simpson
CONSULTING ENGINEERS

Arlington House
Park Five Business Park
Harrier Way, Exeter
EX2 7HU
Tel: +44 (0)1392 446648
Email: mail@simpsoneng.com
www.simpsoneng.com

DRAINAGE STATEMENT

FOR PROPOSED LODGE DEVELOPMENT

PLAS COCH

WREXHAM

PREPARED FOR:

MARSTON'S
INNS AND TAVERNS

JOB NO: 14998

DATE: 10.07.18

DOCUMENT HISTORY

Issue	Description	Date
-	First issue	29.03.18
A	Report updated to suit latest architects scheme	22.06.18
B	Levels and drainage strategy updated.	10.07.18

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1. INTRODUCTION

1.1 This report has been prepared by Simpson Associates, on behalf of Marston's Inns & Taverns to accompany a planning application for a proposed 24 bedroom Lodge Development on land to the east of the Plas Coch pub/restaurant, Wrexham.

1.2 A copy of the proposed Site Layout Plan is included in *Appendix A* for reference, and the topographical survey showing the existing site layout has been included in *Appendix B*.

1.3 The report details a strategy for the disposal of foul and surface water runoff from the development including proposals for the management of surface water runoff using Sustainable Urban Drainage Systems (SUDS).

1.4 The report has been prepared in accordance with Welsh Assembly Government's "*Recommended non-statutory standards for sustainable drainage in Wales*", which provides guidance on designing, constructing and maintaining surface water drainage systems in Wales.

2. SURFACE WATER MANAGEMENT & DRAINAGE STRATEGY

Standard S1 - Surface Water Runoff Destination

2.1 The suggested procedures for managing surface water runoff from new developments in Wales are set out in the 2017 Welsh Government Document "*Recommended non-statutory standards for sustainable drainage (SUDS) in Wales – designing, constructing, operating and maintaining surface water drainage systems*".

2.2 Standard S1 of the SUDS Standards Document sets out a hierarchy for the disposal of surface water runoff. The methods of disposal are summarised in *Table 1* with an assessment of each methods suitability also provided.

Table 1: Surface Water Runoff Destination Assessment

Surface Water Runoff Destination	Assessment
Priority Level 1: Surface water runoff is collected for use	Given the proposed development's uses, it is considered that rainwater harvesting would not significantly contribute to a reduction in surface water runoff volumes or peak water demand. Therefore, the collection of surface water runoff for re-use is not considered to be an appropriate surface water runoff destination.
Priority Level 2: Surface water runoff is infiltrated to ground	The underlying soils are considered suitable for disposal of surface water runoff to ground by infiltration with BRE 365 soakaway tests establishing an infiltration rate of 5.5 x 10^{-04} m/s. The soakaway test results are included in *Appendix C*.
Priority Level 3: Surface water runoff is discharged to a surface water body	It has been established that it would be appropriate to discharge surface water runoff to ground by infiltration, therefore, it is not necessary to consider the discharge of surface water runoff to a surface water body.
Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system.	It has been established that it would be appropriate to discharge surface water runoff to ground by infiltration, therefore, it is not necessary to consider the discharge of surface water runoff to a surface water sewer, highway drain, or another drainage system.
Priority Level 5: Surface water runoff is discharged to a combined sewer.	It has been established that it would be appropriate to discharge surface water runoff to ground by infiltration, therefore it is not necessary to consider the discharge of surface water runoff to a combined sewer.

<u>Standard S2 - Surface water runoff hydraulic control</u>

2.3 Standard S2 of the SUDS Standards Document advises that consideration should be given to the use of Sustainable Urban Drainage Systems (SUDS) for the interception of surface water runoff to prevent any discharge from new development for rainfall events less than 5mm in depth and prevent runoff from the first 5mm of rainfall for larger events. The SUDS considered to achieve this requirement are listed in *Table 2* below with an assessment of each methods suitability also provided.

Table 2: Assessment of SUDS Methods considered to prevent any discharge of surface water for rainfall events less than 5mm in depth and prevent runoff from the first 5mm of rainfall for larger events.

System	Assessment
Green Roofs	The lodge is proposed to have traditional pitched roof profiles which would be appropriate to the site and its context, therefore the use of green roofs is not considered appropriate for the management of surface water runoff.
Rainwater Harvesting	Given the proposed development's uses, it is considered that rainwater harvesting would not significantly contribute to a reduction in surface water runoff volumes or peak water demand. Therefore, the collection of surface water runoff for re-use is not considered to be an appropriate surface water runoff destination.
Soakaway / Infiltration Systems	The underlying soils are considered suitable for disposal of surface water runoff to ground by infiltration, therefore soakaways / and other infiltrations systems including infiltration trenches, swales, permeable pavements, infiltration basins are considered appropriate for the interception of surface water runoff.

2.4 Based on the assessment in *Table 2*, a surface water drainage scheme has been developed for the site and is shown on the Preliminary Levels and Drainage Strategy drawing included in *Appendix D*. The drawing shows roof water runoff from the proposed building and runoff from adjacent hand landscaping areas to be discharged to a new geocellular storage crate soakaway located to the south of the development. Roof water would be drained via roof gutters and rainwater downpipes, which would discharge to the soakaway via a traditional network of below ground pipework.

2.5 The SUDS described above and shown on the proposed drainage layout have been designed in accordance with the flood protection requirements of the SUDS Standards Document with sufficient capacity to store and attenuate excess surface water runoff associated with rainfall events exceeding the natural infiltration rate of the underlying soils for up to and including a 1 in 100 year event with 40% allowance for climate change. In accordance with BRE 365 all infiltration features are designed to achieve a half drain time below 24 hours following a 1 in 10 year plus climate change storm event.

2.6 The SUDS have been designed using the Source Control facility in the MicroDrainage software package by XP Solutions based on an infiltration rate of 5.5 x 10^{-04} m/s (1980mm/hr). Design results for both the 1 in 100 year and 1 in 10 year events, each with a 40% climate change allowance, are included in *Appendix E*.

2.7 In the event that the capacity of the surface water drainage network was exceeded, surface water would flow off-site to the south and east, following the falls identified on the Preliminary Levels and Drainage Strategy drawing in *Appendix D*, which closely match the sites existing falls. The finished floor level of the proposed building is raised above the surrounding levels so there would no risk of buildings being affected by such overland flows.

<u>Standard S3 - Water Quality</u>

2.8 Standard S3 of the SUDS Standards Document advises that where surface water is likely to be contaminated, effective management is required to prevent negative impacts on the receiving water quality and/or protect downstream drainage systems, including sewers.

