

FLOSH MEADOWS, CLEATOR, SR12 The Meadows

Drainage Strategy

Issue Date:

09 June 2023

Report Number:

1842-DS1

Client:

Lakeland Associates
(Cleator) Ltd

Revision:

H

Contents

1. Introduction 1

2. Site location, Existing Topography, Geology and Proposals 2

3. Surface and foul Water Disposal 6

4. References 11

- Appendix A – Topographical Survey
- Appendix B – Proposed Site Layout
- Appendix C – Existing Drainage Layout
- Appendix D – Greenfield Runoff Calculations
- Appendix E – Drainage Strategy and Calculations

Executive Summary

Site Location	The site is located off A5086, Cleator, CA23 3EP (nearest) at NGR 301752E 514082N. The development footprint measures approximately 3.30 Ha, entirely greenfield.
Site Proposals	The site is proposed to be developed with residential units.
Ground Conditions	The site is located in an area underlain by drift deposits consisting of soft - stiff clays. Surface water cannot be discharged utilising infiltration techniques.
Nearest Watercourse	The River Ehen is located 300m to the south of the site boundary beyond third party land.
Nearest water feature	Within the development site, an historic man-made culverted mill race flows from north to south and outfalls via a culvert below the public highway located to the south. The mill race conveys flows from agricultural land located to the north of the development site. Surface water should discharge to the surface water feature. Surface water discharge should be restricted to a greenfield rate matching Q_{bar} for the development, in this case 32 litres/sec.
Nearest Surface Water Sewer.	Adjacent to proposed site entrance, discharging within 40m of the head of the run to a UU combined sewer at A5086. Another surface water sewer is located within Howthorne Fields to the south of Flish Meadows. Neither sewers are suitable for disposal of surface water. The reasons are covered in greater detail within section 3.0.
Nearest Combined Sewer	On site adjacent to southern boundary.
Nearest Foul Water Sewer	Adjacent to proposed site entrance, discharging within 40m to a UU combined sewer at A5086
SUDS	Pipes, flow control, cellular storage.

The above summary should not be used in isolation and reference should be made to the full report which provides a detailed assessment of the risks affecting the development.

1. Introduction

Coast Consulting Engineers have been commissioned by Lakeland Associates (Cleator) Ltd to produce a drainage strategy to accompany a planning application for a proposed development at Flish Meadows, Cleator. This strategy is produced only for the phase known as SR12, The Meadows, although the strategy also references the wider site, as the drainage from SR12A (4/17/2214) and Top Meadows (4/17/2390), discharges into the networks constructed for SR12. This Assessment is reviewed in accordance with the National Planning Policy Framework (NPPF) for Development and Flood Risk.

A flood risk assessment has previously been completed by RWO Associates reference RO/14016.200 Version 3, dated October 2017 and has subsequently been approved. As such, this report does not assess flood risk to the proposed development.

2. Site location, Existing Topography, Geology and Proposals

2.1 Site Location

The site is located off A5086, Cleator, CA23 3EP (nearest) at NGR 301752E 514082N. The entire development footprint measures approximately 3.30 Ha, entirely greenfield.

The site location is indicated in Figure 2.11 and the proposed phasing in Figure 2.12 below.

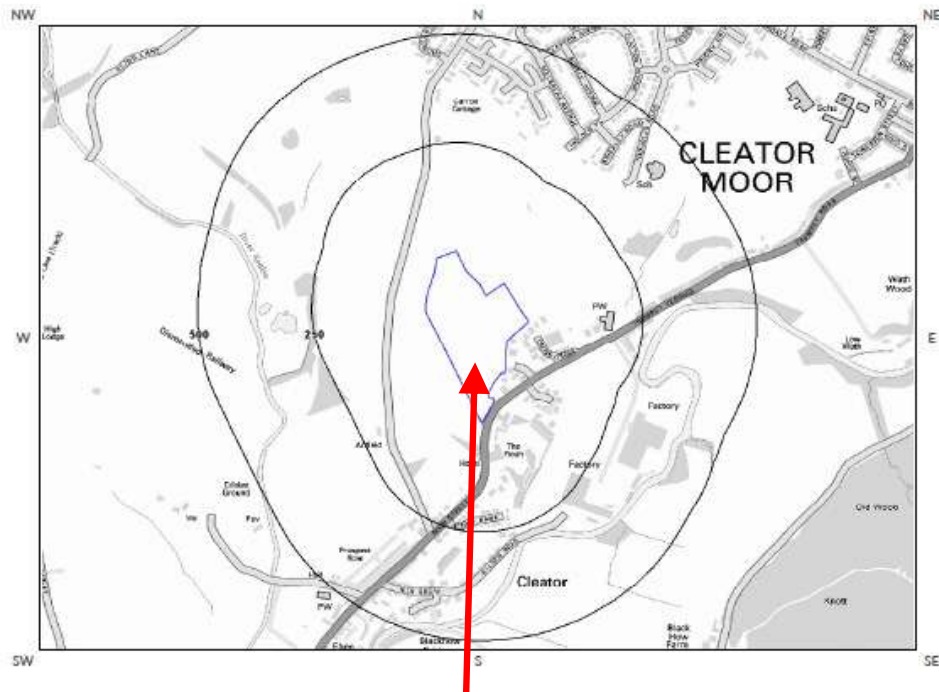


Figure 2.11 – Site Location

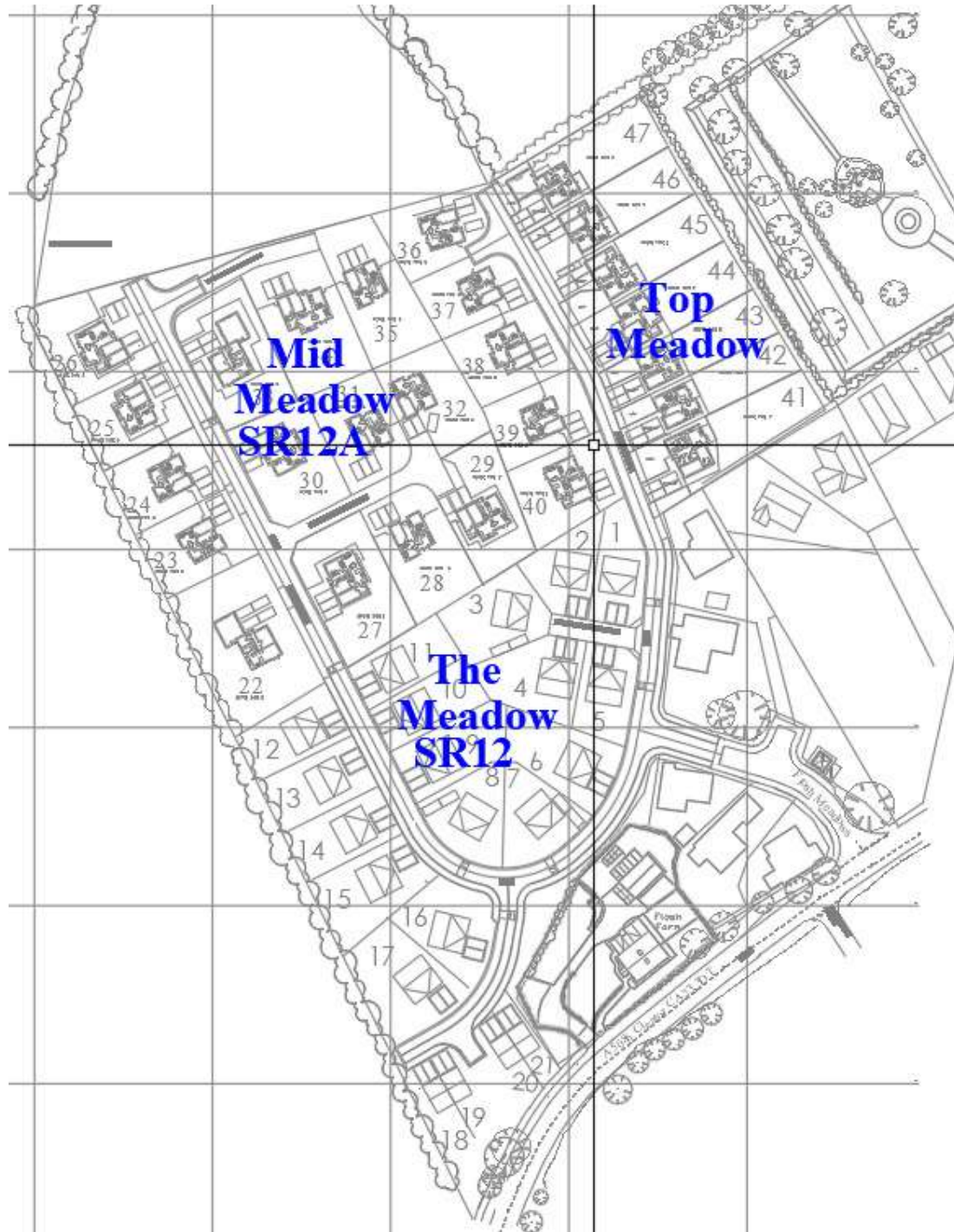


Figure 2.12 – Proposed Phasing

2.2 Existing Topography

A topographical survey of the site has been undertaken and is included in Appendix A. The overall development site generally falls in a southerly direction. Site levels range from approximately 67.50m AOD at the north of SR12A to 63.00m AOD at the southern extents of SR12.

The surrounding area is developed as follows:

North: Agricultural Land
East: Agricultural Land and residential properties
South: Residential properties
West: Agricultural Land

Figure 2.21 below extracted from Google maps shows the existing site.



Figure 2.21 – Satellite image of the existing site.

2.3 Existing sewers and watercourses

A combined sewer is located within the development land, adjacent to the southern boundary line of SR12. Adopted foul and surface water sewers are located within Flish Meadows, adjacent to the proposed site entrance, the head of each run is located at the proposed site entrance. The adopted surface water and foul sewers outfall into a combined sewer approximately 40m downstream of the head of each run. All sewers are owned and maintained by United Utilities Ltd (UU). Figure 2.31 below shows the location of the existing public sewers within the vicinity of the site.

Within the overall development site, an historic man-made culverted mill race flows from north to south and outfalls via a culvert below the public highway located to the south of SR12. The mill race conveys flows from agricultural land located to the north of SR12A. Figure 2.32 overleaf shows the location of the natural watercourses within the vicinity of the site. Please also refer to Appendix C for further information on the existing drainage regime.

The River Ehen is located approximately 300m to the south of the site boundary, beyond third party land.

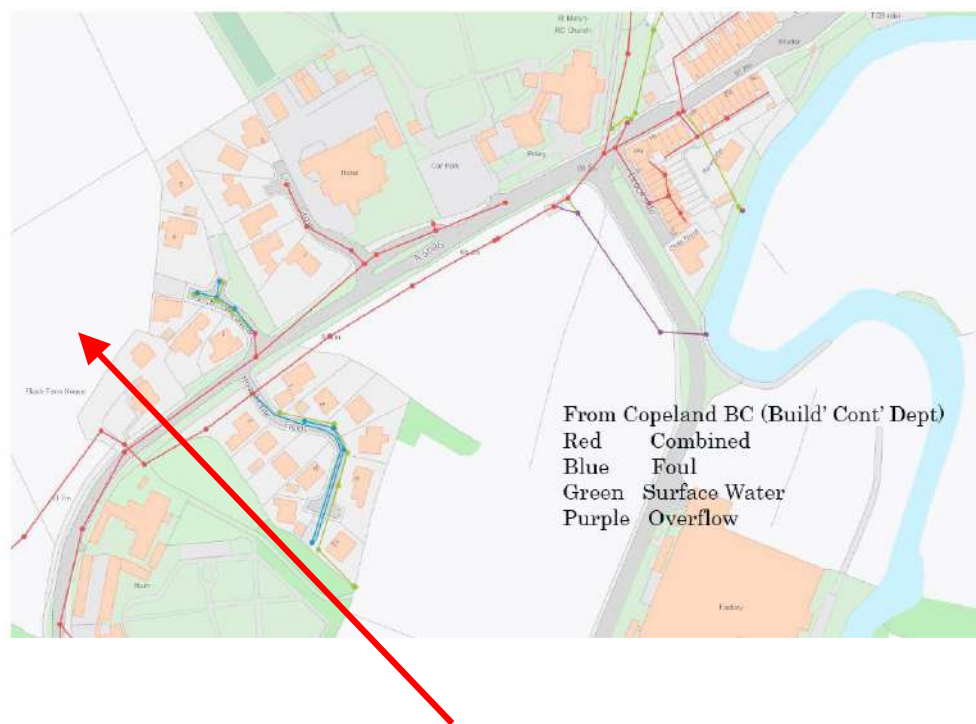


Figure 2.31 – sewers.

