SITE SPECIFIC FLOOD RISK ASSESSMENT & FOUL AND SURFACE WATER DRAINAGE STRATEGY

REDEVELOPMENT OF CHAMBERS BUS DEPOT
BURES, SUFFOLK

FOR: ROSPER ESTATES LIMITED

REVISION F - FEBRUARY 2024

JOB NUMBER J450

ROSE

CONTENTS

1.0 INTRODUCTION

1.1 This Flood Risk Assessment and Drainage Strategy has been produced to support a planning application for residential use at the former Chambers Bus Depot, High Street, Bures, Suffolk, CO8 5AB.

1.2 The calculations appended to this strategy make allowance for the likely effects of climate change. Based on a 100 year period for residential development and current guidelines, an increase of 40% has been added to all 1 in 100 year storm peak rainfall intensities.

1.3 An allowance for urban creep of 10% has been added to proposed residential areas contributing to the surface water drainage networks.

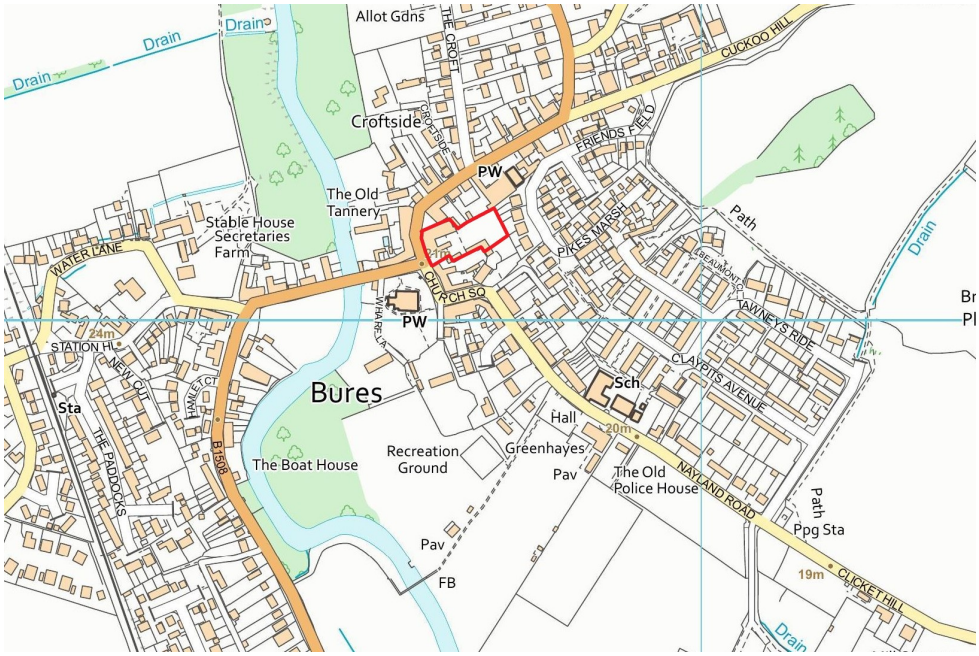
1.4 All areas quoted in this assessment are approximate and should not be relied upon for any purpose other than the calculation of existing or preliminary proposed surface water run-off.

1.5 As the site is less than 1 hectare in area and located in flood zone 1, a formal Site Specific Flood Risk Assessment would not normally be required unless there is a risk of flooding from sources other than rivers and sea. Surface water flood maps indicate a small area of the site to be at low/medium risk of flooding from surface water. Therefore, this report has been extended to assess flood risk to both the site and the surrounding area as a result of the proposed development.

2.0 EXISTING SITE

2.1 The approximate Ordnance Survey Grid location for the centre point of the site is TL 907 340.

Figure 1: Location Plan



2.2 The site consists of an irregular shape of approximately 0.32 hectares (0.8 acres). Refer to Appendix A for a reduced version of the site survey.

2.3 For many years the site was occupied by a bus company as their depot, offices and workshops.

2.4 Preliminary geotechnical investigation has identified the potential for contamination, due to its former use.

2.5 The above location plan shows the River Stour to the west, with no other significant watercourse in the vicinity of the site.

2.6 The topography is such that land falls gently towards the river.

2.7 The Public Sewer records show foul water sewers in the High Street.

2.8 Although not shown on the public sewer records, site survey has shown the existing surface water from the site drains to a surface water sewer in the High Street.

2.9 Referenece should be made to the report on the extensive GPR and CCTV drain survey undertaken by SurvaTec Limited dated 16/03/2022 and the earlier drain survey report by ACD Services UK Limited dated 27/10/2021.

2.10 Drainage surveys have shown the foul drainage from the site drains to the public sewers via a single lateral connection, while the surface water drains to the surface water sewer via two 150mm diameter lateral connections.

2.11 From the drainage surveys, it can be concluded that, although the system is in poor condition is some places, the site has, for many years, been served by separate and comprehensive foul and surface water drainage systems.

2.12 Geological mapping suggests the site lies in an area of River Terrace Deposits (sand and gravel) over Thanet Formation and Lambeth Group to the east (clay, silt and sand), over Lewes Nodular Chalk Formation and Seaford Chalk Formation (chalk). Therefore, a mixture of sands, gravels and clays can be expected across the site.

2.13 Due to the proximity of the river and topography, there exists the potential for groundwater to be encountered within any excavations undertaken across the site.

2.14 Environment Agency groundwater vulnerability maps show the site to be in an area of high vulnerability secondary aquifer. The site lies in a groundwater source protection zone – total catchment zone 3.

