Mr Peter Milner

Proposed Residential Development
White House Farm
Ealand
Near Crowle

Drainage Assessment

Prepared by EWE Associates Ltd
Final RevA March 2020

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CLIENT DETAILS

Mr Peter Milner

CONTRACT

This report describes work commissioned by Mr Peter Milner during February 2020. Mr Peter Milner representative for the contract was Mr Howard Wroot. Lea Favill of EWE Associates Ltd carried out the work.

Date: 8th April 2020

Prepared by: …… [redacted] ……. Lea Favill
Director

REVISION HISTORY

Draft Report Rev0 issued 31st March 2020 - 1No copy issued to Mr Howard Wroot
Final Report RevA issued 8th April 2020 - 1No copy issued to Mr Howard Wroot

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APPENDICES:

1. INTRODUCTION

Terms of Reference

This report was commissioned by Mr Peter Milner to consider the surface water and foul water drainage system for the proposed residential development within the White House Farm development site in Ealand near Crowle.

The proposal involves the construction of 6 residential dwellings. The development will also include an access road. The drainage issues are being considered as part of the current planning conditions.

Approach to the Assessment

For the purposes of this study, the following have been considered: -

- Site level information and proposed finished levels of the buildings and external works.
- Onsite constriction.
- Options available to developer.
- NPPF guidelines with regards to the control of runoff.
- PPG3 pollution prevention guidelines.
- Future adoption and management of drainage system.
- Discharge rates into watercourse.
- Flood risk to adjacent land users.

Design Constraints

For the purposes of this study, the following constraints have been applied: -

- The design is based on the proposed layout provided by the client's representative. At this stage no modifications to the layout are proposed.
- The proposal is for a residential development which will be sold to individual owners as such any drainage features or attenuation structures will be maintained by the individual owner/maintenance company.
- SUDs features are to be recommended where practically possible.
- There are surface water and foul water sewers within Main Street to the east of the site. There is also a foul water pumping station to the north east of the site.
- Shallow ground water was encountered at less than 1m below ground level. Subsequently, infiltration drainage is not considered a practical solution for this site.

- There is an existing ditch watercourse which runs west to east through the site. The ditch watercourse discharges into a culverted watercourse which is shown on the STW sewer plan of the area.
- It is assumed that the minimum design standard is 1 in 100 years plus climate change (30%) as the site is less vulnerable.
- No on site above ground flooding will be acceptable up to and including 1 in 100 years plus climate change (30%) storm.

2. DESIGN OF PROPOSED SURFACE WATER DRAINAGE SYSTEM

Discharge restriction

The existing development site consists of a former farmhouse and yard area. There is some formalised drainage which appears to discharge the site towards the ditch watercourse which runs through the site. A large proportion of the site is unused grassland. The total site area has been estimated at 0.6 hectares. The subsoils consist of low permeability soils with shallow ground water.

The ditch watercourse discharges into a 600mm diameter culvert which is shown on the STW sewer plan to run parallel with Main Street. It is assumed that the culvert eventually discharges into an Internal Drainage Board watercourse. As such, the IDB are likely to restrict the discharge to 1.4l/s/ha pumped drainage rate. Based on a total area of 0.6 hectares the estimated restriction is 0.84l/s. It is considered impractical to restrict to less than 1l/s therefore a peak discharge rate of 1l/s has been adopted.

Proposed Drainage Strategy

It is proposed to ultimately discharge any surface water flows generated by the development of the site which cannot drain via infiltration to the ditch watercourse which runs through the site and discharges into the 600mm diameter culverted watercourse within Main Street.

The proposed impermeable area for the development site has been calculated to be approximately 0.199 ha.

The drainage strategy utilises an appropriately sized hydro brake to restrict the flow rates to 1l/s. This allows the discharge through the hydro brake to vary as the head increases due to the increase in upstream flows. As such, the flow will vary for each of the design storms shown above and it is expected that during the more extreme return periods there will be a considerable betterment as the hydro brake is likely to restrict flows to a lesser rate than estimated at present.

These preliminary calculations would indicate that a total volume of 150m^3 will be required to ensure no flooding occurs for storms up to and including the 1 in 100 year plus 30% climate change event for this site. The tank is to be located directly upstream of the ditch watercourse and the control structure.

