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FOUL AND SURFACE WATER DRAINAGE SCHEME DESIGN REPORT

Rose and Crown Inn, Knowl Road, Golcar, Huddersfield

Proposed Residential Development (7 Dwellings)
2024/62/90839/W

HME Civil Engineering Limited. Registered in England: **15684044**

2024/62/90839/W

Project:
Proposed Residential Development (7 Dwellings)

Client:
Sovereign Development Group Ltd

Prepared by:
HME Civil Engineering Consultants

Condition Reference:
Conditions 9, 10, 11

Date:
April 2026

Site visit date and time:
30th January 2026

Revision:
00 First Revision

Document Compiled by:

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Chartered Member of the Institute of Civil Engineers

Membership Number: 74046405

Contents

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1. Introduction

This Drainage Design Report has been prepared in support of the approved residential development at the former Rose and Crown Inn, Knowl Road, Golcar, Huddersfield, under planning permission 2024/62/90839/W . The development comprises the erection of seven dwellings and associated infrastructure.

This report represents the full drainage design for the development, updated to reflect the Section 78 amendments and to address all outstanding comments raised by the Lead Local Flood Authority (LLFA) and Yorkshire Water (YW) through previous consultation responses.

The report has been structured to provide a comprehensive drainage strategy, including foul and surface water design, hydraulic performance, exceedance routing, and long-term maintenance arrangements, ensuring full compliance with planning conditions and national guidance.

This document is supported by the following appendices:
Appendix A – Foul and Surface Water Drainage General Arrangement
Appendix B – Hydraulic calculations
Appendix C – Drainage Details SH1
Appendix D – Drainage Details SH2

Figure 1: Proposed Site Plan

2. Planning Conditions and Requirements

Planning permission includes several drainage-related conditions, most notably Conditions 9, 10 and 11.

Condition 9 requires submission of a detailed drainage design including discharge rates, attenuation, hydraulic calculations, and construction details. Condition 10 requires an assessment of exceedance flows and flood routing, demonstrating that the development will not increase flood risk on or off site. Condition 11 relates to temporary drainage during construction and has already been formally discharged under previous submissions .

This report therefore focuses on providing the full design information required to satisfy Conditions 9 and 10, incorporating revisions made in response to earlier LLFA comments.

Drainage Summary:

Condition 9:
No new information addressing the LLFA's comments in the Consultation Response dated 20/02/2025 has been submitted, therefore the previous comments still apply.

NOTE: The developer needs to address the LLFA's concerns set out in the Consultation Response dated 20/02/2025 that the various depth of sub-base below each of the permeable parking areas (to provide the required attenuation storage) have not been adequately noted on the drawings. This depth information will be required to be submitted to the LLFA – therefore, until this has been received, Condition 9 **cannot be** discharged.

Condition 10:
As noted in the Consultation Response dated 20/02/2025, no further information has been provided in response to the LLFA comments dated 28/01/2025. Therefore Condition 10 **cannot be** discharged.

Condition 11:
This has already been discharged.

Figure 2: LLFA Consultee Response 21/03/2025

3. Site Description and Existing Drainage

The site comprises a previously developed brownfield plot formerly occupied by a public house and associated hardstanding. The site is located within a built-up area and is currently served by an existing Yorkshire Water combined sewer within Knowl Road .

Ground levels fall generally toward the southeastern corner of the site, which forms the natural drainage low point. The proposed drainage outfall is therefore located within this area, specifically within Plot 4 garden and adjacent to the boundary with the neighbouring Conservative Club car park, where an existing connection to the combined sewer network is anticipated.

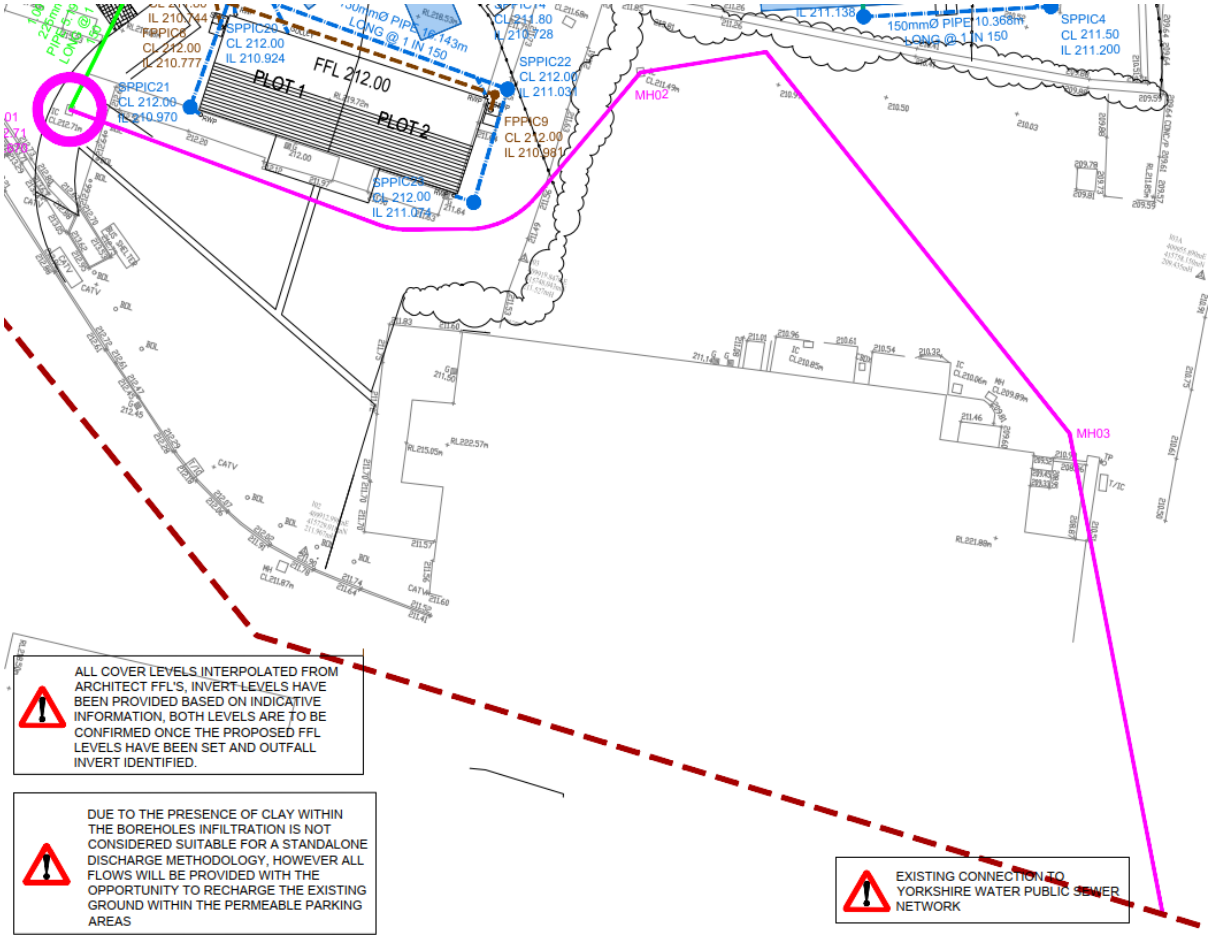

Figure 3: Pink line denotes the existing combined sewer network serving the site

4. Drainage Strategy Overview

The drainage strategy has been developed in accordance with national planning policy, the CIRIA SuDS Manual (C753), and local authority requirements.

A fully separate system of foul and surface water drainage is proposed across the development. Surface water runoff is collected via a network of gullies, permeable paving systems, and pipework before being conveyed to an attenuation system. Flows are then controlled using a Hydrobrake flow control device and discharged at a restricted rate to the existing Yorkshire Water combined sewer.

