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Drainage Technical Note for Reserved Matters Submission

Proposed Residential Development at

Knowle Hill, Allbrook Way, Eastleigh

On behalf of

Bargate Homes

October 2024

Document History and Status

Project Number 23823

Date	Version	Prepared By	Reviewed By	Approved By
17 Oct 2024	Draft 1.0	Stuart Magowan IEng MICE	Steve Doughty Director	Stuart Magowan Director
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CONTENTS

1 Non Technical Summary 1

2 Planning Context 2

3 Detail for Planning Condition 9 4

3.1 Technical Summary of the Flood Risk Assessment and Drainage Strategy dated November 2020 4

3.2 Design Changes from the Approved Outline Planning Scheme 4

3.3 Surface Water Design 5

3.4 Water Quality 6

3.5 Groundwater 8

3.6 Surface Water Exceedance Routes 8

4 Detail for Planning Condition 10 10

4.1 Drainage Management and Maintenance Schedule 10

5 Detail for Planning Condition 11 11

5.1 Foul Drainage 11

6 Detail for Planning Condition 12 12

6.1 Protection Southern Water Asset 12

7 List of Appendices, Images and Tables 13

1 Non Technical Summary

1.1 This Drainage Technical Note has been undertaken on behalf of Bargate Homes Limited in support of a Reserved Matters Planning Application for the construction of 49 residential dwellings with associated access roads, car parking and landscaping on land west of Allbrook Way, Knowle Hill, Eastleigh.

1.2 The proposed development will incorporate a sustainable drainage system which will discharge surface water at a suitably restricted rate to the existing public surface water sewer located beneath the highway of Knowle Hill at the southern boundary of the site and provide storage for all storm return periods up to and including the 1:100 year rainfall event with an allowance for climate change.

1.3 Foul water will be discharged by gravity to the existing public foul sewer located beneath Knowle Hill immediately south of the site.

1.4 Water Quality Treatment in the form of a three-stage wetland will provide suitable mitigation against the pollution risk from the main site.

1.5 This report concludes that a suitable surface water and foul water drainage system has be designed to accommodate the anticipated flows from the proposed development.

2 Planning Context

2.1 Outline Planning Permission reference O/19/86980 was granted by Eastleigh Borough Council on 5 June 2024.

2.2 Conditions 9, 10, 11 and 12, as follows, relate to the site drainage and protection of public water apparatus.

2.2.1 Condition 9

No development shall commence until a detailed surface water drainage scheme for the site, based on the principles within the submitted Flood Risk Assessment and Drainage Strategy (Cole Easdon Consultants, Ref: 6557, Issue 5, November 2020), has been submitted and approved in writing by the Local Planning Authority. The submitted details should include:

a. A technical summary highlighting any changes to the design from that within the above referenced Flood Risk Assessment and Drainage Strategy;

b. Detailed drainage layout drawings at an identified scale indicating catchment areas, referenced drainage features, manhole cover and invert levels and pipe diameters, lengths and gradients;

c. Detailed hydraulic calculations for all rainfall events, including those listed below. The hydraulic calculations should take into account the connectivity of the entire drainage features including the discharge locations. The results should include design and simulation criteria, network design and result tables, manholes schedule tables and summary of critical result by maximum level during the 1 in 1, 1 in 30 and 1 in 100 (plus an allowance for climate change) rainfall events. The drainage features should have the same reference as the submitted drainage layout;

d. Evidence that Urban Creep has been considered in the application and that a 10% increase in impermeable area has been used in calculations to account for this;

e. Confirmation on how impacts of high groundwater will be managed in the design of the proposed drainage system to ensure that storage capacity is not lost, and structural integrity is maintained; and

f. Exceedance plans demonstrating the flow paths and areas of ponding in the event of blockages or storms exceeding design criteria.

The development shall be carried out in accordance with the approved details.

Reason: To secure the provision of satisfactory surface water drainage infrastructure to serve the development.

2.2.2 Condition 10

Prior to first occupation of the development hereby approved, details for the long-term maintenance arrangements for the surface water drainage system shall be submitted to and approved in writing by the Local Planning Authority. The submitted details shall include

a) Maintenance schedules for each drainage feature type and ownership, and

b) Details of protection measures. The surface water drainage system shall be maintained in accordance with the approved details.

Reason: To secure the ongoing provision of satisfactory surface water drainage.

2.2.3 Condition 11

No development shall start until details for the disposal of foul sewerage from the development hereby permitted, and a timetable for its implementation, have been submitted to and approved in writing by the Local Planning Authority. The development shall be carried out in accordance with the approved details.

Reason: To ensure satisfactory provision of foul drainage.

2.2.4 Condition 12

Prior to the commencement of development, measures for the protection of any public water apparatus (water distribution main and water trunk mains) on or in the proximity of the site that could be affected by the development shall be submitted to and approved in writing by the local planning authority, in consultation with Southern Water. The development shall then be carried out in accordance with the approved details.

Reason: To ensure the adequate protection of the public water / sewerage system

3 Detail for Planning Condition 9

3.1 Technical Summary of the Flood Risk Assessment and Drainage Strategy dated November 2020

3.1.1 The Cole Easton Consultants Flood Risk Assessment and Drainage Strategy, Ref: 6557, Issue 5, November 2020 noted that:

'Runoff from the development will be managed onsite within combined attenuation/infiltration system (soakaways, infiltration basin, swales, oversized pipes and tanks). Ground conditions supported infiltration within the southern region whilst failed to work within the northern extent of the site. SuDS/drainage system will be designed for the 1:100 year + 40% event. An urban creep of 10% has also been allowed.

The onsite drainage/SuDS system will finally discharge into the public surface water sewer located at Knowle Hill. Discharge will be limited to the current greenfield rate (Qbar) of 16.9l/s in the 1:100 year + 40% event. The proposal with the reduction in the existing greenfield runoff towards downstream area will therefore represent betterment over the current runoff and flooding situation. The proposed connection into the public sewer will be subject to an agreement with Southern Water.

Residual flooding will be guided towards open space and swale features. SuDS features integrated within the landscape across the development will not only contribute in flood risk and surface water management, but also offer diverse benefit of water quality protection, biodiversity and recreation.

Runoff from all hard areas will receive at least three level of treatment in line with the Eastleigh Borough's requirements. Runoff will be appropriately treated within a combination of pre-treatment units (e.g. silt chambers, trap gullys, Petrol Interceptor) and SuDS devices (rainwater butts, soakaways, infiltration basins and vegetated swales) to ensure that runoff entering the River Itchen (via public sewerage system) is of acceptable quality.'

3.2 Design Changes from the Approved Outline Planning Scheme

3.2.1 Soakage testing was undertaken in the south area of the site in October 2023 to confirm infiltration rates. This additional testing was required as the Outline Planning Application surface water design relied on soakage results from either one test or extrapolated results and therefore testing to BRE 365 was undertaken to confirm the achievable soakage rate for the southern half of the site.

3.2.2 The soakage tests were undertaken in two locations TP1 and TP2 where infiltration features were proposed at 1.9m and 2m in depth to mimic the proposed filtration basin depth. The tests were abandoned after 6 hours as no soakage was recorded in either location.

3.2.3 Extracts of the results and locations of the Wilson Bailey soakage testing and groundwater monitoring are located in Appendix 1 at the rear of this report.

3.2.4 As it was not possible to recreate or prove the earlier soakage results and there are no suitable watercourses that could accept a discharge from site available the design was changed to remove the infiltration element and discharge surface water to the public surface water sewer beneath the highway of Knowle Hill at the southern boundary of the site.

3.2.5 The discharge will be restricted to 16.9l/s in accordance with the Outline Planning Permission and attenuation is provided for all storm events up to and including the 100 year plus 45% Climate Change event to ensure the scheme meets current best practice and guidance.

3.3 Surface Water Design

3.3.1 The main site surface water drainage will comprise areas of permeable paving to private drives and shared access areas, trapped gullies to the main access road, together with catchpits (silt chambers) and a three-stage wetland to provide suitable water quality treatment.

3.3.2 An allowance of 10% urban creep increase to the roof areas has also been applied in line with the requirements of Planning Condition 9.

3.3.3 The small southern section of the access road, which is located at a level too low to be drained to the wetland area, will have its own separate attenuation and storage and will be drained using trapped gullies, catchpits (silt chambers) and a vortex plus downstream defender to provide suitable water quality mitigation.

3.3.4 The vortex plus downstream defender is a more appropriate form of water quality mitigation than the petrol interceptor noted in the Outline Planning Application by Cole Eastman and it follows that this element is in accordance with the options noted in the Outline Planning Application.

3.3.1 The areas of the various positively drained elements of the development are summarised as follows:

- Access Road 3,428m^2
- Shared drives 1,788m^2

- Footways 1,284m^2
- Houses 2,930m^2
- 10% Urban Creep 293m^2
- Garages 503m^2
- Private driveways 1,948m^2

Total 12,174m^2

3.3.2 Detailed hydraulic calculations based on a maximum discharge rate of 16.9l/s during the 1:100 year plus climate change event have been prepared together with the 1 in 2, 1 in 30 and 1 in 100 year rainfall events. The request for 1 in 1 year calculations in noted but the use of FEH rainfall data does not support a in 1 year rainfall model.

3.3.3 The calculations demonstrate that surface water drainage can be adequately accommodated within the site without any increased flood risk elsewhere in accordance with the Outline Scheme.

3.3.4 A copy of the drainage strategy plan together with the hydraulic calculations is located in Appendix 2 at the rear of this report.

3.4 Water Quality

3.4.1 The proposed development is for residential use. In accordance with CIRIA SuDS Manual 2015 (Report C753), the pollution hazard level for this type of development is classified as between very low and low depending on the use / area of the site.

3.4.2 The surface water scheme will include mitigation to ensure that surface water is suitably treated and any pollution risk adequately managed prior to discharge.

3.4.3 Table 26.2 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Pollution Hazard Indices for varying land types. Those of relevance to the development proposals are as follows:

Land Use	**Pollution hazard level**	**Total suspended solids (TSS)**	**Metals**	**Hydrocarbons**
Residential roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car park, low-traffic roads	Low	0.5	0.4	0.4

Table 1: Pollution Hazard Indices

3.4.4 The main surface water drainage design combines the use of permeable paving, trapped gullies, catchpits and a three-stage wetland to provide suitable water quality mitigation all of which form part of the SuDS drainage scheme.

3.4.5 Once surface water has been discharged from the main SuDS wetland area surface water will pass through a further onsite three stage wetland which will provide a further silt capture before discharging to the Southern Water surface water sewer and ultimately to the River Itchen approximately 200mm southeast of the site via the public sewer network.

3.4.6 The drainage design for the small area of access at the south of the site combines the use of trapped gullies, catchpits and a proprietary Vortex Plus Downstream Defender to provide suitable water quality mitigation.

3.4.7 Where multiple drainage components are used in series the individual mitigation index of secondary and tertiary components is lowered by 50% due to reduced performance associated with primary treatment. In this case each of the individual systems meet the required level of treatment to mitigate the site risk.

3.4.8 The total treatment minimum level of treatment from each system is as follows:

Main Site Area (Parking and Driveways)	**Total suspended solids (TSS)**	**Metals**	**Hydrocarbons**
Permeable pavement	0.7	0.6	0.7
SuDS Wetland (at 50%)	0.4	0.4	0.4
Wetland (at 50%)	0.4	0.4	0.4
Total Treatment Provision	**1.5**	**1.6**	**1.5**

Main Site Area (Access and Footways)	**Total suspended solids (TSS)**	**Metals**	**Hydrocarbons**
SuDS Wetland	0.8	0.8	0.8
Wetland (at 50%)	0.4	0.4	0.4
Total Treatment Provision	**1.2**	**1.2**	**1.2**

Section of Highway Access below Wetland Level	**Total suspended solids (TSS)**	**Metals**	**Hydrocarbons**
Propriety Treatment Systems Vortex Plus Downstream Defender	0.5	0.4	0.5
Total Treatment	**0.5**	**0.4**	**0.5**

Table 2: Pollution Mitigation Provision

3.4.9 The proposed drainage design provides suitable mitigation to meet the target treatment level required for runoff with a very low to low risk of pollution.

3.5 Groundwater

3.5.1 Groundwater was not encountered in any of the original site investigation undertaken for the outline application the boreholes of which extended to 1.8m below ground level.

