



FOUL AND SURFACE WATER DRAINAGE STRATEGY

FOR

**PROPOSED DEVELOPMENT OF
LAND AT CHURCH MEWS,
BOLTON-UPON-DEANE**

ON BEHALF OF

OLD YEW BARN LTD

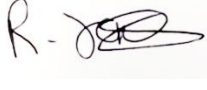
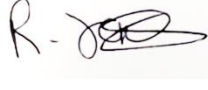
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**Foul and Surface Water Drainage Strategy for Proposed Development of
Land at Church Mews, Bolton-on-Deane
2280/01r2b**

	Initial Issue 17th October 2022	Revision A 13TH December 2022	Revision B 21st December 2022
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1.0 INTRODUCTION

- 1.1 Old Yew Barn Ltd is seeking to develop a parcel of land off Church Mews, Bolton on Deane for approximately 14 residential dwellings. A drainage strategy is required to accompany the planning application and outline how surface water drainage will be sustainably managed at the proposed site.
- 1.2 ARP Associates have been appointed to carry out a Foul and Surface Water Drainage Strategy for the proposed development. The preliminary design has been informed by consultations with statutory consultees as required and preparation of a drainage assessment report to satisfy the requirements of the Planning Authority.
- 1.3 Consultations and initial appraisal of the drainage arrangements for the proposed development have been undertaken in September/December 2022. This Drainage Strategy report has been prepared to take account of feedback from statutory consultees to the planning process and to provide further details on the proposals for draining the site.
- 1.4 The report has been initially prepared for the use and reliance of the Client only. The report shall not be relied upon or transferred to any other parties without the written agreement of ARP Associates. For the avoidance of any doubt, where ARP Associates enters into a letter of reliance for the benefit of a third party, that third party will be permitted to rely on the report. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party without ARP Associates consent.
- 1.5 Attention is drawn to the requirements of the Construction Design and Management Regulations 2015, and in particular, the duties and obligations of the Client.

2.0 SITE DESCRIPTION

General

- 2.1 The development site covers an area of approximately 0.32 hectares (ha), and is centred on Ordnance Survey grid reference 445489, 402460 and is located within the centre of Bolton upon Dearne.
- 2.2 Access is gained from Church Street which is linked to the B6098 Angel Street approximately 120.0 metres (m) to the east of the site.
- 2.3 The previous development at the site consisted of a large stone barn and associated hardstanding, which was estimated to be approximately 0.14 ha. The site is considered a 'brownfield' site for the purposes of this assessment.
- 2.4 The proposed development site is regular in shape and boundary extents clearly delineated by a series of fences and stone walls on all sides. The site is surrounded by residential development on all boundaries. A site location plan is also presented in **Appendix A** for reference purposes.
- 2.5 The development proposals are for the construction of 14 residential dwellings. Plans showing the development proposals are presented in **Appendix B**. The proposals are for six 2-bed and eight 3-bed dwellings. Each plot will be served by two parking spaces with several visitor spots provided across the site.

Topography and Vegetation

- 2.6 A topographical survey of the site was undertaken in March 2022 by Stamford Geomatics Ltd and is presented in **Appendix C**.

- 2.7 The topographical survey indicates site levels range from 27.50 to 32.50 metres Above Ordnance Datum (m AOD). Site levels fall steeply towards the south with an average gradient of 1 in 15.

Existing Drainage

- 2.8 The existing site's barn and outbuildings were served by an existing drainage system. According to the topographic survey there are two existing manhole chambers situated within the south east of the site and it is assumed that the site previously drained to these chambers.
- 2.9 According to Yorkshire Water sewer records (**Appendix D**), these manhole chambers form part of the public sewer network and discharge into the surface water and combined sewer network within Church Street approximately 20.0 metres east of site. The site is served by separate foul and surface water drainage connections.

Hydrology

- 2.10 The nearest watercourse is the River Dearne which is approximately 375 metres (m) to the south of the site. The River Dearne is a 'Main River' as defined by the Environment Agency. The river flows in an easterly direction to the south of the site.

3.0 CONSULTATION

Water Authority Consultation

- 3.1 Yorkshire Water has been consulted by way of a pre-development enquiry. A copy of their response was received September 2022. Further consultations have subsequently been undertaken and Yorkshire Water has been re-consulted in December regarding clarification of discharge rates and a formal response is currently awaited.
- 3.2 It was noted that, due to the change in legislation in October 2011, there may be public sewers within the site boundary which are not recorded on the statutory sewer map, the presence of which should be taken into account in the design of the site.
- 3.3 It was also advised that development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the point of connection to the existing public sewer manholes in the south east of the site.
- 3.4 Yorkshire Water confirms that foul water can discharge to 150 mm diameter foul sewer within the site (manhole reference: 5418). The local sewer network can accommodate the additional flows and does not require any additional reinforcement or off site work.
- 3.5 Yorkshire Water confirms that surface water can discharge to 250 mm diameter surface sewer within the site (manhole reference: 5403), subject to providing satisfactory evidence that other methods of surface water disposal have been discounted. Surface water runoff from the site is to be restricted to 13.4 l/s, subject to confirmation from Yorkshire Water.

