Doc Ref: **2829-BCL-00-XX-C-RP-0002**

Date: **17th September 2024**

Rev: **P02**

Client

Marco Investments Ltd
81 Newton Street
Manchester
M1 1EX

Site Address

123 Barlow Moor Road Drive
Manchester
M20 3JQ

Document Title

Drainage Condition Report

BrennanConsult
Civil & Structural Consulting Engineers
Oak House
2 Gatley Road
Cheadle
Cheshire
SK8 1PY
www.brennanconsult.com
0161 428 2880

Contents

1.0 Introduction 4
2.0 Drainage Strategy 5
2.1 Existing Drainage Layout 5
2.2 Existing Runoff 5
2.3 Geology 6
2.4 Hydrological Assessment 6
2.5 SuDS Hierarchal Approach 6
2.6 Surface Water Drainage Strategy 8
3.0 Management & Maintenance Plan 9
4.0 Drainage Related Planning Condition and Responses 13
4.1 Planning Conditions 13
Appendix A – Brennan Consult Drawing
Appendix B – Hydraulic Calculations

Revision History

Issue	Date	Status	Prepared By	Signature
P01	25.03.24	First Issue	Lee Meadowcroft BSc(Hons) PgDip MScCHE CEng MIStructE MICE IHBC	
P02	17.09.24	Updated to reflect LLFA comments.	Matthew McGowan BEng (Hons)	

Disclaimer

This report is the property of Brennan Consult Ltd and is confidential to the Client designated in the report. Whilst it may be shown to their professional advisers, the contents are not to be disclosed to, or made use of, by any third party, without our express written consent. Without such consent we can accept no responsibility to any third party. Any third parties to which our responsibility is extended are stated below:

This report is made on behalf of Brennan Consult. By receiving it and acting on it, the Client – or any third party relying on it – accepts that no individual is personally liable in contract, tort or breach of statutory duty (including negligence).

1.0 Introduction

1.1 In October 2022 a planning application was submitted to Manchester City Council (MCC) for the erection of a pair of 4 bed 3 storey semi-detached houses and ancillary single storey annexes at rear with parking and landscaping at 123 Barlow Moor Road, Manchester, M20 2TS.

1.2 Planning approval was granted in April 2023 via application number 135315/FO/2022 subject to a number of planning conditions, including one condition relating to the drainage of the development.

1.3 This report has been prepared to remove this drainage related planning condition relevant to the application. The condition is number 17.

2.0 Drainage Strategy

2.1 Existing Drainage Layout

2.1.1 United Utilities

The United Utilities sewer records have been reviewed and indicate a 1200mm diameter combined sewer that passes in a westerly direction beneath Barlow Moor Road at approximately 8m deep. A larger 2100mm diameter is located beyond this sewer, again flowing west. No surface water sewers have been identified in close proximity.

Refer to Figure 1 below.

Figure 1 United Utilities Sewer Records

2.1.2 Private Drainage

The site encompasses an existing residential property.

A CCTV investigation has been completed and indicates that the current site connects into an existing drainage network within the rear garden of the adjacent property, which in turn outfalls to the 1200mm diameter sewer.

2.2 Existing Runoff

2.2.1 The current site can be classed as Brownfield. Figure 2 below defines the existing Brownfield runoff rates based on the modified rational method and respective rainfall intensities, with an impermeable area from the roof and driveway of 0.056ha.

Existing Impermeable Area (ha)	1yr Brownfield Rate (30mm/hr)	30yr Brownfield Rate (65mm/hr)	100yr Brownfield Rate (95mm/hr)
0.040	3.3 l/s	7.2 l/s	10.6 l/s

Figure 2 Existing Brownfield Runoff Rates

2.3 Geology

2.3.1 A site-specific Phase 2 intrusive investigation has been undertaken at the site that included two soakaway tests in line with BRE 365 guidance. Due to the cohesive ground conditions identified, no results could be ascertained. In light of these findings, infiltration is not deemed a suitable option to drain the site.

2.4 Hydrological Assessment

2.4.1 A review of the topographical survey, OS Maps and Environment Agency maps would indicate the closest watercourse to be the River Mersey, located approximately 400m to the west.