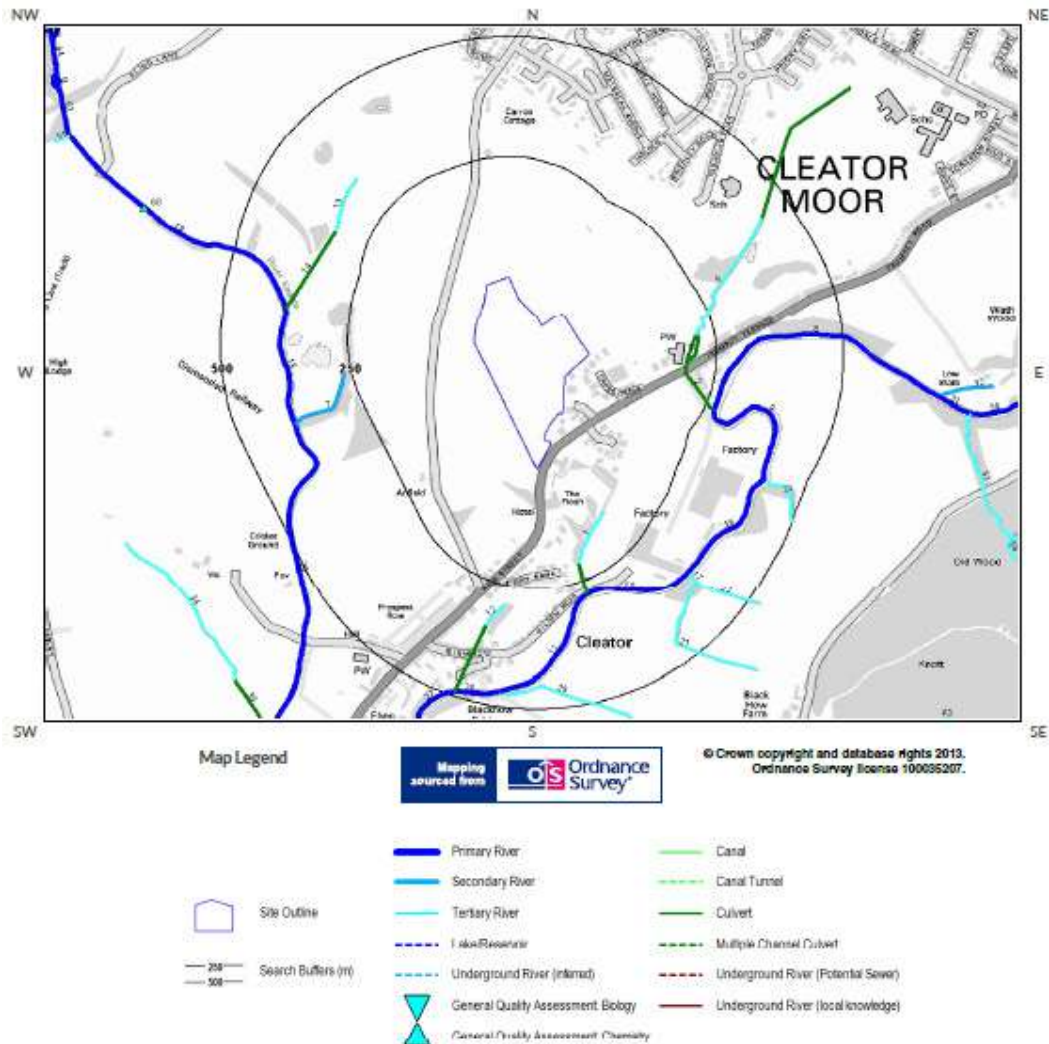


Figure 2.32 – watercourses.

2.4 Geology

A phase 2 intrusive investigation of ground conditions has been completed by Geo Environmental Engineering Ltd, reference 2018-3167 dated 09.08.2018. The report states that the site is underlain by varying ground conditions, largely comprising soft to stiff clays. Ground water was encountered across the site at depths of between 1.50m to 2.90m.

2.5 Development Proposals

The site is proposed to be developed with residential units. A copy of the proposed architectural site layout can be found in Appendix B.

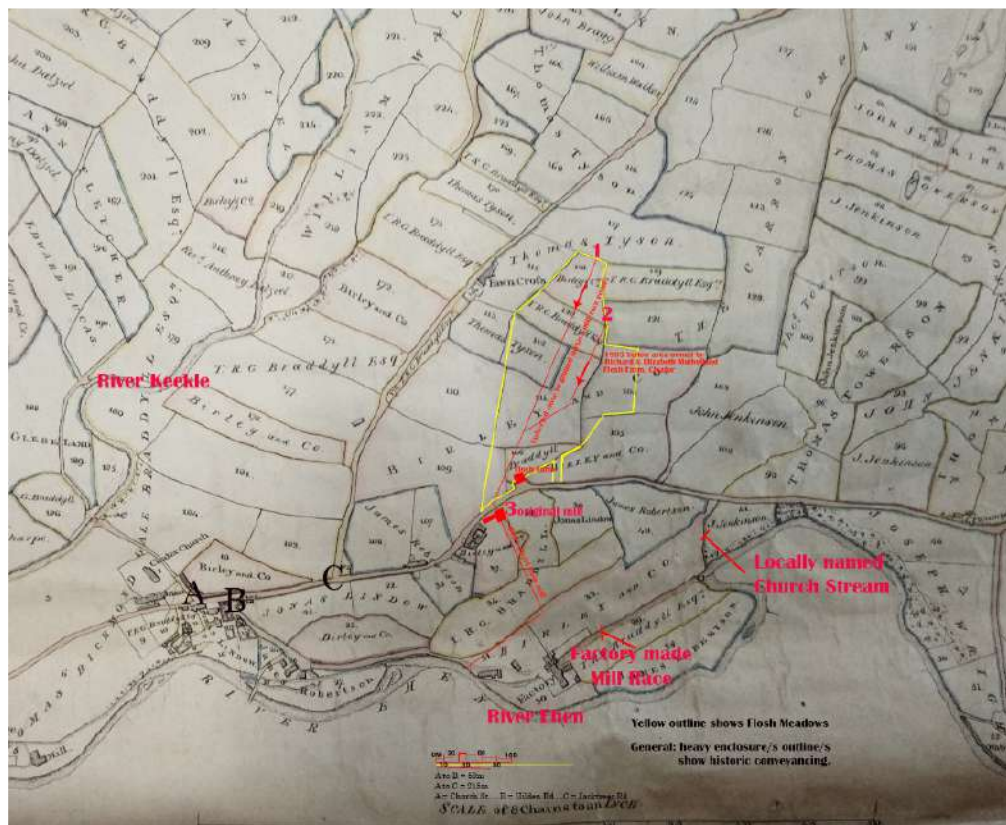
3. Surface Water Disposal

3.1 Existing Surface Water Drainage

There are no existing sewers serving the greenfield site.

An existing historic, man-made, culverted, mill race flows through the site from north to south. The race outfalls from the development via a culvert below the public highway located to the south of SR12. The race is not a natural watercourse and is not identified on GroundSure plans (ref figure 2.32) above or historic Pre 1800's mining plans (ref figure 3.11) below.

Please also refer to Appendix C for further information on the existing drainage regime.



3.2 Proposed Surface Water Drainage

In line with national standards, consideration has been given to the preferred hierarchy for disposal of surface water from the development, as contained in Part H of the Building Regulations. The hierarchy is as follows:

1. By infiltration
2. To watercourse
3. To sewer

As noted earlier, superficial deposits comprise of soft - stiff clays with a low permeability. It is considered that utilisation of infiltration techniques will not be applicable for the proposed development.

The nearest watercourse to the development is located approximately 300m to the south of the site boundary, beyond third party land. As such, it will not be possible to make a direct connection to a watercourse.

Following discussions between the developer and the LLFA, it has been agreed to discharge surface water to the Mill Race located within the site boundary.

3.3 SUDS Techniques

In line with National Planning Policy, SUDS techniques will be utilised as part of the design of the surface water network. The applicable techniques and the benefits that they bring to the development are outlined below.

- Flow control: A vortex flow control device will be utilised to restrict flows to the equivalent of existing site greenfield rate (Qbar)
- Surface water conveyance: Surface water will be conveyed through the development utilising below ground pipes.
- Surface water treatment: Attenuated surface water flows will be stored in a piped network.

3.4 SuDS Maintenance

Regular inspection and maintenance is key to the effective operation of SuDS features. Maintenance responsibility for SuDS features proposed as part of the development is to be placed with a responsible organisation and in this case a nominated management and maintenance company.

Removal of debris and any settled silt from SuDS features is the key maintenance requirement for the continued effective operation of the SuDS features. Most of the maintenance activities can be undertaken as part of regular landscape maintenance activities.

3.5 Post Development Discharge Rate

Proposed surface water discharge rates will be limited from the development to the equivalent of the pre-development Qbar green field run off rate, for all storms up to and including 1 in 100 year return period rainfall event + 50% increase in rainfall intensity to account for the predicted effects of climate change.

In line with national and local standards the greenfield run off rate for 3.30 Ha of developed land has been calculated using the Institute of Hydrology (IH) Report 124 Flood Estimation for Small Catchments (1994) method, with flow rate linearly interpolated due to site being smaller than 50Ha. HR Wallingford Greenfield runoff rate estimation for sites tool, available at <https://www.uksuds.com> has been used to calculate Qbar run off rate at 32.02 l/sec. An assessment of the allowable discharge rate is outlined below in figure 3.51.

Greenfield runoff rates		
	Default	Edited
QBAR (l/s):	32.02	32.02
1 in 1 year (l/s):	27.85	27.85
1 in 30 years (l/s):	54.43	54.43
1 in 100 year (l/s):	66.59	66.59
1 in 200 years (l/s):	75.88	75.88

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Figure 3.51 Greenfield run off rates.

Please refer to Appendix D for further information on green field run off rates.

Note – the ‘developed land’ includes for all phases of the proposed development.

3.6 Surface Water Attenuation

Surface water will be restricted for all events up to an including the 100 year event with a 50% allowance for climate change and a 10% allowance for urban creep. Attenuated flows will be contained on site within a designated storage system. Please refer to the calculations and drainage strategy contained within Appendix E.

Note – the allowable discharge rate and drainage calculations include for all phases of the development.

By restricting the peak rate of discharge from the site Qbar to the watercourse for all events up to and including the 100-year event, **the proposed development will provide betterment from the existing regime in line with the table below.**

Return period	greenfield rate	Proposed	Betterment
Qbar	32.02 l/s	32.0 l/s	0%
30	54.43 l/s	32.0 l/s	31%
100	66.59 l/s	32.0 l/s	52%
100+50%	99.85 l/s	32.0 l/s	68%

3.7 Proposed Foul Drainage

It is proposed to discharge a portion of the foul water to the adjacent UU combined sewer and a portion to the existing foul sewer in Flosch Meadows, both via gravity connections.

4. References

The following reference documents have been used in the preparation of this report.

- National Planning Policy Framework 2021.
- PPG 2021.
- Environment Agency online flood maps.
- Sewers for Adoption 6th Edition - WRC plc, April 2006.
- Building Regulations Document H 2010.
- Improving the Flood Performance of New Buildings – Defra.
- Rainfall runoff management for developments SC030219 – Defra.
- Susdrain.org
- The SuDS Manual CIRIA C753.

Appendices

Appendix A



UTILITY KEY

LINE TYPES		
BT BELOW GROUND		WATER BELOW GROUND
BT ABOVE GROUND		WATER ABOVE GROUND
BT ASSUMED ROUTE		WATER ASSUMED ROUTE
CATV BELOW GROUND		UNION BELOW GROUND
CATV ABOVE GROUND		UNION ABOVE GROUND
CATV ASSUMED ROUTE		UPR BELOW GROUND
COMB BELOW GROUND		COMBINED WATER SEWER
COMB ABOVE GROUND		ASSUMED COMBINED WATER SEWER ROUTE
COMB ASSUMED ROUTE		SEWER SINKER
GAS BELOW GROUND		ASSUMED P-PIPE WATER SEWER ROUTE
GAS ABOVE GROUND		STORM WATER SEWER
GAS ASSUMED ROUTE		ASSUMED STORM WATER SEWER ROUTE
ELECTRIC BELOW GROUND		REINSTATEMENT
ELECTRIC ABOVE GROUND		SURVEY SCAFFOLD
ELECTRIC ASSUMED ROUTE		

DECLARATION: The following data, all sentences shown in the table below have been surveyed using approved standards and the connections between them, if not stated, are assumed to be direct.

No parameters can be used for all the work activities here shown.

In these conditions, the depth accuracy is approximately 10% to 15% of the depth.

Useless and/or long work techniques show depths approximately 10% greater than the top of the utility. Utilities have used this method for many years and it is still used.

Utilities have used Sonar Electromagnetic hydrophones show depths of approximately 10% level.

Surveys are made from the ground. From the ground, it is not possible to get any less than 10% error due to the lack of accuracy at that point indicated.

Due to 87% of pipes are not permitted to be taken at inspection chamber corners.

Surveys should be made to the methodology and can also be detailed with the latest version of Standard Procedures for Utility Location and Mapping.

Standard procedure for excavations are to be carried out with equipment with HSG 47 (loading design from Underground conditions).

Plan accuracy of the order of 10% to 15mm can be achieved but the figure will depend on the depth of the service below ground and the survey area (in use, generally, separation may be acceptable). Separation of the non-metallic pipes may be visible.

Excavation work is not permitted to be carried out without the use of appropriate safety measures.

Excavating work is not permitted to be carried out without the use of appropriate safety measures. Excavating work is not permitted to be carried out without the use of appropriate safety measures.