The pond will be used to accommodate the storage during 1 in 1 year, 30 year, 100 year and 100 year +CC storms (worst case scenario).

The proposed drainage strategy for the site is provided at Appendix B of this report.

Hydraulic Modelling Results

The proposed MicroDrainage models have been simulated with the 1 in 100 year plus climate change (30%) return period design storm events with durations of 15, 45, 60, 300, 600, 900, 960, 1020, 1080, 1140, 1200, 1260 and 1440 minutes. At the request of the Environment Agency seven day 10080 minute duration was also

undertaken. The durations were run in both Winter and Summer profiles. It was found that the Winter profile was critical.

The table below shows a summary of the 1 in 100 year plus climate change model runs and the impact on the drainage system in terms of peak depth within the system and flow through the hydro-brake.

The 1200 minute duration produced the largest flow through the control manhole (1l/s) which is equivalent to the restricted runoff rate (1l/s). The modelled result for the 1200 minute Winter model run is provided at Appendix D.

Return Period	Profile	Duration (min)	Peak water level in tank	Peak flow into ditch	Status
100 year+CC	Winter FSR	15min	2.536	0.6	Flood risk
100 year+CC	Winter FSR	45min	2.686	0.7	Flood risk
100 year+CC	Winter FEH	60min	2.800	0.8	Flood risk
100 year+CC	Winter FEH	300min	2.955	0.9	Flood risk
100 year+CC	Winter FEH	600min	2.995	1.0	Flood risk
100 year+CC	Winter FEH	900min	2.997	1.0	Flood risk
100 year+CC	Winter FEH	960min	2.997	1.0	Flood risk
100 year+CC	Winter FEH	1020min	2.997	1.0	Flood risk
100 year+CC	Winter FEH	1080min	2.997	1.0	Flood risk
100 year+CC	Winter FEH	1140min	2.997	1.0	Flood risk
100 year+CC	Winter FEH	1200min	2.997	1.0	Flood risk
100 year+CC	Winter FEH	1260min	2.996	1.0	Flood risk
100 year+CC	Winter FEH	1440min	2.991	0.9	Flood risk
100 year+CC	Winter FEH	10800min	2.649	0.7	Flood risk

Adoption & Maintenance

The access road and drainage system will remain in private ownership.

3. DESIGN OF PROPOSED FOUL WATER DRAINAGE SYSTEM

Existing Foul Drainage

There is a 150mm diameter foul sewer located adjacent to the site entrance within Main Street which connects to a foul pumping station to the north east of the site. The STW sewer plan is provided at Appendix A. The sewer is approximately 2.89m deep in line with the site.

