

John Brooke Builders

**Proposed Residential Dwellings
Lands Beck Way
Liversedge**

Drainage Assessment

**Prepared by EWE Associates Ltd
Final RevA May 2023**



**EWE Associates Ltd
7 Waveney Close
Burton Upon Stather
Scunthorpe
North Lincolnshire
DN15 9DT
t: 01724 721099
M: 07875 972270**

e: lea.favill@eweassociates.com

This document has been prepared solely as a Drainage Assessment for John Brooke Builders. EWE Associates Ltd accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

CLIENT DETAILS

John Brooke Builders

CONTRACT

This report describes work commissioned by John Brooke Builders during April 2022. John Brooke Builders representative for the contract was Mr Mark Brotherton of Fox Architecture & Design. Lea Favill of EWE Associates Ltd carried out the work.

Date: 5th May 2023

Prepared by:



..... Lea Favill
Director

REVISION HISTORY

Draft Report Rev0 issued 9th May 2022
- 1No copy issued to Mr Mark Brotherton

Final Report RevA issued 5th May 2023
- 1No copy issued to Mr Mark Brotherton

CONTENTS

1.	INTRODUCTION	4
	Terms of Reference	4
	Approach to the Assessment	4
	Design Constraints	4
2.	DESIGN OF PROPOSED SURFACE WATER DRAINAGE SYSTEM	6
	Existing Drainage	6
	Proposed Drainage Strategy	6
	Adoption & Maintenance	7
3.	DESIGN OF PROPOSED FOUL WATER DRAINAGE SYSTEM	8

APPENDICES:

APPENDIX A: -	ADAS RUNOFF CALCULATION
APPENDIX B: -	DRAINAGE DRAWING
APPENDIX C: -	1 IN 100 YEAR+CC WINDES CALCULATION SHEETS
APPENDIX D: -	YW SEWER PLAN

1. INTRODUCTION

Terms of Reference

This report was commissioned by John Brooke Builders to consider the surface water and foul water drainage system for the proposed residential dwelling off Lands Beck Way Liversedge.

The proposal involves the construction of several residential dwellings, access roads and driveways. The drainage issues are being considered as part of the current planning application.

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 19 residential dwellings which will be sold to individual owners as such any private drainage features will be maintained by the individual owners. The primary drainage located within the adoptable highway and attenuation tank located within the easement area will be offered to Yorkshire Water for adoption.
- SUDs features are to be recommended where practically possible.
- There is a 150mm diameter foul public sewer crossing the site. There is a surface water sewer to the south of the site. There are public surface water and combined sewers within the highway to the north.

- The site investigation report comments that the site is underlain by clay materials. Subsequently, infiltration drainage is not considered a practical solution for this site at this stage.
- A discharge rate of 3.8l/s has been estimated for the site. Consenting will be required for the proposed connection into the public sewer.
- It is assumed that the minimum design standard is 1 in 100 years plus climate change (40%) 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 (40%) storm.

2. DESIGN OF PROPOSED SURFACE WATER DRAINAGE SYSTEM

Existing Drainage

The existing development site consists of a single grassed field which is 0.782 hectares in area and slopes from north to south. There is a surface water sewer to the south.

Any discharge from the site into the surface water sewer will require the consent of the appropriate water authority, as such, they will also need to be approached to agree the discharge restriction from the site.

The existing peak runoff rate from the site based on Q_{bar} is 3.8 l/s. The existing runoff calculation sheet is provided at Appendix A.

Proposed Drainage Strategy

A peak discharge rate from the site of 3.8 l/s has been estimated. An assessment of the required balance volume has been made using the estimated post development impermeable area of 0.3904 hectares. Using WinDes software developed by Microdrainage the required attenuation has been calculated for the 1 in 100 year plus climate change (40%) event.

The drainage strategy utilises an appropriately sized hydro brake to restrict the flow rate to a maximum of 3.8 l/s. 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.

Based upon the assumption that the drainage authority will agree to the maximum discharge rates of 3.8 l/s, a preliminary surface water network has been developed and attenuation has been sized using MicroDrainage software.

The model data for the proposed surface water drainage network has been obtained from the proposed development layout drawing and the drainage strategy drawing is provided at Appendix B of this report. A model has been developed to represent the main drainage runs within the proposed drainage network and contributing drainage areas within the development.

