

Surface Water Drainage Report

67-69 Elmer Road, Middleton-On-Sea, PO22 6EH

Planning Reference Number: M/92/20/HH

For

Mrs S Towers

Rev - C

Reference **C1672**

Date **7th January 2022**

Revision	Date of Issue	Comments	Prepared By	Checked By
P	07.01.22	Initial Issue	LH	CS
A	12.01.22	Updated to suit Arun DC comments	CS	CS
B	19.01.22	Updated to suit Arun DC comments	CS	CS
C	25.01.22	Updated to suit Arun DC comments	CS	CS

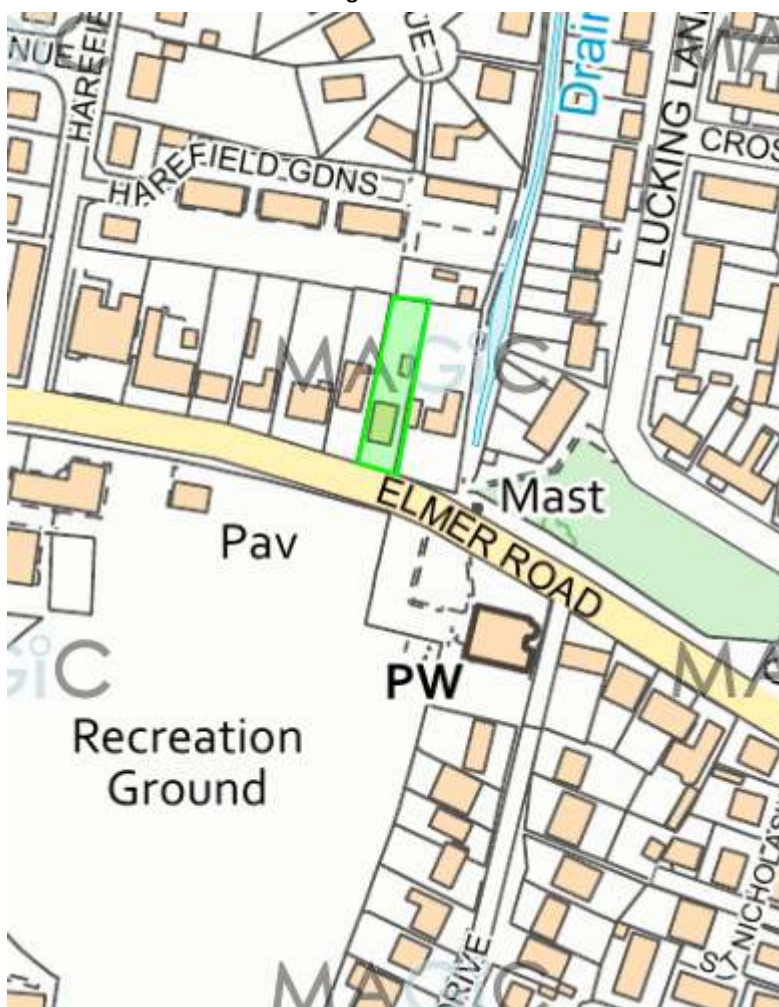
Contents

1	INTRODUCTION	3
2	SITE GEOLOGY	4
3	EXISTING DRAINAGE	5
4	PROPOSED DRAINAGE STRATEGY.....	5
5	MAINTENANCE.....	7
6	SUMMARY AND CONCLUSIONS.....	11
7	APPENDICES	12

1 Introduction

- 1.1.1 CGS Civils Ltd have been appointed by Mrs S Towers to undertake a drainage strategy report for a proposed development at 67 – 69 Elmer Road in Middleton-On-Sea.
- 1.1.2 The purpose of this drainage strategy is to demonstrate how the development area can be satisfactorily drained without increasing flood risk onsite and elsewhere.
- 1.1.3 The existing site consists of an existing single domestic dwelling. The proposed development will consist of the two storey rear extension and single storey front extension, first floor front extension of the existing property.
- 1.1.4 The proposed development is located as OS Grid Reference SU97700041 and has the post code PO22 6EH.
- 1.1.5 The total green line boundary is approximately 0.067 Ha and the proposed development will result in an increase of 0.008 Ha of impermeable area.
- 1.1.6 The proposed floor plan can be found in **Appendix A**.

Fig 1. Site Location

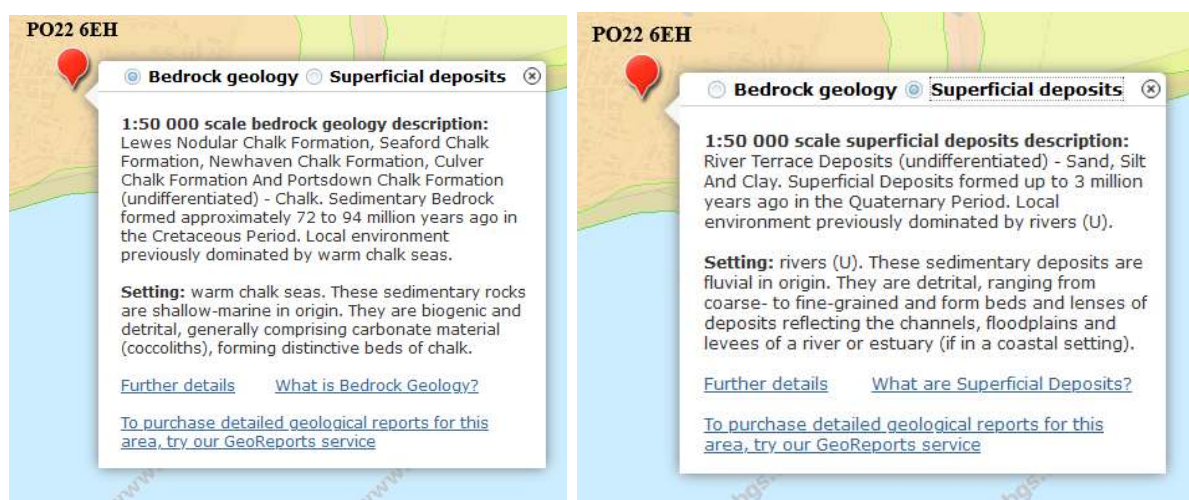


2 Site Geology

2.1 British Geological Survey information

- 2.1.1 The British Geological Survey confirms the bedrock geology to be made up of Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation, which are all primarily comprised of Chalk. The BGS website confirms the superficial deposits on site to be made up of River Terrace Deposits which is primarily comprised of Sand, Silt and Clay.
- 2.1.2 The British Geological survey also holds records of historical boreholes near the site which give some insight into the ground geology.
- Borehole SU90SE6/A-E (Located approx. 265m West of the site) – Clay and Sand.

Fig 2. British Geological Survey



2.2 Geological Assessment

- 2.2.1 An onsite infiltration test to BRE365 was undertaken by CGS Civils on 3rd December 2021. A Trial pit with the dimensions 300x1000x900mm deep was dug and filled with water until 75% full. The time it took for the water to soakaway from 75% to 25% full was noted and recorded and performed three times.
- 2.2.2 In addition to the soakaway test pit, a borehole was dug to a depth of 1.5m using a hand auger. This was covered and monitored over 48 hours and remained dry.
- 2.2.3 The results were calculated which confirmed an infiltration rate of 4.33×10^{-5} m/s, this rate will be used for the proposed design. A copy of this test can be found in **Appendix E**.

2.3 Hydrogeology Setting

- 2.3.1 The Environment Agency (EA) mapping service, as provided by Magic Map, indicates the aquifer designation for the bedrock and superficial drift geology and the groundwater vulnerability in the area. The mapping, as included in **Appendix F**, provides the following information for the site:
- 2.3.2 The site will not pose a risk to the groundwater on site as there will be no discharge of any hazardous materials to ground.

Geology Map	Site Description
Aquifer Designation (Bedrock)	Principal
Aquifer Designation (Superficial Drift)	Secondary A
Groundwater Vulnerability	Medium-High
Groundwater Source Protection Zone	N/A

3 Existing Drainage

- 3.1.1 It is not currently known how the existing site discharges surface water runoff. However due to the recorded infiltration rate, it can be safely presumed it discharges to ground via infiltration.

4 Proposed Drainage Strategy

4.1 SuDS Hierarchy

- 4.1.1 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.

Discharge Destination	
Discharge to Ground	Yes – Recorded Infiltration rate of 4.33×10^{-5} m/s
Discharge to Watercourse	N/A
Discharge to Surface Water Sewer	N/A
Discharge to Other Sewer	N/A

4.2 Surface Water Drainage

- 4.2.1 In order to follow the SuDS hierarchy, the use of soakaways was investigated and an onsite infiltration test to BRE365 was carried out. This test yielded an infiltration rate of 4.33×10^{-5} m/s which is a good rate and infiltration will be possible. It is therefore proposed that all surface water runoff is to be discharged to ground via infiltration; all roof areas are to be collected into a positive drainage network before being discharged to ground via infiltration through the use of geocellular soakaway. The geocellular soakaway has been designed to cater for the 1 in 100-year +40% storm.
- 4.2.2 Hydraulic calculations have been carried out which can be found at **Appendix C**.

4.3 Water Quality

- 4.3.1 A key requirement of any SuDS system is that it protects the receiving water body from the risk of pollution.
- 4.3.2 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.
- 4.3.3 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
- 4.3.4 The EA website indicates that the site does not lie within a Source Protection Zone.
- 4.3.5 The recommended approaches for water quality risk management are given in the SuDS Manual Table 26.1.

Fig 5. 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	

- 4.3.6 As per Table 26.1 Simple Index approach will be used as a design method for this site.
- 4.3.7 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
- 4.3.8 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

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

Fig 6. 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

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

Table 1: 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	Ground Water	Very Low	0.2	0.2	0.05

4.3.11 As noted in the above statement – section 4.2.1 – there are no treatment measures in place on the proposed drainage network, however, the pollutants that will be discharged into the groundwater will be negligible due to it being only residential roof runoff and all TSS will be caught within the silt trap within the network.

