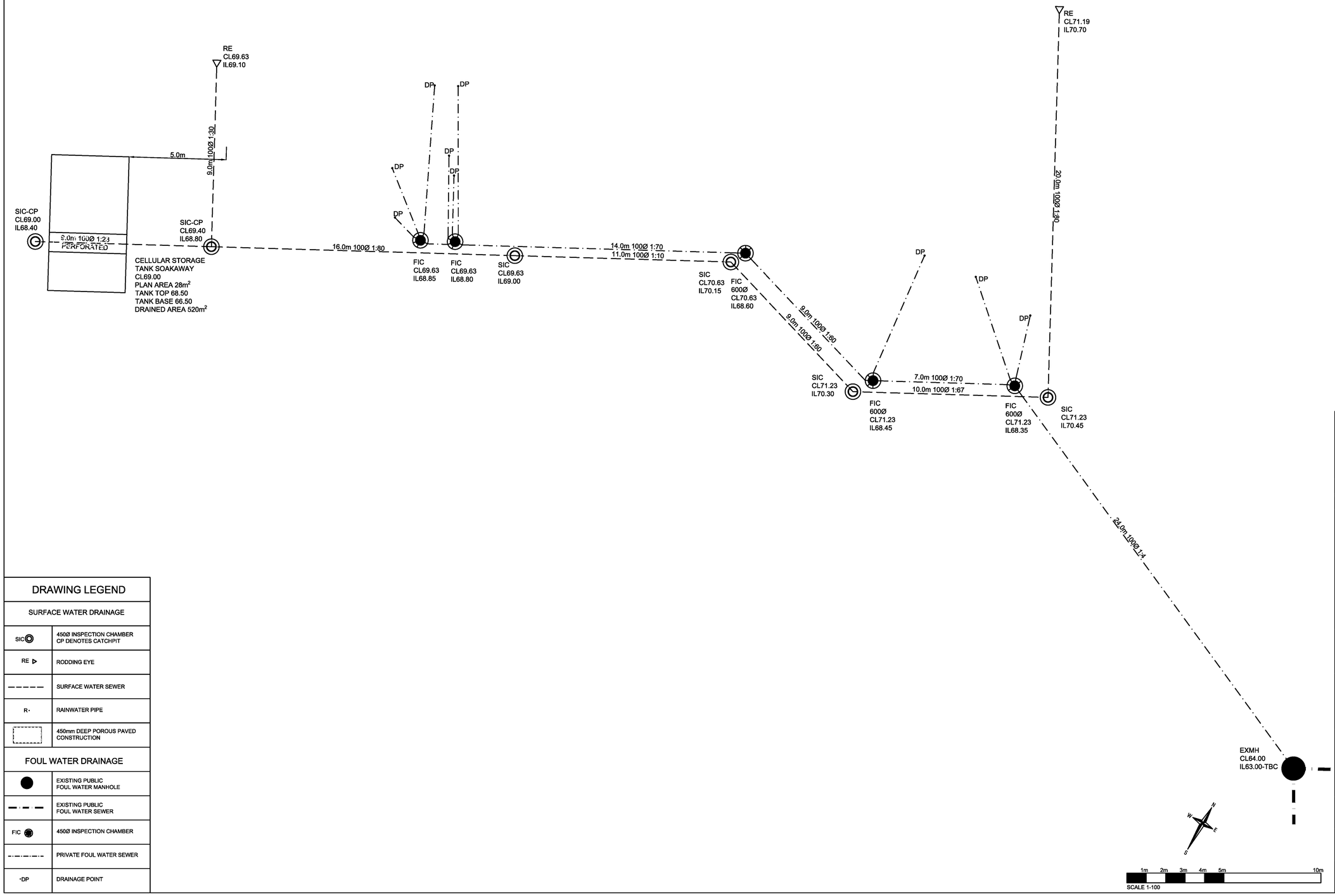
7. ALL ABOVE GROUND DRAINAGE TO INCORPORATE RODDING ACCESS FACILITIES.