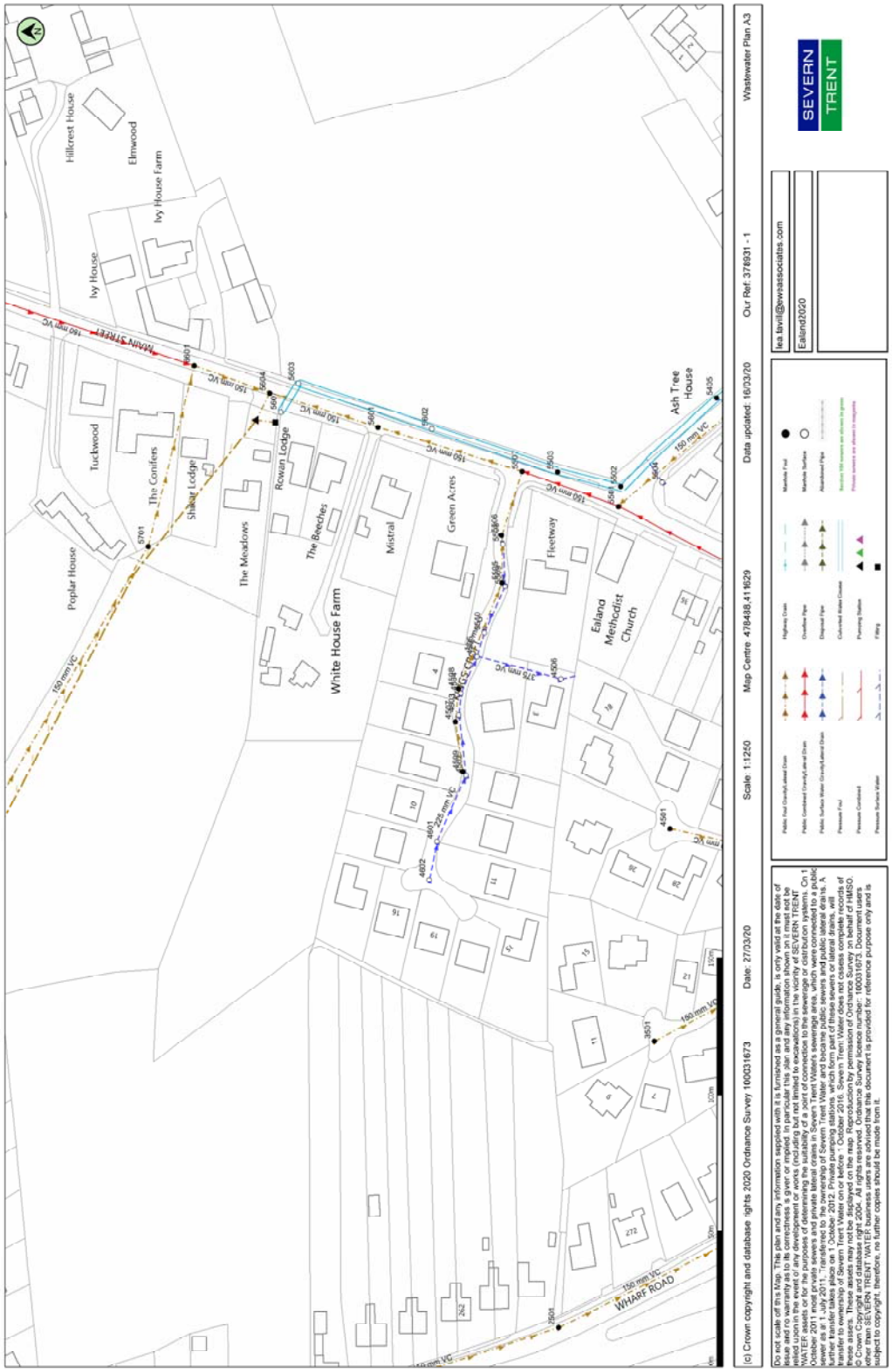
Proposed Foul Drainage

By lifting the site to at least 4mOD it is considered that the whole development can drain to the existing foul sewer within Main Street via gravity.

Adoption & Maintenance

The access road and drainage system will remain in private ownership.