Foul water is collected independently and conveyed via a separate gravity system to the same combined sewer network, ensuring full compliance with Yorkshire Water requirements for separate systems on site.

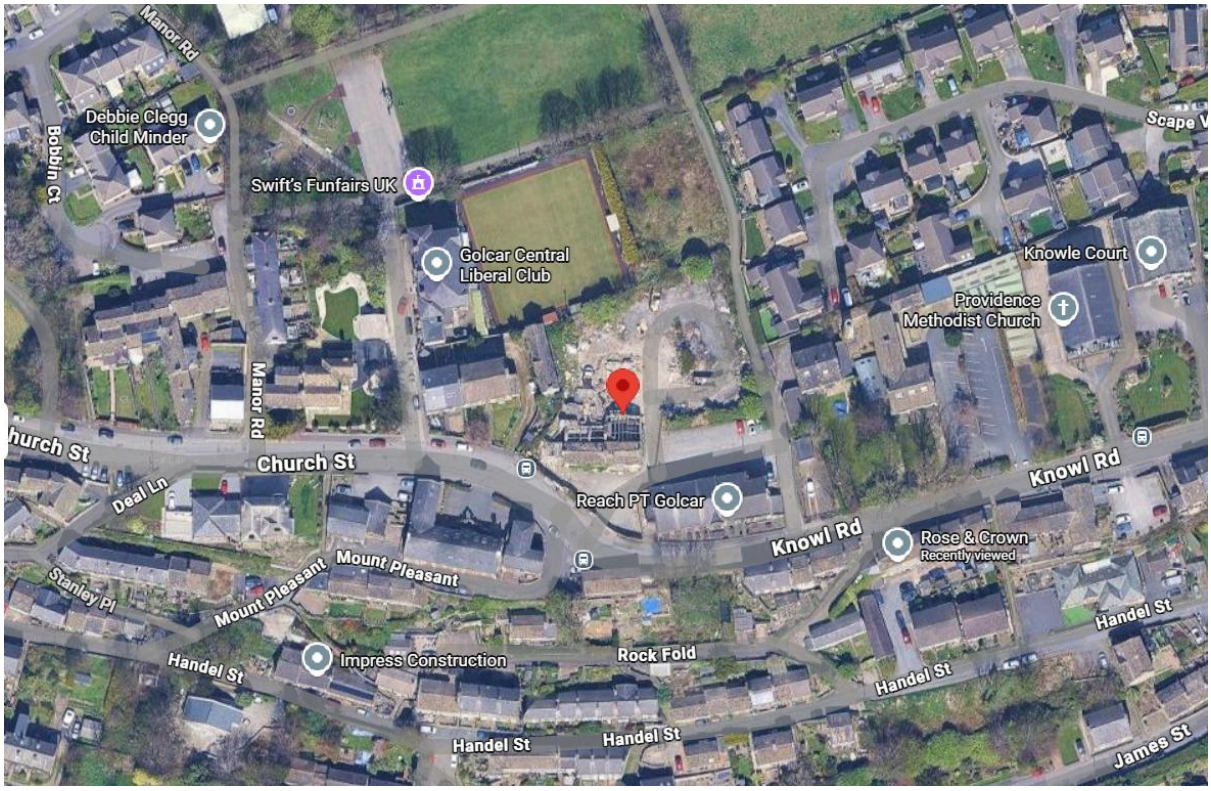

Figure 4: Site Ariel Image Location Plan

5. Drainage Hierarchy Assessment

The drainage strategy has been developed in accordance with the established hierarchy, prioritising infiltration where feasible. However, site investigations and infiltration testing have demonstrated that infiltration is not a viable option for this development.

Testing undertaken at the site confirms negligible infiltration potential, with modelling parameters indicating zero effective infiltration rates within the sub-base storage systems. Furthermore, previous LLFA consultation responses highlight the risk of surface water re-emergence and potential impacts on neighbouring properties at lower elevations, particularly those with basements.

Given these constraints, infiltration has been discounted. No suitable watercourse is available within proximity to the site, and therefore discharge to the public sewer has been adopted as the only practicable solution, in line with Yorkshire Water requirements

6. Proposed Surface Water Drainage Design

Surface water runoff from roofs, hardstanding, and permeable areas is managed through a combination of source control and attenuation features.

Permeable paving is utilised across parking and hardstanding areas, incorporating a granular sub-base (typically circa 350mm depth) to provide distributed attenuation storage. This is supplemented by pipe storage and inspection chambers across the network, forming a fully integrated drainage system.

The system has been designed to accommodate storm events up to the 1 in 100 year return period plus 45% climate change allowance, ensuring no flooding occurs within the site boundary.

Sub-base depths and storage volumes have been clearly defined within the updated drainage drawings and calculations (Appendices A and B), addressing previous LLFA concerns regarding insufficient detail.

7. Flow Control and Storage

Surface water discharge from the site is restricted via a Hydrobrake flow control device, designed to limit outflow to a maximum rate of 3.0 litres per second.

This controlled discharge represents a significant reduction compared to the existing runoff regime and achieves compliance with Yorkshire Water's requirement for a minimum 30% betterment in discharge rates.

The outfall is located at the southeastern boundary of the site and connects to the existing Yorkshire Water combined sewer network.

8. Hydraulic Modelling and Performance

Hydraulic modelling has been undertaken using Causeway Flow software to verify the performance of the drainage system.

The modelling demonstrates that the system operates effectively under all design storm events, with no flooding of nodes or exceedance of storage capacity. Flows are attenuated and discharged at the designed rate, with sufficient storage available across the network to accommodate peak rainfall events.

These results confirm that the system satisfies LLFA requirements for attenuation and performance under extreme storm conditions

9. Exceedance Flow Routing (Condition 10)

An assessment of exceedance flows has been undertaken to ensure that, in the event of rainfall exceeding the design capacity or partial system failure, surface water is safely managed within the site.

The layout has been designed to direct exceedance flows away from buildings and toward external hardstanding and roadways, ultimately routing water toward the southeast outfall location. Finished floor levels are set above surrounding ground levels to provide additional protection.

This ensures that no internal flooding of dwellings occurs and that the development does not increase flood risk to adjacent land, thereby satisfying Condition 10. GA Drainage plan show overland flow routes.

10. Foul Water Drainage

Foul water generated by the proposed dwellings will be collected via a conventional gravity drainage system, comprising underground pipework and inspection chambers. The layout of the foul drainage network is shown on the Foul Water General Arrangement drawing included in Appendix A.

The foul drainage system will convey flows to a connection point on the existing 225mm diameter combined sewer located within the Conservative Club Carpark. The connection will be made subject to approval from Yorkshire Water under a Section 106 sewer connection application.

The system will be designed and constructed in accordance with Building Regulations Part H, Sewers for Adoption (or the current Code for Adoption), and Yorkshire Water developer guidance. All pipework gradients, diameters and chamber arrangements will ensure efficient operation and maintenance access.