8. INSITU CONCRETE FOR USE IN GENERAL DRAINAGE WORKS, GRADE TO BS: 5328.

9. FOR INTERNAL DRAINAGE POSITIONS REFER TO ARCHITECT'S CURRENT WORKING DRAWINGS.

10. FOR LANDSCAPING SURFACE MATERIAL FINISHES REFER TO ARCHITECT'S CURRENT WORKING DRAWINGS.

11. ALL PIPES TO BE 100mm DIAMETER UNLESS NOTED OTHERWISE.



DRAWING LEGEND

SURFACE WATER DRAINAGE	
SIC	450Ø INSPECTION CHAMBER CP DENOTES CATCHPIT
RE	RODDING EYE
	SURFACE WATER SEWER
R	RAINWATER PIPE
	450mm DEEP POROUS PAVED CONSTRUCTION
FOUL WATER DRAINAGE	
	EXISTING PUBLIC FOUL WATER MANHOLE
	EXISTING PUBLIC FOUL WATER SEWER
FIC	450Ø INSPECTION CHAMBER
	PRIVATE FOUL WATER SEWER
DP	DRAINAGE POINT

REV	AMENDMENT	DATE	CHKD
P1	PRELIMINARY ISSUE	14.07.2023	RAC

DRAWING STATUS: PRELIMINARY

RCD

RCD CONSULTANTS LTD
9 BIRCH TREE WAY, MAIDSTONE, KENT, ME15 7RP
MOBILE: 07702 052 137
EMAIL: ray@rcd-consultants.com

CLIENT

PROJECT

PROPOSED RESIDENTIAL DEVELOPMENT
NOVA, PRIMROSE ROAD
CLITHEROE

DRAWING TITLE

DRAINAGE STRATEGY LAYOUT

CIVILS

SCALE	DRAWN BY	CHECKED	DATE
1:100 @ A1 1:200 @ A3	RAC	RAC	JUL 2023

DRAWING NUMBER	REVISION
1165-2301-CIV-DS10	P1

Appendix E

1, 30 and 100 year surface water calculations

Summary of Results for 1 year Return Period

Half Drain Time : 1446 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	66.599	0.099	0.0	2.6	O K
30 min Summer	66.637	0.137	0.0	3.6	O K
60 min Summer	66.686	0.186	0.0	4.9	O K
120 min Summer	66.747	0.247	0.1	6.6	O K
180 min Summer	66.790	0.290	0.1	7.7	O K
240 min Summer	66.820	0.320	0.1	8.5	O K
360 min Summer	66.866	0.366	0.1	9.7	O K
480 min Summer	66.899	0.399	0.1	10.6	O K
600 min Summer	66.925	0.425	0.1	11.3	O K
720 min Summer	66.944	0.444	0.1	11.8	O K
960 min Summer	66.972	0.472	0.1	12.6	O K
1440 min Summer	67.013	0.513	0.1	13.7	O K
2160 min Summer	67.054	0.554	0.1	14.7	O K
2880 min Summer	67.076	0.576	0.1	15.3	O K
4320 min Summer	67.096	0.596	0.1	15.8	O K
5760 min Summer	67.097	0.597	0.1	15.9	O K
7200 min Summer	67.088	0.588	0.1	15.6	O K
8640 min Summer	67.077	0.577	0.1	15.3	O K
10080 min Summer	67.064	0.564	0.1	15.0	O K
15 min Winter	66.610	0.110	0.0	2.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	27.149	0.0	23
30 min Summer	18.889	0.0	38
60 min Summer	12.944	0.0	68
120 min Summer	8.757	0.0	126
180 min Summer	6.944	0.0	186
240 min Summer	5.842	0.0	246
360 min Summer	4.579	0.0	364
480 min Summer	3.854	0.0	482
600 min Summer	3.373	0.0	602
720 min Summer	3.026	0.0	720
960 min Summer	2.544	0.0	898
1440 min Summer	1.995	0.0	1128
2160 min Summer	1.568	0.0	1516
2880 min Summer	1.314	0.0	1932
4320 min Summer	1.024	0.0	2768
5760 min Summer	0.855	0.0	3576
7200 min Summer	0.740	0.0	4392
8640 min Summer	0.657	0.0	5184
10080 min Summer	0.595	0.0	5952
15 min Winter	27.149	0.0	23

