

GWK STRUCTURAL SOLUTIONS LTD **CONSULTING ENGINEERS**

Proposed Drainage Strategy to Discharge Planning Condition 5 of Application Ref:23/01256/FUL

PROJECT REFERENCE:

- **Project No:** GK4863
- **Project Location:** 962 Edenfield Road, Norden, Rochdale, OL12 7TW.
- **Project Title:** 962 Edenfield Road.
- **Client:** Mrs H Jackson

				APPROVALS	
Issue	Date	Pages	Issue Description	By	Check
A	16/01/2025		Issued to discharge planning condition	PG	GWK
☒ Entire Report Issued this Revision		Report Issued for:			
☐ Revised Pages Only Issued this Revision		☐ In-house Review	☐ Purchase		
		☐ Client Approval	☐ Construction		
		☐ Inquiry	☒ Planning		

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1.0 Introduction

1.1 Summary

In 2023 a planning application was submitted to Rochdale Borough Council for the construction of a detached dwelling associated car parking, access and landscaping on land at 962 Edenfield Roda, Norden, Rochdale, OL12 7TW.

Planning approval was granted (ref:23/01256/FUL) in 2024

This report has been prepared to discharge the drainage related planning condition; Number 5.

2.0 Drainage Strategy

2.1 Existing Drainage

The United Utilities sewer records have been reviewed and identify a 225mm diameter combined water public sewer flowing in a south easterly direction beneath Edenfield Road. No surface water sewers have been identified in close proximity. Refer to Figure 1 below.

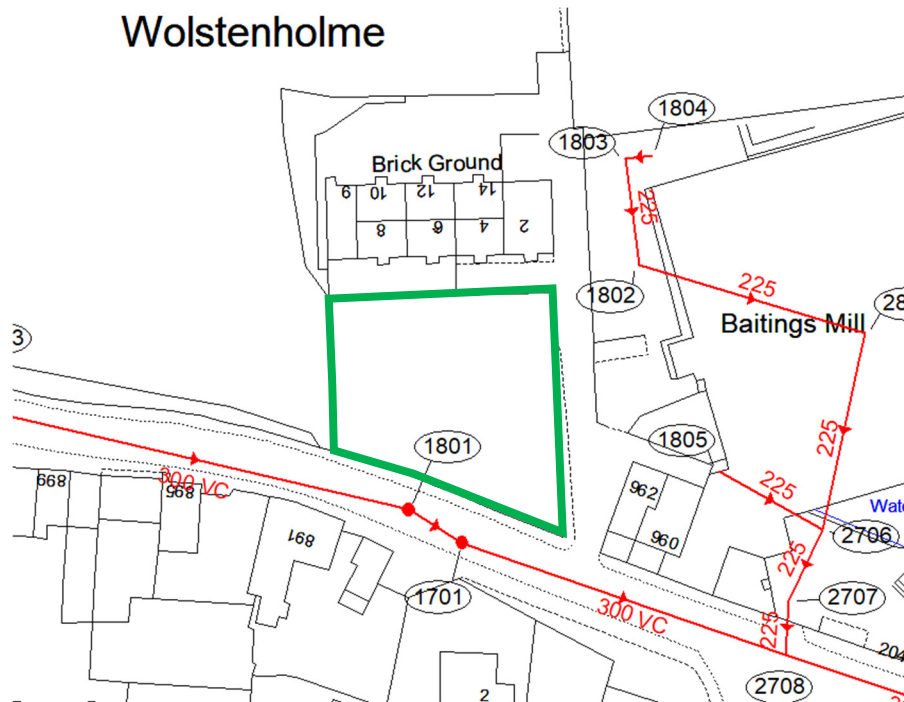


Figure 1: UU Sewer Plans (from 2006)

The area of the proposed development currently encompasses an unmade area of land with no positive drainage identified.

2.2 Existing Geology

At this time a Phase 2 ground investigation has not been completed at the site. A review of the BGS dataset has indicated the superficial geology to encompass Till/Devensian – Silts and clays with the Bedrock geology comprising the Pennine Lower Coal Measures Formation – Mudstone.

In light of these findings and the underlying cohesive ground, infiltration as a means of draining the site has been discounted.

2.3 Hydrology

The closest identified watercourse is the Mill Croft Brook, located 425m to the south west of the proposed site flowing in a southerly direction.

2.4 Sustainable Drainage

Sustainable Drainage Systems (SuDS) are utilised in line with the CIRIA 753 guidance with the aim to minimise the development's impact on the runoff quantity and quality and maximise amenity and biodiversity opportunities.

