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Land off Sandy Lane, Ystradowen, Cowbridge

SAB COMPLIANCE STRATEGY

prepared for

Lewis Homes

Date: May 2023

Document ref no. 19351-R-601-SAB COMPLIANCE STRATEGY

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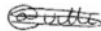


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SAB COMPLIANCE STRATEGY

19351

Document Control

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Approval	Director	Andrew Willis	22 May 2023	
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Signatories in this approval box have checked this document in line with the requirements of QuadConsult QMS Procedures				

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A	July 2023	Planning	
B	September 2023	Planning	
C	March 2024	Planning	
D			
E			
F			

Distribution

	Function Title	Company	Name
1		-	-
2			
3			

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References

- 1 CIRIA – The SuDS Manual (C753)
- 2 UK SUDS (www.uksuds.com)
- 3 Welsh Water Asset Plans
- 5 Google Maps
- 6 Ordnance Survey Mapping
- 7 BRE Digest 365 Soakaway Design
- 8 National Soil Resources Institute (SoilScapes)
- 10 NRW Online Flood Risk Map
- 12 Francis Sant Reports (D/WWG/D/1444)
- 13 Welsh Water Hydraulic report (DCWW 141 – SW135A)

Abbreviations

DCWW	DWR Cymru Welsh Water
A.O.D.	Above Ordnance Datum
FW	Foul Water
SW	Surface Water
SuDS	Sustainable Drainage Systems
l/s	Litres Per Second
NRW	Natural Resources Wales
SAB	Suds Approval Body

This document has been created during the design stage of the project and should not be used as a replacement for the final operation and maintenance requirements of the proposed works. It shall remain relative only to those features identified on the attached plan. This document is intended to support the development of the official operation and maintenance document which shall be the responsibility of the principle contractor.

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1.0 INTRODUCTION

- 1.1 QuadConsult Ltd was commissioned to produce a drainage strategy for a proposed development on land located at Ystradowen, Cowbridge.
- 1.2 This report will draw upon information supplied by the Client and that available within the public domain.
- 1.3 The aim of this report is to demonstrate that a suitable site-specific surface drainage strategy can be implemented to service the proposed development.

2.0 SITE LOCATION & DESCRIPTION

- 2.1 The site is located on Sandy Lane in Ystradowen, located in the Vale of Glamorgan. Approximately 3 miles north of Cowbridge nearest post code is CF71 7TZ, site coordinates E:301551, N:177865.
- 2.2 The existing site topography (Appendix 1) falls in a northerly direction. The site is currently open green space and is bounded to the north and east by greenfield areas. Sandy Lane and existing residential development to the south and Badgers Brook close with existing residential development to the west. The A4222 (Cowbridge Road) is located circa 90m to the north and west.
- 2.3 The redline land parcel site boundary is 1.58ha (Application Boundary 1.63ha)



Figure 1 – Site Location Plan and Application Boundary

3.0 EXISTING DRAINAGE

3.1 Land Drainage

Overland flow from the site flows in a northern direction into the adjacent green field (noted as very wet on the topographical survey) before discharging into a drainage ditch circa 85m north of the site boundary. The drainage ditch is likely to feed into the wider Nant Dyfrigi watercourse located 400m to the north.

3.2 Overland Flow & Exceedance Routes

Existing exceedance, overland flow paths would follow the existing topography and initially discharge into the greenfield to the north discharging into a drainage ditch as noted in section 3.1. The land to the north is noted as marsh/wetland and likely ecology rich. The presence of the marshland confirms limited infiltration at shallow depths on the site.

3.3 Surface Water Drainage Network

Welsh Water asset plans indicate no current surface water sewers within or immediately adjacent to the site. A network is indicated to the south of the site serving the existing residential development.

3.4 Foul Water Drainage Network

Welsh Water asset plans indicate no foul water sewer within the site curtilage, an extensive network is noted serving the surrounding existing residential properties.

3.5 Combined / Other Drainage

Welsh Water asset plans indicate no current combined water sewers within or immediately adjacent to the site.

4.0 EXISTING FLOOD RISK

4.1 NRW flood map indicates the development parcel is within a Flood Zone A – At little or no risk of fluvial or coastal / tidal flooding.

4.2 Flood Risk from Rivers

NRW flood mapping (Refer to Appendix 3) indicates little / no risk of flooding from main rivers.

4.3 Flood Risk from Sea

NRW flood mapping (Refer to Appendix 3) indicates little / no risk of flooding from the sea.

4.4 Flood Risk from Surface Water & Small Watercourses

NRW flood mapping (Refer to Appendix 3) indicates little / no risk of flooding from Surface water / small watercourses.

4.5 Flood Risk from Reservoir

NRW flood mapping (Refer to Appendix 3) indicates no risk of flooding from the reservoirs.

4.6 Other Flood Risk (Mines, Piped Network, etc)

NRW flood mapping (Refer to Appendix 3) indicates no recorded flood events. The presence of live Welsh Water assets adjacent to the site could pose a very limited flood risk due to failure of infrastructure. The topography of the site would direct any exceedance flows from Sandy Lane and the existing properties to the south into the site curtilage.

5.0 PROPOSED DRAINAGE STRATEGY

5.1 The proposed development consists of proposed residential areas with associated infrastructure including public open spaces and vehicular / pedestrian access arrangements.

5.2 Surface Water

The surface water drainage for the proposal will comply with SAB/SuDS protocols, and work within the site layout & constraints of the proposed development.

The proposed surface water discharge from the development will be captured, treated, and limited before discharging. The network will be designed for a 100-year storm event with 40% allowance for climate change. An allowance of 10% increase in development catchment through urban creep will also be catered for. The proposed design will utilise design principles outlined in section 6 and follow current local authority SAB and Welsh government guidance.

Following the Drainage hierarchy set out in section 6.0, onsite Infiltration testing indicates infiltration is not viable onsite as a primary route to dispose of surface water. It is noted that the saturated topsoil layer across the site indicates lateral movement and overland flow of surface water towards the existing drainage ditch to the north. The logged ground water levels 2.1-3.0m bgl confirm the saturated top layer is captured storm water rather than ground water.

As an initial approach following this strategy it is envisaged that the plots would drain through localised bioretention features located within garden / landscape areas, along with permeable surfacing to hard paved areas. This will allow the plot drainage to remain private and under the responsibility of the homeowner for future maintenance. The wider network and associated drainage features will fall under the SAB adoption remit.

General development principles will allow the wider network including highway drainage to flow through bio-retention and/or conveyance features (Swales, Tree pits, Rain gardens, etc) before discharging into local water courses via the attenuation basin feature and flow control devices.

The proposed development will aim to discharge from a detention basin to the north of the land parcel at an agreed limited rate. A greenfield discharge rate of 8.1l/s has been agreed with VoG SAB, a possible reduction in line with catchment area may be required. Additional storage may be required to accommodate any reduction in allowable discharge rates. Possible use of drive subbase with small diameter flow control chamber / devices may offer the required additional storage within a cascaded network.

Under the current Welsh Government policy, any surface water infrastructure conveying flows from more than 1 curtilage requires adoption by the local authority SAB.

Open market plots will fall under this arrangement. Council & housing association developments can be treated as a single curtilage where houses are to be kept under their ownership and not offered for open market sales in the future.

Any infrastructure being adopted by the local authority SAB will be subject to commuted sums calculated for the lifetime maintenance and end of life replacement construction costs. Under a single development curtilage, the surface water elements can be kept private. In both instances the adopted / private network must be maintained in accordance with the project maintenance schedule and CIRIA SuDs manual guidance.

5.3 Foul Drainage

Following an initial capacity enquiry, Welsh Water (DCWW) confirmed the local foul network has sufficient capacity for the proposed development. Following onsite investigation works and confirmation from DCWW, a gravity connection into an existing chamber to the north of the site boundary. The developer has agreed access rights to lay drainage to the chamber with the 3rd party landowners. Initial discussions with DCWW have confirmed a reduced easement and welded joint construction through areas of root protection zones for existing trees.

A section 104 application with Welsh Water would be required for any sewers conveying flows from more than 1 dwelling or crossing land boundaries. A Section 106 agreement is required to allow a connection into any of the existing DCWW assets.

5.4 Land Drainage

Although no existing land drainage network is currently evident, additional investigation / confirmation is required.

The existing overland flow paths would follow the existing topography utilising infiltration before excess flows discharge onto the existing marshland /wet greenfield to the north prior to discharge into an existing drainage ditch north of the site.

5.5 Other Drainage

No other drainage is noted within the land boundary.

6.0 COMPLIANCE WITH NATIONAL SUDS STANDARDS

The following sections detail the design principles that will be incorporated in the development proposals for the scheme and the measures incorporated to satisfy the requirements for future SAB approval.

6.1 Standard S1 – Surface Water Destination

Priority Level 1 – Reuse of Rainwater

The use of SuDS planters, Rain gardens & Rain Butts are proposed to intercept roof runoff and act as a point of source control. This will allow a limited re-use of rainwater and to facilitate the planter and associated flora.

Priority Level 2 – Infiltration to Ground

Infiltration tests have been carried out by Integral Geotechnique, Initial results have proved inconclusive, rates between 1.0×10^{-6} and 1.2×10^{-5} have been noted and may offer a partial allowance for direct discharge to ground as part of the wider strategy.

Priority Level 3 – Discharge to Water Body

Applicable for this development. / Attenuation with controlled discharge based on agreed rate. Planned discharge to local watercourse upstream of Nant Dyfrgi.

Priority Level 4 – Discharge to Surface Water Sewer, Highway Drain, or other System

Deemed as not required unless infiltration and watercourse connection prove unviable, further investigation required.

Priority Level 5: Discharge to a Combined Sewer – N/A

Deemed not required for this development.

6.2 Standard S2 – Surface Water Runoff Hydraulic Control

It is proposed that the storm water network system will be designed such that it is sufficient to accommodate critical storm duration flows in the 100yr+40% event. Calculations are appended. As noted above there have been no reductions made to the sizing of the network features to reflect reductions afforded by the rain gardens or operation of the SuDS planters. Therefore, allowing for a worst-case scenario. An allowance of a 10% increase in permeable catchment has also been included for future urban creep where applicable.

First 5mm Interception

Interception mechanisms will be required to ensure compliance with the requirement of zero runoff for the first 5mm rainfall for 80% of storm events during the summer and 50% in winter.

The provision of SuDS planter features and rain gardens along with flows through permeable drive subbase will contribute to the objective of first 5mm interception. Deemed to comply with the SAB standards.

Exceedance/Blockage

Any exceedance flows will follow surface topography. The topography is such that any excess flows will be directed in a southern direction towards the existing watercourse and open greenfield areas.

6.3 Standard S3 – Water Quality

The proposed SuDS treatment train devices (SuDS planters, Rain Gardens / Bio-Retention, Permeable paving, and Detention Basin) will deliver the requisite cleansing and filtration of runoff for this residential (low pollution hazard level) development.

6.4 Standard S4 – Amenity

The soft suds features (SuDS planters, Rain Gardens and Detention Basin) will be carefully designed and integrated into the landscaping scheme for the development, to promote aesthetics and well-being as well as any designed drainage function.