3.0 PROPOSED DEVELOPMENT

3.1 The proposed development comprises of 14 residential units, with associated access, parking spaces etc.

3.2 Due to the dense urban nature of the proposals and the surrounding environment, open water SuDS features are not considered appropriate. Any storage of surface water run-off will be accommodated below ground.

3.3 The development is to be via the existing access (to be modified) off of Church Square.

3.4 Reference should be made to the planning application for full details of the proposals.

4.0 FLOOD RISK

4.1 Refer to Appendix C for an extract of the flood map for planning and, both as published by Gov.uk.

4.2 From the details in Appendix C, it can be seen that the site lies in Flood Zone 1 (Low Probability), and is therefore suitable, in terms of flooding, for all types of development.

4.3 As the site lies within flood zone 1 and is less than 1 hectare in area, a formal site specific flood risk assessment is only required where there is a risk of flooding from sources other than rivers and the sea. The extract or the Gov.uk 'risk of flooding from surface water' map, also included in Appendix C, shows the site to have a small area at low/medium risk of flooding from surface water. The following flood risks are therefore considered as follows.

4.4 **Flooding from Rivers** – The River Stour lying to the west of the site provides a possible source of flooding for the surrounding area. Environment Agency flood analysis and mapping shows this potential flood does not reach the site when 1 in 1000 year scenarios are considered. Therefore, the risks of fluvial flooding are considered acceptable for the type of development proposed.

4.5 **Flooding from the Sea** – Ordnance Survey maps show the site to lay above the 20m contour. Therefore, flooding by the sea is not considered a risk.

4.6 **Flooding from Land** – From site inspection, topographical survey and Ordnance Survey mapping it can be seen that from the higher ground in the east, the site falls westwards towards the High Street. The extract of the Gov.uk. 'risk of flooding from surface water' map contained in Appendix C, shows a small area of the site at low risk of surface water flooding as a result of overland flow (pale blue relates to 1000 year return period), together with a very small area at medium risk (100 year return period). When this is viewed in conjunction with the site topographical survey, it can be seen that the site has a gentle fall in a south-westerly direction, towards the public highway. This natural topography, combined with buildings being sited sufficiently high enough above surrounding ground levels, will ensure that any overland flow will be routed away from

buildings. Therefore, flooding from surface water is not considered a risk. Refer to Appendix G for details of finished levels and proposed flood/exceedance flow routes.

4.7 **Flooding from Groundwater** – With the potential presence of sands and gravels over cohesive material and the nearby River Stour, groundwater can be expected across the site. Other than temporary measures during construction, this should not present a problem providing that ground levels remain relatively unchanged and there are no proposals for basements.

4.8 **Flooding from Sewers** – The site lies within the existing urban environment and survey has confirmed that foul and surface water sewers/drains exist in the lower ground to the west. Care must be taken when setting proposed finished floor levels and external paving levels to ensure that any potential flooding is routed away from buildings. All new surface water sewers within the site shall be designed to avoid surface flooding for all storms up to a 1 in 30 year return period. Any potential flooding from storms greater than 1 in 30 year return period up to any storm of a 1 in 100 year return period (plus the likely effects of climate change) shall be accommodated either by storage or controlled temporary flooding within the confines of the site.

4.9 **Flooding from Reservoirs, Canals and Other Artificial Sources** - There are no known artificial sources of potential flooding.

5.0 EXISTING SURFACE WATER RUN-OFF

5.1 The topographical and drainage surveys shows the site to be served by a comprehensive positive surface water drainage systems. These systems have been proven to discharge to the off-site surface water sewer in High Street/Bridge, via two 150mm diameter lateral connections.

5.2 CCTV survey shows the lateral connections require some repair works to bring them to an acceptable standard.

5.3 The area of existing roofs and external paving draining to the surface water system has been measured to be 1460 sq.m.

5.4 Suffolk Surface Water Drainage (SuDS) Guidance states that for previously developed (Brownfield) sites, if the existing drainage network is known then it shall be modelled using best practice simulation modelling to determine the flow rates at discharge points.

5.5 Calculations in Appendix D, illustrate an annual existing peak rate of surface water run-off from the site, via the two laterals. The existing combined annual maximum rate of discharge is 19.7 litres/second.

6.0 SURFACE WATER DRAINAGE

6.1 As described earlier in this report, due to the varied former uses of the site, there exists the potential for significant contamination. This, together with the ground conditions and the presence of a groundwater source protection zone, dictate that soakaways and other infiltration features are not a desirable solution for this site.

6.2 As with the existing site, a positive drainage system will be provided with discharge of surface water via an existing connection to the surface water sewer in the Bridge Street/High Street.

6.3 The development will be formed largely of paved and roof areas, totalling approximately 2307 sq.m. Refer to drawing J450-106 for details of the areas contributing to the proposed surface water network.

6.4 In calculating preliminary storage volumes for surface water attenuation, an allowance of 10% for urban creep, will be appropriate to all residential areas. This makes a total design area contributing of 2538 sq.m.

6.5 An additional 40% will be added as an allowance for Climate Change.

6.6 Suffolk Surface Water Drainage (SuDS) Guidance states, where a site is previously developed, SCC will expect discharge rates to be restricted as close to greenfield rates as reasonable practical. Alternatively, the brownfield 1yr, 30yr and 100yr peak runoff rates are be used with a betterment of at least 30% – as per section 3.2.2 in Ciria SuDS Manual C753.

6.7 To provide considerable betterment, the existing run-off rates for the 30yr and 100yr storms have been ignored and it has been proposed that all design storms up to 1 in 100yr return period (+40%) shall be restricted to 25% of the existing maximum annual run-off. This provides a betterment of 75% for the annual storm, and considerably more for storms of greater intensity.

