

PEN YR ALLTWEN
RHOS
DRAINAGE STRATEGY

1.0 Summary

- 1.1 This Drainage Strategy Technical Note has been prepared, along with the appended drawings and calculations, for a planning application for the proposed residential development comprising eight dwellings at Pen Yr Alltwen.
- 1.2 The development comprises the proposed erection of eight dwellinghouses and an associated access road and parking immediately south of Pen-Yr-Alltwen, at the north west of Rhos in Neath Port Talbot.
- 1.3 The site is not at risk of flooding from any source.
- 1.4 All surface water from within the developed area of the site will be discharged to shallow infiltration features in the form of permeable paving with various sub-base materials.

2.0 Introduction

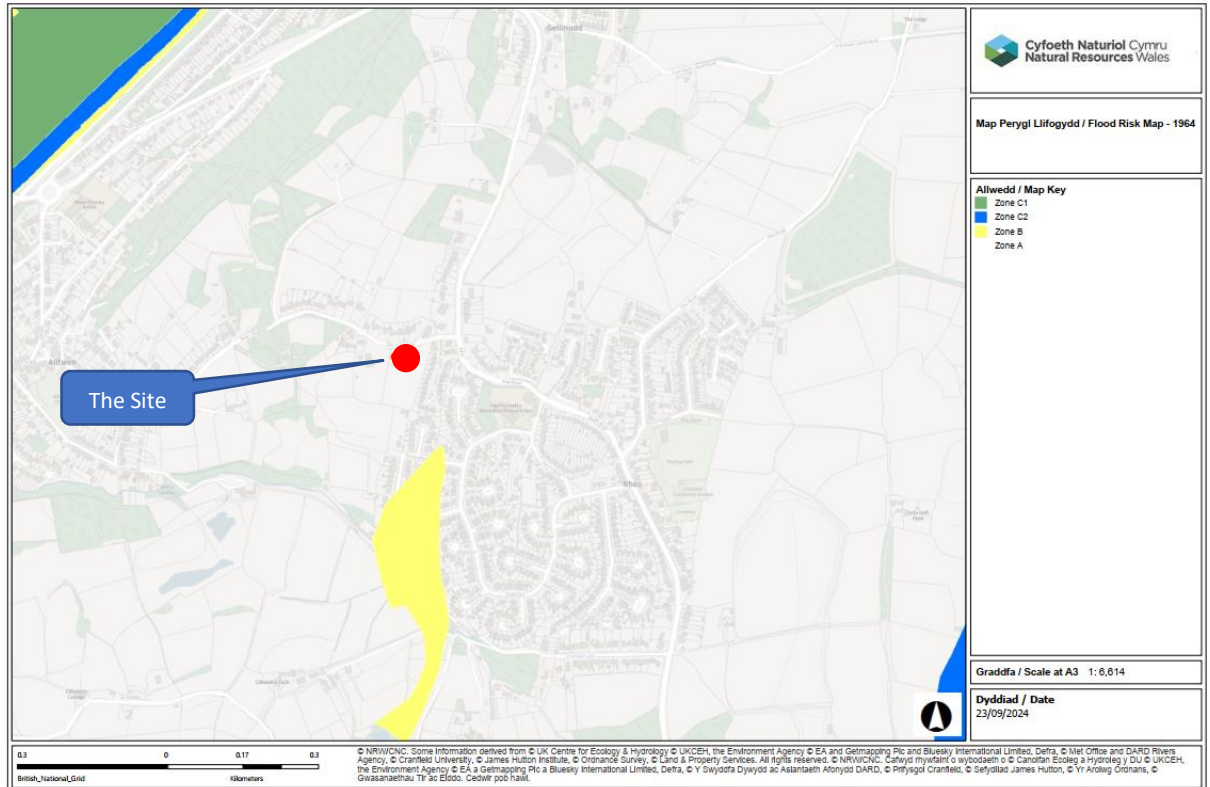
- 2.1 Condon Drew Associates Ltd. (CDA) have been appointed by Ms. Dawn Davies (the Client) to prepare a Sustainable Drainage System (SuDS) Design to support a proposed development for eight dwellings at Pen-Yr-Alltwen in Rhos. The site is currently open space and is situated within the Settlement Limit (SC1) of Rhos.
- 2.2 Neath Port Talbot Council (NPT) as the Lead Local Flood Authority (LLFA) act as the SuDS Approval Body (SAB). As part of any development comprising more than one dwelling, or covering a construction area of over 100m², a SuDS design is required. This technical note explains the rationale behind the drainage design and following planning approval could form part of the SAB application.
- 2.3 This Drainage design follows a previous submission which was approved in principle, however, included drainage infrastructure outside the red line boundary. This design has been implemented with all drainage features kept within the red line.

3.0 Flood Risk

- 3.1 The Natural Resources Wales (NRW) Development Advice Map, included as **Figure 3.1**, overleaf, indicates that the site lies within Zone A, comprising land assessed as having less than a 1 in 1000

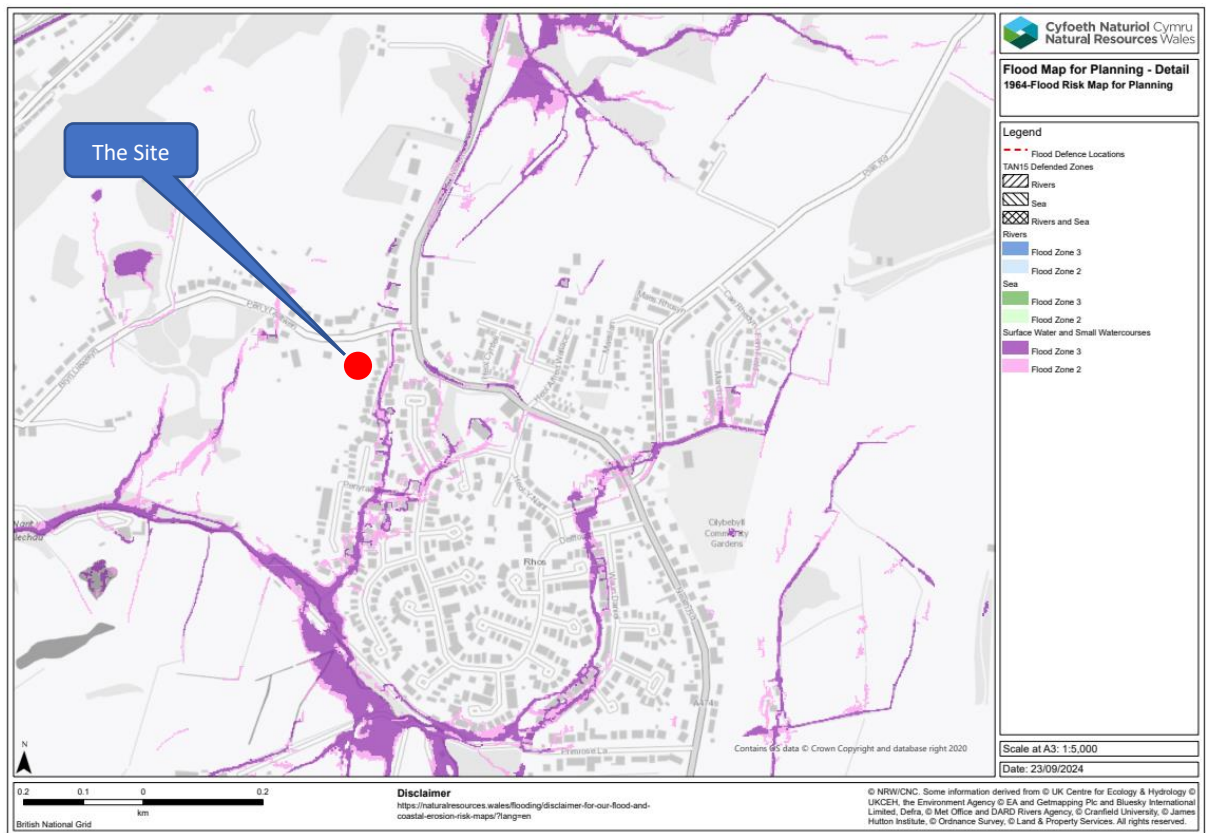
annual probability of river flooding in any year ($<0.1\%$). As such the mapping indicates that the Site is not at risk from fluvial flooding, and under TAN 15, a flood consequences assessment is not required. One however will be prepared for the SAB Application.

