

SuDS and Drainage Report

Land Adj The Hollies, Barnham Road, Barnham PO22 0ES

Rev: **P3**

Ref: **C3876**

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Document Control

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Author	LH	Signature	

Revision History

Date	Revision	Author	Approved
05.11.2025	P	LH	CS
13.11.2025	P1	LH	CS
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21.05.2026	P4	LH	CS

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1 Introduction

- 1.1.1 CGS Civils Ltd has been appointed to undertake a drainage strategy report for a proposed development at Land Adj The Hollies, Barnham Road in Barnham, West Sussex.
- 1.1.2 The proposed development will consist of the construction of 2 No. dwellings which will be utilised by the adjacent care home. The proposed development is located as OS Grid Reference SU 95757 04556 and has the post code PO22 0ES.
- 1.1.3 The purpose of this drainage strategy is to demonstrate how the development area can be satisfactorily drained without increasing flood risk onsite and elsewhere. In addition, the report is intended to supply the relevant data:
- The results of an assessment into the potential for disposing of surface water by means of Sustainable Drainage System (SuDS).
 - The appropriate design standard for the surface water drainage scheme must be the 1 in 100 year return period with a 45% allowance for climate change.

Fig 1. Site Location



2 Executive Summary:

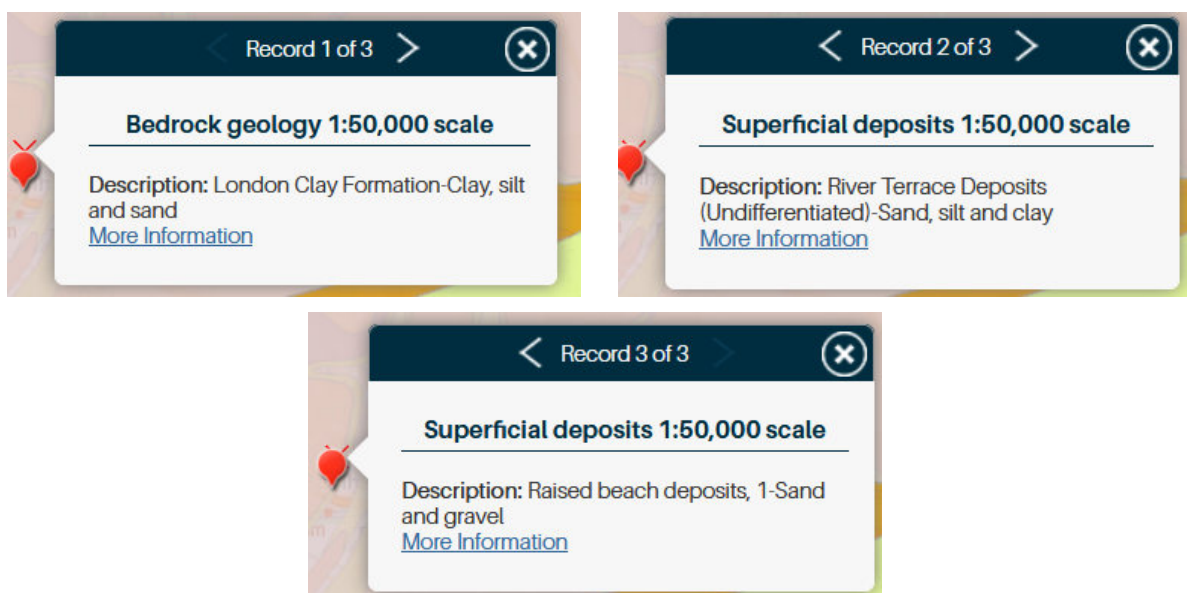
- 2.1.1 The discharge of surface water to ground confirmed to not be suitable after infiltration test failed. Winter groundwater monitoring was carried out in late 2022 and early 2023 which recorded a highest groundwater level of 1.0mgb. Infiltration features are therefore not viable under Arun District Council policy.
- 2.1.2 It is therefore proposed that surface water runoff is to be discharged into an existing surface water sewer located within Market Close at a restricted rate of 0.5l/s. Storage will be supplied within the sub-base of a tanked permeable parking area and within an attenuation tank.
- 2.1.3 The proposed network has been designed to cater for 1 in 100-year +45% CCA storm +10% urban creep.
- 2.1.4 The proposed foul water network is to be connected into the existing foul water system on site via the construction of a new chamber over the existing drain. Remedial works have been carried out on the foul drainage system and it is now flowing freely.

3 Site Geology

3.1 British Geological Survey information

- 3.1.1 The British Geological Survey confirms the bedrock geology to be made up of London Clay Formation. The BGS website confirms the superficial deposits on site to be made up of River Terrace Deposits and Raised Beach Deposits. The geology is noted to be comprised of Clay, Silt and Sand.
- 3.1.2 The British Geological survey also holds records of historical boreholes near the site which give some insight into the ground geology.
- Borehole SU90SE54 (Located approx. 170m Southwest of the site) – Clay and sand

Fig 2. British Geological Survey



3.2 Geological Assessment

- 3.2.1 A groundwater monitoring well was installed on site in 2022 and monitoring was conducted during the winter period of late 2022 and early 2023. Further monitoring was undertaken on site during February 2026 to confirm any changes in groundwater levels.
- 3.2.2 During the monitoring window in both 2022-2023 and within February 2026, the highest recorded groundwater level was 1.0mbgl which rules out the use of infiltration on site. Therefore, as per National Standards for SuDS guidelines in addition to Arun DC policy, the use of infiltration features is not possible as there will be insufficient easement between base of infiltration feature and highest groundwater level. See **Appendix F**.
- 3.2.3 In addition to the ground water monitoring, an infiltration test to BRE365 was conducted within February 2023. A trial pit measuring 0.3 x 1m x 0.9m deep was excavated and rapidly filled with water; which failed to drain within a sufficient time period and is therefore considered a failure.
- 3.2.4 Photos of both the groundwater monitoring wells and the infiltration test can be found in Fig 3. Below.

Fig 3. Groundwater Monitoring Well locations and soakaway test photographs



4 Existing Drainage

- 4.1.1 A CCTV Drainage Survey was conducted on the existing The Hollies. It was confirmed that both the foul and surface water runoff from the property discharges via a combined drain into the foul water sewer within Barnham Road.

5 Proposed Drainage Strategy

5.1 SuDS Hierarchy

- 5.1.1 All options for the destination of run-off generated on site have been assessed in line with the SuDS hierarchy as set out in Building Regulations Part H document and DEFRA's Draft National Standards for SuDS.