Lead Local Flood Authority Consultation

- 3.6 An initial pre-application consultation was submitted to Barnsley Metropolitan Borough Council (MBC) by way of email in September 2022. A response by their highway drainage team confirmed the South Yorkshire - Interim Local Guidance for Sustainable Drainage Systems is

still the latest design guide. This outlines previously developed sites should demonstrate a minimum 30% betterment on the existing 1 in 1 year event for the brownfield site.

Local Planning Authority Consultation

- 3.7 Local planning policy is set out within the Barnsley Metropolitan Borough Council (MBC) Local Plan, which was formally adopted in January 2019. The following local planning policies relate to drainage and are as follows:

3.43.1 Policy CC1: Climate Change

We will seek to reduce the causes of and adapt to the future impacts of climate change by:

- *Giving preference to development of previously developed land in sustainable locations;*
- *Promoting the reduction of greenhouse gas emissions through sustainable design and construction techniques;*
- *Locating and designing development to reduce the risk of flooding;*
- *Promoting the use of Sustainable Drainage Systems (SuDS);*
- *Promoting and supporting the delivery of renewable and low carbon energy; and*
- *Promoting investment in Green Infrastructure to promote and encourage biodiversity gain.*

3.43.2 Policy CC4: Sustainable Drainage Systems (SuDS)

All major development will be expected to use Sustainable Drainage Systems (SuDS) to manage surface water drainage, unless it can be demonstrated that all types of SuDS are inappropriate.

The Council will also promote the use of SuDS on minor development.

To enable the Council to determine the suitability of a proposed SuDS scheme:

- *Outline Planning applications must be supported by a conceptual drainage plan and SuDS design statement; and*
- *Detailed Planning applications must be supported by a detailed drainage plan and SuDS design statement, which should contain information on how the SuDS will operate, be managed and maintained for the lifetime of the development.*

4.0 CLIMATE CHANGE

- 4.1 NPPF requires that the projected impacts of climate change are taken into account over the lifetime of a development. The NPPF and PPG have indicated that the Global sea level will continue to rise, depending on greenhouse gas emissions, and the sensitivity of the climate system and there will be an increase in river flows and rainfall across the country. United Kingdom climate change guidance was revised in February 2016; Recommended allowances for assessment are set out in Environment Agency publication 'Flood risk assessments: climate change allowances' (February 2016; updated October 2021).
- 4.2 In accordance with the revised national climate change guidance, for an expected development life of greater than 50 years, the anticipated increase in rainfall intensity could range from 25% to 40%, subject to the location within the country.
- 4.3 As per the requirements of the LLFA, an additional 30% allowance on the 1 in 100 year design rainfall intensity will be considered in the design of any surface water drainage systems for the new development.

5.0 SURFACE WATER DRAINAGE

- 5.1 It is a requirement of the NPPF to ensure that surface water run-off from any proposed development has negligible consequence on downstream areas, either in terms of impact upon downstream sewer capacity or flood risk impacts due to discharge to a watercourse. The existing and likely proposed surface water run-off regime is considered below.
- 5.2 This section should be read in conjunction with the ARP Drainage Strategy plan (drawing 2280/01/SK11) which has been prepared to illustrate the proposals (**Appendix G**).

Existing Surface Water Run-off

- 5.3 The site has been previously developed, and the pre-development runoff from hardstanding has been estimated using the modified rational method within Causeway Flow. Runoff from the hardstanding is shown within **Table 1**.
- 5.4 The site is approximately 0.32 ha in area, of which 0.14 ha was previously impermeable area. The existing brownfield runoff rates for the existing site are outlined below in **Table 1**.

Table 1: Existing Runoff Rates

Return Period	Existing Brownfield (0.14 ha)
1 in 1	19.2
1 in 2 / QBAR	24.7
1 in 30	45.2
1 in 100	57.1

Proposed Surface Water Runoff Destination

- 5.5 The proposed means of managing surface water runoff from the proposed development has been considered with respect to the hierarchy as set out in Building Regulations (2010) Part H and the Planning Practice Guidance (PPG). Consideration should firstly be given to infiltration (into the ground), to a surface water body, to a surface sewer and or highway drain and lastly, to a combined sewer. Where appropriate, soakaways, swales and infiltration trenches (SUDS) may be adopted as part of the public sewer network.
- 5.6 Infiltration - The potential for use of infiltration has been considered within the Stage 1 Geo-Environmental Desk Study Report which was undertaken by ARP Geotechnical Ltd, dated 8th August 2022 (reference TNK/01r1a). This states that the likely strata at the site may be sufficient to allow the disposal of surface water using soakaways. However, they recommended percolation testing be undertaken to confirm if rates are suitable for the proposed development.
- In addition to this, given the steeply sloping nature of the site and proximity of neighbouring dwellings, infiltration has been discounted to reduce the risk of adversely affecting neighbouring properties situated adjacent and below the site.
- 5.7 Watercourse – The site lies approximately 375 m from the nearest watercourse, the River Dearne. The proximity of the watercourse precludes this method of disposal and has therefore been discounted.
- 5.8 Public Sewer – It is proposed that surface water generated by the proposed development will be directed to the public surface water sewer system within the site (manhole reference: 5403).