Figure 3.1: Development Advice Map



3.2 The NRW's Flood Risk Map in **Figure 3.2**, overleaf, shows the extent of flood risk from rivers, the sea and surface water. The mapping indicates that there are no sources of flood risk to the site.

Figure 3.2: Surface Water Flood Risk Map



- 3.3 The site covers an area of 3,348m²(0.335ha), with no existing impermeable areas within the boundary. The proposals for the site introduce roof (459m²), patio/driveway (599m²) and highway (874m²) areas, totalling 1,932m². A 10% allowance for urban creep has been added to the roof areas within the hydraulic model.
- 3.4 This addition of impermeable areas would, unmitigated, increase the runoff rate from the site and subsequently flood risk downstream of the site. As such a SuDS strategy has been developed to regulate discharge from the site to ground.
- 3.5 The site is in a developed area, with residential development to the north, east and west. The south of the application site is the remainder of the field, with residential areas beyond.

4.0 Surface Water Drainage Design

- 4.1 As can be seen from the levels on the topographical survey, the site falls predominantly west to east, with a slight north to south fall, with surface water runoff leaving the site via overland flows via a ditch bordering the adjacent gardens of Corner Meadows.
- 4.2 Infiltration testing was undertaken on the site as part of the previous design work and is included in

Appendix A. Infiltration rates are suitable for design purposes and, as previously mentioned formed the basis of the previous drainage strategy.

- 4.3 Greenfield runoff rates have been calculated for the site and are included in **Appendix B** and summarised in **Table 4.1**, below:

Table 4.1: Runoff Rates

Return Period	Greenfield Runoff (ls^{-1})
Q2	2.7
Qbar	2.9
Q30	5.3
Q100	6.4

- 4.4 Due to groundwater at 1.7m bgl in Trial Pit 1, shallow infiltration devices have been used to ensure a minimum clearance of 1m is achieved between the base of the infiltration devices and the groundwater.
- 4.5 All driveways are to be constructed from permeable paving with a high-void sub-base replacement included (such as Permavoid) which will provide the required storage volume while infiltration occurs.
- 4.6 The majority of the highway will be constructed from traditional permeable paving with a sub-based providing a minimum 30% void for storage. A small section of the highway at the lower end of the site will require the high-void sub-base alternative.
- 4.7 The permeable paving provides the required volume for the surface water generated from the site. As the areas of permeable paving abut one another, infiltration has been modelled out of the base only, with no lateral / side infiltration. This adds a measure of conservatism to the model as certain areas of the paving will allow for infiltration from the sides.
- 4.8 In addition to the permeable paving, it is also recommended that rainwater harvesting is employed, using rain water butts. Private rain gardens and raised rain planters can also be employed at each plot.
- 4.9 The area of open space at the site access has been identified as a bioretention area such as a raingarden. At detailed design stage, the additional storage and infiltration potential for this area

could reduce the storage volume required in the highway and may result in the removal of the high-void sub-base replacement within the highway land.

- 4.10 These additional features have not been included in the hydraulic model as there are several options available that could be included as part of the site drainage. Furthermore, in the case of items such as rainwater butts, there is no guarantee of the volume that will be available at the start of any storm. Again, this adds a factor of safety to the model as there is likely to be some storage available within the site that is not accounted for in the model results.
- 4.11 Design parameters used within the model are based on best practise as well as local and national guidance. The following values have been used within the model, which is available as a .mdx file or .pfd file on request:
- Summer Cv: 0.75
 - Winter Cv: 1.0
 - Raio-R: 0.2
 - M5-60: 20
 - SAAR: 1,574mm
 - Soil Index: 3
 - Hydrological Region: 9
 - Drain Down Time: 1,440 minutes:
 - Additional Storage: 0m³/ha
 - Storm Duration: 15 minutes to 2,160 minutes (Longest Critical Storm is 960 minutes)
- 4.12 Details of the surface water drainage system are shown on drawing 1964-501, included in **Appendix C**, while the hydraulic model for the site is included in **Appendix B**. The model shows that there is no flooding on site in events up to and including the Q100+40% event.
- 4.13 **Table 4.2**, below shows the details of the proposed infiltration devices including the half drain times, all of which are less than 1,440 minutes.

Table 4.2: Proposed SuDS features

SuDS Reference	Area (m ²)	Void (%)	Depth (mm)	Half Drain Time (mins)
Plot-1	47.7	95	450	1,080
Plot-2	83.0	95	300	450
Plot-3	33.0	95	340	900
Plot-4	33.0	95	300	675
Plot-5	24.6	95	340	816

Plot-6	40.0	95	300	735
Plot-7	86.8	95	255	96
Plot-8	85.0	95	235	464
H-Way-01	96.0	30	375	360
H-Way-02	86.0	30	375	152
H-Way-03	186.0	30	375	180
H-Way-04	39.0	30	375	336
H-Way-05	106.0	95	385	1,008

- 4.14 The system has been designed to ensure no flooding up to and including the Q100 rainfall event with a 40% allowance for climate change.
- 4.15 If the above mitigation measures are provided as part of the development, it is considered that the primary residual flood risk would be as a result of some type of failure of the site's drainage system during the lifetime of the development. Regular, ongoing maintenance will therefore be required to ensure that the capacity of the system is maintained as it has been designed. It is proposed that maintenance is carried out in accordance with the SuDS Manual (Ciria 753).
- 4.16 There remains a residual risk of a storm event that exceeds the capacity of the drainage system, as events beyond the 1 in 100 year plus 40% allowance for climate change storm event will not be catered for explicitly. This is in line with planning guidance as designing for more extreme storm becomes unviable due to the increased mitigation required versus the decreasing chance of such a storm occurring.
- 4.17 In the event of an exceedance event, overland flows will follow the topography of the land, eastwards towards the existing ditch that currently takes run off from the site. This will mimic the existing conditions, however flows off the site will be lower than they would in the current situation due to the storage available onsite. Exceedance flows are shown on the drainage strategy in **Appendix C**.

5.0 SuDS

- 5.1 As mentioned previously, SuDS have been incorporated into the surface water drainage design. Proposed SuDS for the site include permeable paving, though it is recommended that rain planters and / or rain water butts are installed to encourage water reuse.

- 5.2 The permeable paving has been included in the model to consider the water quality of the site. As all surface water will flow into at least one area of permeable paving, they have been identified as part of the treatment train in order to provide a conservative assessment. The mitigation indices for TSS, Metals and Hydrocarbons are all shown as sufficient. This can be seen in the calculations in **Appendix B.**

6.0 Report Summary

- 6.1 This Drainage Strategy Technical Note has been prepared for a planning application for a proposed development comprising the erection of eight dwellings at Pen-Yr-Alltwen, Rhos.
- 6.2 The site is shown not to be at any risk of flooding.
- 6.3 Surface water has been designed to discharge to ground via permeable paving with various sub-base materials and depths.
- 6.4 SuDS features will be used as both storage and treatment devices within the site, with permeable paving used for surfaces and rain planters where appropriate at down pipes.
- 6.5 There is no flooding on site in the Q100 year + climate change event

Appendix A

Infiltration Testing Results

Our Ref: MW/16570/Let1

Your Ref:

Contact: Michael Watkins

Terra Firma (Wales) Ltd.

Consulting Geotechnical & Geo-Environmental Engineers
Site Investigation Contractors

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17th December 2020

Mrs Dawn. Davies,
34 Lon Catwg,
Gellinudd,
Pontardawe.
SA8 3DU

For the attn. of Mrs Dawn Davies

Dear Dawn,

IN-SITU INFILTRATION TESTING: PROPOSED RESIDENTIAL DEVELOPMENT AT MIN YR AWEL, PEN YR ALLTWEN, RHOS, PONTARDAWE

1.0 Introduction

Mrs Dawn Davies (hereafter known as the Client) is proposing the construction of a new residential development at a field known as Min Yr Awel, off Pen Yr Alltwn, in Rhos, near Pontardawe.

Terra Firma Wales Ltd have been commissioned by LRM Planning Limited on behalf of the Client to undertake a day of soakaway testing to the general requirements of BRE 365 at the site.

LRM Planning Limited is the planning consultant for the proposed development.

1.1 Limitations and Exceptions of Investigation

The Client has requested that in-situ soakaway testing be performed at the site.

The report has been conducted and this report has been prepared for the sole internal reliance of the Client and their design team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The report represents the findings and opinions of experienced geotechnical and geo-environmental consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may also be required. The subsurface geological profiles, any contamination and other plots are generalised by necessity and have been based on the information found at the locations of the exploratory holes and depths sampled and tested.