Table 1. SuDS Hierarchy

Discharge Destination	
Rainwater Harvesting	Rainwater harvesting has been designed into drainage network.
Discharge to Ground	No – Infiltration test failed and groundwater was recorded at 1.0mbgl.
Discharge to Watercourse	None nearby
Discharge to Surface Water Sewer	Yes – Discharge into surface water sewer within Market Close adjacent to the site. Discharge rate to be restricted to 0.5l/s.
Discharge to Other Sewer	N/A due to above.

5.2 Proposed Hydraulic Calculation Specifications:

Table 2. SuDS Hierarchy

Hydraulic Calculations Settings:	
Rainfall Methodology	FEH-22
Volumetric Run-off Coefficient Cv	1
CV Winter and Summer	1
Additional Storage (m ³ / ha)	0.0
Maximum Rainfall (mm/hr)	75
Flow Control	1.30m Head @ 0.5l/s discharge
Attenuation Tank Design	Base Coefficient (m/hr): 0.00000
	Side Coefficient (m/hr): 0.00000
	Factor of Safety: 2
	Porosity: 95%
Carpark Design	Base Coefficient (m/hr): 0.00000
	Side Coefficient (m/hr): 0.00000
	Factor of Safety: 2
	Porosity: 30%

5.3 Surface Water Drainage

- 5.3.1 Due to the failure on on-site infiltration testing it is confirmed that the discharge of surface water runoff via infiltration is not viable. It is therefore determined that all surface water runoff from the site is to be discharged into an existing surface water sewer located within Market Close at a restricted discharge rate of 0.5l/s which is the minimum practical rate to ensure self-cleansing velocity within the network and reducing the risks of blocking the orifice within the flow control chamber.
- 5.3.2 The hard paved areas are to be constructed from a permeable surface with the sub-base wrapped in an impermeable geomembrane which will allow the permeable paved areas to act as a blanket attenuation tank. Distribution tanks are to be located within the sub-base to allow runoff to convey between the sub-base and the remainder of the surface water network.
- 5.3.3 Rainwater harvesting tanks are to be installed along the drainage network which will allow harvested rainwater to be re-used within the properties.
- 5.3.4 Bioretention planters are also to be utilised within the drainage design which will intercept surface water runoff whilst also providing amenity and biodiversity. Additionally bioretention planters will provide treatment to the surface water and therefore will tackle all 4 pillars of SuDS.
- 5.3.5 An attenuation tank is to be installed to provide the additional storage required to cater for the 1 in 100-year +45% storm + 10% Urban Creep.
- 5.3.6 Greenfield Runoff and Hydraulic calculations have been carried out which can be found at Appendix C. The urban creep has been applied directly to the catchment area on the calculations to accommodate for this increase on roof areas only and not hard paved areas.
- 5.3.7 The proposed discharge to the Southern Water sewer has been agreed in principle by Southern Water who provided the following response:
- “Dear Luke, Thank you for your comments. At this stage, I can confirm that Southern Water has no objections to the proposal, provided that all relevant Southern Water policies and standards are fully adhered to. To progress the application to technical review and for Approval to be granted we require full planning permission, as previously stated”
- 5.3.8 It has also been confirmed that a connection is possible via gravity with the levels of the existing surface water sewer provided on the drainage layout being taken from Southern Water sewer records – See **Appendix E**.

Table 3. Greenfield Runoff Calculations

Greenfield Runoff Calculations			
Storm period	Greenfield runoff rate (l/s)	Proposed Discharge Rate (l/s)	Difference (l/s)
Q _{BAR}	0.1	0.5	+ 0.4
1	0.1	0.5	+ 0.4
2	0.1	0.5	+ 0.4
30	0.2	0.5	+ 0.3
100	0.2	0.5	+ 0.3

5.4 Water Quality

- 5.4.1 A key requirement of any SuDS system is that it protects the receiving water body from the risk of pollution.
- 5.4.2 Frequent and short duration rainfall events are those that are most loaded with potential contaminants (silts, fines, heavy metals, and various organic and inorganic contaminants) Therefore the first 5-10mm of rainfall should be adequately treated with SuDS.
- 5.4.3 The new SuDS Manual (Ciria C753, November 2015) introduces slightly different approach compared to the previous version for the water quality management of surface water. The Manual describes risks posed by the surface water runoff to the receiving environment as a function of:
- The pollution hazard at a particular site (i.e., the pollution source)
 - The effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels
 - The sensitivity of the receiving environment
- 5.4.4 The recommended approaches for water quality risk management are given in the SuDS Manual Table 26.1.

Table 26.1 from SuDS manual. Approaches to Water Quality Risk Management

Table 26.1 Approaches to Water Quality Risk Management			
Design method	Hazard Characterisation	Risk Reduction	
		For Surface Water	For Groundwater
Simple Index Approach	Simple pollution hazard indices based on land use (Table 26.2)	Simple SuDS hazard mitigation indices (Table 26.3)	Simple SuDS hazard mitigation indices (Table 26.4)
Risk Screening	Factors characterising traffic density and extent of infiltration likely to occur (Table 26.5)	N/A	Factors characterising unsaturated soil depth and type, and predominant flow type through the soils (Table 26.5)
Detailed Risk Assessment	Site specific information used to define likely pollutants and their significance	More detailed, component specific performance information used to demonstrate that the proposed SuDS components reduce the hazard to acceptable levels	
Process-based treatment modelling	Time series rainfall used with generic pollution characteristics to determine statistical distributions of likely concentrations and loadings in the runoff	Models that represent the treatment processes in the proposed SuDS components give estimates of reductions in even mean discharge concentrations and total annual load reductions delivered by the system	

- 5.4.5 As per Table 26.1 Simple Index approach will be used as a design method for this site.
- 5.4.6 Table 26.2 will provide hazard classification of different land uses. The land uses for the surface water drainage for this site are.
- Residential Roofs
 - Individual Property driveways and residential car parks
 - Low traffic roads

5.4.7 To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index for each contaminant type that equals or exceeds the pollution hazard index for each contaminant type. Therefore, the following must be achieved for the surface running off the site.

Total SuDS mitigation index $\geq$ pollution hazard index

5.4.8 Pollution Hazard Indices are given for different land uses in Table 26.2 of the SuDS manual;

Table 26.2 from SuDS manual. Pollution Hazard Indices for Different Land Use Classifications

Table 26.2 Pollution hazard indices for different land use classifications				
Land Use	Pollution Hazard Level	Total Suspended solids (TSS)	Metals	Hydro-Carbons
Residential roofs	Very Low	0.2	0.2	0.05
Other roofs (Typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g., cul-de-sacs, homezones 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
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g., hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g., haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

5.4.9 From Table 26.2 the following information is tabulated in Table 1

Table 3: Pollution hazard index and destination of runoff for the proposed site

Table 3: Pollution Hazard Index and Destination of runoff for the proposed Site					
Land Use	Destination of Runoff	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Roof	Surface Water	Very Low	0.2	0.2	0.05
Individual driveways, residential car parks and low traffic roads	Surface water	Low	0.5	0.4	0.4

5.4.10 The SuDS mitigation index will be obtained from Table 26.4 (for groundwater) of the SuDS manual.

Table 26.4 from SuDS manual. Indicative SuDS Mitigation Indices for discharges to ground waters.