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	66.653	0.153	0.0	4.1	O K
60 min Winter	66.708	0.208	0.1	5.5	O K
120 min Winter	66.778	0.278	0.1	7.4	O K
180 min Winter	66.826	0.326	0.1	8.7	O K
240 min Winter	66.860	0.360	0.1	9.6	O K
360 min Winter	66.912	0.412	0.1	11.0	O K
480 min Winter	66.950	0.450	0.1	12.0	O K
600 min Winter	66.979	0.479	0.1	12.7	O K
720 min Winter	67.003	0.503	0.1	13.4	O K
960 min Winter	67.036	0.536	0.1	14.3	O K
1440 min Winter	67.078	0.578	0.1	15.4	O K
2160 min Winter	67.121	0.621	0.1	16.5	O K
2880 min Winter	67.139	0.639	0.1	17.0	O K
4320 min Winter	67.147	0.647	0.1	17.2	O K
5760 min Winter	67.135	0.635	0.1	16.9	O K
7200 min Winter	67.115	0.615	0.1	16.4	O K
8640 min Winter	67.093	0.593	0.1	15.8	O K
10080 min Winter	67.071	0.571	0.1	15.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	18.889	0.0	37
60 min Winter	12.944	0.0	66
120 min Winter	8.757	0.0	124
180 min Winter	6.944	0.0	182
240 min Winter	5.842	0.0	240
360 min Winter	4.579	0.0	358
480 min Winter	3.854	0.0	472
600 min Winter	3.373	0.0	586
720 min Winter	3.026	0.0	698
960 min Winter	2.544	0.0	914
1440 min Winter	1.995	0.0	1156
2160 min Winter	1.568	0.0	1608
2880 min Winter	1.314	0.0	2076
4320 min Winter	1.024	0.0	2980
5760 min Winter	0.855	0.0	3808
7200 min Winter	0.740	0.0	4680
8640 min Winter	0.657	0.0	5456
10080 min Winter	0.595	0.0	6264

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.200	Shortest Storm (mins)	15
Ratio R	0.260	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.052

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.026	4	8	0.026

Model Details

Storage is Online Cover Level (m) 69.000

Cellular Storage Structure

Invert Level (m) 66.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00360 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.06000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	28.0	28.0	2.001	0.0	70.3
2.000	28.0	70.3			

Summary of Results for 10 year Return Period

Half Drain Time : 1525 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	66.691	0.191	0.0	5.1	O K
30 min Summer	66.764	0.264	0.1	7.0	O K
60 min Summer	66.849	0.349	0.1	9.3	O K
120 min Summer	66.948	0.448	0.1	11.9	O K
180 min Summer	67.010	0.510	0.1	13.6	O K
240 min Summer	67.056	0.556	0.1	14.8	O K
360 min Summer	67.123	0.623	0.1	16.6	O K
480 min Summer	67.169	0.669	0.1	17.8	O K
600 min Summer	67.203	0.703	0.1	18.7	O K
720 min Summer	67.229	0.729	0.1	19.4	O K
960 min Summer	67.262	0.762	0.1	20.3	O K
1440 min Summer	67.306	0.806	0.2	21.5	O K
2160 min Summer	67.346	0.846	0.2	22.5	O K
2880 min Summer	67.367	0.867	0.2	23.1	O K
4320 min Summer	67.381	0.881	0.2	23.4	O K
5760 min Summer	67.375	0.875	0.2	23.3	O K
7200 min Summer	67.362	0.862	0.2	22.9	O K
8640 min Summer	67.345	0.845	0.2	22.5	O K
10080 min Summer	67.326	0.826	0.2	22.0	O K
15 min Winter	66.714	0.214	0.1	5.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	52.597	0.0	23
30 min Summer	36.360	0.0	38
60 min Summer	24.244	0.0	68
120 min Summer	15.766	0.0	126
180 min Summer	12.141	0.0	186
240 min Summer	10.075	0.0	246
360 min Summer	7.729	0.0	364
480 min Summer	6.397	0.0	484
600 min Summer	5.521	0.0	602
720 min Summer	4.893	0.0	722
960 min Summer	4.043	0.0	932
1440 min Summer	3.085	0.0	1142
2160 min Summer	2.352	0.0	1520
2880 min Summer	1.941	0.0	1936
4320 min Summer	1.480	0.0	2768
5760 min Summer	1.222	0.0	3576
7200 min Summer	1.053	0.0	4392
8640 min Summer	0.933	0.0	5184
10080 min Summer	0.843	0.0	5952
15 min Winter	52.597	0.0	23