2.5 SuDS Hierarchal Approach

2.5.1 Based on the existing drainage configuration, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in detail below:

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Whilst the Groundtech consulting geo-environmental appraisal notes that '*the use of soakaways may be considered feasible if sufficient attenuation and storage is available'*, the test results indicate that it is not compliant with BRE 365 due to the insufficient time to drain past 25% effective depth. Additionally, due to the constraints on site and restrictions with the location of a soakaway in regards to building location and site boundary, there is insufficient space available to install a soakaway that could service the site. Therefore infiltration is not deemed viable.
Connection to Watercourse	No	No watercourse in close proximity.
Connection to Surface Water Sewer	No	No surface water sewer in close proximity.

Connection to a Combined Sewer	Yes	Higher options available.

Figure 3 SuDS Hierarchal Approach

2.6 Surface Water Drainage Strategy

2.6.1 The SuDS assessment and hierarchal approach discussed in Figure 2 above has defined the overall SuDS strategy. The general principal of the surface water drainage strategy is to collect the runoff from the roof of the two new residential units. The water will then be directed to a new below ground surface water drainage network that will outfall to the existing manhole at the front of the property, which in turn outfalls to the combined public sewer. To comply with MCC policy a flow control restriction of 2.5l/s will be incorporated onto the outfall from each property, providing a peak flow rate of 5l/s. This provides greater than a 50% reduction to both the pre development 30 year and 100-year discharge rates.

2.6.2 Permeable surfacing will be incorporated to the front driveways.

2.6.3 A detailed drainage GA drawing and calculations can be found in the Appendices. This has shown no flooding for the 30-year and extreme 100 year + 45% climate change events.

3.0 Management & Maintenance Plan

3.0.1 The drainage network encompasses standard pipework, manholes and a flow control. As long as the gullies at the base of the rainwater pipes are kept clear of leaves and detritus by regular inspection by the property owners then this should negate it passing into the network.

3.0.2 All management and maintenance of the drainage will be with the property owners. This will involve general maintenance of the drainage network in accordance with best practice. All drainage will remain private and not be adopted by the local sewerage authority.

3.0.3 This section is intended to give an overview of the operation and maintenance for the drainage features included with the drainage strategy and in relation to typical details. Where proprietary products are specified, the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints. The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the site requirements.

3.0.4 There are three types of maintenance activities associated with surface water drainage systems. The SuDS Manual, CIRIA C753, defines these as:

- Regular Maintenance – 'basic tasks undertaken on a frequent and predictable schedule' including vegetation management, litter and debris removal, and inspections.'
- Occasional Maintenance – 'tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example.'
- Remedial Maintenance – 'intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.'

3.0.5 Specific maintenance needs should be monitored and maintenance schedules adjusted to suit the location and condition of the drainage feature in question.

<u>Piped Networks, Inspection, Manhole and Catchpit Chambers</u>

3.0.6 The appropriate health and safety equipment must be used when accessing manholes. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained from the Maintenance Manager prior to any access.

3.0.7 Pipes are proprietary products, and the materials can vary across the site and as such where used the manufacture's recommendations should be followed.

3.0.8 Pipes are intended to be the main conveyance across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except for during rainfall events. These have been designed to be self-cleaning where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

3.0.9 Access for maintenance is provided through access chambers and manholes.

3.0.10 Regular inspection and maintenance are important to identify areas which may have been obstructed /clogged and may not be drainage correctly thus exposing the site to a greater level of flood risk.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any features that are not operating correctly. If required, take remedial action	Monthly for three months, then six monthly
	Debris removal from catchment surface / gratings (where may cause risks to performance)	Monthly (and after large storms)
	Remove sediment from trapped sumps, manholes and catchpits.	Annually or as required
Remedial Maintenance	Repair / rehabilitation of gratings, inlets and outlets	As required
Monitoring	Inspect / check all gratings, trapped sumps, manholes and catchpits to ensure that they are in good condition and operating as designed	Annually and after large storm events
Structure Rehabilitation / Repair	Regular Maintenance and Monitoring to identify if repair and / or replacement of features or pipework is required.	As required

Figure 4 Operation and Maintenance Requirements of Piped Networks and Inspection Chambers

Flow Control Units

3.0.11 The flow control units are intended for flood control and flow restriction.

3.0.12 The flow control is specified as a Hydro Brake Optimum and is a proprietary product; therefore, manufacturer's recommendations should also be taken into consideration.

