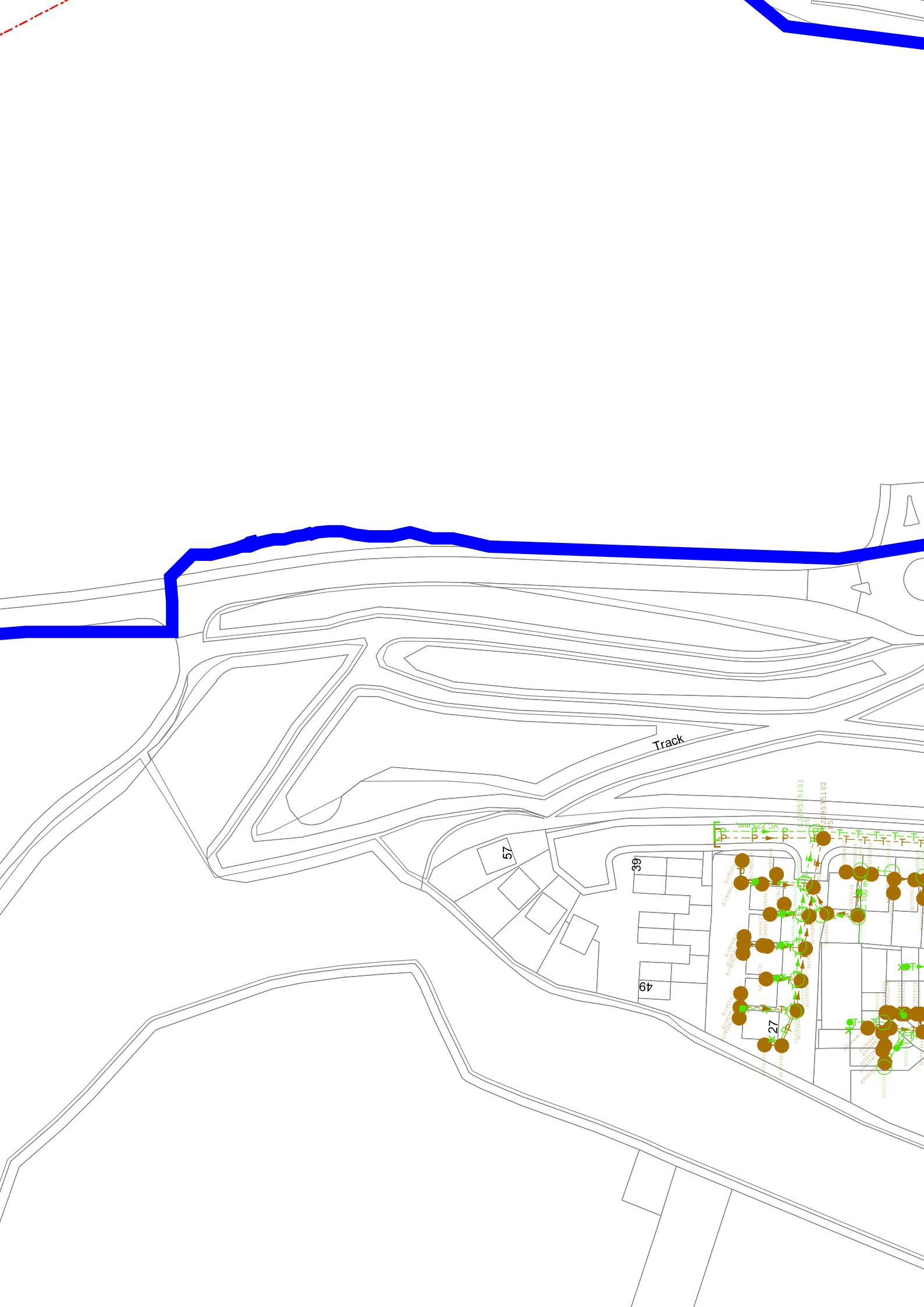


APPENDICES

APPENDIX 1

Welsh Water Public Sewer Records



APPENDIX 2

TAN15 Development Advice Map

Map Title

Map Perygl Llif

Allwedd / Map P

Zone C1

Zone C2

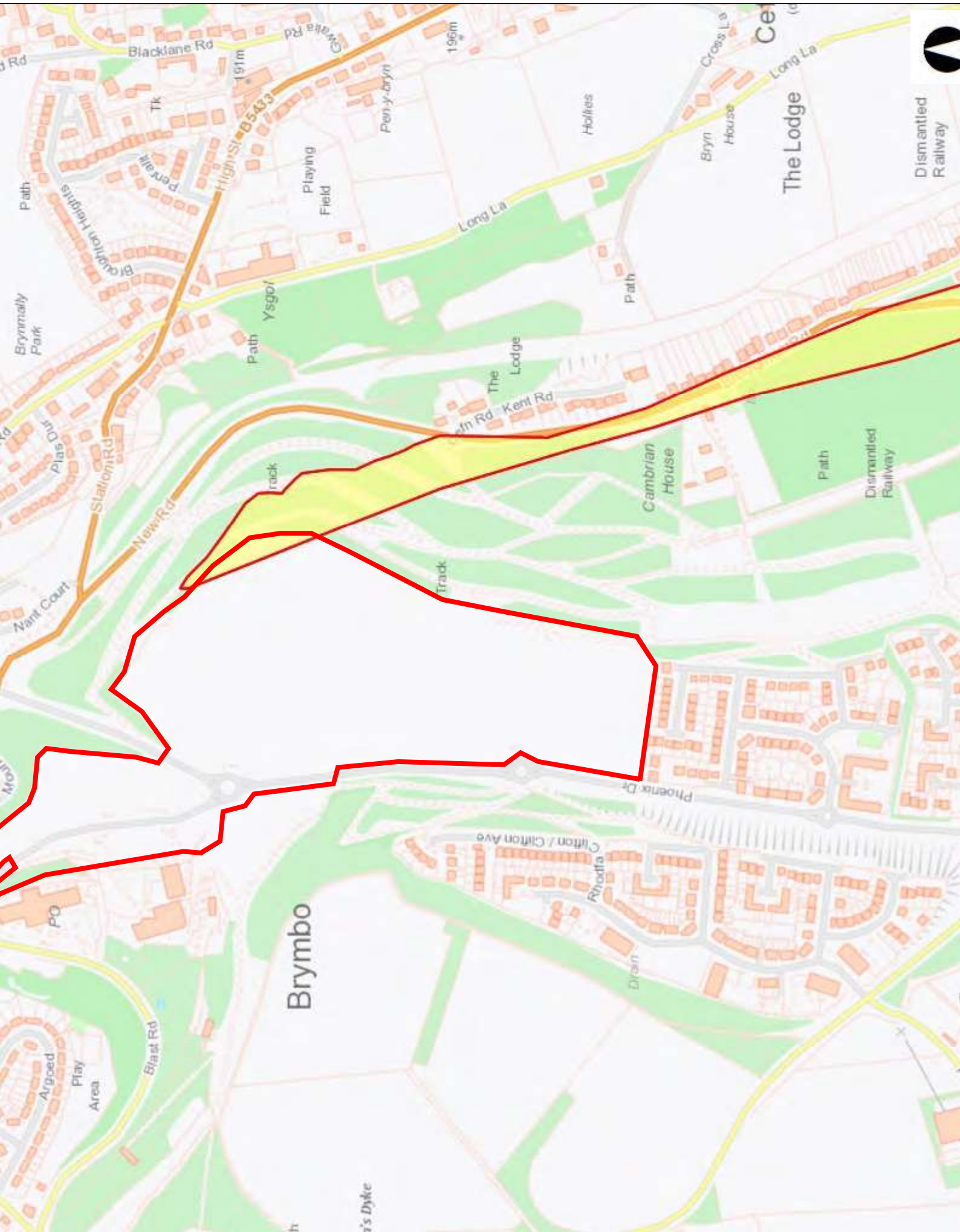
Zone B

Zone A

Graddfa / Scale

Dyddiad / Dat

12/02/2020



APPENDIX 3

Lead Local Flood Authority Correspondence

Griffiths, Bryn

From: Neil Taunt <Neil.Taunt@wrexham.gov.uk>
Sent: 18 September 2018 12:04
To: Griffiths, Bryn
Cc: Sharon Williams; Matthew Phillips
Subject: RE: Flood Consequence Assessment guidance - Brymbo, Wrexham
Attachments: Former Brymbo Steelworks.pdf; Management of Surface Water Generated from New Dev_E.pdf

Categories: Saved

Good Afternoon Bryn,

In response to your request for flood related information for the above site, I can provide the following comments:

The attached plan outlines the latest flood related information for the site. We hold no specific information relating to flood incidents within the site boundary.

With regards to surface water management for the site I have attached a guidance note detailing the level of information normally required to support any planning application.

In addition to the attached guidance note there is a significant change to drainage requirements will impact new developments from January 2019.

From January 7th 2019, all new developments of at least 2 properties or over 100m² of construction area will require sustainable drainage to manage on-site surface water. The Surface water drainage systems must be designed and built in accordance with national standards for sustainable drainage published by Welsh Ministers. These systems must be approved by the local authority acting in its SuDS Approving Body (SAB) role before construction work begins. The SAB will have a duty to adopt compliant systems that serve more than one property.

Schedule 3 of the Flood and Water Management Act (FWMA) 2010 requires surface water drainage for new developments to comply with mandatory National Standards for sustainable drainage (SuDS). The statutory standards will be published by Welsh Government in the autumn but in the meantime, we recommend that you refer to the Non-Statutory Ministerial National Standards and the CIRIA 753: The SuDS Manual . Schedule 3 also places a duty on local authorities as SuDS Approving Body to approve, adopt and maintain systems compliant with section 17 of the Act. For further information on the legislation, please go to the Schedule 3 of the Flood & Water Management Act.

If you anticipate an application being made after the 7th January 2019, or that any reserved matters or conditions would not be discharged prior to 7th January 2020, you will be required to obtain SAB approval prior to the commencement of any development. If it is likely that SAB approval will be required then consideration of how the development will incorporate sustainable drainage and demonstrate compliance with the nation standards should be made at the earliest possible stage.