5.4.11 SuDS mitigation index are tabulated in Table 5 as followed.

Table 26.4 Indicative SuDS mitigation indices for discharges to surface waters			
Type of SuDS Components	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention System	0.8	0.8	0.8
Permeable Pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area		

Table 4: SuDS mitigation index

Table 4 Mitigation Indices						
Runoff Source	Destination of Runoff	Mitigation Index Source	Type of SuDS Component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Surface Water	Table 26.3	Bioretention System	0.8	0.8	0.8
Individual driveways, residential car parks and low traffic roads	Surface water	Table 26.3 (for surface waters)	Permeable Paving	0.7	0.6	0.7

5.4.12 The above analysis demonstrates that the SuDS devices within the design will mitigate any pollution present within the surface water system.

5.5 Foul water drainage

- 5.5.1 The foul water will discharge into the local foul water sewer via the construction of a new chamber on the existing private foul water drainage on site. The foul water drain discharges into the Southern Water sewer located within Barnham Road.
- 5.5.2 Due to the location of the site, the foul water sewer discharges into the Lidsey Wastewater Treatment Works (WwTW), which is subject to stricter sewage capacity requirements. It is to be noted that only foul water from the development will discharge into the public foul sewer, ensuring that only domestic wastewater is directed to Lidsey WwTW in accordance with Southern Water's requirements and best practice for sustainable drainage design.
- 5.5.3 A CCTV drainage survey was carried out on the existing drainage network which recorded a blockage downstream of the proposed connection point. Remedial works have been carried out on the foul system and it is now clear of blockages and flowing freely.

Fig 4. Sewer Records



6 Summary and Conclusions

- 6.1.1 CGS Civils has been instructed to produce a Drainage statement under National Planning Policy Framework (NPPF) to support the Planning Application for the construction of 2 No. dwellings that is to be utilised by the adjacent care home.
- 6.1.2 The Surface Water will discharge to an existing surface water sewer located within Market close. The surface water discharge rate is to be restricted to 0.5 l/s and will utilise attenuations tanks and a attenuated sub-base of a car park in order to cater for the 1 in 100-year +45% storm +10% urban creep.
- 6.1.3 The proposed foul water network is to be connected into the existing foul water system on site via the construction of a new chamber over the existing drain. Remedial works have been carried out on the foul system and it is now clear of blockages and flowing freely.
- 6.1.4 The report has demonstrated that the proposed drainage measures ensure that suitable means of surface water drainage can be achieved for the proposed development.

7 Appendices

7.1 Appendix A – Site Plan



Notes

1. This drawing is the copyright of MH Architects Ltd

2. Do not scale this drawing except for Local Authority planning purposes

3. All dimensions must be checked on site by the contractor prior to commencement of the works.

X

A - Approved

X

B - Approved with comments

X

C - Do not use

Rev.	Revision Note/Purpose of Issue	Drw By	Date	Chk By	Date
P01	Preliminary	AE	30/09/25	CP	30/09/25
P02	Site boundary added, units detached	AE	09/10/25	CP	09/10/25
P03	Tree survey added	CP	13/10/25	CP	13/10/25
P04	Hatching	AE	15/10/25	CP	15/10/25

Client

Elberry Estates Ltd

Job title

84 Barnham Road
Barnham
West Sussex PO22 0ES

Drawing title

Proposed
Site Plan

Drawn	Date	Checked	Date	Scale at A1				
AE	Sep 25	CJP	Sep 25	1:200				
Job No.	Pro.	Org.	Zone	Level	Type	Role	No.	Rev.
23-087	BHR	MHA	XX	00	DR	A	0043	P05

Purpose of Issue

PRELIMINARY

Ground Floor 1Bicentennial Building
Southern Gate 1 Chichester
West Sussex PO19 8EZ

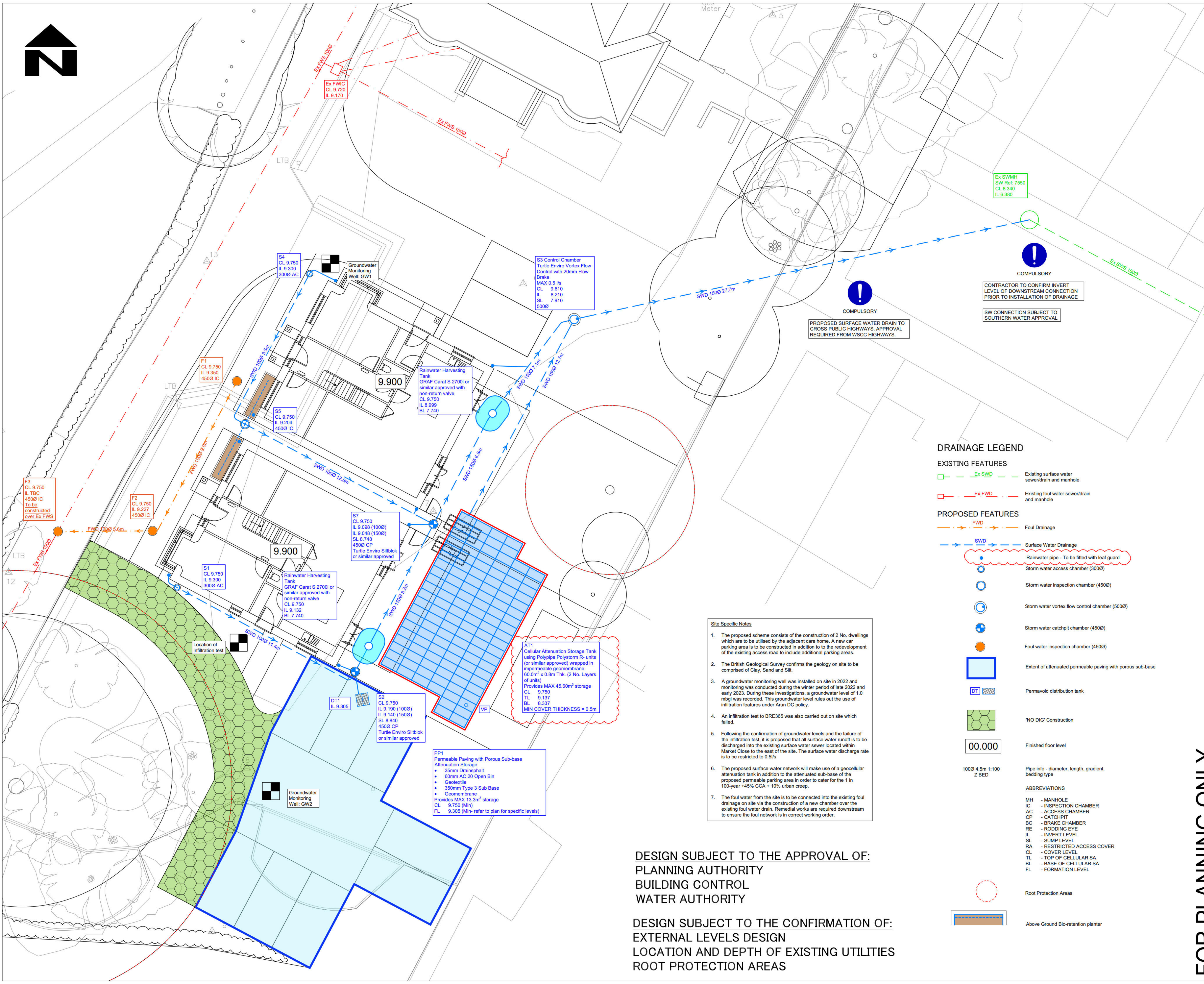
1. 01243 774748
e. admin@mharchitects.co.uk
www.mharchitects.co.uk