3.5.2 Further Groundwater monitoring was undertaken by Wilson Bailey over the winter of 2023 /24 and noted ground water at a highest level of 1.55m below ground level.

3.5.3 The underlying ground is London Clay with very low permeability and low risk of groundwater emergence.

3.5.4 The proposed wetland will extend at its deepest point to a level at approximately 39.3m AOD, approximately 3.5m below ground level. It is proposed to use site won clay for its construction which will be puddled on site prior to placing the growing medium.

3.5.5 The standing water level in the wetland is 40.8m AOD with storage above this level during rainfall events.

3.5.6 The puddling and very slow to non-existent soakage rates recorded in the area of the wetland together with the standing water in the wetlands reduce the risk of groundwater emergence to the wetland.

3.5.7 The drainage system pipework is generally less than 2m in depth below ground and the proposed crate storage will be lined.

3.5.8 These mitigation measures reduce the risk of groundwater entering the surface water system to practically zero.

3.6 Surface Water Exceedance Routes

3.6.1 In the event that part of the onsite surface water drainage network was to become blocked or suffer a failure due to lack of maintenance surface water would migrate overland and be collected within the gully network downstream of any blockage or overtopping and ultimately be directed towards the location of the wetlands and onsite storage crates.

3.6.2 In the event of a storm return period in excess of the 100 year +45% design standard surface water would flow overland towards the southern corner of the site and into the highway of Knowle Hill mimicking the existing exceedance event. From Knowle Hill any overland flow would be directed via the local highway network towards the River Itchen to the east.

3.6.3 There is no associated increase in flood risk to the downstream catchment area.

3.6.4 A surface water exceedance route plan is located in Appendix 3 at the rear of this report.

4 Detail for Planning Condition 10

4.1 Drainage Management and Maintenance Schedule

4.1.1 A Drainage Management and Maintenance Schedule has been prepared that details the long-term maintenance for each drainage feature and details responsibilities, action required and schedules regular and irregular maintenance the surface water system.

4.1.2 A copy of the Drainge Management and Maintenance Schedule is located in Appendix 4 at the rear of this report.

5 Detail for Planning Condition 11

5.1 Foul Drainage

5.1.1 Foul water drainage will be discharged to the existing Southern Water Public Foul Water sewer located beneath in Knowle Hill in accordance with the Outline Planning Permission.

5.1.2 The foul water drainage infrastructure will be installed and tested prior to the first house occupation on site approximately 9-12 months after a successful site start.

5.1.3 A copy of the drainage strategy plan detailing the foul water drainage is located in Appendix 2 at the rear of this report.

6 Detail for Planning Condition 12

6.1 Protection Southern Water Asset

6.1.1 There is a Southern Water watermain crossing the south and southwest Boundary of the site.

6.1.2 A 8m easement has been indicated on Drawing 46 and there are no works planned with the exception of surface pathways within that easement area.

6.1.3 Drawing 46 also details existing and proposed ground levels along the easement and confirm that there is no impact on the ground levels along the route of the easement.

6.1.4 The easement area will be fenced to prevent construction traffic accessing the area and to ensure protection of the Southern Water Asset.

6.1.5 A Southern Water Asset Easement Plan is located in Appendix 5 at the rear of this report

7 List of Appendices, Images and Tables

Appendix 1	Extracts of Wilson Bailey Soakage Testing and Groundwater Monitoring
Appendix 2	Drainage Strategy Plan and Hydraulic Calculations
Appendix 3	Surface Water Exceedance Route Plan
Appendix 4	Drainge Management and Maintenance Schedule
Appendix 5	Southern Water Asset Easement Plan

Table 1 Pollution Hazard Indices

Table 2 Pollution Mitigation Provision

Appendix 1

Extracts of Wilson Bailey Soakage Testing

and

Groundwater Monitoring

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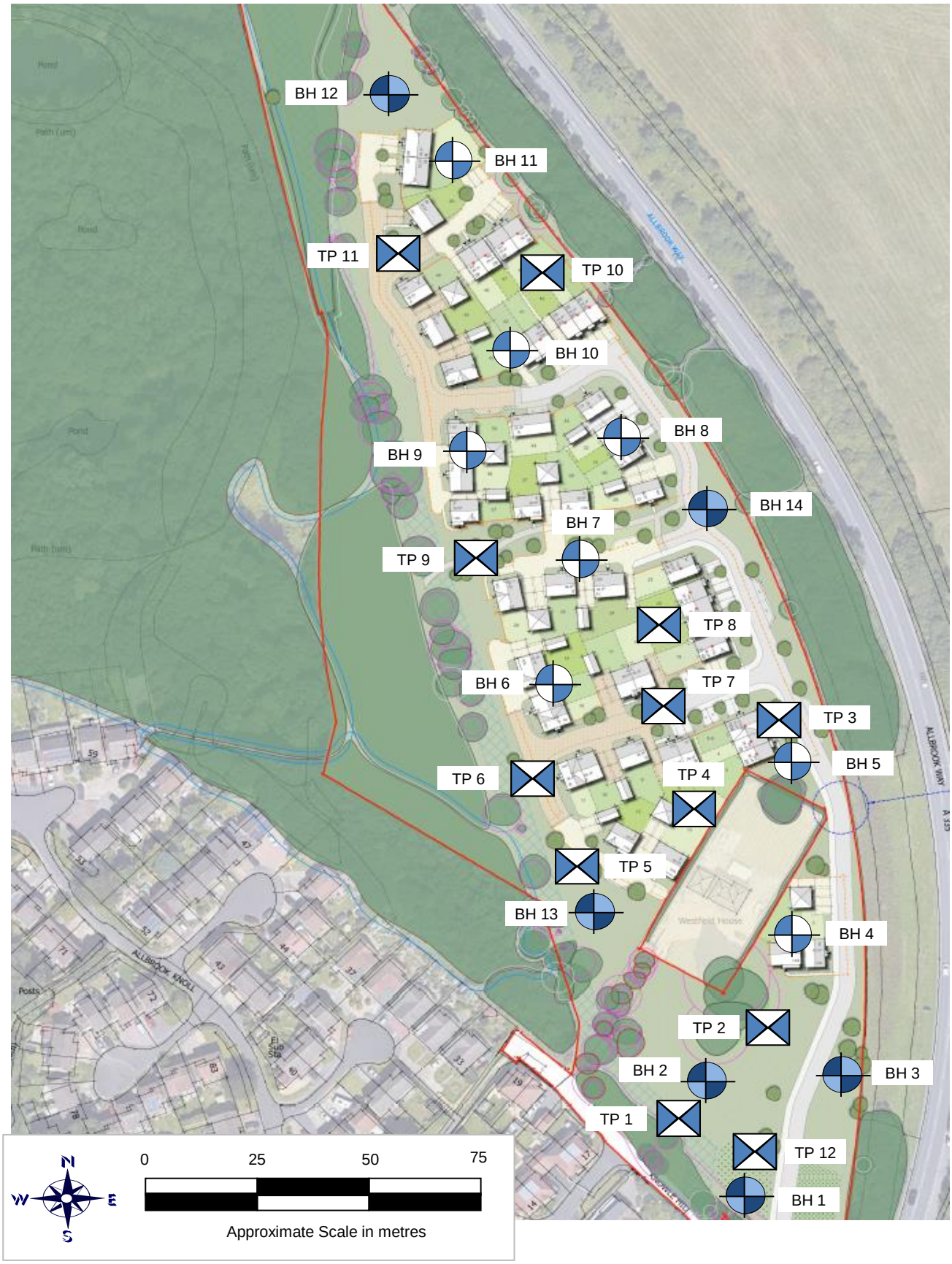
Northdown Farmhouse
Donhead St Mary
Wiltshire
SP7 9DD

Site Plan

Site Knowle Hill Site, Allbrook, Eastleigh

Client Bargate Homes



Site Plan

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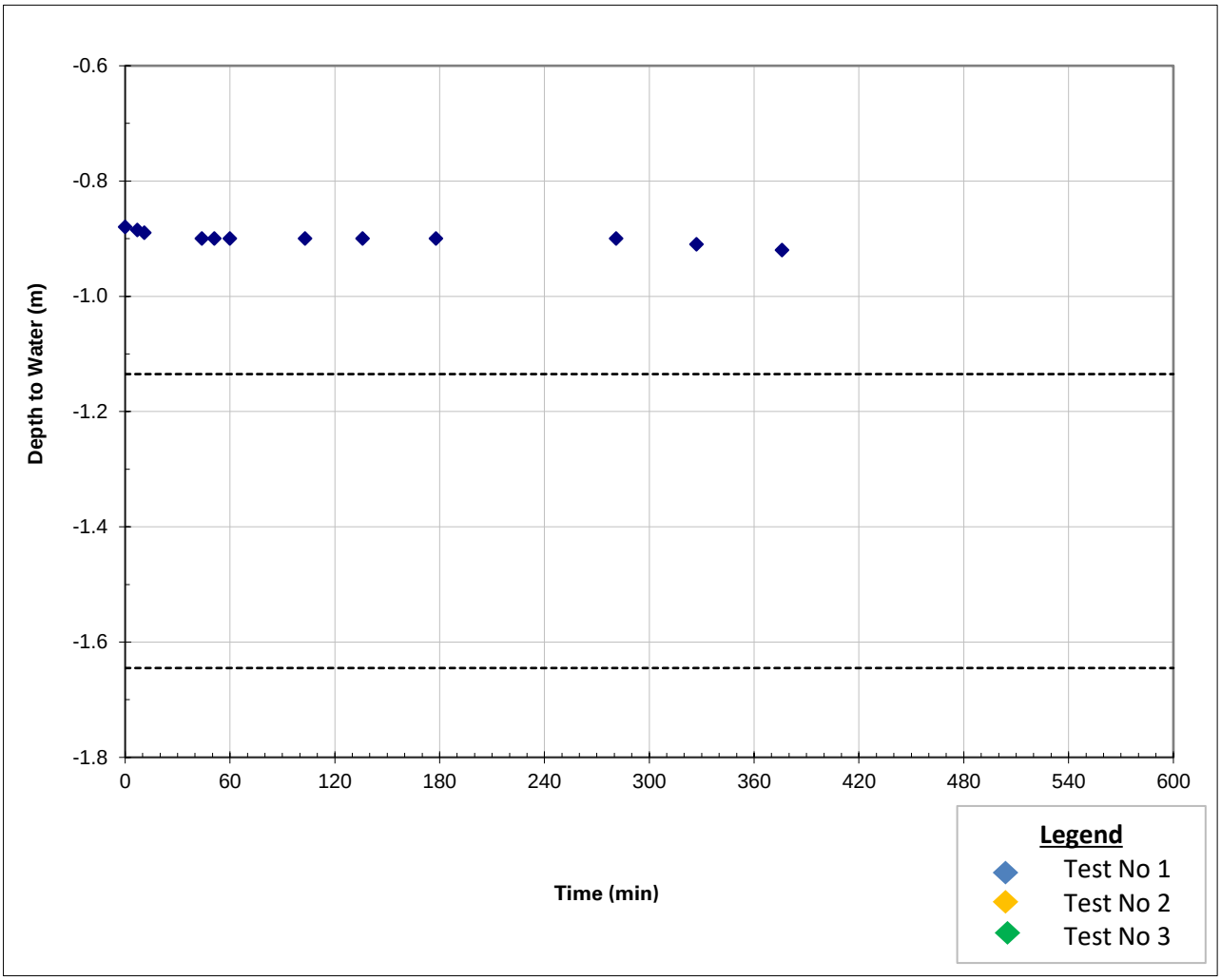
Northdown Farmhouse
Donhead St Mary
Wiltshire
SP7 9DD

Soakage Test Results

Site Knowle Hill, Allbrook, Eastleigh

Client Bargate Homes

Trial Pit No.	1	Pit Length (m)	1.45
Date of test	11/10/2023	Pit Width (m)	0.5
		Pit Depth (m)	1.9



Design Soakage Rate	--	m/s	(based on linear portion of graph as shown)
	--	m/day	(line represents lower bound rate measured)