Proposed Surface Water Drainage

- 5.9 It is proposed that surface water will be directed to the public surface water sewer in the south east corner of the site. In accordance with local design guidance, there is an

opportunity to provide significant betterment by reducing existing runoff from the site to the existing 1 in 1 year event with a 30% reduction as shown in **Table 1**.

- 5.10 It is proposed to restrict the existing 1 in 1 year existing runoff rate with a 30% betterment provided. It is therefore proposed to restrict to a peak discharge rate of 13.4 l/s post redevelopment via a flow control device. Discharge rate is subject to approval from Yorkshire Water and Barnsley MBC LLFA.
- 5.11 The proposed surface water system should be designed to accommodate a 1 in 30 year storm event without flooding and, to accommodate the 1 in 100 year plus 30% climate change allowance event without causing flooding of property or third-party land.
- 5.12 Based on the development masterplan (**Appendix B**), the proposed impermeable area of the development has been assessed to be approximately 0.16 ha.
- 5.13 The proposed surface water drainage network has been modelled within Causeway Flow hydraulic modelling program. The network has been modelled to accommodate the 1 in 100 year plus 30% climate change event and results are presented within **Appendix H**.
- 5.14 The calculations indicate that with a flow restriction of 13.4 l/s, approximately 32.5 m³ of attenuation storage is required within the storage structure, pipe and manhole network. It is proposed approximately 24.3 m³ of attenuation storage will be provided within a geocellular storage tank which has a plan area of 32.0 m² and a depth of 0.8 m.
- 5.15 There is potential for further storage and treatment to be provided by permeable paving within the parking bays. This will be considered at the detailed design stage. The exact location and type of storage will be confirmed at the detailed design stage.

Exceedance Flow Routes

- 5.16 For rainfall events in excess of the design standard (i.e. greater than 1 in 100 year plus climate change event) the capacity of the drainage system is likely to be exceeded. There also remains a residual risk of flows leaving the surface water drainage system in the event of a blockage.

- 5.17 So that exceedance flows do not adversely affect properties on or off site, site levels should be designed to direct flows away from the building entrances where possible, so that any flooding remains in landscaped areas, car parks, or roads, where the consequences of surface water flooding would be less significant.
- 5.18 Exceedance flow routes should be reviewed as part of the detailed drainage and levels design, and should be agreed with the LLFA.

Sustainable Drainage Systems (SuDS)

- 5.19 NPPF requires that SuDS are implemented in 'major development', if feasible. It must be recognised that not all types of SuDS are feasible or appropriate for all development sites, with factors such as available space, ground conditions, and site gradient influencing the feasibility of their use.
- 5.20 As discussed above, the use of infiltration drainage systems are not considered feasible on this site. However, SuDS in the form of permeable paving in car parking areas and attenuation of runoff rates to the existing 1 in 1 year event with 30% betterment are proposed, as indicated in the ARP Drainage Strategy plan (drawing 2280/01/SK11), subject to further assessment at the detailed design stages.

Surface Water Quality

- 5.21 Appropriate measures will need to be incorporated in the surface water drainage system to mitigate the risk of contaminated runoff from the site causing adverse impacts on surface water bodies downstream.
- 5.22 As assessment of the pollution hazards posed by the site has been assessed using the CIRIA SuDS Manual C753 –Table 26.2 pollution hazard indices table. The site is to consist of

residential roofs and roads which provide a very low and low pollution hazard level respectively.

- 5.23 Residential roofs are generally considered to be relatively ‘clean’ surface water run-off, and would be expected to have a very low level of potential contamination. On this basis no specific treatment for this run-off is proposed, except for suitable leaf debris traps and silt traps.
- 5.24 Areas subject to vehicular traffic (i.e. low traffic residential roads) may have the propensity to contain suspended solids, metals and hydrocarbons, and may require more treatment to reduce the risk to receiving waters, and therefore warrant further consideration at the detailed design stage.
- 5.25 The use of SuDS in surface water management is an effective means of managing surface water quality whilst providing other benefits (as discussed above), and it is recommended that surface water drainage systems for parking areas should therefore be designed in accordance with the risk-based approach outlined in CIRIA C753 The SuDS Manual. The ‘simple index approach’, as discussed below, can be used to make a preliminary assessment of the likely pollution hazard and the likely requirements for mitigation.
- 5.26 The SuDS Manual sets out the ‘Pollution Hazard Indices’ for different proposed land uses. **Table 2** summarises the likely applicable indices for the areas of development subject to vehicular traffic.