5 Maintenance

5.1 Introduction

- 5.1.1 During construction, the Contractor will be responsible for maintaining the drainage and SuDS (Sustainable Drainage Systems). Upon handover, the occupier will take on the responsibility of these duties as laid out in this report.
- 5.1.2 The maintenance schedule for the proposed development will be split down into two separate categories; SuDS features and regular private drainage.

5.2 SuDS at 67–69 Elmer Road, Bognor Road

- 5.2.1 As listed above, in section 5.1.2, the SuDS features used on site will be **Geocellular Soakaway**
- 5.2.2 The SuDS features have been designed for easy maintenance and comprise:
- Regular Day-to-Day care – litter collection, regular gardening to control vegetation growth and checking inlets where water enters the SuDS features
 - Occasional tasks – checking the SuDS features and removing any silt that builds up in the SuDS feature
 - Remedial work – repairing damage where necessary

5.3 SuDS Drainage Maintenance Specification

5.3.1 Soakaway

In order to maintain the functioning of the attenuation tanks, the following maintenance requirements should be adhered to:

Table 21.3 Operation and maintenance requirements for attenuation storage tanks/Soakaways		
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae, or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from per-treatment structures and/or internal forebays	Annually, or as required
Remedial Actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

5.4 General Drainage Maintenance Specification

5.4.1 Inlet Structures and Inspection Chambers

- Inlet structures such as rainwater downpipes, road gullies and channel drains should be free from obstruction at all times to allow free flow through the SuDS
- Inspection Chambers and Rodding Eyes are used on bends or where pipes come together. They allow access and cleaning to the system if necessary.

Inlet Structures and Inspection Chambers	
Regular Maintenance	Frequency
Inlet Structures Inspect rainwater downpipes, channel drains and road gullies, removing obstructions and silt as necessary. Check that there is no physical damage. Trim vegetation 1m min surround to structures and keep area free from silt and debris	Monthly
Inspection Chambers and below ground control chambers. Remove cover and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in Autumn	Annually
Occasional Maintenance Check topsoil levels are 20mm above edges of chambers to avoid mower damage.	As necessary
Remedial Work Repair physical damage if necessary	As required

5.4.2 Below ground drainage pipes

- Below ground drainage pipes convey water to the SuDS system. They should always be free from obstruction to allow free flow.

Below Ground Drainage Pipes	
Regular Maintenance	Frequency
Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months then annually
Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually or as required
Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks.	Monthly or as required
Remedial Work	
Repair physical damage if necessary	As required
Monitoring	
Inspect all inlets, outlets and vents to ensure that they are in good conditions and operating as designed.	Annually
Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required

6 Summary and Conclusions

- 6.1.1 CGS Civils has been instructed by Mrs S Towers to produce a Drainage statement under National Planning Policy Framework (NPPF) to support the Planning Application for the extension of an existing domestic property.
- 6.1.2 The Surface Water will discharge to ground via infiltration through the use of a soakaway that has been designed to cater for the 1 in 100-year +40% storm.
- 6.1.3 The report has demonstrated that the proposed drainage measures ensure that suitable means of surface water and foul drainage can be achieved for the proposed development.

7 Appendices

7.1 Appendix A – Floor Plans

Notes

CDM REGULATIONS 2015
The client must abide by the Construction Design and Management Regulations 2015. The client must appoint a contractor. If more than one contractor is to be involved, the client will need to appoint (in writing) a principal designer (to plan, manage and coordinate the planning and design work) and a principal contractor (to plan, manage and coordinate the construction and ensure there are arrangements in place for managing and organising the project).

Domestic clients
The domestic client is to appoint a principal designer and a principal contractor when there is more than one contractor. If not your duties will automatically transferred to the contractor or principal contractor.

The designer can take on the duties, provided there is a written agreement between you and the designer to do so.

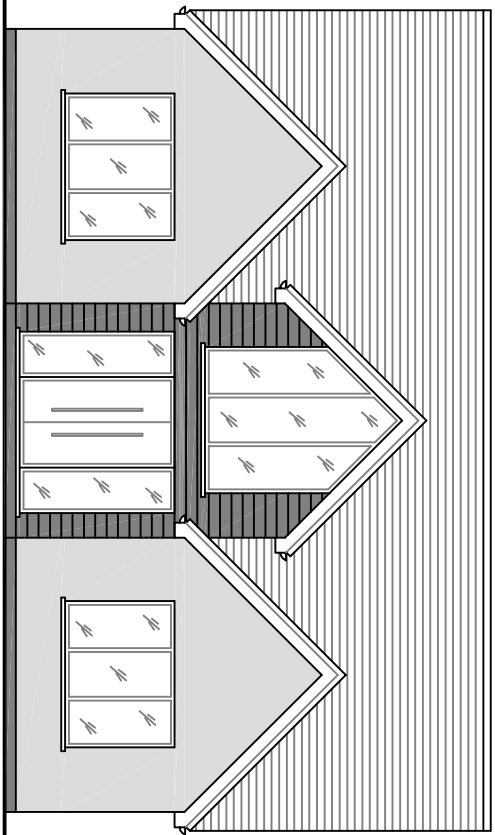
The Health and Safety Executive is to be notified as soon as possible before construction work starts if the works:

(a) Last longer than 30 working days and has more than 20 workers working simultaneously at any point in the project.

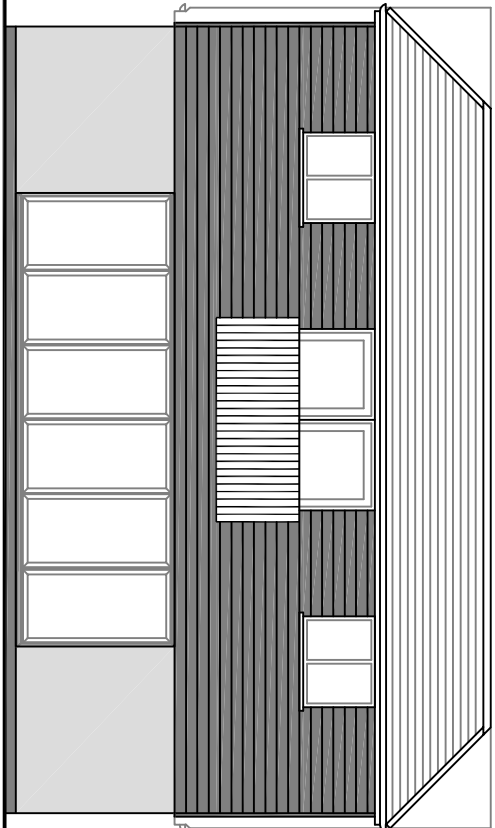
Or:

(b) Exceeds 500 person days.

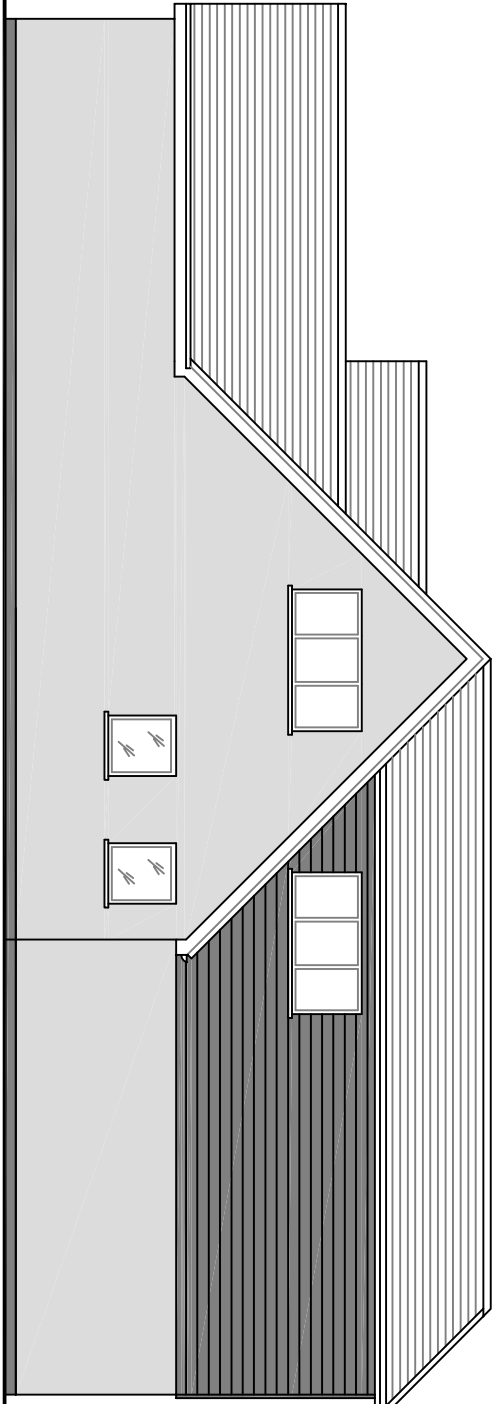
All contractors/sub-contractors must ensure that they are in possession of the currently issued drawings and details before commencing the relevant work-stage. All measurements to be checked before starting. Any discrepancies must be reported to the designer and any alterations can be made prior to commencement of building works.