Notes

Testing abandoned after 6 hours
No effective infiltration

WILSON BAILEY
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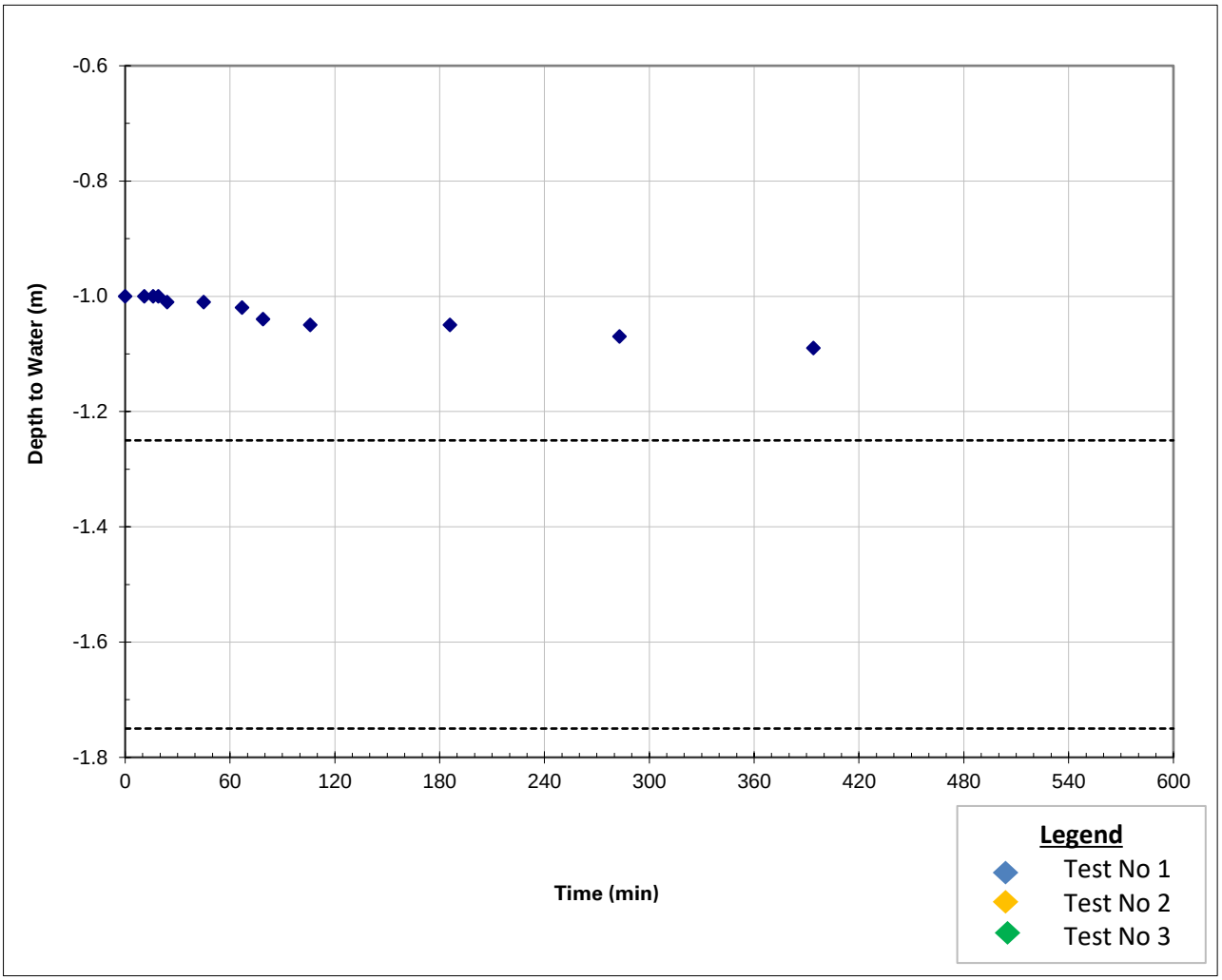
Northdown Farmhouse
Donhead St Mary
Wiltshire
SP7 9DD

Soakage Test Results

Site Knowle Hill, Allbrook, Eastleigh

Client Bargate Homes

Trial Pit No.	2	Pit Length (m)	1.4
Date of test	11/10/2023	Pit Width (m)	0.5
		Pit Depth (m)	2



Design Soakage Rate	--	m/s	(based on linear portion of graph as shown)
	--	m/day	(line represents lower bound rate measured)

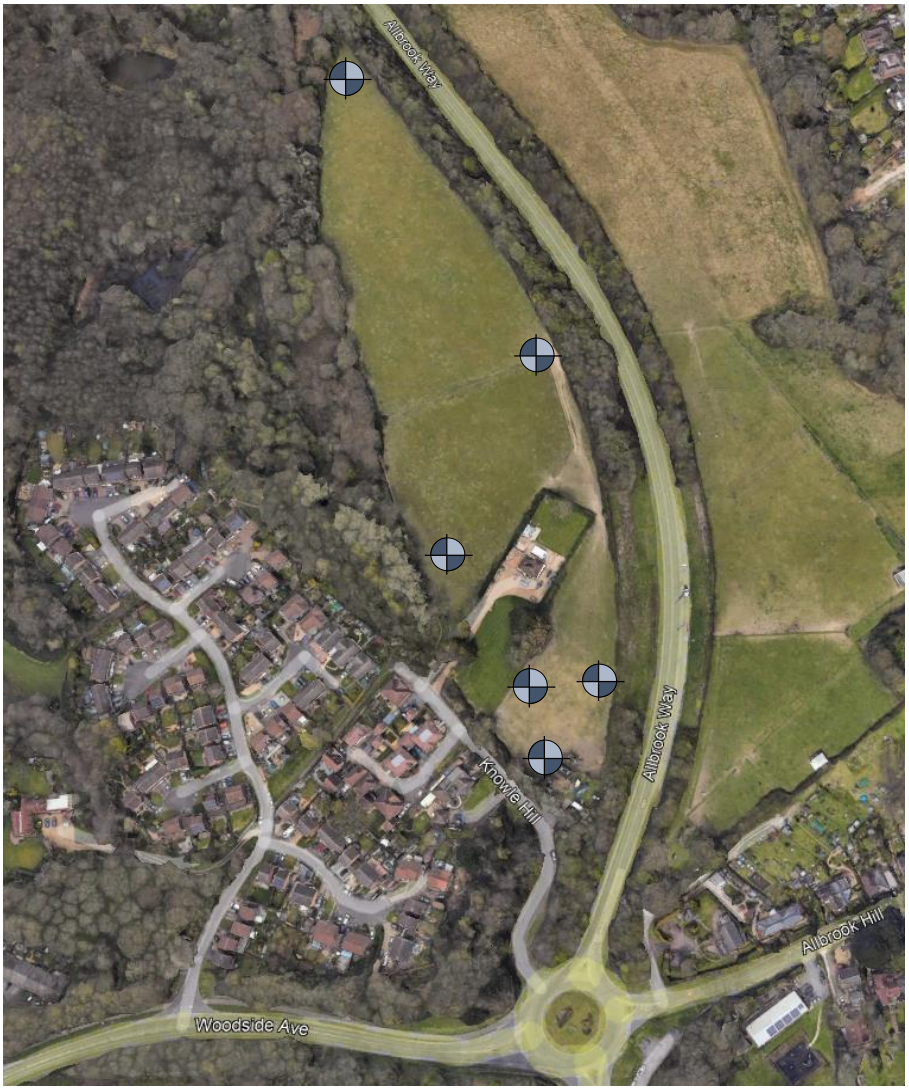
Notes

Testing abandoned after 6 hours
No effective infiltration

Knowle Hill Allbrook Entrance SO50 4LZ chest.wiring.lovely

Gate Code 1984 All recorded as depth below ground level

	BH 1	BH 2	BH 3	BH 12	BH 13	BH 14
W3W	///dock.sank.wizard	///hogs.loves.gasp	///donor.rablle.design	///camps.groups.beyond	///starts.finley.sling	///booth.unable.neat
12/10/2023	5.48	5.69	4.08	3.07	3.83	3.78
16/11/2023	2.72	1.86	2.80	0.42	0.49	3.75
09/12/2023	1.55	1.93	2.75	0.16	0.17	3.75
06/01/2024	2.38	1.88	2.72	0.39	0.31	3.74
04/02/2024	3.68	2.09	3.04	1.89	2.35	3.75
02/03/2024	2.04	1.89	2.76	0.27	0.90	3.75



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GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL		
					(0.30) 0.50	Orange-brown silty sandy fine to medium flint GRAVEL		
0.50	D1				(0.70)	Firm orange-brown silty sandy CLAY		
1.00-1.45 1.00	SPT N=16 D2		3,3/4,4,4,4		1.20			
1.50	D3				(0.70) 1.90	Orange-brown clayey silty fine to medium SAND		
2.00-2.45 2.00	SPT N=9 D4		2,2/2,2,2,3			Firm orange-brown silty sandy locally very sandy CLAY		
2.50	D5							
3.00-3.45 3.00	SPT N=24 D6		6,6/6,6,6,6		(2.40)			
3.50	D7							
4.00-4.45 4.00	SPT N=9 D8		6,6/3,2,2,2		4.30			
4.50	D9					Orange-brown clayey silty SAND with pockets and layers of silty sandy clay		
5.00-5.45 5.00	SPT N=19 D10		4,4/5,4,5,5					
5.50	D11							
6.00-6.45 6.00	SPT N=20 D12		4,4/5,5,5,5		(3.70)			
6.50	D13							
7.00	D14							
7.50	D15							
			Water strike(1) at 7.80m.					▽1
8.00	D16				8.00	Complete at 8.00m		

Remarks
Groundwater encountered at 7.80m. Standpipe installed with a response zone from 1.00m to 8.00m.

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH1

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WILSON BAILEY
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Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH10

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25) 0.25	TOPSOIL with abundany gravel		
0.50	D1					Firm pale orange-brown and pale grey silty CLAY with partings of orange-brown silty fine sand		
1.00	D2							
1.50	D3				(2.75)			
2.00	D4							
2.50	D5							
3.00	D6				3.00	Complete at 3.00m		

Remarks

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH10

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Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH11

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25) 0.25	TOPSOIL		
0.50	D1					Firm pale orange-brown pale grey and brown mottled silty CLAY		
1.00-1.45 1.00	SPT N=8 D2		2,2/2,2,2,2					
1.50	D3				(2.75)			
2.00-2.45 2.00	SPT N=12 D4		2,3/3,3,3,3					
2.50	D5							
3.00-3.45 3.00	SPT N=11 D6		3,3/3,2,3,3		3.00	Complete at 3.00m		

Remarks

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH11

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WILSON BAILEY
GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH12

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL		
0.50	D1					Firm pale yellowish brown, orange-brown and aple grey slightly silty CLAY with partings and layers of orange-brown silty fine sand and degraded ironstone		
1.00	D2							
1.50	D3							
2.00	D4							
2.50	D5							
3.00	D6							
3.50	D7				(6.80)			
4.00	D8							
4.50	D9							
5.00	D10							
5.50	D11							
6.00	D12							
6.50	D13							
7.00	D14				7.00	Complete at 7.00m		

Remarks
Groudnwater not encountered. Standpipe installed with a response zone from 1.00m to 6.00m.

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH12

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WILSON BAILEY
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Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH13

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30) 0.30	TOPSOIL with abundant fine to medium flint gravel		
0.50	D1				(0.80)	Orange-brown silty sandy clayey fine to medium flint GRAVEL		
1.00-1.45 1.00	SPT N=10 D2		2,2/2,2,3,3		1.10	Firm orange-brown and brown silty sandy CLAy with abundant flint gravel		
1.50	D3				(1.20)			
2.00-2.45 2.00	SPT N=12 D4		3,3/3,3,3,3		2.30	Firm orange-brown and brown silty sandy CLAY with pockeys of pale yellowish brown and orange-brown silty sand with abundant fine to medium flint gravel		
2.50	D5				(0.90)			
3.00-3.45 3.00	SPT N=10 D6		3,3/2,2,3,3		3.20	Pale yellowish brown and orange-brown silty fine to medium SAND		
3.50	D7							
4.00	D8							
4.50	D9				(2.80)			
5.00	D10							
5.50	D11							∇1
			Water strike(1) at 5.80m.					
6.00	D12				6.00	Complete at 6.00m		

Remarks
Groundwater encountered at 5.80m. Standpipe installed with a response zone from 1.00m to 6.00m.

