FOXDEN WAY, GREAT BOURTON
TECHNICAL NOTE: DRAINAGE STATEMENT
MARCH 2021
REF: 264337-01-TN-01 REV A

M-EC
Consulting Development Engineers

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Introduction

Mewies Engineering Consultants Ltd (M-EC) has been commissioned by Fernhill Estates to produce a Drainage Statement in support of a proposed residential development at Foxden Way, Great Bourton. A site location plan is provided in Appendix A.

The proposed residential development will comprise up to 9 dwellings, with associated infrastructure, parking and access to Foxden Way. The development will take place on the Greenfield site west of Foxden Way, south of Great Bourton and is centred on OS grid reference 445709, 245315. The total site area is approximately 0.92ha and is shown indicatively in red in Figure 1 below. A proposed site layout is contained in Appendix B.

Figure 1: Site location plan

A review of the Flood Maps for Planning shows the site lies wholly within Flood Zone 1 (FZ1). Flood Zone 1 is defined as land assessed as having an annual probability of river flooding less than 0.1%. The Environment Agency Flood Risk from Surface Water Map indicates there is generally a very low risk of surface water flooding within the site.

Surface Water Management Strategy
It is essential that the proposed development does not increase flood risk to adjacent land or downstream of the site, as well as protecting the development from flooding itself. To ensure that the flood risk is minimised, the drainage design will incorporate the following flood mitigation measures:

- Finished floor levels will be designed to retain and direct all overland surface water flows away from the dwellings following the natural topography of the land.

- The proposed development will include a surface water drainage system that will intercept the runoff generated within the development. This will minimise the risk to the new buildings and also reduce the incidence of overland flows.

- The surface water drainage system will convey flows to an attenuation basin on site. The surface water flows generated from the development up to and including a 1 in 100-year return period, plus 40% climate change, will be stored on-site and discharged at a restricted rate of 3l/s.

Surface water arising from developed sites should, as far as practical, be managed in a sustainable manner to mimic the surface water flows arising from the undeveloped site. When considering the surface water discharge the SuDS hierarchy needs to be adhered to. The SuDS hierarchy states that the top option has to be adhered to or evidenced otherwise before moving down the hierarchy. Each option is considered below:

- **Discharge to a source (soakaway)**: The local geology comprises mudstone (clay) and is therefore considered impermeable. Soakage testing completed on land to this north of this site and for a different development proposal confirms soakage isn't feasible. Soakage testing can be conditioned to any planning permission and completed in due course as part of a detailed site investigation. For the purpose of this assessment soakage is not considered feasible.

- **Watercourse**: A ditch is noted along Foxden Way and adjacent to the eastern boundary of the site. This is considered to be a viable outfall route for surface water flows from the site and is likely to receive existing overland flows from the site. This ditch course will therefore be the outfall location for surface water flows from the proposed development.

- **Public Sewer**: No sewers are noted close to the site and as a discharge option is available higher up the hierarchy this option is not considered further.

Land Use
In order to calculate the drainage requirements, an understanding of the land uses on-site needs to be known. Table 1, below summarises the proposed land uses within the site. The current site is 100% Greenfield and the current land use has been calculated using the existing site plan and the post-development land use has been measured from the proposed layout.

Table 1: Existing and Proposed Land Use Summary

Land Use Type	Existing Site Areas		Proposed Site Areas	
	Ha	%	Ha	%
Impermeable Areas	0.00	0	0.36	39
Green Landscape / Permeable areas	0.92	100	0.56	61
TOTAL	**0.92**	**100**	**0.92**	**100**

Urban Creep Allowances
Urban creep is the conversion of permeable surfaces to impermeable ones over time, e.g. extensions to existing buildings. It has been shown that, over the lifetime of development, urban creep can increase impermeable areas by as much as 10%. An allowance of 10% for increases in the impermeable area

due to urban creep over the lifetime of the development will be included in the drainage calculations and the total calculated impermeable area will be 0.39ha based on a 10% increase to proposed values

Drainage Strategy
The overall drainage strategy has been based on the land use table, discharge rate and the current site layout presented in Appendix B. In accordance with the National SuDS Standards strategy involves conveying surface water flows to an attenuation pond on-site, which will discharge into the existing ditch network along the eastern boundary of the site at a restricted rate of 3l/s.