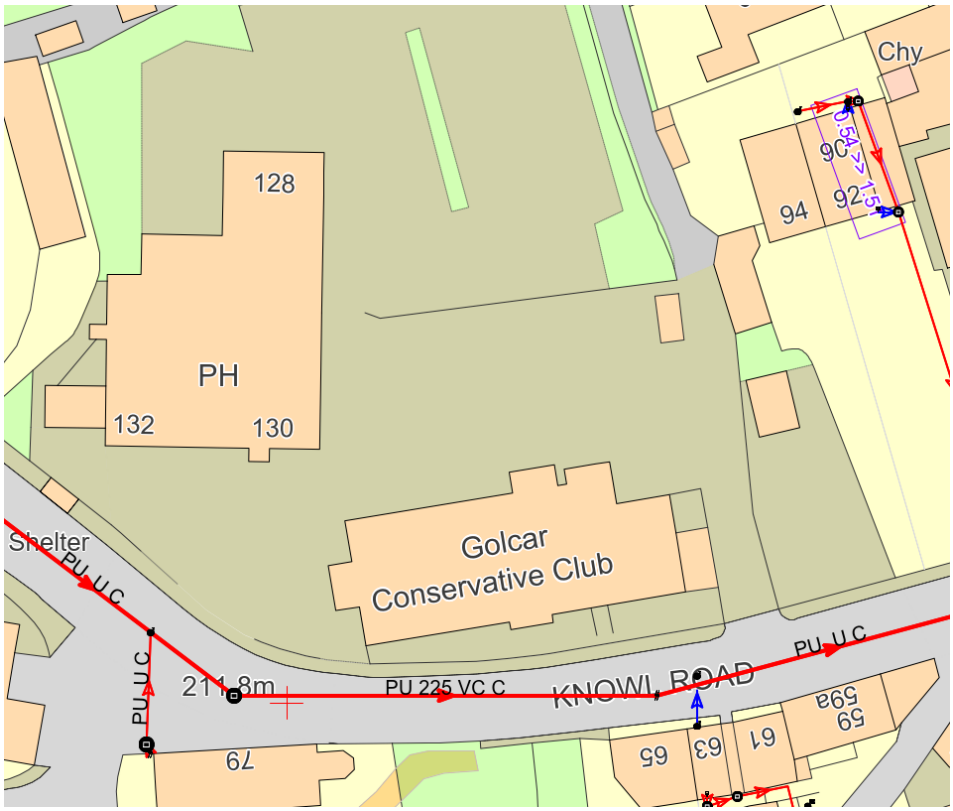

Figure 3 Existing Yorkshire Water Records

11. Maintenance and Management Plan

11.1. Overview

This Maintenance and Management Plan sets out the procedures and responsibilities for the ongoing operation and upkeep of the foul and surface water drainage systems serving the development at the Rose and Crown site, Golcar.

The objective of this plan is to ensure that the drainage system continues to function in accordance with the approved design for the lifetime of the development. This includes maintaining hydraulic performance, preserving attenuation capacity, preventing blockages and pollution, and ensuring that discharge rates remain compliant with the approved strategy.

The drainage system has been designed with accessible components, including inspection chambers, permeable paving systems, and flow control devices, to facilitate safe and efficient inspection and maintenance.

11.2. Ownership and Responsibility

All drainage infrastructure within private plots will be owned and maintained by individual property owners. Shared surface water infrastructure, including attenuation features, permeable paving areas serving multiple plots, and flow control structures, will be maintained by a site management company or other responsible body.

Any adopted sewer infrastructure and final connections to the existing Yorkshire Water combined sewer network will fall under the responsibility of Yorkshire Water following formal adoption, where applicable.

11.3. Maintenance Objectives

The maintenance strategy has been developed to achieve the following objectives:

- Ensure the continued effective operation of both surface water and foul drainage systems
- Prevent siltation, blockage, and deterioration of drainage components
- Maintain designed attenuation storage volumes and discharge rates
- Protect downstream sewer infrastructure from excessive flows or debris
- Ensure safe access for inspection and maintenance activities
- Provide a clear and auditable record of maintenance operations

11.4. Inspection and Maintenance Schedule

Routine inspection and maintenance shall be undertaken in accordance with the schedule below. This schedule has been prepared to reflect the specific components of the drainage system, including permeable paving, pipework, chambers, and flow control devices.

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Surface Water Drainage System

Element	Maintenance Activity	Frequency	Responsibility
Gullies / Drainage Inlets	Inspect for debris, leaves, and silt. Remove blockages and clean as required.	Quarterly and after heavy rainfall events	Property Owner / Management Company
Permeable Paving	Sweep surface to prevent clogging. Inspect for ponding or reduced permeability. Vacuum clean if required.	Twice yearly and after significant storms	Management Company
Sub-base Storage (Permeable Areas)	Inspect indirectly via surface performance (check for prolonged standing water).	Annually	Management Company
Surface Water Manholes / Chambers	Inspect for silt accumulation, debris, and structural condition. Remove silt where necessary.	Annually	Management Company
Pipework	Jet clean if reduced flow is observed. CCTV survey if persistent issues occur.	Every 3–5 years or as required	Management Company / Contractor
Hydrobrake Flow Control	Inspect chamber and control unit for blockage or debris. Confirm free operation and discharge control.	Annually	Specialist Contractor / Management Company
Outfall Connection	Inspect for obstruction, backflow, or damage at connection to combined sewer.	Annually	Management Company

Foul Water Drainage System

Element	Maintenance Activity	Frequency	Responsibility
Foul Inspection Chambers	Inspect for blockages, odours, or debris. Clean if required.	Annually	Property Owner
Private Foul Pipework	Check for signs of restricted flow or leaks. Jet clean if necessary.	As required	Property Owner / Contractor
Connection to Combined Sewer	Confirm integrity of connection and absence of surcharge or backflow issues.	Every 5 years or as required	Property Owner / Contractor

11.5. Emergency and Corrective Actions

In the event of system failure, blockage, or flooding, the responsible party shall arrange for immediate investigation by a competent drainage contractor.

Any blockages shall be cleared without delay, and damaged components repaired or replaced as necessary. Where issues relate to shared infrastructure or adopted systems, the relevant authority or management company shall be notified immediately.

All incidents and remedial actions shall be recorded within a maintenance log for future reference.

11.6. Record Keeping and Review

A record of all inspection, maintenance, and repair activities shall be maintained by the responsible party. These records shall include details of the date, nature of the inspection, any defects identified, and actions taken.

The maintenance plan shall be reviewed periodically, and at a minimum every five years, or following any significant changes to the drainage system or site layout.

This plan shall be retained with property documentation and passed to future owners or management bodies to ensure continuity of maintenance.

11.7. Summary

The proposed drainage system has been designed to be robust, accessible, and maintainable. Implementation of the above maintenance regime will ensure that the system continues to operate effectively, maintains its attenuation and discharge performance, and remains compliant with planning and regulatory requirements throughout the lifetime of the development.