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH13

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WILSON BAILEY
GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH14

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50) 0.50	TOPSOIL with adbundant fine to medium flint gravel		
0.50	D1					Firm pale brown and pale grey mottled very silty locally sandy CLAY		
1.00	D2							
1.50	D3				(2.30)			
2.00	D4							
2.50	D5				2.80			
3.00	D6				(0.40) 3.20	Firm pale brown and pale orange-brown silty sandy CLAY with scattred fine to medium flint gravel		
3.50	D7					Dark reddish orange-brown, orange-brown and pale yellow SAND		
4.00	D8				(1.40)			
4.50	D9				4.60	Complete at 4.60m		

Remarks
Groundwater not encountered. Sampler refused at 4.60m.

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH14

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WILSON BAILEY
GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25) 0.25	TOPSOIL		
0.50	D1					Firm orange-brown silty slightly sandy CLAY with scattred fine to medium flint gravel		
1.00	D2							
1.50	D3				(2.85)			
2.00	D4							
2.50	D5							
3.00	D6				3.10	Firm orange-brown silty sloghtly sandy CLAY		
3.50	D7				(1.10)			
4.00	D8				4.20	Orange-brown silty locally very silty sandy CLAY with partings of dak reddish orange-brown silty fine sand		
4.50	D9							
5.00	D10							
5.50	D11				(2.80)			
6.00	D12							
6.50	D13							
7.00	D14				7.00	Complete at 7.00m		

Remarks
Groundwater not encountered. Standpipe installed with a response zone from 1.00m to 6.00m.

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH2

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WILSON BAILEY
GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.60)	TOPSOIL with abudant fine to medium flint gravel - possible made ground		
0.50	D1				0.60	Firm orange-brown silty sandy CLAY		
1.00	D2							
1.50	D3				(2.40)			
2.00	D4							
2.50	D5							
3.00	D6				3.00	Dark orange -brown very silty very clayey sandy fine to medium flint GRAVEL		
3.50	D7				(1.30)			
4.00	D8				4.30	Firm orange-brown and pale brown silty sandy CLAY		
4.50	D9				(0.50)			
5.00	D10				4.80	Pale orange-brown very clayey sandy SILT with layers and partings of fine to medium very silty very sandy clay		
5.50	D11				(1.20)			
6.00	D12				6.00	Complete at 6.00m		

Remarks
Groundwater not encountered. Standpipe installed with a response zone from 1.00m to 6.00m.

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH3

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WILSON BAILEY
GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH4

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.45) 0.45	TOPSOIL		
0.50	D1					Firm pale orange-brown silty sandy locally very silty CLAY		
1.00-1.45 1.00	SPT N=8 D2		2,2/2,2,2,2					
1.50	D3				(2.55)			
2.00-2.45 2.00	SPT N=8 D4		2,2/2,2,2,2					
2.50	D5							
3.00-3.45 3.00	SPT N=9 D6		2,2/2,2,2,3		3.00	Complete at 3.00m		

Remarks
Groundwater not encountered.

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH4

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WILSON BAILEY
GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH5

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL		
0.50	D1				(0.60) 0.80	Firm orange-brown silty sandy CLAY		
1.00	D2				(0.40) 1.20	Fir orange-brown very silty very sandy CLAY		
1.50	D3					Pale orange-brown, yellowish brown and pale grey silty SAND		
2.00	D4				(1.80)			
2.50	D5							
3.00	D6				3.00	Complete at 3.00m		

Remarks	Scale (approx)	Logged By
	1:50	
	Figure No. J202334.BH5	

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WILSON BAILEY
GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH6

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30) 0.30	TOPSOIL		
						Firm pale orange-brown silty sandy locally very silty CLAY		
0.50	D1							
1.00	D2							
1.50	D3							
					(3.15)			
2.00	D4							
2.50	D5							
3.00	D6							
					3.45			
3.45	D7					Complete at 3.45m		

Remarks

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH6

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WILSON BAILEY
GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH7

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL		
					(0.50)	Pale yellowish brown silty calyey sandy fine to medium flint GRAVEL		
0.50	D1				0.70	Firm orange-brown and pale grey silty slightly sandy CLAY		
1.00-1.45 1.00	SPT N=10 D2		2,2/2,2,3,3					
1.50	D3							
					(2.30)			
2.00-2.45 2.00	SPT N=11 D4		2,2/2,3,3,3					
2.50	D5							
					3.00			
3.00-3.45 3.00	SPT N=10 D6		2,3/2,2,3,3			Complete at 3.00m		

Remarks

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH7

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WILSON BAILEY
GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH8

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30) 0.30	TOPSOIL with abundant gravel		
0.50	D1					Firm pale orange-brown and pale grey mottled silty sandy CLAY		
1.00	D2							
1.50	D3				(2.70)			
2.00	D4							
2.50	D5							
3.00	D6				3.00	Complete at 3.00m		

Remarks	Scale (approx)	Logged By
	1:50	
	Figure No. J202334.BH8	

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WILSON BAILEY
GEOTECHNICAL & ENVIROMENTAL

Site	Number
Knowle Hill, Allbrooke, Eastleigh	BH9

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Bargate Homes	J202334
	Location	**Dates** 12/10/2023	**Engineer** DPB	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	MADE GROUND (reworked topsoil)		
					(0.50) 0.70	MADE GROUND (reworked topsoil with brick and gravel)		
0.50	D1					Firm pale orange-brown and pale grey silty sandy CLAY		
1.00-1.45 1.00	SPT N=8 D2		1,2/2,2,2,2					
1.50	D3							
2.00-2.45 2.00	SPT N=12 D4		2,2/3,3,3,3		(2.75)			
2.50	D5							
3.00-3.45 3.00	SPT N=11 D6		2,3/2,3,3,3					
3.45	D7				3.45	Complete at 3.45m		

Remarks

Scale (approx)	Logged By
1:50	

Figure No. J202334.BH9

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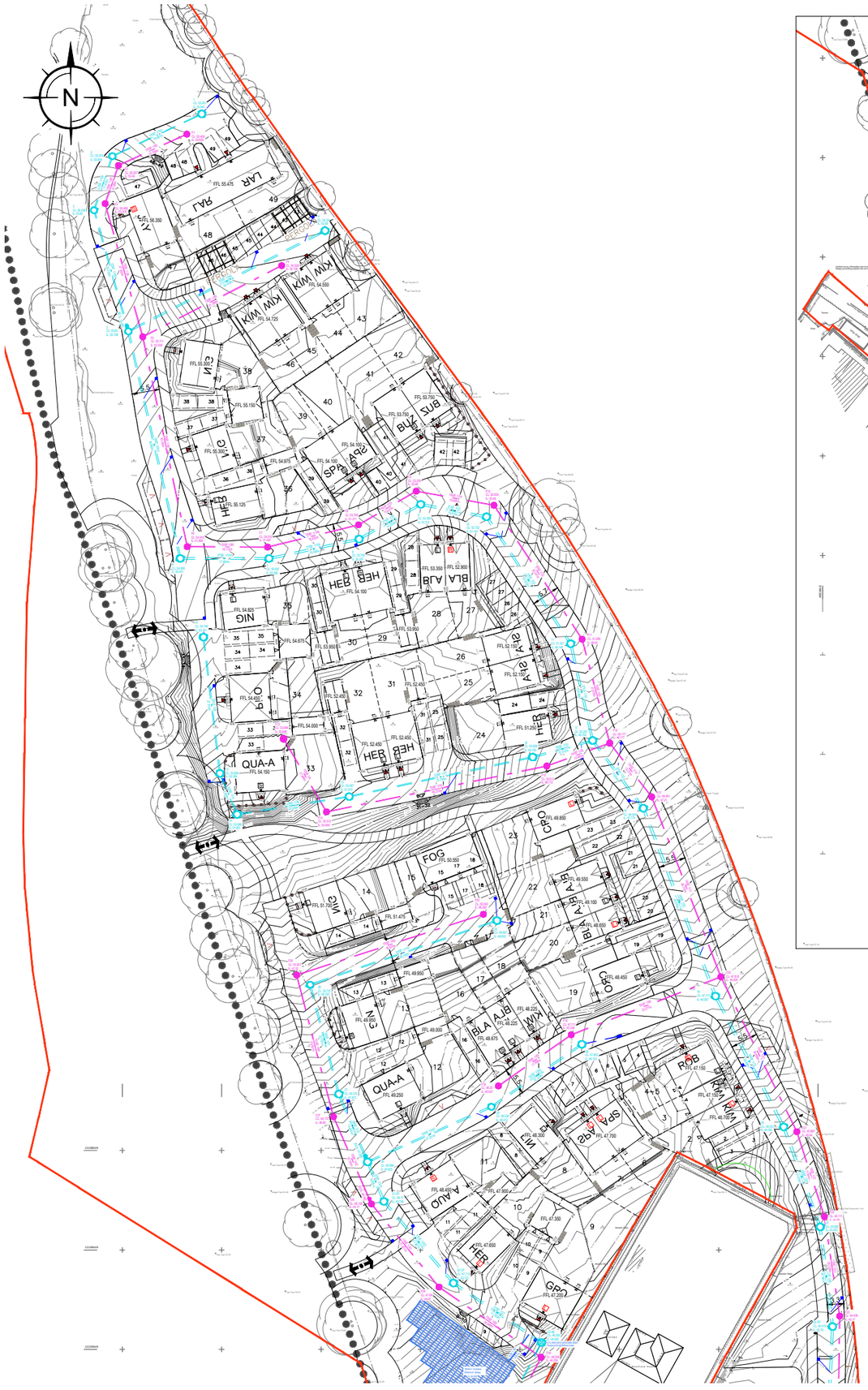
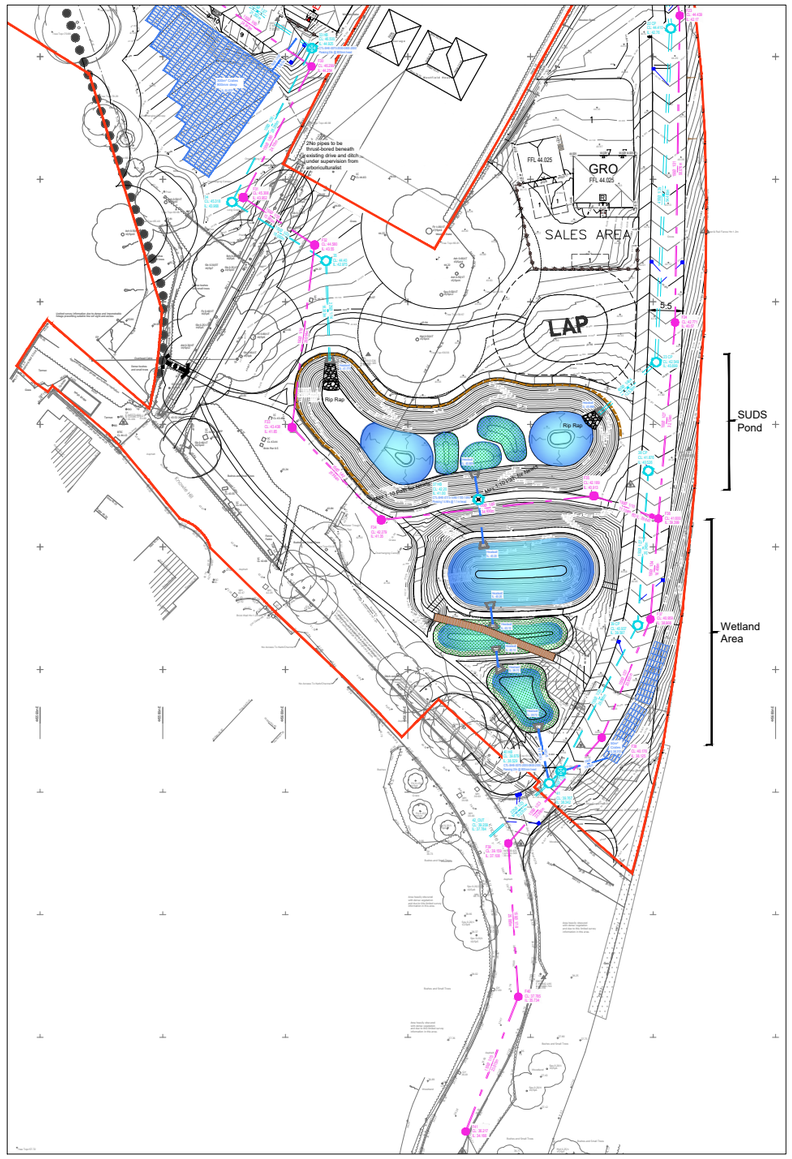
Appendix 2