3.0.13 Access for maintenance has been provided by locating within manhole chambers.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Inspect inlets for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance).	Monthly
	Remove sediment from pre- treatment structures and flow control chambers.	Annually (or as required after heavy rainfall events)
Remedial Actions	Repair/rehabilitation of inlets.	As required.

Figure 5: Operation and Maintenance Requirements for Flow Controls

Permeable Paving

3.0.14 Permeable paving provides a surface suitable for vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying structural layers. The surface itself is impervious to water, but the blocks are laid to provide void space through the surface to the sub-base. The water is temporarily stored within this sub-base before controlled discharge downstream.

3.0.15 Permeable surfaces, together with their associated substructures, are an efficient means of managing surface water runoff close to its source – intercepting runoff, reducing the volume and frequency of runoff, and providing a treatment medium. Treatment processes that occur within the surface structure, sub-base and geotextile layers include filtration, absorption, biodegradation and sedimentation.

3.0.16 Permeable paving should be inspected regularly, preferably during and after heavy rainfall to check effective operation and identify areas of ponding. Permeable paving needs to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. Evidence suggests that sweeping once per year should be sufficient to maintain an acceptable infiltration rate on most developments.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, or when required during autumn leaf fall
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48hours	Every 3 months, 48 hours after large storms.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Manage other weeds and vegetation and remove nuisance plants	Once a year, or when required
Remedial Actions	Repair erosion of any adjacent soft landscaping adjacent to the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Figure 6: Operation and Maintenance Requirements for Permeable Paving

4.0 Drainage Related Planning Condition and Responses

4.1 Planning Conditions

Condition 17 is detailed below in *italics* with the Brennan Consult response beneath in Blue.

Condition 17

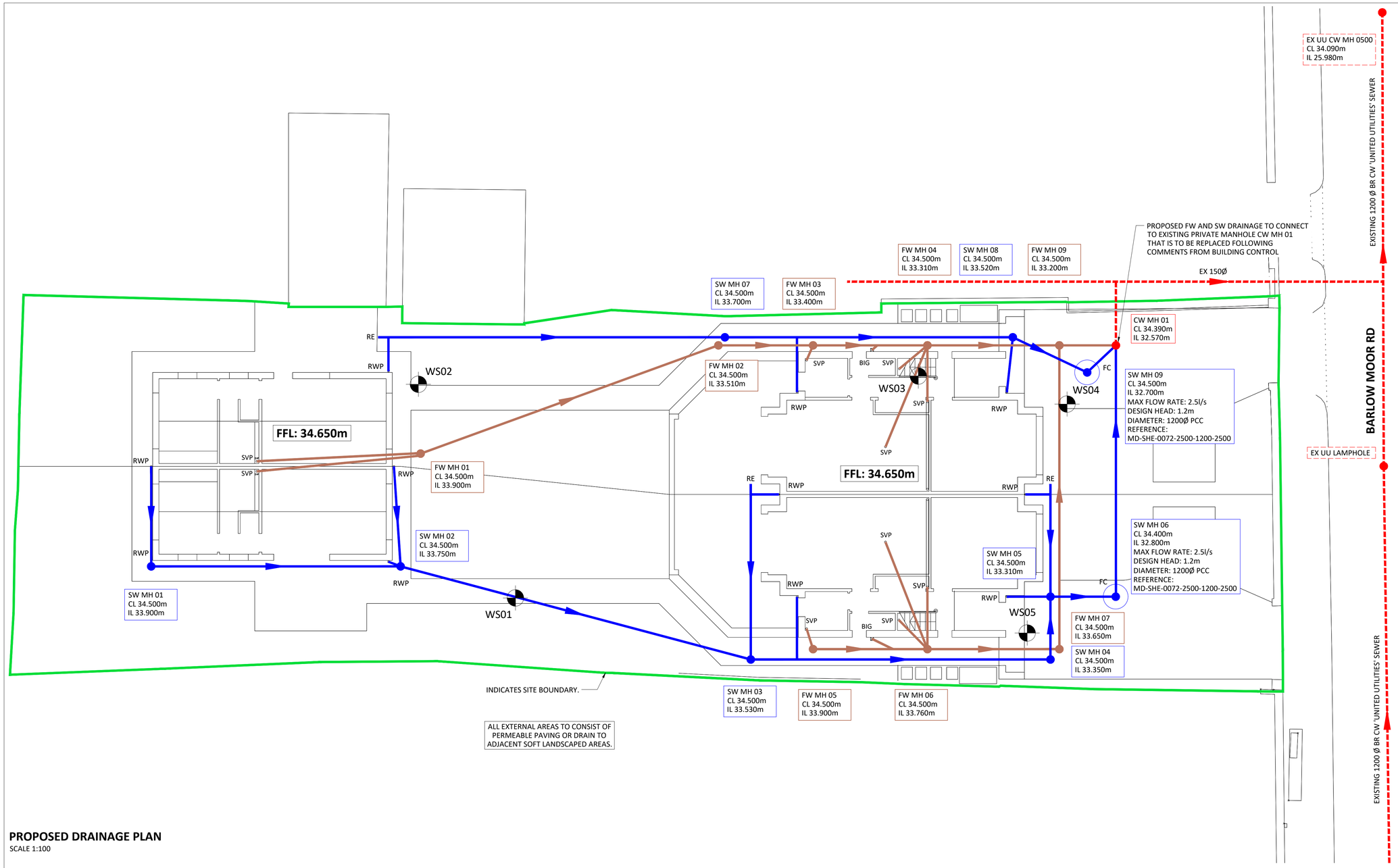
Development shall not begin until a surface water drainage scheme for the site, based on sustainable drainage principles has been submitted to and approved in writing by the local planning authority. The development shall be constructed and completed in accordance with the approved details and retained thereafter for the lifetime of the development.