6.5 Standard S5 – Biodiversity

The soft suds features (SuDS planters, Rain Gardens and Detention Basin) will be carefully designed with gradients/profiles, planting species and soil properties selected to ensure suitable habitat is delivered to promote biodiversity. Planting information is included within the SUDS planting information. These proposals will augment the green infrastructure element of the design proposals to demonstrate a robust response to this Standard.

6.6 Standard S6 - Construction, Operation and Maintenance and Structural Integrity

Initial infrastructure maintenance will be dealt with at a property level as many of the first phase systems employed are contained within a single property curtilage. Wider SuDS features will be offered for adoption through the SAB application process, extents to be agreed during pre-SAB discussions. All of the proposed SuDS infrastructure will be located with accessible areas for ease of maintenance. The surface water network including any land drainage will be designed to be fully roddable and jettable, with suitably positioned rodding eyes and mini-access chambers.

The SuDS devices are low maintenance surface/shallow items with established regular maintenance regimes.

The proposed design solution will be designed in accordance with the SuDS manual and is generally served by shallow SuDs features and accessible details. There are no inherent safety issues with the proposed scheme.

The on-property drainage infrastructure will be managed by the Tenant. The principal issue is the management of the SuDS planters / Rain Gardens, which primarily involves periodic inspection to check the overflows are clear and ensure the free-flowing operation. These inspections will also serve to monitor the build-up of any silt in the system to facilitate any cleaning required.

7.0 SUMMARY & RECOMMENDATIONS

7.1 SUMMARY

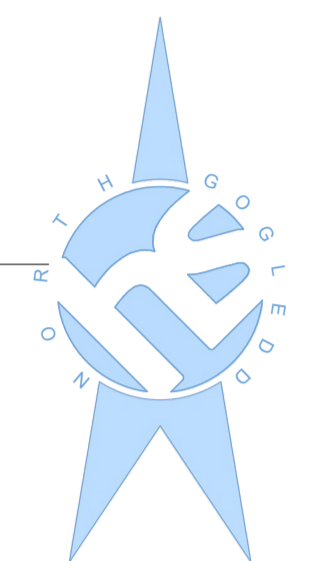
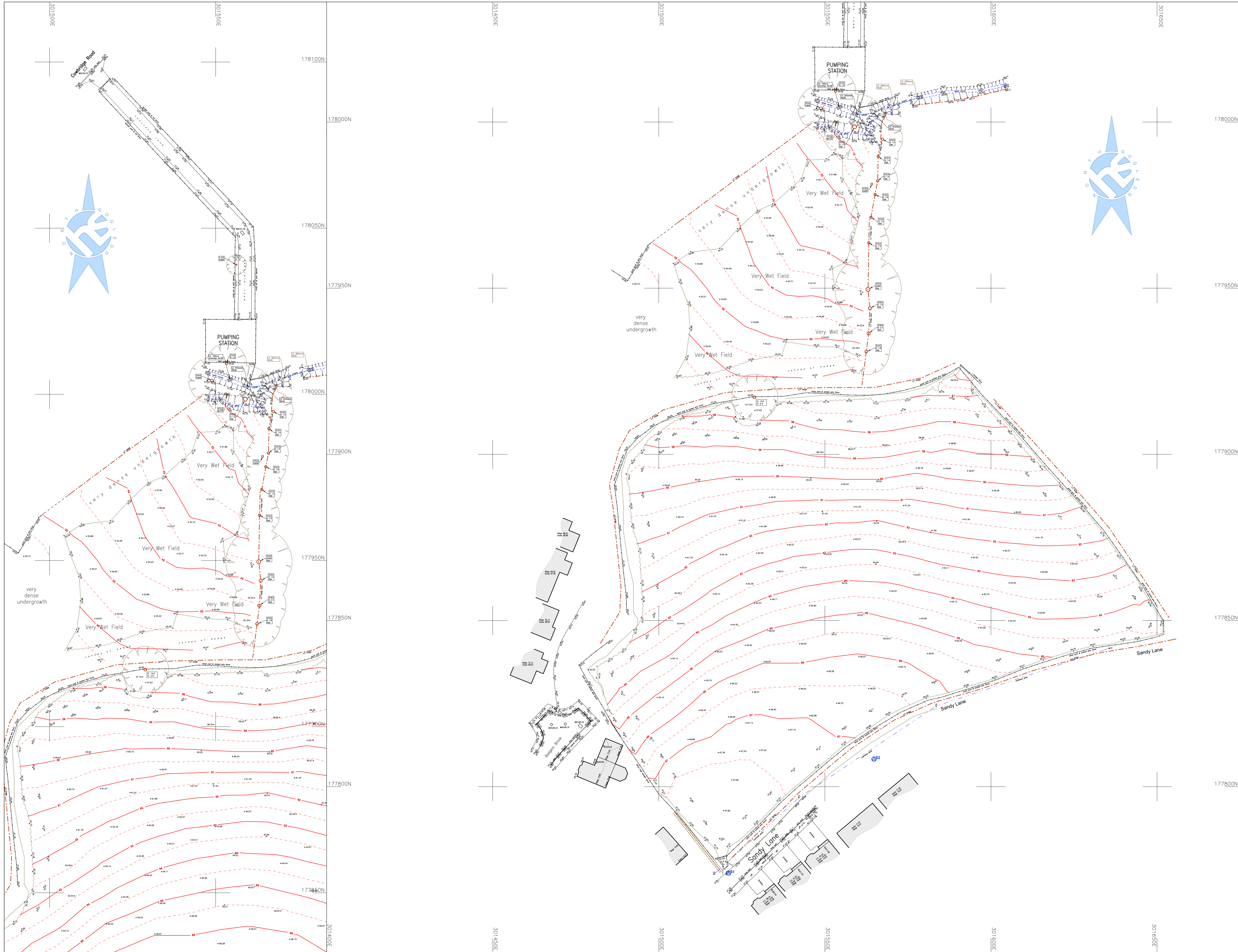
The proposed development will follow current Welsh Government, local authority, and Welsh Water guidance in relation to drainage strategy. Any element of the proposed foul network conveying flows from more than one dwelling will be offered to DCWW through the Section 104 application process. The surface water network will follow the principles set out by the Ciria SuDs manual (C753) and Local SAB requirements. The surface water will be collected, treated, and discharged to a viable source at an acceptable rate following SAB hierarchy guidance. Where appropriate, surface water elements will be adopted by the local authority through SAB application process.

7.2 RECOMMENDATIONS

The following actions are recommended to allow a robust suitable site-specific surface and foul water drainage strategy can be implemented to service the proposed development.

- Further Infiltration testing to BRE365 at proposed suds feature formation levels if SAB require.
- Walkover and possible Dye testing to confirm drainage ditch to the north discharges to Nant Dyfrgi.
- PreSAB application and discussion with Vale of Glamorgan SAB to confirm strategy and acceptable discharge rates.
- S104 & S106 to be submitted to DC/WW

APPENDIX 1 – EXISTING SITE SURVEY



Legend:

- Kerb line (& top of kerb)
- Drop Kerb (& top of kerb)
- Surface edge (type of surface annotated)
- Embankment (with slope demarkation)
- Fenceline (type and height as annotated)
- Wall (type and height as annotated)
- Hedgeline
- Barrier (type as annotated)
- Gate
- Stile
- Building
- Telegraph pole (and overhead wires)
- EP Electricity pole (and overhead wires)
- LP Lighting Column
- Road Gully
- MHCL 50.00 Manhole and cover level
- I/CCL 50.00 Inspection Chamber and cover level
- BT Telecomms. service box
- CATV Cable TV service box
- EB Electricity / BT Control Gear Box
- W Stop Tap (Water)
- SV Stop Valve (Water)
- AV Air Valve (Water)
- FH Fire Hydrant
- Gas Gas Valve
- Foliage (Ground vegetation) extent
- Foliage (Overhanging canopy) extent
- RS Road Sign (multiple)
- RS+ Road Sign (single)
- M+ Marker Post
- Tree with Spread/Girth/Species
- S1 Survey Station and Reference

Notes:
 Any surveyed features not shown above are annotated appropriately. Tree species is only annotated where known. Service covers are surveyed where accessible. Healer Surveys cannot accept liability for missing covers due to them being buried or obscured by parked vehicles at the time of site visit.

Station Table:

Station	Easting	Northing	Level
S1	301520.993	177773.978	67.366
S2	301564.778	177808.296	66.119

Grid Origin and Level Datum:
 Ordnance Survey GPS OSG36(15) Grid and Levels used.
 GPS Grid to Ground Scale Factor used 1.000

Revisions:

Revision	Description
A	Additional survey added 10/01/2020 - JHP
B	
C	
D	
E	
F	
G	
H	

Client:

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Project:
New A1 Sheet

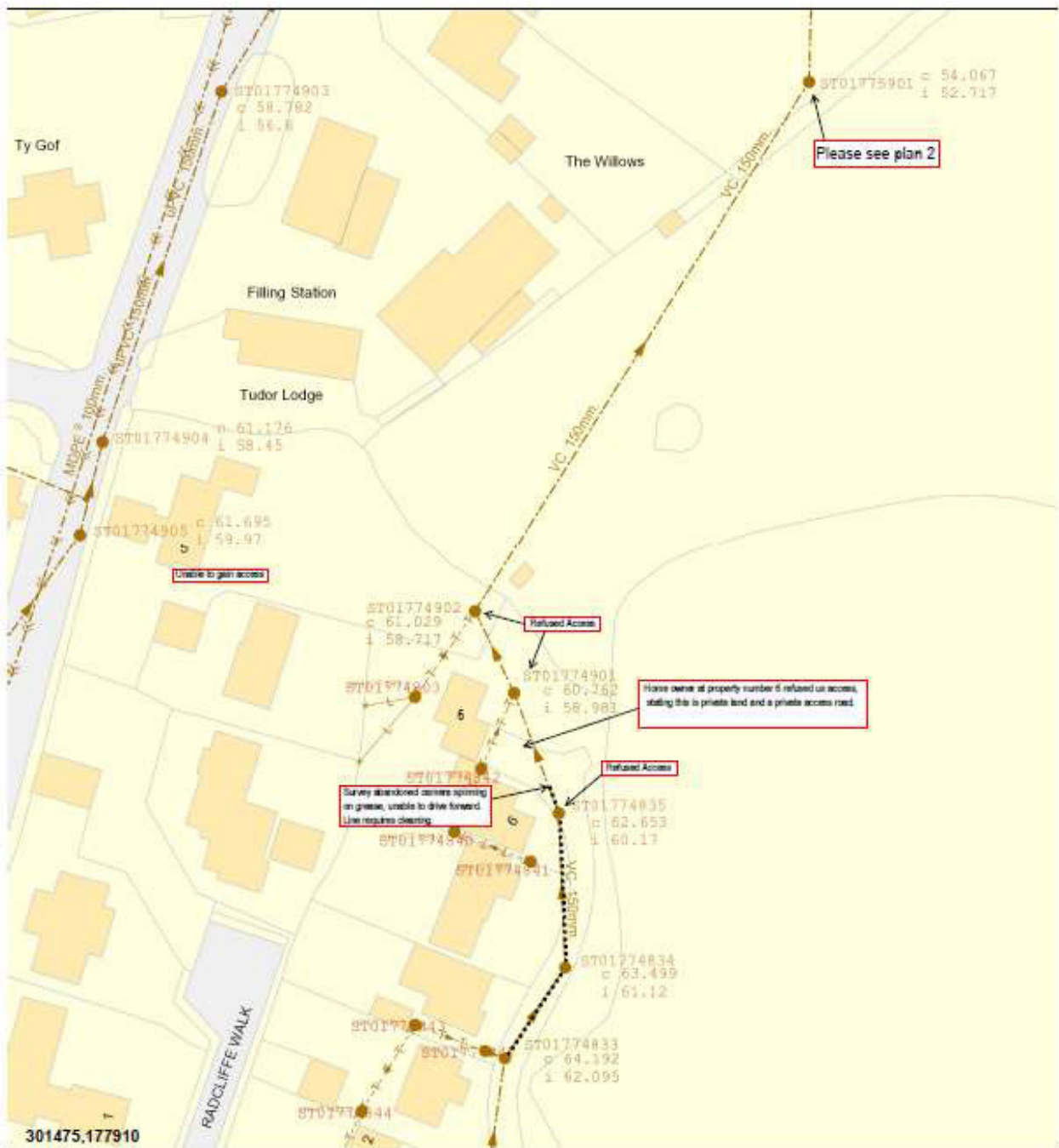
Drawing:
Topographic Survey

Date: January 2020
 Surveyed: DT / JHP
 Drawn: DT / JHP
 Checked: RE

Scale: 1:500	Sheet Size: A1	Sheet No: 1 of 1
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Job No: **P3113** Rev: **A**