Many thanks

Neil

Neil Taunt MCIWEM C.WEM CEnv CSci
Uwch Swyddog Rheoli Llifogydd / Senior Flood Management Officer



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✉ Amgylchedd a Chynllunio, Cyngor Bwrdeistref Sirol Wrexham, De Ffordd yr Abaty, Ystad Ddiwydiannol Wrexham, Wrexham LL13 9PW
✉ Environment & Planning, Wrexham County Borough Council, Abbey Road South, Wrexham Industrial Estate, Wrexham LL13 9PW
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🐦 twitter.com/cbswrexham | twitter.com/wrexhamcbc
📘 facebook.com/cyngorwrexham | facebook.com/wrexhamcouncil

From: Sharon Williams
Sent: 11 September 2018 14:08
To: Neil Taunt
Cc: bgriffiths@wardell-armstrong.com
Subject: FW: Flood Consequence Assessment guidance - Brymbo, Wrexham

Hi Neil,

Please see email below asking for your comments I would be grateful if you could copy Matthew Phillips in Planning into any response you may have.

Regards

Sharon

Sharon Williams
Business Support Officer (Development Control)



☎ 01978 298785
✉ Cyngor Bwrdeistref Sirol Wrexham, Adran Amgylchedd a Chynllunio, 16 Stryt yr Arglwydd, Wrexham LL11 1LG
✉ Wrexham County Borough Council, Environment and Planning Department, 16 Lord Street, Wrexham LL11 1LG
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📘 facebook.com/wrexhamcouncil | facebook.com/cyngorwrexham

From: Griffiths, Bryn [<mailto:bgriffiths@wardell-armstrong.com>]
Sent: 10 September 2018 12:46
To: planning
Subject: Flood Consequence Assessment guidance - Brymbo, Wrexham

Good afternoon,

I am working on a Flood Consequence Assessment for a mixed commercial and residential development at the former Brymbo Steelworks in Brymbo, Wrexham, LL11 5BT – approximate grid reference 329743, 353316, (see attached Development Advice Map). As shown on the Development Advice Map, the majority of the site is located within Zone A, with a small area within Zone B, which appears to coincide with a section of alluvial deposits in this area.

In order to assist with the assessment, I would welcome any pre-planning comments that you wish to make with respect to flood risk and drainage at the site. In particular, if you have any local knowledge of historic flood incidents or drainage problems with respect to ordinary watercourses, surface water and groundwater, I would be grateful if you could comment. I would also be grateful for any advice on local guidance and policies relating to surface water management/SuDS in this area.

Please let me know if you require any further information to assist you. Also, if this is not the correct department to contact with this enquiry it would be very much appreciated if you could forward this on to the team able to advise on this request.

Regards,
Bryn

Bryn Griffiths | Senior Environmental Scientist
Wardell Armstrong LLP
Sir Henry Doulton House, Forge Lane, Etruria, Staffordshire, UK
t: 01782 276700 m: 07469 856653



Rydym yn croesawu gohebiaeth yn Gymraeg. Byddwn yn ymateb i unrhyw ohebiaeth yn Gymraeg ac ni fydd hyn yn arwain at unrhyw oedi.

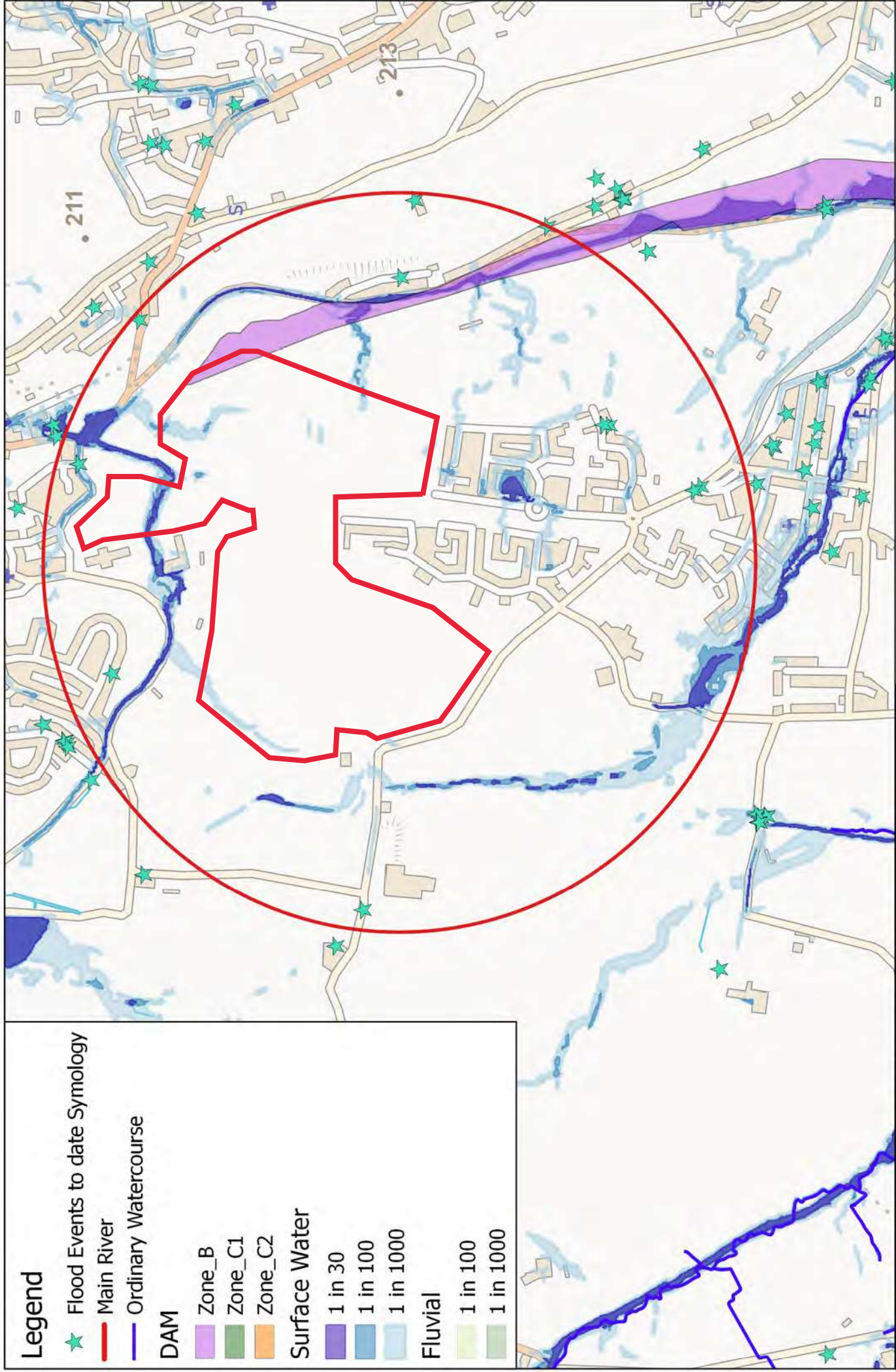
Ewch i weld - mi fedrwch chi dalu, rhoi gwybod, gwneud cais, dweud eich dweud, a dod o hyd i wybodaeth ar-lein yn www.wreccsam.gov.uk. Arbedwch bapur - meddylwch cyn argraffu!

Mae'r neges e-bost hon ac unrhyw atodiadau wedi eu bwriadu ar gyfer yr unigolyn neu'r sefydliad y'i cyfeirir atynt yn unig. Am yr amodau llawn ynglŷn ? chynnwys a defnyddio'r neges e-bost hon, ac unrhyw atodiadau, cyfeiriwch at www.wreccsam.gov.uk/top_navigation/disclaimersw.htm

We welcome correspondence in Welsh. We will respond to any correspondence in Welsh and this will not lead to any delay.

Take a look - you can pay, report, request, have your say and find information online at www.wrexham.gov.uk. Save paper - think before you print!

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Griffiths, Bryn

From: Neil Taunt <Neil.Taunt@wrexham.gov.uk>
Sent: 11 October 2018 07:47
To: Griffiths, Bryn
Subject: RE: Flood Consequence Assessment guidance - Brymbo, Wrexham

Categories: Saved

Hi Bryn,

We normally accept a minimum 30% increase unless a more appropriate figure can be evidenced as being appropriate.

Thanks

Neil

From: Griffiths, Bryn [mailto:bgriffiths@wardell-armstrong.com]
Sent: 09 October 2018 11:11
To: Neil Taunt
Subject: RE: Flood Consequence Assessment guidance - Brymbo, Wrexham

Hi Neil,

Thank you for the information provided last month. I have also been consulting with Natural Resources Wales as part of my FCA. One thing I was looking for clarification on to assist with designing suitably-sized SuDS features for the drainage strategy is the a climate change allowance to use in runoff calculations. My experience is primarily in Flood Risk Assessments in England where we would apply an allowance of 40% to models based on guidance in the February 2016 "Flood risk assessments: climate change allowances" report. The reports states this is only applicable to English sites.

I have been on the Welsh Government website "CL-03-16 - Climate change allowances for Planning purposes" and looked at the report "Flood Consequence Assessments: Climate change allowances". This gives allowances for river flow and sea level height but not for rainfall intensity. I spoke with Daniel Davies at NRW but he said that they do not have a specific allowance for rainfall intensity to be applied to calculations, but he advised me to speak with yourself to see if the LLFA in the Wrexham area has a preferred rainfall intensity percentage to apply in an FCA for a residential development.