Appendix A: - STW sewer plan



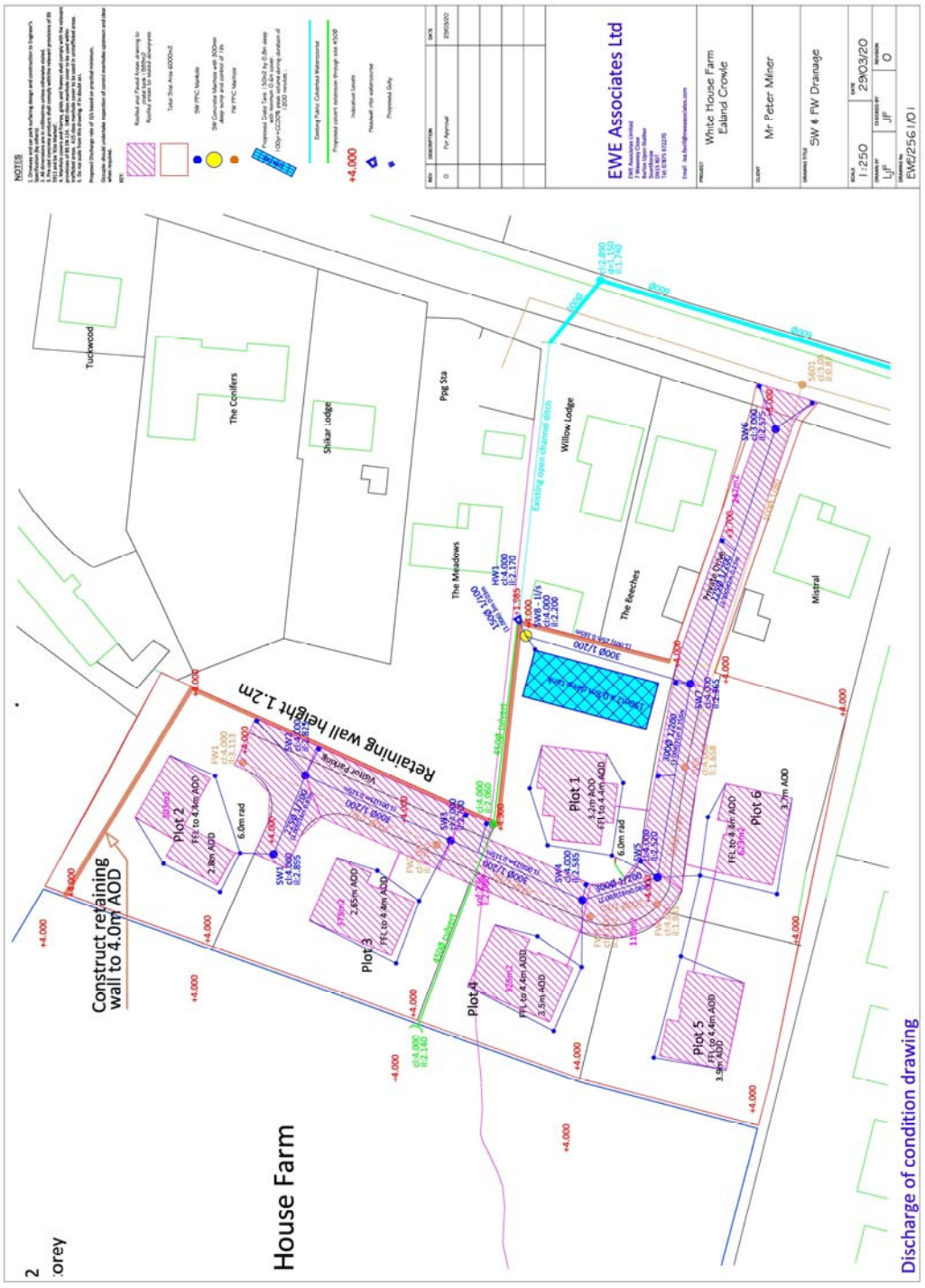
Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
5405	C	4.31	0	4.31
5502	C	3.94	0	3.94
5503	C	3.93	0	3.93
2501	F	4.88	3.33	1.55
3501	F	4.24	3.16	1.08
4501	F	4.37	3.35	1.02
4507	F	3.95	1.77	2.18
4508	F	3.87	1.71	2.15
4509	F	4.17	1.92	2.26
5501	F	3.93	1.3	2.63
5505	F	3.86	1.43	2.43
5506	F	3.65	1.31	2.34
5507	F	3.65	1.15	2.5
5601	F	3.05	0.87	2.18
5604	F	2.81	0.18	2.63
5701	F	-	0	0
6601	F	2.87	0.28	2.59
4502	S	4.19	2.62	1.57
4503	S	3.96	2.52	1.44
4504	S	3.88	2.48	1.4
4505	S	3.74	2.35	1.39
4506	S	3.81	2.24	1.57
4601	S	4.41	2.83	1.58
4602	S	4.36	2.94	1.42
5504	S	4.11	3.23	0.88
5508	S	3.7	2.76	0.94
5509	S	3.86	2.67	1.19
5510	S	3.73	2.56	1.18
5602	S	3.18	0	3.18
5603	S	2.89	0	2.89
5607	S	2.32	0	2.32