2.0 Site Work

A ground investigation comprising the excavation of 5No. trial pits was undertaken on the 27th November 2020.

The fieldwork was supervised by Terra Firma (Wales) Limited, who logged the exploratory holes to the requirements of BS 5930:2015+A1:2020. The proposed locations of the exploratory holes were determined by Terra Firma (Wales) Ltd.

Trial pits referenced TP01 to TP05, were formed using a 6-tonne tracked excavator with 0.45m and 0.60m wide buckets.

The trial pit logs are presented in **Annex A**.

Soakaway tests were carried out in trial pits TP02 to TP05 in general accordance with BRE Digest 365:2016. The excavation sides were squared using the excavator bucket and dimensions recorded within the test section. The trial pit was partially filled with clean water using a dedicated bowser with a 75mm diameter outlet and the fall in level recorded against time. The results are presented in **Annex B**.

On completion all trial pits were backfilled with materials arisings compacted in layers using the excavator bucket. The ground surface was left proud to accommodate future settlement of backfilled materials.

Drawing 01 shows the positions of the exploratory hole and test positions.

3.0 Ground Conditions

The ground conditions encountered by the exploratory holes can in general be summarised as shown in **Table 3.1**.

Table 3.1 Summary of Typical Ground Conditions

Depth (m)			Thickness (m)	Stratum
0.00	-	0.15/0.3	0.15/0.3	Grass over brown organic-rich sandy slightly gravelly CLAY
0.15/0.3	-	0.45/>3.0	Absent/>2.65	Firm becoming stiff grey and brown slightly sandy slightly gravelly CLAY
0.45/2.2	-	>1.3/>2.5	-	[Medium dense] brown and grey slightly clayey gravelly SAND /clayey sandy GRAVEL

3.1 Groundwater

Groundwater information recorded during the site investigation is summarised in **Table 3.2**.

Table 3.2 Groundwater Summary

Location	Depth (m)	Details
TP01	2.4	Standing water rose to 1.70m after 2 hours
TP05	3.0	Very slow inflow

4.0 In-situ Soakaway Test Results

Soakaway tests were undertaken in trial pits TP02 to TP05 to the requirements of BRE Digest 365. A summary of the test results is presented in **Table 4.1**.

Table 4.1 Summary of Soakaway Results

Trial Pit	Depth Range of Test (m)	Infiltration Rate (ms⁻¹)
TP02	1.45 - 2.00	8.43 x10 ⁻⁰⁶
TP03	1.26 - 1.70	1.55 x10 ⁻⁰⁵
TP04	0.81 - 1.3	2.56 x10 ⁻⁰⁵
TP05	1.5 - 3.0	No infiltration recorded

A copy of the in-situ soakaway test results is presented in **Annex B**.

Due to the slow rate of infiltration only one test could be achieved during the one day allowed for the investigation.

We trust that the above is to your satisfaction, however, if you have any queries or require any further information please do not hesitate to contact us.

Yours sincerely
for: **Terra Firma (Wales) Ltd**



Michael Watkins

enc.

ANNEX A
Trial Pit Logs



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Trial Pit No:

TP01

Sheet 1 of 1

Project Name: Min yr Awl

Project No:
16570

Co-ords: -
Level:

Date:
27/11/2020

Location: Pen yr Alltwen, Rhos

Dimensions:
Depth 2.50
1.80
0.60

Scale:
1:25

Logged:
MW

Client: Mrs Dawn Davies

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.30			Grass over brown organic-rich sandy slightly gravelly CLAY. Gravel is angular sandstone. Some roots and rootlets. Moist.	
							Firm orangish brown sandy slightly gravelly CLAY with low cobble content. Occasional roots and rootlets. Gravel and cobbles are angular sandstone. Moist.	1
				1.30			Firm grey mottled brown slightly sandy gravelly CLAY with low cobble and boulder content. Gravel, cobbles and boulders are angular sandstone.	
				1.80			Stiff grey and brown mottled black slightly sandy slightly gravelly CLAY. Gravel is angular sandstone.	2
				2.20			[Medium dense] grey slightly clayey sandy GRAVEL of angular sandstone.	
				2.50			End of Pit at 2.500m	3
								4
								5

Stability: Stable

Remarks: 1] Consistency, strength and density indicators are based upon field judgement. 2] Density indicator is in brackets and is for guidance only, and is not in accordance with BS 5930:2015. 3] Trial pit terminated due to shallow groundwater inflow. 4] Groundwater level in trial pit rose to 1.70m after 2 hours. 5] Trial pit backfilled with arisings.



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CF23 7HA

Trial Pit No:
TP02
Sheet 1 of 1

Project Name: Min yr Awl Project No: 16570 Co-ords: - Level: Date: 27/11/2020

Location: Pen yr Alltwen, Rhos Dimensions: 1.80 Scale: 1:25
Client: Mrs Dawn Davies Depth 2.00 0.60 Logged: MW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			Grass over brown organic-rich sandy slightly gravelly CLAY. Gravel is angular sandstone. Some roots and rootlets. Moist. Firm orangish brown sandy slightly gravelly CLAY with medium cobble and low boulder content. Gravel and cobbles are angular sandstone. Moist.	
				0.70			[Medium dense] brown clayey very sandy GRAVEL with medium cobble and low boulder content. Gravel, cobbles and boulders are angular sandstone. Moist.	1
				2.00			End of Pit at 2.000m	2
								3
								4
								5

Stability: Stable

Remarks: 1] Consistency, strength and density indicators are based upon field judgement. 2] Density indicator is in brackets and is for guidance only, and is not in accordance with BS 5930:2015. 3] Trial pit terminated to perform infiltration test. 4] Trial pit backfilled with arisings on completion of test.



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Terra Firma (Wales) Limited
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CF23 7HA

Trial Pit No:

TP04

Sheet 1 of 1

Project Name: Min yr Awl

Project No:
16570

Co-ords: -
Level:

Date:
27/11/2020

Location: Pen yr Alltwn, Rhos

Dimensions:

1.40

Depth

0.50

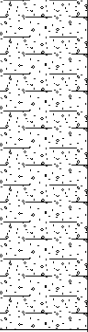
1.30

Scale:

1:25

Logged:
MW

Client: Mrs Dawn Davies

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.15			Grass over brown organic-rich sandy slightly gravelly CLAY. Gravel is angular sandstone. Some roots and rootlets. Moist.
				1.30			[Medium dense] greyish brown mottled orangish brown slightly clayey gravelly SAND with medium cobble content. Gravel and cobbles are angular sandstone. Moist.
							End of Pit at 1.300m

Stability: Stable

Remarks: 1] Consistency, strength and density indicators are based upon field judgement. 2] Density indicator is in brackets and is for guidance only, and is not in accordance with BS 5930:2015. 3] Trial pit terminated to perform infiltration test. 4] Trial pit backfilled with arisings on completion of test.



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Trial Pit No:

TP05

Sheet 1 of 1

Project Name: Min yr Awl

Project No:
16570

Co-ords: -
Level:

Date:
27/11/2020

Location: Pen yr Alltwen, Rhos

Dimensions:

1.80

Depth
3.00

0.50

Scale:
1:25

Logged:
MW

Client: Mrs Dawn Davies

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.35			Grass over brown organic-rich sandy slightly gravelly CLAY. Gravel is angular sandstone. Some roots and rootlets. Moist.	
							Soft grey and orangish brown slightly sandy slightly gravelly silty CLAY. Gravel is angular sandstone. Moist.	
							Becoming stiff from 1.0m.	1
								2
				3.00			End of Pit at 3.000m	3
								4
								5

Stability: Stable

Remarks: 1] Consistency, strength and density indicators are based upon field judgement. 2] Density indicator is in brackets and is for guidance only, and is not in accordance with BS 5930:2015. 3] Trial pit terminated at extent of excavator's reach. 4] Trial pit backfilled with arisings.