Regards,
Bryn

Bryn Griffiths | Senior Environmental Scientist
Wardell Armstrong LLP
Sir Henry Doulton House, Forge Lane, Etruria, Staffordshire, UK
t: 01782 276700 m: 07469 856653



From: Neil Taunt <Neil.Taunt@wrexham.gov.uk>
Sent: 18 September 2018 12:04
To: Griffiths, Bryn <bgriffiths@wardell-armstrong.com>
Cc: Sharon Williams <Sharon.Williams@wrexham.gov.uk>; Matthew Phillips <Matthew.Phillips@wrexham.gov.uk>
Subject: RE: Flood Consequence Assessment guidance - Brymbo, Wrexham

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Many thanks

Neil

Neil Taunt MCIWEM C.WEM CEnv CSci

Uwch Swyddog Rheoli Llifogydd / Senior Flood Management Officer



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✉ Amgylchedd a Chynllunio, Cyngor Bwrdeistref Sirol Wrecsam, De Ffordd yr Abaty, Ystad Ddiwydiannol Wrecsam, Wrecsam LL13 9PW

📍 Environment & Planning, Wrexham County Borough Council, Abbey Road South, Wrexham Industrial Estate, Wrexham LL13 9PW

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Regards

Sharon

Sharon Williams
Business Support Officer (Development Control)



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From: Griffiths, Bryn [<mailto:bgriffiths@wardell-armstrong.com>]
Sent: 10 September 2018 12:46
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Subject: Flood Consequence Assessment guidance - Brymbo, Wrexham

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Click [here](#) if the original attachments are required (justification needed).

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incidents or drainage problems with respect to ordinary watercourses, surface water and groundwater, I would be grateful if you could comment. I would also be grateful for any advice on local guidance and policies relating to surface water management/SuDS in this area.

Please let me know if you require any further information to assist you. Also, if this is not the correct department to contact with this enquiry it would be very much appreciated if you could forward this on the team able to advise on this request.

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Bryn

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Rydym yn croesawu gohebiaeth yn Gymraeg. Byddwn yn ymateb i unrhyw ohebiaeth yn Gymraeg ac ni fydd hyn yn arwain at unrhyw oedi.

Ewch i weld - mi fedrwch chi dalu, rhoi gwybod, gwneud cais, dweud eich dweud, a dod o hyd i wybodaeth ar-lein yn www.wreccsam.gov.uk. Arbedwch bapur - meddyliwch cyn argraffu!

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APPENDIX 4

Drainage Network Modelling

URS Infrastructure & Environment UK Ltd		Page 0
Scott House Alencon Link Basingstoke RG21 7PP		
Date 05/10/2015 12:32 File No D Road ModelA flow a...	Designed by 32961sjc Checked by	
XP Solutions	Network 2014.1.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for NO D ROAD MODELA.SWS

Pipe Sizes NO D ROAD MODELA Manhole Sizes NO D ROAD MODELA

FSR Rainfall Model - England and Wales

Return Period (years)	2	Add Flow / Climate Change (%)	10
M5-60 (mm)	18.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.322	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	0.75
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Network Design Table for NO D ROAD MODELA.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S1.000	70.724	1.469	48.1	0.128	5.00	0.0	0.600	o	225	
S1.001	55.001	0.917	60.0	0.103	0.00	0.0	0.600	o	225	
S2.000	24.540	0.282	87.0	0.062	5.00	0.0	0.600	o	225	
S1.002	51.978	0.711	73.1	0.108	0.00	0.0	0.600	o	300	
S1.003	35.591	0.487	73.1	0.039	0.00	0.0	0.600	o	300	
S1.004	65.542	0.906	72.3	0.101	0.00	0.0	0.600	o	300	
S3.004	15.217	0.076	200.2	0.000	0.00	0.0	0.600	o	300	
S1.005	55.431	1.500	37.0	0.060	0.00	0.0	0.600	o	300	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	0.00	5.62	200.113	0.128	0.0	0.0	0.0	1.89	75.1	0.0
S1.001	0.00	6.17	198.644	0.231	0.0	0.0	0.0	1.69	67.3	0.0
S2.000	0.00	5.29	198.009	0.062	0.0	0.0	0.0	1.40	55.8	0.0
S1.002	0.00	6.64	197.652	0.401	0.0	0.0	0.0	1.84	130.1	0.0
S1.003	0.00	6.96	196.941	0.440	0.0	0.0	0.0	1.84	130.2	0.0
S1.004	0.00	7.55	196.454	0.541	0.0	0.0	0.0	1.85	130.8	0.0
S3.004	0.00	6.48	195.624	1.900	0.0	0.0	0.0	1.11	78.3	0.0
S1.005	0.00	7.90	195.548	2.501	0.0	0.0	0.0	2.59	183.4	0.0

URS Infrastructure & Environment UK Ltd										Page 1	
Scott House Alencon Link Basingstoke RG21 7PP											
Date 05/10/2015 12:32 File No D Road ModelA flow a...						Designed by 32961sjc Checked by					
XP Solutions						Network 2014.1.1					
<u>Network Design Table for NO D ROAD MODELA.SWS</u>											
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design	
S4.005	15.059	0.075	200.8	0.000	0.00	0.0	0.600	o	300		
S5.002	14.360	0.084	171.0	0.000	0.00	0.0	0.600	o	225		
S1.006	68.961	0.575	119.9	0.098	0.00	0.0	0.600	o	525		
S1.007	38.127	0.379	100.6	0.070	0.00	0.0	0.600	o	675		
S6.000	26.414	2.247	11.8	0.062	5.00	0.0	0.600	o	225		
S7.005	10.515	1.945	5.4	0.000	0.00	0.0	0.600	o	225		
S6.001	31.534	1.757	17.9	0.037	0.00	0.0	0.600	o	225		
S6.002	36.208	2.017	18.0	0.074	0.00	0.0	0.600	o	225		
S6.003	40.412	2.251	18.0	0.042	0.00	0.0	0.600	o	225		
S6.004	30.619	1.480	20.7	0.043	0.00	0.0	0.600	o	225		
S8.005	16.767	0.099	169.4	0.000	0.00	0.0	0.600	o	225		
S6.005	73.915	0.863	85.6	0.104	0.00	0.0	0.600	o	375		
S9.005	16.991	0.085	199.9	0.000	0.00	0.0	0.600	o	300		
<u>Network Results Table</u>											
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	
S4.005	0.00	7.74	194.123	0.355	0.0	0.0	0.0	1.11	78.2	0.0	
S5.002	0.00	5.49	194.207	0.300	0.0	0.0	0.0	1.00	39.6	0.0	
S1.006	0.00	8.47	193.823	3.254	0.0	0.0	0.0	2.04	442.5	0.0	
S1.007	0.00	8.71	193.098	3.324	0.0	0.0	0.0	2.61	935.1	0.0	
S6.000	0.00	5.11	205.144	0.062	0.0	0.0	0.0	3.84	152.6	0.0	
S7.005	0.00	5.58	204.842	0.498	0.0	0.0	0.0	5.67	225.3	0.0	
S6.001	0.00	5.75	202.897	0.597	0.0	0.0	0.0	3.10	123.4	0.0	
S6.002	0.00	5.95	201.140	0.671	0.0	0.0	0.0	3.10	123.4	0.0	
S6.003	0.00	6.16	199.123	0.713	0.0	0.0	0.0	3.10	123.4	0.0	
S6.004	0.00	6.34	196.872	0.756	0.0	0.0	0.0	2.89	114.9	0.0	
S8.005	0.00	6.17	195.491	0.200	0.0	0.0	0.0	1.00	39.8	0.0	
S6.005	0.00	6.97	195.242	1.060	0.0	0.0	0.0	1.96	216.4	0.0	
S9.005	0.00	6.29	194.539	0.520	0.0	0.0	0.0	1.11	78.3	0.0	
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Page 2

Scott House
Alencon Link
Basingstoke RG21 7PP

Date 05/10/2015 12:32
File No D Road ModelA flow a...

Designed by 32961sjc
Checked by

XP Solutions

Network 2014.1.1

Network Design Table for NO D ROAD MODELA.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S6.006	34.855	0.407	85.6	0.058	0.00	0.0	0.600	o	450	
S6.007	48.941	0.953	51.4	0.060	0.00	0.0	0.600	o	450	
S1.008	9.047	0.023	393.4	0.000	0.00	0.0	0.600	o	750	
S1.009	20.342	0.043	473.1	0.094	0.00	0.0	0.600	o	750	
S1.010	4.682	0.047	99.6	0.000	0.00	0.0	0.600	o	750	
S1.011	21.513	0.127	169.4	0.060	0.00	0.0	0.600	o	600	
S1.012	30.932	0.245	126.3	0.027	0.00	0.0	0.600	o	600	
S1.013	34.953	2.148	16.3	0.045	0.00	0.0	0.600	o	600	
S10.005	14.649	1.361	10.8	0.000	0.00	0.0	0.600	o	225	
S1.014	24.154	2.237	10.8	0.038	0.00	0.0	0.600	o	600	
S1.015	37.098	3.702	10.0	0.052	0.00	0.0	0.600	o	600	
S11.007	20.815	1.857	11.2	0.000	0.00	0.0	0.600	o	300	
S1.016	67.917	6.860	9.9	0.061	0.00	0.0	0.600	o	600	
S1.017	23.792	2.379	10.0	0.027	0.00	0.0	1.500	o	600	
S1.018	25.392	2.539	10.0	0.040	0.00	0.0	1.500	o	600	
S1.019	16.009	0.640	25.0	0.028	0.00	0.0	1.500	o	600	
S1.020	10.549	0.264	40.0	0.000	0.00	0.0	1.500	o	600	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.006	0.00	7.23	194.304	1.638	0.0	0.0	0.0	2.20	349.6	0.0
S6.007	0.00	7.52	193.897	1.698	0.0	0.0	0.0	2.84	452.0	0.0
S1.008	0.00	8.82	192.644	5.022	0.0	0.0	0.0	1.40	620.6	0.0
S1.009	0.00	9.08	192.621	5.116	0.0	0.0	0.0	1.28	565.5	0.0
S1.010	0.00	9.11	192.578	5.116	0.0	0.0	0.0	2.80	1238.8	0.0
S1.011	0.00	9.30	192.531	5.176	0.0	0.0	0.0	1.87	528.2	0.0
S1.012	0.00	9.54	192.404	5.203	0.0	0.0	0.0	2.17	612.4	0.0
S1.013	0.00	9.64	192.159	5.248	0.0	0.0	0.0	6.06	1712.5	0.0
S10.005	0.00	5.85	191.747	0.155	0.0	0.0	0.0	4.01	159.5	0.0
S1.014	0.00	9.69	190.011	5.441	0.0	0.0	0.0	7.44	2103.1	0.0
S1.015	0.00	9.77	187.774	5.493	0.0	0.0	0.0	7.72	2183.2	0.0
S11.007	0.00	5.75	186.229	0.644	0.0	0.0	0.0	4.72	333.8	0.0
S1.016	0.00	9.92	184.072	6.198	0.0	0.0	0.0	7.77	2196.5	0.0
S1.017	0.00	9.97	177.212	6.225	0.0	0.0	0.0	6.87	1943.6	0.0
S1.018	0.00	10.04	174.833	6.265	0.0	0.0	0.0	6.87	1943.5	0.0
S1.019	0.00	10.10	172.294	6.293	0.0	0.0	0.0	4.34	1228.3	0.0
S1.020	0.00	10.15	171.654	6.293	0.0	0.0	0.0	3.43	971.0	0.0