As defined in Section 2, the intrusive investigation has confirmed that the underlying ground comprises clay and thus unsuitable for infiltration-based options. There are no watercourses that are accessible via gravity and no surface water sewers in close proximity. In light of this the existing connection will be reused to the combined public sewer in Barlow Moor Road via two flow restricting devices, each rated at 2.5l/s.

Section 3 provides details on the management and maintenance of all the drainage and SuDS features by the future occupiers of the residential units.

Appendix A – Brennan Consult Drawing

- 2829 101 – Drainage GA



PROPOSED DRAINAGE PLAN
SCALE 1:100

© THIS DRAWING AND ITS CONTENTS ARE STRICTLY THE COPYRIGHT OF BRENNANCONSULT LTD

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ASSOCIATED DRAWINGS. ANY DISCREPANCY TO BE RAISED PRIOR TO CONSTRUCTION. ANY CONSTRUCTION WORKS WHICH COMMENCE BEFORE THESE DRAWINGS ARE APPROVED ARE AT THE RISK OF THE BUILDING CONTRACTOR.
2. ALL DIMENSIONS ARE IN MILLIMETERS (mm). DO NOT SCALE FROM THIS DRAWING, WORK TO STATED DIMENSIONS ONLY.
3. BUILDING CONTRACTOR TO ENSURE ALL WORKS COMPLY WITH THE CURRENT EDITION OF THE BUILDING REGULATIONS. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH APPROVED DOCUMENT REGULATION 7.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, FABRICATION, ERECTION AND REMOVAL OF ALL TEMPORARY WORKS AND SHALL PROVIDE ALL TEMPORARY BRACING AS NECESSARY TO MAINTAIN STRUCTURAL STABILITY DURING CONSTRUCTION.
5. IF THE CONTRACTOR CONSIDERS THAT THEY DO NOT HAVE SUFFICIENT INFORMATION TO SAFELY COMPLETE THE WORKS DETAILED ON THIS DRAWING, THEY SHOULD CONTACT THE ENGINEER.