Drainage Strategy Plan

and

Hydraulic Calculations





MH No.	MANHOLE DIAMETER (mm)	MANHOLE TYPE	COVER LEVEL (m)	INVERT LEVEL (m)	DEPTH TO SOFFIT (m)	EASTING (m)	NORTHING (m)
1	1350	Type C	55.291	53.941	1.200	445535.996	121488.460
2	1200	Type B	55.979	53.668	2.086	445518.018	121479.959
3	1200	Type B	56.436	53.600	2.611	445514.319	121469.100
4	1350	Type C	54.390	52.890	1.200	445560.787	121464.955
5	1200	Type B	55.820	52.708	2.812	445521.226	121444.737
6	1350	Type B	54.936	52.441	2.120	445531.673	121399.054
7	1350	Type B	54.497	52.385	1.737	445549.527	121399.054
8	1350	Type C	53.782	52.207	1.200	445567.650	121402.956
9	1350	Type C	53.306	51.731	1.200	445580.056	121409.933
10	1350	Type C	52.722	51.147	1.200	445593.292	121407.435
11	1350	Type C	51.321	49.746	1.200	445610.230	121381.912
12	1350	Type C	54.746	53.321	1.200	445536.341	121383.250
13	1350	Type C	53.809	52.384	1.200	445539.655	121355.837
14	1350	Type C	53.086	51.661	1.200	445543.119	121347.584
15	1350	Type C	52.497	51.072	1.200	445565.653	121351.175
16	1350	Type C	50.658	49.158	1.200	445602.587	121359.123
17	1350	Type C	50.281	48.706	1.200	445614.650	121362.450
18	1350	Type C	49.424	47.774	1.200	445624.836	121348.834
19	1350	Type C	47.717	46.067	1.200	445639.355	121311.048
20	1350	Type C	46.031	44.381	1.200	445653.073	121284.758
21	1350	Type C	45.083	43.433	1.200	445660.421	121264.639
22	1350	Type C	44.410	42.760	1.200	445662.902	121244.598
23	1350	Type C	42.549	40.899	1.200	445660.506	121190.166
25	1350	Type C	49.927	48.502	1.200	445595.387	121326.234
26	1200	Type B	50.737	48.193	2.244	445557.796	121313.324
27	1350	Type C	49.373	47.873	1.200	445563.580	121291.337
28	1350	Type C	47.603	46.103	1.200	445612.476	121301.359
29	1200	Type B	48.228	46.012	1.916	445594.265	121288.792
30	1350	Type B	48.588	45.825	2.388	445569.369	121277.709
31	1350	Type B	48.170	45.798	1.997	445572.649	121269.750
32	1350	Type B	47.713	45.731	1.607	445586.643	121253.339
33 HB	1350	Type C	46.500	44.925	1.425	445604.352	121241.393
34	1350	Type C	45.318	43.968	1.200	445591.306	121216.292
35	1350	Type C	44.400	42.975	1.200	445606.643	121206.699
37 HB	1350	Type C	42.200	41.000	0.975	445631.535	121167.741
38	1350	Type C	41.876	40.526	1.200	445659.228	121172.408
39	1350	Type C	40.937	39.587	1.200	445657.499	121147.222
40 HB	1350	Type C	39.879	38.529	1.200	445644.971	121123.420
41	1350	Type C	39.767	38.342	1.200	445643.056	121121.435

MH No.	MANHOLE DIAMETER (mm)	MANHOLE TYPE	COVER LEVEL (m)	INVERT LEVEL (m)	DEPTH TO SOFFIT (m)	EASTING (m)	NORTHING (m)
F1	1200	Type B	55.409	53.609	1.650	445532.984	121484.399
F2	1200	Type B	56.057	53.420	2.487	445519.245	121478.112
F3	1200	Type B	56.466	53.318	2.998	445516.550	121470.433
F4	1200	Type B	54.528	52.728	1.650	445552.064	121457.962
F5	1200	Type A	55.711	52.238	3.323	445524.125	121443.641
F6	1200	Type A	54.916	51.899	3.067	445533.077	121401.440
F7	1200	Type B	54.510	51.497	2.863	445549.252	121401.360
F8	1200	Type B	53.756	51.371	2.235	445567.537	121405.824
F9	1200	Type B	53.239	50.960	2.129	445579.149	121412.605
F10	1200	Type B	52.659	50.490	2.019	445594.793	121409.761
F11	1200	Type B	51.289	49.040	2.099	445612.523	121382.825
F13	1350	Type C	53.998	52.648	1.200	445552.458	121362.803
F14	1200	Type B	52.512	50.499	1.863	445561.079	121348.096
F15	1200	Type B	50.512	48.712	1.650	445605.402	121357.317
F16	1200	Type B	50.177	48.177	1.850	445618.081	121361.933
F17	1200	Type B	49.461	47.210	2.101	445626.526	121351.119
F18	1200	Type B	48.250	45.627	2.473	445595.689	121292.991
F19	1200	Type B	47.711	45.328	2.233	445610.332	121303.280
F20	1200	Type B	47.816	44.925	2.741	445640.434	121314.929
F21	1200	Type B	45.887	43.640	2.097	445655.717	121283.777
F22	1200	Type B	45.111	42.800	2.161	445661.264	121266.691
F23	1200	Type B	44.439	42.170	2.119	445664.349	121246.702
F24	1200	Type B	42.771	40.570	2.051	445663.597	121196.632
F25	1200	Type B	50.093	48.293	1.650	445592.657	121327.508
F26	1200	Type A	50.937	47.520	3.267	445555.072	121315.294
F27	1200	Type B	49.172	46.850	2.172	445562.487	121286.792
F28	1200	Type B	48.192	45.170	2.872	445570.144	121269.245
F29	1200	Type B	47.690	44.670	2.870	445583.719	121252.545
F30	1200	Type B	46.299	44.254	1.895	445604.279	121238.420
F31	1350	Type C	45.308	43.952	1.206	445593.139	121217.029
F32	1350	Type C	44.580	43.550	0.880	445604.782	121209.274
F33	1350	Type C	43.438	41.850	1.438	445601.101	121179.507
F34	1350	Type C	42.279	41.350	0.779	445615.652	121164.416
F35	1350	Type C	42.189	40.913	1.126	445650.361	121168.336
F36	1200	Type B	41.600	39.399	2.051	445660.863	121164.625
F37	1200	Type B	40.959	38.908	1.901	445659.576	121148.219
F38	1200	Type B	40.176	38.125	1.901	445651.634	121128.883
F39	1200	Type B	39.159	37.108	1.901	445636.396	121111.656
F40	1200	Type B	37.785	35.734	1.901	445638.016	121086.623
F41	1200	Type B	36.217	34.166	1.901	445629.431	121064.624

GENERAL NOTES:

1. All dimensions to be checked on site. All details and dimensions relating to sub-Contractors work must be checked and agreed between the sub-Contractor or supplier and the general Contractor.

2. This drawing is to be read in conjunction with all relevant Architect's and Engineer's drawings and specification.

3. The main Contractor is responsible for ensuring the stability of the structure whilst the works are in progress.

4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority. No liability is accepted by the Consultant and the main Contractor is responsible for obtaining and checking all information and taking due care and attention whilst undertaking the works.

REV	DATE	INT	DESCRIPTION	CHK
B	18.10.24	MJP	Minor updates to levels layout	SRM
A	17.10.24	MJP	Minor updates to drainage layout	SRM

Issue Status: FOR APPROVAL

Drainage Key

- Storm drainage
- Foul drainage
- Gullies
- HB Hydrobrake chamber
- CP Catchpit chamber
- Aquacell storage tanks

-5m 0 5 10 15 20m

The Civil Engineering Practice
11 Tungsten Building
George Street
Fishersgate
Sussex
BN41 1RA

01273 424424
reception@civil.co.uk
www.civil.co.uk

CLIENT: Bargate Home

PROJECT: Knowel Hill, Albrook, Eastleigh

TITLE: Proposed Drainage Layout Plan, Whole Site

DRAWN	DATE	PROJECT NO.
M Pacifico	Oct 2024	23823
ENGINEER: S Magowan	CHECKED:	ORIG. No. 200 / REV. B
SCALE: 1:500 @ A1		

Drainage Areas Key	
3428m²	roads
1788m²	shared areas
1284m²	footway
3219 m²	houses (includes 10% UC (2926m² without)
503m²	garages
1948m²	private drives
11,877m²	TOTAL (exc. Urban Creep)
12,170m²	TOTAL (inc. Urban Creep)
389m²	gravel footway (self draining excluded from total)

GENERAL NOTES:

1. All dimensions to be checked on site. All details and dimensions relating to sub-Contractors work must be checked and agreed between the sub-Contractor or supplier and the general Contractor.

2. This drawing is to be read in conjunction with all relevant Architect's and Engineer's drawings and specification.

3. The main Contractor is responsible for ensuring the stability of the structure whilst the works are in progress.

4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority. No liability is accepted by the Consultant and the main Contractor is responsible for obtaining and checking all information and taking due care and attention whilst undertaking the works.

REV	DATE	INT	DESCRIPTION	CHK

Issue Status: FOR APPROVAL

The Civil Engineering Practice
11 Tungsten Building
George Street
Fishersgate
Sussex
BN41 1RA

01273 424424
reception@civil.co.uk
www.civil.co.uk

CLIENT: Bargate Home

PROJECT: Knowel Hill, Albrook, Eastleigh

TITLE: Proposed Drainage Areas Plan

DRAWN	DATE	PROJECT NO.
M Pacifico	Oct 2024	23823
ENGINEER: S Magowan	CHECKED	ORG. No. / REV.
SCALE: 1:500 @ A1		43

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.500
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	150.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.035	5.00	55.291	1200	445535.996	121488.460	1.350
2	0.004	5.00	55.979	1200	445518.018	121479.959	2.311
3	0.025	5.00	56.436	1200	445514.319	121469.100	2.836
4	0.083	5.00	54.390	1200	445560.787	121464.955	1.500
5	0.058	5.00	55.820	1200	445521.226	121444.737	3.112
6	0.018	5.00	54.936	1350	445531.673	121399.054	2.495
7	0.024	5.00	54.497	1350	445549.527	121399.054	2.112
8	0.039	5.00	53.782	1350	445567.650	121402.956	1.575
9	0.044	5.00	53.306	1350	445580.056	121409.933	1.575
10	0.058	5.00	52.722	1350	445593.292	121407.435	1.575
11	0.017	5.00	51.321	1350	445610.230	121381.912	1.575
12	0.078	5.00	54.746	1200	445536.341	121383.250	1.425
13			53.809	1200	445539.655	121355.837	1.425
14	0.009	5.00	53.086	1200	445543.119	121347.584	1.425
15	0.045	5.00	52.497	1200	445565.653	121351.175	1.425
16	0.022	5.00	50.658	1200	445602.587	121359.123	1.500
17	0.039	5.00	50.281	1350	445614.650	121362.450	1.575
18	0.070	5.00	49.424	1350	445624.836	121348.834	1.650
19	0.059	5.00	47.717	1350	445639.355	121311.048	1.650
20	0.013	5.00	46.031	1350	445653.073	121284.758	1.650
21	0.015	5.00	45.083	1350	445660.421	121264.639	1.650
22	0.041	5.00	44.410	1350	445662.902	121244.598	1.650
23	0.028	5.00	42.549	1350	445660.506	121190.166	1.650
24			42.200		445651.211	121181.750	1.365
25	0.056	5.00	49.927	1200	445595.387	121326.234	1.425
26	0.053	5.00	50.737	1200	445557.796	121313.324	2.544
27	0.009	5.00	49.373	1200	445563.580	121291.337	1.500
28	0.058	5.00	47.603	1200	445612.476	121301.359	1.500
29	0.017	5.00	48.228	1200	445594.265	121288.792	2.216
30	0.024	5.00	48.588	1350	445569.369	121277.709	2.763
31	0.018	5.00	48.170	1350	445572.649	121269.750	2.372
32	0.083	5.00	47.713	1350	445586.643	121253.339	1.982
33			46.500	1350	445604.352	121241.393	1.575
34			45.318	1200	445591.306	121216.292	1.350
35			44.400	1200	445606.643	121206.699	1.425
36			42.200		445607.233	121190.407	1.365
37		5.00	42.200	1500	445631.535	121167.741	1.400
38	0.044	5.00	41.876	1200	445659.228	121172.408	1.350
39			40.937	1200	445657.499	121147.222	1.350
40	0.027	5.00	39.879	1200	445644.971	121123.420	1.350
41			39.767	1200	445643.056	121121.435	1.425
42			39.209	1200	445633.357	121112.732	1.425