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Network Design Table for NO D ROAD MODEL A.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S1.021	26.061	0.052	501.2	0.081	0.00	0.0	0.600	o	900	
S1.022	24.978	0.624	40.0	0.000	0.00	0.0	0.600	o	925	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.021	0.00	10.46	169.727	6.374	0.0	0.0	0.0	1.39	886.0	0.0
S1.022	0.00	10.54	169.650	6.374	0.0	0.0	0.0	5.05	3390.3	0.0

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Scott House Alencon Link Basingstoke RG21 7PP																																																										
Date 05/10/2015 12:30 File No D Road ModelA flow a...	Designed by 32961sjc Checked by																																																									
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<u>Simulation Criteria for NO D ROAD MODELA.SWS</u> <table> <tr> <td>Volumetric Runoff Coeff</td> <td>0.840</td> <td>Additional Flow - % of Total Flow</td> <td>0.000</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.000</td> <td>MADD Factor * 10m³/ha Storage</td> <td>0.000</td> </tr> <tr> <td>Hot Start (mins)</td> <td>0</td> <td>Inlet Coefficient</td> <td>0.800</td> </tr> <tr> <td>Hot Start Level (mm)</td> <td>0</td> <td>Flow per Person per Day (l/per/day)</td> <td>0.000</td> </tr> <tr> <td>Manhole Headloss Coeff (Global)</td> <td>0.500</td> <td>Run Time (mins)</td> <td>60</td> </tr> <tr> <td>Foul Sewage per hectare (l/s)</td> <td>0.000</td> <td>Output Interval (mins)</td> <td>1</td> </tr> </table> <table> <tr> <td>Number of Input Hydrographs</td> <td>0</td> <td>Number of Storage Structures</td> <td>0</td> </tr> <tr> <td>Number of Online Controls</td> <td>8</td> <td>Number of Time/Area Diagrams</td> <td>0</td> </tr> <tr> <td>Number of Offline Controls</td> <td>1</td> <td>Number of Real Time Controls</td> <td>0</td> </tr> </table> <u>Synthetic Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Profile Type</td> <td>Winter</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.000</td> <td>Storm Duration (mins)</td> <td>30</td> </tr> <tr> <td>Ratio R</td> <td>0.322</td> <td></td> <td></td> </tr> </table>			Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	0.000	Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	0.000	Hot Start (mins)	0	Inlet Coefficient	0.800	Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000	Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60	Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1	Number of Input Hydrographs	0	Number of Storage Structures	0	Number of Online Controls	8	Number of Time/Area Diagrams	0	Number of Offline Controls	1	Number of Real Time Controls	0	Rainfall Model	FSR	Profile Type	Winter	Return Period (years)	2	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Storm Duration (mins)	30	Ratio R	0.322		
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Summary of Results for 30 minute 2 year Winter (NO D ROAD MODELA.SWS)

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Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF
      Analysis Timestep   Fine Inertia Status OFF
      DTS Status          ON
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	US/MH	Water	Surcharged	Flooded	Pipe			Status		
		Level	Depth	Volume	Flow /	Overflow	Flow			
	PN	Name	(m)	(m)	(m³)	Cap.	(l/s)	(l/s)		
Catchment A	S1.000	S1	200.183	-0.155	0.000	0.21	0.0	15.3	OK	
	S1.001	S2	198.745	-0.124	0.000	0.41	0.0	26.6	OK	
	S2.000	S3	198.066	-0.168	0.000	0.15	0.0	7.5	OK	
	S1.002	S4	197.779	-0.173	0.000	0.37	0.0	45.8	OK	
	S1.003	S5	197.076	-0.165	0.000	0.42	0.0	49.8	OK	
	S1.004	S6	196.602	-0.152	0.000	0.48	0.0	60.5	OK	
	S3.000	S7	196.399	-1.475	0.000	0.01	0.0	55.8	OK	
	S3.001	S57	196.399	-1.317	0.000	0.02	0.0	75.6	OK	
	S3.002	S58	196.398	-1.182	0.000	0.02	0.0	79.7	OK	
	S3.003	S60	196.396	-1.068	0.000	0.03	0.0	84.1	OK	
	S3.004	S59	196.395	0.471	0.000	1.16	0.0	76.5	SURCHARGED	
Catchment B	S1.005	S8	195.750	-0.098	0.000	0.79	0.0	136.8	OK	
	S4.000	S9	194.724	-0.674	0.000	0.02	0.0	8.5	OK	
	S4.001	S65	194.657	-0.663	0.000	0.03	0.0	16.0	OK	
	S4.002	S61	194.507	-0.634	0.000	0.04	0.0	22.3	OK	
	S4.003	S62	194.443	-0.542	0.000	0.05	0.0	24.0	OK	
	S4.004	S63	194.436	-0.461	0.000	0.08	0.0	25.2	OK	
		S4.005	S64	194.434	0.011	0.000	0.37	0.0	24.5	SURCHARGED
	S5.000	S10	194.922	-0.863	0.000	0.01	0.0	22.1	OK	
	S5.001	S134	194.922	-0.823	0.000	0.01	0.0	18.7	OK	
	S5.002	S135	194.922	0.490	0.000	0.15	0.0	5.2	SURCHARGED	
	S1.006	S11	194.062	-0.286	0.000	0.43	0.0	172.9	OK	
	S1.007	S12	193.325	-0.448	0.000	0.23	0.0	179.1	OK	
	S6.000	S13	205.177	-0.192	0.000	0.05	0.0	7.5	OK	
	S7.000	S14	212.464	-0.741	0.000	0.02	0.0	20.0	OK	
	S7.001	S66	212.273	-0.713	0.000	0.05	0.0	38.4	OK	
	S7.002	S67	212.115	-0.668	0.000	0.06	0.0	56.7	OK	
	S7.003	S68	212.093	0.160	0.000	0.33	0.0	50.2	SURCHARGED	
	S7.004	S69	211.943	3.540	0.000	0.20	0.0	37.9	SURCHARGED	
	S7.005	S70	204.910	-0.157	0.000	0.20	0.0	37.9	OK	
	S6.001	S15	202.998	-0.124	0.000	0.42	0.0	48.3	OK	
	S6.002	S16	201.251	-0.114	0.000	0.48	0.0	56.5	OK	
	S6.003	S17	199.239	-0.109	0.000	0.52	0.0	61.1	OK	
	S6.004	S18	197.000	-0.097	0.000	0.61	0.0	65.9	OK	
	S8.000	S19	195.821	-0.708	0.000	0.01	0.0	4.8	OK	
	S8.001	S71	195.788	-0.638	0.000	0.02	0.0	8.4	OK	
	S8.002	S72	195.786	-0.582	0.000	0.02	0.0	11.1	OK	
	S8.003	S73	195.785	-0.518	0.000	0.03	0.0	12.5	OK	
	S8.004	S74	195.783	-0.477	0.000	0.04	0.0	14.3	OK	
		S8.005	S75	195.783	0.067	0.000	0.40	0.0	14.0	SURCHARGED
	S6.005	S20	195.416	-0.201	0.000	0.44	0.0	89.5	OK	
Catchment D	S9.000	S21	194.935	-1.093	0.000	0.01	0.0	12.1	OK	
	S9.001	S76	194.926	-0.987	0.000	0.02	0.0	19.1	OK	
	S9.002	S77	194.925	-0.966	0.000	0.02	0.0	28.9	OK	
	S9.003	S78	194.921	-0.859	0.000	0.04	0.0	28.6	OK	
	S9.004	S79	194.920	-0.840	0.000	0.05	0.0	36.4	OK	

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Summary of Results for 30 minute 2 year Winter (NO D ROAD MODELA.SWS)

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S9.005	S80	194.919	0.080	0.000	0.53	0.0	35.6	SURCHARGED
S6.006	S22	194.508	-0.246	0.000	0.42	0.0	128.8	OK
S6.007	S23	194.075	-0.272	0.000	0.33	0.0	134.9	OK
S1.008	S24	193.213	-0.181	0.000	1.04	0.0	312.7	OK
S1.009	S44	193.158	-0.213	0.000	0.86	0.0	319.8	OK
S1.010	S45	192.996	-0.332	0.000	0.60	0.0	319.9	OK
S1.011	S46	192.979	-0.152	0.000	0.91	0.0	324.6	OK
S1.012	S47	192.759	-0.245	0.000	0.66	0.0	326.0	OK
S1.013	S47A	192.353	-0.406	0.000	0.23	0.0	328.8	OK
S10.000	S140	192.667	-0.536	0.000	0.01	0.0	3.7	OK
S10.001	S122	192.651	-0.498	0.000	0.03	0.0	6.9	OK
S10.002	S123	192.648	-0.485	0.000	0.05	0.0	10.2	OK
S10.003	S124	192.637	-0.458	0.000	0.08	0.0	16.4	OK
S10.004	S125	192.626	-0.063	0.000	0.12	0.0	14.8	OK
Catchment E S10.005	S126	192.613	0.641	0.000	0.09	0.0	13.1	SURCHARGED
S1.014	S48	190.205	-0.406	0.000	0.23	0.0	344.0	OK
S1.015	S49	187.950	-0.424	0.000	0.19	0.0	347.5	OK
S11.000	S50	190.145	-1.396	0.000	0.00	0.0	10.9	OK
S11.001	S127	190.136	-1.344	0.000	0.01	0.0	31.2	OK
S11.002	S128	190.106	-1.310	0.000	0.03	0.0	51.4	OK
S11.003	S129	190.073	-1.312	0.000	0.04	0.0	71.6	OK
S11.004	S130	189.917	-1.423	0.000	0.01	0.0	71.3	OK
S11.005	S131	188.801	-1.433	0.000	0.01	0.0	71.4	OK
S11.006	S132	187.768	-0.976	0.000	0.01	0.0	66.3	OK
Catchment F S11.007	S133	187.768	1.239	0.000	0.15	0.0	43.5	SURCHARGED
S1.016	S51	184.253	-0.419	0.000	0.20	0.0	394.7	OK
S1.017	S52	177.418	-0.394	0.000	0.26	0.0	396.6	OK
S1.018	S53	175.036	-0.397	0.000	0.25	0.0	399.2	OK
S1.019	S54	172.594	-0.300	0.000	0.50	0.0	400.9	OK
S1.020	S55	172.053	-0.201	0.000	0.78	0.0	400.7	OK
S1.021	S56	170.252	-0.375	0.000	0.64	0.0	404.4	OK
S1.022	S200	169.940	-0.635	0.000	0.22	0.0	404.9	OK