2.9 The proposed drainage layout drawing included in *Appendix D* shows roof water runoff from the proposed building and runoff from the adjacent hand landscaping areas to be discharged to ground using a geocellular storage crate soakaway with granular surround which will offer one stage of treatment, complying with the standards.

<u>Standard S4 & S5 – Amenity & Biodiversity</u>

2.10 Standard S4 of the SUDS Standards Document advises that the design of the surface water management system should maximise amenity benefits, while Standard S5 requires the design of the surface water management system to maximise biodiversity benefits.

2.11 The proposed drainage layout drawing included in *Appendix D* shows all of the proposed surface water storage to be located below ground and no unnecessary loss of amenity space is therefore required to enable the development. The proposals also maximise the opportunity for biodiversity benefits to be implemented within the retained open space at the site.

Standard S6 – Design of drainage for Construction, Operation and Maintenance

2.12 Standard S6 sets out requirements for surface water drainage systems so that they can be easily and safely constructed, maintained and operated, taking account of the need to minimise negative impacts on the environment and natural resources.

2.13 The SUDS Implementation Plan included in *Appendix F* sets out measures to be implemented during construction of the scheme to ensure the site and areas downstream are protected from surface water runoff during construction phases.

2.14 Following handover of the drainage system to the Operations Team, it is recommended that the surface water drainage system is maintained in accordance with the SUDS Maintenance Plan included in *Appendix G*. The measures would help to prevent a reduction in the performance of the surface water drainage system over the lifetime of the development.

3. FOUL WATER DRAINAGE STRATEGY

3.1 The proposed drainage layout drawing included in *Appendix* D shows foul water to be discharged via a system of underground pipework to an existing manhole on the line of an existing 150mm diameter foul drain which serves the Plas Coch Pub.

3.2 The proposed foul drainage network will remain under private ownership and therefore the property owners would be responsible for any maintenance up to the connection with the public sewerage network.

4. CONCLUSIONS

4.1 New development can increase the volume and rate at which surface water runoff is discharged from a site when compared to the existing situation, which can cause an increase in flood risk both on the site and elsewhere within the catchment. Therefore, a surface water drainage scheme has been prepared for the development that will allow for surface water runoff to infiltrate into the ground using Sustainable Urban Drainage Systems (SUDS) in the form of a geocellular storage crate soakaway with granular surround, the drainage strategy will ensure excess surface water runoff from the development is stored and attenuated up to a 1 in 100 year plus 40% climate change event.

4.2 Foul water runoff from the development would be discharged to the public sewerage network via the sites existing foul water drainage netowk.

4.3 It is concluded that the development can be occupied and operated safely and that there will be no increase in the level of flood risk to the site or neighbouring sites as a result of the development. Therefore, the development can be considered acceptable in terms of flood risk.

APPENDIX A
SITE LAYOUT PLAN

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NORTH

0 10 15 20 25 30 m

SITE AREA = 1.446 ACRES

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KEY

- Soft Landscaping See Separate Drawing
- Bitmac Surface to Parking Areas with Thermoplastic White Lining
- Existing tarmac
- Tarmac to Road suitable for HGVs
- Tegular Style Concrete Sett Block Paving to match existing
- Post & Rail Fence to boundary
- Stained 1100mm Timber Picket Fence
- Knee Rail fence
- Tree removed
- Tree remain
- 8m clearance zone
- RPA

Rev	Date	Description	By
J	7/6/18	Lodge moved east further 2.5m; Parking rearranged	SF
I	-	-	-
H	7/6/18	6m tree clearance shown	SF
G	5/6/18	Lodge moved east 1.6m	SF
F	26/3/18	Parking bays 31 & 32 amended	MG
E	22/3/18	Path increased for lodge linen access	SF
D	14/3/18	Updated with topo survey & arbo advice	SF
C	19/02/18	Surveyed tree locations added	SF
B	14/2/18	ADDITIONAL LANDSCAPE ADDED	NW
A	23/1/18	EXISTING FOOTPRINT UPDATED	NW

AXIOM ARCHITECTS
1 Brooklands Yard Southover High Street Lewes East Sussex BN7 1HU
Tel. 01273 479434 www.axiomarchitects.co.uk