NOTES

SUITE 5 VITA HOUSE
FISH QUAY
NORTH SHIELDS
NE30 1JA
T: 0191 257 2911
www.silescanltd.com

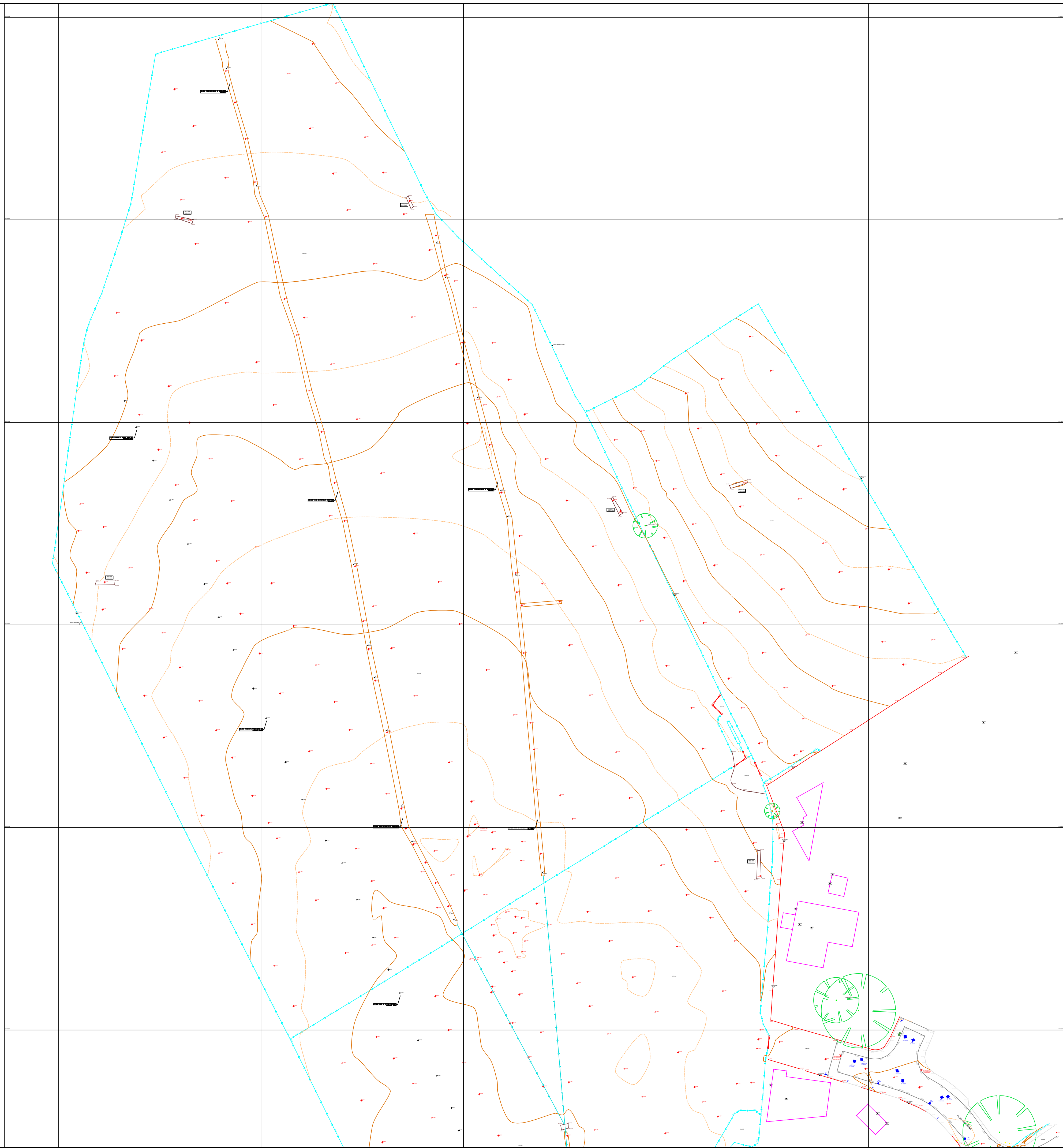


RICHARD MULHOLLAND

AND AT FLOSH MEADOWS
CLEATOR
CUMBRIA

TOPOGRAPHICAL SURVEY

PROJECT No.	SHEET No.	REV
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[illegible]

DISCLAIMER

Unless otherwise stated, all services shown on this plan have been surveyed using approved detectors and the connections and terminations mentioned, are not tested, are assumed to be correct.

No guarantee can be given that all services have been shown.

In some conditions the depth measured by the ground penetrating utilities locators is $\pm 15\%$ of depth.

Utilities having using GPR techniques show depths approximately from ground level to the top of the utility. (Utilities having using other techniques show depths approximately from ground level to the bottom of the utility.)

Diagram and plan views are shown. Some Electronic Imaging techniques show depths as approximately the true level.

Some services are shown as "Taken From Records" on the drawings are not reliable for any use that may arise due to a lack of accuracy in the provided information.

Due to B7's policy we are not permitted to list their inspection chamber details.

Reference should be made to the methodology and on site as detailed within the HSE V41 (Handling Chamber) Standards Document by Utility Locators Surveyors.

Inspection chambers that will occur as a result of the work are indicated with the following:

Plan annotations of the following order are $\pm 150\text{mm}$ may be indicated that the figure will depend on the depth of the service below ground level. The service position and its correct placement, regardless may be responsible. Scoring of the work may be limited.

Existing recorded information showing underground services is the responsibility and liability of the user. It should be regarded as your own responsibility.

NOTES

C	SURVEY EXTENDED ORANGE SURVEYED METAL RELEASE	NP	NG
B		NP	NG
A		NP	NG
REV	AMENDMENT	DRAWN	CHECKED

SUITE 5 VITA HOUSE
FISH QUAY
NORTH SHIELDS
NE30 1JA
T: 0191 257 2911
www.sitescanltd.com



SiteScan
Information to build on

RICHARD MULHOLLAND			
CLIENT			
LAND AT FLOSH MEADOWS CLEATOR CUMBRIA			
PROJECT TITLE			
TOPOGRAPHICAL SURVEY			
DRAWING TITLE			
1:500 @ A1	DATE	OSTN02	
SCALE AT		VERTICAL	
NP	NP	APPROVED	NG
DESIGNED BY		CHECKED BY	
P14053		2/2	C
SHEET NO.		REV	

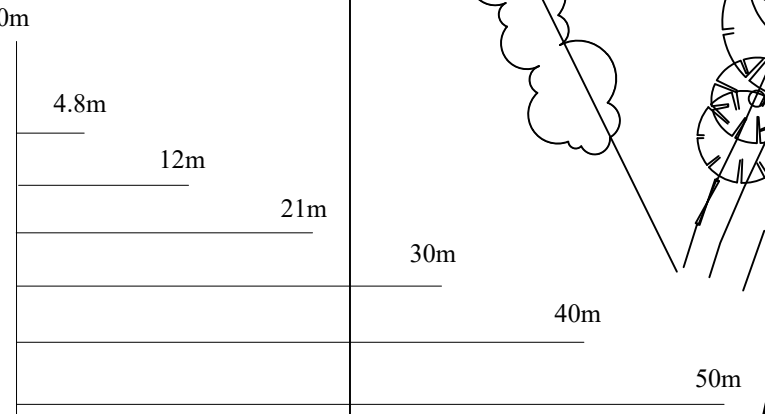
Appendix B



St Mary's Church
Cemetery & 1927
Lourdes replica Grotto

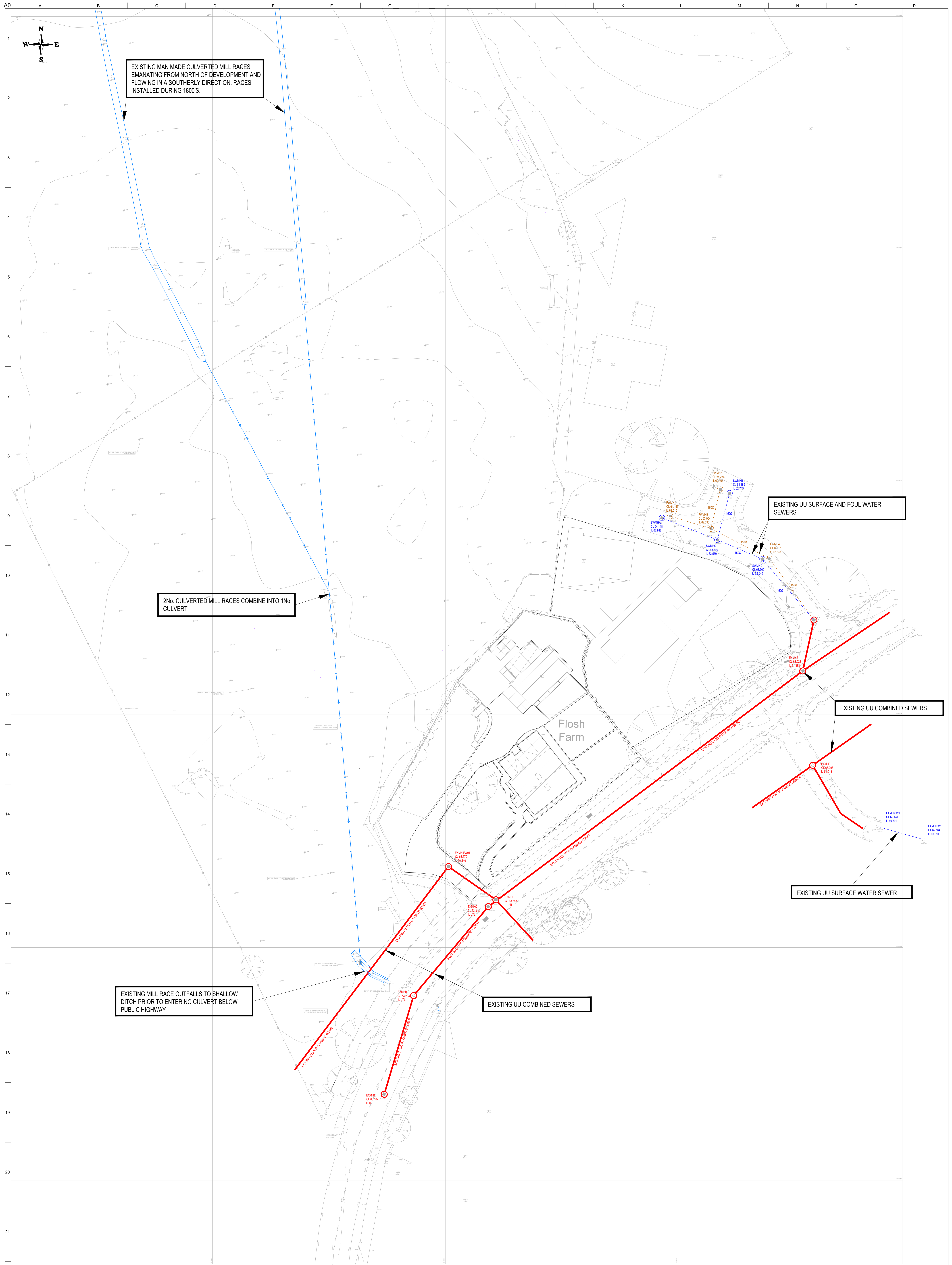
Hawthorne Hedge infill

HEDGE KEY
NEW HAWTHORN HEDGE
DOUBLE LAYER OF WHIPS
PLANTED AT 6 U/M HEIGHT
40x40cm
MATERIALS SCHEDULE
Driveway - Permeable block paving 100x200mm
Colour - Dark grey
Patios and paving to rear - Concrete pre-cast concrete
Flag 50x500mm
Paths to front - Indian Stone random pattern / size
PARKING BAY SIZES 2500 x 5000mm



Issue -		
PLANNING		
Client -		
Mr & Mrs Mulholland		
Project -		
Housing Development		
location / Postcode / what3words		
Flish Meadows, Cleator, Cumbria, CA14 0QP		
media, others, logbook		
Drawing Title - Proposed Site Plan - SR12, SR12A & Top Meadow		
Job No -	1236	Dwg No - 20
DATE	10 Oct 2021	Scale- 1:500
B:\tnap3721042191.png	RIBA Chartered ARCHITECTS	Rev 1 Paper A0
E - greenswallow@btinternet.com		
M - 017530 964114		
Registered Office - Green Swallow North Limited		
Swallow Barn, Blinderake, Cumbria, CA14 0QP		
DIMENSIONS TO BE CHECKED ON SITE		
FIGURED DIMENSIONS TO BE TAKEN IN		
PREFERENCE TO SCALED DIMENSIONS		
copyright Green Swallow North Limited		

Appendix C



LEGEND	
	LAND DRAINAGE
	UU COMBINED WATER SEWER
	UU FOUL WATER SEWER
	UU SURFACE WATER SEWER

P3	19-05-21	Updated to reflect client comments	RH	RH	PL
P2	25-04-21	Updated to reflect client comments	RH	RH	PL
P1	22-04-21	Preliminary issue	RH	RH	PL
Issue	Date	Description	By	Chkd	Appd



Client	MR R.W. MULHOLLAND
Job Title	FLOSH MEADOWS CUMBRIA

Drawing Title	EXISTING DRAINAGE
Scale of A0	1:250
Drawing Status	PRELIMINARY
Job No	1842
Drawing No	201
Issue	P3

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Appendix D

Calculated by:	richard hall
Site name:	Flosh Meadows
Site location:	Cleator

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:	54.51164° N
Longitude:	3.51942° W
Reference:	2032601581
Date:	May 28 2021 13:23

Runoff estimation approach

Site characteristics

Total site area (ha):	3.30
-----------------------	-----------------------------------

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):	1271	1271
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 $SPR/SPRHOST \leq 0.3$?