ANNEX B
Soakaway Test Results

SOAKAWAY CALCULATION SHEET

Job Name: Min yr Awel, Pen yr Alltwen, Rhos

Job Number: 16570

Date of Test: 27.11.2020

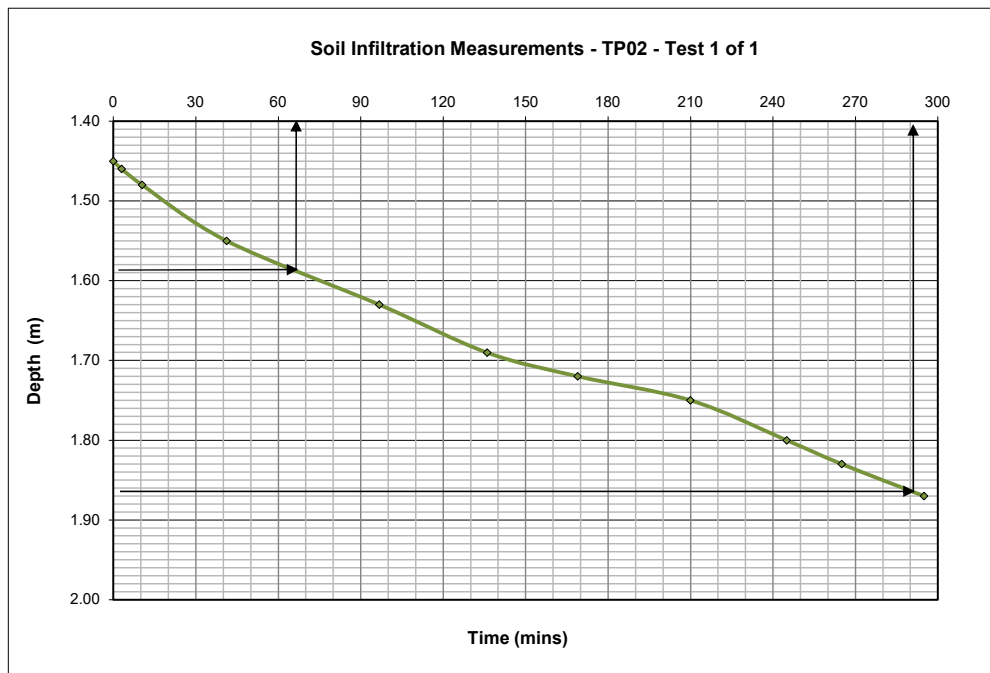
Test No.: TP02 - Test 1 of 1

	Depth to Water (m)	Time (Mins)
(effective depth - 100%)	1.45	0
	1.46	3
	1.48	10.5
	1.55	41.25
	1.63	96.75
	1.69	136
	1.72	169
	1.75	210
	1.80	245
	1.83	265
(effective depth - 0%)	1.87	295

Length of Trial Pit (m)	1.80
Width of Trial Pit (m)	0.50
Depth of Trial Pit (m)	2.00
Effective Storage Depth (m)	0.55
Vp25	1.5875
Vp75	1.8625
Vp75-25	0.248
Outflow (%)	76
50% effective depth (m)	0.275
Mean Surface area ap50 (m2)	2.165
Time for 25% Outflow (tp25)	65
Time for 75% Outflow (tp75)	291
tp75 - 25	226
Soil Infiltration Rate (m/s)	8.43058E-06

From Graph

From Graph



Soil Infiltration Worksheet:

This worksheet has been produced in combination with the document 'BRE Digest 365'.
Worksheet options are identified by a green background.

SOAKAWAY CALCULATION SHEET

Job Name: Min yr Awel, Pen yr Alltwen, Rhos

Job Number: 16570

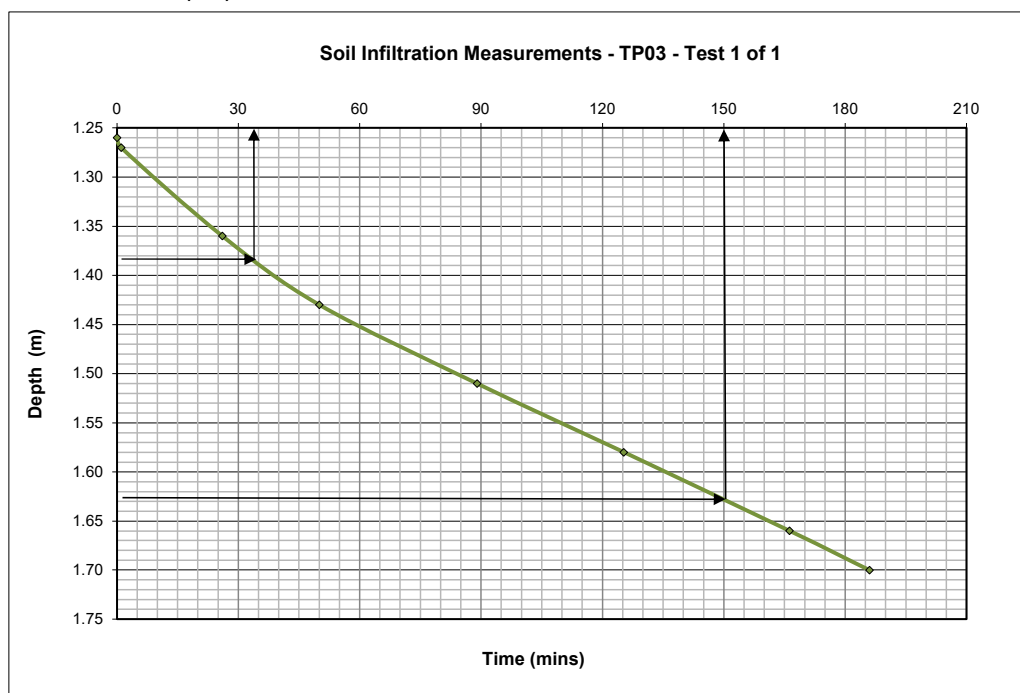
Date of Test: 27.11.2020

Test No.: TP03 - Test 1 of 1

	Depth to Water (m)	Time (Mins)
(effective depth - 100%)	1.26	0
	1.27	1
	1.36	26
	1.43	50
	1.51	89
	1.58	125.25
	1.66	166.25
(effective depth - 0%)	1.70	186

Length of Trial Pit (m)	1.80
Width of Trial Pit (m)	0.50
Depth of Trial Pit (m)	1.75
Effective Storage Depth (m)	0.49
Vp25	1.3825
Vp75	1.6275
Vp75-25	0.221
Outflow (%)	90
50% effective depth (m)	0.245
Mean Surface area ap50 (m2)	2.027

Time for 25% Outflow (tp25)	33	From Graph
Time for 75% Outflow (tp75)	150	From Graph
tp75 - 25	117	
Soil Infiltration Rate (m/s)	1.54959E-05	



Soil Infiltration Worksheet:

This worksheet has been produced in combination with the document 'BRE Digest 365'.
Worksheet options are identified by a green background.

SOAKAWAY CALCULATION SHEET

Job Name: Min yr Awel, Pen yr Alltwen, Rhos

Job Number: 16570

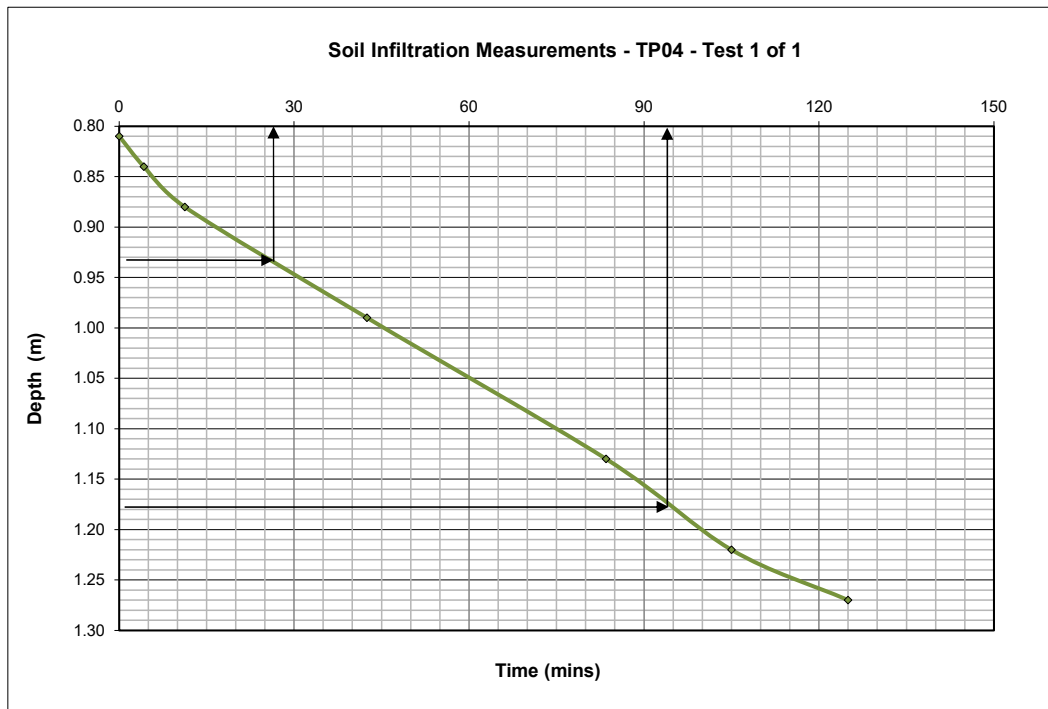
Date of Test: 27.11.2020

Test No.: TP04 - Test 1 of 1

	Depth to Water (m)	Time (Mins)
(effective depth - 100%)	0.81	0
	0.84	4.25
	0.88	11.25
	0.99	42.5
	1.13	83.5
	1.22	105
(effective depth - 0%)	1.27	125