Table 2: Pollution Hazard Indices for Proposed Development

Proposed Land Use	Pollution Hazard Level	Pollution Hazard Index		
		Total Suspended Solids	Metals	Hydro-carbons
Residential Roofs	Very Low	0.20	0.20	0.05
Residential Roads (low traffic)	Low	0.50	0.40	0.40

Based on Table 26.2 of The SuDS Manual.

- 5.27 The SuDS Manual sets out a 'Mitigation Index' for different SuDS components. **Table 3** shows typical mitigation indices for the SuDS components proposed as part of the drainage strategy for the development.

Table 3: Indicative SuDS Mitigation Indices for Proposed SuDS Components

Proposed SuDS Component	Mitigation Index		
	Total Suspended Solids	Metals	Hydro-carbons
Permeable pavement	0.70	0.60	0.70

Based on Table 26.3 of The SuDS Manual.

- 5.28 On this basis an appropriate SuDS strategy can provide the required mitigation for water quality impacts from the low traffic residential roads, without the need for an oil separator. The water quality treatment should be reviewed at the detailed design stage and agreed with statutory consultees.

Groundwater

- 5.29 The ARP Geo-Environmental Phase 1 Desk Study report (reference TNK/01r1a) does not identify a significant risk of high groundwater across the development site, however this is subject to an intrusive ground investigation. The detailed design of drainage systems should be undertaken following intrusive ground investigation.

Construction Stage Surface Water Management

- 5.30 During the construction stage, before the permanent drainage systems are installed, measures will need to be taken to mitigate the potential environmental risks posed by runoff from the development site. A detailed Temporary Surface Water Management Plan will be required to address these risks. Key issues which require consideration will include the potential for silt-laden or contaminated runoff to adversely affect flood risk and water quality, and the potential for uncontrolled runoff to cause flooding on or off site.

5.31 A more detailed assessment of the potential construction stage risks will be undertaken before formulating a site-specific Temporary Surface Water Management Plan to manage the risk. The plan will need to be approved by the LLFA prior to implementation.

6.0 FOUL DRAINAGE

- 6.1 This section sets out the proposed means of managing foul discharge from a proposed development of the site. This section should be read in conjunction with the ARP Drainage Strategy plan (drawing 2280/01/SK11) which has been prepared to illustrate the proposals.

Existing Foul Drainage

- 6.2 A review of the Yorkshire Water sewer records (**Appendix D**) indicates that the nearest foul water public sewer is located within the south east corner of the site. It is approximately 150 mm in diameter and discharges into the 225 mm diameter combined sewer within Church Street.

Proposed Foul Drainage

- 6.3 In accordance with the hierarchy of foul drainage options set out in Building Regulations (2010) Part H, foul drainage should be disposed to a public sewer if available. It is proposed that foul water from the 14 residential dwellings be directed to the public foul sewer within the site (manhole reference: 5418).
- 6.4 A pre-development enquiry with Yorkshire Water confirmed that a point of connection to the public foul sewer within the site is acceptable.
- 6.5 It is estimated the proposed development would generate a peak foul loading of approximately 0.6 l/s. Yorkshire Water did not advise that there were any capacity issues within the adjacent combined sewer network within their pre-development enquiry response. It is therefore assumed there is sufficient capacity within the local sewer network to accommodate the foul loadings from the proposed development without the need for offsite reinforcement.
- 6.6 The proposals for foul drainage are subject to detailed design and subject to the approval of the Regulatory Authorities.

7.0 MAINTENANCE

- 7.1 There is a residual risk of flooding from any drainage systems in the event of siltation or a blockage occurring. It is therefore essential that all drainage systems are subject to periodic inspection and maintenance, so that the design standard is not compromised, and to reduce the risk of blockage.
- 7.2 The proposed surface and foul water drainage is subject to detailed design. It is assumed that both assets will be put forward for adoption with the local water authority, Yorkshire Water. Upon formal adoption the responsibility and maintenance will be transferred over to Yorkshire Water.
- 7.3 In the event the proposed surface and or foul water sewer network remain private, then responsibility for the inspection and maintenance of the assets within public/shared spaces would be the responsibility of the site owners, which would be expected to be transferred to an appropriate Management Company.
- 7.4 Inspection and maintenance of SuDS elements and drainage assets and within the curtilage of private dwellings would be subject to the owner of the private property.
- 7.5 An appropriate inspection and maintenance plan will need to be developed for approval by the Lead Local Flood Authority, and implemented thereafter by the site/building owner or management company, using suitably qualified professionals.