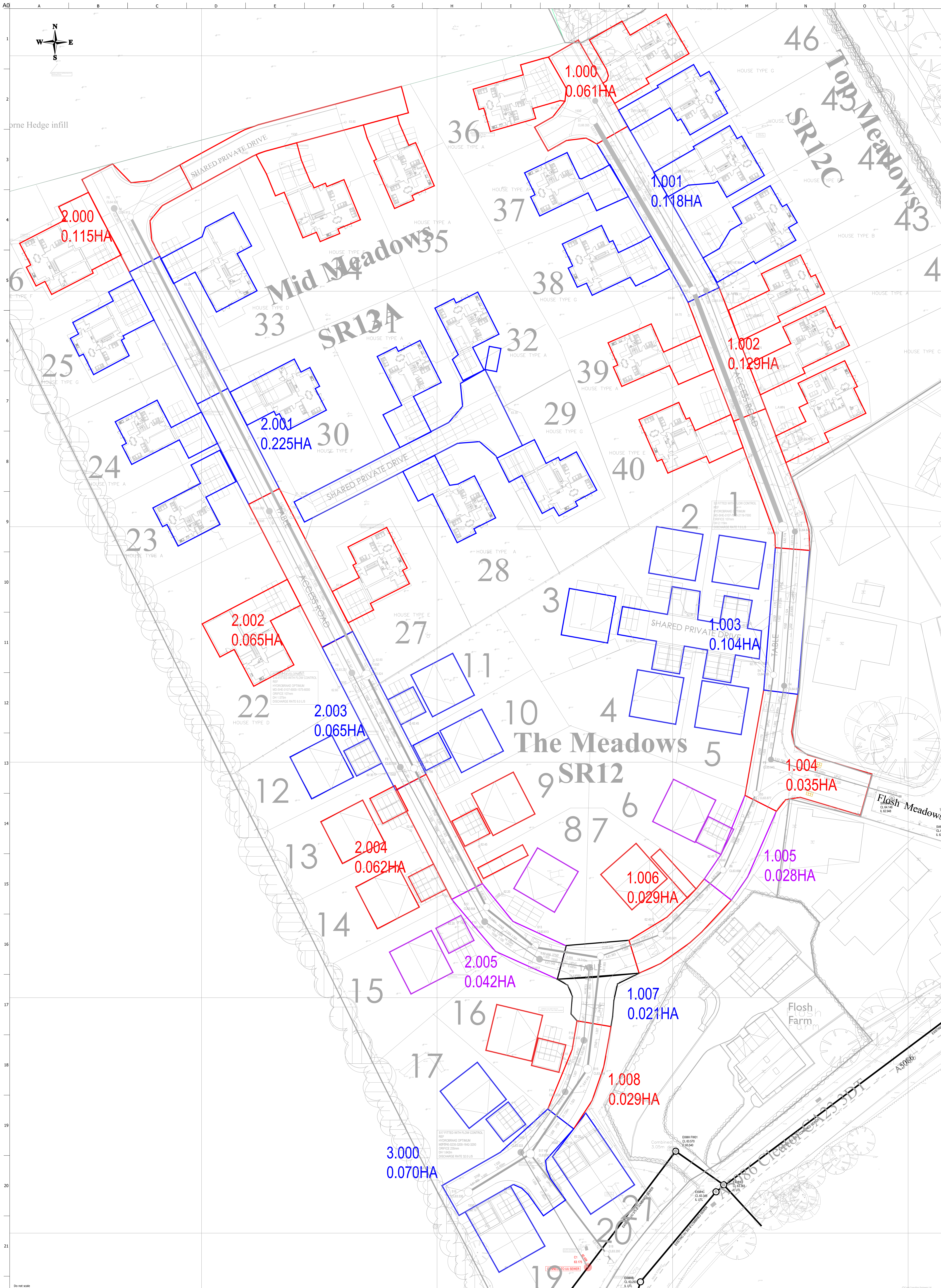
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

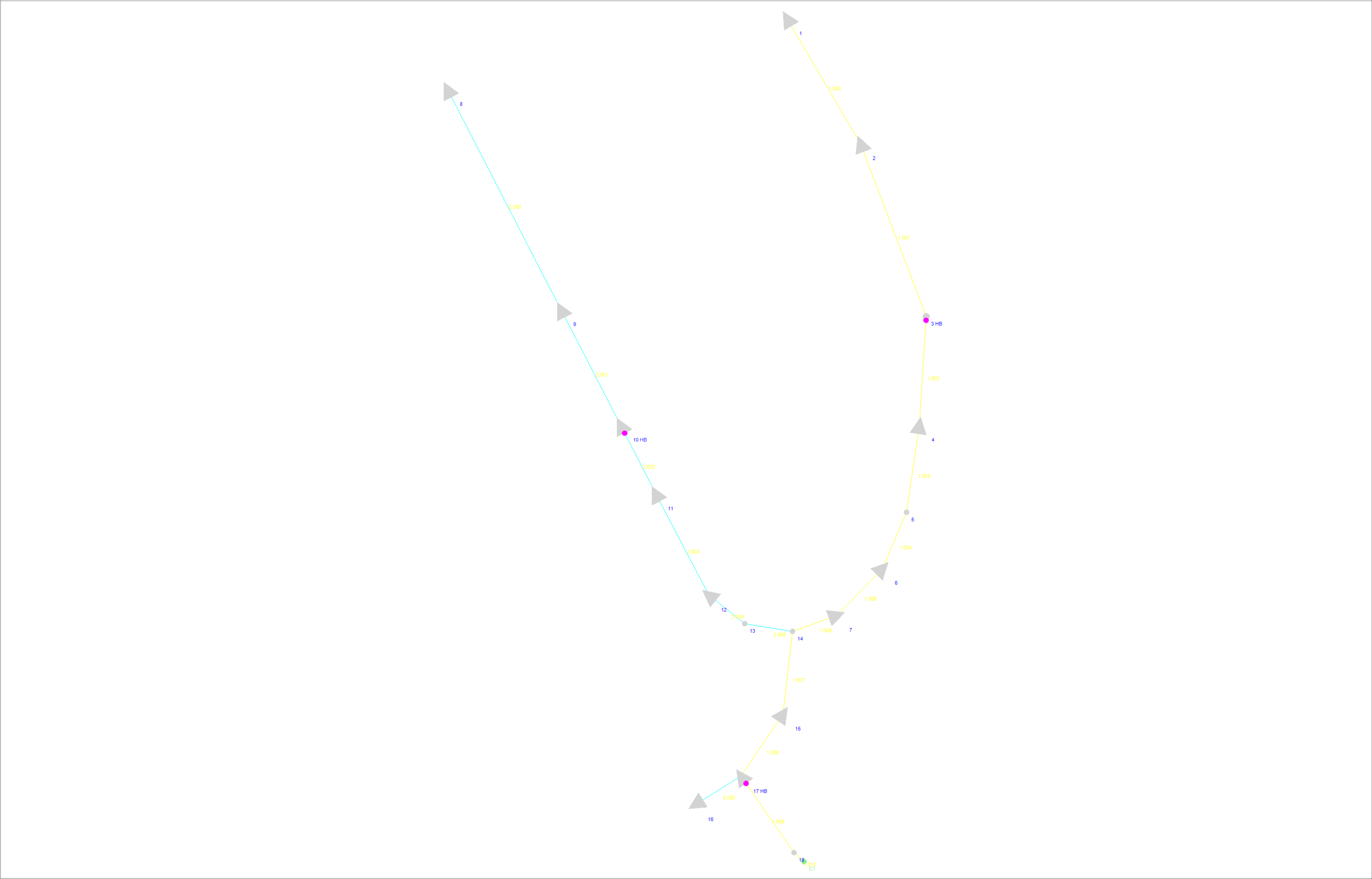
	Default	Edited
Q _{BAR} (l/s):	32.02	32.02
1 in 1 year (l/s):	27.85	27.85
1 in 30 years (l/s):	54.43	54.43
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Appendix E



Drawing Title				Client				Drawing Title			
COAST CONSULTING ENGINEERS				MR R.W. MULHOLLAND				IMPERMEABLE AREAS			
7 Silvertown Court, Northumberland Business Park, NE23 7RY				Job Title				Scale at A0			
Issue				FLOSH MEADOWS CUMBRIA				1:250			
Date				Drawing Status				TENDER			
Description				Job No				Drawing No			
By				1842				121			
Appd				Issue				T3			



Coast Consulting Engineers Ltd		Page 0
Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:2	
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE W...	Checked by PL	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for 180518 SW1.SWS

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
1.000	41.957	0.105	399.6	0.061	5.00	0.0	0.600	o	975	Pipe/Conduit	
1.001	53.639	0.134	400.3	0.118	0.00	0.0	0.600	o	975	Pipe/Conduit	
1.002	31.512	0.185	170.3	0.129	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	25.483	0.150	169.9	0.104	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	17.652	0.104	169.7	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	18.982	0.112	169.5	0.028	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	13.655	0.080	170.7	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	71.706	0.221	324.5	0.115	5.00	0.0	0.600	o	525	Pipe/Conduit	
2.001	37.730	0.116	325.3	0.225	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.002	22.253	0.068	325.0	0.065	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.003	33.218	0.102	325.7	0.065	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.004	13.246	0.041	323.1	0.062	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.005	14.105	0.043	328.0	0.042	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.007	24.092	0.074	325.6	0.021	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.008	21.726	0.067	324.3	0.029	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	5.43	63.013	0.061	0.0	0.0	0.0	1.64	1225.0	0.0
1.001	0.00	5.97	62.908	0.179	0.0	0.0	0.0	1.64	1223.9	0.0
1.002	0.00	6.50	62.774	0.308	0.0	0.0	0.0	1.00	39.7	0.0
1.003	0.00	6.92	62.589	0.412	0.0	0.0	0.0	1.00	39.8	0.0
1.004	0.00	7.22	62.439	0.447	0.0	0.0	0.0	1.00	39.8	0.0
1.005	0.00	7.53	62.335	0.475	0.0	0.0	0.0	1.00	39.8	0.0
1.006	0.00	7.76	62.223	0.504	0.0	0.0	0.0	1.00	39.7	0.0
2.000	0.00	5.97	62.586	0.115	0.0	0.0	0.0	1.24	268.0	0.0
2.001	0.00	6.47	62.365	0.340	0.0	0.0	0.0	1.24	267.7	0.0
2.002	0.00	6.85	62.249	0.405	0.0	0.0	0.0	1.00	110.4	0.0
2.003	0.00	7.40	62.181	0.470	0.0	0.0	0.0	1.00	110.3	0.0
2.004	0.00	7.62	62.079	0.532	0.0	0.0	0.0	1.00	110.7	0.0
2.005	0.00	7.86	62.038	0.574	0.0	0.0	0.0	0.99	109.9	0.0
1.007	0.00	8.26	61.993	1.099	0.0	0.0	0.0	1.00	110.3	0.0
1.008	0.00	8.62	61.919	1.128	0.0	0.0	0.0	1.00	110.5	0.0

Coast Consulting Engineers Ltd										Page 1	
Suite 6, Vita House Fish Quay North Shields NE30 1JA					FLOSH MEADOWS CLEATOR 1:2						
Date 09/06/2023					Designed by RH						
File 230609 REVISED SURFACE W...					Checked by PL						
Innovyze					Network 2020.1						

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for 180518 SW1.SWS

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
3.000	15.459	0.048	322.1	0.070	5.00	0.0	0.600	o	375	Pipe/Conduit	
1.009	26.775	0.109	245.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.010	3.900	0.016	243.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	0.00	5.26	61.900	0.070	0.0	0.0	0.0	1.00	110.9	0.0
1.009	0.00	9.07	61.852	1.198	0.0	0.0	0.0	1.00	70.6	0.0
1.010	0.00	9.13	61.743	1.198	0.0	0.0	0.0	1.00	70.9	0.0

Free Flowing Outfall Details for 180518 SW1.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.010	C1	63.006	61.727	61.727	1350	0

Simulation Criteria for 180518 SW1.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	13
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	19.600
Return Period (years)	2	Ratio R	0.223
Region		England and Wales	Profile Type Summer

