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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

QuadConsult ENGINEERS IN PARTNERSHIP
Consulting Civil & Structural Engineers

SAB COMPLIANCE STRATEGY

19351

Document Control

Responsible for	Job Title	Name	Date	Signature
Content	Engineer	Mark Llewellin	22 May 2023	
Checked	Engineer	Meurig Hughes	22 May 2023	
Approval	Director	Andrew Villis	22 May 2023	
Copyright:	QuadConsult ©2022	Document Reference:	19351-R-601-DRAINAGE STRATEGY	
Signatories in this approval box have checked this document in line with the requirements of QuadConsult QMS Procedures				

Revision History

Revision	Date	Purpose/Status	Approved
0	May 2023	Comment/Draft	
A			
B			
C			
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.

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 1.5ha

Figure 1 – Site Location Plan (Google Earth extract)

3.0 EXISTING DRAINAGE

3.1 Land Drainage

Overland flow from the site flows in a northern direct 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. An initial calculation indicates greenfield rate of 5.4l/s, this will need to be agreed with the SAB, a possible reduction inline 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. A possible gravity connection is noted on the DCWW response into an existing chamber just outside the site's western boundary. If legal /3rd party issues prove this option to be unviable, a pumped solution will be proposed with a connection with the existing asset located within Sandy Lane.

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 1.0x10-6 and 1.2x10-5 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.