APPENDIX 2 – EXISTING DRAINAGE SURVEY



Draintech Surveys Ltd
Job / Plan Ref : 14177 - 01 - 001

Scale: 1:750

18/03/2022

LEGEND

●	Block Valve	→	Gravity Sewer
◆	Air-View SINGLE	⊙	Rising Main
X	Tap	△	Outlet
⊗	Pressure Reducing Valve	⊙	Pumping Station
□	Water	⊙	Lamp Pole
■	Bulk Meter	⊙	Controlled Sewer Overflow
⊙	Pipe Hydrant	⊙	Special Purpose Chamber
⊙	Cap	⊙	Treatment Works
⊙	Non Dwr Cymru Existing Distribution Main	⊙	Private Sewer Transfer
⊙	Inspection Chamber	⊙	Latent Drain
		⊙	Over/under other utilities (to see type)
		⊙	Control
		⊙	Subsidence
		⊙	Foul

EXACT LOCATION OF ALL APPARATUS TO BE DETERMINED ON SITE

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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 (PF)) 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 Cyfyngedig (the Company) gives this information as to the position of its underground apparatus by way of general guidance only and 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 cause of locating the apparatus before carrying out any excavations rests entirely on you. The information which is supplied hereby by the company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 based particular, but without prejudice to the generality of that foregoing, it should be noted that the records that are available to the company may not disclose the existence of a drain sewer or disposal main laid before 1 September 1989, or if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the company's right to be compensated for any damage to its apparatus.



DRAINTECH

helping to improve the drainage network

Drainage Survey Report

Job Number : 14177

Project Number: 1

Project Name: Ystradowen

Company: Quad Consult

Site Date: 21-03-2022

DrainTech Surveys Ltd| Atlantic House| Chamwood Park| Bridgesid| CF31 3PL| 01656 767000| www.draintech.co.uk




	Draintech Surveys Ltd Atlantic House, Chamwood park, CF31 3PL
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Project Name	Project Number	Project Date
14177 - Ystradowen	14177 - 01	21/03/2022

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Section Item 2: ST01774834 > ST01774835 (ST01774834X)	2
Section Item 3: ST01774835 > ST01774901 (ST01774835X)	3

 <p>DRAINTECH Helping to improve the drainage network</p>	Draintech Surveys Ltd Atlantic House, Chamwood park, CF31 3PL	
Project Information		
Project Name 14177 - Ystradowen	Project Number 14177 - 01	Project Date 21/03/2022
Client		
Company:	Quad Consult	
Contact:	Steve McCarthy	
Mobile:	07775697329	
Site		
Company:	Draintech Surveys Ltd	
Contact:	Martin Cox	
Contractor		
Company:	Draintech Surveys Ltd	
Department:	Process Co-Ordinator	
Street:	Atlantic House, Chamwood park	
Town or City:	CF31 3PL	



				DrainTech Surveys Ltd Atlantic House, Chamwood park, CF31 3PL					
Section Inspection - 21/03/2022 - ST01774833X									
Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR		
1	1	21/03/22	10:05	Not Specified	No Rain Or Snow	No	ST01774833X		
Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID		
M.COX		YXH		Ipek	Not Specified	Public Sewer	Not Specified		
Town or Village:		Ystradowen		Inspection Direction:	Downstream	Upstream Node:	ST01774833		
Road:		Off Sandy Lane		Inspected Length:	14.08 m	Upstream Pipe Depth:	2.370 m		
Location:		Road		Total Length:	14.08 m	Downstream Node:	ST01774834		
Surface Type:				Joint Length:		Downstream Pipe Depth:	2.300 m		
Use:	Foul			Pipe Shape:	Circular				
Type of Pipe:	Gravity drain/sewer			Dia/Height:	150 mm				
Flow Control:	No flow control			Material:	Vitrified clay				
Year Constructed:	Not Specified			Lining Type:	No Lining				
Inspection Purpose:	Investment planning			Lining Material:	No Lining				
Comments: Recommendations:									
Scale:	1:122	Position [m]	Code	Observation	MPEG	Photo	Grade		
Depth: 2.37 m ST01774833									
0.00		MH	Start node type, manhole, reference number: ST01774833	00:00:07					
0.00		WL	Water level, 5% of the vertical dimension	00:00:08					
0.40	S01	DEG	Attached deposits, grease from 7 o'clock to 5 o'clock, 5% cross-sectional area loss, start: Patchy	00:00:13					
2.06	O01	DEG	Attached deposits, grease from 7 o'clock to 5 o'clock, 10% cross-sectional area loss, change: Patchy	00:01:09					
6.00	O01	DEG	Attached deposits, grease from 7 o'clock to 5 o'clock, 5% cross-sectional area loss, change: Patchy						
13.72	F01	DEG	Attached deposits, grease from 7 o'clock to 5 o'clock, 5% cross-sectional area loss, finish: Patchy				3		
14.08		MHF	Finish node type, manhole, reference number: ST01774834	00:01:35					
Depth: 2.30 m ST01774834									
Construction Features				Miscellaneous Features					
Structural Defects				Service & Operational Observations					
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	1	4.0	4.0	56.0	4.0
14177 - Ystradowen					1				

		DrainTech Surveys Ltd Atlantic House, Chamwood park, CF31 3PL							
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Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID		
M.COX		YXH		Ipek	Not Specified	Public Sewer	Not Specified		
Town or Village:		Ystradowen		Inspection Direction:		Downstream			
Road:		Off Sandy Lane		Inspected Length:		21.05 m			
Location:		Road		Total Length:		21.05 m			
Surface Type:				Joint Length:					
Upstream Node:		ST01774834		Upstream Pipe Depth:		2.300 m			
Downstream Node:		ST01774835		Downstream Pipe Depth:					
Use:	Foul			Pipe Shape:	Circular				
Type of Pipe:	Gravity drain/sewer			Dia/Height:	150 mm				
Flow Control:	No flow control			Material:	Vitrified clay				
Year Constructed:	Not Specified			Lining Type:	No Lining				
Inspection Purpose:	Investment planning			Lining Material:	No Lining				
Comments:		Private , refused access							
Recommendations:									
Scale:	1:183	Position [m]	Code	Observation	MPEG	Photo	Grade		
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0.40	S01	DEG Attached deposits, grease from 7 o'clock to 5 o'clock, 5% cross-sectional area loss, start: Patchy	00:00:12						
3.14	C01	DEG Attached deposits, grease from 7 o'clock to 5 o'clock, 10% cross-sectional area loss, change: Patchy	00:00:37						
19.56	LD	Line deviates down: Slight	00:06:46						
21.05	F01	DEG Attached deposits, grease from 7 o'clock to 5 o'clock, 10% cross-sectional area loss, finish: Patchy	00:07:14	3					
21.05	MHF	Finish node type, manhole, reference number: ST01774835	00:07:15						
ST01774835 Depth: m									
Construction Features				Miscellaneous Features					
Structural Defects				Service & Operational Observations					
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	1	4.0	4.0	84.0	4.0

		DrainTech Surveys Ltd Atlantic House, Chamwood park, CF31 3PL							
Section Inspection - 21/03/2022 - ST01774835X									
Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR		
3	1	21/03/22	10:35	Not Specified	No Rain Or Snow	No	ST01774835X		
Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID		
M.COX		YXH		Ipek	Not Specified	Public Sewer	Not Specified		
Town or Village:		Ystradowen		Inspection Direction:		Downstream			
Road:		Off Sandy Lane		Inspected Length:		2.02 m			
Location:		Road		Total Length:		2.02 m			
Surface Type:				Joint Length:					
Upstream Node:				Upstream Pipe Depth:		ST01774835			
Downstream Node:				Downstream Pipe Depth:		ST01774901			
Use:	Foul			Pipe Shape:	Circular				
Type of Pipe:	Gravity drain/sewer			Dia/Height:	150 mm				
Flow Control:	No flow control			Material:	Vitrified clay				
Year Constructed:	Not Specified			Lining Type:	No Lining				
Inspection Purpose:	Investment planning			Lining Material:	No Lining				
Comments: No Manhole Depths - Private - Refused access									
Recommendations:									
Scale:	1:50	Position [m]	Code	Observation	MPEG	Photo	Grade		
0.00	MH	Start node type, manhole, reference number: ST01774835	00:00:05						
0.00	WL	Water level, 5% of the vertical dimension	00:00:06						
0.00	S01	DEG Attached deposits, grease from 7 o'clock to 5 o'clock, 10% cross-sectional area loss, start: Patchy	00:00:10						
2.02	F01	DEG Attached deposits, grease from 7 o'clock to 5 o'clock, 10% cross-sectional area loss, finish: Patchy	00:02:50				3		
2.02	SA	Survey abandoned: Line needs cleaning - Spinning on grease	00:02:52			1			
Construction Features				Miscellaneous Features					
Structural Defects				Service & Operational Observations					
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	1	4.0	5.9	12.0	5.0

	Draintech Surveys Ltd Atlantic House, Charmwood park, CF31 3PL
---	--

Section Pictures - 21/03/2022 - ST01774835X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
3	Downstream	ST01774835X		