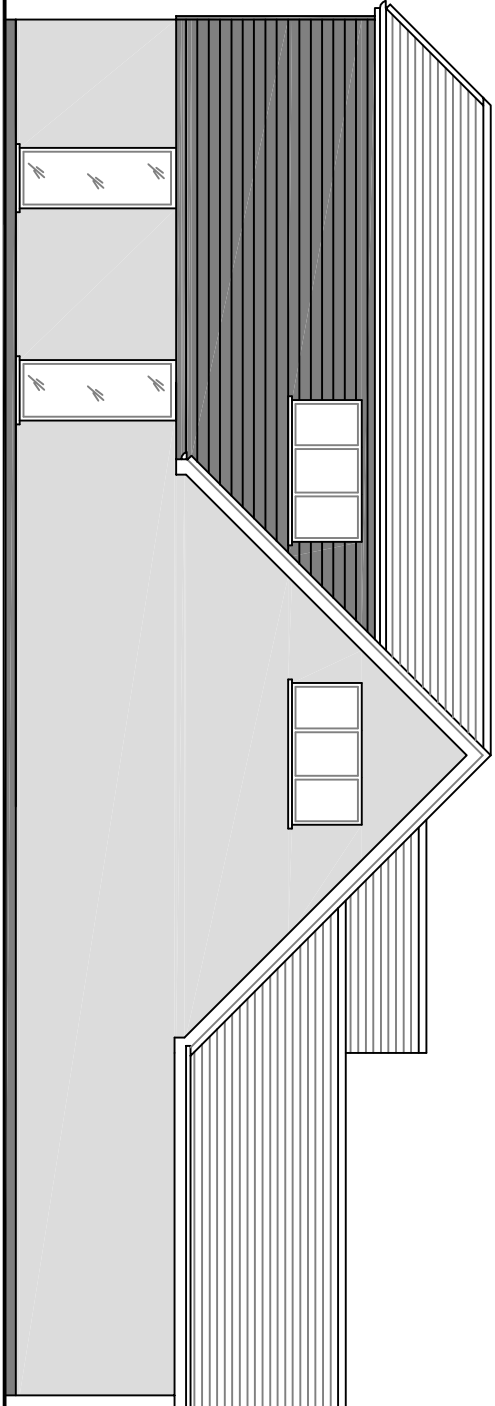
Proposed South Facade



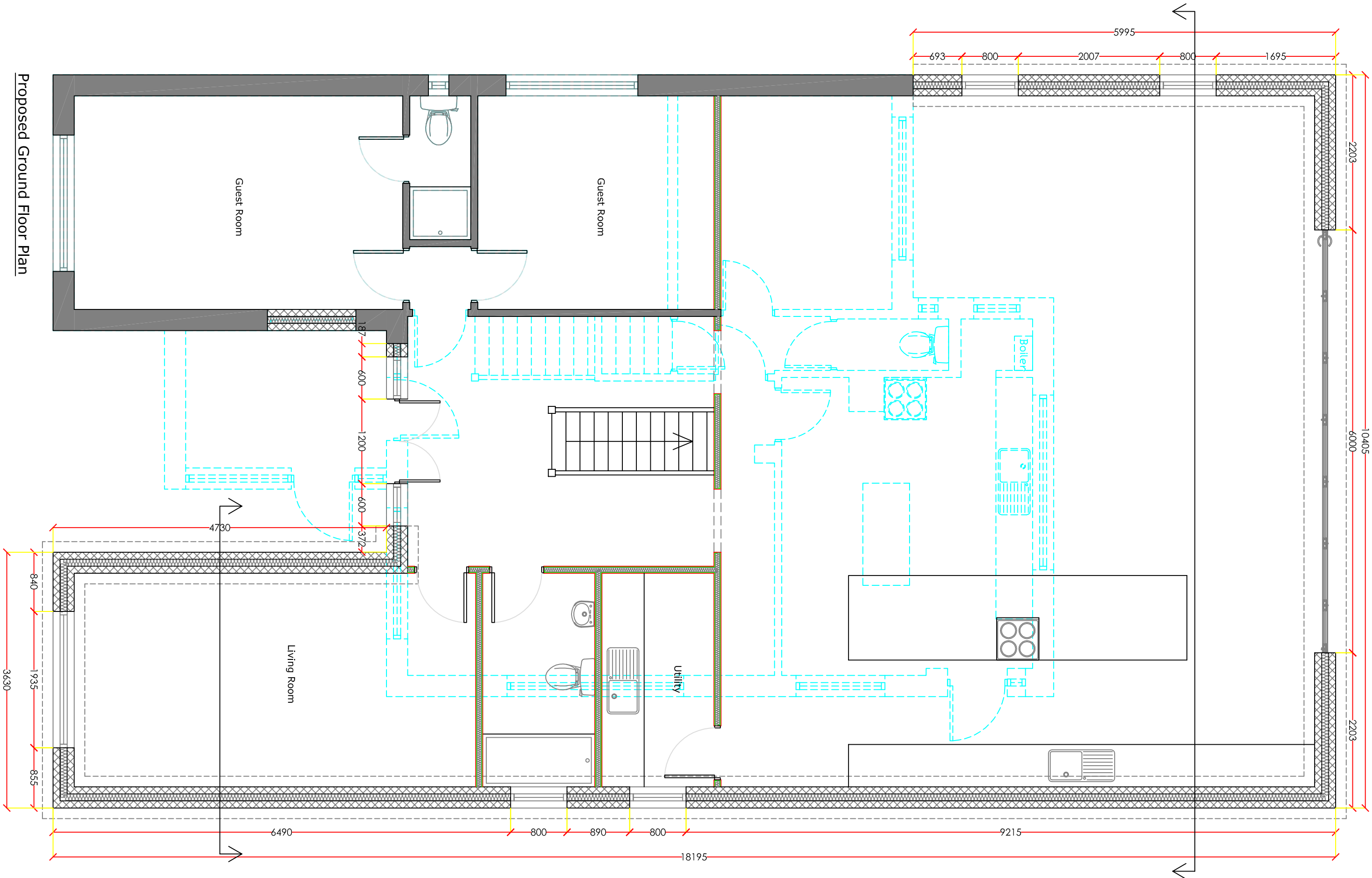
Proposed North Facade



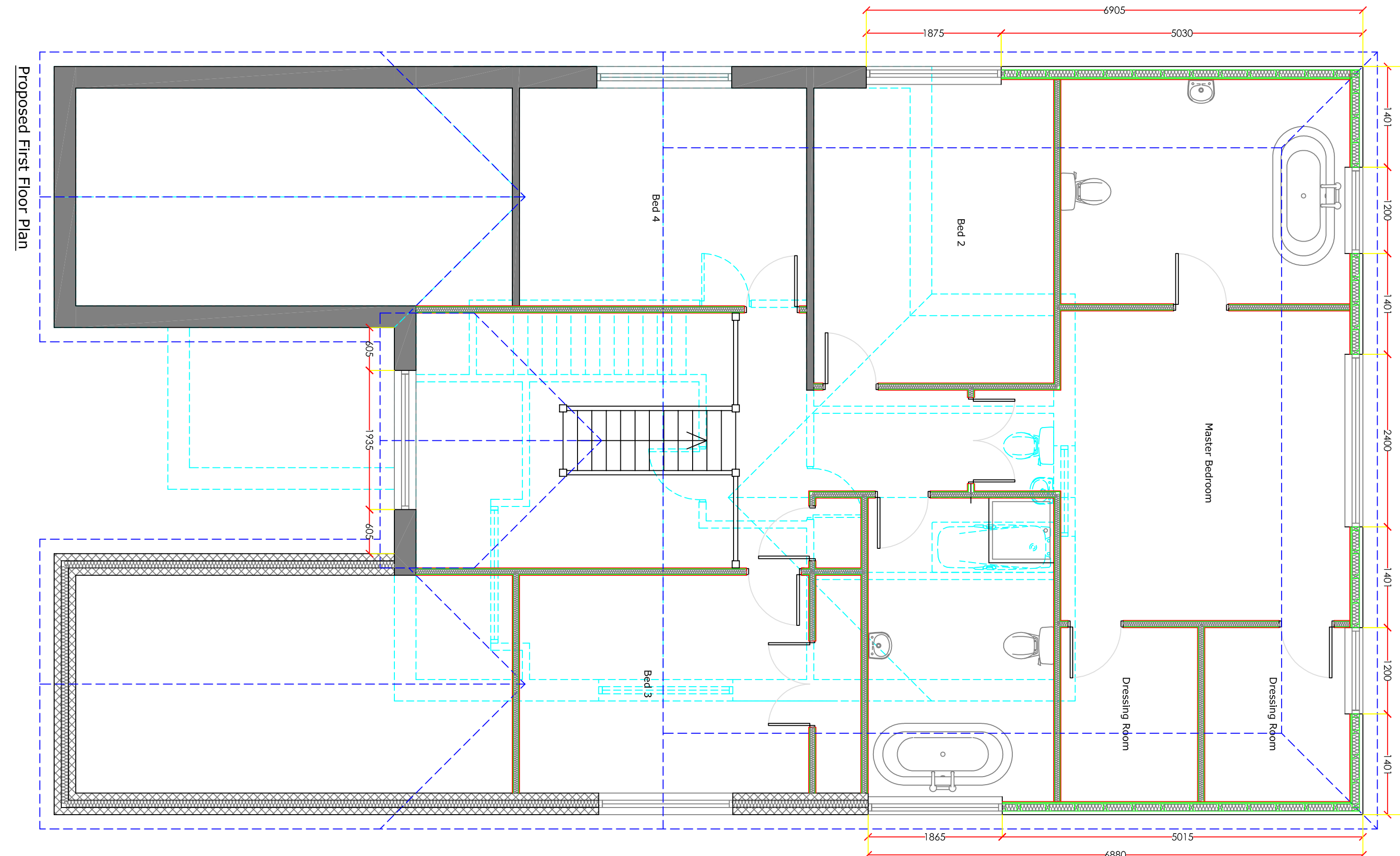
Proposed East Facade



Proposed West Facade



Proposed Ground Floor Plan



Proposed First Floor Plan



MULBERRY ARCHITECTURE LTD
25 Aldwick Road
Bognor Regis
PO21 2LN
info@mulberrybg.co.uk
01243 824814