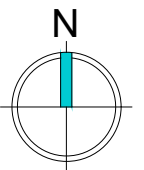
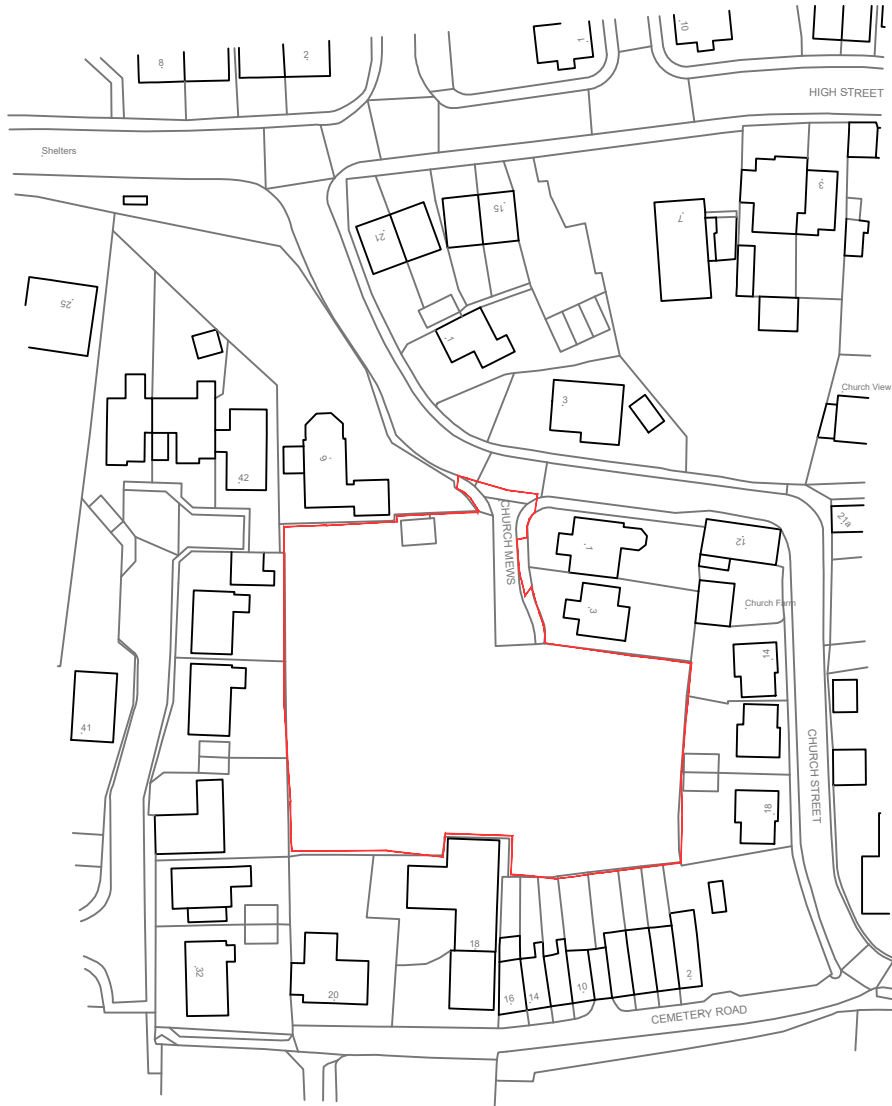
8.0 SUMMARY

- 8.1 The principles of a sustainable surface water management strategy for the proposed 14 residential dwellings are set out within the report. It has been determined that infiltration techniques are unsuitable on this particular site and discharge to a watercourse is not feasible. In accordance with the drainage hierarchy, surface water runoff from the proposed development will be directed to the public surface water sewer within the site.
- 8.2 It is proposed that the surface water runoff will be restricted to approximately 13.4 l/s. This is to restrict the existing 1 in 1 year event with 30% betterment as per local SuDS design guidance. The peak flow rate from the site will be controlled by an appropriate flow control prior to discharge to the public sewer.
- 8.3 In order to restrict discharge rates at the site, surface water will be attenuated predominantly by the use of a geocellular storage tank, with some attenuation provided within the pipe and manhole network. The drainage network has been designed to accommodate up to and including the 1 in 100 year plus 30% climate change rainfall event.
- 8.4 Domestic foul water waste from the proposed 14 dwellings will be directed to the public foul sewer within the site. Yorkshire Water did not advise any issues with capacity in the receiving public foul/combined sewer network.
- 8.5 The proposed strategy is illustrated in the ARP Drainage Strategy plan (drawing 2280/01/SK11), and supporting calculations are included within the Appendices for reference.
- 8.6 Further survey of existing drainage systems within and outside of the site is required before the detailed design can be confirmed.
- 8.7 Suitable maintenance regimes will be required for proposed drainage infrastructure. Details of maintenance plans will be confirmed and agreed at the detailed design stage.

- 8.8 The findings of this report are subject to the approval of the Regulatory Authorities. The detailed design and calculations shall be submitted to the Planning Authority for approval prior to construction on the development site.
- 8.9 Subject to compliance with the above, the proposed development can satisfy the requirements of the National Planning Policy Framework and the Planning Practice Guidance in relation to surface water management and foul drainage.