6.8 Due to the urban location and density of development required to maintain the heritage of the historic site, above ground open storage features are not feasible.

6.9 The calculations in Appendix E show that the proposed below ground storage crates will provide adequate attenuation to avoid surface water flooding for all storm events up to and including the 1 in 100 year return period, plus an additional allowance of 40% for climate change.

6.10 Due to the servere restriction in future discharge rates, only one of the existing surface water lateral connections will be re-used and this will be repaired/re-laid as necessary.

7.0 WATER QUALITY TREATMENT

7.1 As mentioned in Section 6, soakaways and other infiltration features are not a desirable solution for this site.

7.2 Due to the relatively small site area and the proposed use, the potential for pollutants in the surface water run-off is very low to low. The parking of cars is considered the greatest risk. Reference to Table 26.2 of CIRIA Report C753 (the SuDS Manual), gives pollution indices for the access, driveways and small parking areas of 0.5 Total Suspended Solids (TSS), 0.4 Metals and 0.4 Hydro-Carbons.

7.3 Discharge of surface water will be via the existing connection to the surface water sewer in the High Street. Subject to confirmation, this is believed to discharge to the River Stour.

7.4 As there is low pollution potential and discharge is not to a small watercourse, the need for on-site water quality treatment is minimal.

7.5 It is proposed that all access road and parking area external paving, are formed in permeable block paving with a tanked sub-base containing drainage via perforated pipes, before discharge to underground storage crates. This will provide treatment to both liquid and solid pollutants, with mitigation indices of 0.7 Total Suspended Solids (TSS), 0.6 Metals and 0.7 Hydro-Carbons (all greater than the pollution indices).

7.6 A suitable management company will be established to secure the future maintenance of the SuDS features.

8.0 FOUL WATER DRAINAGE

8.1 The foul drainage from the development will be piped to the existing public foul sewer that runs along the High Street.

8.2 CCTV survey has shown that the existing lateral connection is in poor condition and will require replacement. The number of dwellings proposed, dictates that foul drainage must discharge directly to a public foul water manhole (not a branch connection). The new connection will be subject to a Section 106 application with the Water Authority.

8.3 The existing sewer is of sufficient depth to allow the development to connect by gravity.

8.4 A development of 14 dwellings is likely to generate an additional flow within the existing public foul sewers of no more than 0.65 litres/second. For comparison, the existing 9” public sewer is likely to have a total capacity of over 30 litres/second.

9.0 CONCLUSIONS

9.1 From the findings of this assessment, it can be concluded that the site lies within an area of Flood Zone 1 – Low Probability as defined by the Technical Guidance to the National Planning Policy Framework.

9.2 There are no significant risks to the site from flooding by fluvial, tidal, overland, groundwater, sewers and artificial sources.

9.3 It has been demonstrated that the low/medium risk of flooding from surface water can be managed appropriately by creating flood flow/exceedance routes across the site, in conjunction with the existing topography. The proposed buildings are sited above the flow paths to ensure they have a significant risk of flooding from surface water.

9.4 A SUDS 'management train' has been carefully considered and the most suitable SUDS solution has been proposed, combining permeable paving with below ground storage to both treat water quality and temporarily store surface water run-off.

9.5 Discharge rates of surface water via the existing (repaired) off-site connection will be restricted to less than 25% of the existing annual peak discharge rate. This will provide significant betterment for the 1 in 1 year return period storms and an even greater reduction in off-site flood risk for storms of greater return period.

9.6 A suitable estate management company will be established to maintain the communal surface water drainage systems.

9.7 The proposed foul discharge to the public sewers will be via a replacement lateral connected directly to a public foul water manhole. It is proposed that all foul water across the site will drain by gravity.