Client
MARSTONS PLC

Project
PROPOSED LODGE
PLAS COCH
WREXHAM

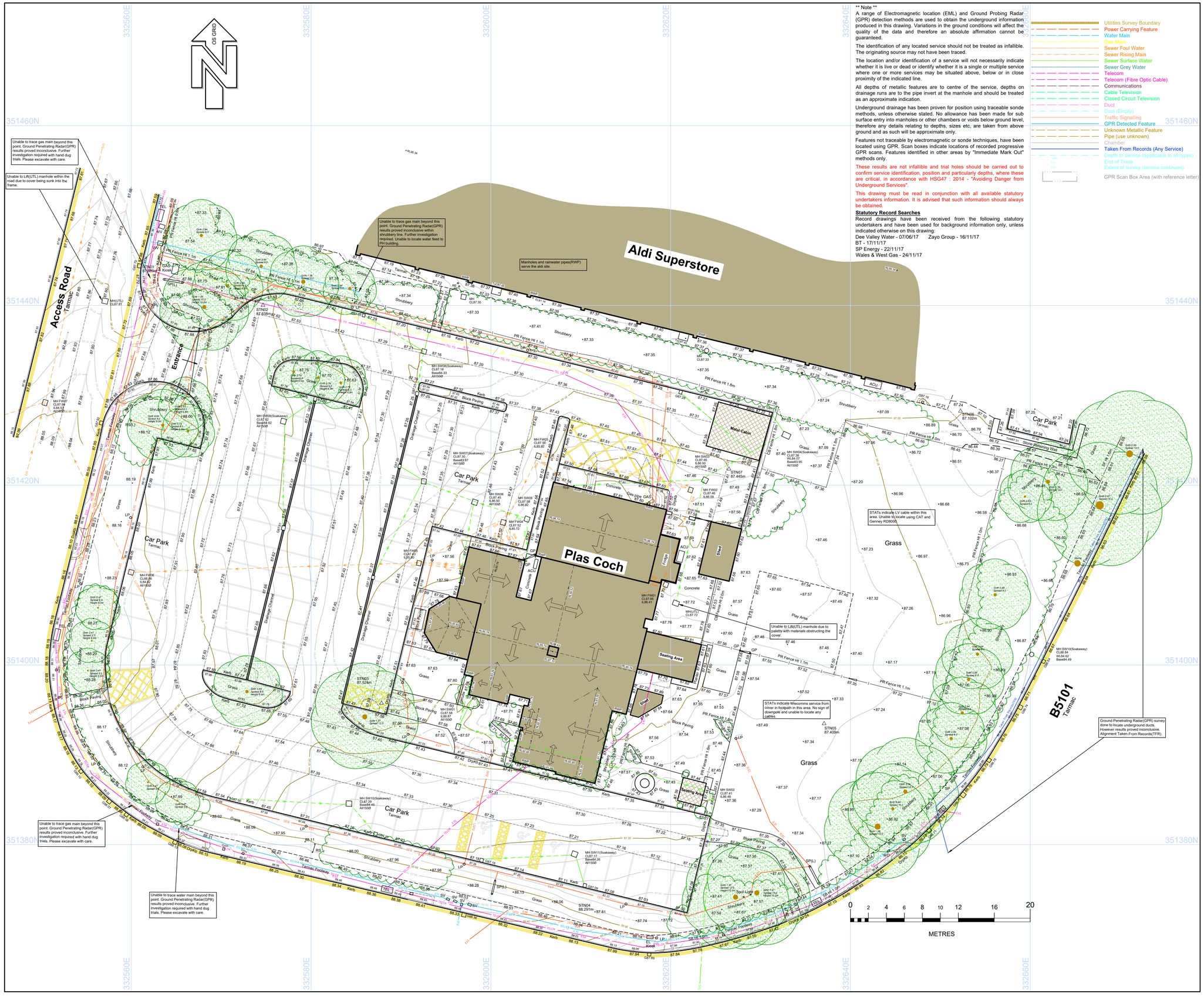
Drawing
SITE PLAN

Scale	Status	Date	Drawn	Checked
1:500 @ A3	PLANNING	17.10.17	ACR	

Drawing No. **4481/P104**

Revision **J**

APPENDIX B
TOPOGRAPHICAL SURVEY



** Note **

A range of Electromagnetic location (EML) and Ground Probing Radar (GPR) detection methods are used to obtain the underground information produced in this drawing. Variations in the ground conditions will affect the quality of the data and therefore an absolute affirmation cannot be guaranteed.

The identification of any located service should not be treated as infallible. The originating source may not have been traced.

The location and/or identification of a service will not necessarily indicate whether it is live or dead or identify whether it is a single or multiple service where one or more services may be situated above, below or in close proximity of the indicated line.

All depths of metallic features are to centre of the service, depths on drainage runs are to the pipe invert at the manhole and should be treated as an approximate indication.

Underground drainage has been proven for position using traceable sonde methods, unless otherwise stated. No allowance has been made for sub surface entry into manholes or other chambers or voids below ground level, therefore any details relating to depths, sizes etc, are taken from above ground and as such will be approximate only.

Features not traceable by electromagnetic or sonde techniques, have been located using GPR. Scan boxes indicate locations of recorded progressive GPR scans. Features identified in other areas by "Immediate Mark Out" methods only.

These results are not infallible and trial holes should be carried out to confirm service identification, position and particularly depths, where these are critical, in accordance with HSG47 : 2014 - "Avoiding Danger from Underground Services".

This drawing must be read in conjunction with all available statutory undertakers information. It is advised that such information should always be obtained.

Statutory Record Searches

Record drawings have been received from the following statutory undertakers and have been used for background information only, unless indicated otherwise on this drawing:

Dee Valley Water - 07/06/17 Zayo Group - 16/11/17
BT - 17/11/17
SP Energy - 22/11/17
Wales & West Gas - 24/11/17

- Utilities Survey Boundary
- Power Carrying Feature
- Water Main
- Gas Main
- Sewer Foul Water
- Sewer Rising Main
- Sewer Surface Water
- Sewer Grey Water
- Telecom
- Telecom (Fibre Optic Cable)
- Communications
- Cable Television
- Closed Circuit Television
- Duct
- Duct (Empty)
- Traffic Signalling
- GPR Detected Feature
- Unknown Metallic Feature
- Pipe (use unknown)
- Chamber
- Taken From Records (Any Service)
- Depth to service (applicable to all types)
- End of Trace
- Extent of survey (service continues)
- GPR Scan Box Area (with reference letter)

Notes

1. Surveyed February 2018.
2. Survey related to Ordnance Survey "OS Net" at control point STN03, using realtime correction received via Trimble Navigations "VRS Now" service. Survey plotted to flat plane metric grid with no local scale factor applied, i.e. LSF 1.00.
3. Levels related to GPS Orthometric height, converted to MSL (Newlyn) by OSGM15.

Control

STN	East	North	Level	Type
STN01	332563.043	351444.014	87.880	Nail
STN02	332574.659	351440.018	87.638	Nail
STN03	332587.844	351395.748	87.524	Nail
STN04	332610.916	351371.061	88.291	Nail
STN05	332637.069	351393.479	87.409	Peg
STN06	332652.244	351428.243	87.102	Peg
STN07	332626.488	351421.800	87.445	Nail

General

- Every effort is made to identify all visible above ground features. However, it should be borne in mind that at the time of survey, some surface features may have been obscured.
- Visible features in the vicinity of the site extents, as detailed on this survey, may not represent the legally conveyed ownership boundaries.

Legend

Top / Bottom of Bank
Building / Overhead Canopy
Wall
Solid Surface Feature / Road Edge
Hard / Soft Surface Change
Kerb / Dropped Kerb
Combined Kerb & Drainage System
Drainage Channel
Road Traffic Sensors
Fence Line -

BW	Barbed Wire	HR	Hand Rail	PR	Post & Rail		
CB	Close Boarded	IR	Iron Railings	SB	Safety Barrier		
CNut	Chestnut	Mtl PR	Metal Post & Rail	SF	Security Fence		
CL	Chain Link	OB	Open Boarded	TF	Temporary Fence		
CP	Concrete Panel	PA	Paling Fence	WM	Wire Mesh		
(D)	Dilapidated	PC	Post & Chain				

Hedge Line
Tree / Scrub Canopy Line
O/H Telephone / Electric Cable(s)
Rock Face
Pipe Line (Above Ground)
Bush
Tree-Deciduous
Tree-Evergreen

T.PIT 22.5 Trial Pit (with level)
BH 26.5 Borehole (with level)
Survey Station
10.1 Spot Level
Woodland Area (Deciduous)
Gate
Level Datum
Woodland Area (Coniferous)
Electric Pylon
Marsh Land