APPENDIX A

SITE LOCATION PLAN



Scaled @ 1:1250



E	Updated to planning layout REV F	DS	04.04.22
D	Updated to planning layout REV D	DS	21.03.22
C	Updated to planning layout REV C	DS	21.03.22
B	Updated to planning layout REV B	DS	16.03.22
A	Updated to planning layout REV A	DS	09.03.22
REV:	DESCRIPTION:	BY:	DATE:
AMENDMENTS:			

SITE: Church Mews Bolton upon Dearne		TITLE: Location Plan	
DRAWING NO. 2206.02	PROJECT NO. 2206	DATE. 27.01.22	 Web: www.sten-architecture.co.uk Twitter: @STEN_arch Facebook: stenarchitectureltd LinkedIn: stenarchitecture Sten Architecture STEN Architecture Ltd The Studio Harrison Street Wakefield WF1 1PS Tel: 01924 950985
SCALE AT A4. 1:1250	DRAWN. DS	CHECKED. SL	
		REVISION. E	

APPENDIX B

DEVELOPMENT PROPOSALS

Notes:

xx

PLANNING LAYOUT KEY

- Stone wall
- Close boarded timber fence
- Road
- Road markings
- Path
- XXXX

House reference
- xx

Rear garden plot no.
- xx

Drive plot no.
- Site boundary
- Gate
- Block paving
- Tree to be removed

F	Application boundary amended	DS	04.04.22
E	Application boundary amended	DS	01.04.22
D	Application boundary updated to physical boundaries	DS	21.03.22
C	Application boundary updated.	DS	21.03.22
REV:	DESCRIPTION:	BY:	DATE:

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CLIENT:

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SITE:

Church Mews
Bolton upon Dearne

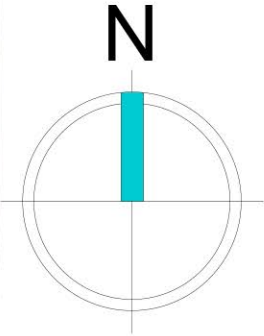
TITLE:

Planning Layout

SCALE AT A3: 1:500	DATE: 26/01/22	DRAWN: DS	CHECKED: SL
PROJECT NO: 2206	DRAWING NO: 2206.01	REVISION:	E

Church Mews, Bolton-upon-Dearne		STEN ARCHITECTURE			
Reference	Floor Area (Sqft)	Storeys	Total	Total Sqft	% of Mix
Private					
2 BEDS					
PLOT 1	750	2	1	750	7.1%
PLOT 4	800	2	1	800	7.1%
PLOT 5	700	2	1	700	7.1%
Type A	635	2	3	1905	21.4%
Sub-Total			6	4155	42.9%
3 BEDS					
PLOT 2	750	2	1	750	12.5%
PLOT 3	900	2	1	900	7.1%
Type C	892	2.5	6	5352	42.9%
Sub-Total			8	7002	57.1%
Total			14	11157	
Please note Plots 1-5 sqftage is approximate					

Scaled @ 1:500



A P P E N D I X C

T O P O G R A P H I C A L S U R V E Y

A P P E N D I X D

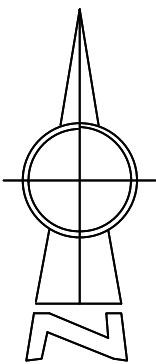
YORKSHIRE WATER SEWER RECORDS

APPENDIX E

DRAINAGE LAYOUT

ATTENTION IS DRAWN TO THE REQUIREMENTS OF THE CONSTRUCTION DESIGN AND MANAGEMENT REGULATIONS 2015 AND THE DUTIES AND RESPONSIBILITIES CONTAINED THEREIN

Site Area	0.32 ha	
Impermeable Area	0.16 ha	Based on Layout Ref: 2206, 2206.01, rev E
Discharge Rate	13.4 l/sec	In accordance with Barnsley Development Management team
Climate Change	40%	
Urban Creep	Nil	Barnsley MBC LLFA Requirements
CV Values	0.75/0.84	Default values (Barnsley LLFA)
1 IN 100 AEP +30% Volume Required	32.50 m³	
Design parameters are based on the latest information available from Barnsley MBC and will be subject to their requirements at detailed design / planning approval stage		



KEY

- Existing Public Surface Water Manhole
- Existing Public Foul/Combined Manhole
- Proposed Surface Water Manhole
- Proposed Foul Water Manhole
- Existing Public Surface Water Sewer
- Existing Public Foul Water Sewer
- Existing Public Combined Sewer
- Proposed Surface Water Sewer
- Proposed Foul Water Sewer
- Geocellular Storage Tank
- Permeable Paving Area
- Existing Sewer Easement (3.0 m)
- Site Outline

OFFLINE GEOCELLULAR ATTENUATION TANK

Cover Level - 28.65
Invert Level - 27.35
Storage Area - 32.0 m²
Storage Depth - 0.80 m
Voids - 95%
Max. Volume - 24.3 m³

1 IN 100 AEP +30%cc - 28.15 m AOD

PARKING BAYS TO BE CONSTRUCTED AS PERMEABLE PAVING IN ACCORDANCE WITH BRITISH STANDARDS.
SUB BASE TO BE A MINIMUM OF 350 mm IN DEPTH AND CONSIST OF TYPE 3 AGGREGATE

EXISTING YORKSHIRE WATER SURFACE WATER MANHOLE TO BE RECONSTRUCTED WITH FLOW CONTROL DEVICE SUBJECT TO YW APPROVAL.
ALTERNATIVELY A FLOW CONTROL CHAMBER CAN BE PROVIDED UPSTREAM OF MH REF 5403.