DRAINAGE NOTES

1. ALL PRIVATE DRAINAGE WITHIN THE SITE IS TO COMPLY WITH THE REQUIREMENTS OF BS EN 752 AND BUILDING REGULATIONS PART H.
2. DETAILS OF EXISTING SEWERS SHALL BE CONFIRMED BY THE CONTRACTOR ON SITE PRIOR TO THE COMMENCEMENT OF WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY. THE CONTRACTOR SHOULD CHECK THE LEVELS OF ALL NEW OUT FALLS IN RELATION TO EXISTING SEWERS PRIOR TO ANY CONSTRUCTION TO ENSURE THE PROPOSED DESIGN CAN BE ACHIEVED.
3. THE CONTRACTOR SHALL ASCERTAIN THE DEPTHS, SIZES AND LOCATIONS OF ALL SERVICES TO BE CROSSED BEFORE EXCAVATION COMMENCES. ANY CONFLICT IN LEVELS BETWEEN NEW AND EXISTING SEWERS TO BE NOTIFIED TO THE ENGINEER.
4. ALL PIPES, CONNECTIONS, GULLIES, ACCESS FITTINGS, INSPECTION CHAMBERS, AND MANHOLES ARE TO COMPLY WITH THE BUILDING REGULATIONS.
5. PIPE BEDDING MATERIAL TO BE IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS, TAKING ACCOUNT OF THE DEPTH & LOADING IN RELATION TO THE PIPE STRENGTH, AND MODIFIED IF NECESSARY WHERE BELOW WATER LEVEL. BEDDING PROPOSALS ARE TO BE ISSUED FOR CONSIDERATION.
6. PIPES CONNECTED TO CHAMBERS ARE TO HAVE SOFFITS LEVEL U.N.O. PIPES 150mm IN DIAMETER OR SMALLER MAY BE LOWERED TO CENTRE LINES LEVEL.
7. ALL RWP CONNECTIONS TO BE 100mm DIAMETER U.N.O. LAID TO A FALL NO FLATTER THAN 1:40 AND WITH ROD ACCESS AT THE BASE.
8. ALL BRICKWORK IN CONNECTION WITH DRAINAGE IS TO BE SOLID CLASS B ENGINEERING BRICK TO BS3921.
9. ALL PRECAST CONCRETE PIPES, CHAMBER PRODUCTS AND ROAD GULLIES SHALL BE TO BS5911 AND BE KITE MARKED.
10. ALL INSITU AND CONCRETE PRODUCTS SHALL COMPLY WITH CLASS DS1 REQUIREMENTS FOR SULPHATE EXPOSURE IN ACCORDANCE WITH BRE SPECIAL DIGEST 1, CONCRETE IN AGGRESSIVE GROUND (2001) PART 1: TABLE 2.
11. UPON COMPLETION OF THE WORKS THE CONTRACTOR SHALL CLEAN ALL DRAINAGE BY JETTING, REMOVING ALL DEBRIS FROM SITE. NO DEBRIS SHALL BE PERMITTED TO ENTER THE EXISTING DRAINAGE SYSTEM.
12. ALL PROPRIETARY PRODUCTS TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS WRITTEN INSTRUCTIONS.
13. ALL RWP's TO DISCHARGE BY DIRECT CONNECTION INTO RODDABLE ACCESS GULLY, WITH INTERGRAL TRAP.
14. ALL SVP's & WWP's POP UP's TO CONSIST OF SLOW BENDS.

CDM DESIGNER'S RISK ASSESSMENT

BRENNANCONSULT ASSUME THAT THE CONTRACTOR IS COMPETENT IN MATTERS OF HEALTH & SAFETY AND IS AWARE OF ALL THE NORMAL RISKS ASSOCIATED WITH CONSTRUCTION OF THE TYPE SHOWN ON THIS DRAWING. REMAINING UNUSUAL RISKS ARE:-

CONSTRUCTION	CHK'D.
1. POSSIBILITY OF UNCHARTED BURIED SERVICES. CONTRACTOR TO SURVEY AND SCAN FOR LOCATION OF ANY POSSIBLE BURIED SERVICES.	CB
MAINTENANCE / CLEANING	
NO UNUSUAL RISKS	CB
DECOMMISSIONING / DEMOLITION	
NO UNUSUAL RISKS	CB

REV	REVISION DESCRIPTION	BY	DATE	CHECKED
P02	UPDATED TO LLFA COMMENTS	MM	17.09.24	CB
P01	PRELIMINARY ISSUE	DF	25.03.24	CB

BrennanConsult
Civil & Structural Consulting Engineers
www.brennanconsult.com
info@brennanconsult.com
0161 428 2880

BrennanConsult Ltd | Oak House | 2 Gatley Road
Cheadle | Stockport | SK8 1PY

DRAINAGE KEY

INDICATES EXISTING FW DRAINAGE — INDICATES NEW FW DRAINAGE
INDICATES EXISTING CW DRAINAGE — INDICATES NEW CW DRAINAGE
INDICATES EXISTING SW DRAINAGE — INDICATES NEW SW DRAINAGE

ALL NEW SURFACE AND FOUL WATER PIPES TO BE 100mm Ø UNO.
ALL MANHOLES TO BE CONCRETE ENCASED PPIC's, REFER TO DETAIL ON DRAWING 2829 - 102.