Feature Abbreviations

ACU	Air Conditioning Unit	FH	Fire Hydrant	NP	Name Plate	SVP	Soil Vent Pipe
BB	Belisha Beacon	FP	Fence Post	PB	Post Box	TAP	Stand Pipe
BO	Bollard	FL	Flood Light	PM	Parking Meter	TCB	Telephone Box
BO(L)	Bollard (Lit)	G	Gully (with Level)	RBB	Rodent Bait Box	TEL	Telecom's Cover
BP	Boundary Post	GP	Gate Post	RE	Rodding Eye	TL	Traffic Light
BS	Bus Stop	GAS	Gas Cover	RS	Road Sign	TP	Telephone Pole
CATV	Cable TV Cover	KO	Kerb Offset	RS(L)	Road Sign (Lit)	TS	Traffic Signal Cover
CCTV	Close Circuit TV	LB	Lighting Beacon	RWP	Rain Water Pipe	VP	Vent Pipe
COL	Column	LBIN	Litter Bin	SNR	Sensor	WM	Water Meter
CP	Concrete Post	LP	Lamp Post	SP	Sign Post	WQ	Wash Out
DWB	Dog Waste Bin	ME	Meter	SP(L)	Sign Post (Lit)	WV	Water Valve
EL	Electric Cover	MH	Manhole	SPDC	Speed Camera	UC7	Unknown Cover
EP	Electricity Pole	MP	Marker Post	STAY	Cable Stay	UTL	Unable to Lift
ER	Earth Rod	MEP	Metal Post	SV	Stop Valve	Ø	Diameter

Description Abbreviations

Asmd Rt	Assumed Route	Flw Bd	Flower Bed	O/H	Overhead
BkDrp	Back Drop	FW	Foul Water	OSBM	Ordnance Survey
Bk	Brick	GTrp	Grease Trap		Bench Mark
BusStKb	Bus Stop Kerb	Ht	Height	RetWall	Retaining Wall
Bldg	Building	Hg	Hedge	Rd Edg	Road Edge
CDrnlpS	Combined Drainage & Kerb System	Intcpr	Interceptor	Spd Rtr	Speed Retarder
		Lvl	Level	St	Stone
Conc	Concrete	m	Metres	STN	Station
CPit	Catch Pit	mm	Millimetres	SW	Surface Water
DrpKB	Drop Kerb	MSL	Mean Sea Level	Tac	Tactile Paving
Drn Chnl	Drainage Channel	No.	Number	Trmc	Tarmac

Level Prefix

AL	Arch Level	RL	Roof / Ridge Level	ToS	Top of Steel Level	FFL	Finished Floor Level
CL	Cover Level	SL	Soffit Level	ToW	Top of Wall Level	1st.FFL	1st Finished Floor Level
DPC	Damp Proof Course	Spls	Springing Level	SLL	Sill Level		
EL	Eaves Level	TL	Threshold Level	WL	Water Level (inc.date & Time)		
IL	Invert Level	ToC	Top of Concrete Level				
PL	Parapet Level	ToP	Top of Pipe Level				

Digital File	4340_10_2D.dwg	Original Size	A1

No.	Description	Date	Signed

Revisions

Drawing Status: FINAL

Surveyed	WM	Date	15.02.18	Scale	1:200
Drawn	WM	Sheet	1 of 1	Approved	AF

Client: **Marstons Plc**

Title: Topographical & Utilities Survey

Project: **Proposed Marstons Lodge Plas Coch Road Wrexham**

Drawing No. 4340/10/001 Rev. -

Clugston

Clugston Survey Services
St Vincent House
Normanby Road
Scunthorpe
North Lincolnshire
DN15 8QT

Tel: 01724 748170
Fax: 01724 748171
survey@clugston.co.uk
www.clugstonsurvey.co.uk

Regional Office in Leeds
Clugston Survey Services is a business name of Clugston Construction Limited Registered in England No. 681537
Registered Office, St Vincent House, Normanby Road, Scunthorpe North Lincolnshire, DN15 8QT