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Coast Consulting Engineers Ltd		Page 2
Suite 6, Vita House Fish Quay North Shields NE30 1JA	FLOSH MEADOWS CLEATOR 1:2	
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE W...	Checked by PL	
Innovyze	Network 2020.1	
Synthetic Rainfall Details Cv (Summer) 0.750 Storm Duration (mins) 30 Cv (Winter) 0.840		
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Coast Consulting Engineers Ltd		Page 3																																																																																										
Suite 6, Vita House Fish Quay North Shields NE30 1JA	FLOSH MEADOWS CLEATOR 1:2																																																																																											
Date 09/06/2023 File 230609 REVISED SURFACE W...	Designed by RH Checked by PL																																																																																											
Innovyze Network 2020.1																																																																																												
Online Controls for 180518 SW1.SWS Hydro-Brake® Optimum Manhole: 3 HB, DS/PN: 1.002, Volume (m³): 45.9 Unit Reference MD-SHE-0107-7000-2119-7000 Design Head (m)2.119 Design Flow (l/s)7.0 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)107 Invert Level (m)62.774 Minimum Outlet Pipe Diameter (mm)150 Suggested Manhole Diameter (mm)1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>2.119</td><td>7.0</td><td>Kick-Flo®</td><td>0.957</td><td>4.8</td></tr><tr><td>Flush-Flo™</td><td>0.469</td><td>6.1</td><td>Mean Flow over Head Range</td><td>-</td><td>5.6</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>3.7</td><td>1.200</td><td>5.4</td><td>3.000</td><td>8.2</td><td>7.000</td><td>12.3</td></tr><tr><td>0.200</td><td>5.4</td><td>1.400</td><td>5.8</td><td>3.500</td><td>8.9</td><td>7.500</td><td>12.7</td></tr><tr><td>0.300</td><td>5.9</td><td>1.600</td><td>6.1</td><td>4.000</td><td>9.4</td><td>8.000</td><td>13.1</td></tr><tr><td>0.400</td><td>6.0</td><td>1.800</td><td>6.5</td><td>4.500</td><td>10.0</td><td>8.500</td><td>13.5</td></tr><tr><td>0.500</td><td>6.1</td><td>2.000</td><td>6.8</td><td>5.000</td><td>10.5</td><td>9.000</td><td>13.9</td></tr><tr><td>0.600</td><td>6.0</td><td>2.200</td><td>7.1</td><td>5.500</td><td>11.0</td><td>9.500</td><td>14.3</td></tr><tr><td>0.800</td><td>5.6</td><td>2.400</td><td>7.4</td><td>6.000</td><td>11.4</td><td></td><td></td></tr><tr><td>1.000</td><td>4.9</td><td>2.600</td><td>7.7</td><td>6.500</td><td>11.9</td><td></td><td></td></tr></table> Hydro-Brake® Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m³): 13.2 Unit Reference MD-SHE-0107-6000-1575-6000 Design Head (m)1.575 Design Flow (l/s)6.0 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)106 Invert Level (m)62.249 Minimum Outlet Pipe Diameter (mm)150 ©1982-2020 Innovyze			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	2.119	7.0	Kick-Flo®	0.957	4.8	Flush-Flo™	0.469	6.1	Mean Flow over Head Range	-	5.6	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.7	1.200	5.4	3.000	8.2	7.000	12.3	0.200	5.4	1.400	5.8	3.500	8.9	7.500	12.7	0.300	5.9	1.600	6.1	4.000	9.4	8.000	13.1	0.400	6.0	1.800	6.5	4.500	10.0	8.500	13.5	0.500	6.1	2.000	6.8	5.000	10.5	9.000	13.9	0.600	6.0	2.200	7.1	5.500	11.0	9.500	14.3	0.800	5.6	2.400	7.4	6.000	11.4			1.000	4.9	2.600	7.7	6.500	11.9		
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)																																																																																							
Design Point (Calculated)	2.119	7.0	Kick-Flo®	0.957	4.8																																																																																							
Flush-Flo™	0.469	6.1	Mean Flow over Head Range	-	5.6																																																																																							
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																																					
0.100	3.7	1.200	5.4	3.000	8.2	7.000	12.3																																																																																					
0.200	5.4	1.400	5.8	3.500	8.9	7.500	12.7																																																																																					
0.300	5.9	1.600	6.1	4.000	9.4	8.000	13.1																																																																																					
0.400	6.0	1.800	6.5	4.500	10.0	8.500	13.5																																																																																					
0.500	6.1	2.000	6.8	5.000	10.5	9.000	13.9																																																																																					
0.600	6.0	2.200	7.1	5.500	11.0	9.500	14.3																																																																																					
0.800	5.6	2.400	7.4	6.000	11.4																																																																																							
1.000	4.9	2.600	7.7	6.500	11.9																																																																																							

Coast Consulting Engineers Ltd				Page 4	
Suite 6, Vita House		FLOSH MEADOWS			
Fish Quay		CLEATOR			
North Shields NE30 1JA		1:2			
Date 09/06/2023		Designed by RH			
File 230609 REVISED SURFACE W...		Checked by PL			
Innovyze		Network 2020.1			
Hydro-Brake® Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m³): 13.2					
Suggested Manhole Diameter (mm) 1200					
Control Points		Head (m)	Flow (l/s)	Control Points	
Design Point (Calculated)		1.575	6.0	Kick-Flo®	0.952
Flush-Flo™		0.468	5.9	Mean Flow over Head Range	-
					4.7
					5.2
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated					
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.3	3.000	8.1
0.200	5.3	1.400	5.7	3.500	8.7
0.300	5.7	1.600	6.0	4.000	9.3
0.400	5.9	1.800	6.4	4.500	9.8
0.500	5.9	2.000	6.7	5.000	10.3
0.600	5.9	2.200	7.0	5.500	10.8
0.800	5.5	2.400	7.3	6.000	11.3
1.000	4.9	2.600	7.6	6.500	11.7



Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.500	32.0	1.800	33.4	4.000	49.1	7.500	66.6
0.600	31.8	2.000	35.2	4.500	52.0	8.000	68.8
0.800	31.0	2.200	36.8	5.000	54.7	8.500	70.8
1.000	28.8	2.400	38.4	5.500	57.3	9.000	72.8
1.200	27.5	2.600	39.9	6.000	59.8	9.500	74.8
1.400	29.6	3.000	42.8	6.500	62.2		
1.600	31.6	3.500	46.1	7.000	64.4		

Coast Consulting Engineers Ltd		Page 6																																																																								
Suite 6, Vita House Fish Quay North Shields NE30 1JA	FLOSH MEADOWS CLEATOR 1:2																																																																									
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File 230609 REVISED SURFACE W...	Checked by PL																																																																									
Innovyze	Network 2020.1																																																																									
Storage Structures for 180518 SW1.SWS Cellular Storage Manhole: 1, DS/PN: 1.000 Invert Level (m) 63.585 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>51.8</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>51.8</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: 2, DS/PN: 1.001 Invert Level (m) 63.015 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>220.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>220.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: 4, DS/PN: 1.003 Invert Level (m) 62.589 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>129.5</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>129.5</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: 6, DS/PN: 1.005 Invert Level (m) 62.335 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>25.9</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>25.9</td><td>0.0</td><td></td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	51.8	0.0	0.521	0.0	0.0	0.520	51.8	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	220.0	0.0	0.521	0.0	0.0	0.520	220.0	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	129.5	0.0	0.521	0.0	0.0	0.520	129.5	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	25.9	0.0	0.521	0.0	0.0	0.520	25.9	0.0			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																					
0.000	51.8	0.0	0.521	0.0	0.0																																																																					
0.520	51.8	0.0																																																																								
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																					
0.000	220.0	0.0	0.521	0.0	0.0																																																																					
0.520	220.0	0.0																																																																								
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																					
0.000	129.5	0.0	0.521	0.0	0.0																																																																					
0.520	129.5	0.0																																																																								
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																					
0.000	25.9	0.0	0.521	0.0	0.0																																																																					
0.520	25.9	0.0																																																																								
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Coast Consulting Engineers Ltd			Page 7																																																																										
Suite 6, Vita House Fish Quay North Shields NE30 1JA		FLOSH MEADOWS CLEATOR 1:2																																																																											
Date 09/06/2023		Designed by RH																																																																											
File 230609 REVISED SURFACE W...		Checked by PL																																																																											
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<u>Cellular Storage Manhole: 7, DS/PN: 1.006</u> Invert Level (m) 62.224 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>25.9</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>25.9</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 8, DS/PN: 2.000</u> Invert Level (m) 63.413 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>77.7</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>77.7</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 9, DS/PN: 2.001</u> Invert Level (m) 62.621 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>388.5</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>388.5</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 10 HB, DS/PN: 2.002</u> Invert Level (m) 62.249 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>170.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>170.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 11, DS/PN: 2.003</u> Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0						Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	25.9	0.0	0.521	0.0	0.0	0.520	25.9	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	77.7	0.0	0.521	0.0	0.0	0.520	77.7	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	388.5	0.0	0.521	0.0	0.0	0.520	388.5	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	170.0	0.0	0.521	0.0	0.0	0.520	170.0	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																								
0.000	25.9	0.0	0.521	0.0	0.0																																																																								
0.520	25.9	0.0																																																																											
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																								
0.000	77.7	0.0	0.521	0.0	0.0																																																																								
0.520	77.7	0.0																																																																											
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																								
0.000	388.5	0.0	0.521	0.0	0.0																																																																								
0.520	388.5	0.0																																																																											
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																								
0.000	170.0	0.0	0.521	0.0	0.0																																																																								
0.520	170.0	0.0																																																																											
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Coast Consulting Engineers Ltd			Page 8																				
Suite 6, Vita House		FLOSH MEADOWS																					
Fish Quay		CLEATOR																					
North Shields NE30 1JA		1:2																					
Date 09/06/2023		Designed by RH																					
File 230609 REVISED SURFACE W...		Checked by PL																					
Innovyze			Network 2020.1																				
<u>Cellular Storage Manhole: 11, DS/PN: 2.003</u>																							
Porosity 0.95																							
<table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td></tr><tr><td>0.000</td><td>200.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>200.0</td><td>0.0</td><td></td><td></td><td></td></tr></table>						Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	200.0	0.0	0.521	0.0	0.0	0.520	200.0	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																		
0.000	200.0	0.0	0.521	0.0	0.0																		
0.520	200.0	0.0																					
<u>Cellular Storage Manhole: 12, DS/PN: 2.004</u>																							
Invert Level (m) 62.079 Safety Factor 2.0																							
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95																							
Infiltration Coefficient Side (m/hr) 0.00000																							
<table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td></tr><tr><td>0.000</td><td>129.5</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>129.5</td><td>0.0</td><td></td><td></td><td></td></tr></table>						Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	129.5	0.0	0.521	0.0	0.0	0.520	129.5	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																		
0.000	129.5	0.0	0.521	0.0	0.0																		
0.520	129.5	0.0																					
<u>Cellular Storage Manhole: 15, DS/PN: 1.008</u>																							
Invert Level (m) 61.919 Safety Factor 2.0																							
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95																							
Infiltration Coefficient Side (m/hr) 0.00000																							
<table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td></tr><tr><td>0.000</td><td>30.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>30.0</td><td>0.0</td><td></td><td></td><td></td></tr></table>						Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	30.0	0.0	0.521	0.0	0.0	0.520	30.0	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																		
0.000	30.0	0.0	0.521	0.0	0.0																		
0.520	30.0	0.0																					
<u>Cellular Storage Manhole: 16, DS/PN: 3.000</u>																							
Invert Level (m) 61.900 Safety Factor 2.0																							
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95																							
Infiltration Coefficient Side (m/hr) 0.00000																							
<table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td></tr><tr><td>0.000</td><td>51.8</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>51.8</td><td>0.0</td><td></td><td></td><td></td></tr></table>						Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	51.8	0.0	0.521	0.0	0.0	0.520	51.8	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																		
0.000	51.8	0.0	0.521	0.0	0.0																		
0.520	51.8	0.0																					
<u>Cellular Storage Manhole: 17 HB, DS/PN: 1.009</u>																							
Invert Level (m) 61.852 Safety Factor 2.0																							
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95																							
Infiltration Coefficient Side (m/hr) 0.00000																							
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Coast Consulting Engineers Ltd			Page 9																		
Suite 6, Vita House	FLOSH MEADOWS																				
Fish Quay	CLEATOR																				
North Shields NE30 1JA	1:2																				
Date 09/06/2023	Designed by RH																				
File 230609 REVISED SURFACE W...	Checked by PL																				
Innovyze	Network 2020.1																				
Cellular Storage Manhole: 17 HB, DS/PN: 1.009 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>77.7</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>77.7</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table>				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	77.7	0.0	0.521	0.0	0.0	0.520	77.7	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																
0.000	77.7	0.0	0.521	0.0	0.0																
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Manhole Headloss Coeff (Global)		0.500		Flow per Person per Day (l/per/day)		0.000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
Foul Sewage per hectare (l/s)		0.000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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Number of Online Controls		3		Number of Time/Area Diagrams		0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
Number of Offline Controls		0		Number of Real Time Controls		0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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Coast Consulting Engineers Ltd		Page 11
Suite 6, Vita House Fish Quay North Shields NE30 1JA	FLOSH MEADOWS CLEATOR 1:2	
Date 09/06/2023 File 230609 REVISED SURFACE W...	Designed by RH Checked by PL	
Innovyze	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status	Level
		Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)		Exceeded
1.000	1	-0.871	0.000	0.00		80	4.4		OK
1.001	2	-0.766	0.000	0.01		83	6.1		OK
1.002	3 HB	0.117	0.000	0.16			6.0	SURCHARGED	
1.003	4	-0.130	0.000	0.37		140	13.7		OK
1.004	5	-0.117	0.000	0.46			16.5		OK
1.005	6	-0.109	0.000	0.52			18.8		OK
1.006	7	-0.099	0.000	0.60		51	20.8		OK
2.000	8	-0.425	0.000	0.08		6	19.1		OK
2.001	9	-0.272	0.000	0.07		102	15.9		OK
2.002	10 HB	-0.007	0.000	0.06		192	5.8		OK
2.003	11	-0.300	0.000	0.08		315	7.8		OK
2.004	12	-0.260	0.000	0.11		248	9.5		OK
2.005	13	-0.231	0.000	0.13			10.8		OK
1.007	14	-0.194	0.000	0.29			27.8		OK

Coast Consulting Engineers Ltd		Page 12
Suite 6, Vita House Fish Quay North Shields NE30 1JA	FLOSH MEADOWS CLEATOR 1:2	
Date 09/06/2023 File 230609 REVISED SURFACE W...	Designed by RH Checked by PL	
Innovyze	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

US/MH		Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level
PN	Name								(m)
1.008	15	360 Summer	2	+0%					62.152
3.000	16	360 Summer	2	+0%					62.138
1.009	17 HB	360 Summer	2	+0%					62.137
1.010	18	360 Summer	2	+0%					61.897

US/MH		Surcharged Depth		Flooded Volume		Flow / Overflow		Half Drain Time		Pipe Flow		Level	
PN	Name	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	Status	Exceeded				
1.008	15	-0.142	0.000	0.29		126	27.7	OK					
3.000	16	-0.137	0.000	0.02		115	2.0	OK					
1.009	17 HB	-0.015	0.000	0.40		154	25.4	OK					
1.010	18	-0.146	0.000	0.52			25.4	OK					

Coast Consulting Engineers Ltd		Page 0
Suite 6, Vita House Fish Quay North Shields NE30 1JA	FLOSH MEADOWS CLEATOR 1:30	
Date 09/06/2023 File 230609 REVISED SURFACE W...	Designed by RH Checked by PL	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for 180518 SW1.SWS