Existing runoff conditions have been calculated using the ICP SuDS module of MicroDrainage to calculate the Greenfield discharge rate for the developable site area of 0.92ha, the QBAR Greenfield rate has been calculated as 0.4l/s Calculation of Greenfield rate is included in Appendix F. As this rate represent a rate that would lead to increase of blockages within the outfall discharge rates will be restricted to 3l/s to serve as a practicable minimum.

A total storage volume of 220.3m^3 will be available for surface water storage within the attenuation basin to accommodate flows generated by an impermeable area of 0.39ha. This is to allow sufficient time for all surface water to discharge at the proposed rates and cater for all events up to the 1 in 100-year return period with a 40% climate change allowance. Calculations can be found in Appendix G. Additional attenuation storage will be provided within permeable paving, but have not been included in the drainage calculations at this stage.

In the event that there is a failure of the drainage system or an event exceeding the design storm any exceedance flows and overland flows will be routed away from dwelling houses to the areas of lowest risk on the site.

A drainage strategy based on the principles above is shown on drawing 26437_01_230_01 in Appendix G.

Surface Water Quality
The CIRIA SuDS Manual, C753, indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. Surface water runoff from the residential roofs has a very low pollution hazard, while the minor road and parking areas have a low pollution hazard. As shown in Table 2 from the CIRIA SuDS Manual, the Mitigation Indices provided by the infiltration basin are greater than or equal to the Pollution Hazard Indices for each component, ensuring the proposed system provides adequate water quality treatment for surface water runoff.

Table 2: CIRIA C753 Pollution Hazard Indices and SuDS Mitigation Indices

Pollution Hazard Indices				
Land use	**Pollution hazard level**	**Total suspended solids (TSS)**	**Metals**	**Hydro-carbons**
Residential roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4
SuDS Mitigation indices for SuDS components for discharging surface water				
Attenuation Basin		0.5	0.5	0.6
Permeable Paving		0.7	0.6	0.7

Maintenance and Management
The continued maintenance of any adopted sewer will be the responsibility of Thames Water. Private drainage systems will be maintained by the landowners and a management company appointed on their behalf.

The detention basin will first be offered to bodies such as the Local Authority for adoption and future maintenance. Should this not be taken up, a management company will be employed. Full details will be provided of the responsible body to conduct the maintenance activities identified in Table 3.

Table 3: Proposed Maintenance Regime

Drainage Asset	Responsible Organisation	Maintenance Work	Frequency
Pipework / Manholes	Private Ownership / Management Company / Thames Water	Inspect pipework and clear blockages	Annually or after severe storms.
		Inspect manholes and clear blockages	
		Repair any defects in the network	
Headwalls	Local Authority/ Management Company	Inspect structure and remove any debris/litter on structure	Monthly or after severe storms.
Attenuation Basin	Local Authority/ Management Company	Amenity grass cutting of surrounding green spaces	As required
		Litter and debris removal	Monthly
		Inspect and clear inlets, outlets and overflows	6 Monthly

Foul Water Drainage
Foul water generated by the site will be collected and treated on-site via a Klargerster Sewage Treatment Plant or similar and will be discharged as clean water into the existing ditch network along the eastern boundary via the proposed attenuation basin.

The relevant permits will be obtained from the Environmental Agency before discharging treated foul water into the existing ditch network via the proposed attenuation basin to ensure compliance with standards.

Summary
To summarise the key points outlined above:

- All development is located within Flood Zone 1 and is therefore compatible with a “more vulnerable” development in line with policy guidance.
- The risk of flooding from surface water on the site is very low.
- The risk from all other sources of flooding is very low.
- Surface water runoff generated at the site will be conveyed, stored and treated within the proposed attenuation basin on site. Surface water stored within the proposed attenuation basin will discharge into the existing ditch network along the eastern boundary of the site at a restricted rate of 3l/s.
- Surface Water runoff will be stored within the proposed tank and discharge into the ditch network on-site, this will cater for all events up to and including the 1 in 100 year plus 40% climate change storm.
- A total storage volume of 220.3m^3 will be available within the proposed attenuation basin to manage flows generated for events up to and including the 1 in 100 year plus 40% climate change storm.
- Foul Water generated by the site will be collected and collected be treated on-site via a Klargerster Sewage Treatment Plant or similar and will be discharged as clean water via the surface water sewer network. The relevant agreements will be sought from the Environmental Agency to discharge treated foul water to the watercourse on site.