1, 00:02:52, 2.02 m

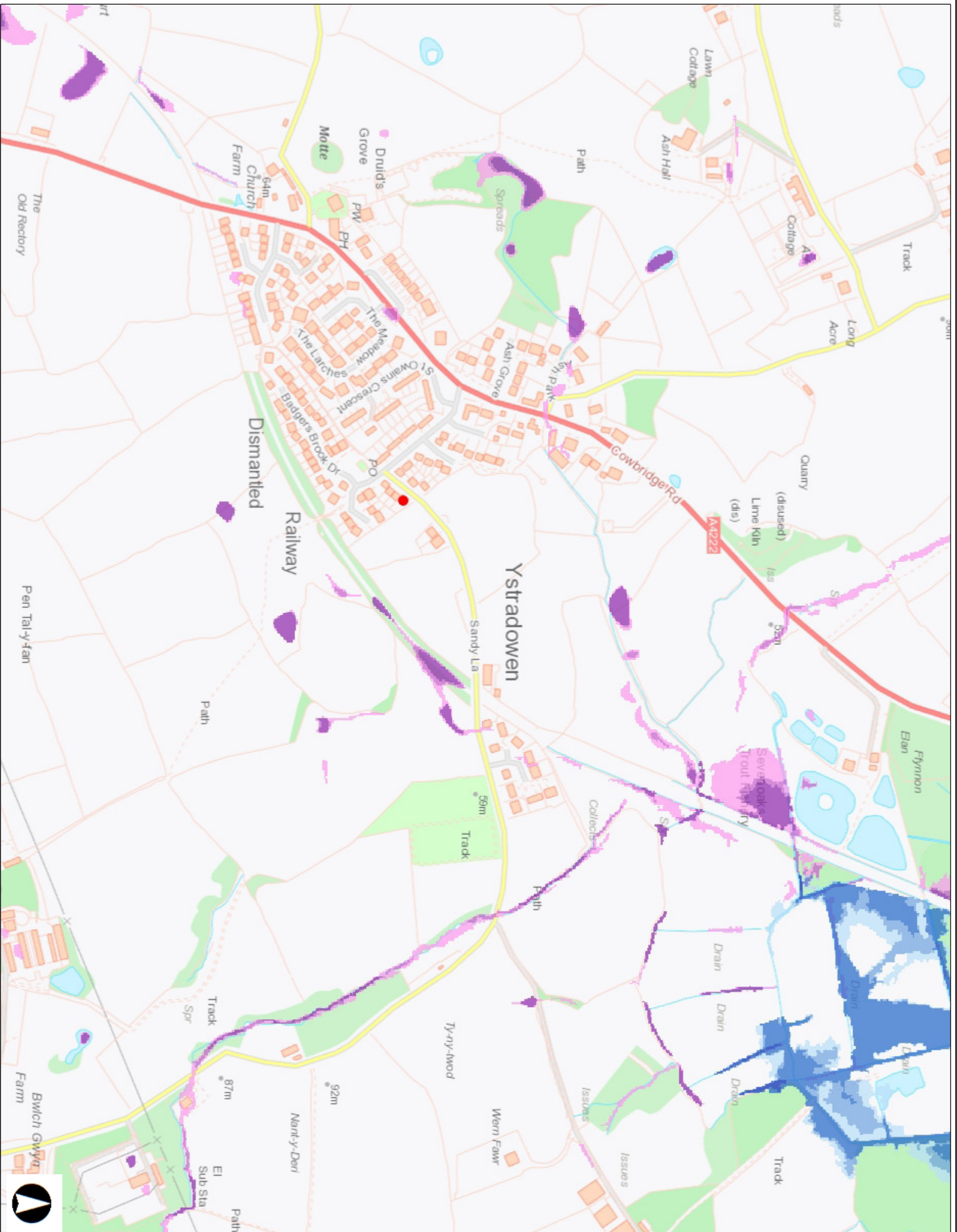
Survey abandoned, Line needs cleaning - Spinning on grease

APPENDIX 3 – FLOOD RISK MAP

Map Perygl Llifogydd / Flood Risk Map -

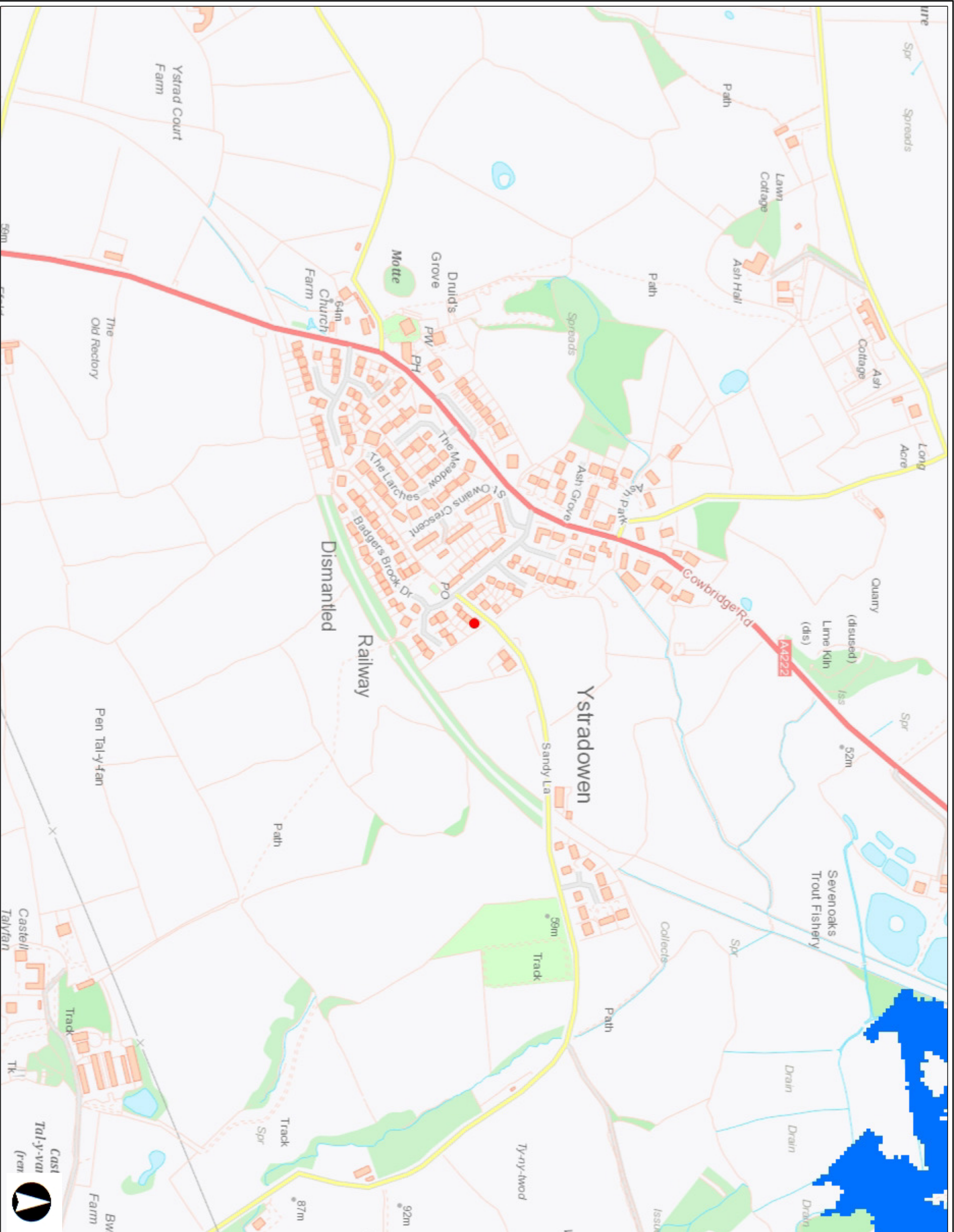
Allwedd / Map Key

- Risk Level Under Review
- Flood Risk from Rivers - Extent
 - High
 - Medium
 - Low
- Flood Risk from the Sea
 - High
 - Medium
 - Low
- Flood Risk from Surface Water & Small Watercourses - Extent
 - High
 - Medium
 - Low



Graddfa / Scale at A3 1 : 4,999

Dyddiad / Date
12/06/2023



Cyfoeth Naturiol Cymru
Natural Resources Wales

Map Perygl Llifogydd / Flood Risk Map -

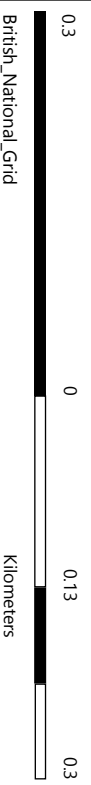
Allwedd / Map Key

- Zone C1
- Zone C2
- Zone B
- Zone A

Graddfa / Scale at A3 1: 4,999

Dyddiad / Date
12/06/2023

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British_National_Grid

APPENDIX 4 – CONCEPT MASTERPLAN

Accommodation Schedule			
House Name	Code	Structural Area (ft ²)	No. of Units / Total Area
Open Market Units			
Hyatt	HV 3	978	8 / 7824
Burnaby	BU 3	1021	5 / 5105
Shelby	SH 4	1213	8 / 9704
Roxbury	ROX 4	1417	3 / 4251
Thornbury	TH 4	1479	3 / 4437
Sub Total			27 / 31321
Affordable Units			
1 Bed Flats	2.1.1	557	8 / 4456
2 Bed House	4.2.1	850	9 / 7650
3 Bed House	5.3.1	1003	2 / 2006
Sub Total			19 / 14112
Total			46 / 45433



- Site Key**
- Application Boundary
 - Social Rented Unit
 - LCHO Unit
 - 1.8m Close Board Fence
 - 1.8m Screen Wall
 - 1.2m Wall (no Screen, Blk. Stone or Front Extensions)
 - 1.2m Ball Top Railings
 - Translocated Hedgerow
 - Proposed Tree Planting
 - Existing Tree and RPPZ
 - Refuse Storage Area
 - Refuse Collection Point
 - Bicycle Storage Shed
 - Indicative Rain Gardens
 - Proposed Retaining Walls and Steps
 - Indicative Location of Photovoltaic Panels
 - Refer to supplier technical specification for accurate information
 - Indicative Location of Air Source Heat Pump
 - Refer to supplier technical specification for accurate information

Revision History

REV	DESCRIPTION	DATE
A	Initial design and planning	01.03.24
B	Final design and planning	01.03.24
C	Final design and planning	01.03.24
D	Final design and planning	01.03.24
E	Final design and planning	01.03.24
F	Final design and planning	01.03.24
G	Final design and planning	01.03.24
H	Final design and planning	01.03.24
I	Final design and planning	01.03.24
J	Final design and planning	01.03.24