'FC' FLOW CONTROL MANHOLE
'ST' SILT TRAP
'RE' RODDING EYE

ALL MANHOLE COVERS TO BE B125 LOAD RATING.

123 BARLOW MOOR RD, DIDSBURY, MANCHESTER, M20 2TS

RESIDENTIAL DEVELOPMENT
PROPOSED DRAINAGE PLAN

Status
PRELIMINARY

Project No.	Originator	Zone	Level	Type	Role	Drawing No.	Revision
2829	BCL	00	XX	DR	D	0101	P02

Scale	Size	Drawn	Date	Checked	Passed
1:100	A1	DF	FEB 24	CB	CB

Appendix B – Hydraulic Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.367	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.024	4-8	0.005

Total Area Contributing (ha) = 0.029

Total Pipe Volume (m³) = 0.884

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	12.000	0.150	80.0	0.006	4.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	17.500	0.220	79.5	0.002	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	14.500	0.180	80.6	0.005	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	3.000	0.040	75.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.004	3.000	0.150	20.0	0.004	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.005	12.000	0.200	60.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	4.23	33.900	0.006	0.0	0.0	0.0	0.86	6.8	0.8
1.001	50.00	4.57	33.750	0.008	0.0	0.0	0.0	0.86	6.8	1.1
1.002	50.00	4.85	33.530	0.013	0.0	0.0	0.0	0.86	6.7	1.8
1.003	50.00	4.91	33.350	0.013	0.0	0.0	0.0	0.89	7.0	1.8
1.004	50.00	4.94	33.310	0.017	0.0	0.0	0.0	1.73	13.6	2.3
1.005	50.00	5.14	32.800	0.017	0.0	0.0	0.0	1.00	7.8	2.3

©1982-2017 XP Solutions

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	17.000	0.200	85.0	0.002	4.00	0.0	0.600	o	100	Pipe/Conduit	
2.001	14.000	0.180	77.8	0.005	0.00	0.0	0.600	o	100	Pipe/Conduit	
2.002	4.000	0.100	40.0	0.005	0.00	0.0	0.600	o	100	Pipe/Conduit	
2.003	2.000	0.100	20.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.006	6.000	0.080	75.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	4.34	33.900	0.002	0.0	0.0	0.0	0.83	6.6	0.3
2.001	50.00	4.61	33.700	0.007	0.0	0.0	0.0	0.87	6.9	0.9
2.002	50.00	4.66	33.520	0.012	0.0	0.0	0.0	1.22	9.6	1.6
2.003	50.00	4.68	32.700	0.012	0.0	0.0	0.0	1.73	13.6	1.6
1.006	50.00	5.22	32.550	0.029	0.0	0.0	0.0	1.16	20.5	3.9

©1982-2017 XP Solutions

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	100	SW MH01	34.500	33.900	0.500	Open Manhole	450
1.001	o	100	SW MH02	34.500	33.750	0.650	Open Manhole	450
1.002	o	100	SW MH03	34.500	33.530	0.870	Open Manhole	450
1.003	o	100	SW MH04	34.500	33.350	1.050	Open Manhole	450
1.004	o	100	SW MH05	34.500	33.310	1.090	Open Manhole	450
1.005	o	100	SW MH06	34.300	32.800	1.400	Open Manhole	1200
2.000	o	100	RE	34.500	33.900	0.500	Open Manhole	100
2.001	o	100	SW MH07	34.500	33.700	0.700	Open Manhole	450
2.002	o	100	SW MH08	34.500	33.520	0.880	Open Manhole	450
2.003	o	100	SW MH09	34.300	32.700	1.500	Open Manhole	1200
1.006	o	150	EXISTING CW01	34.390	32.550	1.690	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	12.000	80.0	SW MH02	34.500	33.750	0.650	Open Manhole	450
1.001	17.500	79.5	SW MH03	34.500	33.530	0.870	Open Manhole	450
1.002	14.500	80.6	SW MH04	34.500	33.350	1.050	Open Manhole	450
1.003	3.000	75.0	SW MH05	34.500	33.310	1.090	Open Manhole	450
1.004	3.000	20.0	SW MH06	34.300	33.160	1.040	Open Manhole	1200
1.005	12.000	60.0	EXISTING CW01	34.390	32.600	1.690	Open Manhole	1200
2.000	17.000	85.0	SW MH07	34.500	33.700	0.700	Open Manhole	450
2.001	14.000	77.8	SW MH08	34.500	33.520	0.880	Open Manhole	450
2.002	4.000	40.0	SW MH09	34.300	33.420	0.780	Open Manhole	1200
2.003	2.000	20.0	EXISTING CW01	34.390	32.600	1.690	Open Manhole	1200
1.006	6.000	75.0	EXISTING	34.300	32.470	1.680	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	EXISTING	34.300	32.470	32.000	0	0