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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	1	2	19.887	0.600	53.941	53.743	0.198	100.4	150	5.33	55.3
1.001	2	3	11.472	0.600	53.668	53.600	0.068	168.7	225	5.52	54.6
1.002	3	5	25.323	0.600	53.600	53.450	0.150	168.8	225	5.94	52.9
2.000	4	5	44.428	0.600	52.890	52.708	0.182	244.1	300	5.74	53.7
1.003	5	6	46.862	0.600	52.708	52.516	0.192	244.1	300	6.72	50.1
1.004	6	7	17.854	0.600	52.441	52.385	0.056	318.8	375	7.02	49.0
1.005	7	8	18.538	0.600	52.385	52.207	0.178	104.1	375	7.19	48.5
1.006	8	9	14.233	0.600	52.207	51.731	0.476	29.9	375	7.26	48.3
1.007	9	10	13.470	0.600	51.731	51.147	0.584	23.1	375	7.32	48.1
1.008	10	11	30.632	0.600	51.147	49.746	1.401	21.9	375	7.45	47.7
1.009	11	17	19.958	0.600	49.746	48.706	1.040	19.2	375	7.53	47.5
3.000	12	13	27.613	0.600	53.321	52.384	0.937	29.5	225	5.19	55.9
3.001	13	14	8.950	0.600	52.384	51.661	0.723	12.4	225	5.23	55.7
3.002	14	15	22.818	0.600	51.661	51.072	0.589	38.7	225	5.41	55.0
3.003	15	16	37.780	0.600	51.072	49.233	1.839	20.5	225	5.63	54.1
3.004	16	17	12.513	0.600	49.158	48.781	0.377	33.2	300	5.70	53.8
1.010	17	18	17.004	0.600	48.706	47.849	0.857	19.8	375	7.60	47.3
1.011	18	19	40.479	0.600	47.774	46.067	1.707	23.7	450	7.76	46.8
1.012	19	20	29.654	0.600	46.067	44.381	1.686	17.6	450	7.86	46.5
1.013	20	21	21.419	0.600	44.381	43.433	0.948	22.6	450	7.95	46.2
1.014	21	22	20.194	0.600	43.433	42.760	0.673	30.0	450	8.04	45.9
1.015	22	23	54.485	0.600	42.760	40.899	1.861	29.3	450	8.28	45.3
1.016	23	24	12.539	0.600	40.899	40.868	0.031	404.5	450	8.49	44.8
4.000	25	26	39.746	0.600	48.502	48.268	0.234	169.9	225	5.66	54.0

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	1.002	17.7	7.0	1.200	2.086	0.035	0.0	65	0.943
1.001	1.004	39.9	7.6	2.086	2.611	0.039	0.0	66	0.776
1.002	1.003	39.9	12.1	2.611	2.145	0.064	0.0	85	0.882
2.000	1.002	70.8	16.1	1.200	2.812	0.083	0.0	97	0.815
1.003	1.002	70.8	37.0	2.812	2.120	0.205	0.0	154	1.012
1.004	1.009	111.4	39.5	2.120	1.737	0.223	0.0	153	0.924
1.005	1.775	196.0	43.2	1.737	1.200	0.247	0.0	119	1.435
1.006	3.324	367.1	49.8	1.200	1.200	0.286	0.0	93	2.351
1.007	3.786	418.2	57.3	1.200	1.200	0.330	0.0	93	2.679
1.008	3.889	429.5	66.8	1.200	1.200	0.387	0.0	99	2.857
1.009	4.152	458.6	69.4	1.200	1.200	0.404	0.0	98	3.026
3.000	2.419	96.2	15.8	1.200	1.200	0.078	0.0	61	1.792
3.001	3.739	148.7	15.7	1.200	1.200	0.078	0.0	49	2.442
3.002	2.108	83.8	17.3	1.200	1.200	0.087	0.0	69	1.668
3.003	2.899	115.3	25.8	1.200	1.200	0.132	0.0	73	2.356
3.004	2.738	193.5	30.0	1.200	1.200	0.154	0.0	79	2.006
1.010	4.083	451.0	102.0	1.200	1.200	0.597	0.0	120	3.324
1.011	4.188	666.1	112.8	1.200	1.200	0.667	0.0	124	3.154
1.012	4.865	773.7	121.9	1.200	1.200	0.726	0.0	120	3.595
1.013	4.291	682.4	123.4	1.200	1.200	0.739	0.0	129	3.292
1.014	3.722	591.9	125.2	1.200	1.200	0.754	0.0	139	2.975
1.015	3.768	599.2	130.1	1.200	1.200	0.795	0.0	142	3.042
1.016	1.004	159.7	133.0	1.200	0.882	0.822	0.0	315	1.118
4.000	1.000	39.8	10.9	1.200	2.244	0.056	0.0	80	0.856

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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)
4.001	26	27	22.735	0.600	48.193	47.873	0.320	71.0	300	5.87	53.2
4.002	27	30	14.807	0.600	47.873	47.088	0.785	18.9	300	5.93	52.9
5.000	28	29	22.126	0.600	46.103	46.012	0.091	243.1	300	5.37	55.2
5.001	29	30	27.251	0.600	46.012	45.900	0.112	243.3	300	5.82	53.4
4.003	30	31	8.608	0.600	45.825	45.798	0.027	318.8	375	6.08	52.4
4.004	31	32	21.567	0.600	45.798	45.731	0.067	321.9	375	6.43	51.1
4.005	32	33	21.362	0.600	45.731	44.925	0.806	26.5	375	6.53	50.7
4.006	33	34	28.289	0.600	44.925	43.968	0.957	29.6	150	6.79	49.9
4.007	34	35	18.090	0.600	43.968	43.050	0.918	19.7	150	6.92	49.4
4.008	35	36	16.303	0.600	42.975	41.775	1.200	13.6	225	7.00	49.1
7.000	37	41	47.718	0.600	40.800	38.342	2.458	19.4	225	5.27	55.6
6.000	38	39	25.245	0.600	40.526	39.587	0.939	26.9	150	5.22	55.8
6.001	39	40	26.898	0.600	39.587	38.529	1.058	25.4	150	5.44	54.9
6.002	40	41	2.758	0.600	38.529	38.417	0.112	24.6	150	5.46	54.8
6.003	41	42	13.031	0.600	38.342	37.784	0.558	23.4	225	5.54	54.5

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)
4.001	1.867	132.0	21.0	2.244	1.200	0.109	0.0	81	1.378
4.002	3.636	257.0	22.6	1.200	1.200	0.118	0.0	59	2.264
5.000	1.004	70.9	11.6	1.200	1.916	0.058	0.0	82	0.745
5.001	1.003	70.9	14.6	1.916	2.388	0.075	0.0	92	0.793
4.003	1.009	111.4	41.1	2.388	1.997	0.217	0.0	157	0.934
4.004	1.004	110.9	43.5	1.997	1.607	0.235	0.0	163	0.945
4.005	3.531	390.0	58.4	1.607	1.200	0.319	0.0	97	2.562
4.006	1.858	32.8	57.4	1.425	1.200	0.319	0.0	150	1.893
4.007	2.279	40.3	56.9	1.200	1.200	0.319	0.0	150	2.321
4.008	3.568	141.9	56.5	1.200	0.200	0.319	0.0	99	3.376
7.000	2.983	118.6	0.0	1.175	1.200	0.000	0.0	0	0.000
6.000	1.949	34.4	9.0	1.200	1.200	0.044	0.0	52	1.638
6.001	2.005	35.4	8.8	1.200	1.200	0.044	0.0	51	1.665
6.002	2.037	36.0	14.2	1.200	1.200	0.071	0.0	65	1.918
6.003	2.719	108.1	14.1	1.200	1.200	0.071	0.0	55	1.899

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	19.887	100.4	150	Circular	55.291	53.941	1.200	55.979	53.743	2.086
1.001	11.472	168.7	225	Circular	55.979	53.668	2.086	56.436	53.600	2.611
1.002	25.323	168.8	225	Circular	56.436	53.600	2.611	55.820	53.450	2.145
2.000	44.428	244.1	300	Circular	54.390	52.890	1.200	55.820	52.708	2.812
1.003	46.862	244.1	300	Circular	55.820	52.708	2.812	54.936	52.516	2.120

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
2.000	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.003	5	1200	Manhole	Adoptable	6	1350	Manhole	Adoptable

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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)
1.004	17.854	318.8	375	Circular	54.936	52.441	2.120	54.497	52.385	1.737
1.005	18.538	104.1	375	Circular	54.497	52.385	1.737	53.782	52.207	1.200
1.006	14.233	29.9	375	Circular	53.782	52.207	1.200	53.306	51.731	1.200
1.007	13.470	23.1	375	Circular	53.306	51.731	1.200	52.722	51.147	1.200
1.008	30.632	21.9	375	Circular	52.722	51.147	1.200	51.321	49.746	1.200
1.009	19.958	19.2	375	Circular	51.321	49.746	1.200	50.281	48.706	1.200
3.000	27.613	29.5	225	Circular	54.746	53.321	1.200	53.809	52.384	1.200
3.001	8.950	12.4	225	Circular	53.809	52.384	1.200	53.086	51.661	1.200
3.002	22.818	38.7	225	Circular	53.086	51.661	1.200	52.497	51.072	1.200
3.003	37.780	20.5	225	Circular	52.497	51.072	1.200	50.658	49.233	1.200
3.004	12.513	33.2	300	Circular	50.658	49.158	1.200	50.281	48.781	1.200
1.010	17.004	19.8	375	Circular	50.281	48.706	1.200	49.424	47.849	1.200
1.011	40.479	23.7	450	Circular	49.424	47.774	1.200	47.717	46.067	1.200
1.012	29.654	17.6	450	Circular	47.717	46.067	1.200	46.031	44.381	1.200
1.013	21.419	22.6	450	Circular	46.031	44.381	1.200	45.083	43.433	1.200
1.014	20.194	30.0	450	Circular	45.083	43.433	1.200	44.410	42.760	1.200
1.015	54.485	29.3	450	Circular	44.410	42.760	1.200	42.549	40.899	1.200
1.016	12.539	404.5	450	Circular	42.549	40.899	1.200	42.200	40.868	0.882
4.000	39.746	169.9	225	Circular	49.927	48.502	1.200	50.737	48.268	2.244
4.001	22.735	71.0	300	Circular	50.737	48.193	2.244	49.373	47.873	1.200
4.002	14.807	18.9	300	Circular	49.373	47.873	1.200	48.588	47.088	1.200
5.000	22.126	243.1	300	Circular	47.603	46.103	1.200	48.228	46.012	1.916
5.001	27.251	243.3	300	Circular	48.228	46.012	1.916	48.588	45.900	2.388
4.003	8.608	318.8	375	Circular	48.588	45.825	2.388	48.170	45.798	1.997
4.004	21.567	321.9	375	Circular	48.170	45.798	1.997	47.713	45.731	1.607

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.004	6	1350	Manhole	Adoptable	7	1350	Manhole	Adoptable
1.005	7	1350	Manhole	Adoptable	8	1350	Manhole	Adoptable
1.006	8	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable
1.007	9	1350	Manhole	Adoptable	10	1350	Manhole	Adoptable
1.008	10	1350	Manhole	Adoptable	11	1350	Manhole	Adoptable
1.009	11	1350	Manhole	Adoptable	17	1350	Manhole	Adoptable
3.000	12	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
3.001	13	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
3.002	14	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
3.003	15	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
3.004	16	1200	Manhole	Adoptable	17	1350	Manhole	Adoptable
1.010	17	1350	Manhole	Adoptable	18	1350	Manhole	Adoptable
1.011	18	1350	Manhole	Adoptable	19	1350	Manhole	Adoptable
1.012	19	1350	Manhole	Adoptable	20	1350	Manhole	Adoptable
1.013	20	1350	Manhole	Adoptable	21	1350	Manhole	Adoptable
1.014	21	1350	Manhole	Adoptable	22	1350	Manhole	Adoptable
1.015	22	1350	Manhole	Adoptable	23	1350	Manhole	Adoptable
1.016	23	1350	Manhole	Adoptable	24		Junction	
4.000	25	1200	Manhole	Adoptable	26	1200	Manhole	Adoptable
4.001	26	1200	Manhole	Adoptable	27	1200	Manhole	Adoptable
4.002	27	1200	Manhole	Adoptable	30	1350	Manhole	Adoptable
5.000	28	1200	Manhole	Adoptable	29	1200	Manhole	Adoptable
5.001	29	1200	Manhole	Adoptable	30	1350	Manhole	Adoptable
4.003	30	1350	Manhole	Adoptable	31	1350	Manhole	Adoptable
4.004	31	1350	Manhole	Adoptable	32	1350	Manhole	Adoptable