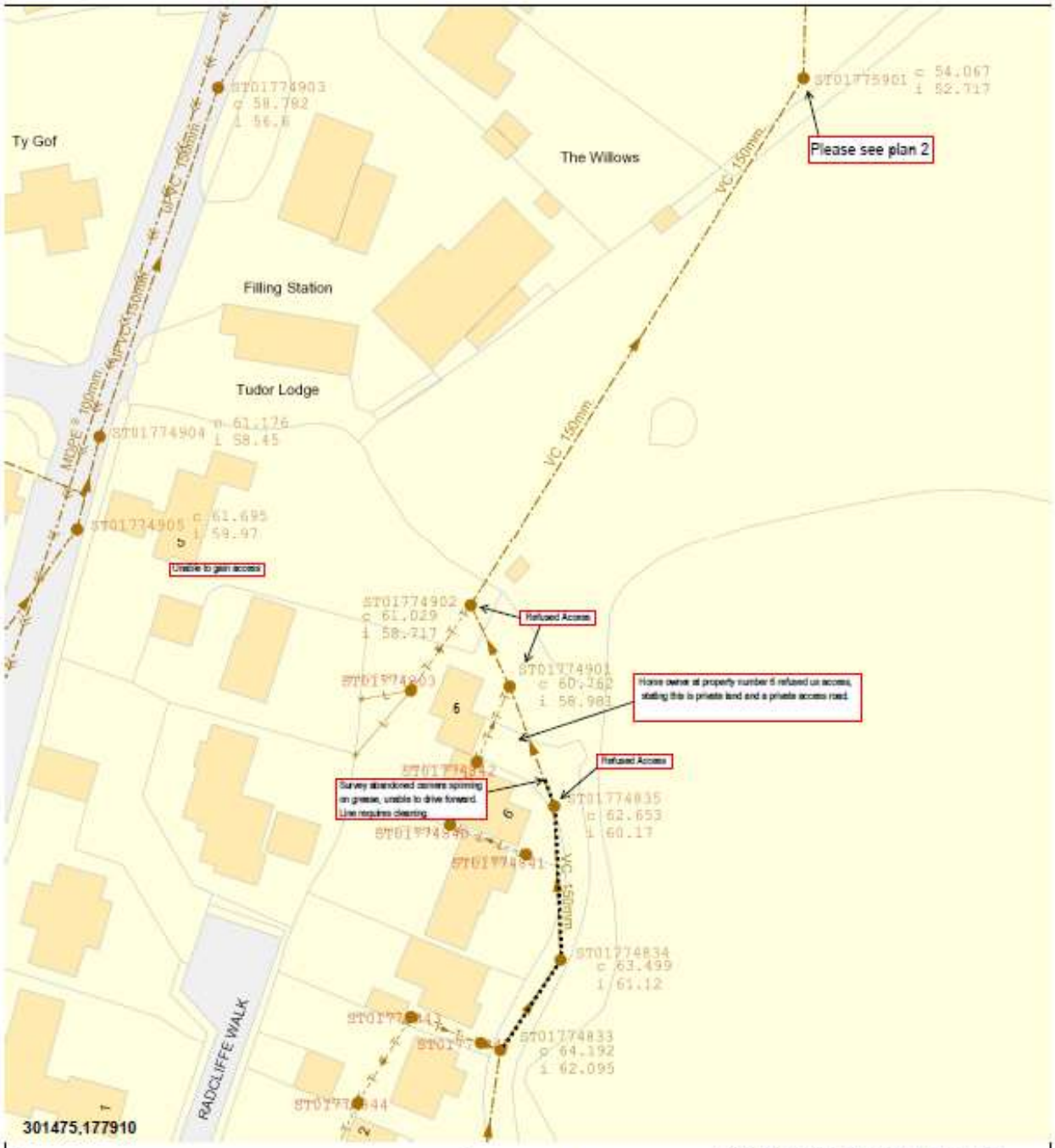
7.2 RECOMMENDATIONS

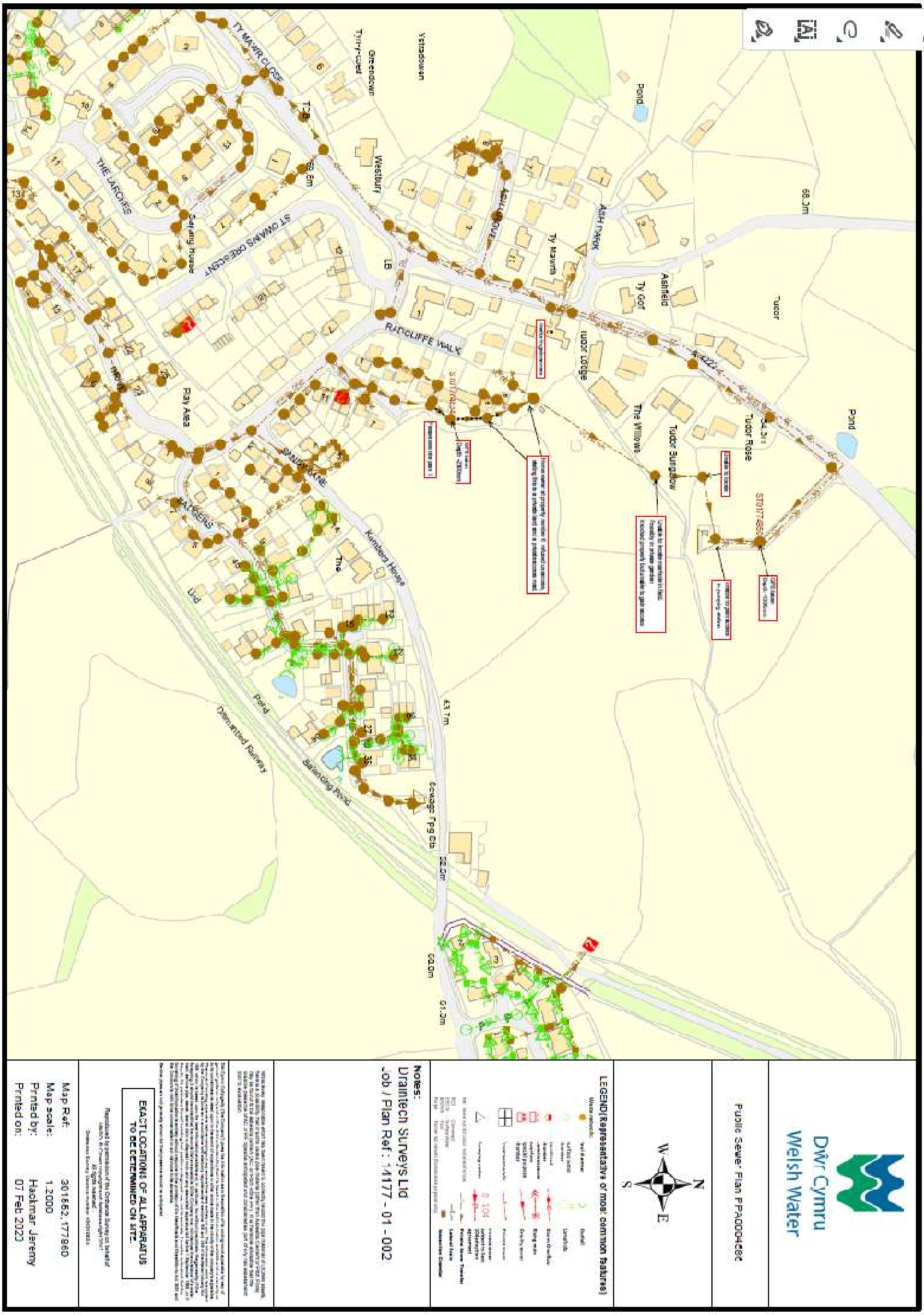
The following actions are recommended to allow a robust suitable site-specific surface and foul water drainage strategy can be implemented to service the proposed development.

- 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

APPENDIX 2 – EXISTING DRAINAGE SURVEY
(To be included once further investigation has been concluded)


Ty Gof
The Willows
Filling Station
Tudor Lodge
RADCLIFFE WALK
Please see plan 2
Unable to gain access
Refused Access
Refused Access
House owner at property number 6 refused us access, stating this is private land and a private access road.
Survey abandoned camera spinning on grease, unable to drive forward. Line requires cleaning
301475,177910
Draintech Surveys Ltd
Job / Plan Ref : 14177 - 01 - 001
Scale: 1:750
18/03/2022
EXACT LOCATION OF ALL APPARATUS TO BE DETERMINED ON SITE
LEGEND
Dŵr Cymru Welsh Water
Reproduced from the Ordnance Surveys's maps with the permission of the Controller of Her Majesty's Stationary Office. Crown Copyright. Licence No: WU298565
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 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 onus 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 be 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 thisinformation 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 damageto its apparatus.



Dŵr Cymru
Welsh Water