Summary of Results for 10 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	66.795	0.295	0.1	7.9	O K
60 min Winter	66.891	0.391	0.1	10.4	O K
120 min Winter	67.002	0.502	0.1	13.4	O K
180 min Winter	67.072	0.572	0.1	15.2	O K
240 min Winter	67.125	0.625	0.1	16.6	O K
360 min Winter	67.200	0.700	0.1	18.6	O K
480 min Winter	67.254	0.754	0.1	20.0	O K
600 min Winter	67.293	0.793	0.2	21.1	O K
720 min Winter	67.323	0.823	0.2	21.9	O K
960 min Winter	67.364	0.864	0.2	23.0	O K
1440 min Winter	67.408	0.908	0.2	24.1	O K
2160 min Winter	67.447	0.947	0.2	25.2	O K
2880 min Winter	67.461	0.961	0.2	25.6	O K
4320 min Winter	67.456	0.956	0.2	25.4	O K
5760 min Winter	67.432	0.932	0.2	24.8	O K
7200 min Winter	67.402	0.902	0.2	24.0	O K
8640 min Winter	67.369	0.869	0.2	23.1	O K
10080 min Winter	67.337	0.837	0.2	22.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	36.360	0.0	37
60 min Winter	24.244	0.0	66
120 min Winter	15.766	0.0	124
180 min Winter	12.141	0.0	182
240 min Winter	10.075	0.0	242
360 min Winter	7.729	0.0	358
480 min Winter	6.397	0.0	472
600 min Winter	5.521	0.0	588
720 min Winter	4.893	0.0	700
960 min Winter	4.043	0.0	916
1440 min Winter	3.085	0.0	1170
2160 min Winter	2.352	0.0	1624
2880 min Winter	1.941	0.0	2080
4320 min Winter	1.480	0.0	2980
5760 min Winter	1.222	0.0	3816
7200 min Winter	1.053	0.0	4680
8640 min Winter	0.933	0.0	5528
10080 min Winter	0.843	0.0	6344

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	10	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.200	Shortest Storm (mins)	15
Ratio R	0.260	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.052

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.026	4	8	0.026

Model Details

Storage is Online Cover Level (m) 69.000

Cellular Storage Structure

Invert Level (m) 66.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00360 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.06000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	28.0	28.0	2.001	0.0	70.3
2.000	28.0	70.3			

Summary of Results for 30 year Return Period

Half Drain Time : 1545 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	66.742	0.242	0.1	6.4	O K
30 min Summer	66.837	0.337	0.1	9.0	O K
60 min Summer	66.948	0.448	0.1	11.9	O K
120 min Summer	67.074	0.574	0.1	15.3	O K
180 min Summer	67.149	0.649	0.1	17.3	O K
240 min Summer	67.204	0.704	0.1	18.7	O K
360 min Summer	67.283	0.783	0.2	20.8	O K
480 min Summer	67.336	0.836	0.2	22.3	O K
600 min Summer	67.375	0.875	0.2	23.3	O K
720 min Summer	67.403	0.903	0.2	24.0	O K
960 min Summer	67.438	0.938	0.2	24.9	O K
1440 min Summer	67.480	0.980	0.2	26.1	O K
2160 min Summer	67.516	1.016	0.2	27.0	O K
2880 min Summer	67.533	1.033	0.2	27.5	O K
4320 min Summer	67.539	1.039	0.2	27.6	O K
5760 min Summer	67.525	1.025	0.2	27.3	O K
7200 min Summer	67.504	1.004	0.2	26.7	O K
8640 min Summer	67.480	0.980	0.2	26.1	O K
10080 min Summer	67.456	0.956	0.2	25.4	O K
15 min Winter	66.771	0.271	0.1	7.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	66.431	0.0	23
30 min Summer	46.404	0.0	38
60 min Summer	31.124	0.0	68
120 min Summer	20.183	0.0	126
180 min Summer	15.423	0.0	186
240 min Summer	12.730	0.0	246
360 min Summer	9.687	0.0	364
480 min Summer	7.967	0.0	484
600 min Summer	6.839	0.0	602
720 min Summer	6.034	0.0	722
960 min Summer	4.947	0.0	936
1440 min Summer	3.731	0.0	1144
2160 min Summer	2.808	0.0	1536
2880 min Summer	2.297	0.0	1936
4320 min Summer	1.731	0.0	2768
5760 min Summer	1.418	0.0	3576
7200 min Summer	1.215	0.0	4392
8640 min Summer	1.072	0.0	5192
10080 min Summer	0.965	0.0	5952
15 min Winter	66.431	0.0	23