9.8 The increase in flow within the public foul sewers will be minimal.

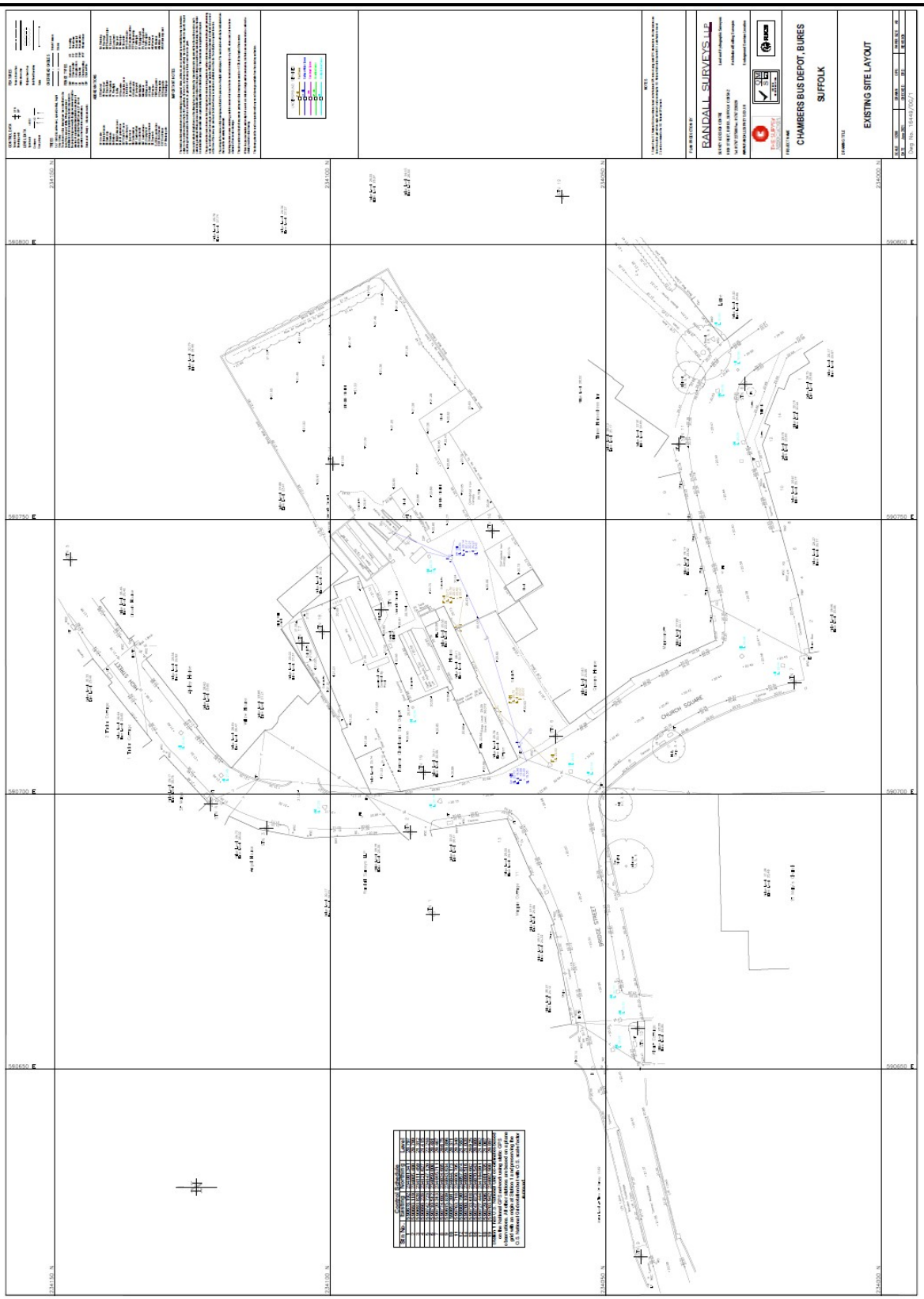
9.9 This report demonstrates that appropriate foul and surface water drainage systems can be provided to adequately serve the proposed development.

THE APPENDICES

APPENDIX A

Site Survey (Not to Scale)

The following page shows a reduced version of the topographical Survey. Refer to Original Drawing by Randall Surveys for full details.


RANDALL SURVEYS LLP
CHAMBERS BUS DEPOT, BURES
SUFFOLK
EXISTING SITE LAYOUT
CHURCH SQUARE
590800 E
590750 E
590700 E
590650 E

APPENDIX B

Proposed Site Plan (Not to Scale)

Refer to the application and drawings by Mark Perkins for further details.

APPENDIX C

Extracts of Planning Flood Map and 'Risk of flooding from surface water' map

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
Bures	**590712/234079**	**15 Oct 2021 7:24**

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2021 OS 100024198. https://flood-map-for-planning.service.gov.uk/os-terms