LEGEND(Representative of most common features)
Notes:
Draintech Surveys Ltd
Job / Plan Ref : 14177 - 01 - 002
EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.
Map Ref:
Map scale: 1:2000
Printed by: Hackmar Jeremy
Printed on: 07 Feb 2023
TY MAWR CLOSE
THE LARCHES
ST OWAINS CRESCENT
RADCLIFFE WALK
ASH GROVE
ASH PARK
Play Area
Dismantled Railway
Sewage Pumping Station
Balancing Pond
Pond

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| Charnwood Park| Bridgend| CF31 3PL| 01656 767001| www.draintech.co.uk

DRAINTECH
Helping to improve the drainage network

Draintech Surveys Ltd
Atlantic House, Charnwood park, CF31 3PL

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Project Name	Project Number	Project Date
14177 - Ystradowen	14177 - 01	21/03/2022

DRAINTECH
Helping to improve the drainage network

Draintech Surveys Ltd
Atlantic House, Charnwood park, CF31 3PL

Project Information

Project Name	Project Number	Project Date
14177 - Ystradowen	14177 - 01	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, Charnwood park
Town or City: CF31 3PL

DRAINTECH
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DRAINTECH
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Draintech Surveys Ltd
Atlantic House, Charnwood park, CF31 3PL

Section Inspection - 21/03/2022 - ST01774833X

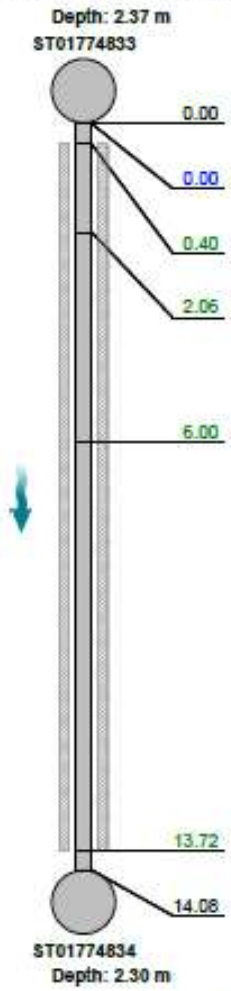
Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
1	1	21/03/22	10:05	Not Specified	No Rain Or Snow	No	ST01774833X