The management train approach is a fundamental principle of SuDS systems, it aims to primarily reduce pollution, flow rates and volume of runoff from the site. The main objective is to treat the runoff as close to the source as possible and where possible for at least two of the following should be included within the drainage strategy.

- **Prevention** – The use of good site design and rainwater re-use measures to prevent runoff.
- **Source Control** – Controlling the runoff as close to source as possible by using green roofs, porous pavements and soakaways.
- **Site Control** – Use of water management techniques within local area, i.e., detention basins and geocellular storage.
- **Regional Control** – Management of water from a number of sites in a specific location, i.e., balancing ponds and wetlands.

The drainage strategy for this development will incorporate source control measures in the form of permeable surfacing and site control methods in the form of a flow control device to retain the peak flows.

2.5 SuDS Hierarchal Approach

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	Investigations have identified the underlying ground to be cohesive and so infiltration is discounted.
Connection to Watercourse	No	No watercourse in close proximity.
Connection to Surface Water Sewer	No	No surface water sewer in close proximity.
Connection to Combined Water Sewer	Yes	New connection to the UU combined water sewer in Edenfield Road at restricted rates.

Figure 2: SuDS Hierarchal Approach

2.6 Surface Water Drainage Strategy

The general principle of the surface water drainage strategy is to collect the runoff from the roof configuration of the new dwelling and direct it to a number of RWPs that will drop down to a new below surface water drainage network. This will flow generally in a southerly direction before outfalling to the existing UU combined water sewer in Edenfield Road at a peak rate of 4.0l/s via a flow control chamber. Source control measures in the form of permeable surfacing will be incorporated.

Full details of this strategy can be found on the GWK Drainage GA drawing in Appendix A and the hydraulic calculations in Appendix B.

2.7 Water Quality

Water quality has been considered, and the following measures have been included within the surface water drainage proposals:

- Runoff from roofs is generally considered to be clean and will be discharged directly into the combined water network.

- All drainage from the small areas of access road will pass through the new permeable surfacing.

2.8 Maintenance

The drainage network encompasses standard pipework and manholes, geocellular tank and 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.

All management and maintenance of the drainage within each of the units and access road will be with the property owners to maintain the gullies, manholes, flows controls and attenuation tank. This will involve general maintenance of the drainage network in accordance with best practice, which is covered in Ciria guidance C753. Annual inspections will need to be carried out and clearing of gullies, channel drains and catchpits constructed.

Typically, the maintenance regime will be in line with the table below.

Future Maintenance of the Drainage System			
Responsibility	Feature	Maintenance	Frequency
Owner	Rainwater gutters, downpipes and above ground drainage.	Regular maintenance and inspections.	Ad-hoc sweeping and emptying of silt and debris required. Annual visual inspections to check for damage/leaks.
	Flow control chambers.	Regular maintenance / removal of blockages and debris.	Annual inspection and following significant rainfall events.
	Permeable Surfacing	Regular maintenance / removal of excess debris from surface	Annual inspection and following significant rainfall events.
	Pipes, sewers, manholes	Regular maintenance / removal of blockages and debris.	Annual inspection and removal of silts if required.

Figure 3: Outline Management & Maintenance Plan

3.0 Drainage Related Planning Condition and Responses

3.1 Planning Conditions

Detailed below are the drainage condition Number 5 is in italics with the GWK response in Blue beneath each point.

Condition 5

Prior to the commencement of development, details of a sustainable surface water drainage scheme and a foul water drainage scheme shall be submitted to and approved in writing by the Local Planning Authority. United Utilities may request evidence that the drainage hierarchy has been fully investigated and why more sustainable options are not achievable before a surface water connection to the public sewer is acceptable.

The drainage scheme shall include:

- (i) *An investigation of the hierarchy of drainage options in the National Planning Practice Guidance (or any subsequent amendment thereof). This investigation shall include evidence of an assessment of ground conditions and the potential for infiltration of surface water.*

As described in the earlier sections, the hierarchal approach has been considered for the draining of surface water from the development site. The underlying ground is cohesive and so a connection is to be made to the adjacent combined water sewer at a restricted peak rate of 4l/s.

- (ii) *A restricted rate of surface water discharge to public combined sewer, but only if the Planning Authority agrees that infiltration is discounted by the Applicant's ground infiltration investigations; in this case, the rate should match the existing predevelopment greenfield runoff rate from the site or 4l/s, whichever is the larger value.*

Flow rates restricted to 4l/s, considered the minimum orifice size to prevent blockage.

- (iii) *Construction details for permeable paving including kerbing and cross-section of open graded sub-base, if this type of paving forms part of the sustainable drainage system.*

Refer to the drainage GA in Appendix A.