Report Prepared By:

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Ryan Chafer BSc (Hons)
Assistant Flood Risk Engineer

Report Checked By:

.....
Alexander Bennett BSc (Hons) MCIHT MTPS
Director

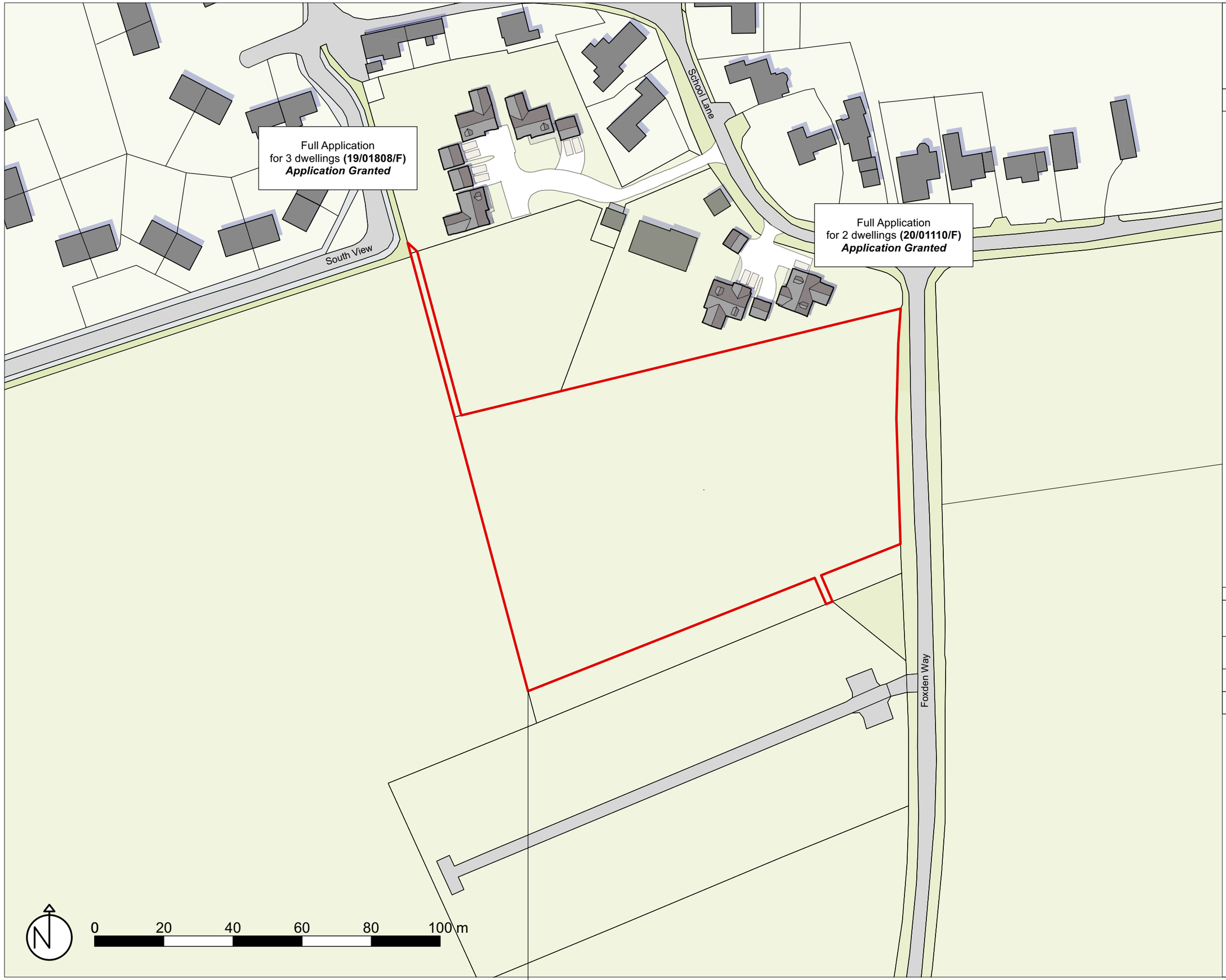
Appendix:

A. Site Location Plan
B. Proposed Site Layout Plan
C. Greenfield Calculations
D. Surface Water Attenuation Calculations
E. Drainage Strategy Drawing – 26437_01_230_01a

Registration of Amendments

Revision	Comments	Prepared By:	Checked By:
- March 2020	Initial submission	RC	AB
A March 2020	Addition of permeable paving	RC	AB

APPENDIX A



PLANNING

Site boundary *(0.92ha)*

Rev.	Date	Description

Land to the west of Foxden Way,
GREAT BOURTON

Location Plan

Job ref:	Drawing number:	Revision:
333	L01	-

Scale:	Date:
1:1,000 @ A3	March 2021

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APPENDIX B

Unit Type	GIA (sqm)	GIA (sqft)	Total provided	TOTAL GIA (sqm)	TOTAL GIA (sqft)
2B4P domer bungalows	90.6	975	2	*181.2*	*1950.0*
3B6P detached house - A	98.4	1059	2	*196.8*	*2118.4*
3B6P detached house - B	104.0	1119	4	*416.0*	*4477.8*
4B7P detached house	116.3	1252	1	*116.3*	*1251.9*
		TOTAL	**9**	***910.3***	***9798***

PLANNING

- Site boundary *(0.92ha)*
- 1 Proposed footpath
- 2 Proposed play area
- 3 Area reserved for attenutation

Rev.	Date	Description

Land to the west of Foxden Way,
GREAT BOURTON

Illustrative Masterplan

Job ref:	Drawing number:	Revision:
333	P01	-

Scale:	Date:
1:1,000 @ A3	March 2021

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APPENDIX C

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 700 Urban 0.000
Area (ha) 0.920 Soil 0.150 Region Number Region 4

Results l/s

QBAR Rural 0.4
QBAR Urban 0.4

Q100 years 1.0

Q1 year 0.3
Q30 years 0.7
Q100 years 1.0

APPENDIX D

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Project No	26437
Sheet	1 of 5
Engineer	R.Chafer
Date	March 2021
Revision	-

DESIGN CALCULATIONS FRONT SHEET

SCHEME	Foxden Way, Great Bourton
CLIENT	Fernhill Estates
ASPECTS OF SCHEME TO BE DESIGNED	1. Surface water attenuation design/simulations for the 1 in 100 year + 40% climate change design event for the development site.
CODES OF PRACTICE, DESIGN SPECIFICATIONS & BRITISH STANDARDS	1. Design and analysis of urban storm drainage. Wallingford Procedure Vol. 1. 2. Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems – 2015 3. The SuDS Manual – CIRIA C753.
NOTES	Calculations carried out using the Source Control system within MicroDrainage computer program.

INDEX

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	142.342	0.342	3.0	95.7	O K
30 min Summer	142.432	0.432	3.0	124.4	O K
60 min Summer	142.514	0.514	3.0	151.9	O K
120 min Summer	142.581	0.581	3.0	175.4	O K
180 min Summer	142.608	0.608	3.0	185.2	O K
240 min Summer	142.619	0.619	3.0	189.1	O K
360 min Summer	142.619	0.619	3.0	189.4	O K
480 min Summer	142.608	0.608	3.0	185.3	O K
600 min Summer	142.592	0.592	3.0	179.3	O K
720 min Summer	142.577	0.577	3.0	174.1	O K
960 min Summer	142.553	0.553	3.0	165.4	O K
1440 min Summer	142.511	0.511	3.0	150.9	O K
2160 min Summer	142.450	0.450	3.0	130.3	O K
2880 min Summer	142.381	0.381	3.0	108.0	O K
4320 min Summer	142.258	0.258	3.0	70.4	O K
5760 min Summer	142.163	0.163	3.0	42.9	O K
7200 min Summer	142.094	0.094	3.0	24.4	O K
8640 min Summer	142.049	0.049	2.9	12.5	O K
10080 min Summer	142.020	0.020	2.8	5.1	O K
15 min Winter	142.380	0.380	3.0	107.8	O K
30 min Winter	142.479	0.479	3.0	140.2	O K
60 min Winter	142.570	0.570	3.0	171.6	O K
120 min Winter	142.646	0.646	3.0	199.3	O K
180 min Winter	142.679	0.679	3.0	211.6	O K
240 min Winter	142.695	0.695	3.0	217.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.945	0.0	100.0	26
30 min Summer	89.598	0.0	130.9	41
60 min Summer	55.837	0.0	163.2	70
120 min Summer	33.631	0.0	196.5	128
180 min Summer	24.676	0.0	216.4	186
240 min Summer	19.697	0.0	230.3	246
360 min Summer	14.271	0.0	250.2	362
480 min Summer	11.359	0.0	265.7	480
600 min Summer	9.509	0.0	278.2	554
720 min Summer	8.220	0.0	288.4	610
960 min Summer	6.527	0.0	305.5	734
1440 min Summer	4.709	0.0	330.5	1002
2160 min Summer	3.392	0.0	356.8	1416
2880 min Summer	2.685	0.0	377.0	1816
4320 min Summer	1.929	0.0	406.3	2548
5760 min Summer	1.524	0.0	428.1	3232
7200 min Summer	1.269	0.0	445.0	3896
8640 min Summer	1.092	0.0	459.8	4576
10080 min Summer	0.962	0.0	472.5	5240
15 min Winter	136.945	0.0	112.0	26
30 min Winter	89.598	0.0	146.6	40
60 min Winter	55.837	0.0	182.8	68
120 min Winter	33.631	0.0	220.1	126
180 min Winter	24.676	0.0	242.5	184
240 min Winter	19.697	0.0	258.0	240