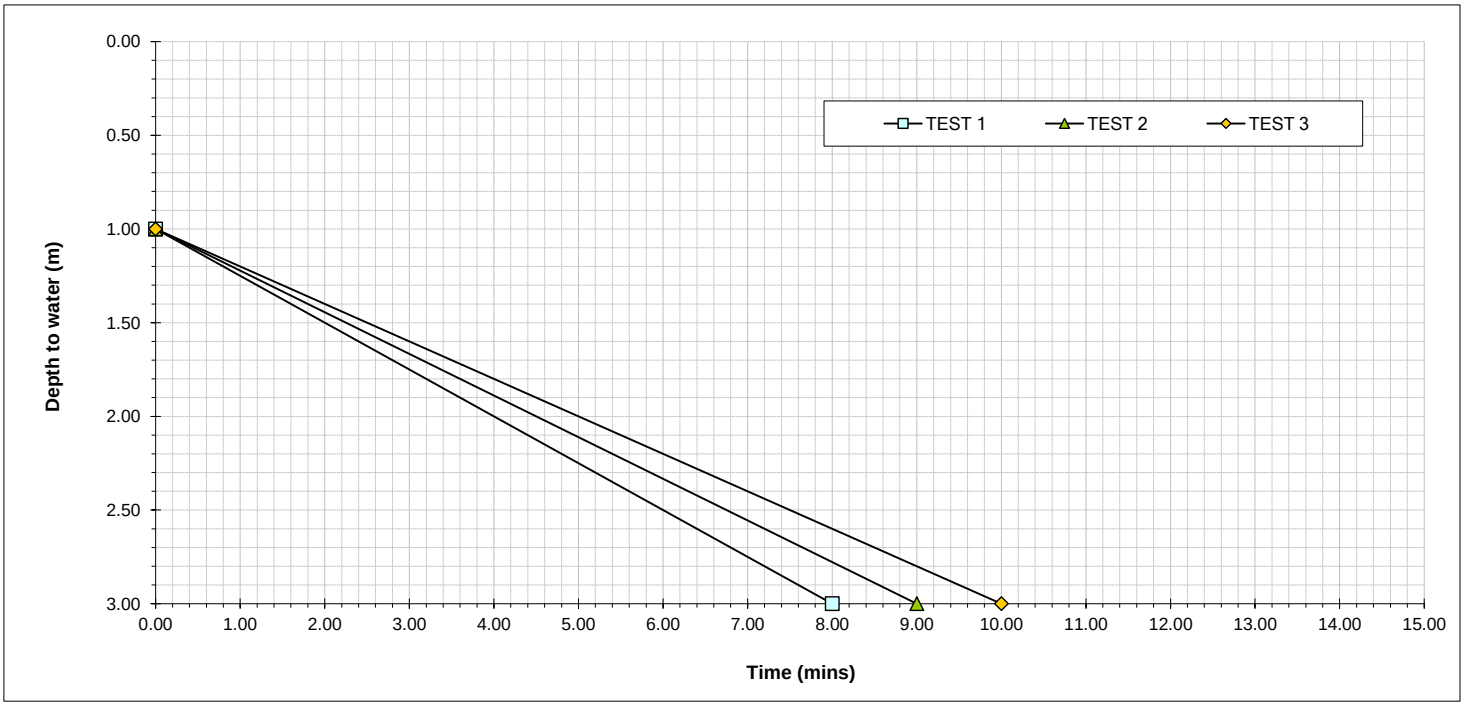
APPENDIX C
SOAKAWAY TEST RESULTS

enzygo	Site..... **Wrexham** Job Number..... **CRM.427.008** Date of Test..... 08.03.18	Soakaway Number..... SA1 Length..... 1.70 m Width..... 0.60 m Depth..... 3.00 m
	SOIL INFILTRATION RATE TEST **See B.R.E. Digest 365, 1991, Soakaway Design.**	Groundwater Level..... Dry m

Remarks -	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.00 - 0.40m bgl TOPSOIL						
0.40 - 1.90m bgl Dark madeground sandy	0.0	1.00	0.0	1.00	0.0	1.00
gravel and SILT	8.0	3.00	9.0	3.00	10.0	3.00
1.90 - 3.00m bgl MADEGROUND (bricks	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.0	0.00	0.0	0.00	0.0	0.00
	0.00	0.00	0.0	0.00	0.0	0.00
	0.00	0.00	0.00	0.00	0.0	0.00
	0.00	0.00	0.00	0.00	0.0	0.00
	0.00	0.00	0.00	0.00	0.00	0.00

Effective Storage Depth	m	2.00	2.00	2.00
75% Effective Storage Depth	m	1.50	1.50	1.50
(i.e. depth below GL)	m	**1.50**	**1.50**	**1.50**
25% Effective Storage Depth	m	0.50	0.50	0.50
(i.e. depth below GL)	m	**2.50**	**2.50**	**2.50**
Effective Storage Depth 75%-25%	m	1.00	1.00	1.00
Time to fall to 75% effective depth	mins	2.00	2.25	2.50
Time to fall to 25% effective depth	mins	6.00	7.00	8.00
V (75%-25%)	m3	1.02	1.02	1.02
a (50%)	m2	5.62	5.62	5.62
t (75%-25%)	mins	4.00	4.75	5.50
SOIL INFILTRATION RATE	m/s	**7.56E-04**	**6.37E-04**	**5.50E-04**

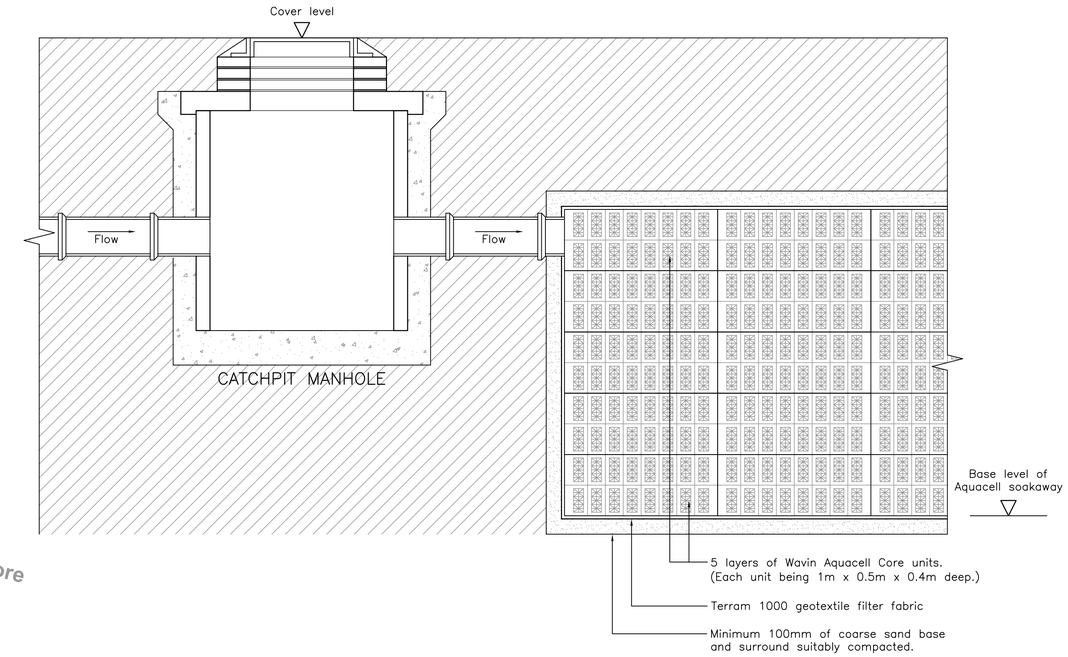
DESIGN SOIL INFILTRATION RATE, f **5.50E-04** **m/s**



Compiled By:	Date:	Checked By:	Date:	Approved By:	Date:
A. Jubb	08.02.18	A.Hodgkinson	08.02.18	S.Dawson	08.02.18

APPENDIX D
PRELIMINARY LEVELS AND DRAINAGE STRATEGY

DO NOT SCALE



AQUACELL SOAKAWAY DETAIL

LEGEND

[FFL 87.60]	Proposed finished floor level
87.48 +	Proposed level
× 87.34	Existing level
1 in 42.3	Proposed gradient
	Proposed bank
R600	Denotes extent of retaining wall with max. retaining height shown
	Tree root protection zone
	8m tree clearance zone
	Exceedance flood route
RG	Trapped road gully
CG	Channel drain and trapped outfall unit
	Surface water drain
	Surface water filter drain
	Foul water drain
	SW Drain to be removed
	Surface water inspection chamber
	Foul water inspection chamber
	Surface water catchpit manhole
	Surface water manhole
	Site Boundary