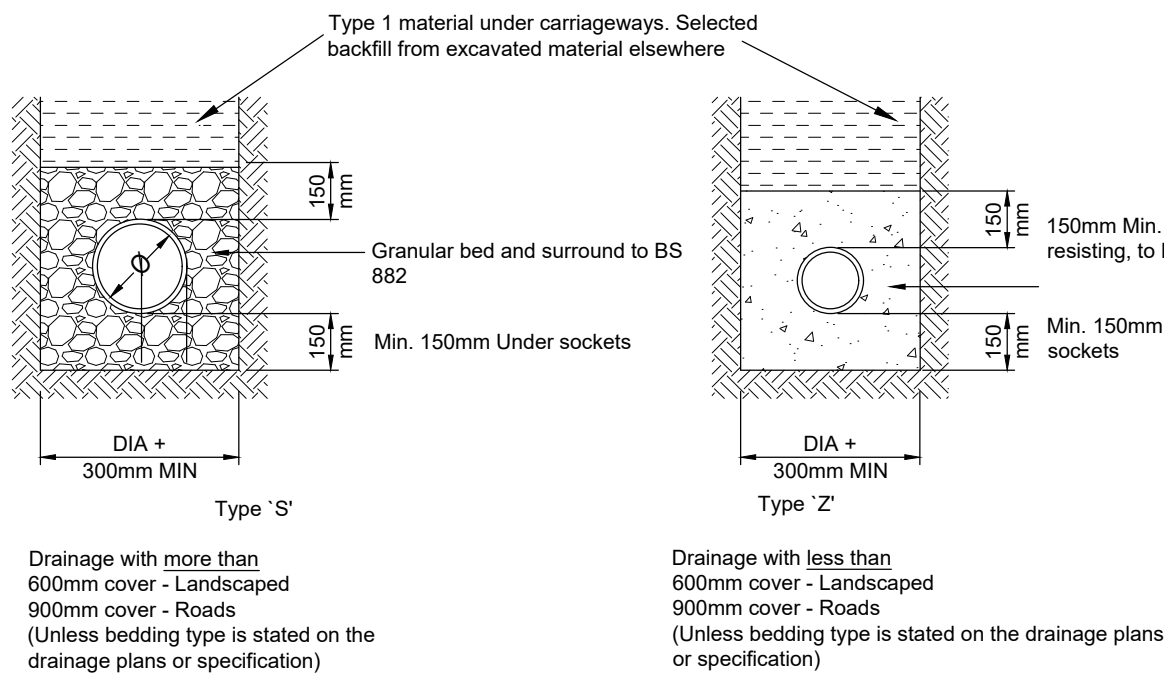
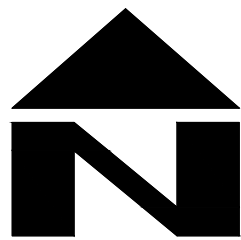
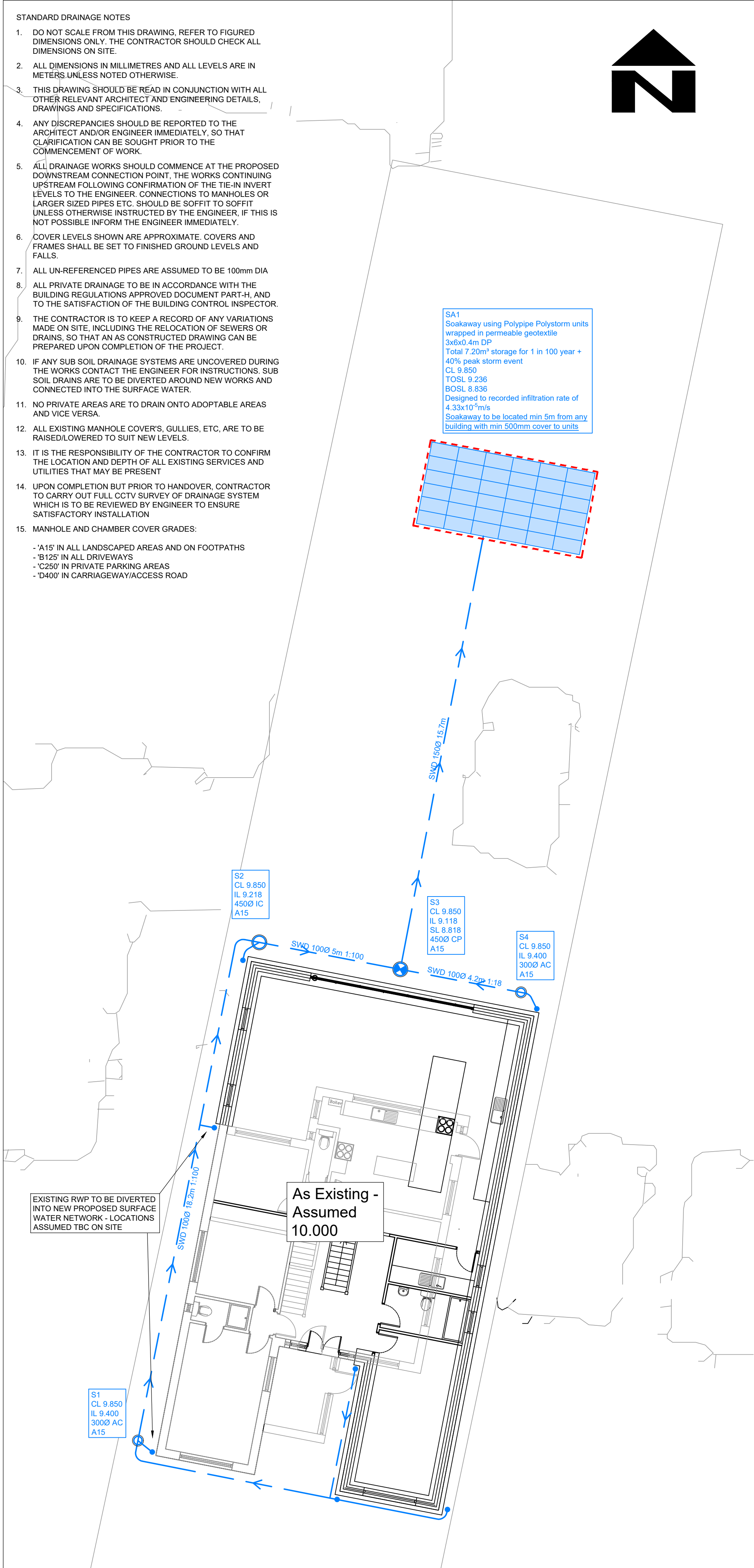
67-69 Elmer Road
Middleton on Sea
Bognor Regis
West Sussex
PO22 0EH