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
1.000	41.957	0.105	399.6	0.061	5.00	0.0	0.600	o	975	Pipe/Conduit	
1.001	53.639	0.134	400.3	0.118	0.00	0.0	0.600	o	975	Pipe/Conduit	
1.002	31.512	0.185	170.3	0.129	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	25.483	0.150	169.9	0.104	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	17.652	0.104	169.7	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	18.982	0.112	169.5	0.028	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	13.655	0.080	170.7	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	71.706	0.221	324.5	0.115	5.00	0.0	0.600	o	525	Pipe/Conduit	
2.001	37.730	0.116	325.3	0.225	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.002	22.253	0.068	325.0	0.065	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.003	33.218	0.102	325.7	0.065	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.004	13.246	0.041	323.1	0.062	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.005	14.105	0.043	328.0	0.042	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.007	24.092	0.074	325.6	0.021	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.008	21.726	0.067	324.3	0.029	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	5.43	63.013	0.061	0.0	0.0	0.0	1.64	1225.0	0.0
1.001	0.00	5.97	62.908	0.179	0.0	0.0	0.0	1.64	1223.9	0.0
1.002	0.00	6.50	62.774	0.308	0.0	0.0	0.0	1.00	39.7	0.0
1.003	0.00	6.92	62.589	0.412	0.0	0.0	0.0	1.00	39.8	0.0
1.004	0.00	7.22	62.439	0.447	0.0	0.0	0.0	1.00	39.8	0.0
1.005	0.00	7.53	62.335	0.475	0.0	0.0	0.0	1.00	39.8	0.0
1.006	0.00	7.76	62.223	0.504	0.0	0.0	0.0	1.00	39.7	0.0
2.000	0.00	5.97	62.586	0.115	0.0	0.0	0.0	1.24	268.0	0.0
2.001	0.00	6.47	62.365	0.340	0.0	0.0	0.0	1.24	267.7	0.0
2.002	0.00	6.85	62.249	0.405	0.0	0.0	0.0	1.00	110.4	0.0
2.003	0.00	7.40	62.181	0.470	0.0	0.0	0.0	1.00	110.3	0.0
2.004	0.00	7.62	62.079	0.532	0.0	0.0	0.0	1.00	110.7	0.0
2.005	0.00	7.86	62.038	0.574	0.0	0.0	0.0	0.99	109.9	0.0
1.007	0.00	8.26	61.993	1.099	0.0	0.0	0.0	1.00	110.3	0.0
1.008	0.00	8.62	61.919	1.128	0.0	0.0	0.0	1.00	110.5	0.0

Coast Consulting Engineers Ltd		Page 2
Suite 6, Vita House Fish Quay North Shields NE30 1JA	FLOSH MEADOWS CLEATOR 1:30	
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE W...	Checked by PL	
Innovyze	Network 2020.1	
Synthetic Rainfall Details Cv (Summer) 0.750 Storm Duration (mins) 30 Cv (Winter) 0.840		
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Coast Consulting Engineers Ltd			Page 3																																																																									
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Hydro-Brake® Optimum Manhole: 3 HB, DS/PN: 1.002, Volume (m³): 45.9																																																																												
Unit Reference MD-SHE-0107-7000-2119-7000 Design Head (m)2.119 Design Flow (l/s)7.0 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)107 Invert Level (m)62.774 Minimum Outlet Pipe Diameter (mm)150 Suggested Manhole Diameter (mm)1200																																																																												
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Coast Consulting Engineers Ltd				Page 4																																																																									
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<table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>3.6</td><td>1.200</td><td>5.3</td><td>3.000</td><td>8.1</td><td>7.000</td><td>12.1</td></tr><tr><td>0.200</td><td>5.3</td><td>1.400</td><td>5.7</td><td>3.500</td><td>8.7</td><td>7.500</td><td>12.5</td></tr><tr><td>0.300</td><td>5.7</td><td>1.600</td><td>6.0</td><td>4.000</td><td>9.3</td><td>8.000</td><td>12.9</td></tr><tr><td>0.400</td><td>5.9</td><td>1.800</td><td>6.4</td><td>4.500</td><td>9.8</td><td>8.500</td><td>13.3</td></tr><tr><td>0.500</td><td>5.9</td><td>2.000</td><td>6.7</td><td>5.000</td><td>10.3</td><td>9.000</td><td>13.7</td></tr><tr><td>0.600</td><td>5.9</td><td>2.200</td><td>7.0</td><td>5.500</td><td>10.8</td><td>9.500</td><td>14.0</td></tr><tr><td>0.800</td><td>5.5</td><td>2.400</td><td>7.3</td><td>6.000</td><td>11.3</td><td></td><td></td></tr><tr><td>1.000</td><td>4.9</td><td>2.600</td><td>7.6</td><td>6.500</td><td>11.7</td><td></td><td></td></tr></table>						Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.6	1.200	5.3	3.000	8.1	7.000	12.1	0.200	5.3	1.400	5.7	3.500	8.7	7.500	12.5	0.300	5.7	1.600	6.0	4.000	9.3	8.000	12.9	0.400	5.9	1.800	6.4	4.500	9.8	8.500	13.3	0.500	5.9	2.000	6.7	5.000	10.3	9.000	13.7	0.600	5.9	2.200	7.0	5.500	10.8	9.500	14.0	0.800	5.5	2.400	7.3	6.000	11.3			1.000	4.9	2.600	7.6	6.500	11.7		
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1.000	4.9	2.600	7.6	6.500	11.7																																																																								
Hydro-Brake® Optimum Manhole: 17 HB, DS/PN: 1.009, Volume (m³): 9.6																																																																													
Unit Reference MD-SHE-0235-3200-1642-3200																																																																													
Design Head (m) 1.642																																																																													
Design Flow (l/s) 32.0																																																																													
Flush-Flo™ Calculated																																																																													
Objective Minimise upstream storage																																																																													
Application Surface																																																																													
Sump Available Yes																																																																													
Diameter (mm) 235																																																																													
Invert Level (m) 61.852																																																																													
Minimum Outlet Pipe Diameter (mm) 300																																																																													
Suggested Manhole Diameter (mm) 1800																																																																													
<table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.642</td><td>32.0</td><td>Kick-Flo®</td><td>1.101</td><td>26.4</td></tr><tr><td>Flush-Flo™</td><td>0.503</td><td>32.0</td><td>Mean Flow over Head Range</td><td>-</td><td>27.5</td></tr></table>						Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.642	32.0	Kick-Flo®	1.101	26.4	Flush-Flo™	0.503	32.0	Mean Flow over Head Range	-	27.5																																																						
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File 230609 REVISED SURFACE W...	Checked by PL																																																																									
Innovyze	Network 2020.1																																																																									
Storage Structures for 180518 SW1.SWS Cellular Storage Manhole: 1, DS/PN: 1.000 Invert Level (m) 63.585 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>51.8</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>51.8</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table> Cellular Storage Manhole: 2, DS/PN: 1.001 Invert Level (m) 63.015 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>220.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>220.0</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table> Cellular Storage Manhole: 4, DS/PN: 1.003 Invert Level (m) 62.589 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>129.5</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>129.5</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table> Cellular Storage Manhole: 6, DS/PN: 1.005 Invert Level (m) 62.335 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>25.9</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>25.9</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	51.8	0.0	0.521	0.0	0.0	0.520	51.8	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	220.0	0.0	0.521	0.0	0.0	0.520	220.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	129.5	0.0	0.521	0.0	0.0	0.520	129.5	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	25.9	0.0	0.521	0.0	0.0	0.520	25.9	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
0.000	51.8	0.0	0.521	0.0	0.0																																																																					
0.520	51.8	0.0																																																																								
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
0.000	220.0	0.0	0.521	0.0	0.0																																																																					
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0.000	129.5	0.0	0.521	0.0	0.0																																																																					
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0.000	25.9	0.0	0.521	0.0	0.0																																																																					
0.520	25.9	0.0																																																																								
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<u>Cellular Storage Manhole: 7, DS/PN: 1.006</u> Invert Level (m) 62.224 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>25.9</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>25.9</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 8, DS/PN: 2.000</u> Invert Level (m) 63.413 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>77.7</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>77.7</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 9, DS/PN: 2.001</u> Invert Level (m) 62.621 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>388.5</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>388.5</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 10 HB, DS/PN: 2.002</u> Invert Level (m) 62.249 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>170.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>170.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 11, DS/PN: 2.003</u> Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0						Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	25.9	0.0	0.521	0.0	0.0	0.520	25.9	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	77.7	0.0	0.521	0.0	0.0	0.520	77.7	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	388.5	0.0	0.521	0.0	0.0	0.520	388.5	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	170.0	0.0	0.521	0.0	0.0	0.520	170.0	0.0			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	25.9	0.0	0.521	0.0	0.0																																																																								
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Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	77.7	0.0	0.521	0.0	0.0																																																																								
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Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	388.5	0.0	0.521	0.0	0.0																																																																								
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<u>Cellular Storage Manhole: 11, DS/PN: 2.003</u> Porosity 0.95 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>200.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>200.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 12, DS/PN: 2.004</u> Invert Level (m) 62.079 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>129.5</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>129.5</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 15, DS/PN: 1.008</u> Invert Level (m) 61.919 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>30.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>30.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 16, DS/PN: 3.000</u> Invert Level (m) 61.900 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>51.8</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>51.8</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 17 HB, DS/PN: 1.009</u> Invert Level (m) 61.852 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000						Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	200.0	0.0	0.521	0.0	0.0	0.520	200.0	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	129.5	0.0	0.521	0.0	0.0	0.520	129.5	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	30.0	0.0	0.521	0.0	0.0	0.520	30.0	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	51.8	0.0	0.521	0.0	0.0	0.520	51.8	0.0			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	200.0	0.0	0.521	0.0	0.0																																																																								
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0.000	129.5	0.0	0.521	0.0	0.0																																																																								
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File 230609 REVISED SURFACE W...		Checked by PL																					
Innovyze			Network 2020.1																				
<u>Cellular Storage Manhole: 17 HB, DS/PN: 1.009</u> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>77.7</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>77.7</td><td>0.0</td><td></td><td></td><td></td></tr></table>						Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	77.7	0.0	0.521	0.0	0.0	0.520	77.7	0.0			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																		
0.000	77.7	0.0	0.521	0.0	0.0																		
0.520	77.7	0.0																					
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Coast Consulting Engineers Ltd										Page 10																																																																																																																																																																											
Suite 6, Vita House					FLOSH MEADOWS																																																																																																																																																																																
Fish Quay					CLEATOR																																																																																																																																																																																
North Shields NE30 1JA					1:30																																																																																																																																																																																
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<u>Simulation Criteria</u>																																																																																																																																																																																					
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																																																																																																																																																																																					
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Foul Sewage per hectare (l/s) 0.000																																																																																																																																																																																					
Number of Input Hydrographs 0 Number of Storage Structures 13																																																																																																																																																																																					
Number of Online Controls 3 Number of Time/Area Diagrams 0																																																																																																																																																																																					
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<u>Synthetic Rainfall Details</u>																																																																																																																																																																																					
Rainfall Model FSR Ratio R 0.220																																																																																																																																																																																					
Region England and Wales Cv (Summer) 1.000																																																																																																																																																																																					
M5-60 (mm) 18.600 Cv (Winter) 1.000																																																																																																																																																																																					
Margin for Flood Risk Warning (mm) 300.0																																																																																																																																																																																					
Analysis Timestep 2.5 Second Increment (Extended)																																																																																																																																																																																					
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DVD Status OFF																																																																																																																																																																																					
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Profile(s) Summer and Winter																																																																																																																																																																																					
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440																																																																																																																																																																																					
Return Period(s) (years) 30																																																																																																																																																																																					
Climate Change (%) 0																																																																																																																																																																																					
<table><tr><th>PN</th><th>US/MH</th><th></th><th>Return</th><th>Climate</th><th>First (X)</th><th>First (Y)</th><th>First (Z)</th><th>Overflow</th><th>Water</th></tr><tr><th></th><th>Name</th><th>Storm</th><th>Period</th><th>Change</th><th>Surchage</th><th>Flood</th><th>Overflow</th><th>Act.</th><th>Level</th></tr><tr><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>(m)</th></tr><tr><td>1.000</td><td>1</td><td>360 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>63.286</td></tr><tr><td>1.001</td><td>2</td><td>360 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>63.286</td></tr><tr><td>1.002</td><td>3 HB</td><td>360 Summer</td><td>30</td><td>+0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>63.286</td></tr><tr><td>1.003</td><td>4</td><td>60 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>62.721</td></tr><tr><td>1.004</td><td>5</td><td>60 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>62.600</td></tr><tr><td>1.005</td><td>6</td><td>60 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>62.524</td></tr><tr><td>1.006</td><td>7</td><td>60 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>62.437</td></tr><tr><td>2.000</td><td>8</td><td>600 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>62.751</td></tr><tr><td>2.001</td><td>9</td><td>600 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>62.751</td></tr><tr><td>2.002</td><td>10 HB</td><td>600 Summer</td><td>30</td><td>+0%</td><td>30/30 Summer</td><td></td><td></td><td></td><td>62.750</td></tr><tr><td>2.003</td><td>11</td><td>240 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>62.328</td></tr><tr><td>2.004</td><td>12</td><td>240 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>62.323</td></tr><tr><td>2.005</td><td>13</td><td>240 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>62.318</td></tr><tr><td>1.007</td><td>14</td><td>240 Summer</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>62.313</td></tr></table>												PN	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water		Name	Storm	Period	Change	Surchage	Flood	Overflow	Act.	Level										(m)	1.000	1	360 Summer	30	+0%					63.286	1.001	2	360 Summer	30	+0%					63.286	1.002	3 HB	360 Summer	30	+0%	30/15 Summer				63.286	1.003	4	60 Summer	30	+0%					62.721	1.004	5	60 Summer	30	+0%					62.600	1.005	6	60 Summer	30	+0%					62.524	1.006	7	60 Summer	30	+0%					62.437	2.000	8	600 Summer	30	+0%					62.751	2.001	9	600 Summer	30	+0%					62.751	2.002	10 HB	600 Summer	30	+0%	30/30 Summer				62.750	2.003	11	240 Summer	30	+0%					62.328	2.004	12	240 Summer	30	+0%					62.323	2.005	13	240 Summer	30	+0%					62.318	1.007	14	240 Summer	30	+0%					62.313
PN	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water																																																																																																																																																																												
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1.001	2	360 Summer	30	+0%					63.286																																																																																																																																																																												
1.002	3 HB	360 Summer	30	+0%	30/15 Summer				63.286																																																																																																																																																																												
1.003	4	60 Summer	30	+0%					62.721																																																																																																																																																																												
1.004	5	60 Summer	30	+0%					62.600																																																																																																																																																																												
1.005	6	60 Summer	30	+0%					62.524																																																																																																																																																																												
1.006	7	60 Summer	30	+0%					62.437																																																																																																																																																																												
2.000	8	600 Summer	30	+0%					62.751																																																																																																																																																																												
2.001	9	600 Summer	30	+0%					62.751																																																																																																																																																																												
2.002	10 HB	600 Summer	30	+0%	30/30 Summer				62.750																																																																																																																																																																												
2.003	11	240 Summer	30	+0%					62.328																																																																																																																																																																												
2.004	12	240 Summer	30	+0%					62.323																																																																																																																																																																												
2.005	13	240 Summer	30	+0%					62.318																																																																																																																																																																												
1.007	14	240 Summer	30	+0%					62.313																																																																																																																																																																												
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Coast Consulting Engineers Ltd		Page 11
Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:30	
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE W...	Checked by PL	
Innovyze	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status	Level
		Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)		Exceeded
1.000	1	-0.702	0.000	0.01		183	6.1		OK
1.001	2	-0.597	0.000	0.01		181	5.2		OK
1.002	3 HB	0.287	0.000	0.16			6.1	SURCHARGED	
1.003	4	-0.093	0.000	0.65		41	23.7		OK
1.004	5	-0.064	0.000	0.85			30.4		OK
1.005	6	-0.036	0.000	0.93		20	33.4		OK
1.006	7	-0.011	0.000	1.00		18	34.5		OK
2.000	8	-0.360	0.000	0.03		250	8.6		OK
2.001	9	-0.139	0.000	0.08		233	18.9		OK
2.002	10 HB	0.126	0.000	0.06		405	5.9	SURCHARGED	
2.003	11	-0.227	0.000	0.10		101	9.9		OK
2.004	12	-0.131	0.000	0.17		96	14.0		OK
2.005	13	-0.094	0.000	0.18			14.7		OK
1.007	14	-0.055	0.000	0.41			39.2		OK