MK	REVISION	BY	DATE
B	DRAWING UPDATED FOLLOWING COMMENTS FROM COUNCIL. CONNECTION FROM EXISTING MANHOLE SW03 SHOWN TO PROPOSED SURFACE WATER NETWORK.	PB	10.07.18
A	DRAWING UPDATED TO SUIT LATEST ARCHITECT'S DRAWING 4481/P104 J. LODGE POSITION ALTERED. LEVELS AND DRAINAGE UPDATED TO SUIT. EXISTING SOAKAWAY IN NORTH OF SITE SHOWN TO BE REMOVED AND PROPOSED SOAKAWAY AMENDED TO GEOCELLULAR TANK.	PB	21.06.18

Carter Lauren

DRAWING STATUS

NOT FOR CONSTRUCTION

DRAWING TITLE

FINISHED LEVEL AND DRAINAGE LAYOUT

PROJECT Project Number 14998

MARSTON'S LODGE
PLAS COCH
WREXHAM

simpson
8 Friday Street
Henley on Thames
Oxfordshire RG9 1AH
T.01491 576221
London, Henley-on Thames, Gloucester and Exeter

Drawn	Ch'kd	Scales	Date
J.J.H.	G.S.C.	1:200	MAR'18

Purpose of Issue

PLANNING

Drawing Number	Revision
14998-SK02	B

A1

APPENDIX E
MICRODRAINAGE DESIGN RESULTS

Summary of Results for 10 year Return Period (+40%)

Half Drain Time : 28 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	85.087	0.737	6.1	14.0	O K
30 min Summer	85.207	0.857	6.5	16.3	O K
60 min Summer	85.254	0.904	6.7	17.2	O K
120 min Summer	85.218	0.868	6.5	16.5	O K
180 min Summer	85.148	0.798	6.3	15.2	O K
240 min Summer	85.074	0.724	6.1	13.7	O K
360 min Summer	84.935	0.585	5.6	11.1	O K
480 min Summer	84.820	0.470	5.2	8.9	O K
600 min Summer	84.724	0.374	4.9	7.1	O K
720 min Summer	84.645	0.295	4.6	5.6	O K
960 min Summer	84.525	0.175	4.2	3.3	O K
1440 min Summer	84.403	0.053	3.8	1.0	O K
2160 min Summer	84.388	0.038	2.9	0.7	O K
2880 min Summer	84.381	0.031	2.4	0.6	O K
4320 min Summer	84.373	0.023	1.8	0.4	O K
5760 min Summer	84.369	0.019	1.5	0.4	O K
7200 min Summer	84.366	0.016	1.2	0.3	O K
8640 min Summer	84.364	0.014	1.1	0.3	O K
10080 min Summer	84.363	0.013	1.0	0.2	O K
15 min Winter	85.194	0.844	6.5	16.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	69.371	0.0	16
30 min Summer	46.640	0.0	26
60 min Summer	30.208	0.0	44
120 min Summer	19.108	0.0	78
180 min Summer	14.500	0.0	112
240 min Summer	11.884	0.0	144
360 min Summer	8.956	0.0	208
480 min Summer	7.323	0.0	270
600 min Summer	6.261	0.0	332
720 min Summer	5.507	0.0	390
960 min Summer	4.496	0.0	510
1440 min Summer	3.375	0.0	734
2160 min Summer	2.531	0.0	1100
2880 min Summer	2.062	0.0	1432
4320 min Summer	1.544	0.0	2172
5760 min Summer	1.257	0.0	2920
7200 min Summer	1.073	0.0	3576
8640 min Summer	0.942	0.0	4400
10080 min Summer	0.844	0.0	5096
15 min Winter	69.371	0.0	16

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Summary of Results for 10 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	85.339	0.989	6.9	18.8	O K
60 min Winter	85.385	1.035	7.1	19.7	O K
120 min Winter	85.300	0.950	6.8	18.0	O K
180 min Winter	85.180	0.830	6.4	15.8	O K
240 min Winter	85.063	0.713	6.0	13.6	O K
360 min Winter	84.865	0.515	5.4	9.8	O K
480 min Winter	84.710	0.360	4.9	6.8	O K
600 min Winter	84.589	0.239	4.5	4.5	O K
720 min Winter	84.495	0.145	4.1	2.8	O K
960 min Winter	84.399	0.049	3.7	0.9	O K
1440 min Winter	84.387	0.037	2.8	0.7	O K
2160 min Winter	84.378	0.028	2.1	0.5	O K
2880 min Winter	84.373	0.023	1.7	0.4	O K
4320 min Winter	84.367	0.017	1.3	0.3	O K
5760 min Winter	84.364	0.014	1.1	0.3	O K
7200 min Winter	84.362	0.012	0.9	0.2	O K
8640 min Winter	84.360	0.010	0.8	0.2	O K
10080 min Winter	84.359	0.009	0.7	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	46.640	0.0	28
60 min Winter	30.208	0.0	46
120 min Winter	19.108	0.0	84
180 min Winter	14.500	0.0	118
240 min Winter	11.884	0.0	154
360 min Winter	8.956	0.0	218
480 min Winter	7.323	0.0	280
600 min Winter	6.261	0.0	340
720 min Winter	5.507	0.0	398
960 min Winter	4.496	0.0	490
1440 min Winter	3.375	0.0	730
2160 min Winter	2.531	0.0	1084
2880 min Winter	2.062	0.0	1460
4320 min Winter	1.544	0.0	2200
5760 min Winter	1.257	0.0	2904
7200 min Winter	1.073	0.0	3544
8640 min Winter	0.942	0.0	4344
10080 min Winter	0.844	0.0	5120

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	10	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.311	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.141

Time (mins) From:	To:	Area (ha)
0	4	0.141

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Model Details

Storage is Online Cover Level (m) 87.350

Cellular Storage Structure

Invert Level (m) 84.350 Safety Factor 3.0
Infiltration Coefficient Base (m/hr) 1.98000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 1.98000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	20.0	20.0	2.001	0.0	56.0
2.000	20.0	56.0			