Proposed Extensions
Plans and Elevations
Building Regulations

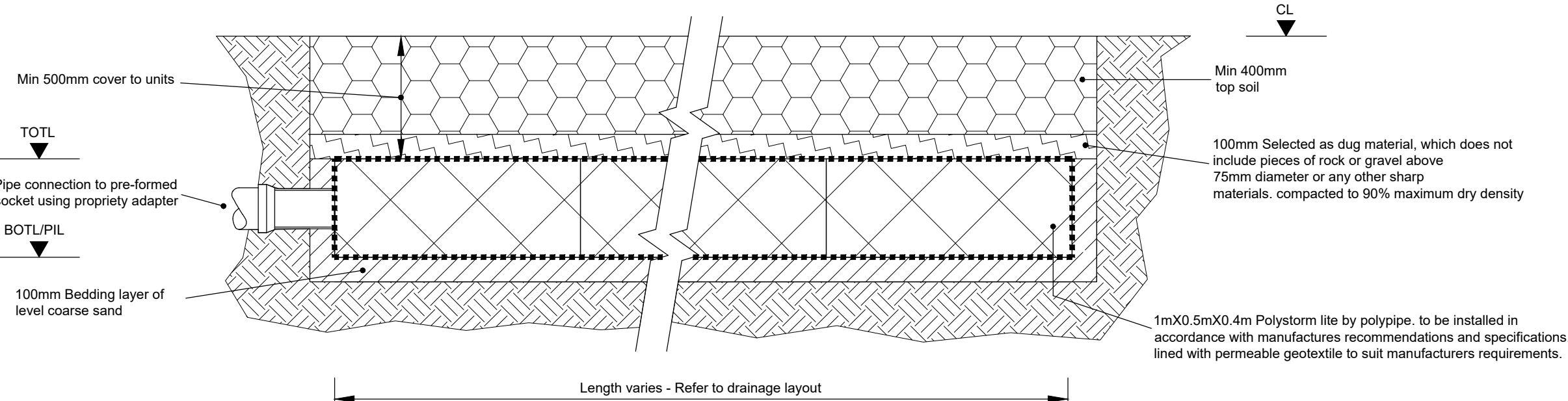
Date
March 2021

Scale
1:50 1:100

7.2 **Appendix B – Drainage Layout**



Pipe bedding details in private Areas

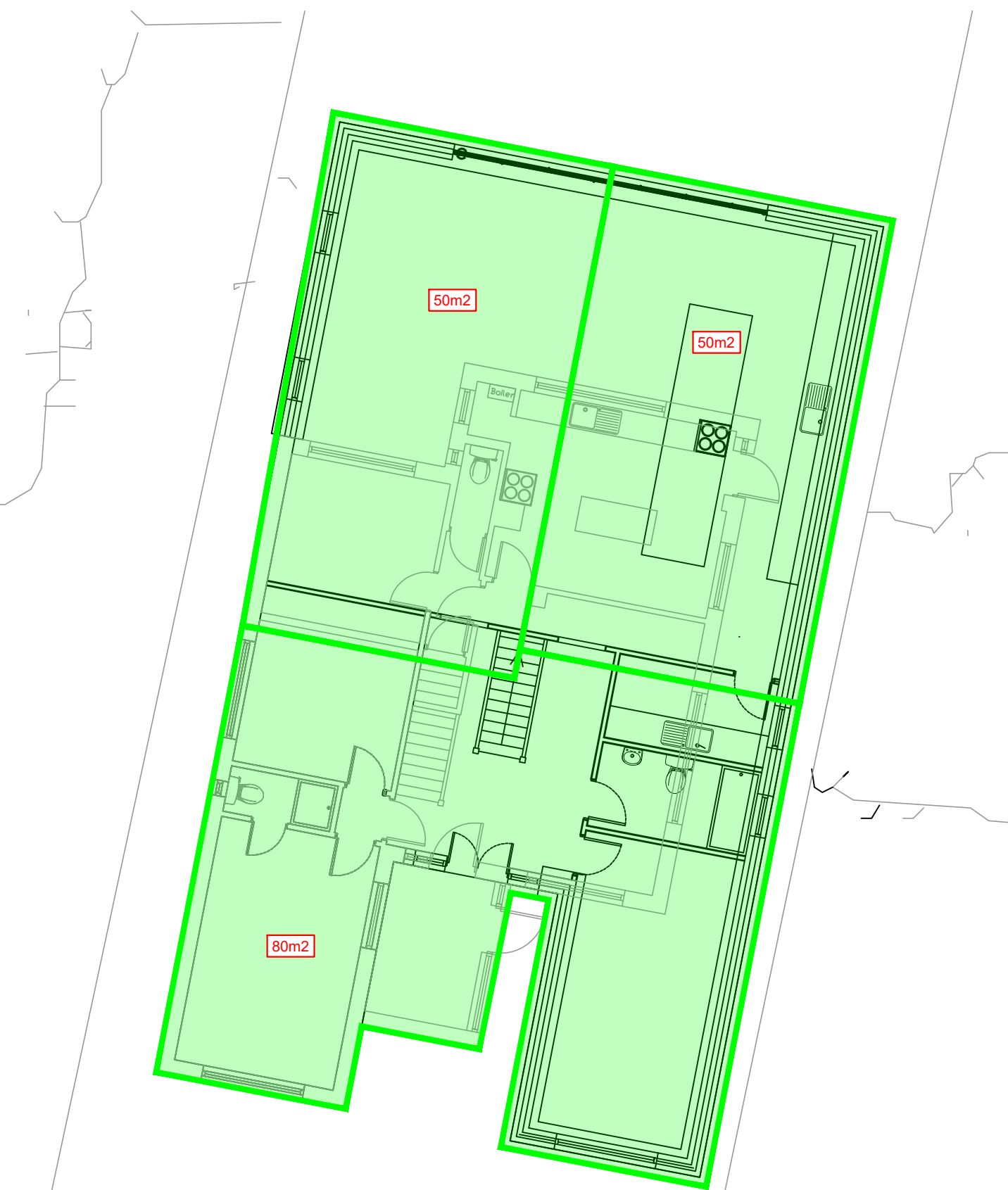


Trench soakaway using Polystorm Lite Geomodular units Landscaped areas only

All storage tank drainage works shall be carried out in accordance with the specifications, method statements and recommendations of Polypipe

DESIGN SUBJECT TO THE APPROVAL OF:
PLANNING AUTHORITY
BUILDING CONTROL

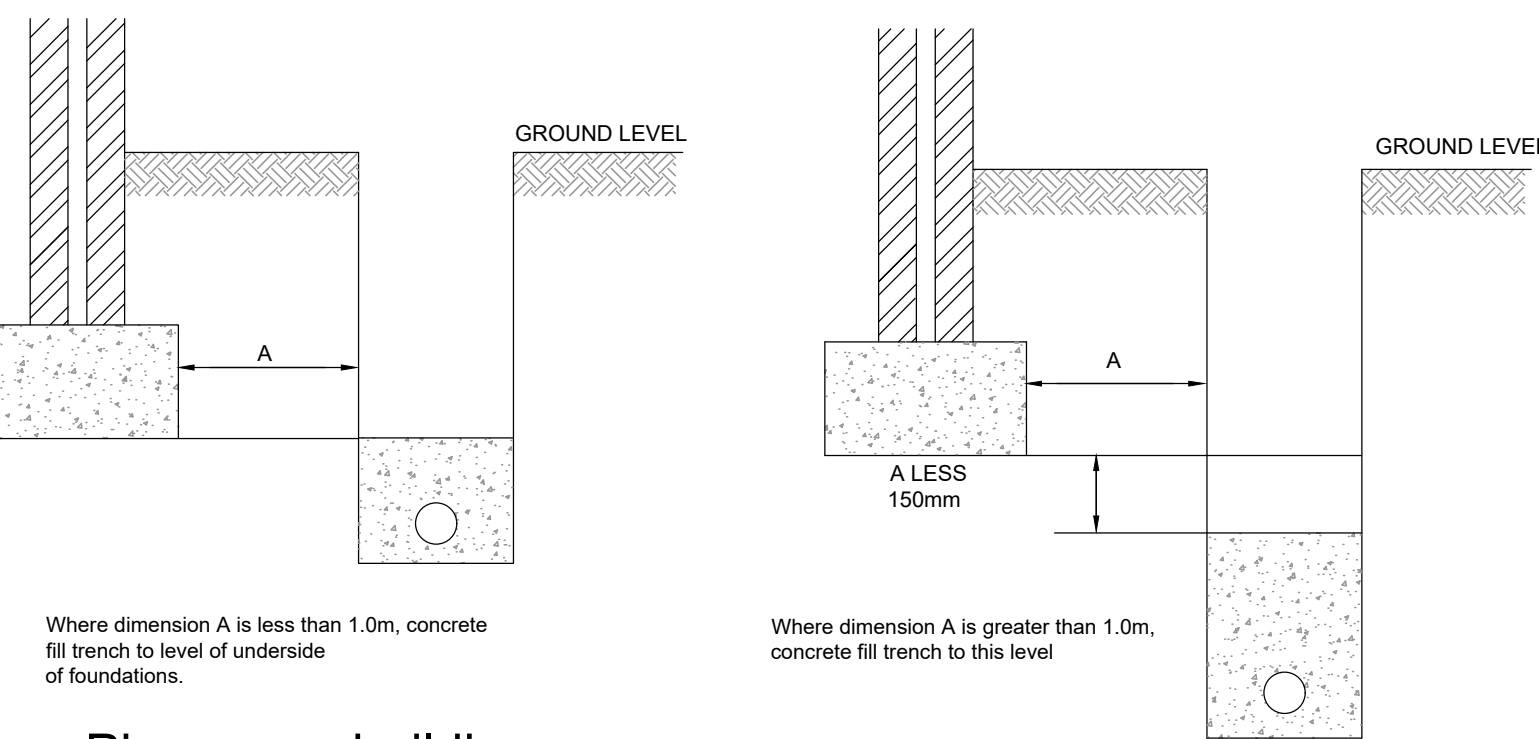
DESIGN SUBJECT TO THE CONFIRMATION OF:
POSITIONS OF RWP's ASSUMED – TBC BY ARCHITECT



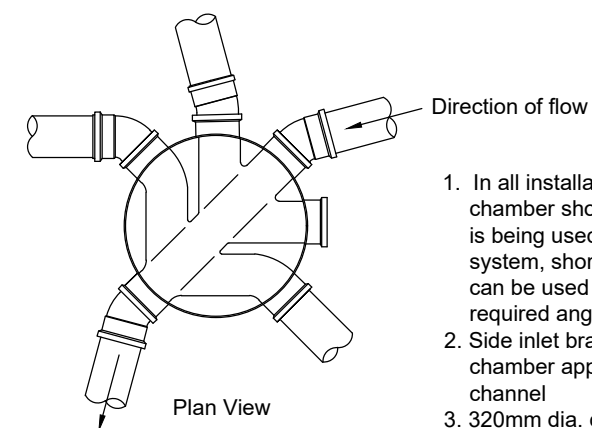
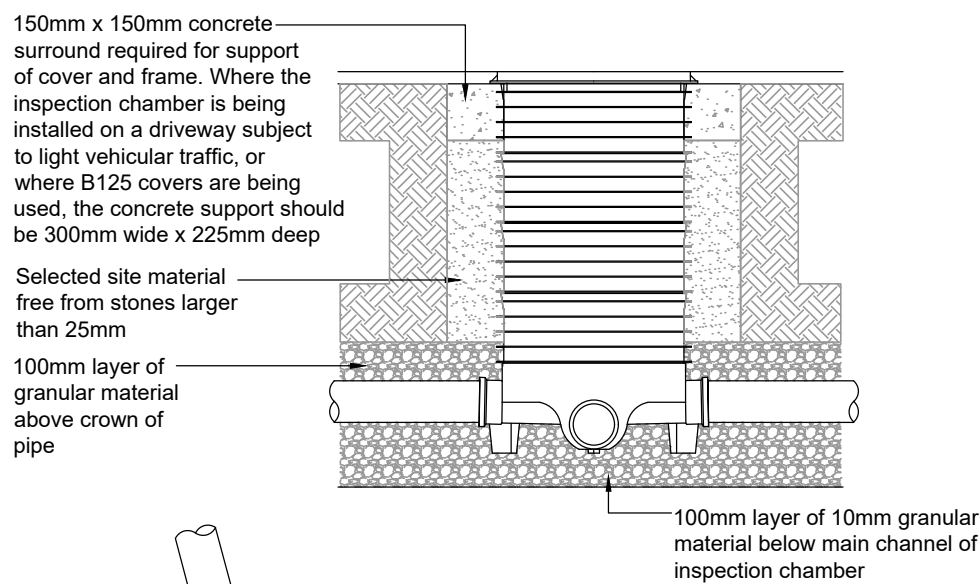
Drained areas