Catchment C not modelled

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<u>Simulation Criteria for NO D ROAD MODELA.SWS</u> Volumetric Runoff Coeff 0.840 Additional Flow - % of Total Flow 0.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 0.000 Hot Start (mins) 0 Inlet Coefficient 0.800 Hot Start Level (mm) 0 Flow per Person per Day (l/per/day) 0.000 Manhole Headloss Coeff (Global) 0.500 Run Time (mins) 60 Foul Sewage per hectare (l/s) 0.000 Output Interval (mins) 1 Number of Input Hydrographs 0 Number of Storage Structures 0 Number of Online Controls 8 Number of Time/Area Diagrams 0 Number of Offline Controls 1 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Profile Type</td> <td>Winter</td> </tr> <tr> <td>Return Period (years)</td> <td>30</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.000</td> <td>Storm Duration (mins)</td> <td>30</td> </tr> <tr> <td>Ratio R</td> <td>0.322</td> <td></td> <td></td> </tr> </table>			Rainfall Model	FSR	Profile Type	Winter	Return Period (years)	30	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Storm Duration (mins)	30	Ratio R	0.322		
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Summary of Results for 30 minute 30 year Winter (NO D ROAD MODELA.SWS)

	PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status
			Level	Depth	Volume			Flow	
			(m)	(m)	(m³)			(l/s)	
Catchment A	S1.000	S1	200.212	-0.126	0.000	0.40	0.0	29.1	OK
	S1.001	S2	198.800	-0.069	0.000	0.81	0.0	52.4	OK
	S2.000	S3	198.089	-0.145	0.000	0.28	0.0	14.2	OK
	S1.002	S4	197.846	-0.106	0.000	0.74	0.0	90.5	OK
	S1.003	S5	197.179	-0.062	0.000	0.82	0.0	98.1	OK
	S1.004	S6	196.887	0.133	0.000	0.90	0.0	111.8	SURCHARGED
Catchment B	S3.004	S59	196.827	0.903	0.000	1.54	0.0	101.1	SURCHARGED
	S1.005	S8	196.185	0.337	0.000	1.11	0.0	192.8	SURCHARGED
	S4.005	S64	194.618	0.195	0.000	0.50	0.0	32.8	SURCHARGED
Catchment D	S5.002	S135	195.404	0.972	0.000	0.20	0.0	6.8	SURCHARGED
	S1.006	S11	194.119	-0.229	0.000	0.60	0.0	245.2	OK
	S1.007	S12	193.457	-0.316	0.000	0.33	0.0	256.9	OK
	S6.000	S13	205.192	-0.177	0.000	0.10	0.0	14.2	OK
	S7.005	S70	204.912	-0.155	0.000	0.22	0.0	40.7	OK
	S6.001	S15	203.015	-0.107	0.000	0.54	0.0	61.9	OK
	S6.002	S16	201.277	-0.088	0.000	0.68	0.0	79.0	OK
	S6.003	S17	199.271	-0.077	0.000	0.76	0.0	88.7	OK
	S6.004	S18	197.042	-0.055	0.000	0.92	0.0	98.8	OK
	S8.005	S75	195.963	0.247	0.000	0.53	0.0	18.7	SURCHARGED
	S6.005	S20	195.469	-0.148	0.000	0.67	0.0	138.2	OK
	S9.005	S80	195.167	0.328	0.000	0.73	0.0	48.5	SURCHARGED
	S6.006	S22	194.561	-0.193	0.000	0.62	0.0	188.9	OK
	S6.007	S23	194.120	-0.227	0.000	0.49	0.0	201.2	OK
	S1.008	S24	193.411	0.017	0.000	1.52	0.0	456.9	SURCHARGED
	S1.009	S44	193.371	0.000	0.000	1.28	0.0	474.4	OK
	S1.010	S45	193.245	-0.083	0.000	0.88	0.0	472.9	OK
	S1.011	S46	193.208	0.077	0.000	1.35	0.0	482.7	SURCHARGED
Catchment E	S1.012	S47	192.879	-0.125	0.000	0.98	0.0	488.0	OK
	S1.013	S47A	192.402	-0.357	0.000	0.35	0.0	495.0	OK
	S10.005	S126	192.855	0.883	0.000	0.11	0.0	14.8	SURCHARGED
	S1.014	S48	190.253	-0.358	0.000	0.34	0.0	515.2	OK
	S1.015	S49	187.992	-0.382	0.000	0.28	0.0	522.6	OK
Catchment F	S11.007	S133	189.330	2.801	0.000	0.21	0.0	62.4	SURCHARGED
	S1.016	S51	184.295	-0.377	0.000	0.30	0.0	589.1	OK
	S1.017	S52	177.470	-0.342	0.000	0.38	0.0	592.1	OK
	S1.018	S53	175.087	-0.346	0.000	0.37	0.0	598.2	OK
	S1.019	S54	172.687	-0.207	0.000	0.75	0.0	602.6	OK
	S1.020	S55	172.323	0.069	0.000	1.17	0.0	603.2	SURCHARGED
	S1.021	S56	170.430	-0.197	0.000	0.96	0.0	609.0	OK
	S1.022	S200	170.012	-0.563	0.000	0.32	0.0	610.9	OK

Catchment B

Catchment D

Catchment E

Catchment F

Catchment C not modelled

URS Infrastructure & Environment UK Ltd		Page 0																																																								
Scott House Alencon Link Basingstoke RG21 7PP																																																										
Date 05/10/2015 12:26 File No D Road ModelA flow a...	Designed by 32961sjc Checked by																																																									
XP Solutions Network 2014.1.1																																																										
<u>Simulation Criteria for NO D ROAD MODELA.SWS</u> <table> <tr> <td>Volumetric Runoff Coeff</td> <td>0.840</td> <td>Additional Flow - % of Total Flow</td> <td>20.000</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.000</td> <td>MADD Factor * 10m³/ha Storage</td> <td>0.000</td> </tr> <tr> <td>Hot Start (mins)</td> <td>0</td> <td>Inlet Coefficient</td> <td>0.800</td> </tr> <tr> <td>Hot Start Level (mm)</td> <td>0</td> <td>Flow per Person per Day (l/per/day)</td> <td>0.000</td> </tr> <tr> <td>Manhole Headloss Coeff (Global)</td> <td>0.500</td> <td>Run Time (mins)</td> <td>60</td> </tr> <tr> <td>Foul Sewage per hectare (l/s)</td> <td>0.000</td> <td>Output Interval (mins)</td> <td>1</td> </tr> </table> <table> <tr> <td>Number of Input Hydrographs</td> <td>0</td> <td>Number of Storage Structures</td> <td>0</td> </tr> <tr> <td>Number of Online Controls</td> <td>8</td> <td>Number of Time/Area Diagrams</td> <td>0</td> </tr> <tr> <td>Number of Offline Controls</td> <td>1</td> <td>Number of Real Time Controls</td> <td>0</td> </tr> </table> <u>Synthetic Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Profile Type</td> <td>Winter</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.000</td> <td>Storm Duration (mins)</td> <td>30</td> </tr> <tr> <td>Ratio R</td> <td>0.322</td> <td></td> <td></td> </tr> </table>			Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	20.000	Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000	Hot Start (mins)	0	Inlet Coefficient	0.800	Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000	Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60	Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1	Number of Input Hydrographs	0	Number of Storage Structures	0	Number of Online Controls	8	Number of Time/Area Diagrams	0	Number of Offline Controls	1	Number of Real Time Controls	0	Rainfall Model	FSR	Profile Type	Winter	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Storm Duration (mins)	30	Ratio R	0.322		
Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	20.000																																																							
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000																																																							
Hot Start (mins)	0	Inlet Coefficient	0.800																																																							
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000																																																							
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Ratio R	0.322																																																									
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Summary of Results for 30 minute 100 year Winter (NO D ROAD MODELA.SWS)