©1982-2017 XP Solutions

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	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	0
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.367		

©1982-2017 XP Solutions

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SW MH06, DS/PN: 1.005, Volume (m³): 1.7

Unit Reference	MD-SHE-0072-2500-1200-2500
Design Head (m)	1.200
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	32.800
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.5
Flush-Flo™	0.318	2.3
Kick-Flo®	0.644	1.9
Mean Flow over Head Range	-	2.1

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	1.9	1.200	2.5	3.000	3.8	7.000	5.7
0.200	2.2	1.400	2.7	3.500	4.1	7.500	5.9
0.300	2.3	1.600	2.8	4.000	4.4	8.000	6.0
0.400	2.3	1.800	3.0	4.500	4.6	8.500	6.2
0.500	2.2	2.000	3.2	5.000	4.8	9.000	6.4
0.600	2.0	2.200	3.3	5.500	5.1	9.500	6.5
0.800	2.1	2.400	3.4	6.000	5.3		
1.000	2.3	2.600	3.6	6.500	5.5		

Hydro-Brake® Optimum Manhole: SW MH09, DS/PN: 2.003, Volume (m³): 1.8

Unit Reference	MD-SHE-0072-2500-1200-2500
Design Head (m)	1.200
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	32.700
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

©1982-2017 XP Solutions

Hydro-Brake® Optimum Manhole: SW MH09, DS/PN: 2.003, Volume (m³): 1.8

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.5
Flush-Flo™	0.318	2.3
Kick-Flo®	0.644	1.9
Mean Flow over Head Range	-	2.1

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	1.9	1.200	2.5	3.000	3.8	7.000	5.7
0.200	2.2	1.400	2.7	3.500	4.1	7.500	5.9
0.300	2.3	1.600	2.8	4.000	4.4	8.000	6.0
0.400	2.3	1.800	3.0	4.500	4.6	8.500	6.2
0.500	2.2	2.000	3.2	5.000	4.8	9.000	6.4
0.600	2.0	2.200	3.3	5.500	5.1	9.500	6.5
0.800	2.1	2.400	3.4	6.000	5.3		
1.000	2.3	2.600	3.6	6.500	5.5		

©1982-2017 XP Solutions

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.367
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SW MH01	15 Winter	1	+0%	100/15 Summer			
1.001	SW MH02	15 Winter	1	+0%	100/15 Summer			
1.002	SW MH03	15 Winter	1	+0%	100/15 Summer			
1.003	SW MH04	15 Winter	1	+0%	30/15 Summer			
1.004	SW MH05	15 Winter	1	+0%	30/15 Summer			
1.005	SW MH06	15 Winter	1	+0%	30/15 Summer			
2.000	RE	15 Winter	1	+0%				
2.001	SW MH07	15 Winter	1	+0%	100/15 Winter			
2.002	SW MH08	15 Winter	1	+0%	100/15 Summer			
2.003	SW MH09	15 Winter	1	+0%	30/15 Summer			
1.006	EXISTING CW01	15 Winter	1	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW MH01	33.923	-0.077	0.000	0.12		0.8	OK	

©1982-2017 XP Solutions

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.001	SW MH02	33.776	-0.074	0.000	0.15		1.0	OK	
1.002	SW MH03	33.563	-0.067	0.000	0.23		1.5	OK	
1.003	SW MH04	33.385	-0.065	0.000	0.27		1.5	OK	
1.004	SW MH05	33.338	-0.072	0.000	0.18		1.9	OK	
1.005	SW MH06	32.893	-0.007	0.000	0.25		1.8	OK	
2.000	RE	33.913	-0.087	0.000	0.04		0.3	OK	
2.001	SW MH07	33.723	-0.077	0.000	0.12		0.8	OK	
2.002	SW MH08	33.547	-0.073	0.000	0.16		1.3	OK	
2.003	SW MH09	32.764	-0.036	0.000	0.14		1.3	OK	
1.006	EXISTING CW01	32.593	-0.107	0.000	0.18		3.1	OK	