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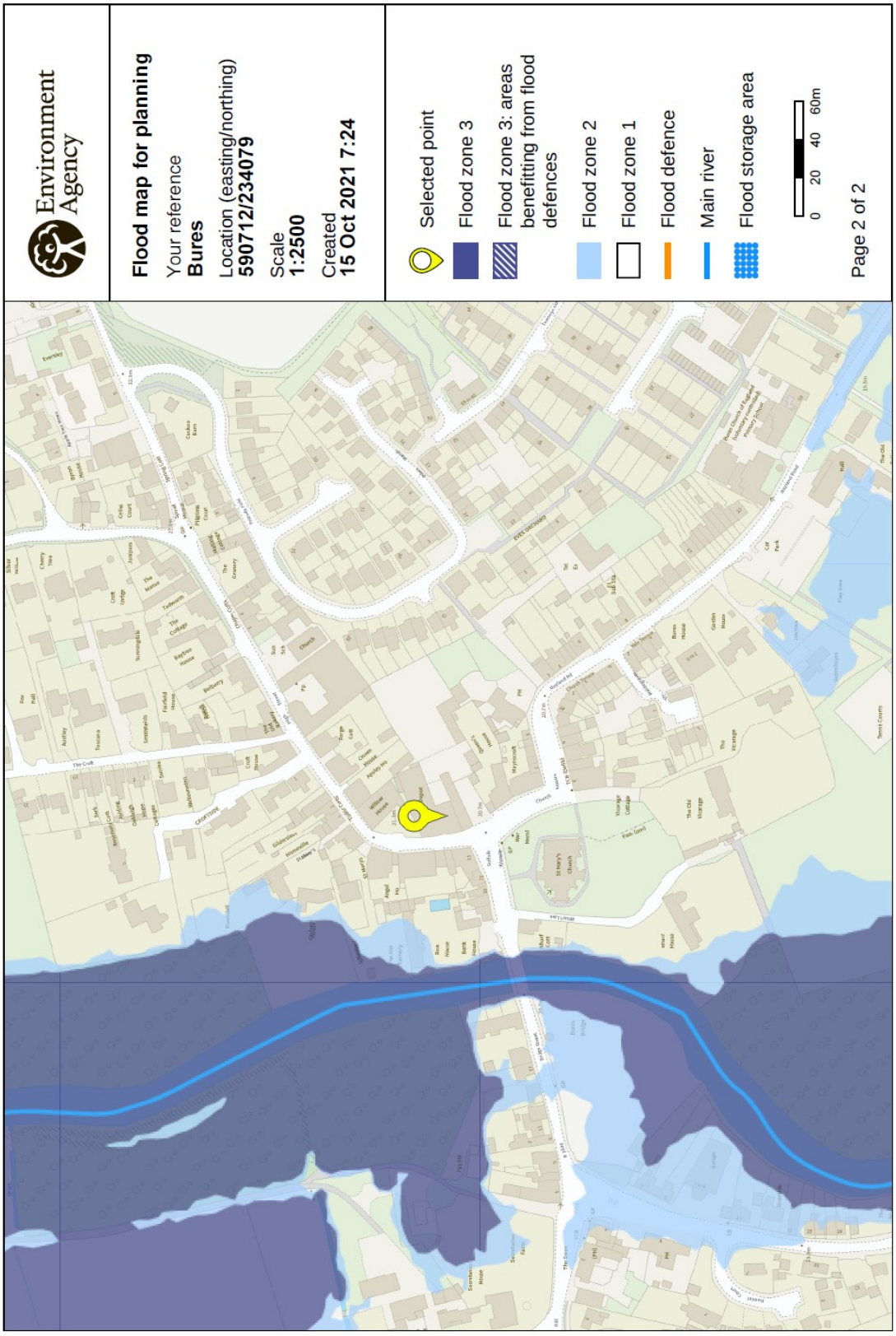
Environment Agency
Flood map for planning
Your reference
Bures
Location (easting/northing)
590712/234079
Scale
1:2500
Created
15 Oct 2021 7:24
Selected point
Flood zone 3
Flood zone 3: areas benefitting from flood defences
Flood zone 2
Flood zone 1
Flood defence
Main river
Flood storage area
0 20 40 60m
Page 2 of 2
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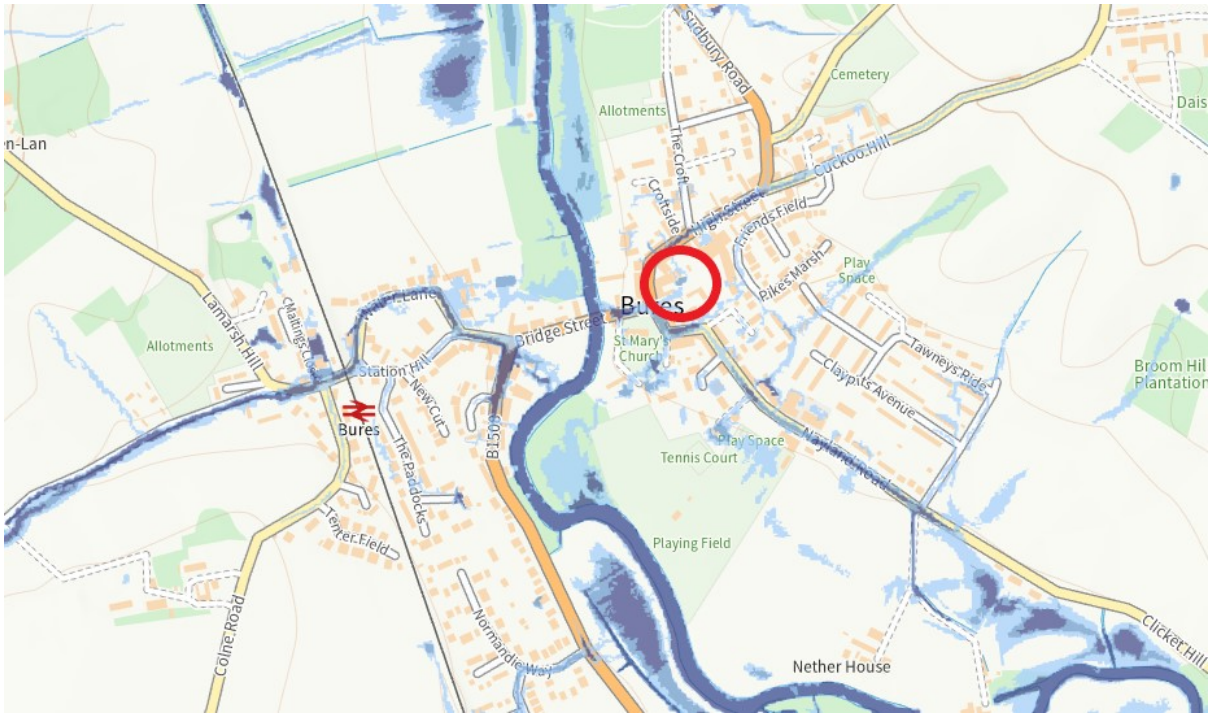
Gov.uk. - Risk of flooding from surface water map



APPENDIX D

Existing Surface Water Run-Off Calculations

KWL		Page 1
P.O. Box 12794 Colchester CO11 9AU	Former Bus Depot Bures Lateral IG1	
Date 14/04/2022 09:47 File EXISTING LATERAL IG1.MDX	Designed by kwl Checked by	
Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	1	Maximum Time of Concentration (mins)	30
		Foul Sewage (l/s/ha)	0.000
FEH Rainfall Version	1999	Volumetric Runoff Coeff.	0.750
Site Location	Bures	PIMP (%)	100
C (1km)	-0.022	Add Flow / Climate Change (%)	0
D1 (1km)	0.283	Minimum Backdrop Height (m)	0.200
D2 (1km)	0.285	Maximum Backdrop Height (m)	1.500
D3 (1km)	0.275	Min Design Depth for Optimisation (m)	1.200
E (1km)	0.314	Min Vel for Auto Design only (m/s)	1.00
F (1km)	2.512	Min Slope for Optimisation (1:X)	500
Maximum Rainfall (mm/hr)	50		

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.000	2.600	0.017	152.9	0.074	3.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	3.05	19.770	0.074	0.0	0.0	0.0	0.81	14.3	10.0