	PN	US/MH Name	Water	Surcharged	Flooded	Pipe			Status
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	
Catchment A	S1.000	S1	200.249	-0.089	0.000	0.62	0.0	45.5	OK
	S1.001	S2	199.861	0.992	0.000	1.06	0.0	68.5	SURCHARGED
	S2.000	S3	198.978	0.744	0.000	0.39	0.0	20.2	SURCHARGED
	S1.002	S4	198.941	0.989	0.000	0.90	0.0	110.8	SURCHARGED
	S1.003	S5	198.376	1.135	0.000	0.98	0.0	117.7	SURCHARGED
	S1.004	S6	197.909	1.155	0.000	1.14	0.0	141.8	SURCHARGED
	S3.004	S59	197.429	1.505	0.000	1.91	0.0	125.9	FLOOD RISK
Catchment B	S1.005	S8	196.760	0.912	0.000	1.27	0.0	220.6	SURCHARGED
	S4.005	S64	194.813	0.390	0.000	0.59	0.0	39.0	SURCHARGED
Catchment D	S5.002	S135	197.133	2.701	0.000	0.31	0.0	10.7	FLOOD RISK
	S1.006	S11	194.148	-0.200	0.000	0.70	0.0	282.8	OK
	S1.007	S12	193.670	-0.103	0.000	0.39	0.0	300.5	OK
	S6.000	S13	205.203	-0.166	0.000	0.16	0.0	22.2	OK
	S7.005	S70	204.916	-0.151	0.000	0.24	0.0	44.6	OK
	S6.001	S15	203.032	-0.090	0.000	0.66	0.0	76.7	OK
	S6.002	S16	201.334	-0.031	0.000	0.88	0.0	102.7	OK
	S6.003	S17	199.833	0.485	0.000	0.97	0.0	114.0	SURCHARGED
	S6.004	S18	197.701	0.604	0.000	1.19	0.0	127.4	SURCHARGED
	S8.005	S75	196.178	0.462	0.000	0.65	0.0	23.0	SURCHARGED
Catchment E	S6.005	S20	195.517	-0.100	0.000	0.88	0.0	180.6	OK
	S9.005	S80	195.435	0.596	0.000	0.88	0.0	59.0	SURCHARGED
	S6.006	S22	194.613	-0.141	0.000	0.81	0.0	247.0	OK
	S6.007	S23	194.162	-0.185	0.000	0.65	0.0	265.2	OK
	S1.008	S24	193.614	0.220	0.000	1.83	0.0	551.1	SURCHARGED
	S1.009	S44	193.556	0.185	0.000	1.53	0.0	570.4	SURCHARGED
	S1.010	S45	193.468	0.140	0.000	1.06	0.0	571.1	SURCHARGED
	S1.011	S46	193.415	0.284	0.000	1.63	0.0	583.3	SURCHARGED
	S1.012	S47	193.075	0.071	0.000	1.19	0.0	588.6	SURCHARGED
	S1.013	S47A	192.429	-0.330	0.000	0.42	0.0	597.5	OK
Catchment F	S10.005	S126	193.239	1.267	0.000	0.12	0.0	17.3	SURCHARGED
	S1.014	S48	190.280	-0.331	0.000	0.41	0.0	621.8	OK
	S1.015	S49	188.017	-0.357	0.000	0.34	0.0	632.1	OK
	S11.007	S133	190.491	3.962	0.000	0.25	0.0	72.6	SURCHARGED
	S1.016	S51	184.321	-0.351	0.000	0.36	0.0	717.6	OK
	S1.017	S52	177.501	-0.311	0.000	0.47	0.0	723.7	OK
	S1.018	S53	175.118	-0.315	0.000	0.46	0.0	732.9	OK
	S1.019	S54	173.050	0.156	0.000	0.92	0.0	738.4	SURCHARGED
	S1.020	S55	172.505	0.251	0.000	1.44	0.0	738.8	SURCHARGED
	S1.021	S56	170.627	0.000	0.000	1.19	0.0	755.4	OK
S1.022	S200	170.057	-0.518	0.000	0.40	0.0	755.8	OK	

Catchment C not modelled

APPENDIX 5

Surface Water Attenuation Calculations

Calculation Sheet



REF:

CLIENT: Brymbo Developments Ltd.	PROJECT: Former Brymbo Steelworks	JOB NO.: ST16882	CALC. REF. NO.:
CALCULATION		CALC. BY:	APPROVED BY:
Attenuation Calculation - Outfall A 1 in 30 year and 1 in 100 year storm event		(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
		P Maddock	
		DATE: 12/02/2020	DATE:

Causeway Quick Storage Estimate

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	17.000
Ratio-R	0.300
Summer CV	☒ 0.750
Winter CV	☒ 0.840
Analysis Speed	Normal
Skip Steady State	☐
Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0
☒ Check Discharge Rate(s)	Calc
1 year (l/s)	27.8
30 year (l/s)	56.9
100 year (l/s)	68.9
☐ Check Discharge Volume	Calc
100 year 360 minute (m³)	
Storage Estimate	Calc

Attenuation calculations are based on no infiltration to ground as a 'worst case' estimate. Discharge rates based on rates agreed during Phase 1 design

Storage Estimate

Return Period (years)	30
Climate Change (%)	0
Impermeable Area (ha)	1.650
Peak Discharge (l/s)	101.100
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	125
to	261
With infiltration (m³)	
from	
to	

Storage Estimate

Return Period (years)	100
Climate Change (%)	30
Impermeable Area (ha)	1.650
Peak Discharge (l/s)	125.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	264
to	532
With infiltration (m³)	
from	
to	

Based on the calculations, approximately 193m³ of storage would be required to attenuate for the 1 in 30 year storm event and 398m³ of storage would be required to attenuate for the 1 in 100 year storm event.

Calculation Sheet



REF:

CLIENT: Brymbo Developments Ltd.	PROJECT: Former Brymbo Steelworks	JOB NO.: ST16882	CALC. REF. NO.:
		PAGE:	OF
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculation - Outfall B 1 in 30 year and 1 in 100 year event	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	P Maddock		
	DATE: 12/02/2020	DATE:	DATE:

Causeway Quick Storage Estimate

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	17.000
Ratio-R	0.300
Summer CV	☒ 0.750
Winter CV	☒ 0.840
Analysis Speed	Normal
Skip Steady State	☐
Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0
☒ Check Discharge Rate(s)	Calc
1 year (l/s)	27.8
30 year (l/s)	56.9
100 year (l/s)	68.9
☐ Check Discharge Volume	Calc
100 year 360 minute (m³)	
Storage Estimate	Calc

Attenuation calculations are based on no infiltration to ground as a 'worst case' estimate. Discharge rates based on rates agreed during Phase 1 design

Storage Estimate

Return Period (years)	30
Climate Change (%)	0
Impermeable Area (ha)	1.440
Peak Discharge (l/s)	32.800
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	203
to	366
With infiltration (m³)	
from	
to	

Storage Estimate

Return Period (years)	100
Climate Change (%)	30
Impermeable Area (ha)	1.440
Peak Discharge (l/s)	39.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	424
to	713
With infiltration (m³)	
from	
to	

Based on the calculations, approximately 285m³ of storage would be required to attenuate for the 1 in 30 year storm event and 569m³ of storage would be required to attenuate for the 1 in 100 year storm event.

Calculation Sheet



REF:

CLIENT: Brymbo Developments Ltd.	PROJECT: Former Brymbo Steelworks	JOB NO.: ST16882	CALC. REF. NO.:
		PAGE:	OF
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Attenuation Calculation - Outfall C 1 in 30 year and 1 in 100 year storm event	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	P Maddock		
	DATE: 12/02/2020	DATE:	DATE:

Causeway Quick Storage Estimate

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	17.000
Ratio-R	0.300
Summer CV	☒ 0.750
Winter CV	☒ 0.840
Analysis Speed	Normal
Skip Steady State	☐
Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0
☒ Check Discharge Rate(s)	Calc
1 year (l/s)	27.8
30 year (l/s)	56.9
100 year (l/s)	68.9
☐ Check Discharge Volume	Calc
100 year 360 minute (m³)	
Storage Estimate	Calc

Attenuation calculations are based on no infiltration to ground as a 'worst case' estimate. Discharge rates based on rates agreed during Phase 1 design

Storage Estimate

Return Period (years)	30
Climate Change (%)	0
Impermeable Area (ha)	0.960
Peak Discharge (l/s)	6.800
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	241
to	393
With infiltration (m³)	
from	
to	

Storage Estimate

Return Period (years)	100
Climate Change (%)	30
Impermeable Area (ha)	0.960
Peak Discharge (l/s)	10.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	431
to	672
With infiltration (m³)	
from	
to	

Based on the calculations, approximately 317m³ of storage would be required to attenuate for the 1 in 30 year storm event and 552m³ of storage would be required to attenuate for the 1 in 100 year storm event.

Calculation Sheet



REF:

CLIENT: Brymbo Developments Ltd.	PROJECT: Former Brymbo Steelworks	JOB NO.: ST16882	CALC. REF. NO.:
CALCULATION		CALC. BY:	APPROVED BY:
Attenuation Calculation - Outfall D 1 in 30 year and 1 in 100 year storm event		(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
		P Maddock	
		DATE: 12/02/2020	DATE:

Causeway Quick Storage Estimate

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	17.000
Ratio-R	0.300
Summer CV	☒ 0.750
Winter CV	☒ 0.840
Analysis Speed	Normal
Skip Steady State	☐
Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0
☒ Check Discharge Rate(s)	Calc
1 year (l/s)	27.8
30 year (l/s)	56.9
100 year (l/s)	68.9
☐ Check Discharge Volume	Calc
100 year 360 minute (m³)	
Storage Estimate	Calc

Attenuation calculations are based on no infiltration to ground as a 'worst case' estimate. Discharge rates based on rates agreed during Phase 1 design

Storage Estimate

Return Period (years)	30
Climate Change (%)	0
Impermeable Area (ha)	0.370
Peak Discharge (l/s)	18.700
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	32
to	65
With infiltration (m³)	
from	
to	

Storage Estimate

Return Period (years)	100
Climate Change (%)	30
Impermeable Area (ha)	0.370
Peak Discharge (l/s)	22.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	70
to	134
With infiltration (m³)	
from	
to	

Based on the calculations, approximately 49m³ of storage would be required to attenuate for the 1 in 30 year storm event and 102m³ of storage would be required to attenuate for the 1 in 100 year storm event.