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:**	14.06 m	**Upstream Pipe Depth:**	2.370 m
Location:	Road	**Total Length:**	14.06 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:



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	2.06	C01	DEG	Attached deposits, grease from 7 o'clock to 5 o'clock, 10% cross-sectional area loss, change: Patchy	00:01:09		
	6.00	C01	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
	14.06		MHF	Finish node type, manhole, reference number: ST01774834	00:01:35		

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
Helping to improve the drainage network

Draintech Surveys Ltd
Atlantic House, Charnwood park, CF31 3PL

Section Inspection - 21/03/2022 - ST01774834X

Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
2	1	21/03/22	10:14	Not Specified	No Rain Or Snow	No	ST01774834X
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:**	ST01774834
Road:	Off Sandy Lane	**Inspected Length:**	21.05 m	**Upstream Pipe Depth:**	2.300 m
Location:	Road	**Total Length:**	21.05 m	**Downstream Node:**	ST01774835
Surface Type:		**Joint Length:**		**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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	0.00		WL	Water level, 5% of the vertical dimension	00:00:06		
	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	64.0	4.0

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DRAINTECH
helping to improve the drainage network

Draintech Surveys Ltd
Atlantic House, Charnwood 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	**Upstream Node:**	ST01774835
Road:	Off Sandy Lane	**Inspected Length:**	2.02 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	2.02 m	**Downstream Node:**	ST01774901
Surface Type:		**Joint Length:**		**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: No Manhole Depths - Private - Refused access
Recommendations:

Scale: 1:50	Position [m]		Code	Observation	MPEG	Photo	Grade
Depth: m ST01774835							
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	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
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14177 - Ystradowen 3

DRAINTECH
Helping to improve the drainage network

Draintech Surveys Ltd
Atlantic House, Charnwood park, CF31 3PL

Section Pictures - 21/03/2022 - ST01774835X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
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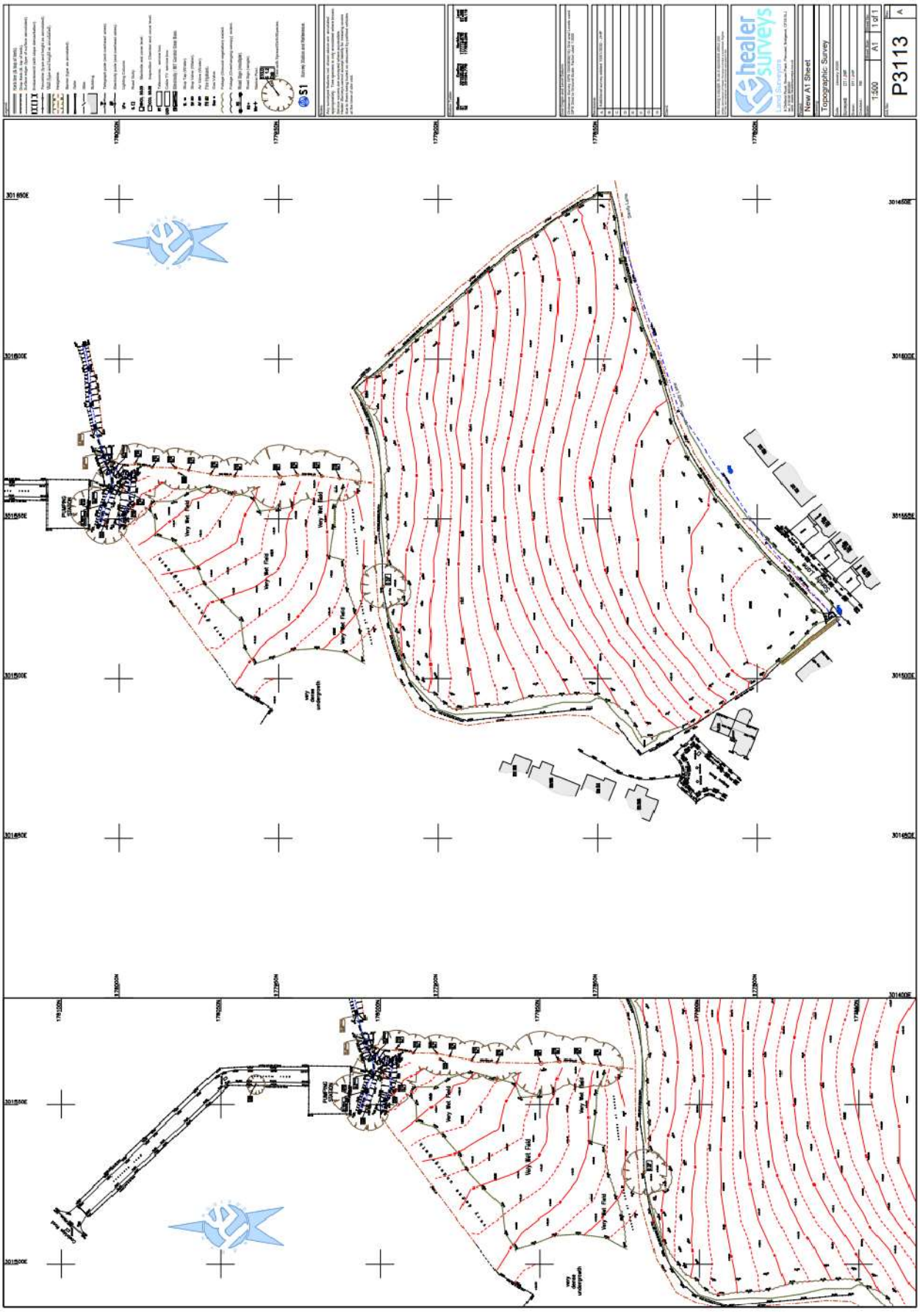
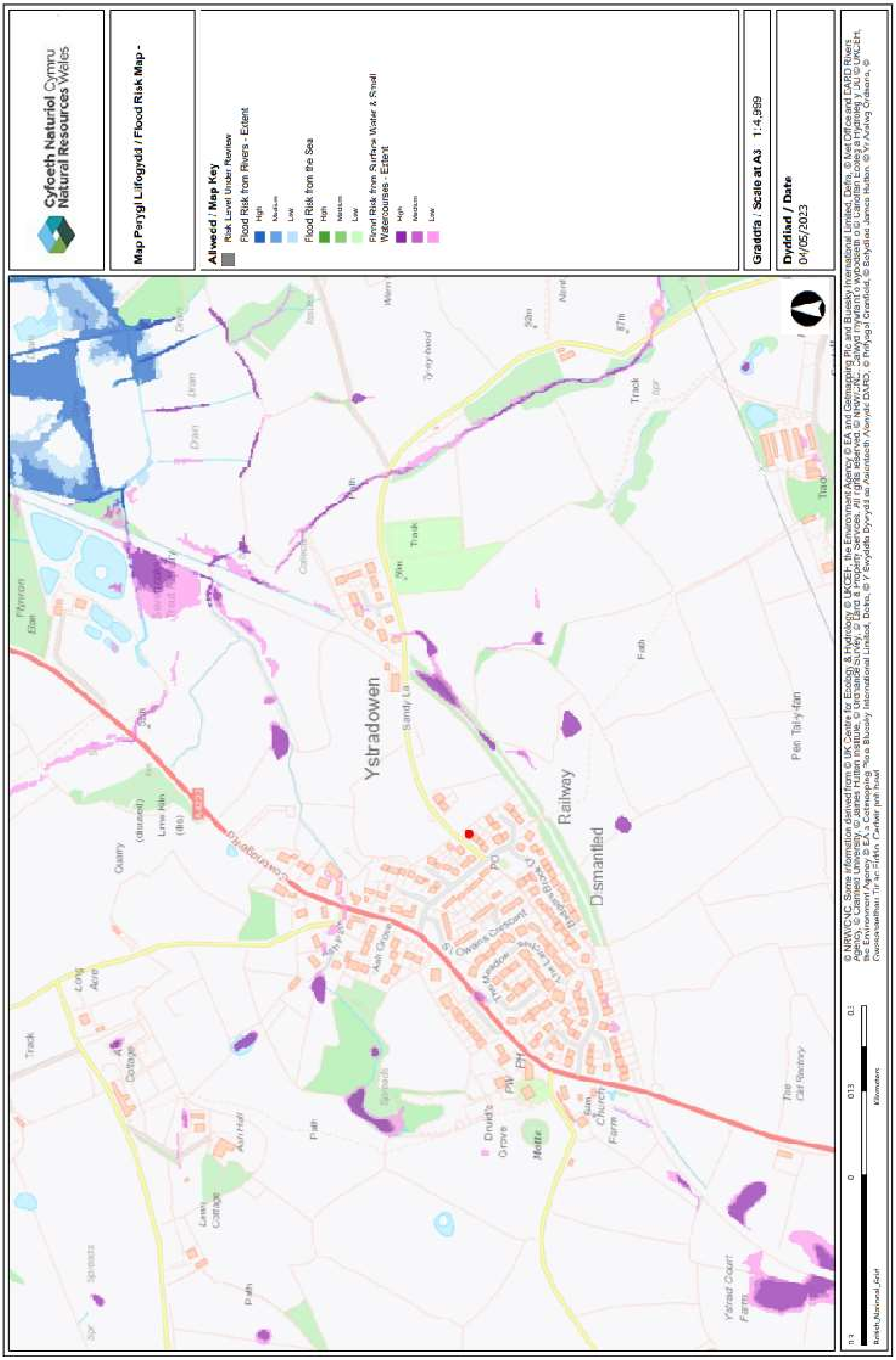
Survey abandoned, Line needs cleaning - Spinning on grease