12. Conclusion

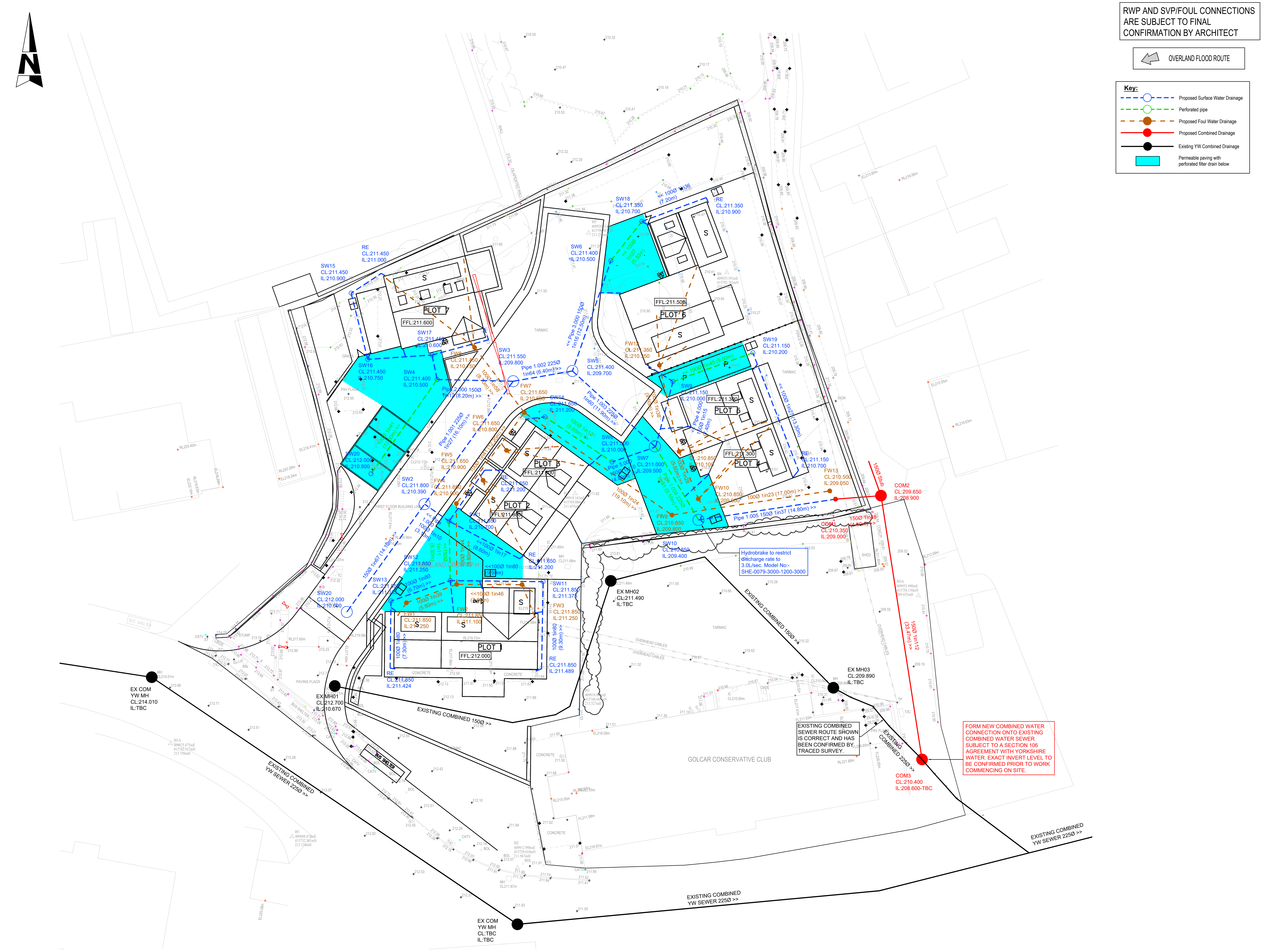
This report presents a comprehensive and fully coordinated drainage design for the approved development at the Rose and Crown Inn site. The design has been updated to reflect Section 78 amendments and to address all previous consultee comments.

The proposed drainage strategy complies with national policy, demonstrates that infiltration is not feasible, and provides a sustainable and controlled discharge to the existing combined sewer network.

The system incorporates appropriate attenuation, flow control, exceedance routing, and long-term maintenance provisions, ensuring that it will operate effectively throughout the lifetime of the development.

The proposals are therefore considered fully compliant with planning requirements and suitable for approval.

Appendix A – Appendix A – Foul and Surface Water Drainage General Arrangement



Proposed Drainage Plan (1:200)

Scale 1:1

0.01m 0m 0.02m 0.04m 0.06m

Drainage Notes

1. All private drainage works are to be constructed in accordance with the relevant provisions of BS EN 752 including by reference BS 8301, Building regulations part H and Sewers for Adoption 6th edition.
2. The Contractor MUST confirm invert levels of existing points of connection prior to commencement of drainage works.
3. Manhole invert levels relate to the downstream pipe. Pipes at manholes to be laid soffit to soffit level.
4. Unless otherwise shown, foul pipes to be 100mm Ø laid at 1 in 40 minimum gradient unless one w.c. connected where gradient may be 1 in 80 minimum.
5. Unless otherwise shown surface water pipes to be 150mm Ø laid at 1 in 100 minimum gradient.
6. Where cover to top of pipe barrel is less than 900mm in lightly trafficked areas and 600mm in non trafficked areas, pipe to have minimum 150mm ST4 concrete surround.
7. Where cover to pipe barrel located beneath highways is less than 1200mm, pipes are to be protected with concrete surround (bed type Z) Grade C20 in accordance with sewers for adoption 6th edition, table 2.4.
8. Manhole cover levels where not shown are to be confirmed at later stage. Covers are to be fixed to a profile corresponding to the surrounding pavement surface and may be adjusted to suit actual site levels.
9. All pipework up to 300mm Ø to be standard strength vitrified clay to BS EN 295 (min crushing strength 40KN/m) or plastic to BS 4660:2000 and BS EN 1401-1:1998 and shall comply with the requirements of Sewers for Adoption 6th Edition.
10. All pipework larger than 300mm Ø to be Class 120 precast concrete to BS EN1916:2002 and shall comply with the requirements of Sewers for Adoption 6th Edition.
11. Bedding to all pipework to be Class S granular bed & surround in accordance with BS882 or Class Z (see manhole schedule and/or details drawing).
12. All backfill above gravel surround in drainage trenches and under building slabs to be Type 1 stone compacted in layers not exceeding 225mm thick.
13. Manholes to be precast concrete to BS EN1917: 2002, Type B, in accordance with the requirements of Sewers for Adoption, 6th Edition unless noted otherwise.
14. Inspection chambers to be polypropylene, 475mm diameter, Hepworth range or similar & approved. Opening restricted to max 350mm where depth of chamber exceeds 1.2m.
15. All manholes covers and gully gratings located in trafficked areas to be ductile iron class D400. Covers located in non trafficked areas to be min class B125 unless noted otherwise on the drainage layout or manhole schedule.
16. Any external recessed cover required or internal manhole covers to be specified by the Architect.
17. Proprietary attenuation systems, cellular soakaways and petrol/oil interceptors to be installed in accordance with the manufacturers details and recommendations, including bedding and surround, membranes, protection and backfill requirements.
18. Position and details of rainwater pipes, and foul connections to be confirmed by Architect.
19. For above ground and internal drainage, vents, fittings and access points refer to Architects and/or M&E details.
20. Cover levels of private drainage chambers may be adjusted to suit actual site levels.
21. The contractor is responsible for applying to Yorkshire Water for a Section 106 sewer connection.
22. The contractor is responsible for identifying and locating all existing services and ensuring that the levels do not conflict with the proposed drainage system. If there are any such conflicts then the Engineer must be made aware immediately.
23. All existing redundant drainage systems are to be abandoned and grubbed up including redundant manholes and pipework. The voids are to be backfilled with as dug material or suitable fill material and compacted in layers.
24. Any live sewer connections found in any sewers that are to be abandoned are to be picked up and diverted.