Client Information

CLIENT: Lewis Homes

JOB TITLE: Sandy Lane, Ystradowen

DRAWING TITLE: Proposed Site Layout

SCALE: A2 | DATE: June 23 | DRAWN BY: RW

1:500 | DRAWING NO.: TP-01 | REVISION: J

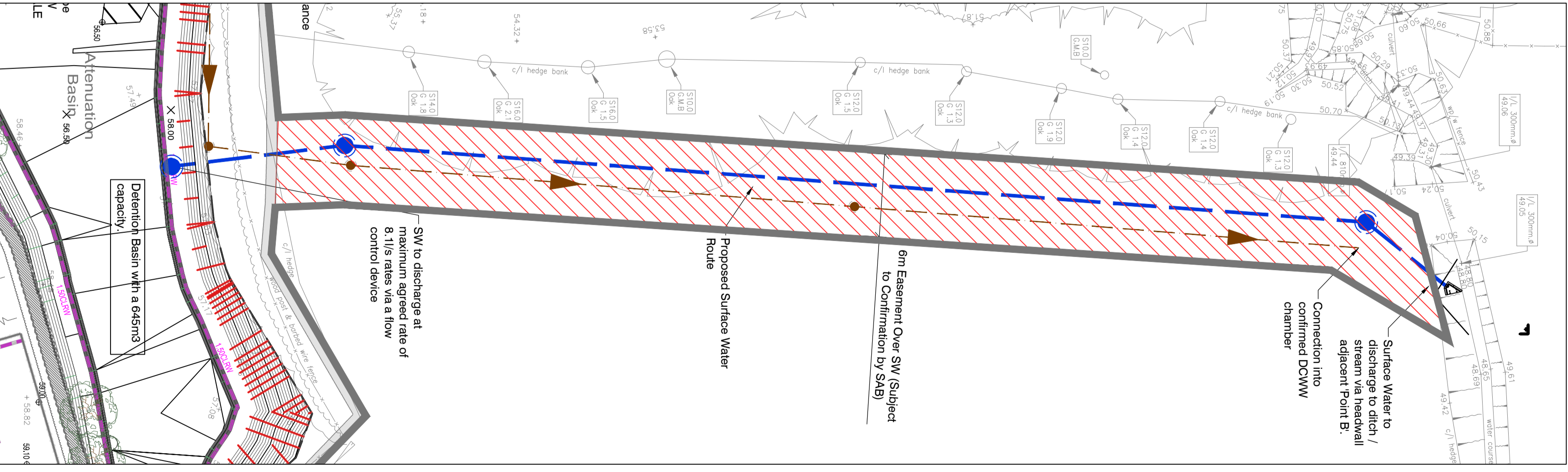
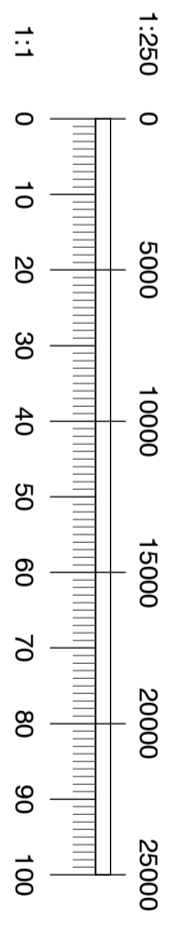
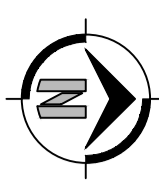
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APPENDIX 5 – PROPOSED DRAINAGE STRATEGY PLAN



Storage Notes:

- Total Development Site area = 1.58ha
- Approximate Discharge Rate = 5.41/s
- Impermeable area incl. UC = 0.79ha
- Estimated Storage = 538 m³ (incl. forced storm required based on hydrocraze)
- Available Volume in Pond Basin with Retaining Wall = 455m³
- Confirmation required from the VOG for the wall arrangement and siting

LEGEND:

- Proposed Retaining Wall - Slope on edge to be considered for walls adjacent gardens / paths for heights up to 0.65m
- Proposed Surface Water Retaining Wall (Refer to S1000)
- Proposed Basin Retaining Wall (Refer to S1000)
- Proposed Underhold
- Proposed Tanking
- Proposed Ground Level
- Proposed Finished Floor Level
- Proposed Embankment
- Proposed Pumping Station Position
- Proposed Filling Main
- Proposed Permeable Paving (Treated) - subject to location approval by VOG
- Proposed Sewer position
- Proposed Rain Gutter
- Permeable Paving Non-Vehicle Loading
- Permeable Distribution Core
- Annual/Storm Size Trap and Flow Control Chamber
- SAB Adoptable Pav / Curbed Drain
- Surface / Direct Surface Water Discharge
- Offsite Connection SAB and Wash Water
- Offsite Connection (VOG)

NOTES:

- Basin/ponds/Trenches to be provided to all flat surface water drainage
- Steps not indicated, to be considered with adjacent retaining wall
- S1000 features indicative only and subject to discussions with VOG
- CC
- Permeable paving to be considered within paid drainage - primarily maintained by house owner

GENERAL NOTES:

- This drawing is to be read in conjunction with and checked against all other drawings, engineering details, specialist documents provided, and other drawings on the site.
- Any correspondence relating to the drawings are to be made to the Design Team.
- All dimensions and levels are in metres, U.N.O.
- Do not scale from this drawing - use figure dimensions
- This drawing is schematic for clarity only, positions of structures and materials may vary on site due to site conditions.
- Surface water drainage subject to S104 / SAB approval
- Final Drainage subject to SAB approval with relevant water authority
- Part of building regulations and the developer's warranty provider
- Without relevant S104, S106, S170, S18, OWI etc agreement being in place with the relevant authorities.

<p>QualConsult ENGINEERS & ARCHITECTS</p> <p>01927 794100 www.qualconsult.co.uk</p> <p>QualConsult ENGINEERS & ARCHITECTS</p> <p>01927 794100 www.qualconsult.co.uk</p>	<p>Lewis Homes</p> <p>Ystradowen Preliminary Engineering Appraisal</p>	<p>FOR INFORMATION ONLY</p> <p>Project No: 19351 Drawing No: SK101 Date: Oct 19 Scale: 1:250 Author: [Name]</p>
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APPENDIX 6 – PROPOSED LANDSCAPE ARCHITECTS LAYOUT AND SCHEDULE

APPENDIX 7 – EXISTING CATCHMENTS & DISCHARGE RATES



Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Mark Llewelin
Site name:	Sandy Lane
Site location:	Ystradowen

Site Details

Latitude:	51.49086° N
Longitude:	3.41925° W
Reference:	1396479956
Date:	Sep 06 2023 12:03

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1.53

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	2	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.37

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	1180	1180
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 30 years:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Growth curve factor 200 years:	2.46	2.46

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates		
	Default	Edited
Q_{BAR} (l/s):	5.14	8.1
1 in 1 year (l/s):	4.52	7.13
1 in 30 years (l/s):	9.14	14.41
1 in 100 year (l/s):	11.2	17.65
1 in 200 years (l/s):	12.64	19.92

APPENDIX 8 – INFILTRATION TEST RESULTS
(Extracted from Integral Geotechnique Report 12604/JJ/20/SI)

7.4 SOIL INFILTRATION TESTS

Soil infiltration testing was carried out at 6No locations across the site in trial pits TP03, TP06, TP05-A, TP07, TP08 and TP12.

The trial pits were rapidly filled with water from a tractor-towed agricultural bowser and the water level monitored over a period of time. Where infiltration and time allowed, repeat cycle tests were carried out in general accordance with BRE365.

The results of the soakaway testing are summarised below and presented in Appendix E. A summary of the results is presented in Table 9.

Test Location	Test Depth (m bgl)	Soil Infiltration Rate (m/s)		
		Test Cycle 1	Test Cycle 2	Test Cycle 3
TP03	2.6	7.0×10^{-8}	n/a	n/a
TP06	2.1	7.4×10^{-6}	n/a	n/a
TP05-A	1.5*	1.2×10^{-5}	n/a	n/a
TP07	1.7	2.1×10^{-5}	2.1×10^{-5}	n/a
TP08	1.4	8.2×10^{-6}	n/a	n/a
TP12	2.0	7.9×10^{-6}	n/a	n/a

* It should be noted that the sides of the excavation in TP05-A collapsed during the soakaway test from 1.50m back up to 0.80m bgl. The soakaway test was continued and a soil infiltration rate of 1.2×10^{-5} m/s was calculated. This result should be used with caution.

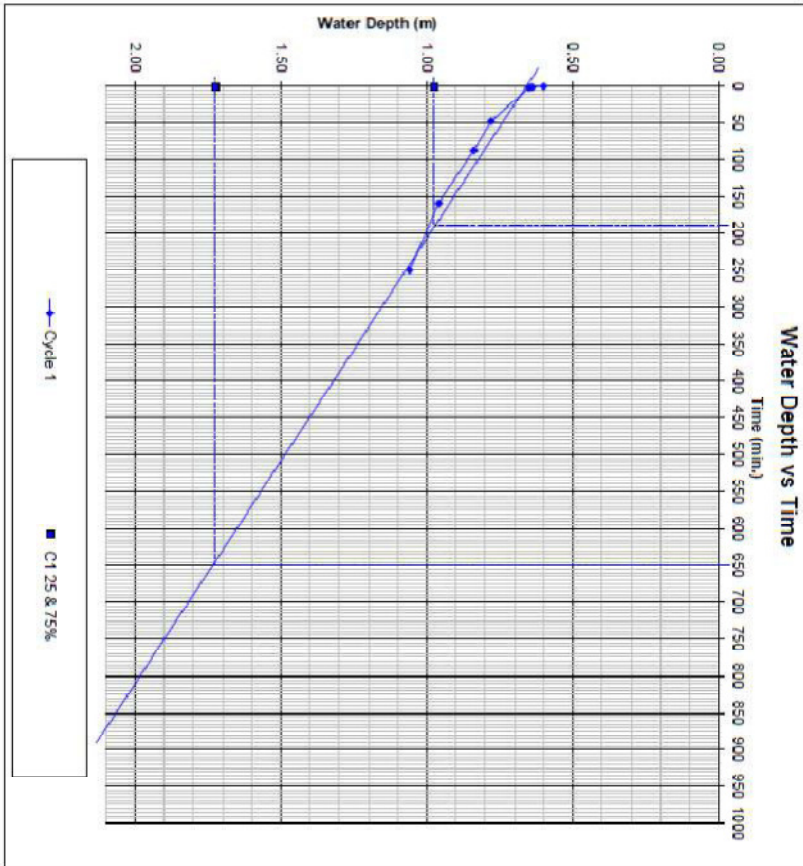
BRE365 SOIL INFILTRATION RATE TEST - TP06
12604 Sandy Lane, Ystradowen

Trial pit information	
Infiltration (mm)	3.63
Depth (m)	0.75
Groundwater	5.18
Weather Conditions	DN
Case	GS-F6-20

Remarks
Notes indicating circumstances in order to achieve soil infiltration rate.
Actual infiltration over the same time period may vary.
Unable to complete second and third test cycles in the time available.