KWL		Page 1
P.O. Box 12794 Colchester CO11 9AU	Former Bus Depot Bures Lateral P2	
Date 14/04/2022 09:48 File Existing Lateral P2.MDX	Designed by kwl Checked by	
Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	1	Maximum Time of Concentration (mins)	30
		Foul Sewage (l/s/ha)	0.000
FEH Rainfall Version	1999	Volumetric Runoff Coeff.	0.750
Site Location	Bures	PIMP (%)	100
C (1km)	-0.022	Add Flow / Climate Change (%)	0
D1 (1km)	0.283	Minimum Backdrop Height (m)	0.200
D2 (1km)	0.285	Maximum Backdrop Height (m)	1.500
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E (1km)	0.314	Min Vel for Auto Design only (m/s)	1.00
F (1km)	2.512	Min Slope for Optimisation (1:X)	500
Maximum Rainfall (mm/hr)	50		

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.000	6.400	0.030	213.3	0.072	3.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	3.16	19.960	0.072	0.0	0.0	0.0	0.68	12.1	9.7

APPENDIX E

Proposed Surface Water Storage Calculations

The following pages show illustrative calculations for a below ground storage system draining the proposed impermeable roofs and paving, together with an allowance of 10% for urban creep on all residential areas.

It is a requirement that new surface water drainage systems for developments of this type are designed so that there is no surface flooding for all rainfall events of a 1 in 30 year return period and that no buildings or adjacent property will flood during storms of 1 in 100 year return period +40%.

Due to the topography and the presence of existing minor overland flooding, it is considered appropriate in enhance the design criteria so that the system is designed to avoid any surface flooding for all storms up to 100 year return period+40%.

With this enhanced design criteria, there is no need for analysis of 30 year return period storms as they will, by their nature, be smaller than the 100yr+40% storms.

K. Welham Limited		Page 1
P.O. Box 238 Richmond DL10 9EW	Bus Depot Bures	
Date 22/01/2024 15:17 File HOUSING.SRCX	Designed by kwl Checked by	
Innovyze	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 257 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	20.255	0.305	0.0	5.0	5.0	108.3	Flood Risk
30 min Summer	20.287	0.337	0.0	5.0	5.0	117.8	Flood Risk
60 min Summer	20.311	0.361	0.0	5.0	5.0	125.2	Flood Risk
120 min Summer	20.319	0.369	0.0	5.0	5.0	127.4	Flood Risk
180 min Summer	20.308	0.358	0.0	5.0	5.0	124.2	Flood Risk
240 min Summer	20.292	0.342	0.0	5.0	5.0	119.4	Flood Risk
360 min Summer	20.262	0.312	0.0	5.0	5.0	110.3	Flood Risk
480 min Summer	20.234	0.284	0.0	5.0	5.0	102.1	O K
600 min Summer	20.210	0.260	0.0	5.0	5.0	94.6	O K
720 min Summer	20.187	0.237	0.0	5.0	5.0	87.8	O K
960 min Summer	20.149	0.199	0.0	5.0	5.0	76.5	O K
1440 min Summer	20.091	0.141	0.0	5.0	5.0	58.0	O K
2160 min Summer	20.045	0.095	0.0	5.0	5.0	39.0	O K
2880 min Summer	20.020	0.070	0.0	4.7	4.7	28.7	O K
4320 min Summer	19.997	0.047	0.0	3.8	3.8	19.3	O K
5760 min Summer	19.984	0.034	0.0	3.1	3.1	14.0	O K
7200 min Summer	19.976	0.026	0.0	2.7	2.7	10.7	O K
8640 min Summer	19.970	0.020	0.0	2.3	2.3	8.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	236.252	0.0	112.3	19
30 min Summer	131.487	0.0	125.0	33
60 min Summer	73.180	0.0	139.2	62
120 min Summer	40.729	0.0	155.0	122
180 min Summer	28.909	0.0	165.0	180
240 min Summer	22.668	0.0	172.5	216
360 min Summer	16.089	0.0	183.8	274
480 min Summer	12.616	0.0	192.0	334
600 min Summer	10.447	0.0	198.8	398
720 min Summer	8.955	0.0	204.4	464
960 min Summer	7.066	0.0	215.1	596
1440 min Summer	5.060	0.0	231.2	850
2160 min Summer	3.624	0.0	248.4	1192
2880 min Summer	2.860	0.0	261.3	1528
4320 min Summer	2.061	0.0	282.5	2248
5760 min Summer	1.634	0.0	298.6	2952
7200 min Summer	1.365	0.0	311.8	3680
8640 min Summer	1.178	0.0	322.9	4408