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ARCHITECTS

7.2 **Appendix B – Drainage Layout**



- | | |
|---|--|
| Prefixed to drawing numbers shall signify the following:- | |
| PL = PLANNING | Shall not be used for contract or construction purposes |
| P = PRELIMINARY | Shall not be used for contract or construction purposes |
| T = TENDER | Shall not be used for construction purposes |
| C = CONSTRUCTION | These are the only drawings that shall be used for construction purposes |
| R = RECORD | Record of actual completed work |

P4	19.05.26	REVISED TO SUIT NEW SITEPLAN	LH	CS	CS
P3	24.02.26	INCLUDED GWM AND INF TEST LOCATIONS	LH	CS	CS
P2	30.01.26	REVISED TO SUIT ADC COMMENTS	LH	CS	CS
P1	13.11.25	REVISED TO SUIT CLIENTS COMMENTS AND TO INCLUDE FOUL WATER DRAINAGE	LH	CS	CS
P-	11.11.25	PRELIMINARY ISSUE	LH	CS	CS
REV	DATE	DESCRIPTION	BY	CHK	APP



DESIGN SUBJECT TO THE CONFIRMATION OF:
EXTERNAL LEVELS DESIGN
LOCATION AND DEPTH OF EXISTING UTILITIES
ROOT PROTECTION AREAS



BLUE ARROWS SHOW ROUTE OF EXCEEDANCE FLOWS FROM PROJECTED POINTS OF EMERGENCE TOWARDS DIRECTION OF FALL.

ALL STRUCTURES DESIGNED TO ACCOMMODATE BELOW GROUND THE CRITICAL 1 IN 100 YEAR STORM EVENT PLUS 45%. EXCEEDANCE WOULD ONLY OCCUR IN STORMS OF GREATER INTENSITY THAN THIS.

DUE TO THE ROUTES OF EXCEEDANCE SHOWN, A SAFETY FACTOR OF 2.0 HAS BEEN SELECTED FOR STORAGE FEATURES.



Prefixes to drawing numbers shall signify the following:-

PL = PLANNING	Shall not be used for contract or construction purposes
P = PRELIMINARY	Shall not be used for contract or construction purposes
T = TENDER	Shall not be used for construction purposes
C = CONSTRUCTION	These are the only drawings that shall be used for construction purposes
R = RECORD	Record of actual completed work

P4	19.05.26	REVISED TO SUIT NEW SITEPLAN	LH	CS	CS
P2	30.01.28	REVISED TO INCLUDE FOOTPATHS AND PATIO	LH	CS	CS
P1	13.11.25	REVISED TO SUIT DRAINAGE LAYOUT	LH	CS	CS
P-	11.11.25	PRELIMINARY ISSUE	LH	CS	CS
REV	DATE	DESCRIPTION	BY	CHK	APP



Consulting Civil Engineers

CLIENT

ELBERRY PROPERTIES LTD

ARCHITECT

MH ARCHITECTS

JOB TITLE

LAND ADJ THE HOLLIES BARNHAM

DRAWING TITLE

IMPERMEABLE AREAS AND OVERLAND FLOW ROUTE PLAN

DRAWN	ENGINEER	CHECKED	APPROVED
LH	C SLADE	CS	CS

DATE	SCALE @ A1
NOV 2025	1:100

JOB No.	STATUS	DRAWING No.	REV.
C3876	P	101	P3

FOR PLANNING ONLY

7.3 **Appendix C – Surface Water Calculations**

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)	0.200
CV	1.000	Preferred Cover Depth (m)	0.350
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	75.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
S2	0.036	5.00	9.750	450	495750.094	104541.613	0.610	9.140
S3	0.019	5.00	9.610	1200	495761.520	104563.110	1.400	8.210
ExSWMH	0.000		8.340	1050	495788.529	104568.165	1.960	6.380
ExSWS			8.340	1200	495791.178	104566.728	1.990	6.350

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	S2	S3	24.345	0.600	9.140	8.210	0.930	26.2	150	5.21	55.9
1.001	S3	ExSWMH	27.478	0.600	8.210	6.380	1.830	15.0	150	5.38	55.2
1.002	ExSWMH	ExSWS	3.014	0.600	6.380	6.350	0.030	100.5	150	5.43	55.0

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	1.976	34.9	7.3	0.460	1.250	0.036	0.0	47	1.569
1.001	2.613	46.2	11.0	1.250	1.810	0.055	0.0	50	2.144
1.002	1.002	17.7	10.9	1.810	1.840	0.055	0.0	85	1.054

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	24.345	26.2	150	Circular	9.750	9.140	0.460	9.610	8.210	1.250
1.001	27.478	15.0	150	Circular	9.610	8.210	1.250	8.340	6.380	1.810
1.002	3.014	100.5	150	Circular	8.340	6.380	1.810	8.340	6.350	1.840