P3113
New A1 Sheet
Topographic Survey
1:500
A1
1 of 1
healer surveys
Land Surveyors

APPENDIX 3 – FLOOD RISK MAP

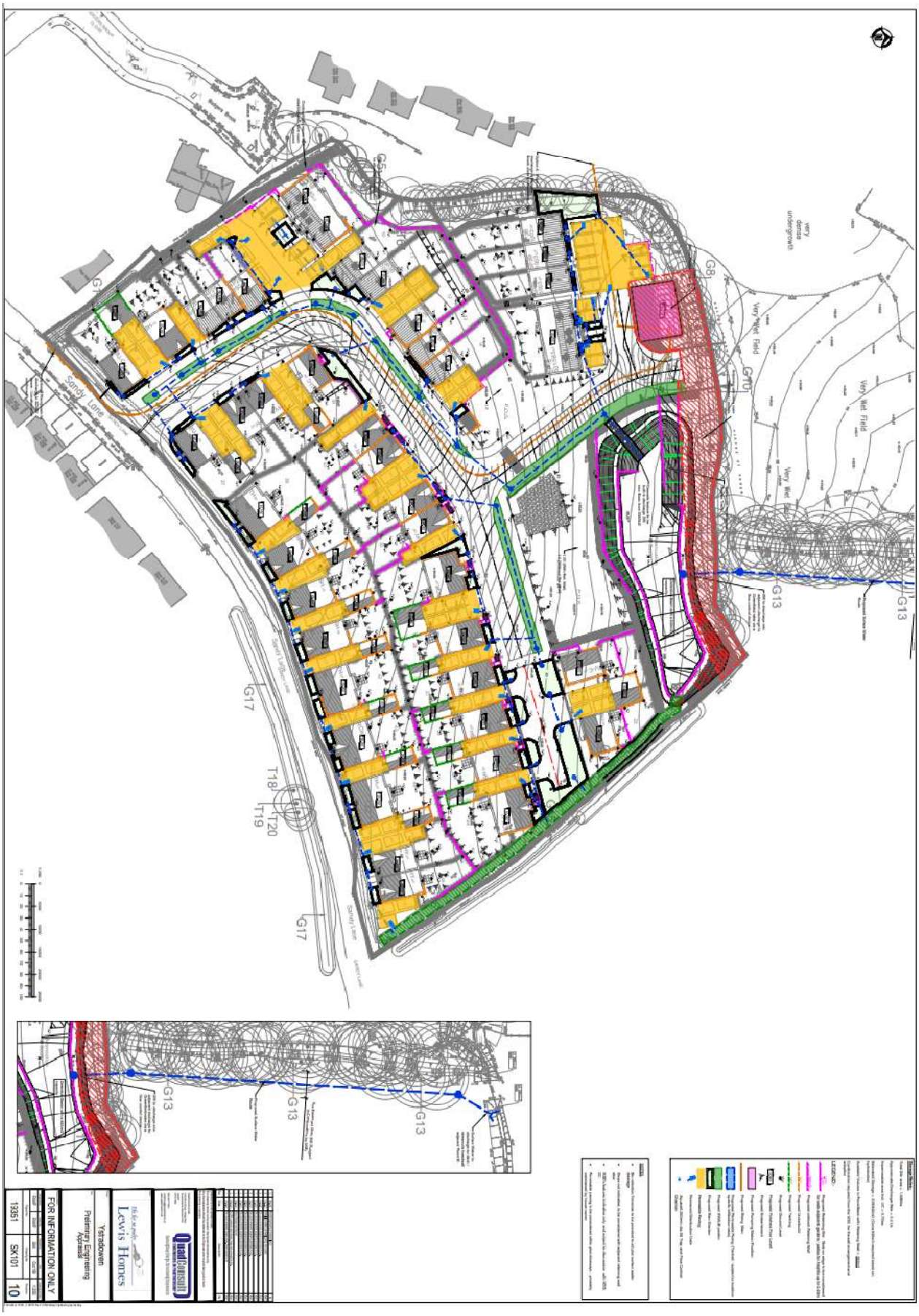

Cyfoeth Naturiol Cymru
Natural Resources Wales
Map Perygl Llifogydd / Flood Risk Map -
Allwedd / Map Key
Risk Level Under Review
Flood Risk from Rivers - Extent
High
Medium
Low
Flood Risk from the Sea
High
Medium
Low
Flood Risk from Surface Water & Small Watercourses - Extent
High
Medium
Low
Graddfa / Scale at A3 1:4,999
Dyddiad / Date
04/05/2023
Ystradowen
Railway
Dismantled
Sandy La
Pen Tal-y-fan

APPENDIX 4 – CONCEPT MASTERPLAN

Accomodation Schedule

House Name	Code	Beds	Stuctural Area (ft²)	No. of Units	Total Area
Open Market Units					
Hyatt	HY	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			Finished Area (ft²)		
1 Bed Flats	2.1.1	1	557	8	4456
2 Bed House	4.2.1	2	850	5	4250
3 Bed House	5.3.1	3	1003	6	6018
Sub Total				**19**	**14724**
Total				**46**	**46045**

APPENDIX 5 – PROPOSED DRAINAGE STRATEGY PLAN


Sandy Lane
Very Wet Field
G13
G17
T18
T19
T20
FOR INFORMATION ONLY
Ystradowen
Preliminary Engineering Appraisal
Lewis Homes
QuadConsult
19341
SK101
10

APPENDIX 6 – PROPOSED LANDSCAPE ARCHITECTS LAYOUT AND SCHEDULE
(To be included when completed)

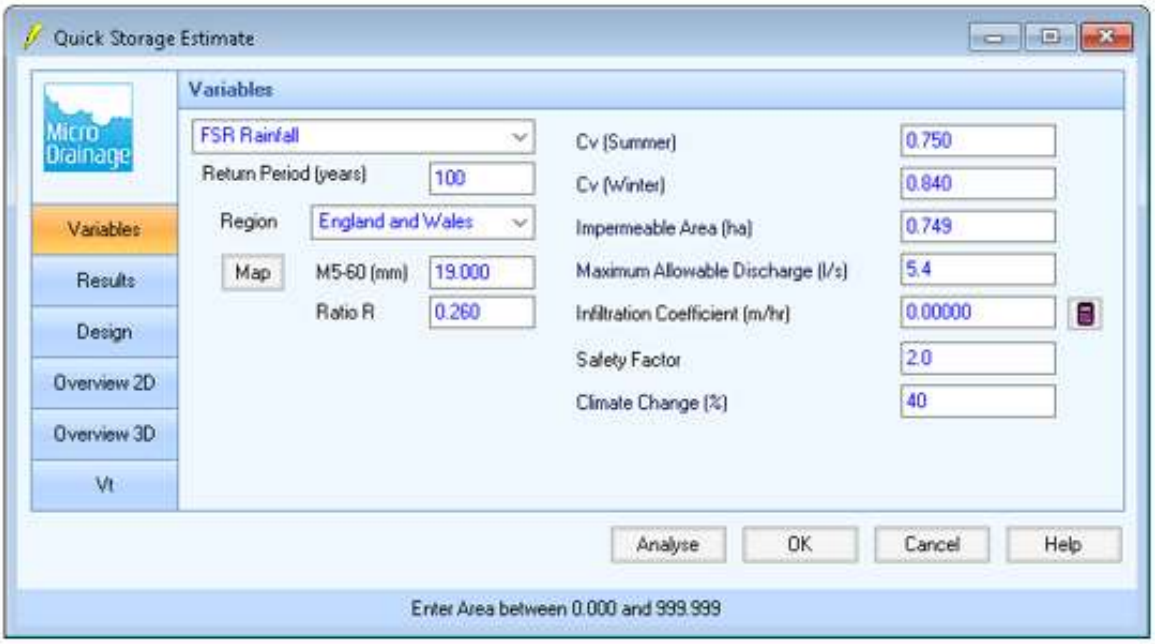
APPENDIX 7 – EXISTING CATCHMENTS & DISCHARGE RATES

19351 Ystradowen Estimated Storages

Site Area = 1.568ha

Discharge rate = Circa 5.4l/s

Imp Area Incl. Urban Creep = 0.75ha



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.