SUBJECT TO THE APPROVAL OF ALL RELEVANT AUTHORITIES

B	MD	08.12.22	Attenuation Storage amended	RJ	MI
A	MD	17.10.22	Issued for approval	RJ	RJ
Rev	By	Date	Revision	Chk	Apvd.

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ARP Associates is a trading division of ARP Geotechnical Ltd, a company registered in England and Wales with company number 3773813, whose registered office is at 5/6 Northwest Business Park, Servia Hill, Leeds LS6 2QH

TITLE DRAINAGE LAYOUT					
PROJECT LAND AT CHURCH MEWS BOLTON-ON-DEARNE					
CLIENT OLD YEW BARN LTD					
DRAWING STATUS PRELIMINARY					
Scale	1:250 @ A1	Date	SEP 22	Drawn	MD
				Chk.	RJ
Dwg. No.	2280-01-SK11				Rev B

APPENDIX F

DRAINAGE CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.380	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.055	5.00	30.600	1200	445469.791	402470.934	1.500
S2	0.026	5.00	30.300	1200	445490.697	402472.396	1.500
S3	0.057	5.00	28.650	1200	445494.694	402446.064	1.300
S4	0.023	5.00	28.600	1200	445497.976	402446.153	1.300
5403			28.900	1200	445519.838	402443.688	1.750
5406			28.800	1200	445528.906	402443.689	1.750

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	S1	S2	20.957	0.600	29.100	28.875	0.225	93.1	150	5.34	50.0
1.001	S2	S4	27.234	0.600	28.800	27.300	1.500	18.2	225	5.48	50.0
1.002	S4	5403	22.001	0.600	27.300	27.150	0.150	146.7	225	5.82	50.0
1.003	5403	5406	9.068	0.600	27.150	27.050	0.100	90.7	225	5.93	50.0
2.000	S3	S4	3.283	0.600	27.350	27.300	0.050	65.7	225	5.03	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	1.041	18.4	10.4	1.350	1.275	0.055	0.0	81	1.075
1.001	3.085	122.7	15.4	1.275	1.075	0.081	0.0	53	2.116
1.002	1.077	42.8	30.5	1.075	1.525	0.161	0.0	141	1.168
1.003	1.373	54.6	30.5	1.525	1.525	0.161	0.0	120	1.409
2.000	1.616	64.3	10.8	1.075	1.075	0.057	0.0	62	1.206

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	20.957	93.1	150	Circular	30.600	29.100	1.350	30.300	28.875	1.275
1.001	27.234	18.2	225	Circular	30.300	28.800	1.275	28.600	27.300	1.075
1.002	22.001	146.7	225	Circular	28.600	27.300	1.075	28.900	27.150	1.525
1.003	9.068	90.7	225	Circular	28.900	27.150	1.525	28.800	27.050	1.525

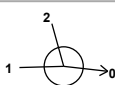
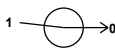
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	1200	Manhole	Adoptable	S2	1200	Manhole	Adoptable
1.001	S2	1200	Manhole	Adoptable	S4	1200	Manhole	Adoptable
1.002	S4	1200	Manhole	Adoptable	5403	1200	Manhole	Adoptable
1.003	5403	1200	Manhole	Adoptable	5406	1200	Manhole	Adoptable

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)
2.000	3.283	65.7	225	Circular	28.650	27.350	1.075	28.600	27.300	1.075

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	S3	1200	Manhole	Adoptable	S4	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S1	445469.791	402470.934	30.600	1.500	1200		0	1.000	29.100	150
S2	445490.697	402472.396	30.300	1.500	1200		1 0	1.000 1.001	28.875 28.800	150 225
S3	445494.694	402446.064	28.650	1.300	1200		0	2.000	27.350	225
S4	445497.976	402446.153	28.600	1.300	1200		1 2 0	2.000 1.001 1.002	27.300 27.300 27.300	225 225 225
5403	445519.838	402443.688	28.900	1.750	1200		1 0	1.002 1.003	27.150 27.150	225 225
5406	445528.906	402443.689	28.800	1.750	1200		1	1.003	27.050	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	19.000	Drain Down Time (mins)	240
Ratio-R	0.380	Additional Storage (m³/ha)	20.0
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
2	0	0	0
30	0	0	0
100	0	0	0
100	30	0	0