Rainwater pipe connection

Pipes near buildings

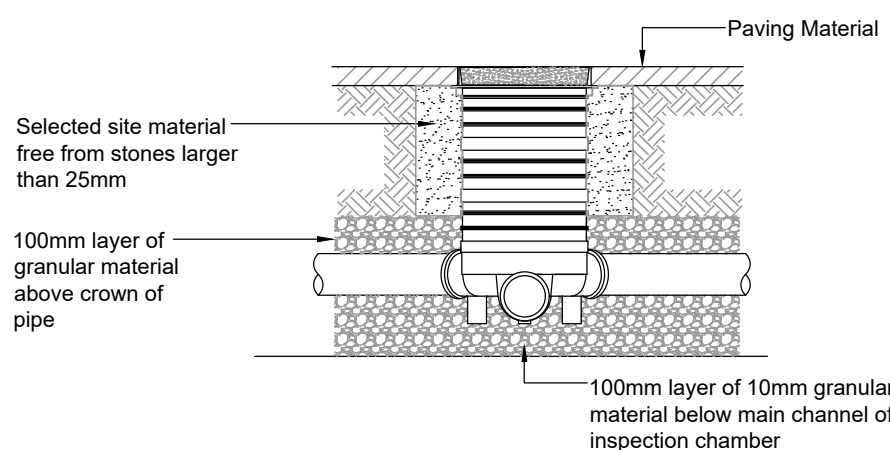


Pipes near buildings

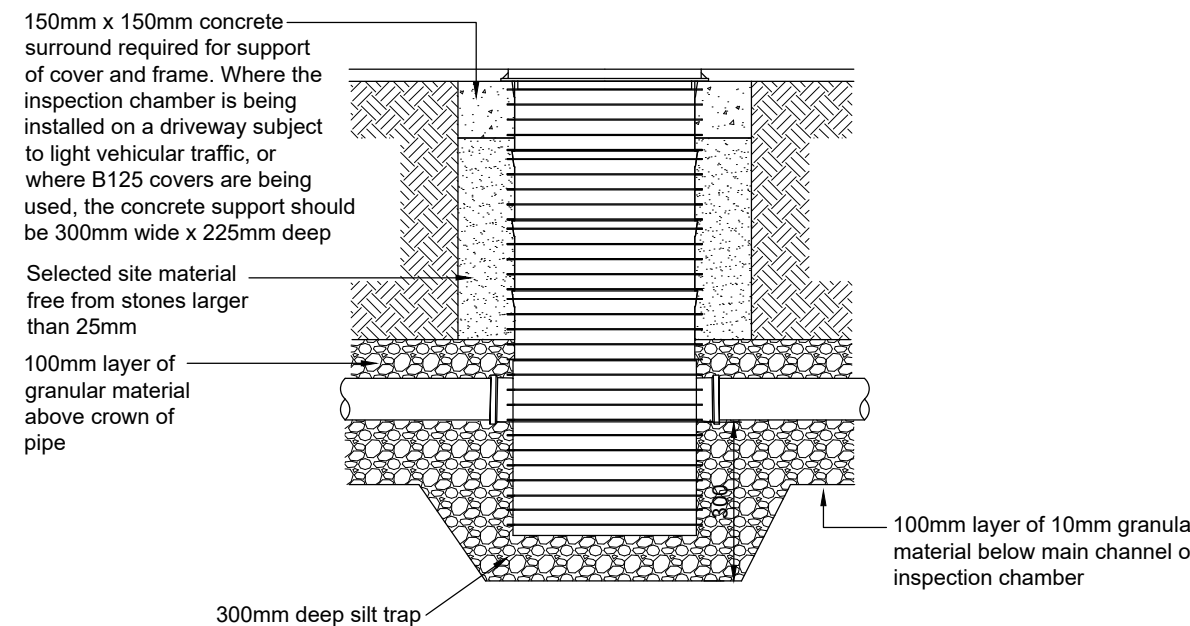


- In all installations, the main channel of the inspection chamber should always be used. Where the chamber is being used as a change of direction for the drainage system, short radius bends of 11¼°, 15°, 30° and 45° can be used in the inlet and outlet to achieve the required angle.
- Side inlet branch connections enter the inspection chamber approx. 55mm above the invert of the main channel
- 320mm dia. chambers are supplied with 2no. blanking plugs for the side inlets and 460mm dia. chambers are supplied with 3no. blanking plugs.

300mmØ SHALLOW INSPECTION CHAMBER DETAIL

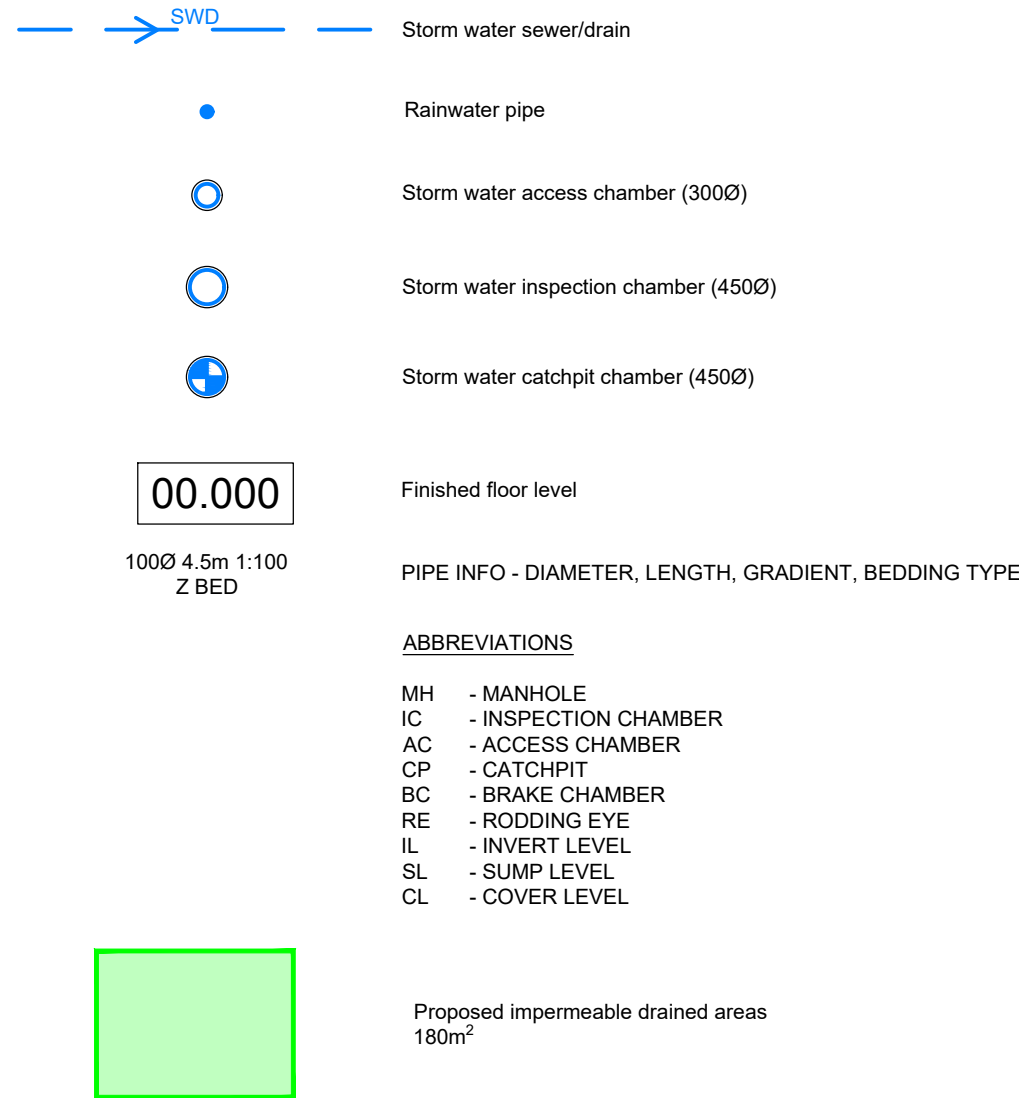


460mmØ INSPECTION CHAMBER DETAIL



450mmØ POLYPIPE BASIC SILT TRAP DETAIL

DRAINAGE LEGEND (1:100) PROPOSED FEATURES



Prefixed to drawing numbers shall signify the following:-

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

P2	25.01.22	UPDATED TO SUIT ARJUN DC COMMENTS	CS	CS	CS
P1	11.01.22	UPDATED TO SUIT ARJUN DC COMMENTS	CS	CS	CS
P-	07.01.22	PRELIMINARY ISSUE	LH	CS	CS
REV	DATE	DESCRIPTION	BY	CHK	APP

 Consulting Civil Engineers					
CLIENT		MRS S TOWERS			
ARCHITECT		MULBERRY ARCHITECTURE LTD			
JOB TITLE		67-69 ELMER ROAD MIDDLETON ON SEA			
DRAWING TITLE		SURFACE WATER DRAINAGE LAYOUT			
DRAWN		ENGINEER		CHECKED	APPROVED
LH		C SLADE		CS	CS
DATE		DECEMBER 2021		SCALE @ A1	1:100
JOB No.		STATUS		DRAWING No.	
C1672		P		100	
				REV.	
				P2	

PRELIMINARY

7.3 **Appendix C – Surface Water Calculations**

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	0.350
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.008	5.00	9.850	300	1474.096	946.301	0.450
S2	0.005	5.00	9.850	450	1478.480	964.308	0.632
S3	0.000		9.850	500	1483.576	963.334	0.732
SA1	0.000		9.850	100	1484.468	967.985	0.764
S4	0.005	5.00	9.850	300	1488.251	962.441	0.450

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	S1	S2	18.533	0.600	9.400	9.218	0.182	101.8	100	5.41	50.0
1.001	S2	S3	5.188	0.600	9.218	9.168	0.050	103.8	100	5.52	50.0
1.002	S3	SA1	4.736	0.600	9.118	9.086	0.032	150.0	150	5.62	50.0
2.000	S4	S3	4.760	0.600	9.400	9.168	0.232	20.5	100	5.05	50.0

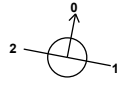
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.762	6.0	1.1	0.350	0.532	0.008	0.0	29	0.573
1.001	0.754	5.9	1.8	0.532	0.582	0.013	0.0	37	0.655
1.002	0.818	14.5	2.4	0.582	0.614	0.018	0.0	42	0.611
2.000	1.712	13.4	0.7	0.350	0.582	0.005	0.0	15	0.885

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	18.533	101.8	100	Circular	9.850	9.400	0.350	9.850	9.218	0.532
1.001	5.188	103.8	100	Circular	9.850	9.218	0.532	9.850	9.168	0.582
1.002	4.736	150.0	150	Circular	9.850	9.118	0.582	9.850	9.086	0.614
2.000	4.760	20.5	100	Circular	9.850	9.400	0.350	9.850	9.168	0.582

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	300	Manhole	Adoptable	S2	450	Manhole	Adoptable
1.001	S2	450	Manhole	Adoptable	S3	500	Manhole	Adoptable
1.002	S3	500	Manhole	Adoptable	SA1	100	Manhole	Adoptable
2.000	S4	300	Manhole	Adoptable	S3	500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S1	1474.096	946.301	9.850	0.450	300		0	1.000	9.400	100
S2	1478.480	964.308	9.850	0.632	450		1	1.000	9.218	100
S3	1483.576	963.334	9.850	0.732	500		0 1 2	1.001 2.000 1.001	9.218 9.168 9.168	100 100 100
SA1	1484.468	967.985	9.850	0.764	100		1	1.002	9.118	150
S4	1488.251	962.441	9.850	0.450	300		0	2.000	9.400	100

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	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	0	0	0
10	0	0	0
30	0	0	0
100	40	0	0

Node SA1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.15588	Invert Level (m)	8.836	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.15588	Time to half empty (mins)	122	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	3.000	Number Required	1
Porosity	0.95	Pit Length (m)	6.000		