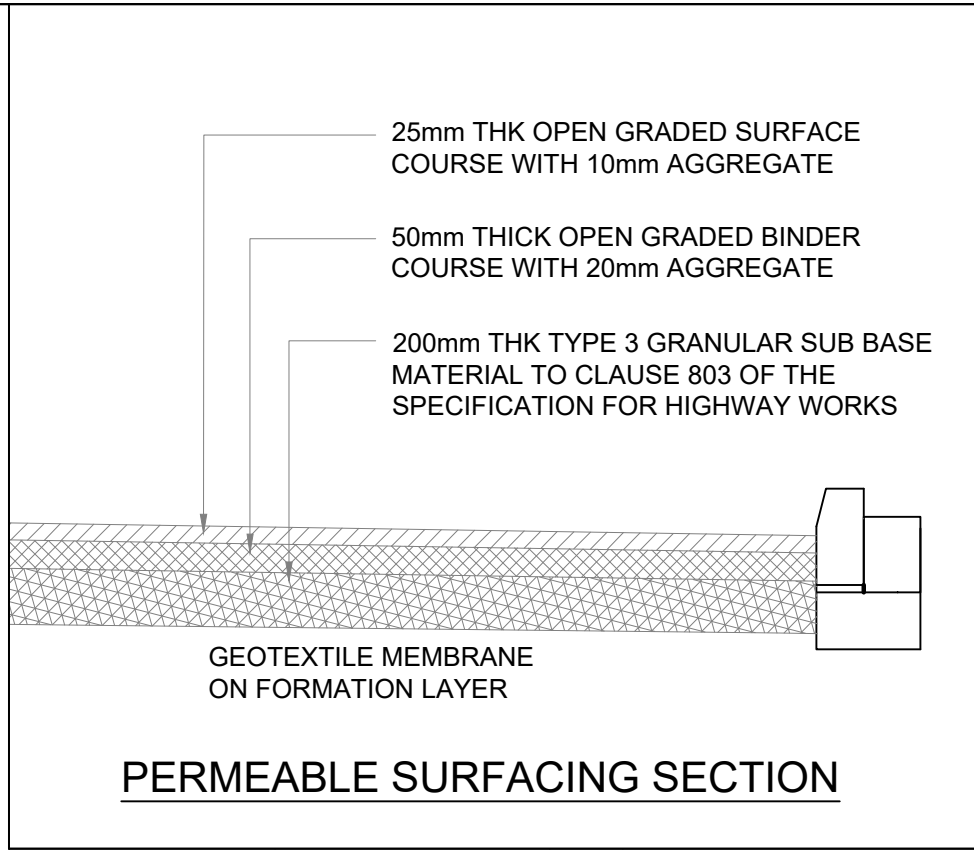
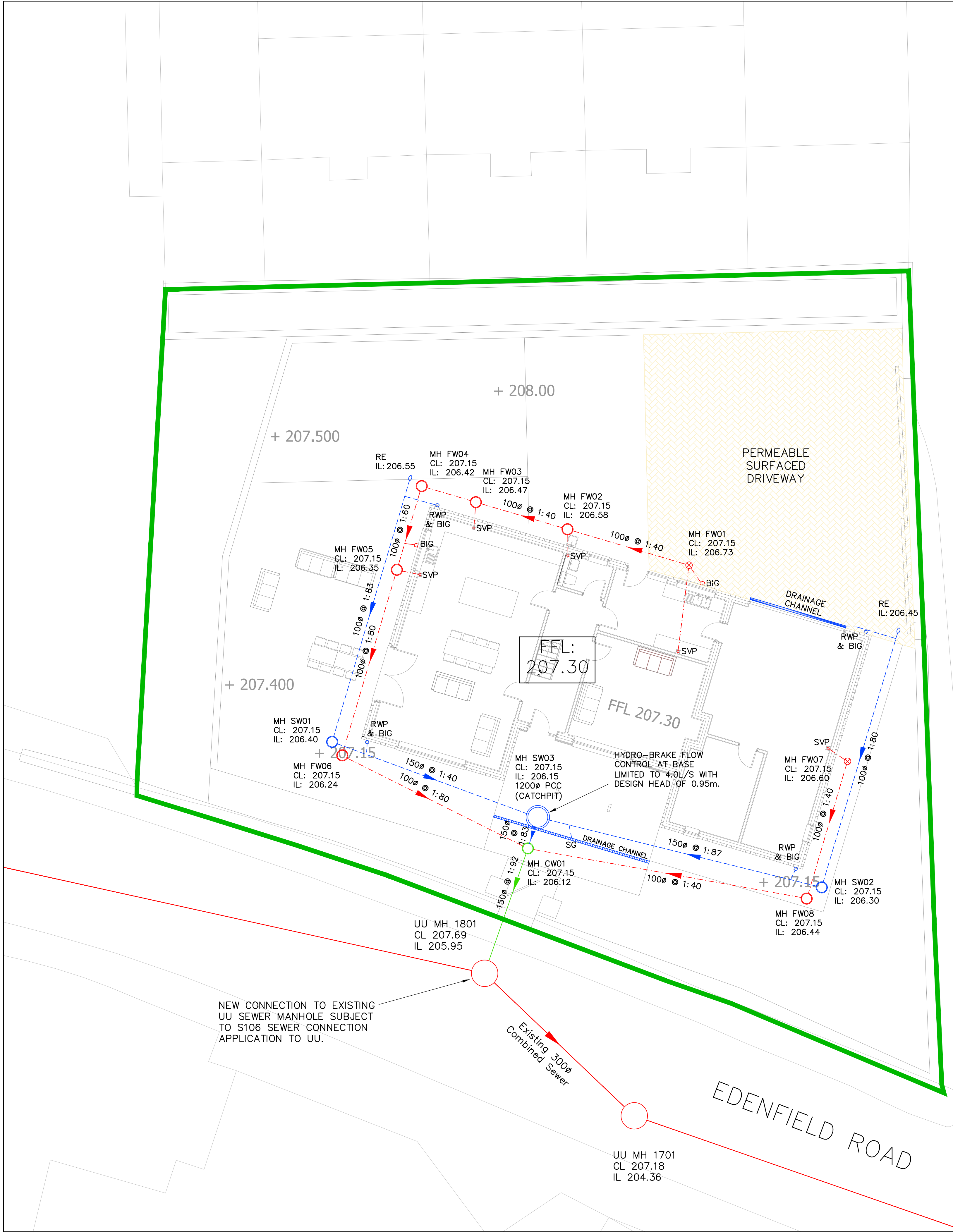
- (iv) *Levels of the proposed drainage systems including proposed ground and finished floor levels in mAOD. Foul and surface water shall drain on separate systems at least to the point of discharge from the site, in accordance with Building Control Part H Drainage requirements. The background calculations of the MicroDrainage® model or any other software or calculations that have been used for the drainage design.*