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S2	450	Manhole	Adoptable	S3	1200	Manhole	Adoptable
1.001	S3	1200	Manhole	Adoptable	ExSWMH	1050	Manhole	Adoptable
1.002	ExSWMH	1050	Manhole	Adoptable	ExSWS	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S2	495750.094	104541.613	9.750	0.610	450		0	1.000	9.140	150
S3	495761.520	104563.110	9.610	1.400	1200		1	1.000	8.210	150
ExSWMH	495788.529	104568.165	8.340	1.960	1050		0	1.001	8.210	150
							1	1.001	6.380	150
ExSWS	495791.178	104566.728	8.340	1.990	1200		0	1.002	6.380	150
							1	1.002	6.350	150

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	1 year (l/s)	0.1
Rainfall Events	Singular	Drain Down Time (mins)	240	10 year (l/s)	0.3
Summer CV	1.000	Additional Storage (m³/ha)	0.0	30 year (l/s)	0.3
Winter CV	1.000	Starting Level (m)	8.210	100 year (l/s)	0.4
Analysis Speed	Normal	Check Discharge Rate(s)	✓	Check Discharge Volume	x

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 %)
1	45	0	0
10	45	0	0
30	45	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	FEH	Growth Factor 100 year	2.48
Positively Drained Area (ha)	0.136	Betterment (%)	0
SAAR (mm)	762	QMed	0.2
Host	7	QBar	0.2
BFIHost	0.790	Q 1 year (l/s)	0.1
Region	1	Q 10 year (l/s)	0.3
QBar/QMed conversion factor	1.111	Q 30 year (l/s)	0.3
Growth Factor 1 year	0.85	Q 100 year (l/s)	0.4
Growth Factor 10 year	1.45		

Node S3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	8.210	Product Number	CTL-SHE-0030-5000-1300-5000
Design Depth (m)	1.300	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.5	Min Node Diameter (mm)	1200

Node S3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	8.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	60.0	60.0	0.800	60.0	82.0	0.801	0.0	82.0

Results for 1 year +45% CC Critical Storm Duration. Lowest mass balance: 72.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S2	10	9.184	0.044	6.5	0.0070	0.0000	OK
360 minute winter	S3	344	8.477	0.267	2.0	10.4179	0.0000	SURCHARGED
15 minute summer	ExSWMH	1	6.507	0.127	0.3	0.1103	0.0000	OK
15 minute summer	ExSWS	1	6.464	0.114	16.5	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	S2	1.000	S3	6.5	0.677	0.185	0.2494	
360 minute winter	S3	1.001	ExSWMH	0.3	0.494	0.007	0.0170	
15 minute summer	ExSWMH	1.002	ExSWS	16.5	1.085	0.931	0.0457	5.3

Results for 10 year +45% CC Critical Storm Duration. Lowest mass balance: 88.67%

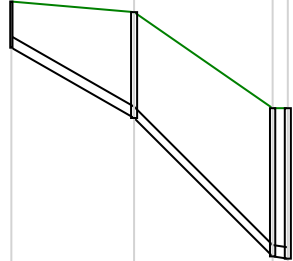
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S2	10	9.219	0.079	19.0	0.0125	0.0000	OK
360 minute winter	S3	352	8.783	0.573	4.1	28.2113	0.0000	SURCHARGED
15 minute summer	ExSWMH	1	6.507	0.127	0.3	0.1103	0.0000	OK
15 minute summer	ExSWS	1	6.464	0.114	16.5	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	S2	1.000	S3	19.0	1.238	0.544	0.3286	
360 minute winter	S3	1.001	ExSWMH	0.4	0.516	0.008	0.0190	
15 minute summer	ExSWMH	1.002	ExSWS	16.5	1.085	0.931	0.0457	5.2

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 91.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S2	10	9.233	0.093	24.6	0.0148	0.0000	OK
480 minute winter	S3	472	8.924	0.714	4.0	36.4104	0.0000	SURCHARGED
15 minute summer	ExSWMH	1	6.507	0.127	0.3	0.1103	0.0000	OK
15 minute summer	ExSWS	1	6.464	0.114	16.5	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	S2	1.000	S3	24.6	1.525	0.703	0.3537	
480 minute winter	S3	1.001	ExSWMH	0.4	0.531	0.008	0.0203	
15 minute summer	ExSWMH	1.002	ExSWS	16.5	1.085	0.931	0.0457	5.2

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 92.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	S2	585	9.303	0.163	2.7	0.0259	0.0000	SURCHARGED
600 minute winter	S3	585	9.303	1.093	4.1	46.8927	0.0000	SURCHARGED
15 minute summer	ExSWMH	1	6.507	0.127	0.3	0.1103	0.0000	OK
15 minute summer	ExSWS	1	6.464	0.114	16.5	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)
600 minute winter	S2	1.000	S3	2.7	0.225	0.077	0.4286	
600 minute winter	S3	1.001	ExSWMH	0.5	0.560	0.010	0.0232	
15 minute summer	ExSWMH	1.002	ExSWS	16.5	1.085	0.931	0.0457	5.6

Node Name	S2	S3	E2	E3
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 2.000				
	1.000	1.001	1	
	150mm	150mm	1	
	26.2	15.0	1	
	9.750	9.610	8.340	
Invert Level (m)	9.140	8.210	6.380	6.380
Length (m)	24.345	27.478	3	