Revision	Date	Description
B	29/04/26	First Issue
A	24/04/26	First Issue

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Project

ROSE AND CROWN

Drawing Title

DRAINAGE PLAN

Drawing Number DR-001

Drawn: TM | Date: 24/04/2026 | Scale: 1:200 @ A1 | Rev: B

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Appendix B – Hydraulic calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Inverts
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)	Invert Level (m)
SW1	0.025	10.00	211.650	450	0.950	210.700
SW2	0.021	5.00	211.800	1200	1.410	210.390
SW3	0.011	5.00	211.550	1200	1.750	209.800
SW4	0.019	10.00	211.400	450	0.900	210.500
SW5	0.018	5.00	211.400	1200	1.700	209.700
SW6	0.012	10.00	211.400	450	0.900	210.500
SW7	0.015	10.00	211.000	1200	1.500	209.500
SW8	0.009	10.00	211.500	450	1.500	210.000
SW9	0.012	10.00	211.150	450	1.150	210.000
SW10			210.850	1200	1.450	209.400
COM1			210.350	450	1.350	209.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SW1	SW2	3.100	0.600	210.700	210.390	0.310	10.0	150	10.02	38.0
1.001	SW2	SW3	16.100	0.600	210.390	209.800	0.590	27.3	225	10.12	37.8
2.000	SW4	SW3	8.200	0.600	210.500	209.800	0.700	11.7	150	10.05	38.0
1.002	SW3	SW5	6.400	0.600	209.800	209.700	0.100	64.0	225	10.19	37.7
3.000	SW6	SW5	12.500	0.600	210.500	209.700	0.800	15.6	150	10.08	37.9
1.003	SW5	SW7	11.900	0.600	209.700	209.500	0.200	59.5	225	10.30	37.5
4.000	SW9	SW7	7.400	0.600	210.000	209.500	0.500	14.8	150	10.05	38.0
5.000	SW8	SW7	4.800	0.600	210.000	209.500	0.500	9.6	150	10.02	38.0
1.004	SW7	SW10	9.100	0.600	209.500	209.400	0.100	91.0	225	10.42	37.3
1.005	SW10	COM1	14.800	0.600	209.400	209.000	0.400	37.0	150	10.56	0.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	3.204	56.6	2.6	0.800	1.260	0.025	0.0	22	1.639
1.001	2.514	100.0	4.7	1.185	1.525	0.046	0.0	33	1.297
2.000	2.960	52.3	2.0	0.750	1.600	0.019	0.0	20	1.410
1.002	1.637	65.1	7.8	1.525	1.475	0.076	0.0	52	1.111
3.000	2.561	45.3	1.2	0.750	1.550	0.012	0.0	17	1.123
1.003	1.698	67.5	10.8	1.475	1.275	0.106	0.0	60	1.248
4.000	2.632	46.5	1.2	1.000	1.350	0.012	0.0	17	1.129
5.000	3.271	57.8	0.9	1.350	1.350	0.009	0.0	13	1.203
1.004	1.371	54.5	14.4	1.275	1.225	0.142	0.0	79	1.161
1.005	1.660	29.3	0.0	1.300	1.200	0.142	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	3.100	10.0	150	Circular	211.650	210.700	0.800	211.800	210.390	1.260
1.001	16.100	27.3	225	Circular	211.800	210.390	1.185	211.550	209.800	1.525
2.000	8.200	11.7	150	Circular	211.400	210.500	0.750	211.550	209.800	1.600
1.002	6.400	64.0	225	Circular	211.550	209.800	1.525	211.400	209.700	1.475
3.000	12.500	15.6	150	Circular	211.400	210.500	0.750	211.400	209.700	1.550
1.003	11.900	59.5	225	Circular	211.400	209.700	1.475	211.000	209.500	1.275
4.000	7.400	14.8	150	Circular	211.150	210.000	1.000	211.000	209.500	1.350
5.000	4.800	9.6	150	Circular	211.500	210.000	1.350	211.000	209.500	1.350
1.004	9.100	91.0	225	Circular	211.000	209.500	1.275	210.850	209.400	1.225
1.005	14.800	37.0	150	Circular	210.850	209.400	1.300	210.350	209.000	1.200

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SW1	450	Manhole	Adoptable	SW2	1200	Manhole	Adoptable
1.001	SW2	1200	Manhole	Adoptable	SW3	1200	Manhole	Adoptable
2.000	SW4	450	Manhole	Adoptable	SW3	1200	Manhole	Adoptable
1.002	SW3	1200	Manhole	Adoptable	SW5	1200	Manhole	Adoptable
3.000	SW6	450	Manhole	Adoptable	SW5	1200	Manhole	Adoptable
1.003	SW5	1200	Manhole	Adoptable	SW7	1200	Manhole	Adoptable
4.000	SW9	450	Manhole	Adoptable	SW7	1200	Manhole	Adoptable
5.000	SW8	450	Manhole	Adoptable	SW7	1200	Manhole	Adoptable
1.004	SW7	1200	Manhole	Adoptable	SW10	1200	Manhole	Adoptable
1.005	SW10	1200	Manhole	Adoptable	COM1	450	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW1	211.650	0.950	450	0	1.000	210.700	150
SW2	211.800	1.410	1200	1	1.000	210.390	150
				0	1.001	210.390	225
SW3	211.550	1.750	1200	1	2.000	209.800	150
				2	1.001	209.800	225
				0	1.002	209.800	225
SW4	211.400	0.900	450	0	2.000	210.500	150
SW5	211.400	1.700	1200	1	3.000	209.700	150
				2	1.002	209.700	225
				0	1.003	209.700	225
SW6	211.400	0.900	450	0	3.000	210.500	150

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW7	211.000	1.500	1200	1	5.000	209.500	150
				2	4.000	209.500	150
				3	1.003	209.500	225
				0	1.004	209.500	225
SW8	211.500	1.500	450				
				0	5.000	210.000	150
SW9	211.150	1.150	450				
				0	4.000	210.000	150
SW10	210.850	1.450	1200	1	1.004	209.400	225
				0	1.005	209.400	150
COM1	210.350	1.350	450	1	1.005	209.000	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	17.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.300	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	40	0	0
100	45	0	0

Node SW10 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	209.400	Product Number	CTL-SHE-0079-3000-1200-3000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.0	Min Node Diameter (mm)	1200

Node SW1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	210.700	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.35	Length (m)	8.300		

Node SW4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	210.500	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.35	Length (m)	9.300		

Node SW6 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	210.500	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.35	Length (m)	4.100		

Node SW8 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	210.000	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	16	Depth (m)	
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.35	Length (m)	4.400		

Node SW9 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	210.000	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	104	Depth (m)	
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.35	Length (m)	3.000		

Node SW7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	209.500	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	228	Depth (m)	
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.35	Length (m)	7.500		

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW1	14	210.718	0.018	1.8	0.1030	0.0000	OK
15 minute winter	SW2	11	210.420	0.030	3.8	0.0427	0.0000	OK
15 minute winter	SW3	11	209.849	0.049	6.2	0.0620	0.0000	OK
15 minute winter	SW4	14	210.517	0.017	1.4	0.0869	0.0000	OK
15 minute winter	SW5	11	209.755	0.055	8.7	0.0742	0.0000	OK
15 minute winter	SW6	14	210.515	0.015	0.9	0.0639	0.0000	OK
60 minute winter	SW7	49	209.695	0.195	11.0	4.7256	0.0000	OK
15 minute winter	SW8	14	210.012	0.012	0.7	0.0399	0.0000	OK
15 minute winter	SW9	14	210.015	0.015	0.9	0.0615	0.0000	OK
60 minute winter	SW10	48	209.695	0.295	10.6	0.3339	0.0000	SURCHARGED
60 minute winter	COM1	50	209.032	0.032	2.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW1	1.000	SW2	1.8	1.167	0.032	0.0057	
15 minute winter	SW2	1.001	SW3	3.8	0.816	0.038	0.0767	
15 minute winter	SW3	1.002	SW5	6.1	0.887	0.094	0.0447	
15 minute winter	SW4	2.000	SW3	1.4	0.582	0.027	0.0248	
15 minute winter	SW5	1.003	SW7	8.8	1.099	0.130	0.1943	
15 minute winter	SW6	3.000	SW5	0.9	0.357	0.020	0.0417	
60 minute winter	SW7	1.004	SW10	10.6	0.403	0.194	0.3474	
15 minute winter	SW8	5.000	SW7	0.7	0.288	0.012	0.0433	
15 minute winter	SW9	4.000	SW7	0.9	0.238	0.019	0.0675	
60 minute winter	SW10	1.005	COM1	2.9	1.045	0.098	0.0409	12.6