Refer to the drainage GA in Appendix A with full details of the drainage layout, including all levels. Plus the calculations in Appendix B.

The approved scheme shall also be in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) or any subsequent replacement national standards. Prior to occupation/ use of the proposed development, the drainage scheme shall be completed in accordance with the approved details and retained thereafter for the lifetime of the development.

Proposed scheme is designed and constructed in line with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015)

Appendix A - GWK Design Drawings



DRAINAGE NOTES & SPECIFICATIONS

1. THE CONTRACTOR IS RESPONSIBLE FOR THE CONFIRMATION OF ALL POSITIONS AND LEVELS OF EXISTING DRAINS, SEWERS AND MANHOLES PRIOR TO THE COMMENCEMENT OF THE PROPOSED WORKS AND ANY DISCREPANCIES REPORTED IMMEDIATELY TO GWK.
2. ALL PRIVATE DRAINAGE WITHIN THE SITE IS TO COMPLY WITH THE REQUIREMENTS OF BS EN 752 AND BUILDING REGULATIONS PART H.
3. NO DEVIATION FROM THE CONTENT OF THIS DRAWING IS ALLOWED WITHOUT PERMISSION OF GWK.
4. FOR DETAILS OF WORKMANSHIP AND MATERIALS REFER TO THE SPECIFICATION, BUILDING REGULATIONS AND BRITISH STANDARDS CURRENT AT THE TIME OF THE WORK.
5. ADEQUATE PROTECTION IS TO BE PROVIDED TO MAINTAIN INTEGRITY OF THE EXISTING SERVICES AND PROPOSED WORKS DURING CONSTRUCTION.
6. COVER LEVELS ARE PROVISIONAL AND THE FINAL LEVEL SHOULD BE ADJUSTED AND SET TO SUIT THE PROPOSED FINISHED LEVELS AS CONFIRMED BY THE ARCHITECT.
7. CONCRETE SURROUND IS TO BE PROVIDED TO ALL DRAINS WITH A COVER OF LESS THAN 1.2m OF THE FINISHED GROUND LEVEL IN HIGHWAY AREAS OR WITHIN 0.6m IF WITHIN LANDSCAPED AREAS. AN EXPANSION JOINT IS TO BE PROVIDED AT EACH AND EVERY PIPE JOINT.
8. ANY GRADIENTS OF DRAINS INDICATED ARE INDICATIVE ONLY AND THE CONTRACTOR SHALL INSTALL THE DRAINS TO THE SPECIFIED LEVELS SHOWN FOR EACH MANHOLE (U.O.N). CATCHPIT INVERT LEVELS ARE FOR THE OUTGOING PIPE WITH THE SUMP LEVEL SPECIFIED SEPARATELY.
9. ALL PIPEWORK WITHIN MANHOLES ARE TO BE LAID SOFFIT TO SOFFIT (U.O.N). ALL CHAMBER INVERT LEVELS ARE FOR THE OUTGOING PIPE LEVELS. BACKDROP PIPEWORK SHALL BE CONNECTED AT SOFFIT TO SOFFIT WITH THE RODDING ACCESS LEVEL SPECIFIED.
10. ALL INVERT LEVELS PROVIDED FOR 475mm PPIC CHAMBER ARE TO THE LOWEST PIPE WITHIN THE BENCHING ARRANGEMENT.
11. DRAINAGE CHANNELS ARE TO BE ACO MD SYSTEM C/W 'HEELGUARD' GRATES OR 'BRICKSLOT' TO LANDSCAPE ARCHITECT APPROVAL.
12. MANHOLE COVERS AND FRAMES ARE TO BE IN ACCORDANCE WITH BS EN 124 AND THE FOLLOWING:
 - VEHICULAR AREAS: CLASS D400 (E600 IN SERVICE YARD LOCATIONS), DOUBLE TRIANGULAR, 150mm DEEP DUCTILE IRON COVER AND FRAME WITH THREE POINT COVER SEATING, (NON-ROCK DESIGN) BADGED FW OR SW FOR FOUL OR SURFACE WATER DRAINAGE.
 - PEDESTRIAN AREAS: CLASS B125, 100mm DEEP, BADGED FW OR SW FOR FOUL OR SURFACE WATER DRAINAGE.
 - IF COVERS ARE REQUIRED TO BE RECESSED A HOWE GREEN 1050 HEAVY DUTY, STAINLESS STEEL EDGE, EXTERNAL USE, 100mm RECESS OR SIMILAR APPROVED SHALL BE USED.
13. REFER TO ARCHITECT'S DRAWING FOR RWP'S/WPC'S POP UP SIZES. ALL REST BENDS ARE ASSUMED TO BE 100ø, SET 600mm BELOW SSL, UNLESS OTHER SPECIFIED. THE CONTRACTOR SHALL ALLOW FOR SUITABLE VIKING JOHNSON ADAPTORS/COUPLINGS FOR JOINING THE DIFFERENT PIPE MATERIALS/PIPE SIZES.
14. ALL BRICKWORK IN CONNECTION WITH DRAINAGE IS BE SOLID ENGINEERING BRICK CLASS B TO BS 3921.
15. ALL INSITU CONCRETE TO BE GEN3 UNLESS SPECIFIED OTHERWISE.
16. ALL PRECAST CONCRETE PIPES, CHAMBER PRODUCTS AND ROAD GULLIES SHALL BE TO BS 5911 AND BE KITEMARKED.
17. VITRIFIED CLAY PIPES TO CONFORM TO BS EN 295 MANUFACTURER: HEPWORTH SUPERSLEEVE;
 - 100/150mmø -40 kN/m
 - 225mmø -45 kN/m
 - 300mmø -72 kN/mAND BE SUPPLIED WITH EPDM SEALING RINGS AS STANDARD.
18. PLASTIC PIPEWORK IS ACCEPTABLE AND SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.
19. UPON COMPLETION OF THE WORKS, ALL THE DRAINS SHALL BE CLEANED BY JETTING, REMOVING ALL DEBRIS FROM SITE. NO DEBRIS SHALL BE PERMITTED TO ENTER THE EXISTING DRAINAGE SYSTEM.
20. UPON COMPLETION OF THE WORKS THE CONTRACTOR SHALL SURVEY THE WORKS AND PROVIDE A SUITABLY 'MARKED-UP' DRAWINGS FOR 'RECORD' PURPOSES'.

NOTES: –

1. ALL LEVELS ARE IN METRES.
2. ALL DIMENSIONS ARE IN MILLIMETRES.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCURACY OF ALL DIMENSIONS AND LEVELS AND FOR THE CORRECT SETTING OUT OF THE WORK ON SITE UNLESS NOTED OTHERWISE.
4. THE CONTRACTOR SHALL ENSURE ALL NECESSARY PRECAUTIONS ARE TAKEN TO PROTECT EXISTING SERVICES DURING THE WORKS.