Table 9: Summary of Soil Infiltration Test Results

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^{-6}	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 - TP03

12604 Sandy Lane, Ystradowen

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Trial Pit Information	
Length (m)	2.60
Width (m)	0.70
Depth (m)	2.60
Groundwater	Dry
Weather Conditions	Dry
Date	05-Feb-20

Cycle 1		Cycle 2		Cycle 3	
Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
0	1.50				
1	1.52				
6	1.56				
18	1.60				
62	1.62				
102	1.66				
156	1.74				
276	1.90				

Remarks

Sloping of pit sides
Note trenome 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
At end of testing cycle	2.40		
Water Depths (m)			
Water depth at start of test	1.50		
Water depth at end of test	1.90		
Effective depth (measured)	0.40		
% Effective storage depth	0.44		
Effective Storage Depths (m)			
Effective storage depth (100%)	0.90		
Effective storage depth (75%)	0.68		
Effective storage depth (50%)	0.45		
Effective storage depth (25%)	0.23		
Outflow Time (min)			
Time for measured outflow	276		
Time for 100% outflow	930		
Time for 75-25% outflow	410		
Volume of Outflow (m³)			
Over measured effective depth	0.78		
Over 100% effective depth	1.75		
From 75% - 25% effective depth	0.83		
Surface Area (m²)			
For 100% effective storage	8.25		
For 50% effective storage	5.11		
Over measured depth	4.78		
Soil Infiltration Rate (m/s)	Cycle 1	Cycle 2	Cycle 3
Over 100% effective depth	3.8E-05		
Over measured depth	9.9E-05		
Over 75% - 25% effective depth	7.0E-05		

BRE365 SOIL INFILTRATION RATE TEST - TP06

12604 Sandy Lane, Ystradowen

Trial Pit Information	
Length (m)	2.80
Width (m)	0.70
Depth (m)	2.10
Groundwater	DRY
Weather Conditions	DRY
Date	05-Feb-20

Remarks
Note trendline 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

	Cycle 1		Cycle 2		Cycle 3	
	Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
	0	0.60				
	1	0.64				
	2	0.65				
	45	0.73				
	68	0.84				
	159	0.99				
	250	1.06				

Final Excavation Depth (m)		Cycle 1	Cycle 2	Cycle 3
At end of testing cycle		2.10		
Water Depths (m)				
Water depth at start of test		0.60		
Water depth at end of test		1.06		
Effective Depth (measured)		0.46		
% Effective storage Depth		0.31		
Effective Storage Depths (m)				
Effective storage depth (100%)		1.50		
Effective storage depth (75%)		1.13		
Effective storage depth (50%)		0.75		
Effective storage depth (25%)		0.38		
Outflow Time (min)				
Time for measured outflow		250		
Time for 100% outflow		870		
Time for 75-25% outflow		460		
Volume of Outflow (m³)				
Over measured effective depth		0.56		
Over 100% effective depth		2.94		
From 75% - 25% effective depth		1.47		
Surface Areas (m²)				
For 100% effective storage	12.46			
For 50% effective storage	7.21			
Over measured depth	5.18			
Soil Infiltration Rate (m/s)		Cycle 1	Cycle 2	Cycle 3
Over 100% effective depth		4.5E-06		
Over measured depth		1.2E-05		
Over 75% - 25% effective depth		7.4E-06		

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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	Dry
Date	05-Feb-20

Remarks
At end of test, trial pit depth was 0.8m due to spalling of pit sides.

	Cycle 1		Cycle 2		Cycle 3	
	Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
	0	0.40				
	2	0.43				
	4	0.44				
	32	0.54				
	39	0.55				
	61	0.58				
	81	0.60				

		Cycle 1	Cycle 2	Cycle 3
Final Excavation Depth (m)				
At end of testing cycle		0.80		
Water Depths (m)				
Water depth at start of test		0.40		
Water depth at end of test		0.60		
Effective depth (measured)		0.20		
% Effective storage depth		0.50		
Effective Storage Depths (m)				
Effective storage depth (100%)		0.40		
Effective storage depth (75%)		0.30		
Effective storage depth (50%)		0.20		
Effective storage depth (25%)		0.10		
Outflow Time (min)				
Time for measured outflow		61		
Time for 100% outflow		250		
Time for 75-25% outflow		158		
Volume of Outflow (m³)				
Over measured effective depth		0.35		
Over 100% effective depth		0.70		
From 75% - 25% effective depth		0.35		
Surface Area (m²)				
For 100% effective storage		4.31		
For 50% effective storage		3.03		
Over measured depth		3.03		
Soil Infiltration Rate (m/s)	Cycle 1	Cycle 2	Cycle 3	
Over 100% effective depth	1.1E-05			
Over measured depth	2.4E-05			
Over 75% - 25% effective depth	1.2E-05			

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BRE365 SOIL INFILTRATION RATE TEST - TP07

12604 Sandy Lane, Ystradowen

Trial Pit Information	
Length (m)	1.90
Width (m)	0.70
Depth (m)	1.70
Groundwater	Dry
Weather Conditions	
Date	21.02.20

Remarks
Note trendline extapolated 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	0.68		
	35	0.74	104	1.02		
	73	0.90	164	1.25		
	106	1.05				
	136	1.17				
	165	1.27				
	197	1.36				

Final Excavation Depth (m)			
At end of testing cycle	Cycle 1	Cycle 2	Cycle 3
Water Depths (m)	1.70	1.70	
Water depth at start of test	0.55	0.55	
Water depth at end of test	1.36	1.25	
Effective Depth (measured)	0.83	0.70	
% Effective storage depth	0.72	0.61	
Effective Storage Depths (m)			
Effective storage depth (100%)	1.15	1.15	
Effective storage depth (75%)	0.86	0.86	
Effective storage depth (50%)	0.58	0.58	
Effective storage depth (25%)	0.29	0.29	
Outflow Time (min)			
Time for measured outflow	197	154	
Time for 100% outflow	270	270	
Time for 75-25% outflow	140	140	
Volume of Outflow (m³)		0.53	
Over measured effective depth	1.15	1.15	
Over 100% effective depth	1.53	1.53	
From 75% - 25% effective depth	0.76	0.76	
Surface Area (m²)			
For 100% effective storage	7.31	7.31	
For 50% effective storage	4.32	4.32	
Over measured depth	5.55	4.97	
Soil Infiltration Rate (m/s)	Cycle 1	Cycle 2	Cycle 3
Over 100% effective depth	1.3E-05	1.3E-05	
Over measured depth	1.7E-05	1.9E-05	
Over 75% - 25% effective depth	**2.1E-05**	**2.1E-05**	