7.4 **Appendix D – Borehole Logs**

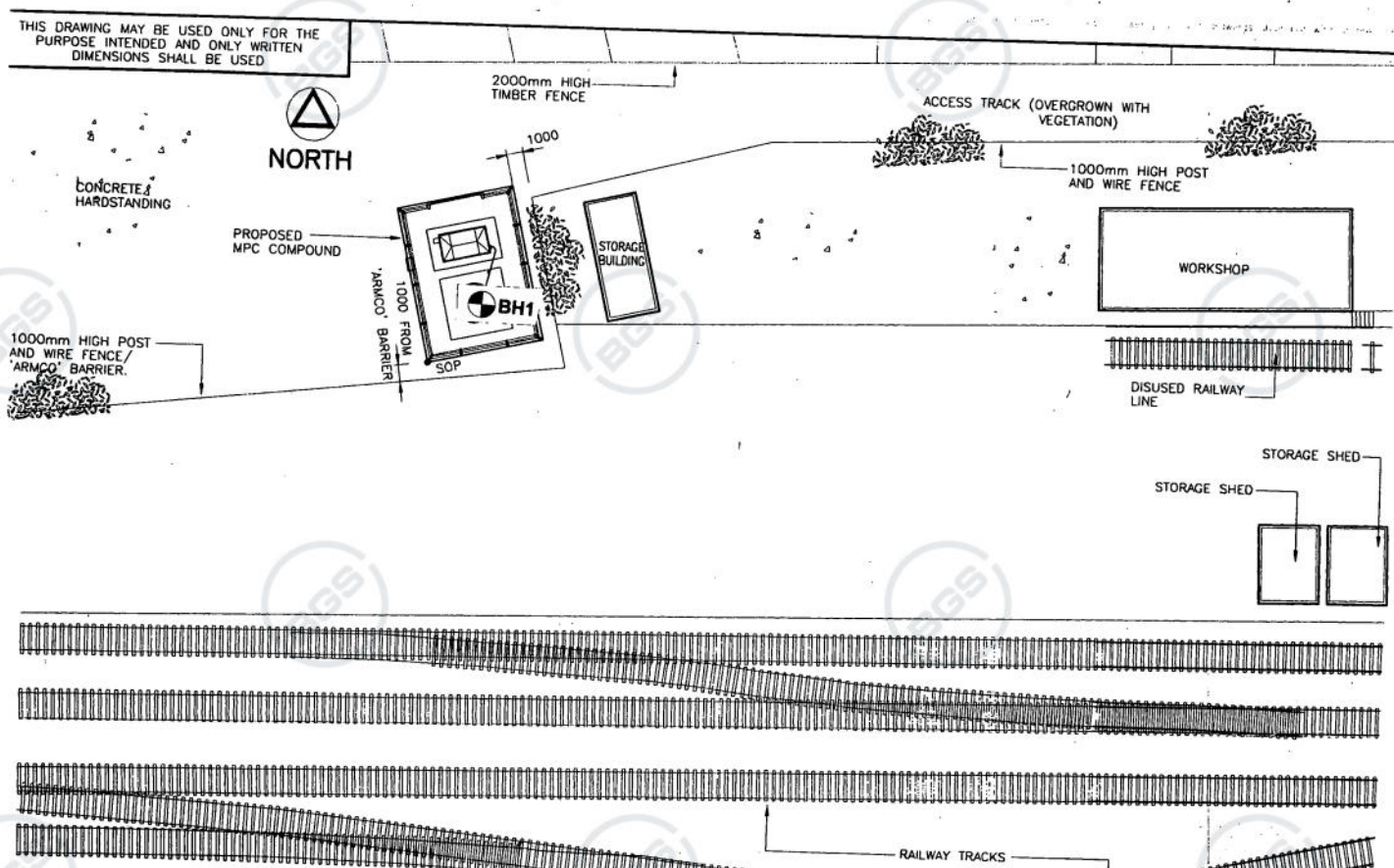


CLIENT SCOTTISH POWER TECHNOLOGY		JOB NO C9984	LOCATION BARNHAM STATION, BOGNOR REGIS		BOREHOLE NO BH1		
DATE FEBRUARY 1999		SCALE 1 to 50	BORING METHOD DYNAMIC SAMPLING		Sheet: 1		
Drilling & Casing Progress	SAMPLE/TEST		SPT N - value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
	Type & No.	Depth(M)					
19TH				MADE GROUND - Concrete.			0.0
				MADE GROUND - Medium dense, fine to coarse sand and gravel.			0.20
				MADE GROUND - Black sandy "silty" clay with some fine to coarse gravel and traces of crushed brick and ash.			0.40
				Stiff light to medium brown/orange sandy CLAY with some fine to coarse gravel and occasional fragments of flint.			0.60
				Generally medium dense, moist, orange clayey/silty SAND with occasional fine gravel and occasional fragments/nodules of flint/chert.			0.90
19TH	U	5.00	> 240.00	Very stiff, moist, dark grey silty CLAY.			4.75
							5.00

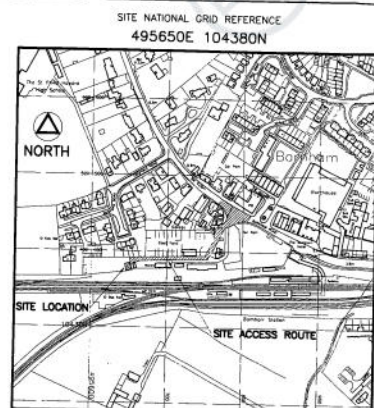
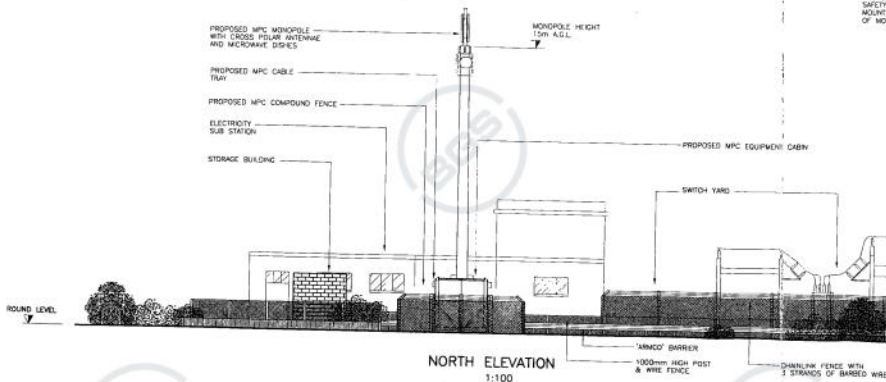
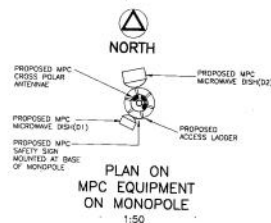
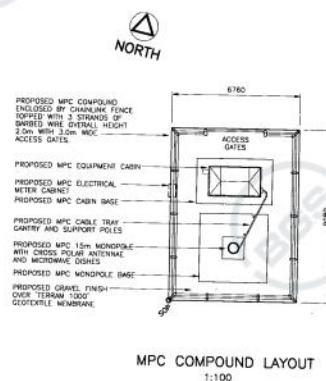
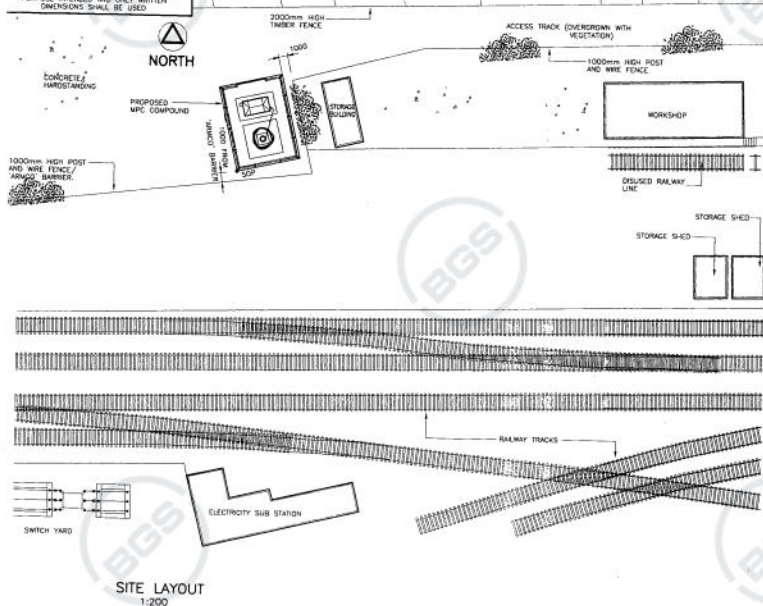
DUNELM DRILLING CO
0191 626 2634 FAX 0191 617 0086

BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
Water ingress noted at 1.00m.
Standing level recorded at 1.20m after 40mins.
Borehole backfilled to within 3.40m.