Time (min)	Cycle 1			Cycle 2			Cycle 3		
	Time (min)	Depth (m)	Time (min)	Time (min)	Depth (m)	Time (min)	Time (min)	Depth (m)	
1		0.62							
2		0.65							
48		0.78							
88		0.84							
159		0.96							
250		1.05							

Final Excavation Depth (m)	Cycle 1	Cycle 2	Cycle 3
Final Excavation Depth (m)	2.10		
Water depth at start of test	0.60		
Water depth at end of test	1.06		
% Effective storage depth	0.31		
Effective storage depth (m)	1.50		
Effective storage depth (100%)	1.13		
Effective storage depth (75%)	0.75		
Effective storage depth (50%)	0.38		
Effective storage depth (25%)			
Outflow Time (min)	250		
Time for 100% outflow	910		
Time for 75-25% outflow	480		
Time for 50-50% outflow			
Time for 25-25% outflow			
Over 100% effective depth	0.50		
Over 75%- 25% effective depth	2.94		
Over 50%- 25% effective depth	1.47		
Surface Area (m ²)			
For 100% effective storage	12.46		
For 50% effective storage	7.21		
Over measured depth	5.18		
Soil Infiltration Rate (mm)			
Over 100% effective depth	4.5E-06		
Over 75%- 25% effective depth	1.2E-05		
Over measured depth	7.4E-06		

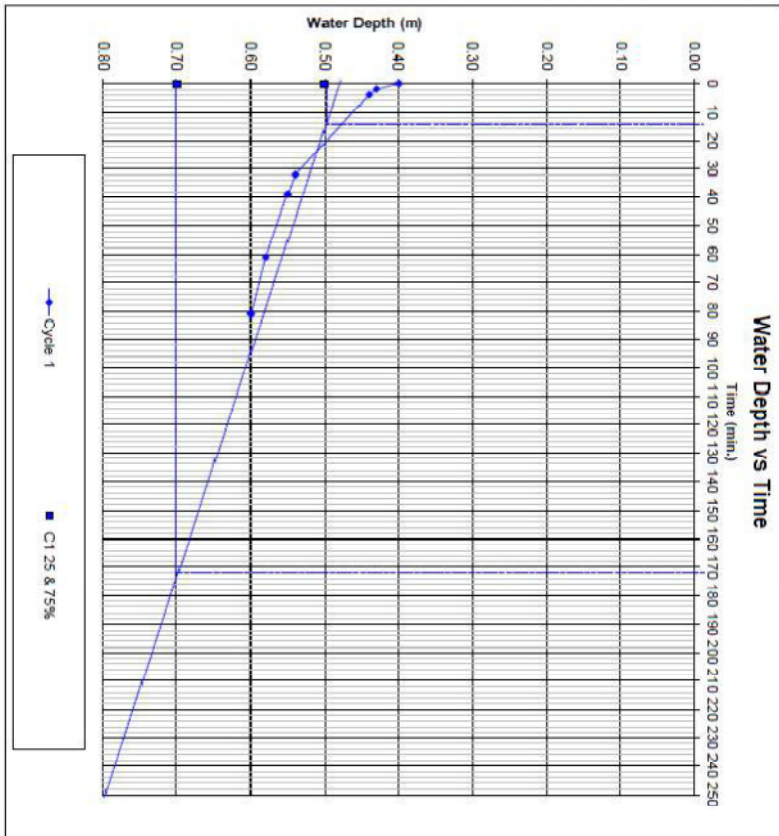


BRE365 SOIL INFILTRATION RATE TEST - TP05A
 12604 Sandy Lane, Ystradowen

Trial pit information	
Length (m)	2.50
Width (m)	0.70
Depth (m)	1.50
Groundwater	1.5
Weather conditions	02-10-20
Time	09:00

Remarks
 At end of test trial pit depth was 0.6m due to spalling of pit sides.

	Cycle 1		Cycle 2		Cycle 3	
	Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
Final excavation Depth (m)	0.60					
At end of testing Cycle						
Water Depth (m)	0.40					
Water depth at start of test	0.50					
Water depth at end of test	0.20					
Effective depth (measured)	0.20					
% effective storage depth	0.50					
Effective storage depth (m)	0.20					
Effective storage depth (100%)	0.20					
Effective storage depth (75%)	0.20					
Effective storage depth (50%)	0.20					
Effective storage depth (25%)	0.10					
Outflow time (min)						
Time for measured outflow	61					
Time for 75% outflow	26					
Time for 50% outflow	15					
Volume of outflow (m ³)						
Over measured effective depth	0.35					
Over 100% effective depth	0.70					
From 75% - 25% effective depth	0.25					
For 100% effective storage	4.31					
For 50% effective storage	3.03					
For 25% effective storage	3.03					
Over measured depth	1.1E-25					
Over measured depth	2.1E-25					
Over 75% - 25% effective depth	1.2E-25					



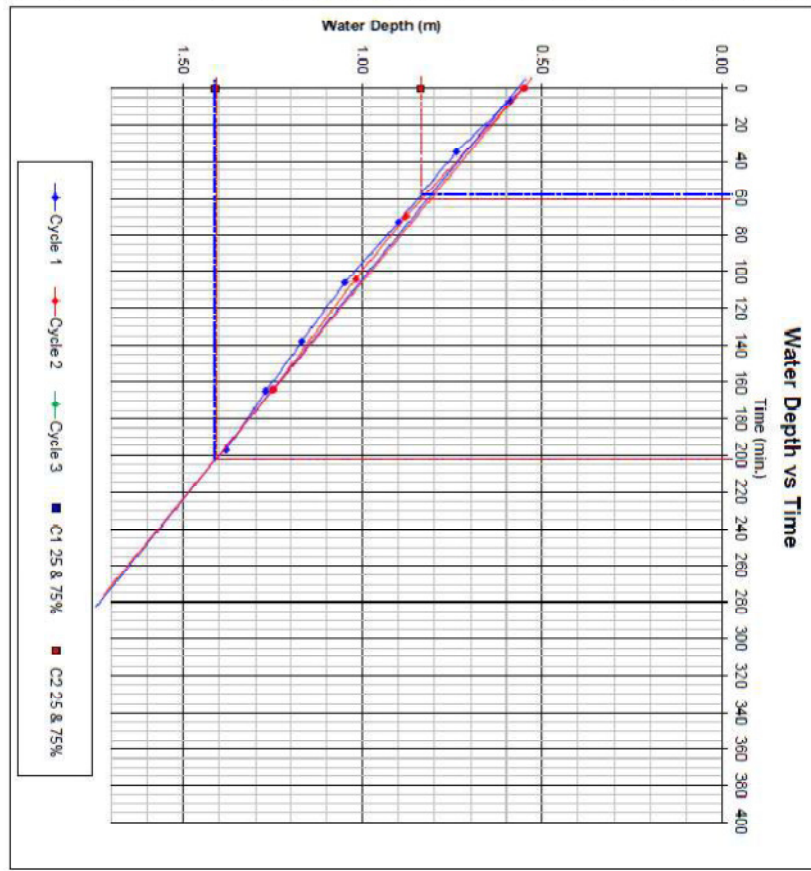
BRE365 SOIL INFILTRATION RATE TEST - TP07
12604 Sandy Lane, Ystradowen

Trial pit information	
Length (m)	1.50
Width (m)	0.70
Depth (m)	1.70
Groundwater	Dry
Weather conditions	21.02.20
Date	

Remarks
Note: readings extrapolated in order to derive soil infiltration rate.
Actual infiltration over the same time period may vary.
Unable to complete third test cycle in time available

	Cycle 1		Cycle 2		Cycle 3	
	Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
	0	0.55	0	0.55		
	7	0.59	70	0.98		
	25	0.74	104	1.02		
	13	0.90	154	1.25		
	105	1.05				
	165	1.27				
	197	1.50				

Final excavation depth (m)	Cycle 1		Cycle 2		Cycle 3	
	Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
At end of testing cycle	1.70	1.70	1.70	1.70		
Water depth at start of test		0.55		0.55		
Water depth at end of test		1.50		1.50		
Effective depth (measured)		0.80		0.70		
% Effective storage depth		0.72		0.61		
Effective storage depth (m)		1.15		1.15		
Effective storage depth (75%)		0.85		0.85		
Effective storage depth (50%)		0.55		0.55		
Effective storage depth (25%)		0.29		0.29		
Outflow Time (min)	197	154				
Time for 100% outflow	270	270				
Time for 75-25% outflow	140	140				
Volume of outflow (m ³)		1.10		0.93		
Over measured effective depth		1.10		0.93		
Over 100% effective depth		1.50		1.50		
Over 75% effective depth		0.78		0.78		
Surface Area (m ²)		1.19		1.19		
For 100% effective storage		7.31		7.31		
For 75% effective storage		4.32		4.32		
Over measured depth		5.65		4.97		
Soil infiltration Rate (mm)						
Over 100% effective depth		1.3E-05		1.3E-05		
Over 75% effective depth		1.7E-05		1.9E-05		
Over 25% effective depth		2.1E-05		2.1E-05		



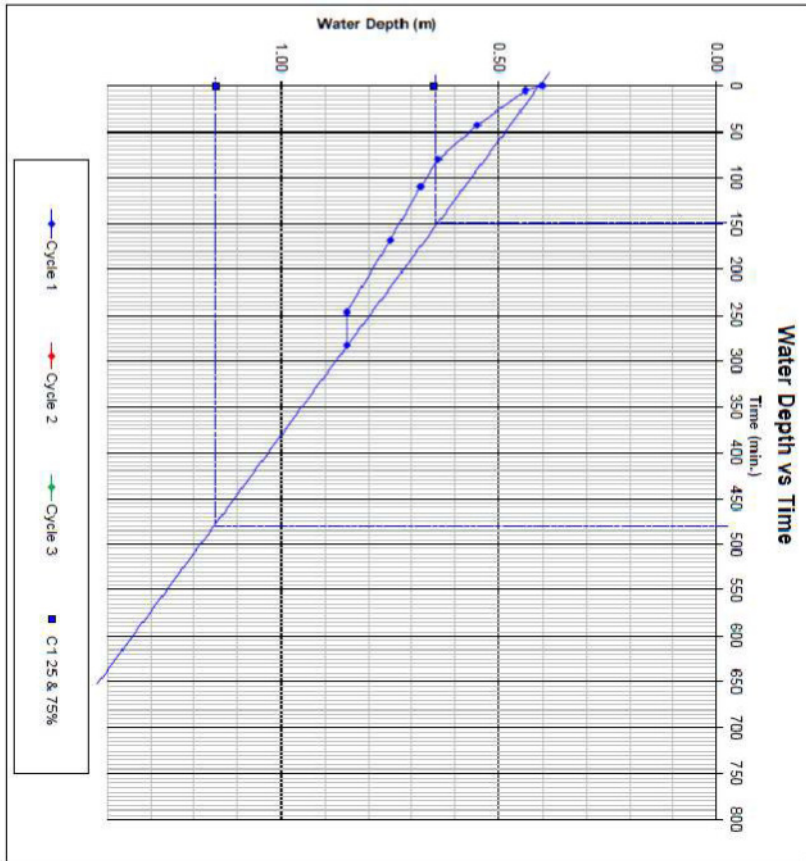
BRE365 SOIL INFILTRATION RATE TEST - TP08

12604 Sandy Lane, Ystradowen

Trial pit information	
Length (m)	1.80
Width (m)	0.55
Depth (m)	1.40
Groundwater	1
Weather Conditions	1
Start	21.02.20
End	

Remarks
 Note: readings extrapolated in order to derive soil infiltration rate
 Actual infiltration over the same time period may vary
 Unable to complete second and third test cycles in the time available

Final Excavation Depth (m)	Cycle 1		Cycle 2		Cycle 3	
	Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
At end of testing cycle						
Water depth (m)		0.40				
Water depth at end of test		0.45				
Effective depth (measured)		0.45				
% Effective storage depth		0.45				
Effective storage depth (m)		1.00				
Effective storage depth (100%)		0.75				
Effective storage depth (50%)		0.50				
Effective storage depth (25%)		0.25				
Outflow Time (min)		283				
Time for measured outflow		300				
Time for 100% outflow		330				
Time for 75.25% outflow		340				
Volume of Outflow (m ³)		0.33				
Over measured effective depth		0.07				
Over 100% effective depth		1.11				
Over 75% - 25% effective depth		0.59				
Surface Area (m ²)		6.07				
For 100% effective storage		3.62				
Over measured depth		3.39				
Soil infiltration rate (mm/s)		Cycle 1		Cycle 2		Cycle 3
Over 100% effective depth		5.0E-06				
Over measured depth		9.2E-06				
Over 75% - 25% effective depth		8.2E-06				