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	142.702	0.702	3.0	220.2	Flood Risk
480 min Winter	142.697	0.697	3.0	218.2	O K
600 min Winter	142.684	0.684	3.0	213.4	O K
720 min Winter	142.667	0.667	3.0	207.1	O K
960 min Winter	142.633	0.633	3.0	194.3	O K
1440 min Winter	142.579	0.579	3.0	174.8	O K
2160 min Winter	142.494	0.494	3.0	145.2	O K
2880 min Winter	142.394	0.394	3.0	112.2	O K
4320 min Winter	142.207	0.207	3.0	55.5	O K
5760 min Winter	142.083	0.083	3.0	21.4	O K
7200 min Winter	142.019	0.019	2.8	4.7	O K
8640 min Winter	142.000	0.000	2.5	0.0	O K
10080 min Winter	142.000	0.000	2.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.271	0.0	280.4	356
480 min Winter	11.359	0.0	297.4	468
600 min Winter	9.509	0.0	311.5	576
720 min Winter	8.220	0.0	323.0	678
960 min Winter	6.527	0.0	341.9	770
1440 min Winter	4.709	0.0	370.1	1078
2160 min Winter	3.392	0.0	399.8	1540
2880 min Winter	2.685	0.0	422.0	1968
4320 min Winter	1.929	0.0	454.8	2648
5760 min Winter	1.524	0.0	479.4	3288
7200 min Winter	1.269	0.0	498.8	3832
8640 min Winter	1.092	0.0	515.2	0
10080 min Winter	0.962	0.0	529.3	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.700	Shortest Storm (mins)	15
Ratio R	0.409	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.390

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.130	4	8	0.130	8	12	0.130

Model Details

Storage is Online Cover Level (m) 143.000

Tank or Pond Structure

Invert Level (m) 142.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	250.0	0.700	381.6	1.000	446.4

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0085-3000-0800-3000
Design Head (m)	0.800
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	85
Invert Level (m)	141.900
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	3.0	Kick-Flo®	0.517	2.5
Flush-Flo™	0.239	3.0	Mean Flow over Head Range	-	2.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.6	0.800	3.0	2.000	4.6	4.000	6.3	7.000	8.3
0.200	3.0	1.000	3.3	2.200	4.8	4.500	6.7	7.500	8.5
0.300	3.0	1.200	3.6	2.400	5.0	5.000	7.0	8.000	8.8
0.400	2.9	1.400	3.9	2.600	5.2	5.500	7.4	8.500	9.0
0.500	2.6	1.600	4.1	3.000	5.5	6.000	7.7	9.000	9.3
0.600	2.6	1.800	4.4	3.500	6.0	6.500	8.0	9.500	9.6

APPENDIX E

South View

Foxden Way

147m
146.5m
146m
145.5m
145m
144.5m
144m
143.5m
143m

ATTENUATION POND DETAILS
DESIGN BASED ON IMPERMEABLE AREA OF 0.39HA INCLUDING A 10% ALLOWANCE FOR URBAN CREEP.