K. Welham Limited		Page 2
P.O. Box 238 Richmond DL10 9EW	Bus Depot Bures	
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Innovyze	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	19.965	0.015	0.0	2.1	2.1	6.3	O K
15 min Winter	20.300	0.350	0.0	5.0	5.0	121.8	Flood Risk
30 min Winter	20.336	0.386	0.0	5.0	5.0	132.7	Flood Risk
60 min Winter	20.366	0.416	0.0	5.0	5.0	141.5	Flood Risk
120 min Winter	20.378	0.428	0.0	5.0	5.0	145.2	Flood Risk
180 min Winter	20.370	0.420	0.0	5.0	5.0	142.9	Flood Risk
240 min Winter	20.355	0.405	0.0	5.0	5.0	138.3	Flood Risk
360 min Winter	20.319	0.369	0.0	5.0	5.0	127.6	Flood Risk
480 min Winter	20.287	0.337	0.0	5.0	5.0	117.9	Flood Risk
600 min Winter	20.252	0.302	0.0	5.0	5.0	107.3	Flood Risk
720 min Winter	20.218	0.268	0.0	5.0	5.0	97.2	O K
960 min Winter	20.161	0.211	0.0	5.0	5.0	80.0	O K
1440 min Winter	20.078	0.128	0.0	5.0	5.0	52.7	O K
2160 min Winter	20.022	0.072	0.0	4.8	4.8	29.7	O K
2880 min Winter	20.002	0.052	0.0	4.0	4.0	21.4	O K
4320 min Winter	19.982	0.032	0.0	3.0	3.0	13.1	O K
5760 min Winter	19.971	0.021	0.0	2.4	2.4	8.6	O K
7200 min Winter	19.964	0.014	0.0	2.0	2.0	5.7	O K
8640 min Winter	19.959	0.009	0.0	1.7	1.7	3.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.040	0.0	332.6	5144
15 min Winter	236.252	0.0	125.8	18
30 min Winter	131.487	0.0	140.1	33
60 min Winter	73.180	0.0	156.0	62
120 min Winter	40.729	0.0	173.5	118
180 min Winter	28.909	0.0	184.8	176
240 min Winter	22.668	0.0	193.2	230
360 min Winter	16.089	0.0	205.8	290
480 min Winter	12.616	0.0	215.2	366
600 min Winter	10.447	0.0	222.6	440
720 min Winter	8.955	0.0	229.1	508
960 min Winter	7.066	0.0	241.1	644
1440 min Winter	5.060	0.0	258.9	892
2160 min Winter	3.624	0.0	278.1	1192
2880 min Winter	2.860	0.0	292.7	1556
4320 min Winter	2.061	0.0	316.5	2288
5760 min Winter	1.634	0.0	334.4	2992
7200 min Winter	1.365	0.0	349.2	3744
8640 min Winter	1.178	0.0	361.7	4416

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Date 22/01/2024 15:17 File HOUSING.SRCX	Designed by kwl Checked by	
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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	19.955	0.005	0.0	1.5	1.5	1.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.040	0.0	372.6	5144

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 590600 234100 TL 90600 34100
C (1km)	-0.024
D1 (1km)	0.265
D2 (1km)	0.287
D3 (1km)	0.303
E (1km)	0.314
F (1km)	2.512
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.254

Time (mins) From:	To:	Area (ha)
0	4	0.254

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Model Details

Storage is Online Cover Level (m) 20.550

Cellular Storage Structure

Invert Level (m) 19.950 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	433.0	0.0	1.300	0.0	0.0
0.150	433.0	0.0	1.400	0.0	0.0
0.151	316.0	0.0	1.500	0.0	0.0
0.450	316.0	0.0	1.600	0.0	0.0
0.451	0.0	0.0	1.700	0.0	0.0
0.500	0.0	0.0	1.800	0.0	0.0
0.600	0.0	0.0	1.900	0.0	0.0
0.700	0.0	0.0	2.000	0.0	0.0
0.800	0.0	0.0	2.100	0.0	0.0
0.900	0.0	0.0	2.200	0.0	0.0
1.000	0.0	0.0	2.300	0.0	0.0
1.100	0.0	0.0	2.400	0.0	0.0
1.200	0.0	0.0	2.500	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0113-5000-0500-5000
Design Head (m)	0.500
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	113
Invert Level (m)	19.900
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	5.0	Kick-Flo®	0.372	4.4
Flush-Flo™	0.179	5.0	Mean Flow over Head Range	-	4.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

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Innovyze	Source Control 2020.1.3	