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BRE365 SOIL INFILTRATION RATE TEST - TP08

12604 Sandy Lane, Ystradowen

Trial Pit Information	
Length (m)	1.80
Width (m)	0.65
Depth (m)	1.40
Groundwater	
Weather Conditions	1
Date	21.04.20

Remarks
Note: trendline 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

	Cycle 1		Cycle 2		Cycle 3	
	Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
	0	0.40				
	5	0.44				
	43	0.55				
	80	0.64				
	110	0.69				
	166	0.75				
	247	0.85				
	283	0.85				

Final Excavation Depth (m)			
At end of testing cycle	Cycle 1	Cycle 2	Cycle 3
Water Depths (m)	1.40		
Water depth at start of test	0.40		
Water depth at end of test	0.85		
Effective depth (measured)	0.45		
% Effective storage depth	0.45		
Effective Storage Depths (m)			
Effective storage depth (100%)	1.00		
Effective storage depth (75%)	0.75		
Effective storage depth (50%)	0.50		
Effective storage depth (25%)	0.25		
Outflow Time (min)			
Time for measured outflow	283		
Time for 100% outflow	640		
Time for 75-25% outflow	330		
Volume of Outflow (m³)			
Over measured effective depth	0.53		
Over 100% effective depth	1.17		
From 75% - 25% effective depth	0.59		
Surface Area (m²)			
For 100% effective storage	6.07		
For 50% effective storage	3.62		
Over measured depth	3.38		
Soil Infiltration Rate (m/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		

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BRE365 SOIL INFILTRATION RATE TEST - TP12

12604 Sandy Lane, Ystradowen

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

Remarks
Note trendline 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

Cycle 1		Cycle 2		Cycle 3	
Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
0	0.64				
16	0.70				
39	0.75				
61	0.83				
150	0.92				
183	0.95				

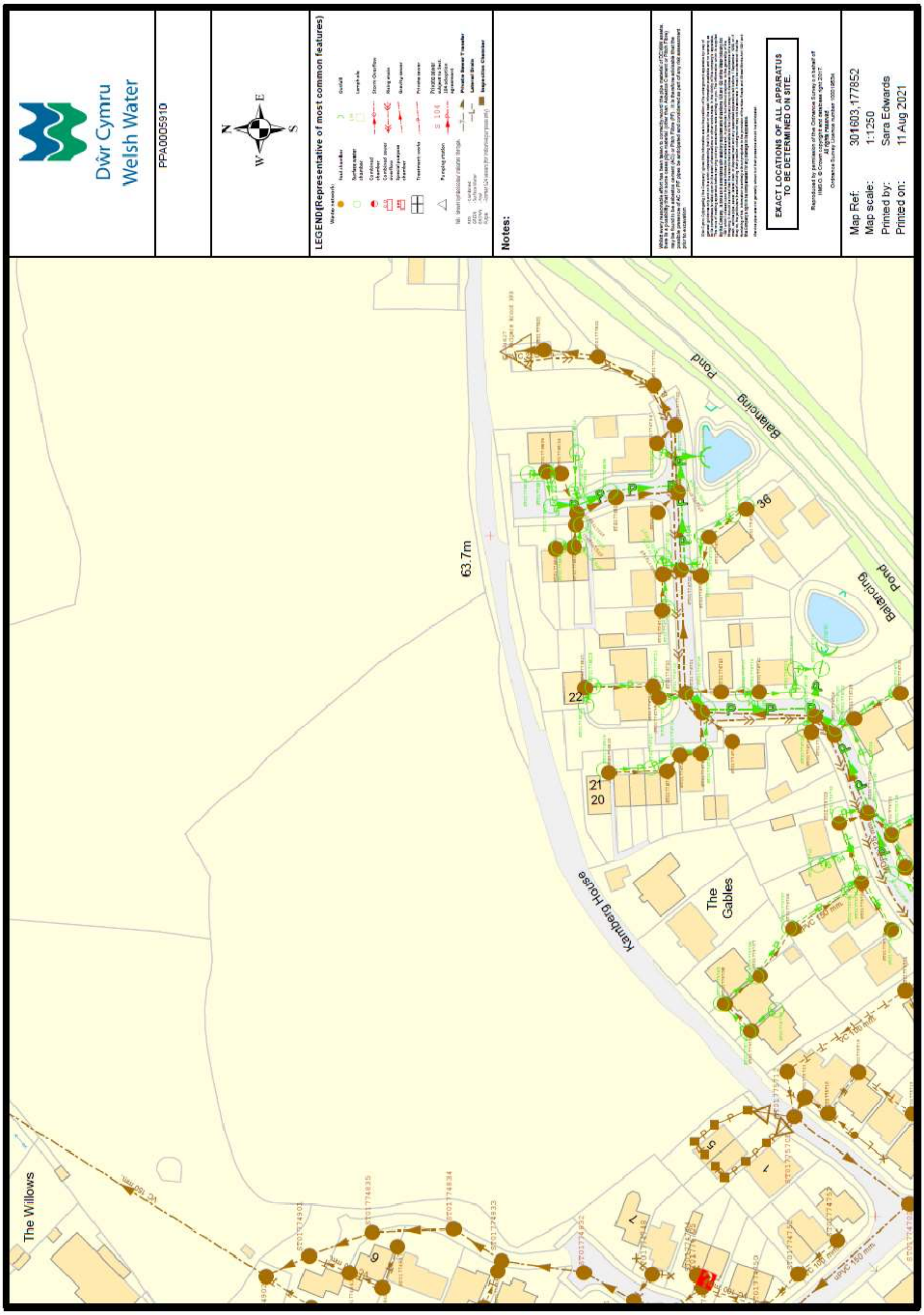
Final Excavation Depth (m)		Cycle 1	Cycle 2	Cycle 3
At end of testing cycle		2.00		
Water Depths (m)				
Water depth at start of test		0.64		
Water depth at end of test		0.95		
Effective depth (measured)		0.32		
% Effective storage depth		0.24		
Effective Storage Depths (m)				
Effective storage depth (100%)		1.35		
Effective storage depth (75%)		1.02		
Effective storage depth (50%)		0.66		
Effective storage depth (25%)		0.34		
Outflow Time (min)				
Time for measured outflow		183		
Time for 100% outflow		780		
Time for 75-25% outflow		380		
Volume of Outflow (m³)				
Over measured effective depth		0.42		
Over 100% effective depth		1.77		
From 75% - 25% effective depth		0.86		
Surface Area (m²)				
For 100% effective storage		8.51		
For 50% effective storage		4.90		
Over measured depth		3.05		
Soil Infiltration Rate (m/s)	Cycle 1	Cycle 2	Cycle 3	
Over 100% effective depth	4.4E-05			
Over measured depth	1.3E-05			
Over 75% - 25% effective depth	7.9E-06			