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSES INTENDED AND ONLY WHEN THE DIMENSIONS SHOWN ARE USED.



SITE LOCATION PLAN 1:2500
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BARNHAM STATION, BARNHAM, BOGNOR REGIS, WEST SUSSEX. PO22 0ER.

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL PROPOSALS WILL BE SUBJECT TO LOCAL AUTHORITY AND OTHER STATUTORY CONSENTS.

MPC EQUIPMENT:

EQUIPMENT CABIN SCHEDULE	
MPC ID	PORTABLE MDI CABIN
SIZE(MM)	2780x1850x2800 HIGH
MATERIAL	STEEL
COLOR	LIGHT GREY (BS10-A-03)

TOWER SCHEDULE

MPC ID	15/PS/CP/BU/3/M

MICROWAVE DISH SCHEDULE

DISH	D1	D2
DISH SIZE	0.4	0.8
HEIGHT (MAGL)	15	T.B.C.
BEARING (CO)	T.B.C.	T.B.C.
SITE LNK	703332	T.B.C.
SITE NAME	FITZLETT HOUSE	T.B.C.

SECTOR ANTENNA SCHEDULE

ANTENNA ID	SECTOR 1	SECTOR 2	SECTOR 3
ANTENNA TYPE	CROSS POLAR ANTENNA (CPA)	CROSS POLAR ANTENNA (CPA)	CROSS POLAR ANTENNA (CPA)
HEIGHT (MAGL)	15	15	15
AZIMUTH	45	120	320