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	66.877	0.377	0.1	10.0	O K
60 min Winter	67.003	0.503	0.1	13.4	O K
120 min Winter	67.143	0.643	0.1	17.1	O K
180 min Winter	67.228	0.728	0.1	19.4	O K
240 min Winter	67.291	0.791	0.2	21.0	O K
360 min Winter	67.380	0.880	0.2	23.4	O K
480 min Winter	67.441	0.941	0.2	25.0	O K
600 min Winter	67.486	0.986	0.2	26.2	O K
720 min Winter	67.519	1.019	0.2	27.1	O K
960 min Winter	67.562	1.062	0.2	28.3	O K
1440 min Winter	67.603	1.103	0.2	29.3	O K
2160 min Winter	67.637	1.137	0.2	30.2	O K
2880 min Winter	67.645	1.145	0.2	30.5	O K
4320 min Winter	67.627	1.127	0.2	30.0	O K
5760 min Winter	67.591	1.091	0.2	29.0	O K
7200 min Winter	67.550	1.050	0.2	27.9	O K
8640 min Winter	67.509	1.009	0.2	26.8	O K
10080 min Winter	67.469	0.969	0.2	25.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	46.404	0.0	37
60 min Winter	31.124	0.0	66
120 min Winter	20.183	0.0	124
180 min Winter	15.423	0.0	182
240 min Winter	12.730	0.0	242
360 min Winter	9.687	0.0	358
480 min Winter	7.967	0.0	474
600 min Winter	6.839	0.0	588
720 min Winter	6.034	0.0	700
960 min Winter	4.947	0.0	918
1440 min Winter	3.731	0.0	1174
2160 min Winter	2.808	0.0	1624
2880 min Winter	2.297	0.0	2080
4320 min Winter	1.731	0.0	2984
5760 min Winter	1.418	0.0	3856
7200 min Winter	1.215	0.0	4680
8640 min Winter	1.072	0.0	5528
10080 min Winter	0.965	0.0	6344

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.200	Shortest Storm (mins)	15
Ratio R	0.260	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.052

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.026	4	8	0.026

Model Details

Storage is Online Cover Level (m) 69.000

Cellular Storage Structure

Invert Level (m) 66.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00360 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.06000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	28.0	28.0	2.001	0.0	70.3
2.000	28.0	70.3			

Summary of Results for 100 year Return Period

Half Drain Time : 1557 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	66.813	0.313	0.1	8.3	O K
30 min Summer	66.940	0.440	0.1	11.7	O K
60 min Summer	67.090	0.590	0.1	15.7	O K
120 min Summer	67.253	0.753	0.1	20.0	O K
180 min Summer	67.345	0.845	0.2	22.5	O K
240 min Summer	67.412	0.912	0.2	24.3	O K
360 min Summer	67.506	1.006	0.2	26.7	O K
480 min Summer	67.567	1.067	0.2	28.4	O K
600 min Summer	67.610	1.110	0.2	29.5	O K
720 min Summer	67.640	1.140	0.2	30.3	O K
960 min Summer	67.675	1.175	0.2	31.3	O K
1440 min Summer	67.714	1.214	0.2	32.3	O K
2160 min Summer	67.741	1.241	0.2	33.0	O K
2880 min Summer	67.751	1.251	0.2	33.3	O K
4320 min Summer	67.742	1.242	0.2	33.0	O K
5760 min Summer	67.716	1.216	0.2	32.4	O K
7200 min Summer	67.685	1.185	0.2	31.5	O K
8640 min Summer	67.653	1.153	0.2	30.7	O K
10080 min Summer	67.621	1.121	0.2	29.8	O K
15 min Winter	66.850	0.350	0.1	9.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	85.803	0.0	23
30 min Summer	60.624	0.0	38
60 min Summer	40.926	0.0	68
120 min Summer	26.457	0.0	126
180 min Summer	20.047	0.0	186
240 min Summer	16.451	0.0	246
360 min Summer	12.407	0.0	364
480 min Summer	10.132	0.0	484
600 min Summer	8.648	0.0	602
720 min Summer	7.592	0.0	722
960 min Summer	6.172	0.0	938
1440 min Summer	4.595	0.0	1154
2160 min Summer	3.409	0.0	1536
2880 min Summer	2.763	0.0	1940
4320 min Summer	2.055	0.0	2768
5760 min Summer	1.669	0.0	3576
7200 min Summer	1.422	0.0	4392
8640 min Summer	1.249	0.0	5192
10080 min Summer	1.121	0.0	5952
15 min Winter	85.803	0.0	23