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW1	14	210.735	0.035	6.3	0.3406	0.0000	OK
15 minute winter	SW2	11	210.445	0.055	13.1	0.0784	0.0000	OK
120 minute winter	SW3	118	210.366	0.566	10.1	0.7116	0.0000	SURCHARGED
15 minute winter	SW4	13	210.531	0.031	4.8	0.2656	0.0000	OK
120 minute winter	SW5	118	210.366	0.666	13.5	0.8945	0.0000	SURCHARGED
15 minute winter	SW6	14	210.526	0.026	3.0	0.1924	0.0000	OK
120 minute winter	SW7	118	210.366	0.866	16.2	23.2266	0.0000	SURCHARGED
120 minute winter	SW8	118	210.366	0.366	4.7	5.4599	0.0000	SURCHARGED
120 minute winter	SW9	118	210.366	0.366	3.8	3.8720	0.0000	SURCHARGED
120 minute winter	SW10	118	210.366	0.965	9.2	1.0919	0.0000	SURCHARGED
15 minute winter	COM1	97	209.032	0.032	2.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW1	1.000	SW2	6.1	1.660	0.108	0.0134	
15 minute winter	SW2	1.001	SW3	13.1	1.074	0.131	0.3596	
120 minute winter	SW3	1.002	SW5	9.5	0.908	0.146	0.2545	
15 minute winter	SW4	2.000	SW3	4.7	0.615	0.091	0.0827	
120 minute winter	SW5	1.003	SW7	13.1	0.714	0.193	0.4733	
15 minute winter	SW6	3.000	SW5	3.0	0.362	0.066	0.1229	
120 minute winter	SW7	1.004	SW10	9.2	0.421	0.168	0.3619	
120 minute winter	SW8	5.000	SW7	-3.5	0.259	-0.060	0.0845	
120 minute winter	SW9	4.000	SW7	-2.2	0.207	-0.048	0.1303	
120 minute winter	SW10	1.005	COM1	2.9	1.050	0.100	0.0413	55.1

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	SW1	21	210.741	0.041	8.5	0.4660	0.0000	OK
180 minute winter	SW2	172	210.619	0.229	6.4	0.3277	0.0000	SURCHARGED
180 minute winter	SW3	172	210.619	0.819	10.6	1.0298	0.0000	SURCHARGED
180 minute winter	SW4	172	210.619	0.119	2.7	2.9464	0.0000	OK
180 minute winter	SW5	172	210.619	0.919	14.0	1.2344	0.0000	SURCHARGED
180 minute winter	SW6	172	210.619	0.119	1.7	1.5514	0.0000	OK
180 minute winter	SW7	172	210.619	1.119	15.6	30.2050	0.0000	SURCHARGED
180 minute winter	SW8	172	210.619	0.619	4.5	9.3966	0.0000	SURCHARGED
180 minute winter	SW9	172	210.619	0.619	3.4	6.6220	0.0000	SURCHARGED
180 minute winter	SW10	172	210.618	1.218	9.6	1.3780	0.0000	FLOOD RISK
180 minute winter	COM1	176	209.032	0.032	3.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	SW1	1.000	SW2	8.3	1.702	0.146	0.0159	
180 minute winter	SW2	1.001	SW3	6.4	0.855	0.064	0.6403	
180 minute winter	SW3	1.002	SW5	9.8	0.869	0.151	0.2545	
180 minute winter	SW4	2.000	SW3	2.7	0.550	0.051	0.1338	
180 minute winter	SW5	1.003	SW7	13.5	0.683	0.200	0.4733	
180 minute winter	SW6	3.000	SW5	1.7	0.298	0.037	0.2038	
180 minute winter	SW7	1.004	SW10	9.6	0.394	0.175	0.3619	
180 minute winter	SW8	5.000	SW7	-3.3	0.292	-0.056	0.0845	
180 minute winter	SW9	4.000	SW7	-2.0	0.251	-0.042	0.1303	
180 minute winter	SW10	1.005	COM1	3.0	1.056	0.102	0.0418	66.3

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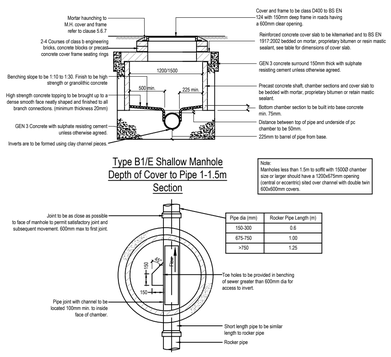
Appendix C – Drainage Details SH1



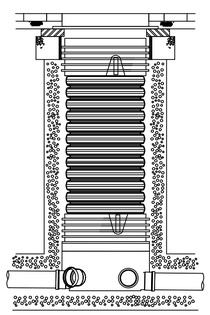
Type B1/E Shallow Manhole
Depth of Cover to Pipe 1-1.5m
Section

Note:
Manholes less than 1.5m to soffit with 1500Ø chamber size or larger should have a 1200x675mm opening (central or eccentric) sited over channel with double twin 600x600mm covers.

Pipe dia (mm)	Rocker Pipe Length (m)
150-300	0.6
675-750	1.00
>750	1.25

Plan

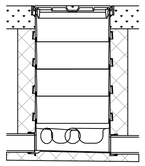
Polypropylene inspection chambers to BS 7158:2001 Kitemarked. min 450mm Ø to be Wavin Deep Inspection Chamber or similar approved



Polypropylene Inspection Chamber (Depth 1.2 - 3m)

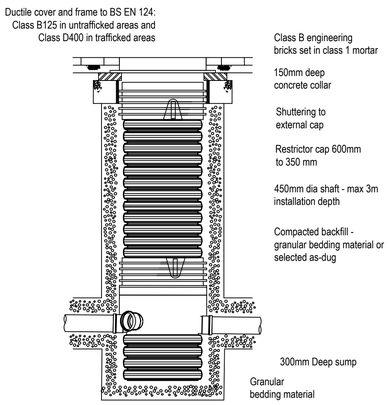
Scale 1:20

Polypropylene inspection chambers to BS 7158:2001 Kitemarked. min 450mm Ø to be Osmadrain Universal Inspection Chamber or similar approved



Polypropylene Inspection Chamber (Depth less than 1.2m) in Untrafficked Areas

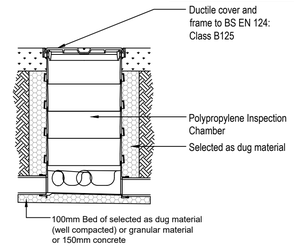
Scale 1:20



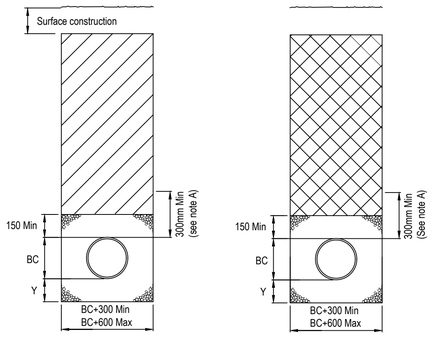
Polypropylene Inspection Chamber Catchpit

Scale 1:20

Polypropylene Inspection Chambers to BS 7158:2001 Kitemarked. Min 450mm Ø to BE OSMADRAIN UNIVERSAL inspection chamber

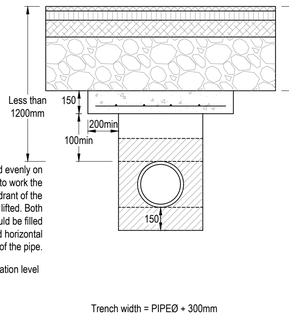


Typical Polypropylene Inspection Chamber in landscaped areas 1:20



Side fill material to be placed evenly on both sides of pipe taking care to work the material under the lower quadrant of the pipe ensuring the pipe is not lifted. Both sides of the trench should be filled simultaneously to avoid horizontal movement of the pipe.

Formation level



Trench width = PIPEØ + 300mm

150mm reinforced concrete slab. min ST4 with A393 mesh or as agreed with adopting authority.

Mechanical compaction of main backfill material should not be commenced until there is a total cover depth of 300mm above the crown of the pipe

Initial backfill

Single size or graded gravel to WIS 4-08-02. See table A2 for details. (Yorkshire Water prefer single size 10mm clean gravel.