Node 5403 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	27.150	Product Number	CTL-SHE-0168-1340-0900-1340
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	13.4	Min Node Diameter (mm)	1200

Node S3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	27.350
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	30

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	32.0	0.0	0.800	32.0	0.0	0.801	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	29.166	0.066	7.2	0.1236	0.0000	OK
15 minute winter	S2	10	28.844	0.044	10.4	0.0650	0.0000	OK
15 minute winter	S3	13	27.409	0.059	7.5	1.9028	0.0000	OK
15 minute winter	S4	13	27.412	0.112	16.9	0.1663	0.0000	OK
15 minute winter	5403	13	27.407	0.257	16.2	0.2907	0.0000	SURCHARGED
15 minute summer	5406	1	27.050	0.000	13.3	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	S1	1.000	S2	7.0	0.957	0.380	0.1536	
15 minute winter	S2	1.001	S4	10.3	1.000	0.084	0.3322	
15 minute winter	S3	2.000	S4	6.9	0.560	0.107	0.0459	
15 minute winter	S4	1.002	5403	16.2	0.626	0.378	0.6544	
15 minute winter	5403	Hydro-Brake®	5406	13.3				9.7

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	29.177	0.077	9.3	0.1441	0.0000	OK
15 minute winter	S2	10	28.850	0.050	13.5	0.0739	0.0000	OK
15 minute winter	S3	14	27.454	0.104	11.4	3.3807	0.0000	OK
15 minute winter	S4	14	27.454	0.154	21.9	0.2284	0.0000	OK
15 minute winter	5403	14	27.441	0.291	15.5	0.3297	0.0000	SURCHARGED
15 minute summer	5406	1	27.050	0.000	13.4	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	S1	1.000	S2	9.1	1.019	0.492	0.1867	
15 minute winter	S2	1.001	S4	13.4	1.141	0.109	0.4572	
15 minute winter	S3	2.000	S4	8.5	0.639	0.132	0.0770	
15 minute winter	S4	1.002	5403	15.5	0.643	0.362	0.7557	
15 minute winter	5403	Hydro-Brake®	5406	13.4				12.6

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	29.223	0.123	17.7	0.2295	0.0000	OK
15 minute winter	S2	10	28.869	0.069	25.5	0.1022	0.0000	OK
30 minute winter	S3	25	27.715	0.365	23.9	11.8244	0.0000	SURCHARGED
30 minute winter	S4	25	27.714	0.414	25.9	0.6150	0.0000	SURCHARGED
30 minute winter	5403	25	27.698	0.548	17.4	0.6200	0.0000	SURCHARGED
15 minute summer	5406	1	27.050	0.000	13.4	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	S1	1.000	S2	17.1	1.153	0.931	0.3125	
15 minute winter	S2	1.001	S4	25.4	1.269	0.207	0.6814	
30 minute winter	S3	2.000	S4	11.7	0.697	0.182	0.1306	
30 minute winter	S4	1.002	5403	17.4	0.610	0.407	0.8750	
30 minute winter	5403	Hydro-Brake®	5406	13.4				31.4

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	11	29.342	0.242	22.9	0.4520	0.0000	SURCHARGED
15 minute winter	S2	11	28.878	0.078	31.7	0.1150	0.0000	OK
30 minute winter	S3	27	27.937	0.587	35.1	19.0274	0.0000	SURCHARGED
30 minute winter	S4	27	27.936	0.636	33.8	0.9450	0.0000	SURCHARGED
30 minute winter	5403	27	27.921	0.771	17.8	0.8717	0.0000	SURCHARGED
15 minute summer	5406	1	27.050	0.000	13.4	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	S1	1.000	S2	21.5	1.226	1.171	0.3573	
15 minute winter	S2	1.001	S4	31.8	1.322	0.259	0.7072	
30 minute winter	S3	2.000	S4	-16.5	0.689	-0.257	0.1306	
30 minute winter	S4	1.002	5403	17.8	0.604	0.414	0.8750	
30 minute winter	5403	Hydro-Brake®	5406	13.4				41.1

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	11	29.598	0.498	29.8	0.9280	0.0000	SURCHARGED
15 minute winter	S2	11	28.889	0.089	40.9	0.1317	0.0000	OK
30 minute winter	S3	27	28.466	1.116	49.8	26.5755	0.0000	FLOOD RISK
30 minute winter	S4	27	28.465	1.165	43.1	1.7296	0.0000	FLOOD RISK
30 minute winter	5403	27	28.440	1.290	17.5	1.4589	0.0000	SURCHARGED
15 minute summer	5406	1	27.050	0.000	13.4	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	S1	1.000	S2	27.6	1.570	1.501	0.3649	
15 minute winter	S2	1.001	S4	41.0	1.303	0.334	0.7406	
30 minute winter	S3	2.000	S4	-25.6	0.694	-0.398	0.1306	
30 minute winter	S4	1.002	5403	17.5	0.610	0.410	0.8750	
30 minute winter	5403	Hydro-Brake®	5406	15.9				53.4