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	66.993	0.493	0.1	13.1	O K
60 min Winter	67.161	0.661	0.1	17.6	O K
120 min Winter	67.344	0.844	0.2	22.5	O K
180 min Winter	67.448	0.948	0.2	25.2	O K
240 min Winter	67.524	1.024	0.2	27.2	O K
360 min Winter	67.630	1.130	0.2	30.1	O K
480 min Winter	67.700	1.200	0.2	31.9	O K
600 min Winter	67.750	1.250	0.2	33.2	O K
720 min Winter	67.786	1.286	0.2	34.2	O K
960 min Winter	67.831	1.331	0.2	35.4	O K
1440 min Winter	67.865	1.365	0.3	36.3	O K
2160 min Winter	67.887	1.387	0.3	36.9	O K
2880 min Winter	67.886	1.386	0.3	36.9	O K
4320 min Winter	67.848	1.348	0.3	35.9	O K
5760 min Winter	67.794	1.294	0.2	34.4	O K
7200 min Winter	67.739	1.239	0.2	33.0	O K
8640 min Winter	67.686	1.186	0.2	31.5	O K
10080 min Winter	67.636	1.136	0.2	30.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	60.624	0.0	37
60 min Winter	40.926	0.0	66
120 min Winter	26.457	0.0	124
180 min Winter	20.047	0.0	184
240 min Winter	16.451	0.0	242
360 min Winter	12.407	0.0	358
480 min Winter	10.132	0.0	474
600 min Winter	8.648	0.0	588
720 min Winter	7.592	0.0	700
960 min Winter	6.172	0.0	918
1440 min Winter	4.595	0.0	1184
2160 min Winter	3.409	0.0	1624
2880 min Winter	2.763	0.0	2080
4320 min Winter	2.055	0.0	2984
5760 min Winter	1.669	0.0	3856
7200 min Winter	1.422	0.0	4680
8640 min Winter	1.249	0.0	5528
10080 min Winter	1.121	0.0	6344

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.200	Shortest Storm (mins)	15
Ratio R	0.260	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.052

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.026	4	8	0.026

Model Details

Storage is Online Cover Level (m) 69.000

Cellular Storage Structure

Invert Level (m) 66.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00360 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.06000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	28.0	28.0	2.001	0.0	70.3
2.000	28.0	70.3			