Overall, the hydraulic models include the following;

- 7 pipes to represent the proposed system
- 1 hydro-brake downstream of pond (3.8 l/s 1.9m head)
- 1 attenuation tank
- 1 outfall into the surface water sewer with no surcharging

Impermeable area contributions have been based on those supplied on the proposed layout drawing, considered to be 100% impermeable, comprising of roofed and paved areas.

The models have been set up as a fixed runoff model assuming 100% runoff coefficient for roofed and paved areas. The rainfall characteristics for Liversedge have been utilised with a value for M5-60 given as 20mm (the depth of rain in a once in five years one hour duration event); and r given as 0.40 (the ratio of the M5-60

rainfall to the M5-2day rainfall). For durations over 60 minutes the FEH runoff data for Liversedge has been used.

Hydraulic Modelling Results

The proposed MicroDrainage models have been simulated with the 1 in 100 year plus climate change (40%) return period design storm events with durations of 15, 45, 60, 360, 600, 900 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 tank and flow through the hydro-brake.

The 900 minute duration produced the largest flow through the hydro-brake (3.4 l/s) which is less than the restricted runoff rate (3.8l/s). The modelled result for the 900 minute Winter model run is provided at Appendix C. There was no flooding during this event.

Return Period	Profile	Duration (min)	Peak water level in tank	Peak flow into sewer	Status
100 year+CC	Winter FSR	15min	102.414	2.6	Surcharge
100 year+CC	Winter FSR	45min	102.621	2.9	Surcharge
100 year+CC	Winter FEH	60min	102.681	2.9	Surcharge
100 year+CC	Winter FEH	360min	103.015	3.3	Surcharge
100 year+CC	Winter FEH	600min	103.037	3.4	Surcharge
100 year+CC	Winter FEH	900min	103.042	3.4	Surcharge
100 year+CC	Winter FEH	1440min	103.039	3.4	Surcharge
100 year+CC	Winter FEH	10080min	102.113	2.1	Surcharge

Adoption & Maintenance

It is considered that the piped drainage systems and attenuation structure will be adopted by Yorkshire Water.

3. DESIGN OF PROPOSED FOUL WATER DRAINAGE SYSTEM

There is a 150mm diameter foul sewer crossing the site. The Yorkshire Water sewer plan is provided at Appendix D.

It is proposed to drain all dwellings within the proposed development site into the foul sewer via gravity. Ground flood levels will be raised to accommodate where required.

Appendix A: - ADAS Runoff Calculation

EWE Associates Ltd		Page 1
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
Date 07/10/2021 18:11 File	Designed By Lea Checked By	
Micro Drainage Source Control W.12.4		

ADAS 345 Mean Annual Flood

Input

Area (ha)	0.782	Soil Type Factor (St)	0.400
Length (m)	100.000	Paved Area (%)	0.000
Average Slope (1:X)	25.0	Dominant Crop Type	Grass
AAR (mm)	766	Region Number	Region 3

Results 1/s

Q0 - Peak Flood Flow	3.3
Total Q0	3.3
QBAR	3.8
Q1 year	3.3
Q1 year	3.3
Q2 years	3.6
Q5 years	4.8
Q10 years	5.6
Q20 years	6.3
Q25 years	6.5
Q30 years	6.7
Q50 years	7.3
Q100 years	8.0
Q200 years	9.1
Q250 years	9.4
Q1000 years	11.7