KEY

- EXISTING COMBINED WATER SEWER
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED COMBINED WATER DRAINAGE
- PROPOSED 450ø PPIC
- PROPOSED 300ø MINI PPIC
- RWP RAINWATER PIPE
- SVP SOIL VENT PIPE
- BIG BACK INLET GULLY
- RE RODDING EYE
- SITE BOUNDARY

NOTE ALL RWP AND SVP LOCATIONS TO BE CONFIRMED BY OTHERS

EXTERNAL LEVELS TO BE AGREED BY OTHERS

ALL PIPEWORK TO BE 100ø UNLESS NOTED OTHERWISE

No	DATE	DRAWN	REV'D	ENG.	AMENDMENT
B	15.01.25	PG	GWK		CHANNEL DRAIN ADDED
A	17.12.24	PG	GWK		ISSUED FOR INFORMATION

GWK STRUCTURAL SOLUTIONS LTD
CONSULTING CIVIL & STRUCTURAL ENGINEERS
37 ANGLESEY DRIVE, POYNTON, STOCKPORT, SK12 1BU
Email: gareth@gwks.co.uk
Web: gwksstructural.co.uk

CLIENT	MRS H JACKSON		
PROJECT	PROPOSED DWELLING 962 EDENFIELD ROAD, NORDEN		
DRAFTER	PG	ENGINEER	GWK
TITLE	DRAINAGE GA		
SCALE	DRAWING No	DATE	AMDT
1:100	GK4863-C-001	17.12.24	B

Appendix B - GWK Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	10	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
RE02	0.005	4.00	207.150	100	0.700
SW02	0.006	4.00	207.150	600	0.850
RE01	0.006	4.00	207.150	100	0.600
SW01	0.005	4.00	207.150	600	0.750
SW03	0.002	4.00	207.150	1200	1.000
CW01			207.150	450	1.030
EX 1801			207.690	1200	1.630

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	RE02	SW02	12.000	0.600	206.450	206.300	0.150	80.0	100	4.23	50.0
1.001	SW02	SW03	13.000	0.600	206.300	206.150	0.150	86.7	150	4.43	50.0
2.000	RE01	SW01	12.500	0.600	206.550	206.400	0.150	83.3	100	4.25	50.0
2.001	SW01	SW03	10.000	0.600	206.400	206.150	0.250	40.0	150	4.35	50.0
1.002	SW03	CW01	2.500	0.600	206.150	206.120	0.030	83.3	150	4.47	50.0
1.003	CW01	EX 1801	5.500	0.600	206.120	206.060	0.060	91.7	150	4.56	50.0

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	0.861	6.8	0.7	0.600	0.750	0.005	0.0	21	0.549
1.001	1.080	19.1	1.5	0.700	0.850	0.011	0.0	28	0.644
2.000	0.843	6.6	0.8	0.500	0.650	0.006	0.0	24	0.572
2.001	1.596	28.2	1.5	0.600	0.850	0.011	0.0	23	0.840
1.002	1.102	19.5	3.3	0.850	0.880	0.024	0.0	41	0.818
1.003	1.050	18.6	3.3	0.880	1.480	0.024	0.0	42	0.791

Pipeline Schedule

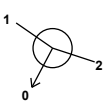
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	12.000	80.0	100	Circular	207.150	206.450	0.600	207.150	206.300	0.750
1.001	13.000	86.7	150	Circular	207.150	206.300	0.700	207.150	206.150	0.850
2.000	12.500	83.3	100	Circular	207.150	206.550	0.500	207.150	206.400	0.650
2.001	10.000	40.0	150	Circular	207.150	206.400	0.600	207.150	206.150	0.850
1.002	2.500	83.3	150	Circular	207.150	206.150	0.850	207.150	206.120	0.880
1.003	5.500	91.7	150	Circular	207.150	206.120	0.880	207.690	206.060	1.480

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	RE02	100	Manhole	Adoptable	SW02	600	Manhole	Adoptable
1.001	SW02	600	Manhole	Adoptable	SW03	1200	Manhole	Adoptable
2.000	RE01	100	Manhole	Adoptable	SW01	600	Manhole	Adoptable
2.001	SW01	600	Manhole	Adoptable	SW03	1200	Manhole	Adoptable
1.002	SW03	1200	Manhole	Adoptable	CW01	450	Manhole	Adoptable
1.003	CW01	450	Manhole	Adoptable	EX 1801	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
RE02	72.045	61.017	207.150	0.700	100				
SW02	47.299	27.966	207.150	0.850	600		0	1.000	206.450
							1	1.000	206.300
RE01	17.977	85.763	207.150	0.600	100		0	1.001	206.300
							0	2.000	206.550