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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)
4.005	21.362	26.5	375	Circular	47.713	45.731	1.607	46.500	44.925	1.200
4.006	28.289	29.6	150	Circular	46.500	44.925	1.425	45.318	43.968	1.200
4.007	18.090	19.7	150	Circular	45.318	43.968	1.200	44.400	43.050	1.200
4.008	16.303	13.6	225	Circular	44.400	42.975	1.200	42.200	41.775	0.200
7.000	47.718	19.4	225	Circular	42.200	40.800	1.175	39.767	38.342	1.200
6.000	25.245	26.9	150	Circular	41.876	40.526	1.200	40.937	39.587	1.200
6.001	26.898	25.4	150	Circular	40.937	39.587	1.200	39.879	38.529	1.200
6.002	2.758	24.6	150	Circular	39.879	38.529	1.200	39.767	38.417	1.200
6.003	13.031	23.4	225	Circular	39.767	38.342	1.200	39.209	37.784	1.200

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.005	32	1350	Manhole	Adoptable	33	1350	Manhole	Adoptable
4.006	33	1350	Manhole	Adoptable	34	1200	Manhole	Adoptable
4.007	34	1200	Manhole	Adoptable	35	1200	Manhole	Adoptable
4.008	35	1200	Manhole	Adoptable	36		Junction	
7.000	37	1500	Manhole	Adoptable	41	1200	Manhole	Adoptable
6.000	38	1200	Manhole	Adoptable	39	1200	Manhole	Adoptable
6.001	39	1200	Manhole	Adoptable	40	1200	Manhole	Adoptable
6.002	40	1200	Manhole	Adoptable	41	1200	Manhole	Adoptable
6.003	41	1200	Manhole	Adoptable	42	1200	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	0.0		

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 %)
100	45	0	0

Node 33 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	44.925	Product Number	CTL-SHE-0070-2000-0800-2000
Design Depth (m)	0.800	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 37 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	40.800	Product Number	CTL-SHE-0173-1490-1100-1490
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	14.9	Min Node Diameter (mm)	1500

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Node 40 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	38.529	Product Number	CTL-SHE-0070-2000-0800-2000
Design Depth (m)	0.800	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 36 Online Orifice Control

Flap Valve	x	Invert Level (m)	40.835	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.450		

Node 24 Online Orifice Control

Flap Valve	x	Invert Level (m)	40.835	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.600		

Node 33 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	44.925
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	1185

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	300.0	0.0	0.800	300.0	0.0	0.801	0.0	0.0

Node 37 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	34.600
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	40.800	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)	364	Main Channel n	0.035

Inlets

36	24

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	339.0	0.0	1.400	848.0	0.0

Node 40 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	38.529
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	178

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	48.0	0.0	0.800	48.0	0.0	0.801	0.0	0.0

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.74%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	11	54.593	0.652	28.3	0.7370	0.0000	SURCHARGED
15 minute summer	2	11	54.141	0.473	28.0	0.5355	0.0000	SURCHARGED
15 minute summer	3	11	54.102	0.502	45.5	0.5675	0.0000	SURCHARGED
15 minute summer	4	11	54.057	1.167	67.0	1.3203	0.0000	SURCHARGED
15 minute summer	5	11	53.889	1.181	150.4	1.3352	0.0000	SURCHARGED
15 minute summer	6	11	52.884	0.443	163.4	0.6335	0.0000	SURCHARGED
15 minute summer	7	11	52.702	0.317	181.6	0.4530	0.0000	OK
15 minute summer	8	11	52.447	0.240	211.1	0.3439	0.0000	OK
15 minute summer	9	11	51.978	0.247	244.8	0.3529	0.0000	OK
15 minute summer	10	10	51.386	0.239	289.0	0.3421	0.0000	OK
15 minute summer	11	11	50.048	0.302	303.0	0.4323	0.0000	OK
15 minute summer	12	10	53.467	0.146	63.0	0.1655	0.0000	OK
15 minute summer	13	10	52.491	0.107	62.7	0.1212	0.0000	OK
15 minute summer	14	10	51.829	0.168	69.7	0.1904	0.0000	OK
15 minute summer	15	10	51.252	0.180	105.5	0.2037	0.0000	OK
15 minute summer	16	11	49.645	0.487	121.9	0.5503	0.0000	SURCHARGED
15 minute summer	17	11	49.434	0.728	443.2	1.0417	0.0000	SURCHARGED
15 minute summer	18	11	48.085	0.311	490.1	0.4444	0.0000	OK
15 minute summer	19	12	46.599	0.532	536.6	0.7608	0.0000	SURCHARGED
15 minute summer	20	12	45.617	1.236	522.7	1.7693	0.0000	SURCHARGED
15 minute summer	21	12	44.832	1.399	510.1	2.0024	0.0000	FLOOD RISK
15 minute summer	22	12	44.056	1.296	536.1	1.8543	0.0000	SURCHARGED
30 minute summer	23	20	42.271	1.372	532.9	1.9639	0.0000	FLOOD RISK
30 minute summer	24	21	41.812	0.977	531.9	0.0000	0.0000	OK
15 minute summer	25	11	48.741	0.239	45.2	0.2701	0.0000	SURCHARGED

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 summer	1	1.000	2	25.1	1.426	1.417	0.3501	
15 minute summer	2	1.001	3	29.7	0.747	0.745	0.4563	
15 minute summer	3	1.002	5	48.4	1.216	1.213	1.0071	
15 minute summer	4	2.000	5	63.1	0.896	0.891	3.1286	
15 minute summer	5	1.003	6	149.6	2.124	2.112	3.3000	
15 minute summer	6	1.004	7	163.1	1.491	1.463	1.8708	
15 minute summer	7	1.005	8	181.1	2.084	0.924	1.6115	
15 minute summer	8	1.006	9	210.9	2.801	0.575	1.0776	
15 minute summer	9	1.007	10	244.6	3.271	0.585	1.0140	
15 minute summer	10	1.008	11	289.9	3.684	0.675	2.5868	
15 minute summer	11	1.009	17	297.5	3.026	0.649	2.0502	
15 minute summer	12	3.000	13	62.7	2.721	0.652	0.6348	
15 minute summer	13	3.001	14	62.4	2.450	0.420	0.2260	
15 minute summer	14	3.002	15	69.2	2.126	0.825	0.7524	
15 minute summer	15	3.003	16	104.1	3.178	0.903	1.3707	
15 minute summer	16	3.004	17	116.3	2.123	0.601	0.8812	
15 minute summer	17	1.010	18	436.6	4.067	0.968	1.7154	
15 minute summer	18	1.011	19	491.2	4.154	0.737	5.4151	
15 minute summer	19	1.012	20	512.9	4.139	0.663	4.6985	
15 minute summer	20	1.013	21	502.3	3.507	0.736	3.3937	
15 minute summer	21	1.014	22	511.8	3.351	0.865	3.1996	
15 minute summer	22	1.015	23	538.6	3.400	0.899	8.6328	
30 minute summer	23	1.016	24	531.9	3.357	3.329	1.9867	
30 minute summer	24	Flow through pond	37	268.1	0.149	0.020	353.9887	
15 minute summer	25	4.000	26	43.4	1.168	1.092	1.4466	

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.74%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	26	10	48.387	0.194	85.0	0.2189	0.0000	OK
15 minute summer	27	11	48.010	0.137	91.9	0.1551	0.0000	OK
15 minute summer	28	11	46.554	0.451	46.8	0.5097	0.0000	SURCHARGED
15 minute summer	29	11	46.506	0.494	60.8	0.5586	0.0000	SURCHARGED
15 minute summer	30	11	46.407	0.582	169.6	0.8331	0.0000	SURCHARGED
15 minute summer	31	11	46.283	0.485	184.3	0.6942	0.0000	SURCHARGED
600 minute winter	32	585	46.021	0.290	20.4	0.4146	0.0000	OK
600 minute winter	33	585	46.021	1.096	20.4	229.7105	0.0000	SURCHARGED
600 minute winter	34	585	43.993	0.025	2.3	0.0280	0.0000	OK
600 minute winter	35	585	42.995	0.020	2.3	0.0228	0.0000	OK
180 minute winter	36	180	41.768	0.934	20.9	0.0000	0.0000	OK
180 minute winter	37	180	41.762	0.962	80.5	1.6991	0.0000	SURCHARGED
15 minute summer	38	11	40.789	0.263	35.9	0.2976	0.0000	SURCHARGED
15 minute summer	39	12	39.791	0.204	33.6	0.2310	0.0000	SURCHARGED
120 minute winter	40	118	39.315	0.786	16.9	36.7308	0.0000	SURCHARGED
120 minute summer	41	56	38.405	0.063	16.9	0.0715	0.0000	OK
120 minute summer	42	56	37.844	0.060	16.9	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 summer	26	4.001	27	84.6	2.132	0.641	0.9028	
15 minute summer	27	4.002	30	91.6	3.135	0.356	0.4329	
15 minute summer	28	5.000	29	46.7	0.861	0.659	1.5581	
15 minute summer	29	5.001	30	59.6	0.847	0.841	1.9190	
15 minute summer	30	4.003	31	170.3	1.544	1.528	0.9494	
15 minute summer	31	4.004	32	185.1	1.848	1.669	2.0811	
600 minute winter	32	4.005	33	20.4	1.601	0.052	2.1542	
600 minute winter	33	Hydro-Brake®	34	2.3				
600 minute winter	34	4.007	35	2.3	1.229	0.057	0.0340	
600 minute winter	35	4.008	36	2.3	1.333	0.016	0.0283	
180 minute winter	36	Flow through pond	37	80.5	0.084	0.006	482.4868	
180 minute winter	37	Hydro-Brake®	41	14.9				
15 minute summer	38	6.000	39	33.6	2.155	0.974	0.4444	
15 minute summer	39	6.001	40	32.9	1.985	0.927	0.4735	
120 minute winter	40	Hydro-Brake®	41	2.0				
120 minute summer	41	6.003	42	16.9	1.923	0.156	0.1145	768.0

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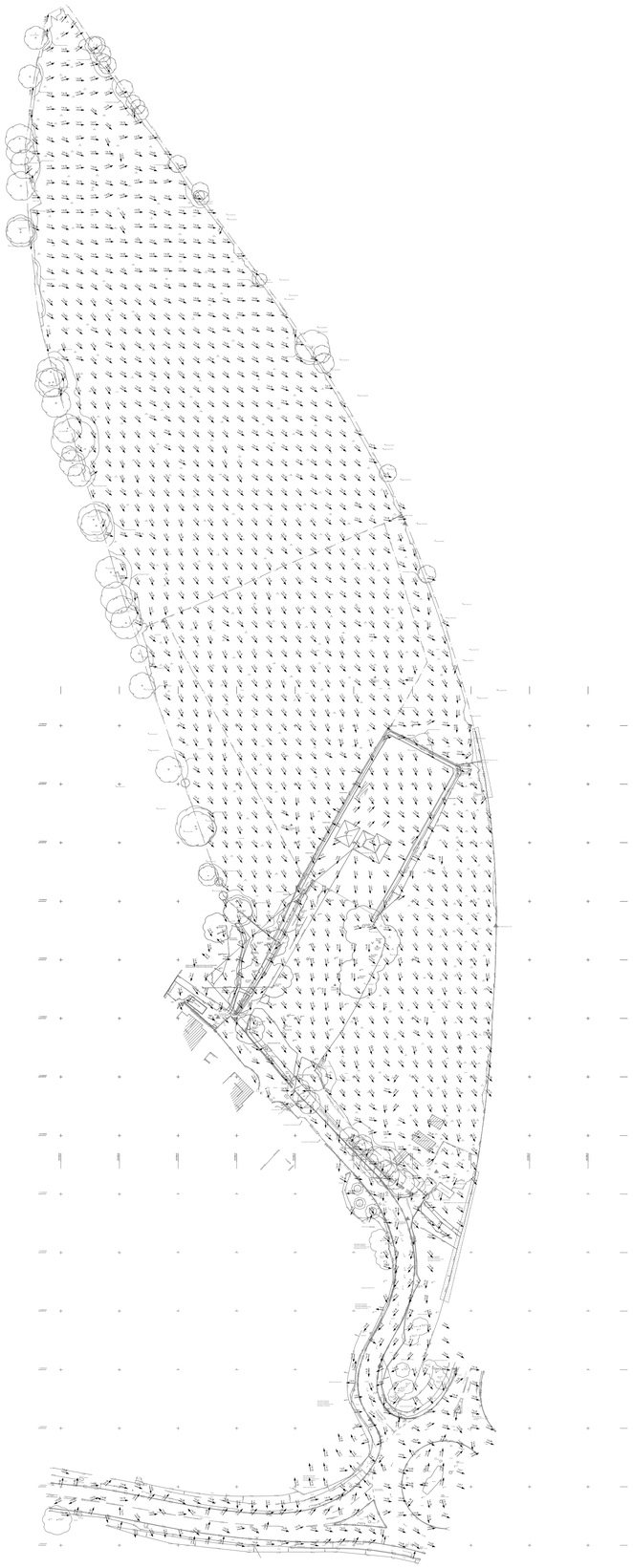
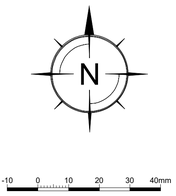
Appendix 3