POND COVER LEVEL = 143.00m
INVERT LEVEL = 142.00m
MAX DEPTH OF WATER = 0.70m
FREEBOARD = 0.30m
PLAN AREA = 446.4m²

STORAGE VOLUME OF 220.2m³ IS REQUIRED TO ACCOMMODATE STORAGE FOR ALL STORM EVENTS UP TO AND INCLUDING A 1 IN 100 YEAR RETURN PERIOD WITH A 40% CLIMATE CHANGE ALLOWANCE.

HYDRO-BRAKE OUTFLOW CONTROL
INVERT LEVEL = 141.90m
DESIGN FLOW = 3 l/s

EXISTING DITCH NETWORK
TOP OF BANK: TBC
INVERT LEVEL: TBC
PROPOSED CONNECTION FOR SURFACE WATER OUTFALL.

PROPOSED HYDRO-BRAKE FLOW CONTROL AT 3 l/s
INVERT LEVEL = 141.90m

PROPOSED KLARGESTER SEWER TREATMENT WORKS TO TREAT FOUL FLOWS FROM THE RESIDENTIAL DWELLINGS. DESIGN AND SPECIFICATION TO BE CONFIRMED AT DETAILED DESIGN STAGE. TREATED FLOWS TO DISCHARGE INTO PROPOSED ATTENUATION BASIN.

NOTES:

1. DO NOT SCALE THIS DRAWING.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SPECIALIST DESIGN DRAWINGS AND DETAILS.
3. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
4. THIS DRAWING IS FOR STRATEGY PURPOSES ONLY AND IS NOT TO BE USED FOR CONSTRUCTION PURPOSES.
5. DESIGN BASED ON 1M DTM LIDAR DATA FROM THE ENVIRONMENTAL AGENCY.
6. DETAILED SURVEY IS TO BE CARRIED OUT TO CONFIRM EXISTING LEVELS AT THE SITE AND WITHIN THE DITCH NETWORK.
7. CONCRETE PROTECTION TO BE PROVIDED TO ANY PIPES WITH LOW COVER.
8. THE DRAINAGE STRATEGY WILL NEED UPDATING IF THE LAYOUT IS REVISED.
9. PROPOSED KLARGESTER SEWER TREATMENT WORKS TO TREAT FOUL FLOWS FROM THE RESIDENTIAL DWELLINGS. DESIGN AND SPECIFICATION TO BE CONFIRMED AT DETAILED DESIGN STAGE. TREATED FLOWS TO DISCHARGE INTO PROPOSED ATTENUATION BASIN.
10. SURFACE WATER FLOWS WILL DISCHARGE INTO THE EXISTING DITCH NETWORK EAST OF THE SITE SUBJECT TO DOWNSTREAM CONNECTIVITY, CAPACITY CHECK AND AGREEMENT FROM THE WATER AUTHORITIES.

KEY

- SITE BOUNDARY
- EXISTING DITCH NETWORK
- PROPOSED FOOT PATH
- PROPOSED ATTENUATION BASIN
- PROPOSED PERMEABLE PAVING
- PROPOSED KLARGERSTER SEWAGE TREATMENT PLANT
- OVERLAND FLOW ROUTES

REV.	AMENDMENTS:	DRN:	CHK:	APP:	DATE:
A	ADDITION OF PERMEABLE PAVING	RC	AB	AB	15.03.21
-	FIRST ISSUE	RC	HR	AB	12.03.21

PROJECT:
FOXDEN WAY, GREAT BOURTON

DRAWING TITLE:
INDICATIVE DRAINAGE STRATEGY

CLIENT:
FERNHILL ESTATES

DRAWING NUMBER:
26437_01_230_01

REVISION:	SHEET SIZE:	SCALE:
A	A2	1:500

STATUS:
PRELIMINARY

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File Location: T:\M-EC Job Book\26437\drawings\01 series-hydrology\26437_01_230_01 - Outline Drainage Strategy.dwg
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- Transport
- Road Safety
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- Structures
- Geo-Environmental
- M-EC Acoustic Air
- Utilities
- M-EC Geomatics
- Street Lighting
- Expert Witness

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