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

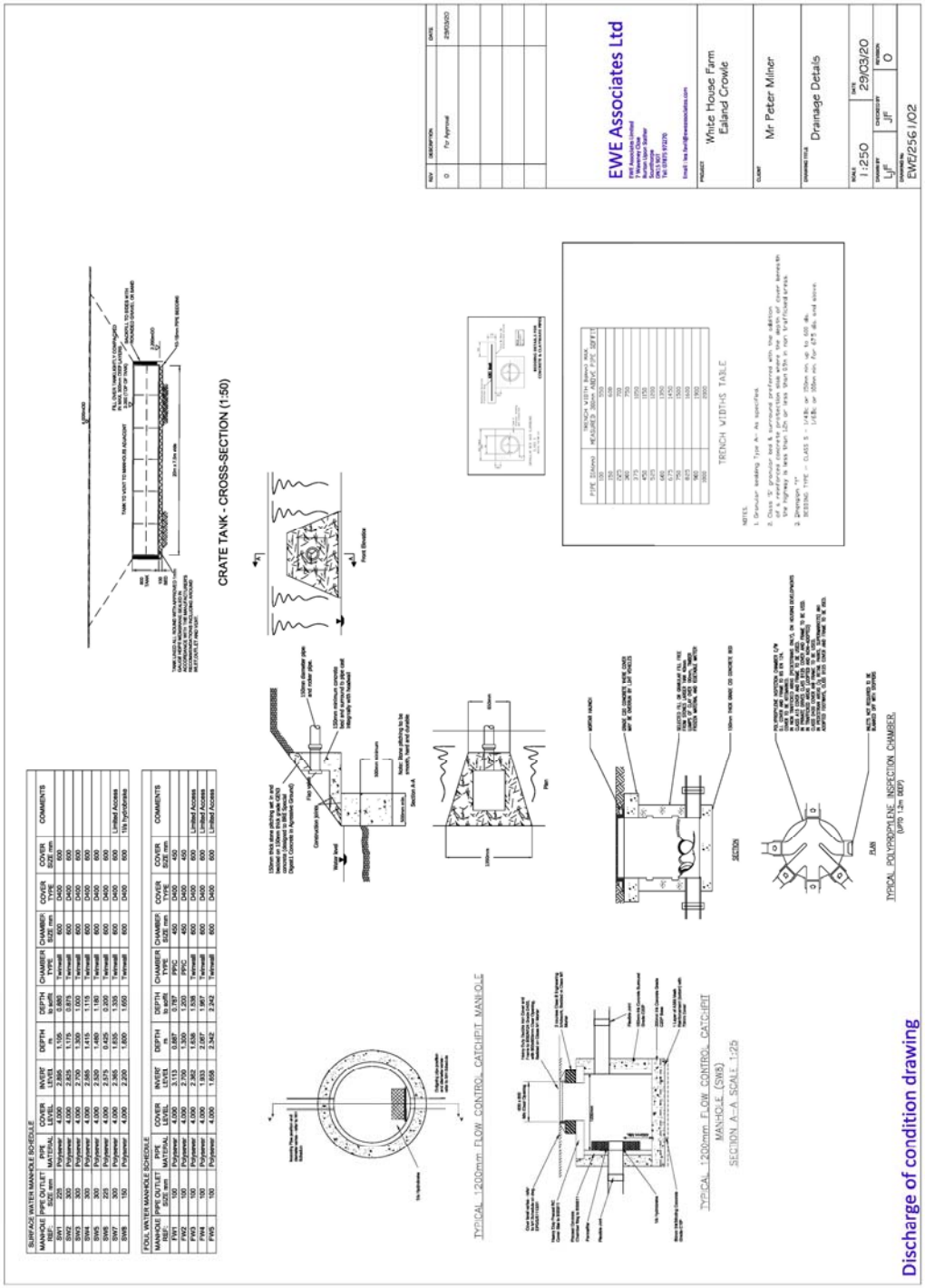
Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Our Ref: 378931 - 1

Appendix B: - Drainage Layout Drawing



Appendix C: - Drainage Details Drawings



Appendix D: -

1 in 100 year+CC
WinDes Calculation Sheets

EWE Associates Ltd		Page 1
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/03/2020 13:44	Designed By Windows7	
File 100yr+CC30%Winter...	Checked By	
Micro Drainage	Network W.12.4	

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)
1.000	14.000	0.070	200.0	0.030	4.00	0.600	o	225
1.001	25.000	0.125	200.0	0.038	0.00	0.600	o	300
1.002	23.000	0.115	200.0	0.033	0.00	0.600	o	300
1.003	13.000	0.065	200.0	0.012	0.00	0.600	o	300
1.004	31.000	0.155	200.0	0.062	0.00	0.600	o	300
2.000	42.000	0.210	200.0	0.025	4.00	0.600	o	225
1.005	25.000	0.165	151.5	0.000	0.00	0.600	o	300
1.006	3.000	0.030	100.0	0.000	0.00	0.600	o	300