Surface Water Exceedance Route Plan





REV	DATE	INT	DESCRIPTION	CHK

Issue Status: FOR APPROVAL

The Civil Engineering Practice
11 Tungsten Building
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BN41 1RA

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CLIENT: Bargate Home

PROJECT: Knowel Hill, Albrook, Eastleigh

TITLE: Exceedance Flow Route Plan

DRAWN	DATE	PROJECT NO.
M Pacifico	Oct 2024	23823
ENGINEER	CHECKED	DRG. No. / REV.
S Magowan		47 / -
SCALE		
1:500 @ A1		

Appendix 4

Drainage Management and Maintenance Schedule

Drainage Management and Maintenance Schedule

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Project	**Land West of Allbrook Way, Knowle Hill, Eastleigh**
Project Number	**23823**
By	Stuart Magowan
Date	17 October 2024

1 Schedule of Maintenance

1.1 Once appointed the Contractor will prepare a site specific method statement for the control of silt and other pollutants during construction. CIRIA Report C532, Control of water pollution from construction sites, provides further guidance on this.

1.2 The Contractor will maintain the proposed drainage system during construction and until the handing over of the site.

1.3 Upon completion the Principal Contractor will collate the data sheets, operation and maintenance details of all materials used in the construction of the site drainage system.

1.4 These details will issued to the Management Company for their records.

1.5 Upon completion management of shared drainage facilities (where not adopted by a Statutory Undertaker) will be passed on to a Management Company appointed by the Developer on behalf of the Residents.

1.6 In the event that the Management Company becomes unable to discharge its duties within two years of first appointment the Developer will endeavour to appoint an alternative on behalf of the Residents.

1.7 Maintenance of individual property drainage connections is the responsibility of the individual property owners.

1.8 The following maintenance schedule details the typical tasks to be undertaken at different intervals.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Manage vegetation and remove nuisance plants – aesthetics	As required
	Litter and debris removal – catchpits, headwalls and wetland areas	Monthly or as required

Citation ISO Certification
Quality management
ISO 9001: 2015
REGISTERED
Certificate No:87852002

Maintenance Schedule	Required Action	Frequency
	Mow all margins to the wetland flow channels with vegetation height to be maintained at between 100mm and 150mm	Monthly or as required
	Cleaning of gutters and any filters on downpipes	3 Monthly
	Remove sediment and debris from trapped gullies, silt trap chambers, channel drains and inlet chambers	6 monthly
	Inspection of wetlands	6 monthly
	Inspection and removal of silt and hydrocarbons from Downstream Defender	6 monthly
	Removal of silt from wetland ponds	Annually
	Visual inspection of permeable paving for defects and settlement	Annually
	Cutting / removal of reeds to maintain heathy growth within the wetlands. Once established 1/3 of reeds to be removed annually.	Annually
	Sweeping / brushing of permeable paving	Every 2 years
	Surface and foul water pipework – jetting / rodding	Every 2 years or as required
Corrective Maintenance	Remove debris / blockages to trapped gullies, silt traps, channel drains and headwalls	As required
	Repairs to access chambers / manhole covers	As required
	Replace any broken permeable blocks / surface, remedial works to any depressions or rutting	As required
	Inspect inlet, outlet from downpipes, channel drains, gullies and headwalls for blockages, standing water and clear	As required
	Reconstruct storage structures if performance deteriorates or failure occurs	As required
	Where there is a build-up of silt in wetland or at inlets to the wetland areas of 50mm or more above the design level remove silt and spread on site. Undertake when ground is damp in autumn or early spring and transplant turf / overseed to original design levels	As required
Monitoring	Inspect silt traps and note the rate sediment has accumulated	Monthly in the first year and then annually
	Water quality to be monitored remotely at the outlet manhole form the site.	For first 5 years after completion
	Inspect storage structures to ensure they are fully emptying	Annually

Indicative Schedule of Maintenance for the Proposed Drainage System

Component	Inspection Frequency					
	1 Month	3 Months	6 Months	1 Year	After leaf fall in Autumn	2 Years
Headwalls, Gullies, Channels and Gutters		✓			✓	
Catchpits	✓				✓	
Surface and Foul Water Pipework						✓
Permeable Paving				✓		
Wetlands			✓			
Flow Controls			✓			
Storage Facilities				✓		
Downstream Defender			✓			
Outfall Manhole	✓					

Inspection Frequency Summary

2 Regular Maintenance Procedures

2.1 It is recommended the Management Company employ a suitably qualified company to undertake the maintenance works on site for all shared drainage. The following procedures provide a guide to the two most common maintenance items, jetting and silt removal, to be undertaken on site.

2.2 Jetting

2.2.1 Equipment Required:

- High-pressure water jetting equipment
- Personal protective equipment (PPE) for operators

2.2.2 Typical Procedure:

- Perform a pre-jetting inspection to assess the level of sedimentation
- Insert the jetting hose into the pipe, starting from the upstream end
- Gradually move the jetting hose downstream, ensuring the entire pipe length is cleaned
- Monitor the process to avoid any damage to the pipe structure.
- Collect dislodged silt and debris at the downstream end using a vacuum or manual removal

2.3 Silt Removal and Disposal

2.3.1 Equipment Required:

- Vacuum truck or manual removal tools

- Containers for temporary storage of silt and debris

2.3.2 Typical Procedure:

From Gullies, catchpits, pipework headwalls

- Collect the dislodged silt and debris from gullies, catchpits, downstream end of the surface water pipe or headwalls.
- Transfer the collected material to the containers
- Dispose of the collected silt and debris following local regulations and environmental guidelines

From Wetland ponds

- Consult Ecologist to ensure works undertaken at appropriate times to minimise any disruption to wildlife
- Remove silt and debris from base of ponds and spread material on the adjacent bank of the wetland area and leave in place for 24-48 hours .
- Transfer material to containers
- Dispose of the collected silt and debris following local regulations and environmental guidelines

3 Design Life

3.1 The design life of the development is likely to exceed the design life of the components within the SuDS network. During the routine drainage inspections it may be determined that some components have reached the end of their functional life cycle.

3.2 Where possible repairs should be the first option considered however if repairs are unviable it will be necessary for the property owner / Management Company to replace the faulty component.

4 Emergency Plan

4.1 Potential flood and maintenance indicators:

- Manholes or inspections chambers overflowing
- Gullies overflowing or ponding
- Channel drains overflowing or ponding
- Other visual indicators of the drainage system not performing as it should

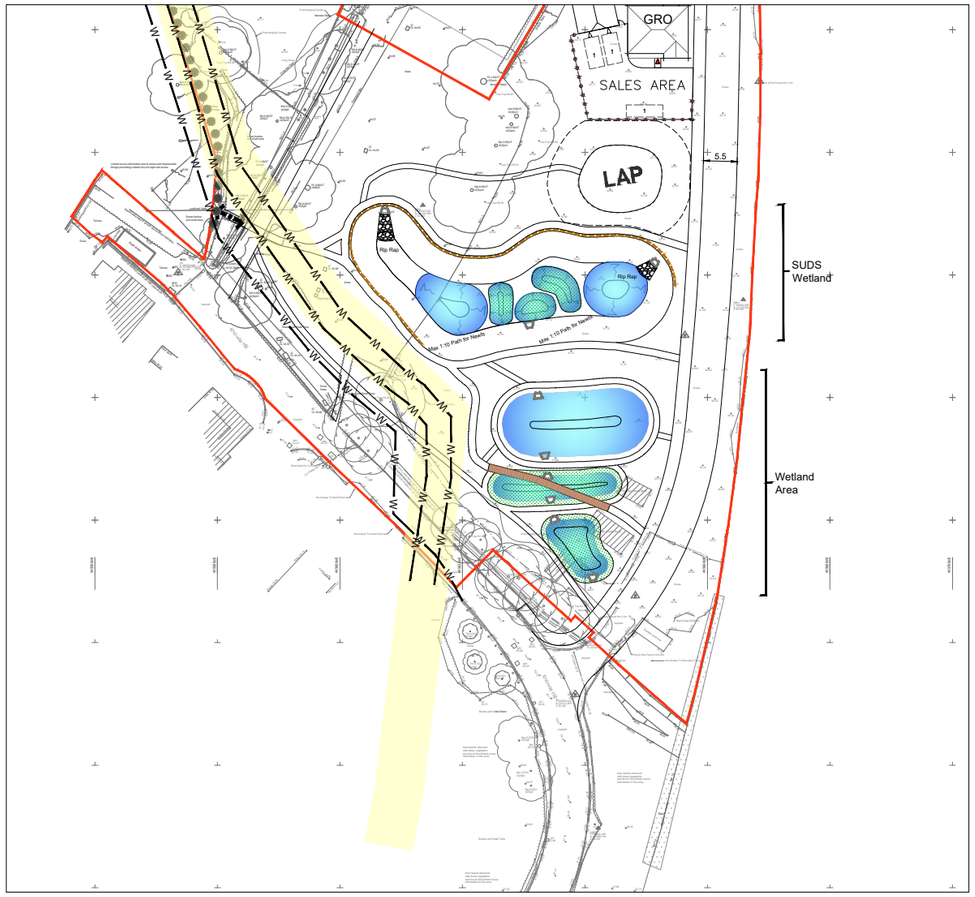
4.2 Should any of the items above occur then immediate action as outlined below should be undertaken:

- Inspect for blockages in the problem area

- Should the problem not be identified via an initial inspection:
  - For unadopted onsite drainage the Management Company should appoint a suitable drainage engineer to inspect and survey the system and jet any blockages
  - For adopted onsite drainage the relevant statutory undertaker should be alerted
  - Where it is suspected that there is a problem with the downstream drainage network the Owner or relevant statutory undertaker of that system should be alerted

Appendix 5

Southern Water Asset Easement Plan



Key

8m Easement to water main

—W——W——W— Location of Water main from Southern Water records

N

-5m 0 5 10 15 20m

GENERAL NOTES:

1. All dimensions to be checked on site. All details and dimensions relating to sub-Contractors work must be checked and agreed between the sub-Contractor or supplier and the general Contractor.

2. This drawing is to be read in conjunction with all relevant Architect's and Engineer's drawings and specification.

3. The main Contractor is responsible for ensuring the stability of the structure whilst the works are in progress.

4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority. No liability is accepted by the Consultant and the main Contractor is responsible for obtaining and checking all information and taking due care and attention whilst undertaking the works.

REV	DATE	INT	DESCRIPTION	CHK

Issue Status: FOR APPROVAL

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CLIENT: Bargate Home

PROJECT: Knowel Hill, Albrook, Eastleigh

TITLE: Mains Water Apperatus Plan

DRAWN	DATE	PROJECT NO.
M Pacifico	Oct 2024	23823
ENGINEER	CHECKED	DRG. No. / REV.
S Magowan		46 -
SCALE		
1:500 @ A1		