Mercury Personal Communications

91406

BARNHAM STATION BARNHAM BOGNOR REGIS WEST SUSSEX PO22 0ER

SITE LAYOUT

201

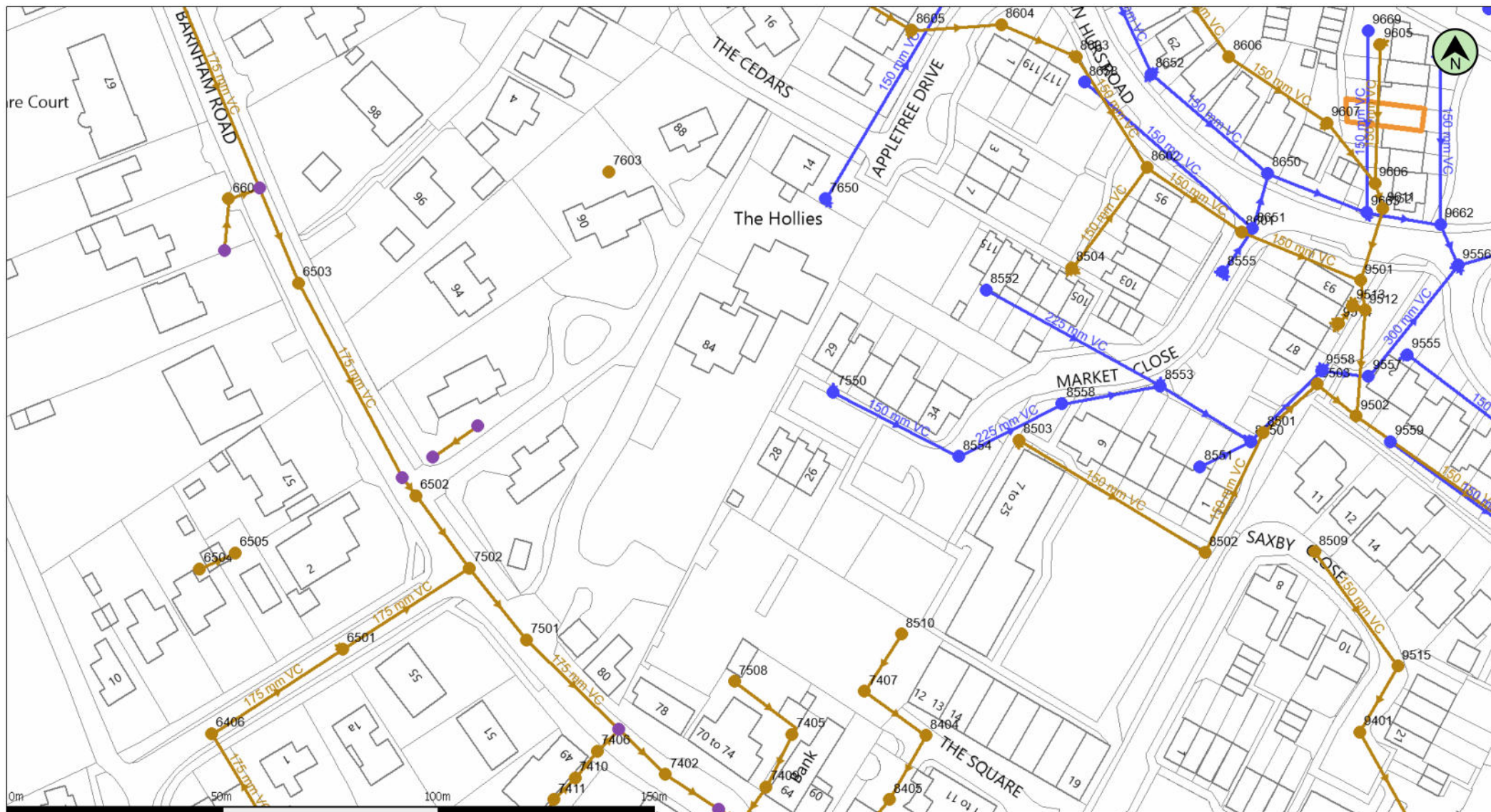
ScottishPower Technology

40-41 Barnham Road, Chichester, West Sussex PO19 1AB

PLANNING

0032/201/002

7.5 **Appendix E – Sewer Records**



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Date: 03/03/22

Scale: 1:1250

Map Centre: 495770,104564

Data updated: 17/01/22

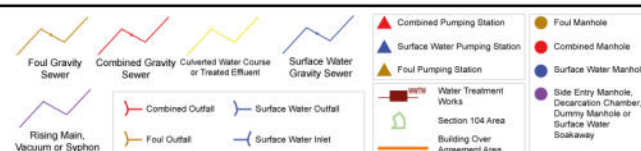
Our Ref: 796472 - 1

Wastewater Plan A4

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



chris@cgscivils.co.uk

84 Barnham Road



Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
6406	F	9.12	6.96	-
6501	F	8.91	6.79	-
6502	F	8.83	5.00	-
6503	F	8.89	5.19	-
6504	F	0.00	0.00	-
6505	F	0.00	0.00	-
6602	F	0.00	0.00	-
7402	F	8.43	4.66	-
7405	F	0.00	0.00	-
7406	F	0.00	0.00	-
7407	F	0.00	0.00	-
7409	F	0.00	0.00	-
7410	F	0.00	0.00	-
7411	F	0.00	0.00	-
7501	F	8.84	4.88	-
7502	F	8.82	4.93	-
7508	F	0.00	0.00	-
7603	F	0.00	0.00	-
8404	F	0.00	0.00	-
8405	F	0.00	0.00	-
8501	F	7.42	5.37	-
8502	F	7.33	5.77	-
8503	F	8.02	6.18	-
8504	F	8.24	6.56	-
8509	F	6.63	4.96	-
8510	F	0.00	0.00	-
8601	F	7.82	5.57	-
8602	F	8.40	5.88	-
8603	F	8.74	6.24	-
8604	F	9.03	6.48	-
8605	F	8.97	6.76	-
8606	F	8.62	7.11	-

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
9401	F	6.52	4.36	-
9501	F	7.48	5.23	-
9502	F	7.25	4.93	-
9503	F	7.45	5.09	-
9512	F	7.41	5.09	-
9513	F	7.51	6.13	-
9514	F	7.52	6.35	-
9515	F	6.44	4.50	-
9605	F	8.04	6.66	-
9606	F	7.67	5.82	-
9607	F	8.11	6.63	-
9611	F	7.59	5.49	-
7550	S	8.34	6.38	-
7650	S	8.88	8.06	-
8550	S	7.46	5.38	-
8551	S	7.28	7.27	-
8552	S	8.69	8.68	-
8553	S	7.78	5.54	-
8554	S	8.00	5.96	-
8555	S	7.73	6.37	-
8558	S	7.99	5.70	-
8650	S	8.09	6.14	-
8651	S	7.82	6.22	-
8652	S	8.60	6.78	-
8658	S	8.69	6.39	-
9555	S	7.06	6.13	-
9556	S	6.91	4.76	-
9557	S	7.20	5.17	-
9558	S	7.48	5.30	-
9559	S	6.96	6.95	-
9652	S	7.52	7.51	-
9662	S	7.19	5.04	-

7.6 **Appendix F – Groundwater monitoring results**

Groundwater Monitoring



Hole ID	Instrument ID	Instrument Type	Recorded Base of Instrument (mBGL)	Reading			
				Date	Water Level (mBGL)	Water level (mOD)	Ground Level m(OD)
GW1	1	SP	4m	04.10.22	1.60	8.18	9.78
				13.10.22	1.57	8.21	9.78
				27.10.22	1.52	8.26	9.78
				11.11.22	1.45	8.33	9.78
				22.11.22	1.50	8.28	9.78
				12.12.22	1.57	8.21	9.78
				06.01.23	1.48	8.30	9.78
				16.01.23	1.22	8.56	9.78
				30.01.23	1.00	8.78	9.78
				13.02.23	1.04	8.74	9.78
				27.02.23	1.00	8.78	9.78
				09.03.23	1.5	8.28	9.78
				09.01.26	1.24	8.34	9.78
				23.01.26	1.16	8.62	9.78
				05.02.26	1.03	8.75	9.78
				13.02.26	1	8.78	9.78
				20.02.26	1.1	8.68	9.78

GW2	2	SP	4m	04.10.22	1.61	8.33	9.94
				13.10.22	1.54	8.4	9.94
				27.10.22	1.52	8.42	9.94
				11.11.22	1.55	8.39	9.94
				22.11.22	1.68	8.26	9.94
				12.12.22	1.74	8.20	9.94
				06.01.23	1.33	8.61	9.94
				16.01.23	1.32	8.62	9.94
				30.01.23	1.05	8.89	9.94
				13.02.23	1.10	8.84	9.94
				27.02.23	1.04	8.90	9.94
				09.03.23	1.60	8.34	9.94
				09.01.26	1.35	8.59	9.94
				23.01.26	1.2	8.74	9.94
				05.02.26	1.10	8.84	9.94
				13.02.26	1.06	8.88	9.94
				20.02.26	1.00	8.84	9.94

Project: The Hollies, Barnham
 Project No: C3876
 Client: Elberry Properties Ltd

GWM

7.7 Appendix G – Response to latest Arun DC Drainage Engineer Comments:

1. **Runoff Destination** - Currently considered insufficient information due to the RWHT needing to be designed to BS EN 16941. This relates to the entire harvesting tank network, not just the tank. So this will cover filters, pumps etc. This will be designed by GRAF themselves and they will specify what is required for the usage we need. They design to BS EN 16941 so we can guarantee that this standard will be followed.

A capacity check with Southern Water has also been submitted. It should be noted that if there is insufficient capacity within the southern water sewer, then they are obliged to provide capacity so this should not be an issue.

It is noted in the correspondence with Southern Water that it is stated that there is sufficient capacity within the sewer network. We have submitted a Section 106 application, however, we are unable to get this application approved without a decision notice from Arun DC.

2. **Interception Drainage** - AS above with the harvesting tank.
3. **Extreme Rainfall and Flooding** - The system is designed around the use of catchpit chambers which will intercept debris and silt and protect the system. It has also been specified that the rainwater downpipes are to be fitted with leafguards in order to stop leaves from entering the system. Particularly with the large trees adjacent the dwellings.

It should also be noted that the rainwater harvesting tanks will be fitted with their own filters further removing silt and debris from the network.

Based upon the catchpits, leaf guards, filters and bioretention planters, there is negligible risk of anything entering the system which would cause a blockage.

The proposed network has been designed with a surcharged outfall, not issues arise.

The contributing areas have been updated to suit

Crossing public highways should not be conditioned and should not hold up approval. This is a construction issue that will be dealt with via Section 50.

6. **Biodiversity** - Accepted. Options are limited with bio-retention planters included where possible.

7. **Construction** - Tree officer comments are noted - the location of the dwellings and the attenuation tank has been moved further away from the protected trees.