Length of Trial Pit (m)	1.40
Width of Trial Pit (m)	0.50
Depth of Trial Pit (m)	1.30
Effective Storage Depth (m)	0.49
Vp25	0.9325
Vp75	1.1775
Vp75-25	0.172
Outflow (%)	94
50% effective depth (m)	0.245
Mean Surface area ap50 (m2)	1.631

Time for 25% Outflow (tp25)	26	From Graph
Time for 75% Outflow (tp75)	94.5	From Graph
tp75 - 25	68.5	
Soil Infiltration Rate (m/s)	2.5584E-05	



Soil Infiltration Worksheet: This worksheet has been produced in combination with the document 'BRE Digest 365'. Worksheet options are identified by a green background.

SOAKAWAY CALCULATION SHEET

Job Name: Min yr Awel, Pen yr Alltwn, Rhos

Job Number: 16570

Date of Test: 27.11.2020

Test No.: TP05 - Test 1 of 1

	Depth to Water (m)	Time (Mins)
(effective depth - 100%)	1.50	0
	1.50	5
	1.50	30
	1.50	60
(effective depth - 0%)	1.50	120

Length of Trial Pit (m)	1.80
Width of Trial Pit (m)	0.50
Depth of Trial Pit (m)	3.00
Effective Storage Depth (m)	1.50
Vp25	1.8750
Vp75	2.6250
Vp75-25	0.675
Outflow (%)	0
50% effective depth (m)	0.750
Mean Surface area ap50 (m2)	4.350

Time for 25% **Outflow** (tp25)

Not achieved

From Graph

Time for 75% **Outflow** (tp75)

Not achieved

From Graph

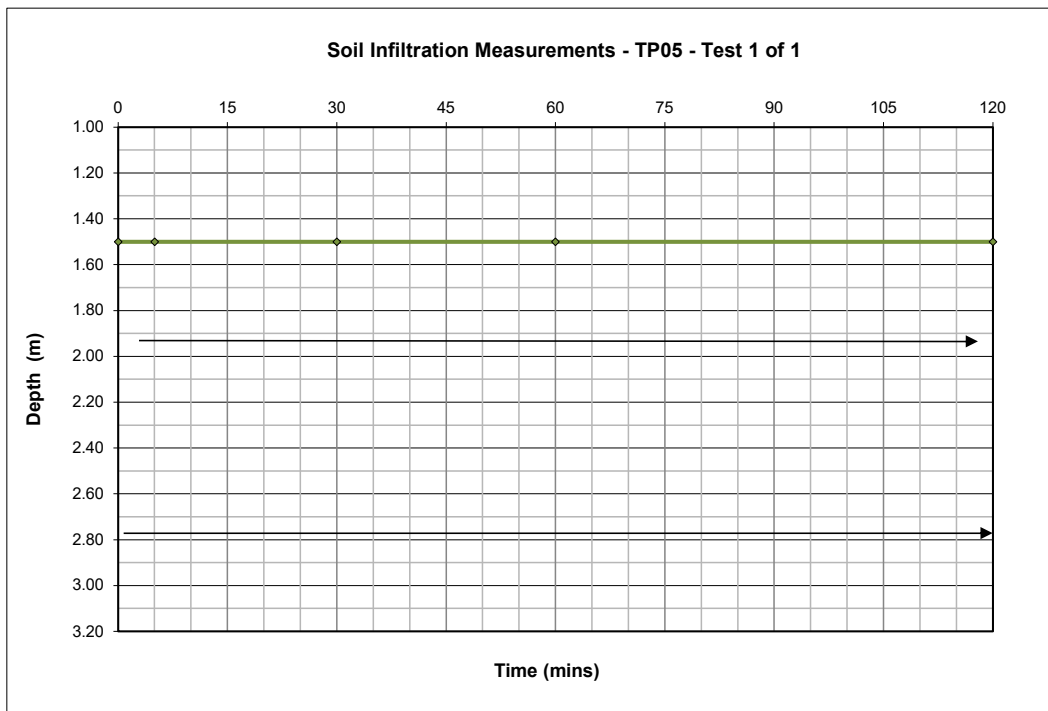
tp75 - 25

#VALUE!

Soil Infiltration Rate (m/s)

#VALUE!

Cannot be calculated due to lack of infiltration



Soil Infiltration Worksheet:

This worksheet has been produced in combination with the document 'BRE Digest 365'.
Worksheet options are identified by a green background.

Drawings



Job Number:

16570

Job Title:

Min yr Awel, Rhos

Drawing Title:

Exploratory Hole Layout

Drawing Number:

01

Scale:

Not To Scale

Legend:

 Trial Pit Location

North



Appendix B

Surface Water Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.200	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	2.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S01	0.017	2.00	112.978	1200	273416.223	203338.669	0.580
S02	0.009	2.00	113.000	1200	273419.119	203354.774	0.580
S03	0.019	2.00	112.474	1200	273426.539	203347.604	0.580
S04	0.025	2.00	111.892	1200	273447.257	203377.121	0.580
S05	0.019	2.00	111.742	1200	273442.783	203357.945	0.580
Hway-Dummy			114.000		273448.727	203356.851	1.000
Plot-1	0.019	2.00	112.000		273431.659	203358.569	0.055
Dummy-1			115.000	180	273429.943	203363.459	1.000
Plot-2	0.020	2.00	113.000		273418.464	203366.663	0.055
Dummy-2			115.000	180	273413.348	203365.610	1.000
Plot-3	0.010	2.00	113.000		273412.257	203348.581	0.055
Dummy-3			115.000	180	273407.094	203351.461	1.000
Plot-4	0.009	2.00	113.000		273409.741	203344.668	0.055
Dummy-4			115.000	180	273404.858	203346.140	1.000
Plot-5	0.008	2.00	113.000		273408.367	203340.531	0.055
Dummy--5			115.000	180	273403.896	203341.443	1.000
Plot-6	0.011	2.00	113.250		273405.085	203333.054	0.055
Dummy-6			115.000	180	273400.529	203333.802	1.000
Plot-7	0.013	2.00	113.032		273421.481	203331.988	0.087
Dummy-7			115.000	180	273426.758	203332.059	1.000
Plot-8	0.017	2.00	112.200		273443.859	203348.778	0.055
Dummy-8			115.000	180	273439.976	203343.393	1.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S01	S03	13.647	0.600	112.398	111.894	0.504	27.1	150	2.12	50.0
2.000	S02	S03	10.318	0.600	112.420	111.894	0.526	19.6	150	2.08	50.0
1.001	S03	S05	19.256	0.600	111.894	111.162	0.732	26.3	150	2.28	50.0
3.000	S04	S05	19.691	0.600	111.312	111.162	0.150	131.3	150	2.37	50.0
1.002	S05	Hway-Dummy	6.044	0.600	111.162	113.000	-1.838	-3.3	150	2.48	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.942	34.3	2.3	0.430	0.430	0.017	0.0
2.000	2.284	40.4	1.2	0.430	0.430	0.009	0.0
1.001	1.971	34.8	6.0	0.430	0.430	0.044	0.0
3.000	0.875	15.5	3.4	0.430	0.430	0.025	0.0
1.002	1.000	17.7	11.9	0.430	0.850	0.088	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.000	Plot-8	Dummy-8	6.639	0.600	112.145	114.000	-1.855	-3.6	50	2.11	50.0
5.000	Plot-3	Dummy-3	5.912	0.600	112.945	114.000	-1.055	-5.6	50	2.10	50.0
6.000	Plot-7	Dummy-7	5.277	0.600	112.945	114.000	-1.055	-5.0	50	2.09	50.0
7.000	Plot-2	Dummy-2	5.223	0.600	112.945	114.000	-1.055	-5.0	50	2.09	50.0
8.000	Plot-1	Dummy-1	5.182	0.600	111.945	114.000	-2.055	-2.5	50	2.09	50.0
9.000	Plot-4	Dummy-4	5.100	0.600	112.945	114.000	-1.055	-4.8	50	2.09	50.0
10.000	Plot-6	Dummy-6	4.617	0.600	113.195	114.000	-0.805	-5.7	50	2.08	50.0
11.000	Plot-5	Dummy--5	4.563	0.600	112.945	114.000	-1.055	-4.3	50	2.08	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
4.000	1.000	2.0	2.3	0.005	0.950	0.017	0.0
5.000	1.000	2.0	1.4	0.005	0.950	0.010	0.0
6.000	1.000	2.0	1.8	0.037	0.950	0.013	0.0
7.000	1.000	2.0	2.7	0.005	0.950	0.020	0.0
8.000	1.000	2.0	2.6	0.005	0.950	0.019	0.0
9.000	1.000	2.0	1.2	0.005	0.950	0.009	0.0
10.000	1.000	2.0	1.5	0.005	0.950	0.011	0.0
11.000	1.000	2.0	1.1	0.005	0.950	0.008	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	13.647	27.1	150	Circular	112.978	112.398	0.430	112.474	111.894	0.430
2.000	10.318	19.6	150	Circular	113.000	112.420	0.430	112.474	111.894	0.430
1.001	19.256	26.3	150	Circular	112.474	111.894	0.430	111.742	111.162	0.430
3.000	19.691	131.3	150	Circular	111.892	111.312	0.430	111.742	111.162	0.430
1.002	6.044	-3.3	150	Circular	111.742	111.162	0.430	114.000	113.000	0.850
4.000	6.639	-3.6	50	Circular	112.200	112.145	0.005	115.000	114.000	0.950
5.000	5.912	-5.6	50	Circular	113.000	112.945	0.005	115.000	114.000	0.950
6.000	5.277	-5.0	50	Circular	113.032	112.945	0.037	115.000	114.000	0.950
7.000	5.223	-5.0	50	Circular	113.000	112.945	0.005	115.000	114.000	0.950
8.000	5.182	-2.5	50	Circular	112.000	111.945	0.005	115.000	114.000	0.950
9.000	5.100	-4.8	50	Circular	113.000	112.945	0.005	115.000	114.000	0.950
10.000	4.617	-5.7	50	Circular	113.250	113.195	0.005	115.000	114.000	0.950