©1982-2010 Micro Drainage Ltd

**Appendix C: - 1 in 100
year+CC WinDes
Calculation
Sheets**

EWE Associates Ltd		Page 1							
Windy Ridge Barn									
Thealby Lane									
Winterton DN15 9TG									
Date 05/05/2023 08:36		Designed By Lea							
File 100yr+CC40%Winter...		Checked By							
Micro Drainage		Network W.12.4							
<u>Existing Network Details for Storm</u>									
PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	k (mm)	HID SECT	DIA (mm)	
1.000	36.000	1.530	23.5	0.074	4.00	0.600	o	225	
1.001	31.800	2.720	11.7	0.076	0.00	0.600	o	225	
1.002	24.000	2.400	10.0	0.052	0.00	0.600	o	225	
2.000	18.000	1.800	10.0	0.065	4.00	0.600	o	225	
2.001	19.000	1.900	10.0	0.047	0.00	0.600	o	225	
1.003	30.000	0.100	300.0	0.073	0.00	0.600	[]	-1	
1.004	69.000	13.360	5.2	0.000	0.00	0.600	o	225	
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	109.750	108.250	1.275	108.220	106.720	1.275		1050
1.001	2	108.220	106.720	1.275	106.600	104.000	2.375		1050
1.002	3	106.600	104.000	2.375	105.400	101.600	3.575		1200
2.000	4	107.000	105.300	1.475	106.200	103.500	2.475		1050
2.001	5	106.200	103.500	2.475	105.400	101.600	3.575		1200
1.003	6	105.400	101.600	3.200	103.500	101.500	1.400		3000
1.004	7	103.500	101.500	1.775	90.000	88.140	1.635	Hydro-Brake®	3000
<u>Free Flowing Outfall Details for Storm</u>									
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)			
1.004		90.000	88.140	88.140	0	0			
<u>Simulation Criteria for Storm</u>									
Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)		0.000					
PIMP (% impervious)	100	Additional Flow - % of Total Flow		40.000					
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage		0.000					
Hot Start (mins)	0	Run Time (mins)		1800					
Hot Start Level (mm)	0	Output Interval (mins)		15					
Manhole Headloss Coeff (Global)	0.500								
Number of Input Hydrographs	0	Number of Storage Structures	0						
Number of Online Controls	1	Number of Time/Area Diagrams	0						
Number of Offline Controls	0								
<u>Synthetic Rainfall Details</u>									
Rainfall Model FEH									
©1982-2010 Micro Drainage Ltd									

EWE Associates Ltd		Page 2
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
Date 05/05/2023 08:36	Designed By Lea	
File 100yr+CC40%Winter...	Checked By	
Micro Drainage	Network W.12.4	
<u>Synthetic Rainfall Details</u>		
Return Period (years)	100	
Site Location	418900 423600 SE 18900 23600	
C (1km)	-0.025	
D1 (1km)	0.350	
D2 (1km)	0.430	
D3 (1km)	0.288	
E (1km)	0.301	
F (1km)	2.351	
Summer Storms	No	
Winter Storms	Yes	
Cv (Summer)	0.750	
Cv (Winter)	0.840	
Storm Duration (mins)	900	
©1982-2010 Micro Drainage Ltd		

EWE Associates Ltd

Windy Ridge Barn

Thealby Lane

Winterton DN15 9TG

Date 05/05/2023 08:36

File 100yr+CC40%Winter...

Designed By Lea

Checked By

Micro Drainage

Network W.12.4

Page 3



Online Controls for Storm

Hydro-Brake® Manhole: 7, DS/PN: 1.004, Volume (m³): 257.1

Design Head (m) 2.000

Hydro-Brake® Type Md4

Invert Level (m) 101.500

Design Flow (l/s) 3.8

Diameter (mm) 59

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6	1.200	3.0	3.000	4.7	7.000	7.2
0.200	1.4	1.400	3.2	3.500	5.1	7.500	7.4
0.300	1.5	1.600	3.4	4.000	5.4	8.000	7.7
0.400	1.7	1.800	3.6	4.500	5.8	8.500	7.9
0.500	1.9	2.000	3.8	5.000	6.1	9.000	8.1
0.600	2.1	2.200	4.0	5.500	6.4	9.500	8.4
0.800	2.4	2.400	4.2	6.000	6.6		
1.000	2.7	2.600	4.4	6.500	6.9		

©1982-2010 Micro Drainage Ltd

EWE Associates Ltd

Windy Ridge Barn

Thealby Lane

Winterton DN15 9TG

Date 05/05/2023 08:36

File 100yr+CC40%Winter...

Designed By Lea

Checked By

Micro Drainage

Network W.12.4

Page 4



Summary of Results for 900 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm)

450.0

DVD Status

OFF

Analysis Timestep

Fine

Inertia Status

OFF

DTS 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	108.276	-0.199	0.000	0.03	0.0	3.3	OK
1.001	2	106.751	-0.194	0.000	0.05	0.0	6.6	OK
1.002	3	104.035	-0.190	0.000	0.06	0.0	8.9	OK
2.000	4	105.321	-0.204	0.000	0.02	0.0	2.9	OK
2.001	5	103.527	-0.198	0.000	0.03	0.0	4.9	OK
1.003	6	103.042	-0.058	0.000	0.00	0.0	16.5	OK
1.004	7	103.042	1.317	0.000	0.02	0.0	3.4	SURCHARGED

©1982-2010 Micro Drainage Ltd

Appendix D: - YW sewer plan