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	11	9.429	0.029	1.1	0.0124	0.0000	OK
15 minute winter	S2	11	9.258	0.040	1.8	0.0126	0.0000	OK
15 minute winter	S3	11	9.163	0.045	2.5	0.0087	0.0000	OK
60 minute winter	SA1	47	8.903	-0.183	1.4	1.1538	0.0000	OK
15 minute winter	S4	11	9.416	0.016	0.7	0.0047	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	S1	1.000	S2	1.1	0.464	0.184	0.0444
15 minute winter	S2	1.001	S3	1.8	0.640	0.303	0.0145
15 minute winter	S3	1.002	SA1	2.5	0.594	0.172	0.0199
60 minute winter	SA1	Infiltration		0.4			
15 minute winter	S4	2.000	S3	0.7	0.886	0.052	0.0038

Results for 10 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	9.442	0.042	2.2	0.0177	0.0000	OK
15 minute winter	S2	11	9.278	0.060	3.6	0.0189	0.0000	OK
15 minute winter	S3	11	9.182	0.064	4.8	0.0126	0.0000	OK
60 minute winter	SA1	52	8.981	-0.105	2.5	2.4813	0.0000	OK
15 minute winter	S4	10	9.423	0.023	1.4	0.0066	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	S1	1.000	S2	2.2	0.548	0.361	0.0732
15 minute winter	S2	1.001	S3	3.5	0.752	0.589	0.0241
15 minute winter	S3	1.002	SA1	4.8	0.708	0.335	0.0325
60 minute winter	SA1	Infiltration		0.4			
15 minute winter	S4	2.000	S3	1.4	1.073	0.103	0.0061

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	9.447	0.047	2.8	0.0202	0.0000	OK
15 minute winter	S2	11	9.287	0.069	4.4	0.0220	0.0000	OK
15 minute winter	S3	11	9.191	0.073	6.0	0.0143	0.0000	OK
60 minute winter	SA1	59	9.041	-0.045	3.2	3.5044	0.0000	OK
15 minute winter	S4	10	9.425	0.025	1.7	0.0073	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	S1	1.000	S2	2.7	0.580	0.457	0.0870
15 minute winter	S2	1.001	S3	4.3	0.788	0.733	0.0286
15 minute winter	S3	1.002	SA1	6.0	0.747	0.416	0.0381
60 minute winter	SA1	Infiltration		0.5			
15 minute winter	S4	2.000	S3	1.7	1.132	0.125	0.0071

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	11	9.472	0.072	5.0	0.0307	0.0000	OK
15 minute winter	S2	11	9.368	0.150	7.9	0.0475	0.0000	SURCHARGED
120 minute winter	S3	116	9.328	0.210	3.6	0.0412	0.0000	SURCHARGED
120 minute winter	SA1	116	9.328	0.242	3.6	6.8505	0.0000	OK
15 minute winter	S4	10	9.433	0.033	3.1	0.0096	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	S1	1.000	S2	4.8	0.647	0.800	0.1285
15 minute winter	S2	1.001	S3	7.7	0.992	1.308	0.0393
120 minute winter	S3	1.002	SA1	3.6	0.655	0.249	0.0834
120 minute winter	SA1	Infiltration		0.5			
15 minute winter	S4	2.000	S3	3.1	1.167	0.230	0.0163

7.4 **Appendix D – Borehole Logs**

A. T. E.

MIDDLETON - ON - SEA

BOREHOLE LOG

SU90SE/6A

u 9744.0000

Borehole No. 1
 Ground Level Approx. 5.7m A.O.D.
 Date 8th & 11th - 13th August 1975

Note:-

Perforated standpipe installed to
 4.5m depth.

Description of Strata	Legend Sample	Depth (m)	Approx O.D. (m)	Remarks
TARMAC		0	5.7	
FILL; brick rubble (0.2m) resting on stoney brown Clay.		0.1	5.6	
CLAY, silty, slightly sandy, orange brown and grey mottled with scattered small stones and chalk fragments.		0.5	5.2	
[Bricks earth]		0.8		
		1.3		
		1.5		
		1.8		
		2.0	3.7	
SAND, fine, variably clayey, light orange brown & grey with thin layers of very sandy clay, many small chalk fragments and scattered flints.		2.2		2.3m depth
[Bricks earth?]		2.5		
		2.7		
		3.0		
		3.2	2.5	
CLAY, very sandy & silty, light orange brown with frequent thin layers of variably clayey fine sand, occasional bands of silt, numerous chalk fragments and scattered flints.		3.5		Water Entry, 3.5m depth.
Becomes green grey with patches of clayey chalk below 6m depth.		3.7		Water level rose to 2.8m in 1 hour.
		4.0		
		4.7		
		5.0		
		6.2		
		6.5		
		7.2	1.5	
CHALK, clayey at top becoming variably clayey & rubbly and harder with depth. Contains occasional flints.		7.7		
		8.0		Water Entry, 8.0m depth.
		8.2		Water level rose to 7.5m depth in 1 hour.
		8.5		
		9.7		
		10.0	4.3	End of borehole

7.5 **Appendix E – Soakage Test Results**

Ref: CS/C1672

Sharyn Towers
67-69 Elmer Road
Bognor

20th December 2021

Re: 67-69 Elmer Road, Bognor – Soakaway Testing – Infiltration Test Result Summary

Dear Sharyn

The following investigation was carried out at the above location in accordance with our quotation.

1. Site Works

The purpose of the investigation was to supply soakaway test data in general accordance with BRE document 365 (Soakaway Design) at one location which would be the approximate intended location for a possible infiltration device to serve a new replacement dwelling.

The appended drawing illustrates the position of the test pit. The BRE365 pit was excavated to a depth of 0.9m in line with the approximate depth of the proposed soakaway.

In addition to the soakaway test pit, a borehole was dug to a depth of 1.5m using a hand auger. This was covered and monitored over 48 hours and remained dry.

The testing commenced on 3rd December 2021 with three tests being undertaken in accordance with BRE 365.

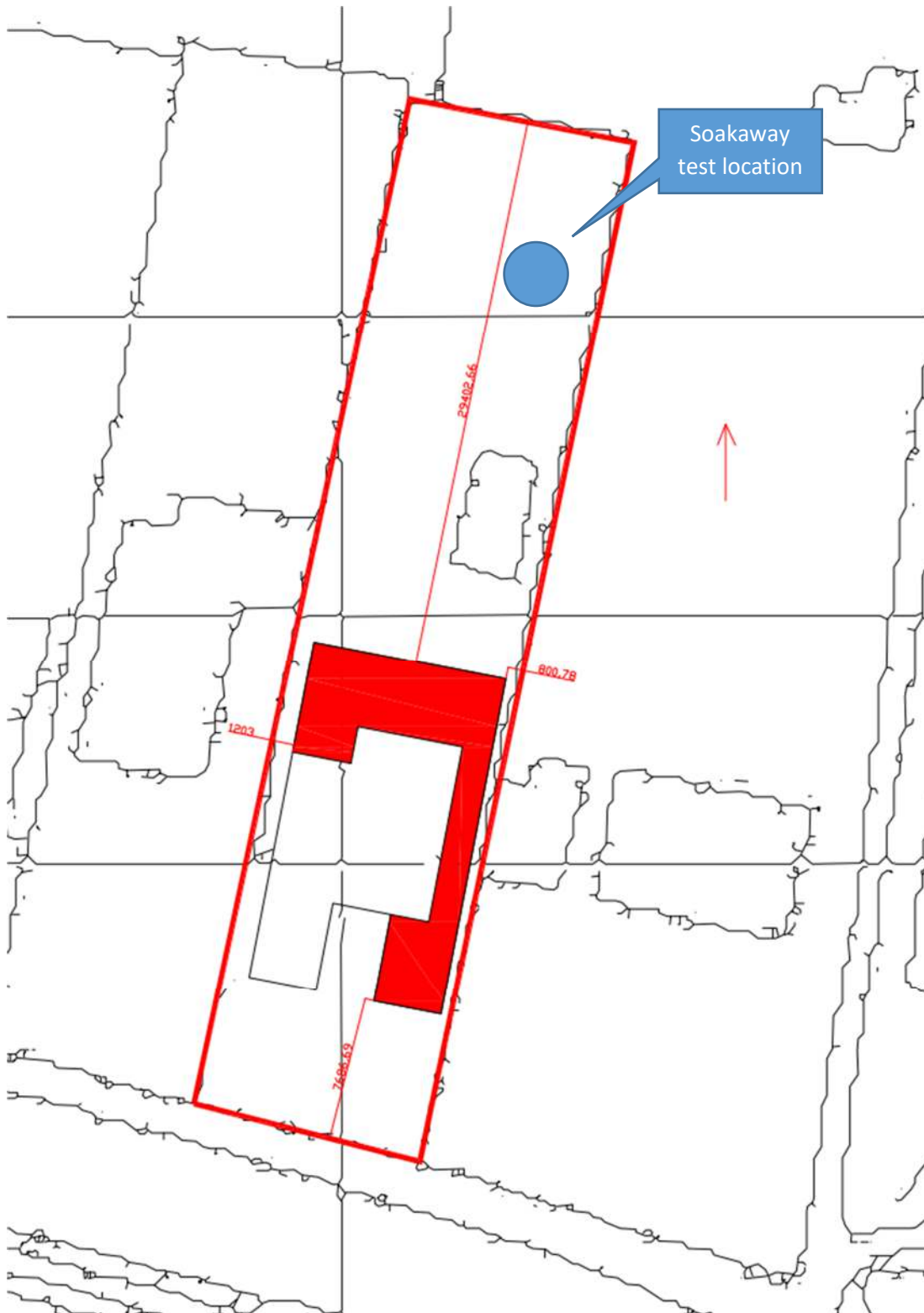
2. BRE 365 Soakaway Test Findings

Testing of the sub soils which was noted as sandy clays produced a BRE 365 design infiltration rate of **4.33x10⁻⁵m/s** at a depth of 0.9m. This rate was the slowest taken from all three tests. This is considered a good rate and will likely be suitable for most infiltration devices.