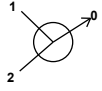
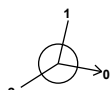
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S01	1200	Manhole	Adoptable	S03	1200	Manhole	Adoptable
2.000	S02	1200	Manhole	Adoptable	S03	1200	Manhole	Adoptable
1.001	S03	1200	Manhole	Adoptable	S05	1200	Manhole	Adoptable
3.000	S04	1200	Manhole	Adoptable	S05	1200	Manhole	Adoptable
1.002	S05	1200	Manhole	Adoptable	Hwy-Dummy		Junction	
4.000	Plot-8		Junction		Dummy-8	180	Manhole	Adoptable
5.000	Plot-3		Junction		Dummy-3	180	Manhole	Adoptable
6.000	Plot-7		Junction		Dummy-7	180	Manhole	Adoptable
7.000	Plot-2		Junction		Dummy-2	180	Manhole	Adoptable
8.000	Plot-1		Junction		Dummy-1	180	Manhole	Adoptable
9.000	Plot-4		Junction		Dummy-4	180	Manhole	Adoptable
10.000	Plot-6		Junction		Dummy-6	180	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
11.000	4.563	-4.3	50	Circular	113.000	112.945	0.005	115.000	114.000	0.950

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
11.000	Plot-5		Junction		Dummy--5	180	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S01	273416.223	203338.669	112.978	0.580	1200		0	1.000	112.398	150
S02	273419.119	203354.774	113.000	0.580	1200		0	2.000	112.420	150
S03	273426.539	203347.604	112.474	0.580	1200		1 2 0	2.000 1.000 1.001	111.894 111.894 111.894	150 150 150
S04	273447.257	203377.121	111.892	0.580	1200		0	3.000	111.312	150
S05	273442.783	203357.945	111.742	0.580	1200		1 2 0	3.000 1.001 1.002	111.162 111.162 111.162	150 150 150
Hway-Dummy	273448.727	203356.851	114.000	1.000			1	1.002	113.000	150
Plot-1	273431.659	203358.569	112.000	0.055			0	8.000	111.945	50
Dummy-1	273429.943	203363.459	115.000	1.000	180		1	8.000	114.000	50
Plot-2	273418.464	203366.663	113.000	0.055			0	7.000	112.945	50
Dummy-2	273413.348	203365.610	115.000	1.000	180		1	7.000	114.000	50

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Plot-3	273412.257	203348.581	113.000	0.055					
						0	5.000	112.945	50
Dummy-3	273407.094	203351.461	115.000	1.000	180		1	5.000	114.000
Plot-4	273409.741	203344.668	113.000	0.055					
						0	9.000	112.945	50
Dummy-4	273404.858	203346.140	115.000	1.000	180		1	9.000	114.000
Plot-5	273408.367	203340.531	113.000	0.055					
						0	11.000	112.945	50
Dummy--5	273403.896	203341.443	115.000	1.000	180		1	11.000	114.000
Plot-6	273405.085	203333.054	113.250	0.055					
						0	10.000	113.195	50
Dummy-6	273400.529	203333.802	115.000	1.000	180		1	10.000	114.000
Plot-7	273421.481	203331.988	113.032	0.087					
						0	6.000	112.945	50
Dummy-7	273426.758	203332.059	115.000	1.000	180		1	6.000	114.000
Plot-8	273443.859	203348.778	112.200	0.055					
						0	4.000	112.145	50
Dummy-8	273439.976	203343.393	115.000	1.000	180		1	4.000	114.000

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	1440
FSR Region	England and Wales	Additional Storage (m³/ha)	0.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.200	2 year (l/s)	2.7
Summer CV	0.750	30 year (l/s)	5.3
Winter CV	1.000	100 year (l/s)	6.4
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 | 2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.80
Greenfield Method	IH124	Growth Factor 100 year	2.18
Positively Drained Area (ha)	0.335	Betterment (%)	0
SAAR (mm)	1574	QBar	2.9
Soil Index	3	Q 2 year (l/s)	2.7
SPR	0.40	Q 30 year (l/s)	5.3
Region	9	Q 100 year (l/s)	6.4
Growth Factor 2 year	0.93		

Node S01 Online Weir Control

Flap Valve	x	Invert Level (m)	112.878	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Width (m)	4.000		

Node S02 Online Weir Control

Flap Valve	x	Invert Level (m)	112.900	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Width (m)	4.000		

Node S03 Online Weir Control

Flap Valve	x	Invert Level (m)	112.374	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Width (m)	4.000		

Node S04 Online Weir Control

Flap Valve	x	Invert Level (m)	111.792	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Width (m)	4.000		

Node S05 Online Weir Control

Flap Valve	x	Invert Level (m)	111.642	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Width (m)	4.000		

Node Plot-1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	111.350
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	1380

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	47.7	47.7	0.450	47.7	47.7	0.451	0.0	47.7

Node Plot-2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	112.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	435

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	83.0	83.0	0.300	83.0	83.0	0.301	0.0	83.0

Node Plot-3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	112.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	690

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	33.0	33.0	0.340	33.0	33.0	0.341	0.0	33.0

Node Plot-4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	112.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	600

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	33.0	33.0	0.300	33.0	33.0	0.301	0.0	33.0

Node Plot-5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	112.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	744

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	24.6	24.6	0.340	24.6	24.6	0.341	0.0	24.6

Node Plot-6 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	112.650
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	600

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	40.0	40.0	0.300	40.0	40.0	0.301	0.0	40.0

Node Plot-7 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	112.432
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	0

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	86.8	86.8	0.255	86.8	86.8	0.256	0.0	86.8

Node Plot-8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	111.730
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	480

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	85.0	85.0	0.235	85.0	85.0	0.236	0.0	85.0

Node S01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	112.398
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	400

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	96.0	96.0	0.375	96.0	96.0	0.376	0.0	96.0

Node S02 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	112.420
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	112

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	86.0	86.0	0.375	86.0	86.0	0.376	0.0	86.0