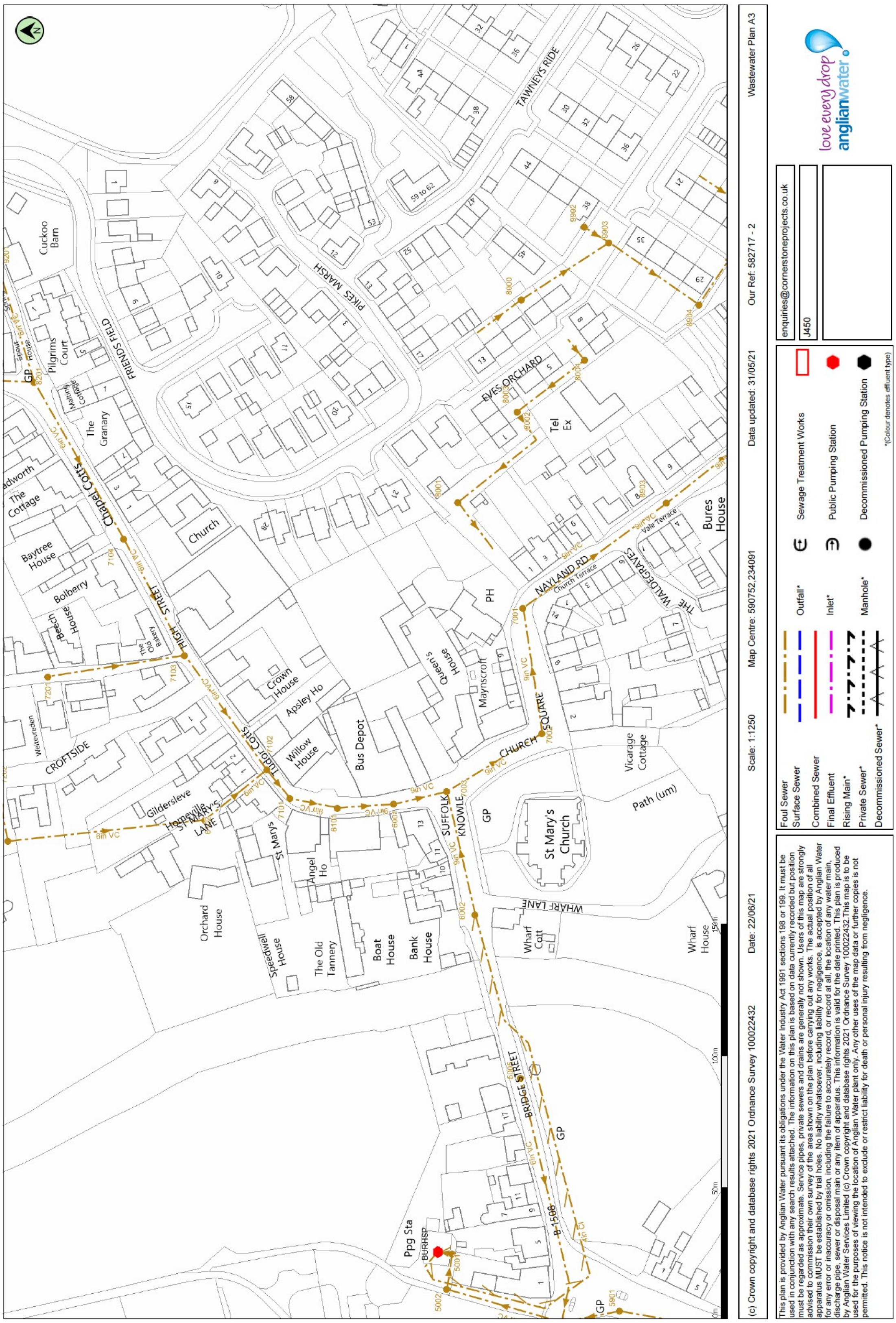
Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	7.5	3.000	11.6	7.000	17.4
0.200	5.0	1.400	8.1	3.500	12.5	7.500	18.1
0.300	4.8	1.600	8.6	4.000	13.3	8.000	18.7
0.400	4.5	1.800	9.1	4.500	14.1	8.500	19.2
0.500	5.0	2.000	9.6	5.000	14.8	9.000	19.8
0.600	5.4	2.200	10.0	5.500	15.4	9.500	20.3
0.800	6.2	2.400	10.4	6.000	16.1		
1.000	6.9	2.600	10.8	6.500	16.8		

APPENDIX F

Extract of Public Sewer Records

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
5001	F	19.508	16.998	2.51
5002	F	19.688	17.328	2.36
5005	F	20.015	18.815	1.2
5901	F	19.716	17.706	2.01
6001	F	20.749	19.089	1.66
6002	F	20.212	19.242	0.97
6101	F	21.199	19.129	2.07
6102	F	20.781	19.461	1.32
6200	F	-	-	-
7001	F	20.547	18.647	1.9
7002	F	20.462	18.842	1.62
7003	F	20.609	18.989	1.62
7101	F	21.462	19.232	2.23
7102	F	21.561	19.291	2.27
7103	F	22.542	20.952	1.59
7104	F	23.976	22.396	1.58
7201	F	-	-	-
8000	F	-	-	-
8001	F	-	-	-
8002	F	-	-	-
8003	F	-	-	-
8004	F	-	-	-
8201	F	26.937	25.347	1.59
8903	F	20.217	18.339	1.878
8904	F	-	-	-
9902	F	-	-	-
9903	F	-	-	-



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Date: 22/06/21
Scale: 1:1250
Map Centre: 590752,234091
Data updated: 31/05/21
Our Ref: 582717 - 2
Wastewater Plan A3
enquiries@cornerstoneprojects.co.uk
J450
love every drop
anglianwater
Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main*
Private Sewer*
Decommissioned Sewer*
Outfall*
Inlet*
Manhole*
Sewage Treatment Works
Public Pumping Station
Decommissioned Pumping Station
*(Colour denotes effluent type)
Bus Depot
St Mary's Church
HIGH STREET
BRIDGE STREET
CHURCH SQUARE
NAYLAND RD
EVES ORCHARD
PIKES MARSH
TAWNEYS RIDE
FRIENDS FIELD
CROFTSIDE
ST MARY'S LANE
SUFFOLK KNOWLE
WHARF LANE
THE WALDEGRAVES
Ppg Sta

APPENDIX G

Exceedance flow routes and finished levels (Not to Scale)

Refer to the original drawing for further details.


NOTES
LEGEND
EXISTING SURFACE WATER SEWER
EXISTING FOUL WATER SEWER
FFL34.375
FINISHED FLOOR LEVEL
EXISTING GROUND LEVEL
FINISHED EXTERNAL LEVEL
EXPOSED BRICKWORK BELOW DPC
RAISED DPC (TANKING)
SYSTEM EXCEEDANCE FLOW PATH
DRAWING FOR APPROVAL
NOT FOR CONSTRUCTION
Rev.
A Plots 8, 9 & 13 Revised
21.02.24
ROSE
CLIENT
Roger Estates Limited
PROJECT
Redevelopment of Former
Chambers Bus Depot
Off Church Square
Bures St Mary, Suffolk
DRAWING TITLE
System Exceedance Flood Flow Routes
JOB NO.
J450
DATE
Jan 2024
SCALES
1:200
DRAWN BY
KWW
CHECKED BY
DWG NO.
105
SHEET NO.
© Copyright Rose Builders Limited
FFL21.750
FFL21.780
FFL20.850
FFL20.925
FFL21.225
GFL21.000
FFL21.150
FFL20.800
FFL20.625
FFL21.100
Three Horseshoes Inn
Queens House
Willow House
Angel House
Randall Surveys LLP
Magpie Cottage
BRIDGE STREET