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW01	-2.531	51.865	207.150	0.750	600		1 2.000	206.400	100
							0 2.001	206.400	150
SW03	18.316	37.458	207.150	1.000	1200		1 2.001	206.150	150
							2 1.001	206.150	150
							0 1.002	206.150	150
CW01	8.994	19.831	207.150	1.030	450		1 1.002	206.120	150
							0 1.003	206.120	150
EX 1801	0.011	5.932	207.690	1.630	1200		1 1.003	206.060	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)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.400	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	0	0	0
100	45	0	0

Node SW03 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	206.150	Product Number	CTL-SHE-0096-4000-0950-4000
Design Depth (m)	0.950	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.0	Min Node Diameter (mm)	0

Approval Settings

Node Size	✓	Accuracy (m)	1.000
Node Losses	✓	Crossings	✓
Link Size	✓	Cover Depth	✓
Minimum Diameter (mm)	150	Minimum Cover Depth (m)	
Link Length	✓	Maximum Cover Depth (m)	3.000
Maximum Length (m)	100.000	Backdrops	✓
Coordinates	✓	Minimum Backdrop Height (m)	

Approval Settings

Maximum Backdrop Height (m)	1.500	Return Period (years)	
Full Bore Velocity	✓	Maximum Surcharged Depth (m)	0.100
Minimum Full Bore Velocity (m/s)		Flooding	✓
Maximum Full Bore Velocity (m/s)	3.000	Return Period (years)	30
Proportional Velocity	✓	Time to Half Empty	x
Return Period (years)		Discharge Rates	✓
Minimum Proportional Velocity (m/s)	0.750	Discharge Volume	✓
Maximum Proportional Velocity (m/s)	3.000	100 year 360 minute (m³)	
Surcharged Depth	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	30 year 360 minute summer	31.221	8.034
1 year 15 minute winter	76.857	30.991	30 year 360 minute winter	20.295	8.034
1 year 30 minute summer	71.439	20.215	30 year 480 minute summer	24.324	6.428
1 year 30 minute winter	50.133	20.215	30 year 480 minute winter	16.160	6.428
1 year 60 minute summer	48.435	12.800	30 year 600 minute summer	19.756	5.404
1 year 60 minute winter	32.179	12.800	30 year 600 minute winter	13.498	5.404
1 year 120 minute summer	30.053	7.942	30 year 720 minute summer	17.490	4.687
1 year 120 minute winter	19.966	7.942	30 year 720 minute winter	11.754	4.687
1 year 180 minute summer	23.233	5.979	30 year 960 minute summer	14.215	3.743
1 year 180 minute winter	15.102	5.979	30 year 960 minute winter	9.416	3.743
1 year 240 minute summer	18.475	4.882	30 year 1440 minute summer	10.161	2.723
1 year 240 minute winter	12.274	4.882	30 year 1440 minute winter	6.829	2.723
1 year 360 minute summer	14.169	3.646	100 year +45% CC 15 minute summer	505.670	143.087
1 year 360 minute winter	9.210	3.646	100 year +45% CC 15 minute winter	354.856	143.087
1 year 480 minute summer	11.185	2.956	100 year +45% CC 30 minute summer	332.000	93.944
1 year 480 minute winter	7.431	2.956	100 year +45% CC 30 minute winter	232.982	93.944
1 year 600 minute summer	9.182	2.511	100 year +45% CC 60 minute summer	222.268	58.739
1 year 600 minute winter	6.274	2.511	100 year +45% CC 60 minute winter	147.669	58.739
1 year 720 minute summer	8.203	2.199	100 year +45% CC 120 minute summer	134.215	35.469
1 year 720 minute winter	5.513	2.199	100 year +45% CC 120 minute winter	89.169	35.469
1 year 960 minute summer	6.768	1.782	100 year +45% CC 180 minute summer	101.219	26.047
1 year 960 minute winter	4.483	1.782	100 year +45% CC 180 minute winter	65.795	26.047
1 year 1440 minute summer	4.949	1.326	100 year +45% CC 240 minute summer	78.690	20.795
1 year 1440 minute winter	3.326	1.326	100 year +45% CC 240 minute winter	52.280	20.795
30 year 15 minute summer	268.706	76.035	100 year +45% CC 360 minute summer	58.701	15.106
30 year 15 minute winter	188.566	76.035	100 year +45% CC 360 minute winter	38.157	15.106
30 year 30 minute summer	174.929	49.499	100 year +45% CC 480 minute summer	45.550	12.038
30 year 30 minute winter	122.757	49.499	100 year +45% CC 480 minute winter	30.262	12.038
30 year 60 minute summer	116.589	30.811	100 year +45% CC 600 minute summer	36.875	10.086
30 year 60 minute winter	77.459	30.811	100 year +45% CC 600 minute winter	25.195	10.086
30 year 120 minute summer	70.438	18.615	100 year +45% CC 720 minute summer	32.556	8.725
30 year 120 minute winter	46.797	18.615	100 year +45% CC 720 minute winter	21.879	8.725
30 year 180 minute summer	53.298	13.715	100 year +45% CC 960 minute summer	26.340	6.936
30 year 180 minute winter	34.645	13.715	100 year +45% CC 960 minute winter	17.448	6.936
30 year 240 minute summer	41.604	10.995	100 year +45% CC 1440 minute summer	18.700	5.012
30 year 240 minute winter	27.641	10.995	100 year +45% CC 1440 minute winter	12.567	5.012