Node S03 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	111.894
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	120

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	186.0	186.0	0.375	186.0	186.0	0.376	0.0	186.0

Node S04 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	111.312
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	335

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	39.0	39.0	0.375	39.0	39.0	0.376	0.0	39.0

Node S05 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03035	Safety Factor	2.0	Invert Level (m)	111.162
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	930

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	106.0	106.0	0.385	106.0	106.0	0.386	0.0	106.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	S01	128	112.475	0.077	1.1	2.2909	0.0000	OK
240 minute winter	S02	156	112.461	0.041	0.5	1.0920	0.0000	OK
180 minute winter	S03	120	111.935	0.041	1.2	2.3191	0.0000	OK
480 minute winter	S04	280	111.794	0.482	0.9	4.9384	0.0000	FLOOD RISK
720 minute winter	S05	480	111.212	0.050	1.0	5.1152	0.0000	OK
15 minute summer	Hway-Dummy	1	113.000	0.000	0.0	0.0000	0.0000	OK
720 minute winter	Plot-1	495	111.455	-0.490	0.6	4.7743	0.0000	OK
15 minute summer	Dummy-1	1	114.000	0.000	0.0	0.0000	0.0000	OK
480 minute winter	Plot-2	320	112.452	-0.493	0.7	4.1191	0.0000	OK
15 minute summer	Dummy-2	1	114.000	0.000	0.0	0.0000	0.0000	OK
600 minute winter	Plot-3	420	112.475	-0.470	0.3	2.3555	0.0000	OK
15 minute summer	Dummy-3	1	114.000	0.000	0.0	0.0000	0.0000	OK
600 minute winter	Plot-4	405	112.467	-0.478	0.3	2.0889	0.0000	OK
15 minute summer	Dummy-4	1	114.000	0.000	0.0	0.0000	0.0000	OK
480 minute winter	Plot-5	320	112.481	-0.465	0.3	1.8807	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	S01	Weir	S03	0.0				
180 minute winter	S01	Infiltration		0.4				
240 minute winter	S02	Weir	S03	0.0				
240 minute winter	S02	Infiltration		0.3				
180 minute winter	S03	Weir	S05	0.0				
180 minute winter	S03	Infiltration		0.6				
480 minute winter	S04	Weir	S05	0.6				
480 minute winter	S04	Infiltration		0.2				
720 minute winter	S05	Weir	Hway-Dummy	0.0				0.0
720 minute winter	S05	Infiltration		0.4				
720 minute winter	Plot-1	8.000	Dummy-1	0.0	0.000	0.000	0.0000	0.0
720 minute winter	Plot-1	Infiltration		0.2				
480 minute winter	Plot-2	7.000	Dummy-2	0.0	0.000	0.000	0.0000	0.0
480 minute winter	Plot-2	Infiltration		0.3				
600 minute winter	Plot-3	5.000	Dummy-3	0.0	0.000	0.000	0.0000	0.0
600 minute winter	Plot-3	Infiltration		0.1				
600 minute winter	Plot-4	9.000	Dummy-4	0.0	0.000	0.000	0.0000	0.0
600 minute winter	Plot-4	Infiltration		0.1				
480 minute winter	Plot-5	11.000	Dummy--5	0.0	0.000	0.000	0.0000	0.0
480 minute winter	Plot-5	Infiltration		0.1				

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Dummy--5	1	114.000	0.000	0.0	0.0000	0.0000	OK
480 minute winter	Plot-6	336	112.715	-0.480	0.4	2.4746	0.0000	OK
15 minute summer	Dummy-6	1	114.000	0.000	0.0	0.0000	0.0000	OK
480 minute winter	Plot-7	320	112.465	-0.480	0.5	2.7006	0.0000	OK
15 minute summer	Dummy-7	1	114.000	0.000	0.0	0.0000	0.0000	OK
480 minute winter	Plot-8	320	111.773	-0.372	0.6	3.4677	0.0000	OK
15 minute summer	Dummy-8	1	114.000	0.000	0.0	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	Plot-6	10.000	Dummy-6	0.0	0.000	0.000	0.0000	0.0
480 minute winter	Plot-6	Infiltration		0.2				
480 minute winter	Plot-7	6.000	Dummy-7	0.0	0.000	0.000	0.0000	0.0
480 minute winter	Plot-7	Infiltration		0.2				
480 minute winter	Plot-8	4.000	Dummy-8	0.0	0.000	0.000	0.0000	0.0
480 minute winter	Plot-8	Infiltration		0.3				

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	S01	180	112.574	0.175	1.6	5.2517	0.0000	SURCHARGED
180 minute winter	S02	128	112.503	0.083	1.0	2.2291	0.0000	OK
180 minute winter	S03	128	111.978	0.083	2.1	4.7529	0.0000	OK
60 minute winter	S04	36	111.799	0.487	5.4	4.9439	0.0000	FLOOD RISK
600 minute winter	S05	450	111.310	0.148	2.1	15.0589	0.0000	OK
15 minute summer	Hwy-Dummy	1	113.000	0.000	0.0	0.0000	0.0000	OK
960 minute winter	Plot-1	705	111.565	-0.380	0.8	9.7223	0.0000	OK
15 minute summer	Dummy-1	1	114.000	0.000	0.0	0.0000	0.0000	OK
360 minute winter	Plot-2	272	112.507	-0.438	1.5	8.4134	0.0000	OK
15 minute summer	Dummy-2	1	114.000	0.000	0.0	0.0000	0.0000	OK
720 minute winter	Plot-3	540	112.548	-0.397	0.5	4.6358	0.0000	OK
15 minute summer	Dummy-3	1	114.000	0.000	0.0	0.0000	0.0000	OK
600 minute winter	Plot-4	450	112.528	-0.417	0.5	4.0094	0.0000	OK
15 minute summer	Dummy-4	1	114.000	0.000	0.0	0.0000	0.0000	OK
960 minute winter	Plot-5	660	112.565	-0.380	0.3	3.8571	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	S01	Weir	S03	0.0				
240 minute winter	S01	Infiltration		0.4				
180 minute winter	S02	Weir	S03	0.0				
180 minute winter	S02	Infiltration		0.4				
180 minute winter	S03	Weir	S05	0.0				
180 minute winter	S03	Infiltration		0.8				
60 minute winter	S04	Weir	S05	4.1				
60 minute winter	S04	Infiltration		0.2				
600 minute winter	S05	Weir	Hwy-Dummy	0.0				0.0
600 minute winter	S05	Infiltration		0.4				
960 minute winter	Plot-1	8.000	Dummy-1	0.0	0.000	0.000	0.0000	0.0
960 minute winter	Plot-1	Infiltration		0.2				
360 minute winter	Plot-2	7.000	Dummy-2	0.0	0.000	0.000	0.0000	0.0
360 minute winter	Plot-2	Infiltration		0.3				
720 minute winter	Plot-3	5.000	Dummy-3	0.0	0.000	0.000	0.0000	0.0
720 minute winter	Plot-3	Infiltration		0.1				
600 minute winter	Plot-4	9.000	Dummy-4	0.0	0.000	0.000	0.0000	0.0
600 minute winter	Plot-4	Infiltration		0.1				
960 minute winter	Plot-5	11.000	Dummy--5	0.0	0.000	0.000	0.0000	0.0
960 minute winter	Plot-5	Infiltration		0.1				

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Dummy--5	1	114.000	0.000	0.0	0.0000	0.0000	OK
600 minute winter	Plot-6	450	112.777	-0.418	0.6	4.8131	0.0000	OK
15 minute summer	Dummy-6	1	114.000	0.000	0.0	0.0000	0.0000	OK
480 minute winter	Plot-7	328	112.489	-0.456	0.8	4.7078	0.0000	OK
15 minute summer	Dummy-7	1	114.000	0.000	0.0	0.0000	0.0000	OK
360 minute winter	Plot-8	264	111.813	-0.332	1.3	6.7026	0.0000	OK
15 minute summer	Dummy-8	1	114.000	0.000	0.0	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	Plot-6	10.000	Dummy-6	0.0	0.000	0.000	0.0000	0.0
600 minute winter	Plot-6	Infiltration		0.2				
480 minute winter	Plot-7	6.000	Dummy-7	0.0	0.000	0.000	0.0000	0.0
480 minute winter	Plot-7	Infiltration		0.4				
360 minute winter	Plot-8	4.000	Dummy-8	0.0	0.000	0.000	0.0000	0.0
360 minute winter	Plot-8	Infiltration		0.4				