Coast Consulting Engineers Ltd		Page 12
Suite 6, Vita House Fish Quay North Shields NE30 1JA	FLOSH MEADOWS CLEATOR 1:30	
Date 09/06/2023 File 230609 REVISED SURFACE W...	Designed by RH Checked by PL	
Innovyze	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

									Water
	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow
PN	Name		Storm	Period	Change	Surcharge	Flood	Overflow	Act.
1.008	15	240	Summer	30	+0%	30/240	Summer		
3.000	16	240	Summer	30	+0%	30/240	Summer		
1.009	17	HB	240	Summer	30	+0%	30/60	Summer	
1.010	18	240	Summer	30	+0%				

US/MH		Surcharged	Flooded	Half Drain		Pipe	Level		
PN	Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Exceeded
1.008	15	0.002	0.000	0.40		122	37.5	SURCHARGED	
3.000	16	0.005	0.000	0.03		126	2.9	SURCHARGED	
1.009	17 HB	0.126	0.000	0.48		135	30.8	SURCHARGED	
1.010	18	-0.127	0.000	0.63			30.8	OK	

Coast Consulting Engineers Ltd		Page 0
Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:100 +50%	
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE W...	Checked by PL	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for 180518 SW1.SWS

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
1.000	41.957	0.105	399.6	0.061	5.00	0.0	0.600	o	975	Pipe/Conduit	
1.001	53.639	0.134	400.3	0.118	0.00	0.0	0.600	o	975	Pipe/Conduit	
1.002	31.512	0.185	170.3	0.129	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	25.483	0.150	169.9	0.104	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	17.652	0.104	169.7	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	18.982	0.112	169.5	0.028	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	13.655	0.080	170.7	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	71.706	0.221	324.5	0.115	5.00	0.0	0.600	o	525	Pipe/Conduit	
2.001	37.730	0.116	325.3	0.225	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.002	22.253	0.068	325.0	0.065	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.003	33.218	0.102	325.7	0.065	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.004	13.246	0.041	323.1	0.062	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.005	14.105	0.043	328.0	0.042	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.007	24.092	0.074	325.6	0.021	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.008	21.726	0.067	324.3	0.029	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	5.43	63.013	0.061	0.0	0.0	0.0	1.64	1225.0	0.0
1.001	0.00	5.97	62.908	0.179	0.0	0.0	0.0	1.64	1223.9	0.0
1.002	0.00	6.50	62.774	0.308	0.0	0.0	0.0	1.00	39.7	0.0
1.003	0.00	6.92	62.589	0.412	0.0	0.0	0.0	1.00	39.8	0.0
1.004	0.00	7.22	62.439	0.447	0.0	0.0	0.0	1.00	39.8	0.0
1.005	0.00	7.53	62.335	0.475	0.0	0.0	0.0	1.00	39.8	0.0
1.006	0.00	7.76	62.223	0.504	0.0	0.0	0.0	1.00	39.7	0.0
2.000	0.00	5.97	62.586	0.115	0.0	0.0	0.0	1.24	268.0	0.0
2.001	0.00	6.47	62.365	0.340	0.0	0.0	0.0	1.24	267.7	0.0
2.002	0.00	6.85	62.249	0.405	0.0	0.0	0.0	1.00	110.4	0.0
2.003	0.00	7.40	62.181	0.470	0.0	0.0	0.0	1.00	110.3	0.0
2.004	0.00	7.62	62.079	0.532	0.0	0.0	0.0	1.00	110.7	0.0
2.005	0.00	7.86	62.038	0.574	0.0	0.0	0.0	0.99	109.9	0.0
1.007	0.00	8.26	61.993	1.099	0.0	0.0	0.0	1.00	110.3	0.0
1.008	0.00	8.62	61.919	1.128	0.0	0.0	0.0	1.00	110.5	0.0

Coast Consulting Engineers Ltd		Page 2
Suite 6, Vita House	FLOSH MEADOWS	
Fish Quay	CLEATOR	
North Shields NE30 1JA	1:100 +50%	
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE W...	Checked by PL	
Innovyze	Network 2020.1	
<u>Synthetic Rainfall Details</u> Cv (Summer) 0.750 Storm Duration (mins) 30 Cv (Winter) 0.840		
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Coast Consulting Engineers Ltd			Page 3																																																																									
Suite 6, Vita House Fish Quay North Shields NE30 1JA		FLOSH MEADOWS CLEATOR 1:100 +50%																																																																										
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Innovyze		Network 2020.1																																																																										
Online Controls for 180518 SW1.SWS																																																																												
Hydro-Brake® Optimum Manhole: 3 HB, DS/PN: 1.002, Volume (m³): 45.9																																																																												
Unit Reference MD-SHE-0107-7000-2119-7000																																																																												
Design Head (m) 2.119																																																																												
Design Flow (l/s) 7.0																																																																												
Flush-Flo™ Calculated																																																																												
Objective Minimise upstream storage																																																																												
Application Surface																																																																												
Sump Available Yes																																																																												
Diameter (mm) 107																																																																												
Invert Level (m) 62.774																																																																												
Minimum Outlet Pipe Diameter (mm) 150																																																																												
Suggested Manhole Diameter (mm) 1200																																																																												
<table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>2.119</td><td>7.0</td><td>Kick-Flo®</td><td>0.957</td><td>4.8</td></tr><tr><td>Flush-Flo™</td><td>0.469</td><td>6.1</td><td>Mean Flow over Head Range</td><td>-</td><td>5.6</td></tr></table>					Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	2.119	7.0	Kick-Flo®	0.957	4.8	Flush-Flo™	0.469	6.1	Mean Flow over Head Range	-	5.6																																																						
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Flush-Flo™	0.469	6.1	Mean Flow over Head Range	-	5.6																																																																							
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated																																																																												
<table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>3.7</td><td>1.200</td><td>5.4</td><td>3.000</td><td>8.2</td><td>7.000</td><td>12.3</td></tr><tr><td>0.200</td><td>5.4</td><td>1.400</td><td>5.8</td><td>3.500</td><td>8.9</td><td>7.500</td><td>12.7</td></tr><tr><td>0.300</td><td>5.9</td><td>1.600</td><td>6.1</td><td>4.000</td><td>9.4</td><td>8.000</td><td>13.1</td></tr><tr><td>0.400</td><td>6.0</td><td>1.800</td><td>6.5</td><td>4.500</td><td>10.0</td><td>8.500</td><td>13.5</td></tr><tr><td>0.500</td><td>6.1</td><td>2.000</td><td>6.8</td><td>5.000</td><td>10.5</td><td>9.000</td><td>13.9</td></tr><tr><td>0.600</td><td>6.0</td><td>2.200</td><td>7.1</td><td>5.500</td><td>11.0</td><td>9.500</td><td>14.3</td></tr><tr><td>0.800</td><td>5.6</td><td>2.400</td><td>7.4</td><td>6.000</td><td>11.4</td><td></td><td></td></tr><tr><td>1.000</td><td>4.9</td><td>2.600</td><td>7.7</td><td>6.500</td><td>11.9</td><td></td><td></td></tr></table>					Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.7	1.200	5.4	3.000	8.2	7.000	12.3	0.200	5.4	1.400	5.8	3.500	8.9	7.500	12.7	0.300	5.9	1.600	6.1	4.000	9.4	8.000	13.1	0.400	6.0	1.800	6.5	4.500	10.0	8.500	13.5	0.500	6.1	2.000	6.8	5.000	10.5	9.000	13.9	0.600	6.0	2.200	7.1	5.500	11.0	9.500	14.3	0.800	5.6	2.400	7.4	6.000	11.4			1.000	4.9	2.600	7.7	6.500	11.9		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																					
0.100	3.7	1.200	5.4	3.000	8.2	7.000	12.3																																																																					
0.200	5.4	1.400	5.8	3.500	8.9	7.500	12.7																																																																					
0.300	5.9	1.600	6.1	4.000	9.4	8.000	13.1																																																																					
0.400	6.0	1.800	6.5	4.500	10.0	8.500	13.5																																																																					
0.500	6.1	2.000	6.8	5.000	10.5	9.000	13.9																																																																					
0.600	6.0	2.200	7.1	5.500	11.0	9.500	14.3																																																																					
0.800	5.6	2.400	7.4	6.000	11.4																																																																							
1.000	4.9	2.600	7.7	6.500	11.9																																																																							
Hydro-Brake® Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m³): 13.2																																																																												
Unit Reference MD-SHE-0107-6000-1575-6000																																																																												
Design Head (m) 1.575																																																																												
Design Flow (l/s) 6.0																																																																												
Flush-Flo™ Calculated																																																																												
Objective Minimise upstream storage																																																																												
Application Surface																																																																												
Sump Available Yes																																																																												
Diameter (mm) 106																																																																												
Invert Level (m) 62.249																																																																												
Minimum Outlet Pipe Diameter (mm) 150																																																																												
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Innovyze		Network 2020.1					
Hydro-Brake® Optimum Manhole: 10 HB, DS/PN: 2.002, Volume (m³): 13.2							
Suggested Manhole Diameter (mm) 1200							
Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)
Design Point (Calculated)		1.575	6.0	Kick-Flo®		0.952	4.7
Flush-Flo™		0.468	5.9	Mean Flow over Head Range		-	5.2
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated							
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.3	3.000	8.1	7.000	12.1
0.200	5.3	1.400	5.7	3.500	8.7	7.500	12.5
0.300	5.7	1.600	6.0	4.000	9.3	8.000	12.9
0.400	5.9	1.800	6.4	4.500	9.8	8.500	13.3
0.500	5.9	2.000	6.7	5.000	10.3	9.000	13.7
0.600	5.9	2.200	7.0	5.500	10.8	9.500	14.0
0.800	5.5	2.400	7.3	6.000	11.3		
1.000	4.9	2.600	7.6	6.500	11.7		
Hydro-Brake® Optimum Manhole: 17 HB, DS/PN: 1.009, Volume (m³): 9.6							
Unit Reference MD-SHE-0235-3200-1642-3200							
Design Head (m)				1.642			
Design Flow (l/s)				32.0			
Flush-Flo™				Calculated			
Objective				Minimise upstream storage			
Application				Surface			
Sump Available				Yes			
Diameter (mm)				235			
Invert Level (m)				61.852			
Minimum Outlet Pipe Diameter (mm)				300			
Suggested Manhole Diameter (mm)				1800			
Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)
Design Point (Calculated)		1.642	32.0	Kick-Flo®		1.101	26.4
Flush-Flo™		0.503	32.0	Mean Flow over Head Range		-	27.5
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated							
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.8	0.200	23.7	0.300	30.6	0.400	31.7
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Date 09/06/2023	Designed by RH																																																																									
File 230609 REVISED SURFACE W...	Checked by PL																																																																									
Innovyze	Network 2020.1																																																																									
Storage Structures for 180518 SW1.SWS Cellular Storage Manhole: 1, DS/PN: 1.000 Invert Level (m) 63.585 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>51.8</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>51.8</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table> Cellular Storage Manhole: 2, DS/PN: 1.001 Invert Level (m) 63.015 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>220.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>220.0</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table> Cellular Storage Manhole: 4, DS/PN: 1.003 Invert Level (m) 62.589 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>129.5</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>129.5</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table> Cellular Storage Manhole: 6, DS/PN: 1.005 Invert Level (m) 62.335 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>25.9</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>25.9</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	51.8	0.0	0.521	0.0	0.0	0.520	51.8	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	220.0	0.0	0.521	0.0	0.0	0.520	220.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	129.5	0.0	0.521	0.0	0.0	0.520	129.5	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	25.9	0.0	0.521	0.0	0.0	0.520	25.9	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
0.000	51.8	0.0	0.521	0.0	0.0																																																																					
0.520	51.8	0.0																																																																								
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
0.000	220.0	0.0	0.521	0.0	0.0																																																																					
0.520	220.0	0.0																																																																								
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
0.000	129.5	0.0	0.521	0.0	0.0																																																																					
0.520	129.5	0.0																																																																								
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
0.000	25.9	0.0	0.521	0.0	0.0																																																																					
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<u>Cellular Storage Manhole: 7, DS/PN: 1.006</u> Invert Level (m) 62.224 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>25.9</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>25.9</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 8, DS/PN: 2.000</u> Invert Level (m) 63.413 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>77.7</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>77.7</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 9, DS/PN: 2.001</u> Invert Level (m) 62.621 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>388.5</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>388.5</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 10 HB, DS/PN: 2.002</u> Invert Level (m) 62.249 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>170.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>170.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 11, DS/PN: 2.003</u> Invert Level (m) 62.181 Infiltration Coefficient Side (m/hr) 0.00000 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0						Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	25.9	0.0	0.521	0.0	0.0	0.520	25.9	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	77.7	0.0	0.521	0.0	0.0	0.520	77.7	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	388.5	0.0	0.521	0.0	0.0	0.520	388.5	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	170.0	0.0	0.521	0.0	0.0	0.520	170.0	0.0			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	25.9	0.0	0.521	0.0	0.0																																																																								
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Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	77.7	0.0	0.521	0.0	0.0																																																																								
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Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	388.5	0.0	0.521	0.0	0.0																																																																								
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Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
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Innovyze			Network 2020.1																																																																										
<u>Cellular Storage Manhole: 11, DS/PN: 2.003</u> Porosity 0.95 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>200.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>200.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 12, DS/PN: 2.004</u> Invert Level (m) 62.079 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>129.5</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>129.5</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 15, DS/PN: 1.008</u> Invert Level (m) 61.919 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>30.0</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>30.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 16, DS/PN: 3.000</u> Invert Level (m) 61.900 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>51.8</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>51.8</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 17 HB, DS/PN: 1.009</u> Invert Level (m) 61.852 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000						Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	200.0	0.0	0.521	0.0	0.0	0.520	200.0	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	129.5	0.0	0.521	0.0	0.0	0.520	129.5	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	30.0	0.0	0.521	0.0	0.0	0.520	30.0	0.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	51.8	0.0	0.521	0.0	0.0	0.520	51.8	0.0			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	200.0	0.0	0.521	0.0	0.0																																																																								
0.520	200.0	0.0																																																																											
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	129.5	0.0	0.521	0.0	0.0																																																																								
0.520	129.5	0.0																																																																											
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	30.0	0.0	0.521	0.0	0.0																																																																								
0.520	30.0	0.0																																																																											
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																								
0.000	51.8	0.0	0.521	0.0	0.0																																																																								
0.520	51.8	0.0																																																																											
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Coast Consulting Engineers Ltd			Page 9																				
Suite 6, Vita House		FLOSH MEADOWS																					
Fish Quay		CLEATOR																					
North Shields NE30 1JA		1:100 +50%																					
Date 09/06/2023		Designed by RH																					
File 230609 REVISED SURFACE W...		Checked by PL																					
Innovyze			Network 2020.1																				
Cellular Storage Manhole: 17 HB, DS/PN: 1.009 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>77.7</td><td>0.0</td><td>0.521</td><td>0.0</td><td>0.0</td></tr><tr><td>0.520</td><td>77.7</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table>						Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	77.7	0.0	0.521	0.0	0.0	0.520	77.7	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																		
0.000	77.7	0.0	0.521	0.0	0.0																		
0.520	77.7	0.0																					
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Coast Consulting Engineers Ltd								Page 10																																																																																																																																																																			
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<u>Simulation Criteria</u>																																																																																																																																																																											
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 Coefficient		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		13																																																																																																																																																																					
Number of Online Controls		3		Number of Time/Area Diagrams		0																																																																																																																																																																					
Number of Offline Controls		0		Number of Real Time Controls		0																																																																																																																																																																					
<u>Synthetic Rainfall Details</u>																																																																																																																																																																											
Rainfall Model		FSR		Ratio R		0.220																																																																																																																																																																					
Region England and Wales Cv (Summer)		1.000																																																																																																																																																																									
M5-60 (mm)		18.600		Cv (Winter)		1.000																																																																																																																																																																					
Margin for Flood Risk Warning (mm)		300.0																																																																																																																																																																									
Analysis Timestep		2.5		Second Increment (Extended)																																																																																																																																																																							
DTS Status		OFF																																																																																																																																																																									
DVD Status		OFF																																																																																																																																																																									
Inertia Status		OFF																																																																																																																																																																									
Profile(s)		Summer and Winter																																																																																																																																																																									
Duration(s) (mins)		15, 30, 60, 120, 180, 240, 360																																																																																																																																																																									
Return Period(s) (years)		100																																																																																																																																																																									
Climate Change (%)		50																																																																																																																																																																									
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	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Water																																																																																																																																																																			
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2.000	8	360 Winter	100	+50%	100/180	Summer		63.794																																																																																																																																																																			
2.001	9	360 Winter	100	+50%	100/60	Summer		63.794																																																																																																																																																																			
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2.003	11	360 Summer	100	+50%	100/120	Summer		62.691																																																																																																																																																																			
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Coast Consulting Engineers Ltd		Page 11
Suite 6, Vita House Fish Quay North Shields NE30 1JA	FLOSH MEADOWS CLEATOR 1:100 +50%	
Date 09/06/2023 File 230609 REVISED SURFACE W...	Designed by RH Checked by PL	
Innovyze	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