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1608 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	66.938	0.438	0.1	11.6	O K
30 min Summer	67.117	0.617	0.1	16.4	O K
60 min Summer	67.327	0.827	0.2	22.0	O K
120 min Summer	67.555	1.055	0.2	28.1	O K
180 min Summer	67.684	1.184	0.2	31.5	O K
240 min Summer	67.780	1.280	0.2	34.0	O K
360 min Summer	67.912	1.412	0.3	37.5	O K
480 min Summer	67.999	1.499	0.3	39.9	O K
600 min Summer	68.060	1.560	0.3	41.5	O K
720 min Summer	68.103	1.603	0.3	42.6	O K
960 min Summer	68.155	1.655	0.3	44.0	O K
1440 min Summer	68.210	1.710	0.3	45.5	O K
2160 min Summer	68.250	1.750	0.3	46.6	O K
2880 min Summer	68.267	1.767	0.3	47.0	O K
4320 min Summer	68.259	1.759	0.3	46.8	O K
5760 min Summer	68.226	1.726	0.3	45.9	O K
7200 min Summer	68.184	1.684	0.3	44.8	O K
8640 min Summer	68.140	1.640	0.3	43.6	O K
10080 min Summer	68.097	1.597	0.3	42.5	O K
15 min Winter	66.990	0.490	0.1	13.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	120.124	0.0	23
30 min Summer	84.873	0.0	38
60 min Summer	57.296	0.0	68
120 min Summer	37.040	0.0	126
180 min Summer	28.065	0.0	186
240 min Summer	23.032	0.0	246
360 min Summer	17.370	0.0	364
480 min Summer	14.185	0.0	484
600 min Summer	12.107	0.0	602
720 min Summer	10.628	0.0	722
960 min Summer	8.640	0.0	952
1440 min Summer	6.433	0.0	1158
2160 min Summer	4.773	0.0	1536
2880 min Summer	3.868	0.0	1956
4320 min Summer	2.878	0.0	2768
5760 min Summer	2.336	0.0	3576
7200 min Summer	1.990	0.0	4392
8640 min Summer	1.748	0.0	5192
10080 min Summer	1.569	0.0	5952
15 min Winter	120.124	0.0	23

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	67.191	0.691	0.1	18.4	O K
60 min Winter	67.427	0.927	0.2	24.6	O K
120 min Winter	67.683	1.183	0.2	31.5	O K
180 min Winter	67.828	1.328	0.2	35.3	O K
240 min Winter	67.936	1.436	0.3	38.2	O K
360 min Winter	68.085	1.585	0.3	42.2	O K
480 min Winter	68.185	1.685	0.3	44.8	O K
600 min Winter	68.256	1.756	0.3	46.7	O K
720 min Winter	68.307	1.807	0.3	48.1	O K
960 min Winter	68.372	1.872	0.3	49.8	O K
1440 min Winter	68.421	1.921	0.4	51.1	O K
2160 min Winter	68.456	1.956	0.4	52.0	O K
2880 min Winter	68.456	1.956	0.4	52.0	O K
4320 min Winter	68.408	1.908	0.4	50.7	O K
5760 min Winter	68.336	1.836	0.3	48.8	O K
7200 min Winter	68.261	1.761	0.3	46.8	O K
8640 min Winter	68.187	1.687	0.3	44.9	O K
10080 min Winter	68.119	1.619	0.3	43.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	84.873	0.0	37
60 min Winter	57.296	0.0	66
120 min Winter	37.040	0.0	124
180 min Winter	28.065	0.0	184
240 min Winter	23.032	0.0	242
360 min Winter	17.370	0.0	358
480 min Winter	14.185	0.0	474
600 min Winter	12.107	0.0	588
720 min Winter	10.628	0.0	700
960 min Winter	8.640	0.0	918
1440 min Winter	6.433	0.0	1190
2160 min Winter	4.773	0.0	1624
2880 min Winter	3.868	0.0	2080
4320 min Winter	2.878	0.0	2984
5760 min Winter	2.336	0.0	3856
7200 min Winter	1.990	0.0	4680
8640 min Winter	1.748	0.0	5528
10080 min Winter	1.569	0.0	6344

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.200	Shortest Storm (mins)	15
Ratio R	0.260	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.052

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.026	4	8	0.026

Model Details

Storage is Online Cover Level (m) 69.000

Cellular Storage Structure

Invert Level (m) 66.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00360 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.06000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	28.0	28.0	2.001	0.0	70.3
2.000	28.0	70.3			