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	S01	248	112.880	0.482	2.2	11.3594	0.0000	FLOOD RISK
360 minute winter	S02	264	112.605	0.185	1.1	4.9717	0.0000	SURCHARGED
360 minute winter	S03	272	112.089	0.195	2.5	11.0906	0.0000	SURCHARGED
30 minute winter	S04	17	111.807	0.495	13.8	4.9527	0.0000	FLOOD RISK
720 minute winter	S05	675	111.537	0.375	3.5	38.2270	0.0000	FLOOD RISK
15 minute summer	Hway-Dummy	1	113.000	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	Plot-1	1110	111.931	-0.014	1.0	20.4144	0.0000	OK
15 minute summer	Dummy-1	1	114.000	0.000	0.0	0.0000	0.0000	OK
720 minute winter	Plot-2	555	112.628	-0.317	1.7	17.9730	0.0000	OK
15 minute summer	Dummy-2	1	114.000	0.000	0.0	0.0000	0.0000	OK
720 minute winter	Plot-3	615	112.712	-0.233	0.8	9.7861	0.0000	OK
15 minute summer	Dummy-3	1	114.000	0.000	0.0	0.0000	0.0000	OK
960 minute winter	Plot-4	735	112.671	-0.274	0.6	8.4854	0.0000	OK
15 minute summer	Dummy-4	1	114.000	0.000	0.0	0.0000	0.0000	OK
480 minute winter	Plot-5	448	112.740	-0.205	0.9	7.9427	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	S01	Weir	S03	0.6				
360 minute winter	S01	Infiltration		0.4				
360 minute winter	S02	Weir	S03	0.0				
360 minute winter	S02	Infiltration		0.4				
360 minute winter	S03	Weir	S05	0.0				
360 minute winter	S03	Infiltration		0.8				
30 minute winter	S04	Weir	S05	13.0				
30 minute winter	S04	Infiltration		0.2				
720 minute winter	S05	Weir	Hway-Dummy	0.0				0.0
720 minute winter	S05	Infiltration		0.4				
1440 minute winter	Plot-1	8.000	Dummy-1	0.0	0.000	0.000	0.0000	0.0
1440 minute winter	Plot-1	Infiltration		0.2				
720 minute winter	Plot-2	7.000	Dummy-2	0.0	0.000	0.000	0.0000	0.0
720 minute winter	Plot-2	Infiltration		0.3				
720 minute winter	Plot-3	5.000	Dummy-3	0.0	0.000	0.000	0.0000	0.0
720 minute winter	Plot-3	Infiltration		0.1				
960 minute winter	Plot-4	9.000	Dummy-4	0.0	0.000	0.000	0.0000	0.0
960 minute winter	Plot-4	Infiltration		0.1				
480 minute winter	Plot-5	11.000	Dummy--5	0.0	0.000	0.000	0.0000	0.0
480 minute winter	Plot-5	Infiltration		0.1				

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Dummy--5	1	114.000	0.000	0.0	0.0000	0.0000	OK
960 minute winter	Plot-6	765	112.927	-0.268	0.8	10.5112	0.0000	OK
15 minute summer	Dummy-6	1	114.000	0.000	0.0	0.0000	0.0000	OK
480 minute winter	Plot-7	360	112.552	-0.393	1.4	9.9056	0.0000	OK
15 minute summer	Dummy-7	1	114.000	0.000	0.0	0.0000	0.0000	OK
720 minute winter	Plot-8	540	111.908	-0.238	1.4	14.3304	0.0000	OK
15 minute summer	Dummy-8	1	114.000	0.000	0.0	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	Plot-6	10.000	Dummy-6	0.0	0.000	0.000	0.0000	0.0
960 minute winter	Plot-6	Infiltration		0.2				
480 minute winter	Plot-7	6.000	Dummy-7	0.0	0.000	0.000	0.0000	0.0
480 minute winter	Plot-7	Infiltration		0.4				
720 minute winter	Plot-8	4.000	Dummy-8	0.0	0.000	0.000	0.0000	0.0
720 minute winter	Plot-8	Infiltration		0.4				

Water Quality

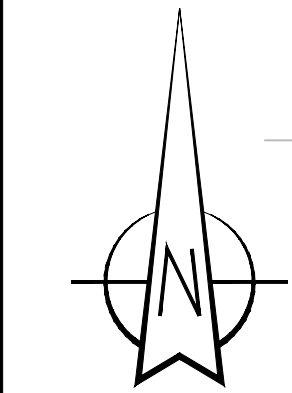
Entering via Node or Link	Name	SuDS Component	Pollution hazard indices			Pollution mitigation indices			Cumulative pollution hazard indices	
			TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons	TSS	Metals
Node	S01	Permeable Surface				0.7	0.6	0.7		
Node	S02	Permeable Surface				0.7	0.6	0.7		
Node	S03	Permeable Surface				0.35	0.3	0.35		
Node	S04	Permeable Surface				0.7	0.6	0.7		
Node	S05	Permeable Surface				0.35	0.3	0.35		
Node	Hwy-Dummy								Sufficient	Sufficient
Node	Plot-1	Permeable Surface				0.7	0.6	0.7		
Node	Dummy-1								Sufficient	Sufficient
Node	Plot-2	Permeable Surface				0.7	0.6	0.7		
Node	Dummy-2								Sufficient	Sufficient
Node	Plot-3	Permeable Surface				0.7	0.6	0.7		
Node	Dummy-3								Sufficient	Sufficient
Node	Plot-4	Permeable Surface				0.7	0.6	0.7		
Node	Dummy-4								Sufficient	Sufficient

Water Quality

nded I Use	Entering via Node or Link	Name	SuDS Component	Pollution hazard indices			Pollution mitigation indices			Cumulative pol hazard indici	
				TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons	TSS	Metals
	Node Node	Plot-5 Dummy--5	Permeable Surface				0.7	0.6	0.7	Sufficient	Sufficient
	Node Node	Plot-6 Dummy-6	Permeable Surface				0.7	0.6	0.7	Sufficient	Sufficient
	Node Node	Plot-7 Dummy-7	Permeable Surface				0.7	0.6	0.7	Sufficient	Sufficient
	Node Node	Plot-8 Dummy-8	Permeable Surface				0.7	0.6	0.7	Sufficient	Sufficient

Appendix C

Surface Water Drainage Strategy



SUDS INFORMATION

REFERENCE	AREA (m²)	DEPTH (mm)	VOID
PLOT-1	47.700	450	95%
PLOT-2	83.000	300	95%
PLOT-3	33.000	340	95%
PLOT-4	33.000	300	95%
PLOT-5	24.600	340	95%
PLOT-6	40.000	300	95%
PLOT-7	86.800	255	95%
PLOT-8	85.000	235	95%
H-WAY-1	96.000	375	30%
H-WAY-2	86.000	375	30%
H-WAY-3	186.000	375	30%
H-WAY-4	39.000	375	30%
H-WAY-5	106.000	385	95%

- KEY
- PERMEABLE PAVING: 375mm GRAVEL SUB-BASE (30% VOID)
 - PERMEABLE PAVING: 385mm PERMAVOID SUB-BASE REPLACEMENT (95% VOID)
 - PERMEABLE PAVING: 235mm PERMAVOID SUB-BASE REPLACEMENT (95% VOID)
 - PERMEABLE PAVING: 255mm PERMAVOID SUB-BASE REPLACEMENT (95% VOID)
 - PERMEABLE PAVING: 300mm PERMAVOID SUB-BASE REPLACEMENT (95% VOID)
 - PERMEABLE PAVING: 340mm PERMAVOID SUB-BASE REPLACEMENT (95% VOID)
 - PERMEABLE PAVING: 450mm PERMAVOID SUB-BASE REPLACEMENT (95% VOID)
 - PROPOSED ADOPTABLE BIO-RETENTION FEATURE
 - BAFFLE (EXACT LOCATIONS TO BE CONFIRMED AT DETAILED DESIGN)
 - EXCEEDANCE FLOW ROUTE

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REV	DETAILS	DRAWN BY	CHECKED BY	DATE
CLIENT: MRS. DAWN DAVIES				
PROJECT: PEN YR ALLTWEN, RHOS				
DRAWING TITLE: SUDS STRATEGY				
SCALES: 1:200		SHEET SIZE: A1		
DRAWN: JD	CHECKED: MM	DATE: 23.09.2024		
DRAWING NUMBER: 1964-501				REVISION: -