©1982-2017 XP Solutions

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.367
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SW MH01	15 Winter	30	+0%	100/15 Summer			
1.001	SW MH02	15 Summer	30	+0%	100/15 Summer			
1.002	SW MH03	15 Winter	30	+0%	100/15 Summer			
1.003	SW MH04	15 Winter	30	+0%	30/15 Summer			
1.004	SW MH05	15 Winter	30	+0%	30/15 Summer			
1.005	SW MH06	15 Winter	30	+0%	30/15 Summer			
2.000	RE	15 Winter	30	+0%				
2.001	SW MH07	15 Winter	30	+0%	100/15 Winter			
2.002	SW MH08	15 Summer	30	+0%	100/15 Summer			
2.003	SW MH09	15 Winter	30	+0%	30/15 Summer			
1.006	EXISTING CW01	30 Summer	30	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW MH01	33.937	-0.063	0.000	0.30		1.9	OK	

©1982-2017 XP Solutions

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.001	SW MH02	33.793	-0.057	0.000	0.39		2.5	OK	
1.002	SW MH03	33.588	-0.042	0.000	0.64		4.1	OK	
1.003	SW MH04	33.524	0.074	0.000	0.73		4.0	SURCHARGED	
1.004	SW MH05	33.520	0.110	0.000	0.49		5.3	SURCHARGED	
1.005	SW MH06	33.514	0.614	0.000	0.31		2.3	SURCHARGED	
2.000	RE	33.921	-0.079	0.000	0.10		0.6	OK	
2.001	SW MH07	33.740	-0.060	0.000	0.34		2.2	OK	
2.002	SW MH08	33.568	-0.052	0.000	0.47		3.8	OK	
2.003	SW MH09	33.083	0.283	0.000	0.26		2.3	SURCHARGED	
1.006	EXISTING CW01	32.602	-0.098	0.000	0.26		4.5	OK	

©1982-2017 XP Solutions

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.367
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SW MH01	30 Winter	100	+45%	100/15 Summer			
1.001	SW MH02	30 Winter	100	+45%	100/15 Summer			
1.002	SW MH03	30 Winter	100	+45%	100/15 Summer			
1.003	SW MH04	30 Winter	100	+45%	30/15 Summer			
1.004	SW MH05	30 Winter	100	+45%	30/15 Summer			
1.005	SW MH06	30 Winter	100	+45%	30/15 Summer			
2.000	RE	15 Winter	100	+45%				
2.001	SW MH07	15 Winter	100	+45%	100/15 Winter			
2.002	SW MH08	15 Winter	100	+45%	100/15 Summer			
2.003	SW MH09	15 Winter	100	+45%	30/15 Summer			
1.006	EXISTING CW01	30 Winter	100	+45%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW MH01	34.246	0.246	0.000	0.43		2.7	FLOOD RISK	

©1982-2017 XP Solutions

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.001	SW MH02	34.237	0.387	0.000	0.54		3.5	FLOOD RISK	
1.002	SW MH03	34.223	0.593	0.000	0.77		5.0	FLOOD RISK	
1.003	SW MH04	34.204	0.754	0.000	0.81		4.5	FLOOD RISK	
1.004	SW MH05	34.197	0.787	0.000	0.53		5.7	SURCHARGED	
1.005	SW MH06	34.188	1.288	0.000	0.36		2.7	FLOOD RISK	
2.000	RE	33.929	-0.071	0.000	0.19		1.2	OK	
2.001	SW MH07	33.830	0.030	0.000	0.64		4.2	SURCHARGED	
2.002	SW MH08	33.816	0.196	0.000	0.87		7.1	SURCHARGED	
2.003	SW MH09	33.805	1.005	0.000	0.27		2.4	SURCHARGED	
1.006	EXISTING CW01	32.605	-0.095	0.000	0.29		5.0	OK	

©1982-2017 XP Solutions