Appendix F

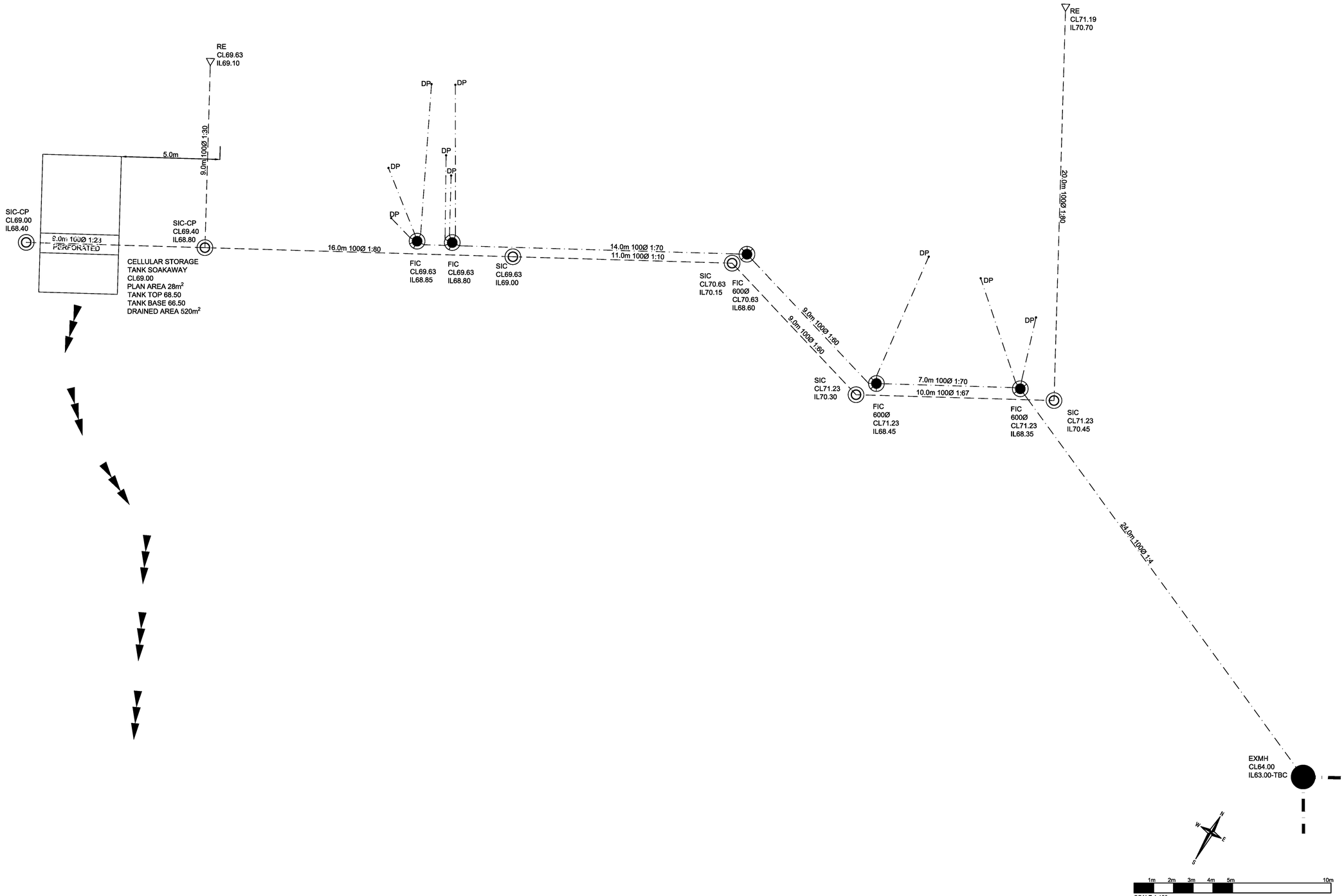
Flood exceedance plan

NOTES

CONTRACTORS MUST VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK ON SHOP DRAWINGS

DO NOT SCALE FROM THIS DRAWING

FLOOD EXCEEDANCE ROUTE



REV	AMENDMENT	DATE	CHKD
P1	PRELIMINARY ISSUE	14.07.2023	RAC

DRAWING STATUS

PRELIMINARY

RCD

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CLIENT

PROJECT

PROPOSED RESIDENTIAL DEVELOPMENT
NOVA, PRIMROSE ROAD
CLITHEROE

DRAWING TITLE

FLOOD EXCEEDANCE PLAN

CIVILS

SCALE	DRAWN BY	CHECKED	DATE
1:100 @ A1 1:200 @ A3	RAC	RAC	JUL 2023

DRAWING NUMBER	REVISION
1165-2301-CIV-DS11	P1