Lower bedding Min.150mm

Drains with Flexible Bed & Surround

Type 'S'

Applicable under roads/service yards where drains have more than 1200 cover (if adopted) or more than 600 cover (if not adopted)

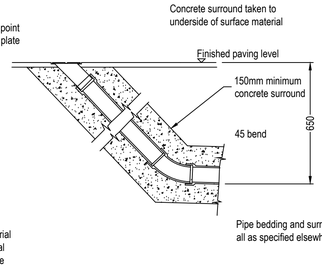
Type 'S'

Applicable under footpaths verges and other non-trafficked areas where drains have more than 900 cover (if adopted) or more than 600 cover (if not adopted)

Type Z Concrete Protection

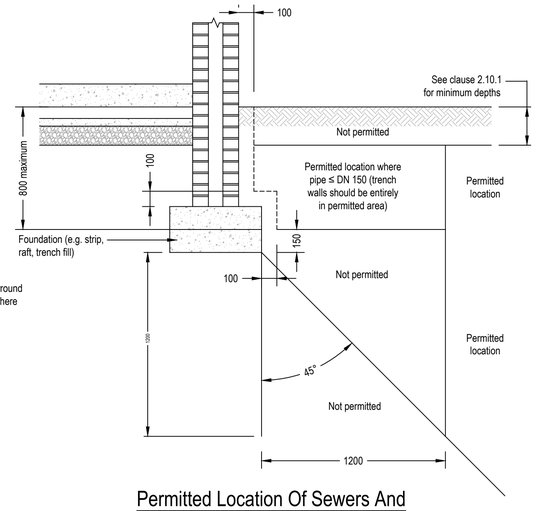
Type 'Z'

Applicable under roads/service yards where drains have less than 1200 cover or footpaths verges and other non-trafficked areas where drains have less than 600 cover



Typical Rodding Eye Detail

Scale 1:20



Permitted Location Of Sewers And Lateral Drains In Proximity To Buildings

Scale 1:20

Bedding & Trench Details

Scale 1:20

Key

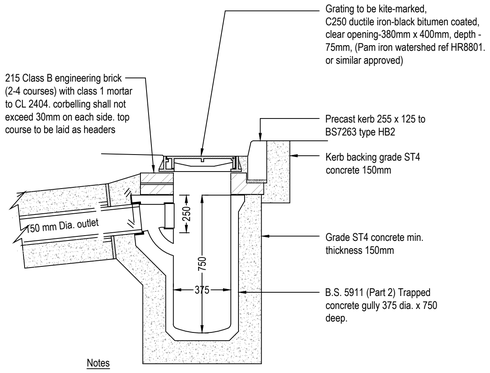
BC	Outside diameter of pipe.
Y	BC/6 OR 100mm under barrels and 50mm min. under sockets whichever is greater (400mm max.)
	or
Y	BC/4 or 200mm under barrels and 150mm min. under sockets whichever is greater (400mm max.) For trenches in hard material.
	Earthworks outline.
	Granular material (see table)
	Selected clean excavated material to SfHW Clause 505 & 601. Class 1, 2, OR 3.
	Granular Type 1 material deposited in layers not exceeding 225mm unconsolidated thickness and then fully compacted.

Granular Material	
Dia. of Drain	Aggregate
100mm	10mm single size
150mm	10mm or 14mm single size or 5-20mm graded.
225mm-525mm	10mm or 14mm single size or 5-20mm graded.
Over 525mm	10, 14, 20 or 40mm single size or 5-20mm graded.

Note A
No mechanical compaction within 300mm of crown of pipe.

Note B
Where drains are laid under buildings refer to engineer for further details.

TRENCH WIDTHS	
DIA OF DRAIN	WIDTH
100	550
150	600
225	700
300	750
375	1020
450	1150
525	1200
600	1350
675	1450
750	1500
825	1600
900	1900
975	2000
1050	2300
1200	2300
Over 1200	Dia+1000

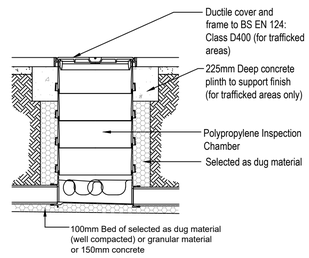


Notes

1. Desirable min. slope of gully outfall to be 1 in 10.
2. Gully connections to be Type Z bed and surround to 1.2m depth.
3. Excavations around gullies to be backfilled with Class 1 material as described in table 6/1 and compacted as described in compliance with Clause 612. where mechanical compaction is impracticable, the excavation is to be backfilled with grade ST2 concrete.

Precast Concrete Road Gully Detail

1:20



Typical Polypropylene Inspection Chamber in trafficked areas 1:20

Drainage Notes

1. All private drainage works are to be constructed in accordance with the relevant provisions of BS EN 752 including by reference BS 8301, Building regulations part H and Sewers for Adoption 6th edition.
2. The Contractor MUST confirm invert levels of existing points of connection prior to commencement of drainage works.
3. Manhole invert levels relate to the downstream pipe. Pipes at manholes to be laid soffit to soffit level.
4. Unless otherwise shown, foul pipes to be 100mm Ø laid at 1 in 40 minimum gradient unless one w.c. connected where gradient may be 1 in 80 minimum.
5. Unless otherwise shown surface water pipes to be 150mm Ø laid at 1 in 100 minimum gradient.
6. Where cover to top of pipe barrel is less than 900mm in lightly trafficked areas and 600mm in non trafficked areas, pipe to have minimum 150mm ST4 concrete surround.
7. Where cover to pipe barrel located beneath highways is less than 1200mm, pipes are to be protected with concrete surround (bed type Z) Grade C20 in accordance with sewers for adoption 6th edition, table 2.4.
8. Manhole cover levels where not shown are to be confirmed at later stage. Covers are to be fixed to a profile corresponding to the surrounding pavement surface and may be adjusted to suit actual site levels.
9. All pipework up to 300mm Ø to be standard strength vitrified clay to BS EN 295 (min crushing strength 40KN/m) or plastic to BS 4660:2000 and BS EN 1401-1:1998 and shall comply with the requirements of Sewers for Adoption 6th Edition.
10. All pipework larger than 300mm Ø to be Class 120 precast concrete to BS EN1916:2002 and shall comply with the requirements of Sewers for Adoption 6th Edition.
11. Bedding to all pipework to be Class S granular bed & surround in accordance with BS882 or Class Z (see manhole schedule and/or details drawing).
12. All backfill above gravel surround in drainage trenches and under building slabs to be Type 1 stone compacted in layers not exceeding 225mm thick.
13. Manholes to be precast concrete to BS EN1917: 2002, Type B, in accordance with the requirements of Sewers for Adoption, 6th Edition unless noted otherwise.
14. Inspection chambers to be polypropylene, 475mm diameter, Hepworth range or similar & approved. Opening restricted to max 350mm where depth of chamber exceeds 1.2m.
15. All manholes covers and gully gratings located in trafficked areas to be ductile iron class D400. Covers located in non trafficked areas to be min class B125 unless noted otherwise on the drainage layout or manhole schedule.
16. Any external recessed cover required or internal manhole covers to be specified by the Architect.
17. Proprietary attenuation systems, cellular soakaways and petrol/oil interceptors to be installed in accordance with the manufacturers details and recommendations, including bedding and surround, membranes, protection and backfill requirements.
18. Position and details of rainwater pipes, and foul connections to be confirmed by Architect.
19. For above ground and internal drainage, vents, fittings and access points refer to Architects and/or M&E details.
20. Cover levels of private drainage chambers may be adjusted to suit actual site levels.
21. The contractor is responsible for applying to Yorkshire Water for a Section 106 sewer connection.
22. The contractor is responsible for identifying and locating all existing services and ensuring that the levels do not conflict with the proposed drainage system. If there are any such conflicts then the Engineer must be made aware immediately.
23. All existing redundant drainage systems are to be abandoned and grubbed up including redundant manholes and pipework. The voids are to be backfilled with as dug material or suitable fill material and compacted in layers.
24. Any live sewer connections found in any sewers that are to be abandoned are to be picked up and diverted.