Calculation Sheet

REF:

CLIENT: Brymbo Developments Ltd.	PROJECT: Former Brymbo Steelworks	JOB NO.: ST16882	CALC. REF. NO.:
CALCULATION		CALC. BY:	APPROVED BY:
Attenuation Calculation - Outfall E 1 in 30 year and 1 in 100 year storm event		(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
		P Maddock	
		DATE: 12/02/2020	DATE:

Causeway Quick Storage Estimate

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	17.000
Ratio-R	0.300
Summer CV	☒ 0.750
Winter CV	☒ 0.840
Analysis Speed	Normal
Skip Steady State	☐
Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0
☒ Check Discharge Rate(s)	Calc
1 year (l/s)	27.8
30 year (l/s)	56.9
100 year (l/s)	68.9
☐ Check Discharge Volume	Calc
100 year 360 minute (m³)	
Storage Estimate	Calc

Attenuation calculations are based on no infiltration to ground as a 'worst case' estimate. Discharge rates based on rates agreed during Phase 1 design

Storage Estimate

Return Period (years)	30
Climate Change (%)	0
Impermeable Area (ha)	0.390
Peak Discharge (l/s)	14.800
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	41
to	79
With infiltration (m³)	
from	
to	

Storage Estimate

Return Period (years)	100
Climate Change (%)	30
Impermeable Area (ha)	0.390
Peak Discharge (l/s)	17.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	88
to	161
With infiltration (m³)	
from	
to	

Based on the calculations, approximately 60m³ of storage would be required to attenuate for the 1 in 30 year storm event and 125m³ of storage would be required to attenuate for the 1 in 100 year storm event.

Calculation Sheet



REF:

CLIENT: Brymbo Developments Ltd.	PROJECT: Former Brymbo Steelworks	JOB NO.: ST16882	CALC. REF. NO.:
CALCULATION		CALC. BY:	APPROVED BY:
Attenuation Calculation - Outfall F 1 in 30 year and 1 in 100 year storm event		(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
		P Maddock	
		DATE: 12/02/2020	DATE:

Causeway Quick Storage Estimate

Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	17.000
Ratio-R	0.300
Summer CV	☒ 0.750
Winter CV	☒ 0.840
Analysis Speed	Normal
Skip Steady State	☐
Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0
☒ Check Discharge Rate(s)	Calc
1 year (l/s)	27.8
30 year (l/s)	56.9
100 year (l/s)	68.9
☐ Check Discharge Volume	Calc
100 year 360 minute (m³)	
Storage Estimate	Calc

Attenuation calculations are based on no infiltration to ground as a 'worst case' estimate. Discharge rates based on rates agreed during Phase 1 design

Storage Estimate

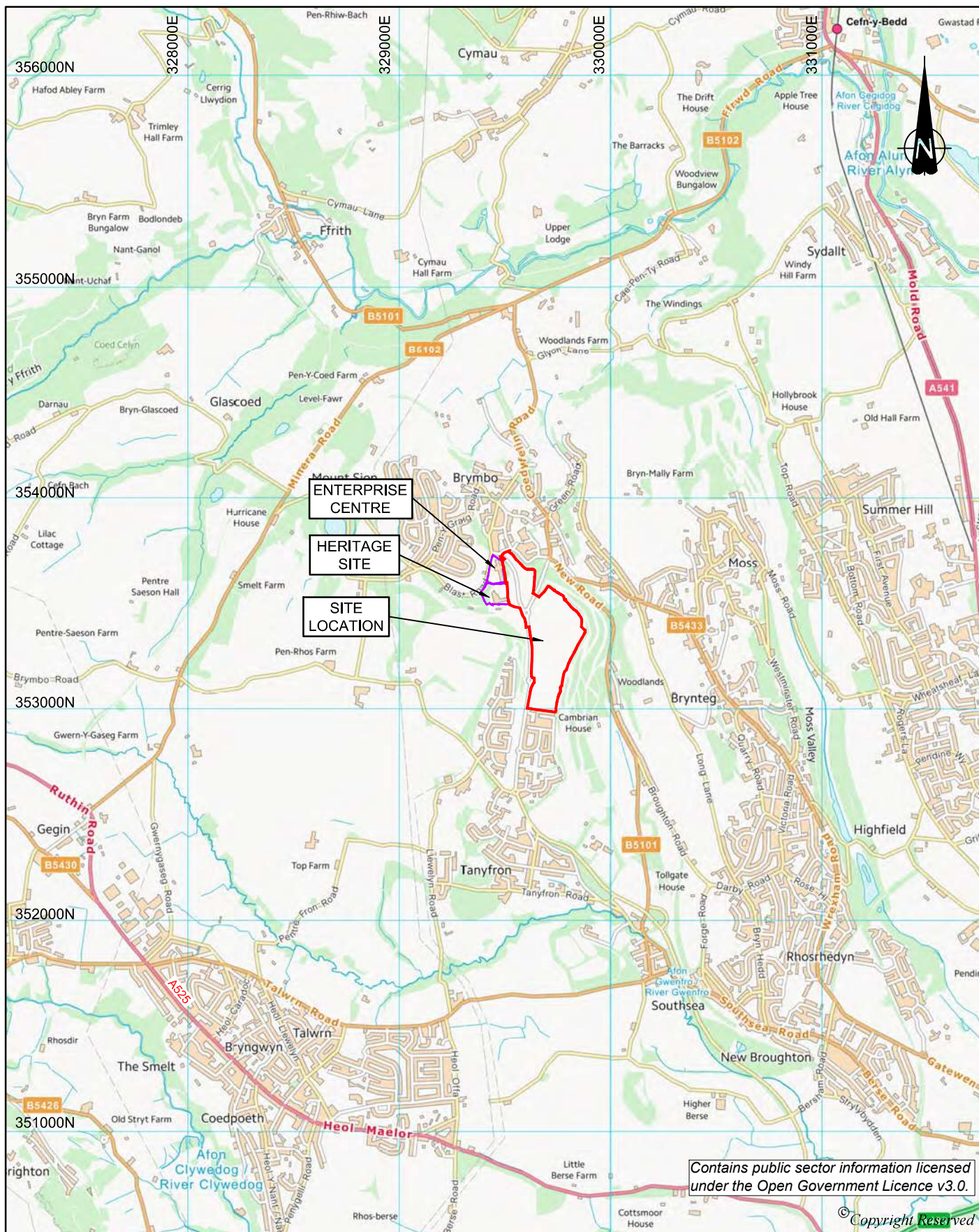
Return Period (years)	30
Climate Change (%)	0
Impermeable Area (ha)	0.360
Peak Discharge (l/s)	62.400
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	9
to	31
With infiltration (m³)	
from	
to	

Storage Estimate

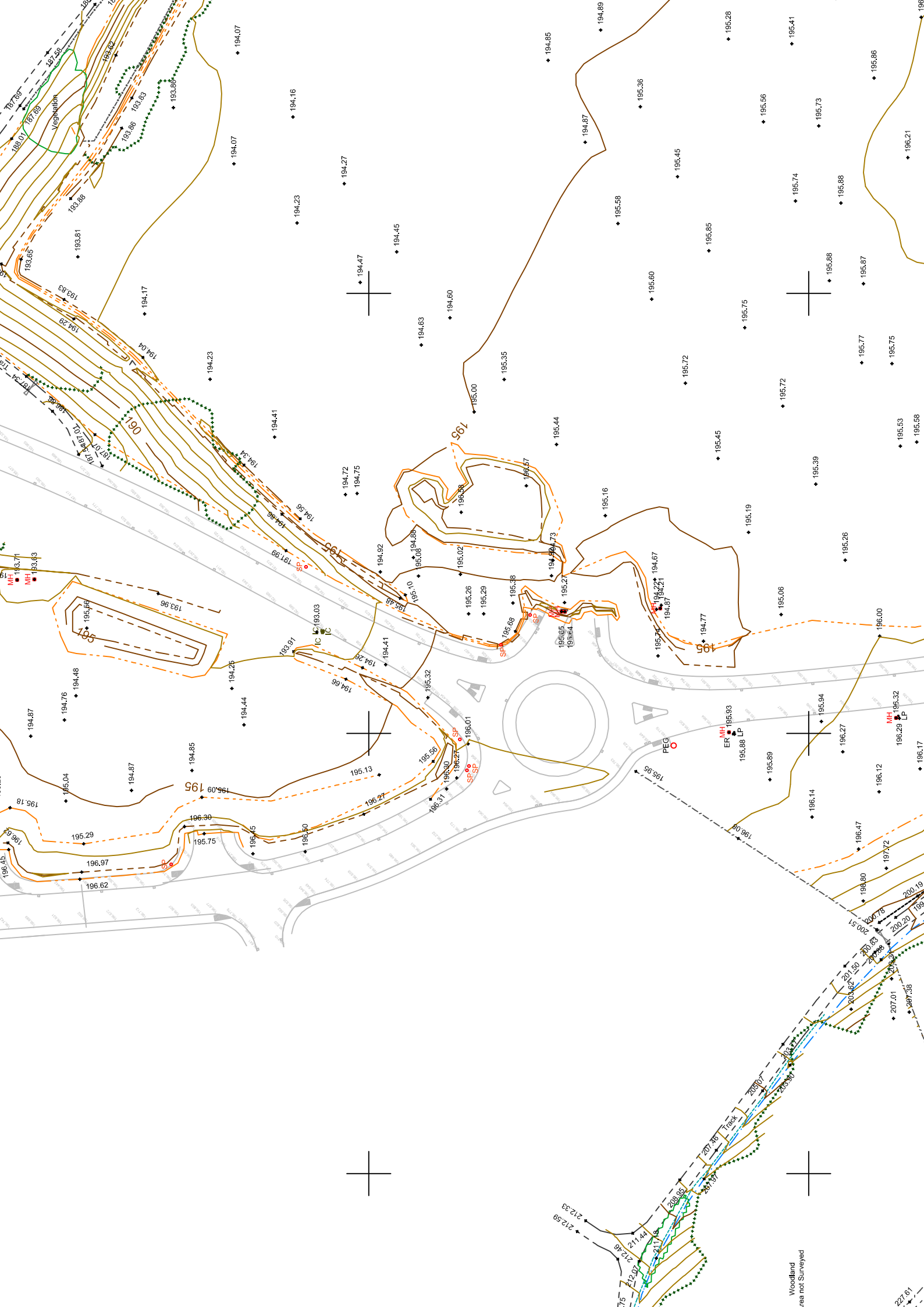
Return Period (years)	100
Climate Change (%)	30
Impermeable Area (ha)	0.360
Peak Discharge (l/s)	72.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	25
to	68
With infiltration (m³)	
from	
to	