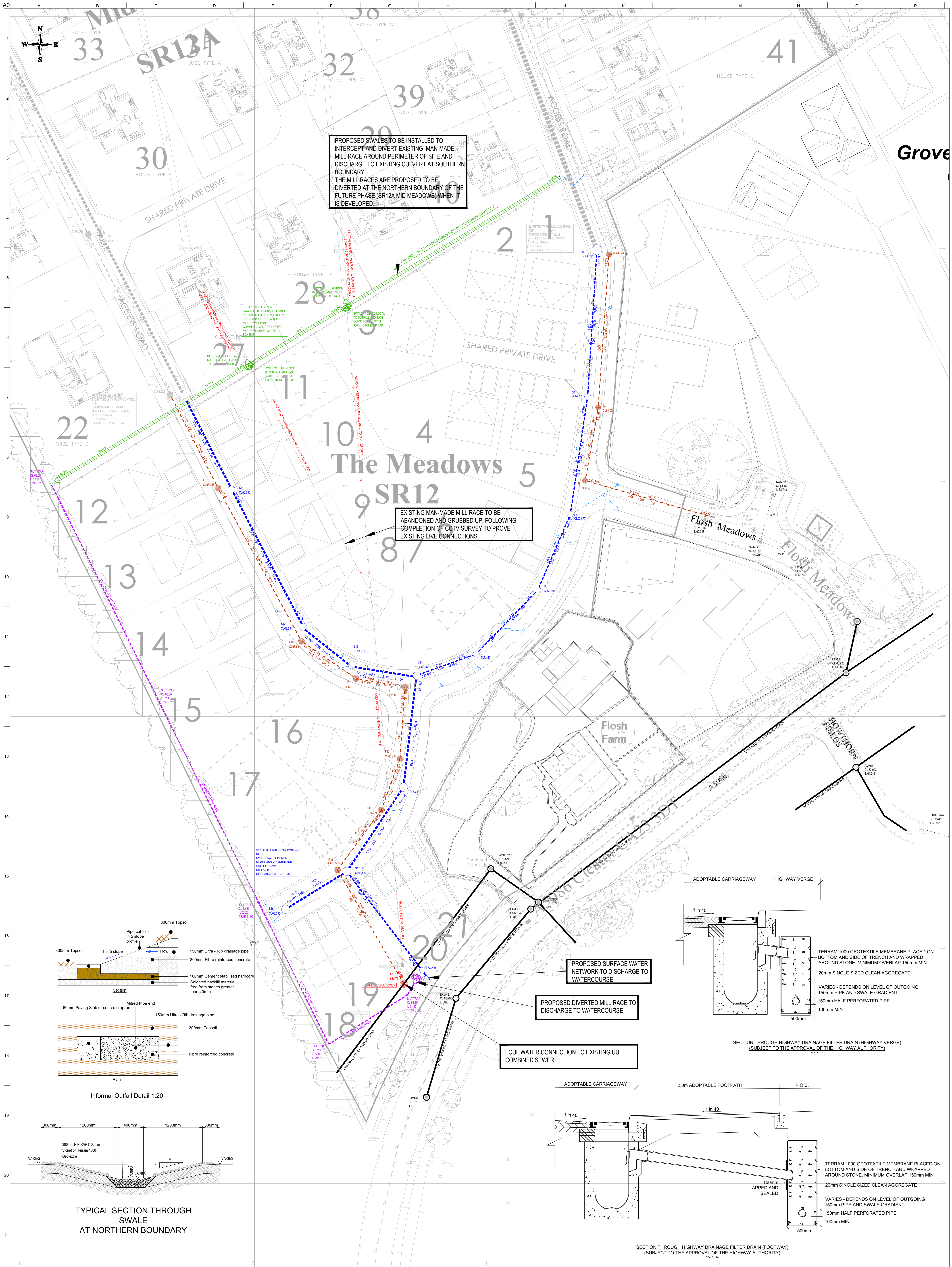
PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)		
1.000	1	0.701	0.000	0.01		99	7.6	SURCHARGED	
1.001	2	0.806	0.000	0.01			6.5	SURCHARGED	
1.002	3 HB	1.691	0.000	0.18			6.7	FLOOD RISK	
1.003	4	0.037	0.000	0.77		25	28.3	SURCHARGED	
1.004	5	0.124	0.000	1.00			35.6	SURCHARGED	
1.005	6	0.169	0.000	1.01		110	36.3	SURCHARGED	
1.006	7	0.252	0.000	0.91		149	31.3	SURCHARGED	
2.000	8	0.683	0.000	0.06		62	14.5	SURCHARGED	
2.001	9	0.904	0.000	0.09			21.5	SURCHARGED	
2.002	10 HB	1.168	0.000	0.06			5.9	FLOOD RISK	
2.003	11	0.136	0.000	0.15		160	15.3	SURCHARGED	
2.004	12	0.232	0.000	0.26		199	21.6	SURCHARGED	
2.005	13	0.268	0.000	0.26			21.7	SURCHARGED	
1.007	14	0.306	0.000	0.38			36.0	SURCHARGED	
1.008	15	0.362	0.000	0.39		254	36.2	SURCHARGED	

Coast Consulting Engineers Ltd		Page 12
Suite 6, Vita House Fish Quay North Shields NE30 1JA	FLOSH MEADOWS CLEATOR 1:100 +50%	
Date 09/06/2023	Designed by RH	
File 230609 REVISED SURFACE W...	Checked by PL	
Innovyze	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for 180518 SW1.SWS

									Water
	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level
3.000	16	360	Summer	100	+50%	100/30	Summer		62.640
1.009	17	HB 360	Summer	100	+50%	100/15	Summer		62.639
1.010	18	240	Summer	100	+50%				61.920

US/MH		Surcharged	Flooded	Half Drain		Pipe	Level		
PN	Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Exceeded
3.000	16	0.365	0.000	0.16		254	13.9	SURCHARGED	
1.009	17 HB	0.487	0.000	0.50		273	32.0	SURCHARGED	
1.010	18	-0.123	0.000	0.66			32.0	OK	



LEGEND			LEGEND						Client MR R.W. MULHOLLAND		Drawing Title PROPOSED DRAINAGE		
EXISTING UU SEWERS			PROPOSED DIVERSION OF MILL RACE MAINTAINED BY MANAGEMENT CO			P9 09-06-23 Drainage layout updated RH RH PL			7 Shelburne Court, Northumberland Business Park, NE23 7RY 0191 5977879		Scale at A0 1:250		
PROPOSED UU COMBINED WATER SEWER			PROPOSED SWALE, MAINTAINED BY MANAGEMENT CO			P8 15-05-23 Drainage layout updated RH RH PL					Drawing Status PRELIMINARY		
PROPOSED UU FOUL WATER SEWER						P7 13-07-22 Filter drains removed RH RH PL					Job No 1842		
PROPOSED UU SURFACE WATER SEWER						P6 07-06-22 Updated to reflect client comments RH RH PL			Drawing No 202			Issue P9	
PROPOSED HIGHWAY DRAINAGE						P5 30-05-22 Updated to reflect client comments RH RH PL							
						P4 09-12-21 Updated to reflect client comments RH RH PL							
						P3 19-05-21 Updated to reflect client comments RH RH PL							
						Issue Date Description By CHKD Appd							



Coast Consulting Engineers Ltd

7 Silverton Court

Northumberland Business Park

NE23 7RY

Tel. 0191 597 7879