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.000	1	4.000	2.895	0.880	4.000	2.825	0.950		1200
1.001	2	4.000	2.825	0.875	4.000	2.700	1.000		1200
1.002	3	4.000	2.700	1.000	4.000	2.585	1.115		1200
1.003	4	4.000	2.585	1.115	4.000	2.520	1.180		1200
1.004	5	4.000	2.520	1.180	4.000	2.365	1.335		1200
2.000	6	3.000	2.575	0.200	4.000	2.365	1.410		1200
1.005	7	4.000	2.365	1.335	4.000	2.200	1.500		1200
1.006	8	4.000	2.200	1.500	4.000	2.170	1.530	Hydro-Brake®	1050

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	HW1	4.000	2.170	2.710	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	30.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	1.000
Hot Start (mins)	0	Run Time (mins)	2400
Hot Start Level (mm)	0	Output Interval (mins)	20
Manhole Headloss Coeff (Global)	0.500		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/03/2020 13:44	Designed By Windows7	
File 100yr+CC30%Winter...	Checked By	
Micro Drainage	Network W.12.4	

Simulation Criteria for Storm

Rainfall Model	FEH
Return Period (years)	100
Site Location	478550 410900 SE 78550 10900
C (1km)	-0.025
D1 (1km)	0.299
D2 (1km)	0.309
D3 (1km)	0.301
E (1km)	0.300
F (1km)	2.458
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	1200

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/03/2020 13:44	Designed By Windows7	
File 100yr+CC30%Winter...	Checked By	
Micro Drainage	Network W.12.4	

Online Controls for Storm

Hydro-Brake® Manhole: 8, DS/PN: 1.006, Volume (m³): 3.2

Design Head (m) 0.900 Hydro-Brake® Type Md4 Invert Level (m) 2.200
Design Flow (l/s) 1.0 Diameter (mm) 37

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.5	1.200	1.2	3.000	1.8	7.000	2.8
0.200	0.5	1.400	1.3	3.500	2.0	7.500	2.9
0.300	0.6	1.600	1.3	4.000	2.1	8.000	3.0
0.400	0.7	1.800	1.4	4.500	2.3	8.500	3.1
0.500	0.8	2.000	1.5	5.000	2.4	9.000	3.2
0.600	0.8	2.200	1.6	5.500	2.5	9.500	3.3
0.800	1.0	2.400	1.7	6.000	2.6		
1.000	1.1	2.600	1.7	6.500	2.7		

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/03/2020 13:44	Designed By Windows7	
File 100yr+CC30%Winter...	Checked By	
Micro Drainage	Network W.12.4	

Storage Structures for Storm

Tank or Pond Manhole: 8, DS/PN: 1.006

Invert Level (m) 2.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	150.0	1.400	0.0	2.800	0.0	4.200	0.0
0.200	150.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	150.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	150.0	2.000	0.0	3.400	0.0	4.800	0.0
0.800	150.0	2.200	0.0	3.600	0.0	5.000	0.0
1.000	0.0	2.400	0.0	3.800	0.0		
1.200	0.0	2.600	0.0	4.000	0.0		

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/03/2020 13:44	Designed By Windows7	
File 100yr+CC30%Winter...	Checked By	
Micro Drainage	Network W.12.4	

Summary of Results for 1200 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	3.000	-0.120	0.000	0.03	0.0	0.9	OK
1.001	2	3.000	-0.125	0.000	0.03	0.0	2.1	OK
1.002	3	3.000	0.000	0.000	0.04	0.0	3.1	OK
1.003	4	2.998	0.113	0.000	0.05	0.0	3.4	SURCHARGED
1.004	5	2.998	0.178	0.000	0.07	0.0	5.2	SURCHARGED
2.000	6	2.997	0.197	0.000	0.02	0.0	0.7	FLOOD RISK
1.005	7	2.997	0.332	0.000	0.07	0.0	5.5	SURCHARGED
1.006	8	2.996	0.496	0.000	0.02	0.0	1.0	SURCHARGED