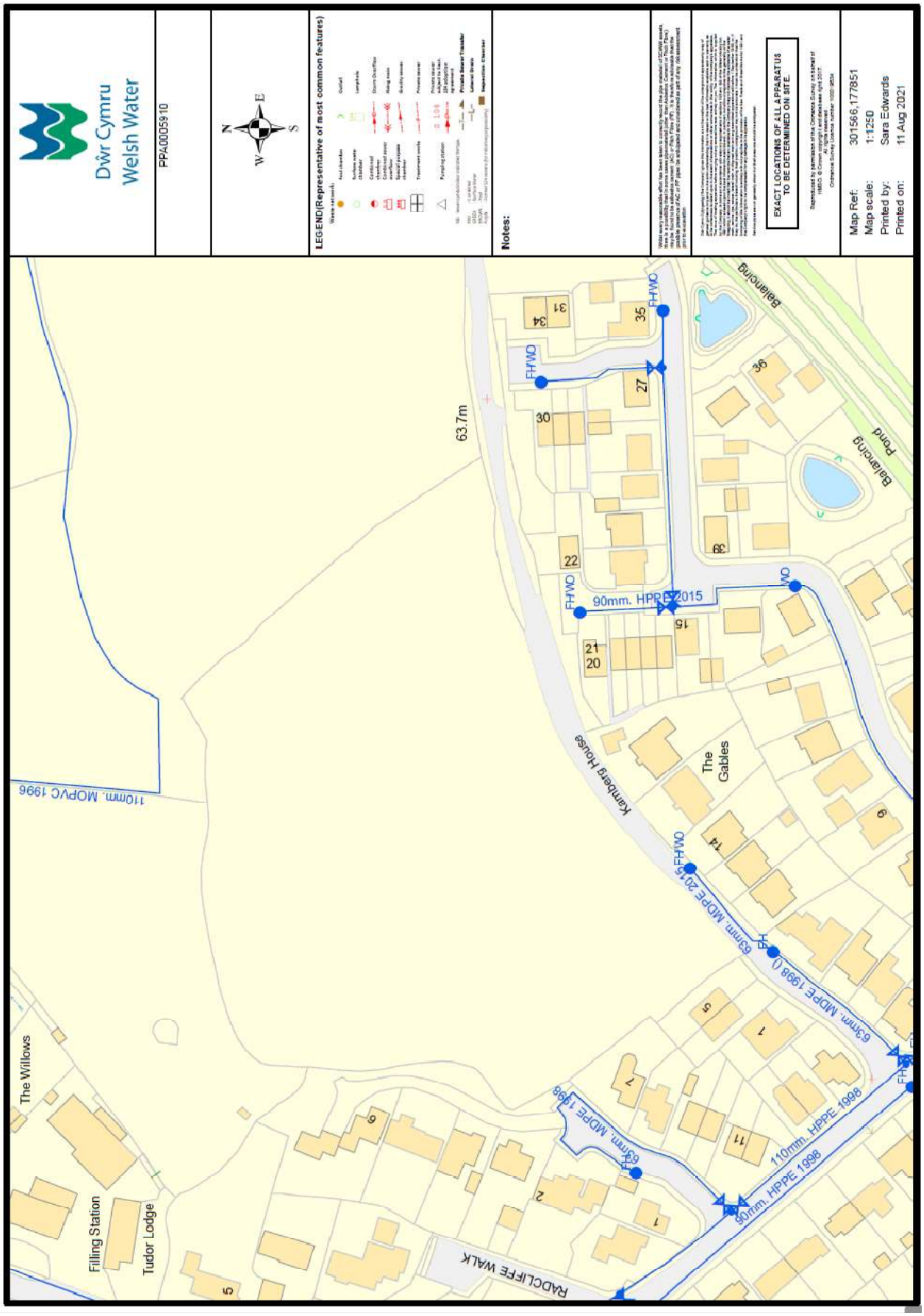
Intégral Géotechnique

APPENDIX 9 – WELSH WATER ASSET MAPS

QuadConsult ENGINEERS IN PARTNERSHIP

Consulting Civil & Structural Engineers




Dŵr Cymru
Welsh Water
PPA0005910
LEGEND(Representative of most common features)
Notes:
EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.
Map Ref: 301566,177851
Map scale: 1:1250
Printed by: Sara Edwards
Printed on: 11 Aug 2021
63.7m
110mm. MOPVC 1996
90mm. HPPE 2015
63mm. MDPE 1998
63mm. MDPE 2015
110mm. HPPE 1998
90mm. HPPE 1998
FHWO
Balancing Pond
Kambeng House
The Gables
The Willows
Filling Station
Tudor Lodge
RADCLIFFE WALK

APPENDIX 10 – CONFIRMATION OF AGREED DISCHARGE RATES
(To be included when completed)

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 Index$_1$ + 0.5 Mitigation Index$_2$

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 Index$_1$ + 0.5 Mitigation Index$_2$

	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.