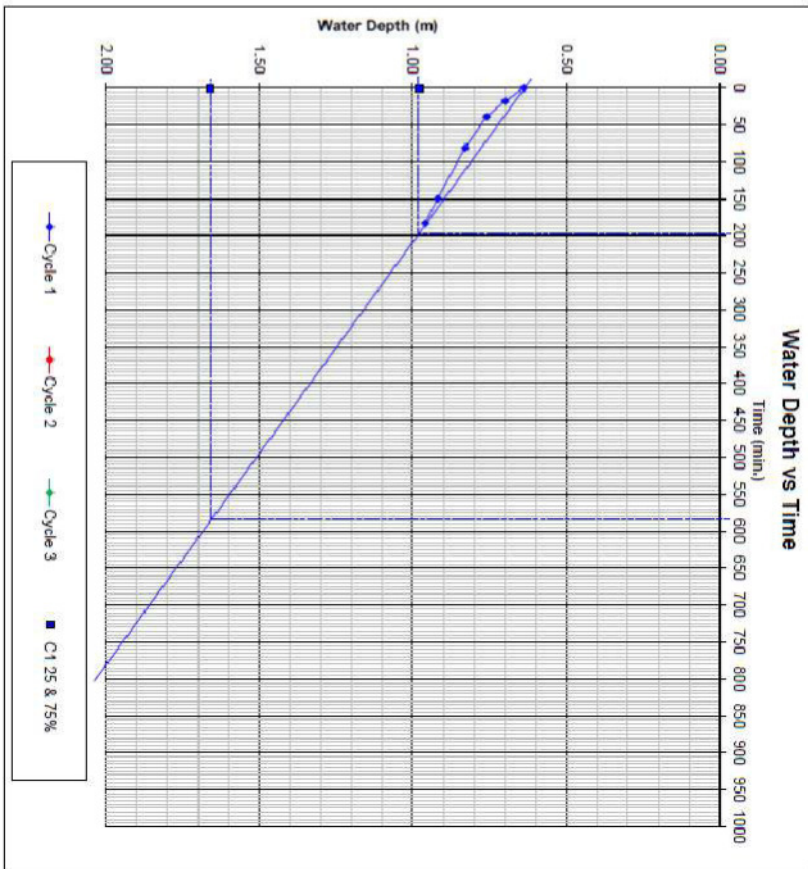


BRE365 SOIL INFILTRATION RATE TEST - TP12
 12604 Sandy Lane, Ystradowen

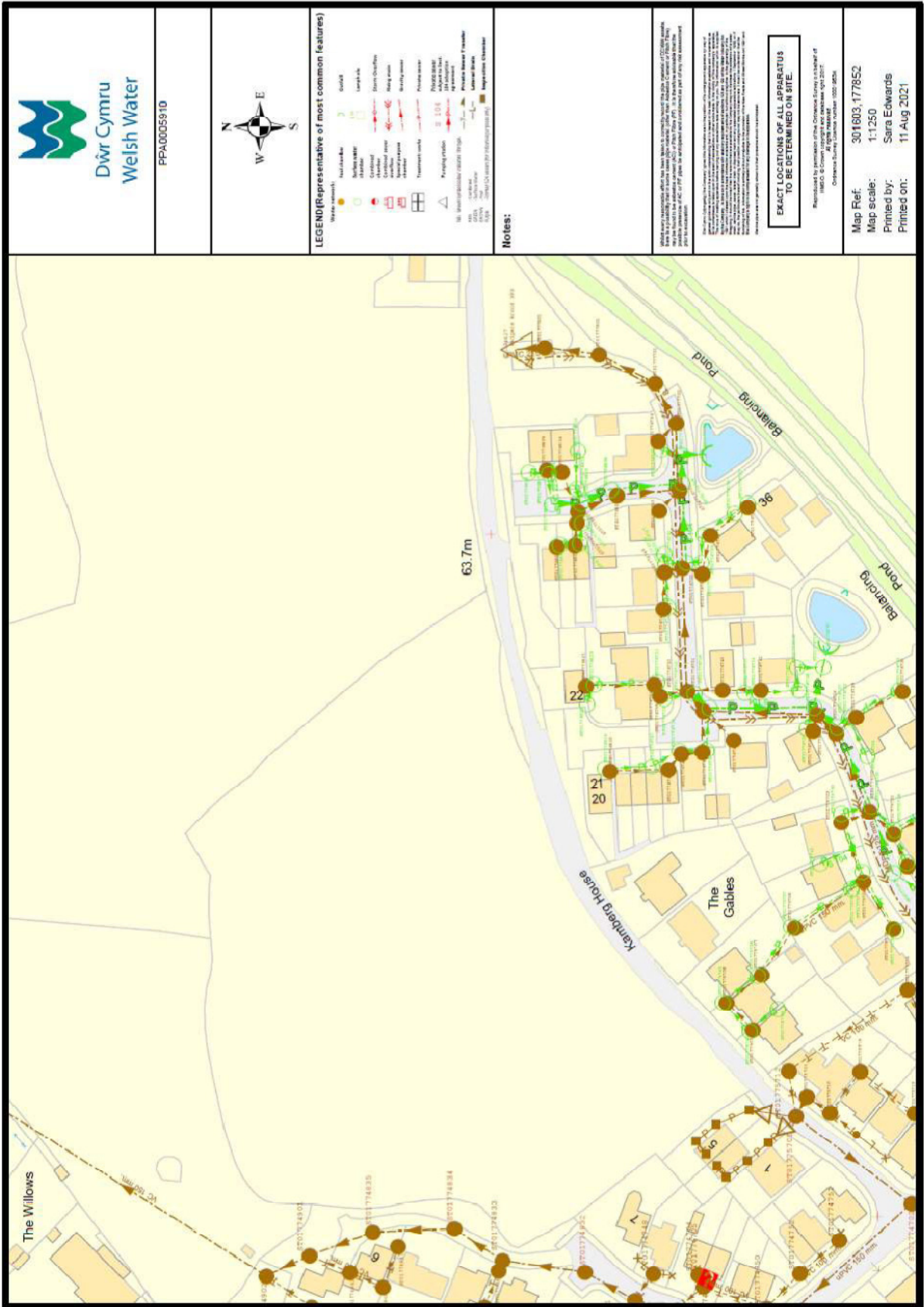
Trial Information	
Length (m)	2.00
Width (m)	0.65
Depth (m)	2.00
Groundwater	Dry
Weather Conditions	
Date	21.02.20

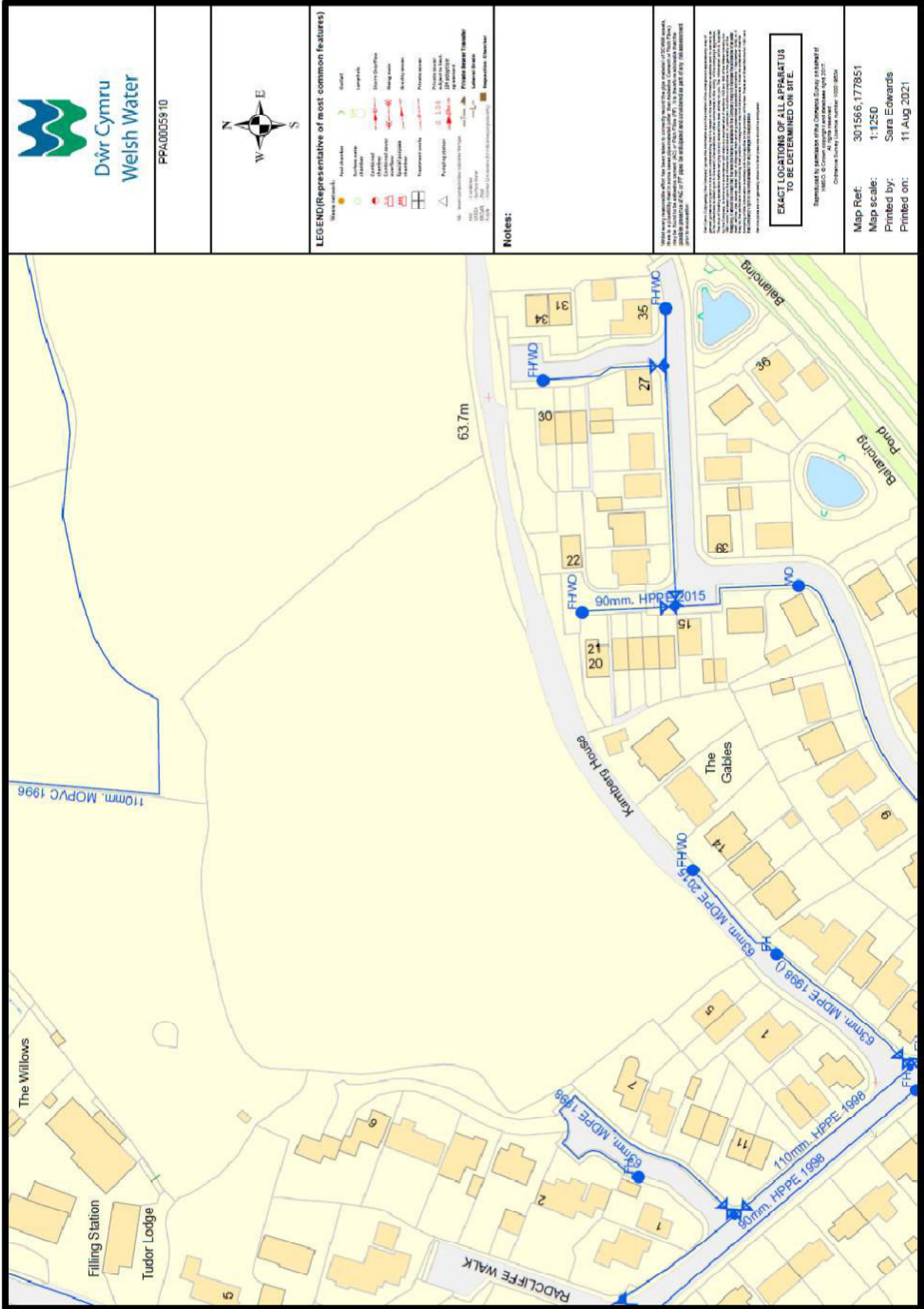
Remarks
 Note trenches excavated in order to derive soil infiltration rate. Actual infiltration over the same time period may be variable to complete second and third test cycles in the time available

	Cycle 1		Cycle 2		Cycle 3	
	Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
At end of testing cycle		2.00				
Water Depth (m)		0.54				
Water depth at start of test		0.54				
Water depth at end of test		0.96				
Effective depth (measured)		0.32				
% Effective storage depth		0.24				
Effective Storage Depth (m)		1.26				
Effective storage depth (100%)		1.02				
Effective storage depth (75%)		0.88				
Effective storage depth (25%)		0.34				
Volume of water infiltrated (m ³)		183				
Time for measured outflow		780				
Time for 100% outflow		380				
Time for 75.25% outflow						
Volume of Outflow (m ³)		0.42				
Over measured effective depth		1.77				
Over 100% effective depth		0.88				
From 75% - 25% effective depth						
Surface Area (m ²)		8.31				
For 100% effective storage		4.90				
For 50% effective storage		3.00				
SOIL INFILTRATION RATE (mm)	Cycle 1	4.4E-06	Cycle 2		Cycle 3	
Over measured depth		1.26E-05				
Over 75% - 25% effective depth		7.2E-06				



APPENDIX 9 – WELSH WATER ASSET MAPS





APPENDIX 10 – CONFIRMATION OF AGREED DISCHARGE RATES

Hi Mark,

Sorry for the delay getting back to you, from the encountered geology and evidence of poor infiltration we have no objection to the use of soil type 3 within the greenfield runoff calculation.