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

Half Drain Time : 38 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	85.627	1.277	7.9	24.3	O K
30 min Summer	85.914	1.564	8.8	29.7	O K
60 min Summer	86.086	1.736	9.4	33.0	O K
120 min Summer	86.094	1.744	9.4	33.1	O K
180 min Summer	86.005	1.655	9.1	31.4	O K
240 min Summer	85.895	1.545	8.8	29.4	O K
360 min Summer	85.685	1.335	8.1	25.4	O K
480 min Summer	85.508	1.158	7.5	22.0	O K
600 min Summer	85.357	1.007	7.0	19.1	O K
720 min Summer	85.227	0.877	6.6	16.7	O K
960 min Summer	85.015	0.665	5.9	12.6	O K
1440 min Summer	84.724	0.374	4.9	7.1	O K
2160 min Summer	84.475	0.125	4.1	2.4	O K
2880 min Summer	84.397	0.047	3.6	0.9	O K
4320 min Summer	84.384	0.034	2.6	0.6	O K
5760 min Summer	84.378	0.028	2.1	0.5	O K
7200 min Summer	84.373	0.023	1.8	0.4	O K
8640 min Summer	84.370	0.020	1.6	0.4	O K
10080 min Summer	84.368	0.018	1.4	0.3	O K
15 min Winter	85.802	1.452	8.5	27.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	112.688	0.0	16
30 min Summer	77.339	0.0	28
60 min Summer	50.812	0.0	44
120 min Summer	32.267	0.0	80
180 min Summer	24.360	0.0	114
240 min Summer	19.797	0.0	148
360 min Summer	14.705	0.0	212
480 min Summer	11.905	0.0	276
600 min Summer	10.097	0.0	338
720 min Summer	8.819	0.0	400
960 min Summer	7.116	0.0	522
1440 min Summer	5.248	0.0	764
2160 min Summer	3.859	0.0	1108
2880 min Summer	3.098	0.0	1452
4320 min Summer	2.269	0.0	2196
5760 min Summer	1.816	0.0	2848
7200 min Summer	1.531	0.0	3664
8640 min Summer	1.331	0.0	4400
10080 min Summer	1.183	0.0	5064
15 min Winter	112.688	0.0	16

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	86.145	1.795	9.6	34.1	O K
60 min Winter	86.335	1.985	10.2	37.7	O K
120 min Winter	86.299	1.949	10.1	37.0	O K
180 min Winter	86.136	1.786	9.6	33.9	O K
240 min Winter	85.965	1.615	9.0	30.7	O K
360 min Winter	85.661	1.311	8.0	24.9	O K
480 min Winter	85.418	1.068	7.2	20.3	O K
600 min Winter	85.221	0.871	6.5	16.5	O K
720 min Winter	85.058	0.708	6.0	13.5	O K
960 min Winter	84.807	0.457	5.2	8.7	O K
1440 min Winter	84.492	0.142	4.1	2.7	O K
2160 min Winter	84.392	0.042	3.2	0.8	O K
2880 min Winter	84.384	0.034	2.6	0.6	O K
4320 min Winter	84.375	0.025	1.9	0.5	O K
5760 min Winter	84.370	0.020	1.5	0.4	O K
7200 min Winter	84.367	0.017	1.3	0.3	O K
8640 min Winter	84.365	0.015	1.1	0.3	O K
10080 min Winter	84.363	0.013	1.0	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	77.339	0.0	29
60 min Winter	50.812	0.0	48
120 min Winter	32.267	0.0	86
180 min Winter	24.360	0.0	122
240 min Winter	19.797	0.0	158
360 min Winter	14.705	0.0	224
480 min Winter	11.905	0.0	290
600 min Winter	10.097	0.0	354
720 min Winter	8.819	0.0	416
960 min Winter	7.116	0.0	540
1440 min Winter	5.248	0.0	768
2160 min Winter	3.859	0.0	1080
2880 min Winter	3.098	0.0	1456
4320 min Winter	2.269	0.0	2184
5760 min Winter	1.816	0.0	2856
7200 min Winter	1.531	0.0	3560
8640 min Winter	1.331	0.0	4488
10080 min Winter	1.183	0.0	5064

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.311	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.141

Time (mins) From:	To:	Area (ha)
0	4	0.141

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Model Details

Storage is Online Cover Level (m) 87.350

Cellular Storage Structure

Invert Level (m) 84.350 Safety Factor 3.0
Infiltration Coefficient Base (m/hr) 1.98000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 1.98000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	20.0	20.0	2.001	0.0	56.0
2.000	20.0	56.0			

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APPENDIX F
SUDS IMPLEMENTATION PLAN

SUDS IMPLEMENTATION PLAN

FOR PROPOSED LODGE DEVELOPMENT

PLAS COCH, WREXHAM

4.1 This SUDS Implementation Plan sets out measures to be implemented during construction of the surface water drainage system for the scheme to ensure the site and areas downstream are protected from runoff during construction of the development. It is recommended that the plan is incorporated into the Contractors Construction Health and Safety Plan with the development carried out in accordance with the measures proposed.

4.2 It may not always be possible to ensure that new impermeable areas are immediately connected to the drainage system. Therefore, the following additional measures should be implemented to ensure construction runoff is appropriately managed:

- Protective coverings should be used to help prevent runoff stripping material stockpiles.
- Plant and wheel washing should take place in a designated location. The area should be tanked and not allowed to discharge into the drainage system or infiltrate into the ground. Effluent should be treated as contaminated waste and disposed of offsite by a licensed waste management operator.
- Surfaces used as access roads and storage areas during construction should be swept regularly to prevent the accumulation of dust and mud.
- Should groundwater be encountered in excavations such water should not be discharged to the drainage system until the amount of suspended solids has been reduced though the controlled use of skips or tanks, which will act as stilling basins.
- To prevent contamination associated with the use of oils and hydrocarbons during construction, the Contractor should ensure that the following precautionary measures are employed during construction:

    - Regular maintenance of machinery and plant.
    - Use of drip trays.
    - Regular checking of machinery and plant for oil leaks.
    - Use of correct storage facilities.
    - Regular checks for signs of wear and tear on tanks.
    - Specific procedures are followed when refuelling.
    - Use of a designated area for refuelling.
    - Emergency spill kit to be located near refuelling area.
    - Regular emptying of bunds.
    - Tanks should be located in secure areas to stop vandalism.

4.3 The above measures would help to ensure that untreated construction runoff would not be discharged to the surface water drainage system.

4.4 During construction all components of the drainage system should be constructed in accordance with relevant drawings, specifications and manufacturer's guidelines. Further to this Building Control should visit site on a regular basis to inspect completed works and ensure that the drainage system is installed correctly.

APPENDIX G
SUDS MAINTENANCE PLAN

DRAINAGE MAINTENANCE & MANAGEMENT PLAN

FOR PROPOSED LODGE DEVELOPMENT

PLAS COCH

WREXHAM

4.1 This Drainage Management and Maintenance Plan provides details of the plan proposed for maintenance and management of the drainage scheme associated with the proposed lodge development at Plas Coch, Wrexham.