Revision	Date	Description
Revision	Date	Description
Revision	Date	Description
Revision	Date	Description
Revision A	Date 24/04/26	Description First Issue

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Project
ROSE AND CROWN

Drawing Title
DRAINAGE DETAILS SH1

Drawing Number
DR-002

Drawn: TM | Date: 24/04/2026 | Scale: As Shown @ A1 | Rev: A

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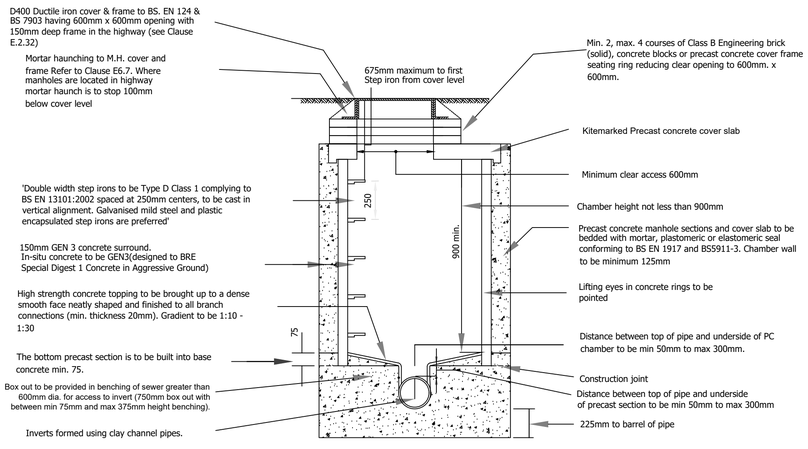
Appendix D – Drainage Details SH2

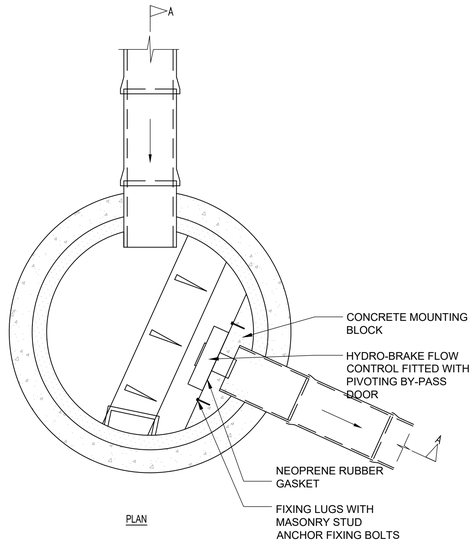
Typical Manhole Construction

Type B (Design and Construction Guidance)

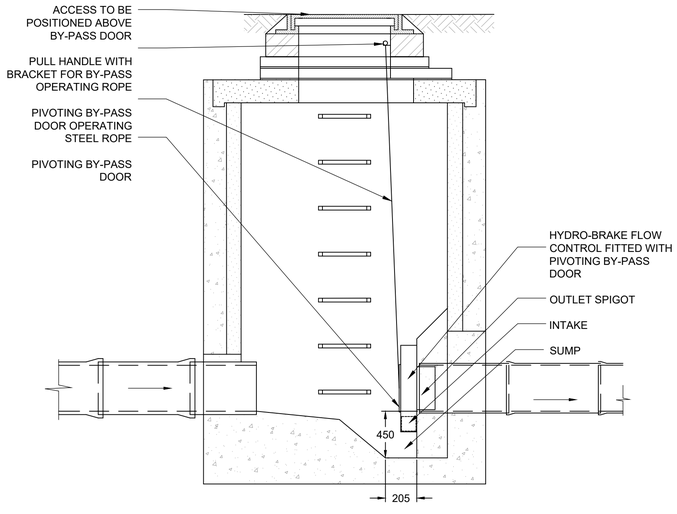
Maximum depth from cover level to sofit of pipe 3000mm



Section View



PLAN



SECTION

TYPICAL HYDROBRAKE CHAMBER

SCALE 1:20

Drainage Notes

1. All private drainage works are to be constructed in accordance with the relevant provisions of BS EN 752 including by reference BS 8301, Building regulations part H and Sewers for Adoption 6th edition.
2. The Contractor MUST confirm invert levels of existing points of connection prior to commencement of drainage works.
3. Manhole invert levels relate to the downstream pipe. Pipes at manholes to be laid soffit to soffit level.
4. Unless otherwise shown, foul pipes to be 100mm Ø laid at 1 in 40 minimum gradient unless one w.c. connected where gradient may be 1 in 80 minimum.
5. Unless otherwise shown surface water pipes to be 150mm Ø laid at 1 in 100 minimum gradient.
6. Where cover to top of pipe barrel is less than 900mm in lightly trafficked areas and 600mm in non trafficked areas, pipe to have minimum 150mm ST4 concrete surround.
7. Where cover to pipe barrel located beneath highways is less than 1200mm, pipes are to be protected with concrete surround (bed type Z) Grade C20 in accordance with sewers for adoption 6th edition, table 2.4.
8. Manhole cover levels where not shown are to be confirmed at later stage. Covers are to be fixed to a profile corresponding to the surrounding pavement surface and may be adjusted to suit actual site levels.
9. All pipework up to 300mm Ø to be standard strength vitrified clay to BS EN 295 (min crushing strength 40KN/m) or plastic to BS 4660:2000 and BS EN 1401-1:1998 and shall comply with the requirements of Sewers for Adoption 6th Edition.
10. All pipework larger than 300mm Ø to be Class 120 precast concrete to BS EN1916:2002 and shall comply with the requirements of Sewers for Adoption 6th Edition.
11. Bedding to all pipework to be Class S granular bed & surround in accordance with BS882 or Class Z (see manhole schedule and/or details drawing).
12. All backfill above gravel surround in drainage trenches and under building slabs to be Type 1 stone compacted in layers not exceeding 225mm thick.
13. Manholes to be precast concrete to BS EN1917: 2002, Type B, in accordance with the requirements of Sewers for Adoption, 6th Edition unless noted otherwise.
14. Inspection chambers to be polypropylene, 475mm diameter, Hepworth range or similar & approved. Opening restricted to max 350mm where depth of chamber exceeds 1.2m.
15. All manholes covers and gully gratings located in trafficked areas to be ductile iron class D400. Covers located in non trafficked areas to be min class B125 unless noted otherwise on the drainage layout or manhole schedule.
16. Any external recessed cover required or internal manhole covers to be specified by the Architect.
17. Proprietary attenuation systems, cellular soakaways and petrol/oil interceptors to be installed in accordance with the manufacturers details and recommendations, including bedding and surround, membranes, protection and backfill requirements.
18. Position and details of rainwater pipes, and foul connections to be confirmed by Architect.
19. For above ground and internal drainage, vents, fittings and access points refer to Architects and/or M&E details.
20. Cover levels of private drainage chambers may be adjusted to suit actual site levels.
21. The contractor is responsible for applying to Yorkshire Water for a Section 106 sewer connection.
22. The contractor is responsible for identifying and locating all existing services and ensuring that the levels do not conflict with the proposed drainage system. If there are any such conflicts then the Engineer must be made aware immediately.
23. All existing redundant drainage systems are to be abandoned and grubbed up including redundant manholes and pipework. The voids are to be backfilled with as dug material or suitable fill material and compacted in layers.
24. Any live sewer connections found in any sewers that are to be abandoned are to be picked up and diverted.

Revision	Date	Description
Revision	Date	Description
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Revision	Date	Description
A	24/04/26	First Issue

HME

CIVIL ENGINEERING

CONSULTANTS

Project

ROSE AND CROWN

Drawing Title

DRAINAGE DETAILS SH2

Drawing Number

DR-003

Drawn:	Date:	Scale:	Rev:
TM	24/04/2026	As Shown @ A1	A