Kind regards

Gareth

Gareth Thelwell-Davies
Principal Engineer - Environment
Visible Services and Transport
Vale of Glamorgan Council / Cyngor Bro Morgannwg
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Correspondence is welcomed in Welsh or English / Croesewir Gohebiaeth yn y Gymraeg neu yn Saesneg.

From: Mark Llewelin <mark.llewelin@quadconsult.co.uk>
Sent: Wednesday, September 6, 2023 12:14 PM
To: Thelwell-Davies, Gareth <gthelwell-davies@valeofglamorgan.gov.uk>
Subject: Sandy lane, Ystradowen

Hi Gareth,

Thank you for your time this morning, please find greenfield rates attached, apologies I thought they were included in the original pack.

The initial soil type was noted as 2 but given how naturally wet the site is I think it's probably a 3 or possibly 4.

Summary Below

1.53ha Greenfield Catchment

Soil Type 2	Soil Type 3
Qbar 5.15l/s	<u>Qbar 8.1l/s</u>

Currently our design utilises the soil type 2 factor, is there any scope to move closer to the Type 3 factor? I believe this will maintain the current scenario and reduce the overall depth of the attenuation basin.

Regards

Mark Llewelin
IEng MIET MCIHT

APPENDIX 11 – RAINWATER HARVESTING VIABILITY STATEMENT

Rainwater Harvesting Viability Assessment

The developer has confirmed there is no requirement for rainwater harvesting for the proposed development from the point of construction or throughout the design life of the development.

The proposed site is currently within easy connectivity to the Welsh Water potable water network. Vale of Glamorgan is not currently or likely to be in the future classed as in danger of suffering regular drought water rationing. Welsh Water draft Drought Plan 2020 also states the unlikelihood of any water rationing being realised within the next 30 years. Welsh Water highlight 2018 as being a very hot year with increased demand on their network but like other parts of the UK did not have to introduce any restriction in the form of hosepipe bans or limited access to the potable water supply.

References:

<https://www.dwrcymru.com/en/our-services/water/water-resources/draft-drought-plan-2020>

APPENDIX 12 – PROPOSED POLLUTION REMOVAL CALCULATIONS

POLLUTION REMOVAL & WATER QUALITY MANAGEMENT SCHEDULE

CIRIA 753 The SuDS Manual Chapter 26, provides design advice to meet water quality standards by adopting the SuDS train treatment mechanism and thereby reduce the risk of pollution by evaluating potential pollution hazards at the outset.

As the proposed drainage strategy proposes to discharge runoff to ground, Chapter 26.3 'Protecting Groundwater' is particularly relevant.

Runoff from residential roofing and pedestrian areas is viewed as low risk (Table 4.3) and the proposed site layout provides the opportunity to introduce SuDS into the scheme to reduce potential contaminant risk still further. For example, the use of porous paving reduces flow velocities and increase retention times promoting a level of absorption into the upper soils (intergranular flow) prior to discharge to ground (fracture flow).

We propose to apply a simple qualitative method to assess the risk (Simple Index Approach) and proposed mitigation measures as defined in Table 26.1 CIRIA SuDS Manual.

Total SuDS Mitigation Index = Mitigation Index₁ + 0.5 Mitigation Index₂

Assuming a roof/hard surface split of 40/60 and using a weighted mean:

Residential Roof 0.4 (40%)	Total Suspended Solids (0.2)	Metals (0.2)	Hydrocarbons (0.05)
Weighted value	0.08	0.08	0.02
Driveways, Access roads 0.6 (60%)	Total Suspended Solids (0.5)	Metals (0.4)	Hydrocarbons (0.4)
Weighted value	0.30	0.24	0.24
Total hazard Index	0.38	0.32	0.26

Hard surface only of and using a weighted mean:

Residential Roof (0%)	Total Suspended Solids (0.2)	Metals (0.2)	Hydrocarbons (0.05)
Weighted value	0.00	0.00	0.00
Driveways, Access roads (100%)	Total Suspended Solids (0.5)	Metals (0.4)	Hydrocarbons (0.4)
Weighted value	0.5	0.4	0.4
Total hazard Index	0.5	0.4	0.4

Comparing against the mitigation indices shown below

SuDS Individual Component Mitigation Indices

	Suspended Solids	Metals	Hydrocarbons
Rain Garden	0.5	0.6	0.6
Pervious Pavement	0.7	0.6	0.7
Swale	0.5	0.6	0.6
Basin	0.5	0.7	0.5
Wetland	0.8	0.8	0.8
Comparison with Hazard Index	ALL>0.38-0.5	ALL>0.32-0.4	ALL>0.26-0.4

7.3 However, within the outline drainage scheme a multi staged treatment is proposed for the majority of the site where practical, creating a Suds Management Train improving treatment locally and further reducing risk with the best and worst case outlined within Table 4.

Table 4 – Total SuDS Mitigation Index

Total SuDS Mitigation Index = Mitigation Index₁ + 0.5 Mitigation Index₂

	Suspended Solids	Metals	Hydrocarbons
SCENARIO 1 (Roof Runoff) Rain Garden-Swale-Basin- Wetland/Ditch	1.4	1.65	1.55
SCENARIO 2 (Private parking) Permeable Paving-Swale-Basin- Wetland/Ditch	1.6	1.55	1.65
CASE SCENARIO 3 (Development Road) Swale-basin-Wetland/Ditch	1.15	1.35	1.25
Comparison with Hazard Index	ALL>0.38-0.5	ALL>0.32-0.4	ALL>0.26-0.4

APPENDIX 13 – SURFACE WATER MAINTENANCE SCHEDULE

Maintenance Plan for the surface water system.

To ensure the surface water systems to function as intended it is important appropriate maintenance arrangements are in place.

The surface water from the proposed development will be maintained in accordance with CIRIA C753 Chapter 32.

Storm Water Maintenance Management Schedule (CIRIA C753 – The SuDS Manual)

Operation and maintenance activity	SuDS component												
	Pond	Wetland	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter drain	Modular storage	Pervious pavement	Swale/bioretention/ trees	Filter strip	Green roofs	Proprietary treatment systems
Regular maintenance													
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter and debris removal	■	■	■	■	□	■	■	□	■	■	■		□
Grass cutting	■	■	■	■	□	■	■	□	□	■	■		
Weed and invasive plant control	□	□	□	□		□	□		□		□	■	
Shrub management (including pruning)	□	□	□	□					□	□	□		
Shoreline vegetation management	■	■	□										
Aquatic vegetation management	■	■	□										
Occasional maintenance													
Sediment management ¹	■	■	■	■	■	■	■	■	■	■	■		■
Vegetation replacement	□	□	□	□						□	□	■	
Vacuum sweeping and brushing									■				
Remedial maintenance													
Structure rehabilitation /repair	□	□	□	□	□	□	□	□	□	□	□	□	
Infiltration surface reconditioning				□	□	□	□		□	□	□		

Key

- will be required
- may be required

Notes

1 Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

Proposed Site SuDS Features

1. Pervious Paving
2. Shallow Depression / Water Garden / Bioretention
3. Highway Swale
4. Attenuation Basin
5. Piped Network Elements

The maintenance management will be highlighted in 3 categories: -

Regular Maintenance

Regular maintenance comprises tasks that are likely to be required regularly to maintain and observe the drainage system typically on a monthly programme.

- Inspection - (Elements - 1, 2, 3, 4)
- Litter and Debris Removal - (Elements - 1, 2, 3, 4)
- Grass Cutting - (Elements - 2, 3, 4)
- Shrub Management - (Elements – 2, 3, 4)

Occasional Maintenance

Occasional maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the regular tasks, typically annually.

- Sediment management - (Elements - 1, 2, 3, 4, 5)
- Catchpit / Silt trap cleaning - (Elements - 5)
- Gully cleaning - (Elements – 2, 3)
- Pipe jetting if required - (Elements - 5)
- Vegetation Replacement - (Elements – 2, 3, 4)
- Vacuum Sweeping and Brushing - (Elements - 1)

Remedial Maintenance

Remedial maintenance describes the intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design, construction, and regular maintenance activities. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and so timings are difficult to predict.

- Structure Rehabilitation / Repair - (Elements - 1, 2, 3, 4, 5)

Site Specific Maintenance Plan (SUDs features)

1. Permeable Pavement

- Annual visual inspections to be undertaken of the pervious system with litter and debris removed.
- Brush / Vacuum joints, replacing any lost jointing material every year. Sediment management to be undertaken at the same time. Upstream chamber of discharge pipe to be inspected and cleaned yearly.
- Remedial maintenance will be undertaken intermittently following the outcome of monthly inspections if required. This may consist of the following items –
 - Weed control
 - Replacement of damaged blocks
 - Repair any rutting
 - Cleaning for aesthetics of the paving blocks
 - De-icing during winter months
 - Inspection of ponding during or following heavy rainfall

2. Shallow Depression Swale / Rain Garden / Bioretention

- Monthly visual inspections to be undertaken of the swale with litter and debris removed. Grass cutting and shrub management to be undertaken at the same time but will be less frequent during winter months.
- Planting to be replaced yearly if required with sediment removed. Condition of outfalls and connecting pipes discharging surface water into system to be reviewed and cleaned yearly.
- Remedial maintenance will be undertaken intermittently following the outcome of monthly inspections if required. This may consist of the following items –
 - Weed control
 - Replacement of damaged planting
 - Structure Rehabilitation / Repair
 - Inspection of ponding during or following heavy rainfall
 - Infiltration Surface Reconditioning

3. Highway Swale / Ditch

- Quarterly visual inspections to be undertaken with litter and debris removed. Shrub management to be undertaken at the same time but will be less frequent during winter months.
- Planting to be replaced yearly as required with sediment removed. Condition of outlets discharging surface water into system to be reviewed and cleaned yearly.
- Remedial maintenance will be undertaken intermittently following the outcome of quarterly inspections if required. This may consist of the following items –
 - Weed control
 - Replacement of damaged planting
 - Structure Rehabilitation / Repair
 - Infiltration Surface Reconditioning

4. Attenuation Basin

- Quarterly visual inspections to be undertaken along with litter and debris removed. planting inspection to be undertaken at the same time but will be less frequent during winter months.
- Remedial maintenance will be undertaken intermittently following the outcome of quarterly inspections if required. This may consist of the following items –
 - Weed control
 - Replacement of damaged planting
 - Structure Rehabilitation / Repair
 - Surface Reconditioning

5. Piped Network

- Gully / catchpit / channel drain cleaning and pipe jetting to be undertaken typically every year. If a blockage is present and flooding occurs, cleaning and clearing the blockage should be undertaken immediately. If item is defective, this should also be repaired or replaced.