4.2 On occupation of the development, the maintenance and management plan should be incorporated into the sites Operation and Maintenance Manual with the as-built drainage system operated and maintained in accordance with the regime set out in the tables below.

Table 1: Below Ground Drainage System - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove all litter and debris from external hard landscaped areas and adjacent landscaping, which may pose a risk to the performance of the system.	Monthly.
	Remove build-up of sediment / silt in catch-pits and dispose of oils / petrol residues using safe standard practices.	As required.
	Stabilise and mow adjacent landscaped areas and remove weeds.	
Remedial actions	Repair or rehabilitate inlet and outlets to ensure they are in good condition and operating as designed.	
	Remediate any landscaping, which has raised to within 50mm of the level of adjacent hard landscaping.	
Monitoring	Check of all inlets / outlets for blockages or evidence of physical damage with any necessary remedial action or clearance carried out if required.	On a monthly basis for the first 3 months of operation, thereafter every 6 months & following severe rainfall events.
	Inspect all surfaces for ponding, or silt accumulation. Record areas where water is ponding for more than 48 hours and carry out any remedial work deemed necessary.	After severe storms.

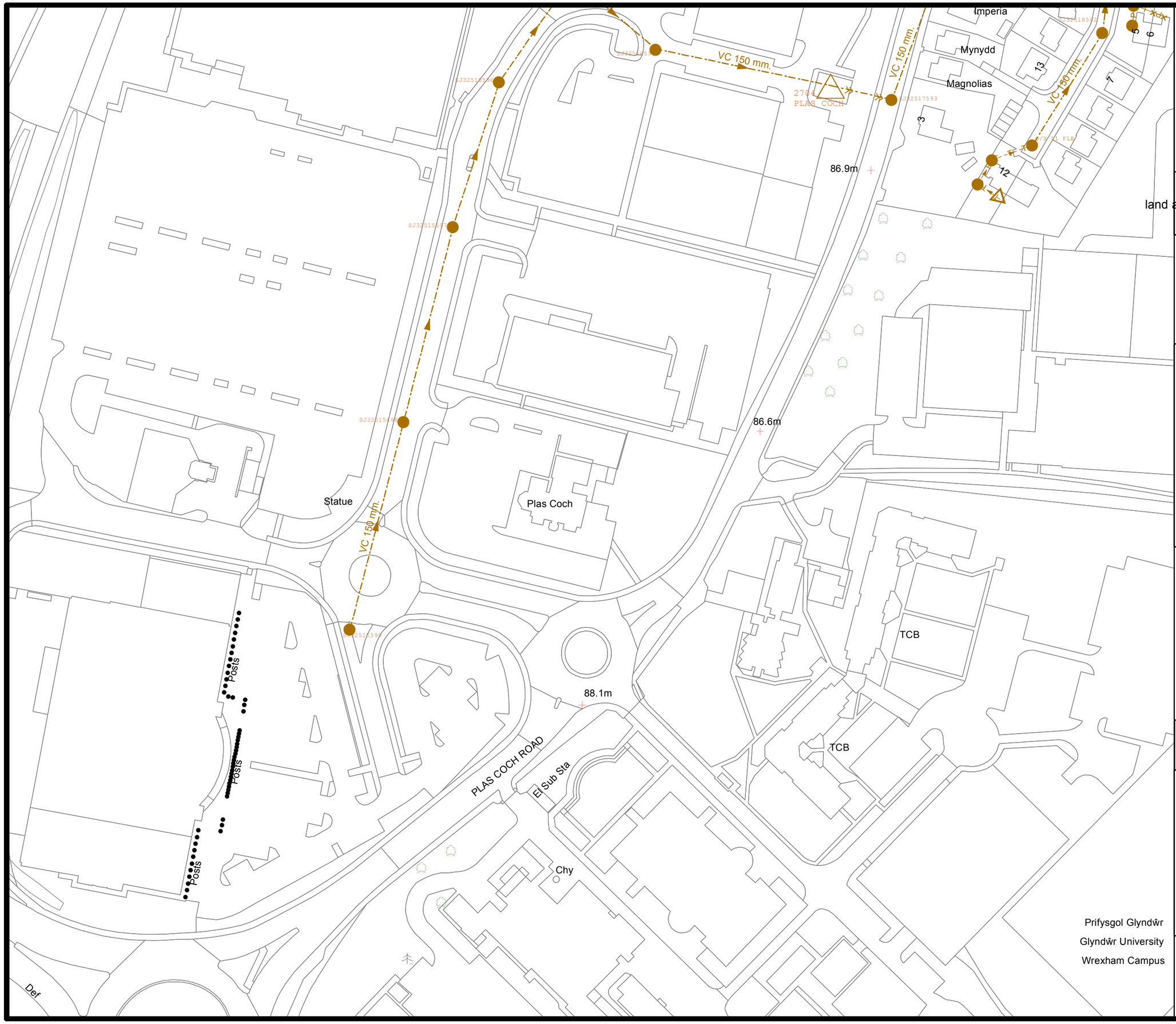
Table 2: Geocellular Soakaway - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
The following requirements should be read in conjunction with the Manufacturers Operation & Maintenance Manual.		
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for first 3 months of operation, then every 6 months.
	Debris removal from catchment surface (where may cause risks to performance).	Monthly.
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly / after severe storms.
	Remove sediment from pre-treatment structures.	Annually, or as required.
Remedial actions	Repair/rehabilitation of 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 and after large storms.

4.3 The Site Manager should ensure that the Maintenance Contractor tasked with carrying out any maintenance works provides a risk assessment and method statement that adopts best practice health and safety policies for maintenance personnel throughout the duration of any maintenance works. Measures may include:

- Ensure the use of safe systems of work and procedures are followed.
- Certificated operatives only to be used for all confined space entry.
- Ensure appropriate PPE is worn at all times including the use of safety goggles, ear defenders and other relevant equipment when using high pressure jetting.
- Do not work in weather conditions where flooding or surging is likely.
- Erect barriers where appropriate and provide adequate lighting.
- No operations to be carried out by operatives working alone.
- Time maintenance to not conflict with other on-site activities.
- Method statement to be prepared and approved prior to entry into confined space.

APPENDIX H
WELSH WATER SEWER RECORDS



Dŵr Cymru
Welsh Water

land at Plas Coch Public House, Plas Coch Road, Wrexham

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow
- Special purpose chamber
- Treatment works
- Pumping station
- Outfall
- Lamphole
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dwr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the Company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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