3. BRE 365 Soakaway Test Results

Test Pit No	Infiltration Rate (1-3 Tests)			Depth of Test	Soil Type
SAT1	6.56x10 ⁻⁵ m/s	6.02x10 ⁻⁵ m/s	4.33x10⁻⁵m/s	0.9m	Silty clay with sand

Appendix A – Soakaway Test Location Plan



Appendix B – Site Photographs





Consulting Civil Engineers

Appendix C – Soakaway Test Results

Job: 67-69 Elmer Road, Bognor - Test 1

Infiltration Calculator

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25} = Effective storage volume between 75% and 25% effective depth

a_{p50} = Internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} = The time for the water level to fall from 75% to 25% effective depth

f = Infiltration rate

Trial pit width	=	0.3
Trial pit depth	=	0.9
Trial pit length	=	1

a_{p50} = 1.32 m/squared

t_{p75-25} = 1560 seconds

V_{p75-25} = 0.135 m/cubed

F =

6.56E-05

Job: 21 Elms Avenue, Poole - Test 2

Infiltration Calculator

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25} = Effective storage volume between 75% and 25% effective depth

a_{p50} = Internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} = The time for the water level to fall from 75% to 25% effective depth

f = Infiltration rate

Trial pit width	=	0.3
Trial pit depth	=	0.9
Trial pit length	=	1

a_{p50} = 1.32 m/squared

t_{p75-25} = 1700 seconds

V_{p75-25} = 0.135 m/cubed

F = 6.02E-05



Job: 21 Elms Avenue, Poole - Test 3

Infiltration Calculator

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25} = Effective storage volume between 75% and 25% effective depth

a_{p50} = Internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} = The time for the water level to fall from 75% to 25% effective depth

f = Infiltration rate

Trial pit width	=	0.3
Trial pit depth	=	0.9
Trial pit length	=	1

a_{p50} =

1.32 m/squared

t_{p75-25} =

2360 seconds

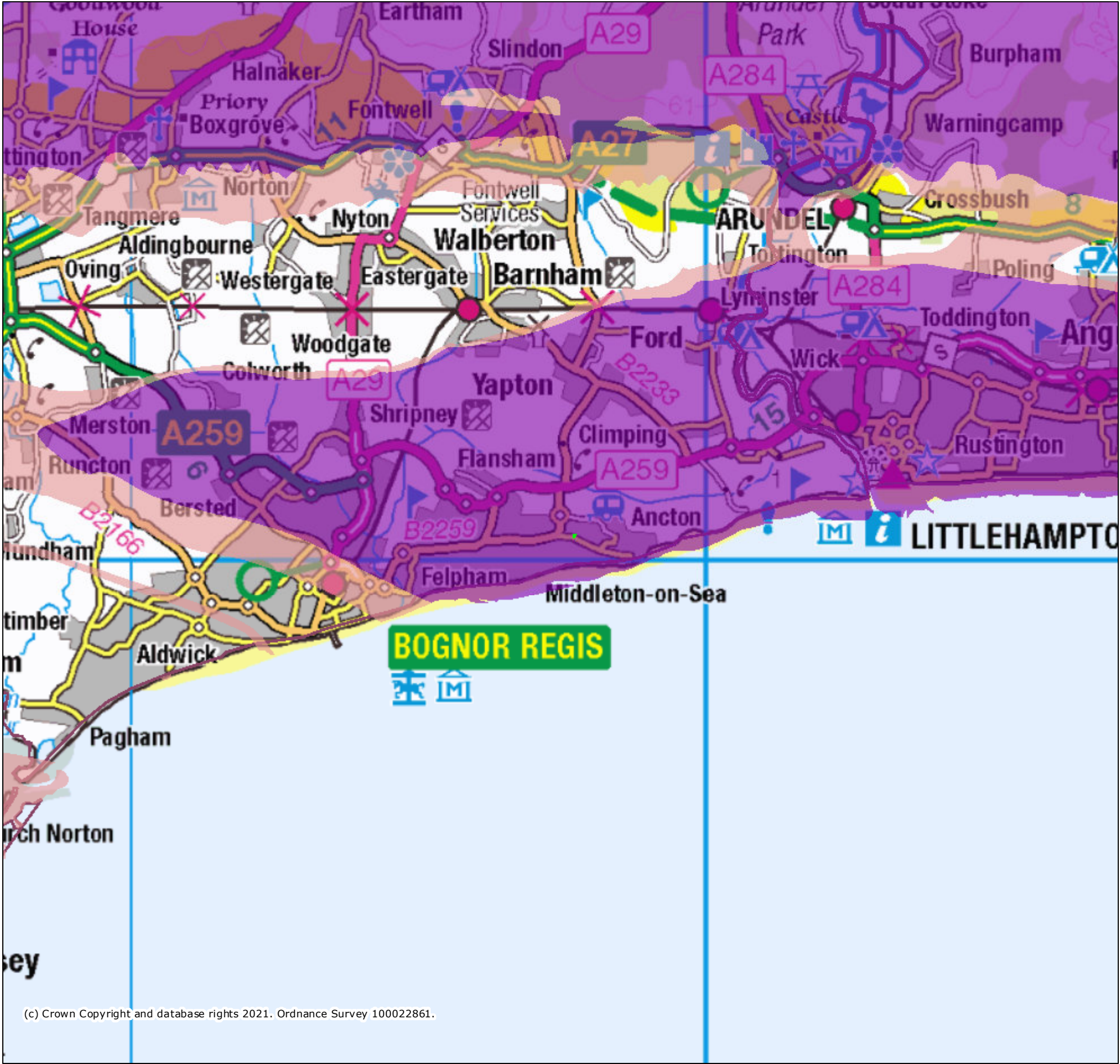
V_{p75-25} =

0.135 m/cubed

F =

4.33E-05

7.6 **Appendix F – Magic Map from Environment Agency**



Legend

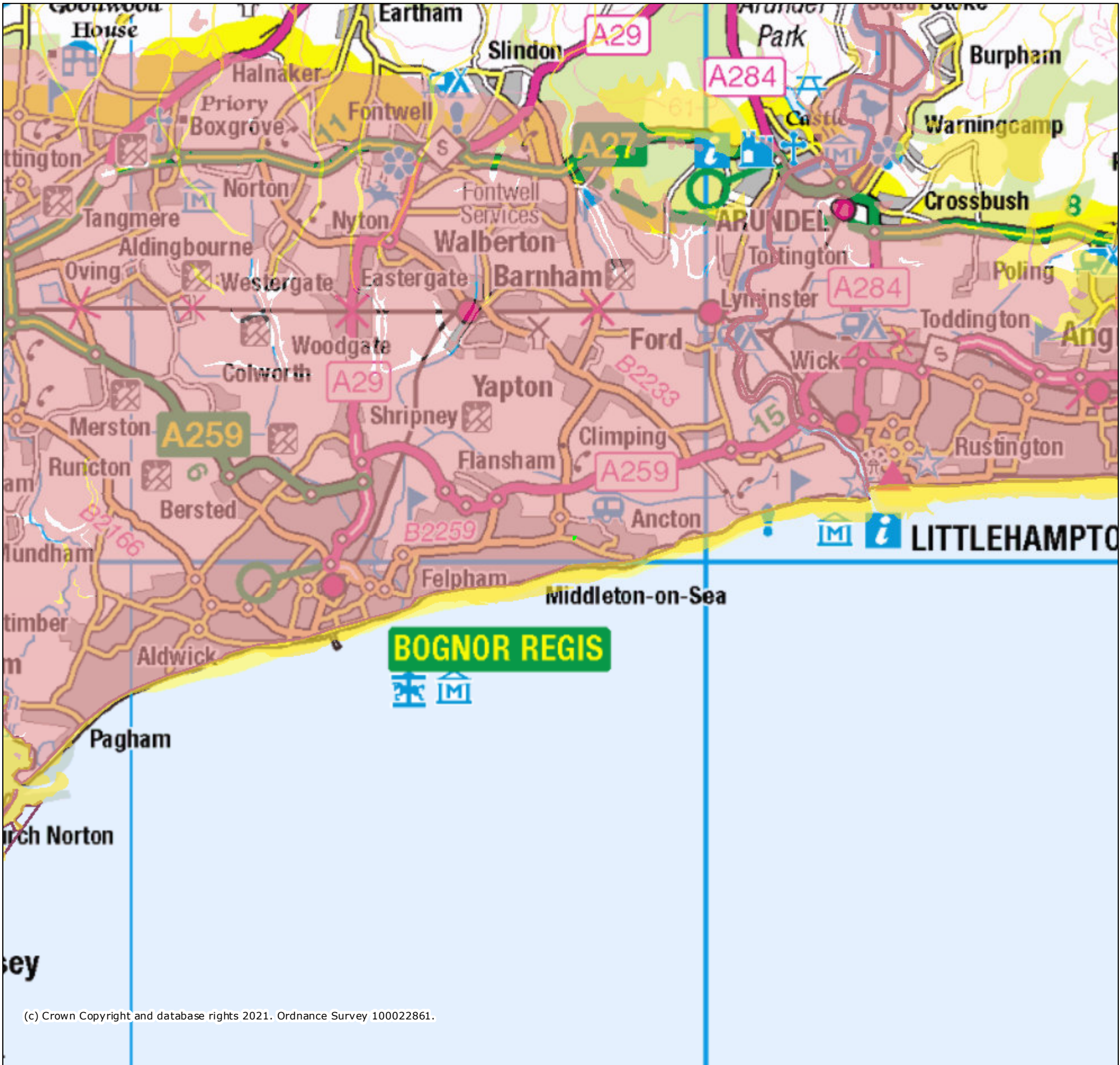
Aquifer Designation Map (Bedrock)
(England)

- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unproductive

Projection = OSGB36
xmin = 485000
ymin = 87610
xmax = 510000
ymax = 113300



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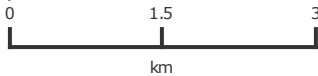


Legend

Aquifer Designation Map (Superficial Drift) (England)

- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unknown (lakes+landslip)
- Unproductive

Projection = OSGB36
xmin = 485000
ymin = 87610
xmax = 510000
ymax = 113300



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Legend

Groundwater Vulnerability Map (England)

- Local Information
- Soluble Rock Risk
- High
- Medium - High
- Medium
- Medium - Low
- Low
- Unproductive

Projection = OSGB36
xmin = 497300
ymin = 99990
xmax = 498000
ymax = 100800
0 0.045 0.09
km

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