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 (m ³)	Flood (m ³)	Status
15 minute winter	RE02	10	206.472	0.022	0.7	0.0033	0.0000	OK
15 minute winter	SW02	10	206.329	0.029	1.6	0.0124	0.0000	OK
15 minute winter	RE01	10	206.575	0.025	0.9	0.0053	0.0000	OK
15 minute winter	SW01	10	206.424	0.024	1.6	0.0101	0.0000	OK
15 minute winter	SW03	11	206.264	0.114	3.5	0.1333	0.0000	OK
15 minute winter	CW01	11	206.164	0.044	3.1	0.0070	0.0000	OK
15 minute winter	EX 1801	12	206.101	0.041	3.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	RE02	1.000	SW02	0.7	0.445	0.103	0.0189	
15 minute winter	SW02	1.001	SW03	1.6	0.346	0.083	0.1082	
15 minute winter	RE01	2.000	SW01	0.9	0.594	0.136	0.0189	
15 minute winter	SW01	2.001	SW03	1.6	0.496	0.057	0.0804	
15 minute winter	SW03	Hydro-Brake®	CW01	3.1				
15 minute winter	CW01	1.003	EX 1801	3.1	0.749	0.165	0.0225	1.6

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	RE02	13	206.537	0.086	1.8	0.0131	0.0000	OK
15 minute winter	SW02	13	206.536	0.236	4.0	0.1001	0.0000	SURCHARGED
15 minute summer	RE01	10	206.591	0.041	2.2	0.0085	0.0000	OK
15 minute winter	SW01	13	206.535	0.135	4.0	0.0562	0.0000	OK
15 minute winter	SW03	13	206.534	0.384	6.8	0.4501	0.0000	SURCHARGED
30 minute summer	CW01	23	206.171	0.051	4.0	0.0081	0.0000	OK
30 minute winter	EX 1801	24	206.107	0.047	4.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	RE02	1.000	SW02	1.8	0.568	0.266	0.0901	
15 minute winter	SW02	1.001	SW03	3.1	0.359	0.161	0.2289	
15 minute summer	RE01	2.000	SW01	2.2	0.763	0.332	0.0618	
15 minute winter	SW01	2.001	SW03	3.8	0.394	0.135	0.1716	
15 minute winter	SW03	Hydro-Brake®	CW01	4.0				
30 minute summer	CW01	1.003	EX 1801	4.0	0.802	0.216	0.0274	4.5

Results for 100 year +45% 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
30 minute winter	RE02	24	207.094	0.644	2.6	0.0972	0.0000	FLOOD RISK
30 minute winter	SW02	24	207.091	0.791	4.3	0.3354	0.0000	FLOOD RISK
30 minute winter	RE01	24	207.095	0.545	3.1	0.1133	0.0000	FLOOD RISK
30 minute winter	SW01	24	207.091	0.691	5.0	0.2873	0.0000	FLOOD RISK
30 minute winter	SW03	24	207.089	0.939	6.4	1.1000	0.0000	FLOOD RISK
60 minute summer	CW01	30	206.171	0.051	4.0	0.0081	0.0000	OK
60 minute summer	EX 1801	30	206.107	0.047	4.0	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	RE02	1.000	SW02	1.9	0.532	0.284	0.0939	
30 minute winter	SW02	1.001	SW03	3.0	0.359	0.158	0.2289	
30 minute winter	RE01	2.000	SW01	2.7	0.766	0.410	0.0978	
30 minute winter	SW01	2.001	SW03	4.1	0.403	0.147	0.1760	
30 minute winter	SW03	Hydro-Brake®	CW01	4.0				
60 minute summer	CW01	1.003	EX 1801	4.0	0.802	0.216	0.0274	10.5