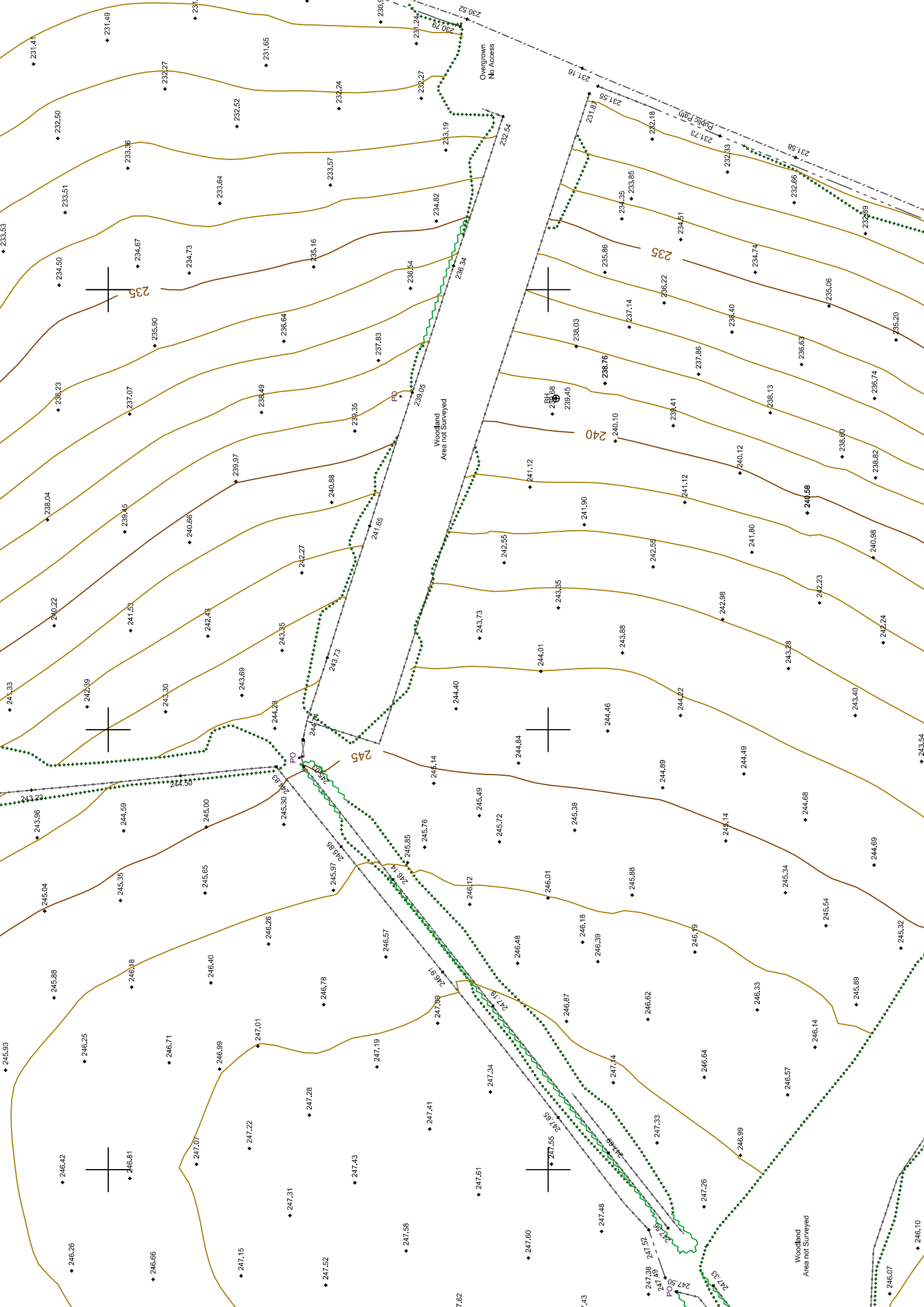
Based on the calculations, approximately 20m³ of storage would be required to attenuate for the 1 in 30 year storm event and 47m³ of storage would be required to attenuate for the 1 in 100 year storm event.

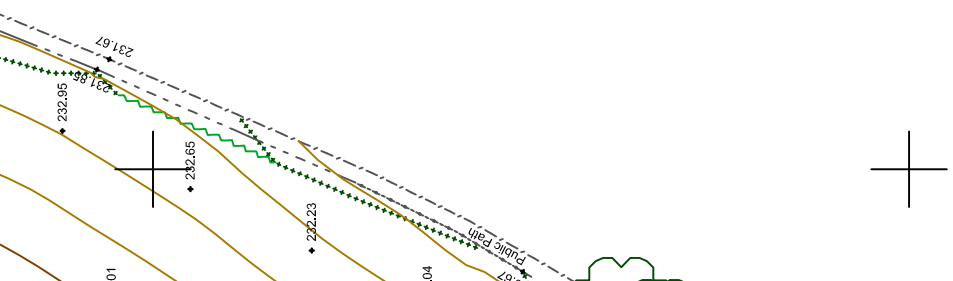
DRAWINGS



CLIENT Parkhill Estates	DRG No. ST16882-008		REV A
	SIZE A4	SCALE 1:25,000	DATE 07-11-18
PROJECT Former Brymbo Steelworks, Wrexham: Link Road Development Module	DRAWN BY DR	CHECKED BY BG	APPROVED BY JG
DRAWING TITLE Site Location	 wardell armstrong <i>your earth our world</i>		







SLOPES/600mm DEPTH INCLUDING
300mm FREEBOARD

- BIORETENTION SYSTEMS
- PERMEABLE PAVING
- GEOCELLULAR STORAGE

OUTFALL D
DISCHARGE RESTRICTED
TO 22 L/s (1 IN 100 YEAR
STORM EVENT)

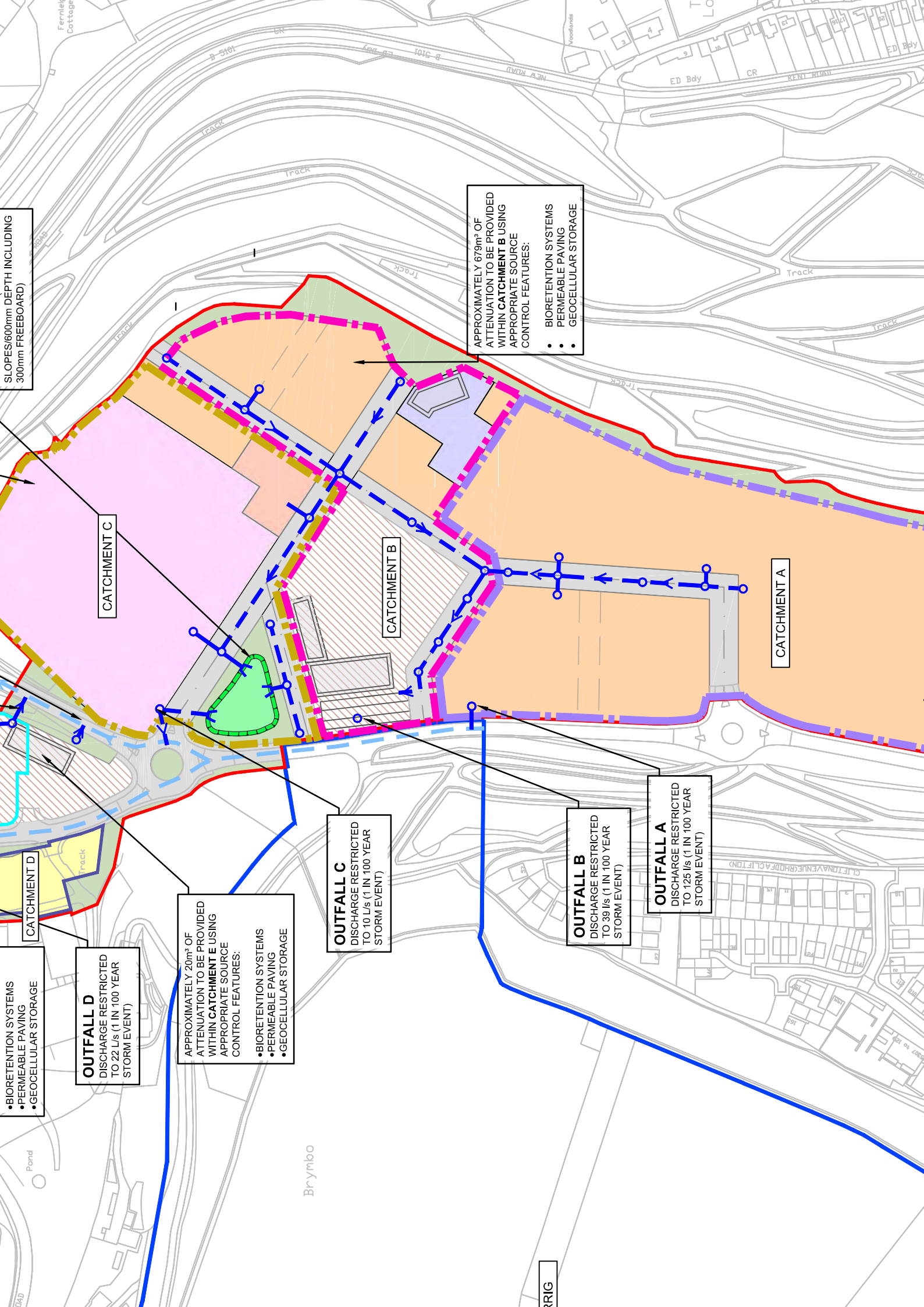
APPROXIMATELY 20m³ OF
ATTENUATION TO BE PROVIDED
WITHIN **CATCHMENT E** USING
APPROPRIATE SOURCE
CONTROL FEATURES:
•BIORETENTION SYSTEMS
•PERMEABLE PAVING
•GEOCELLULAR STORAGE

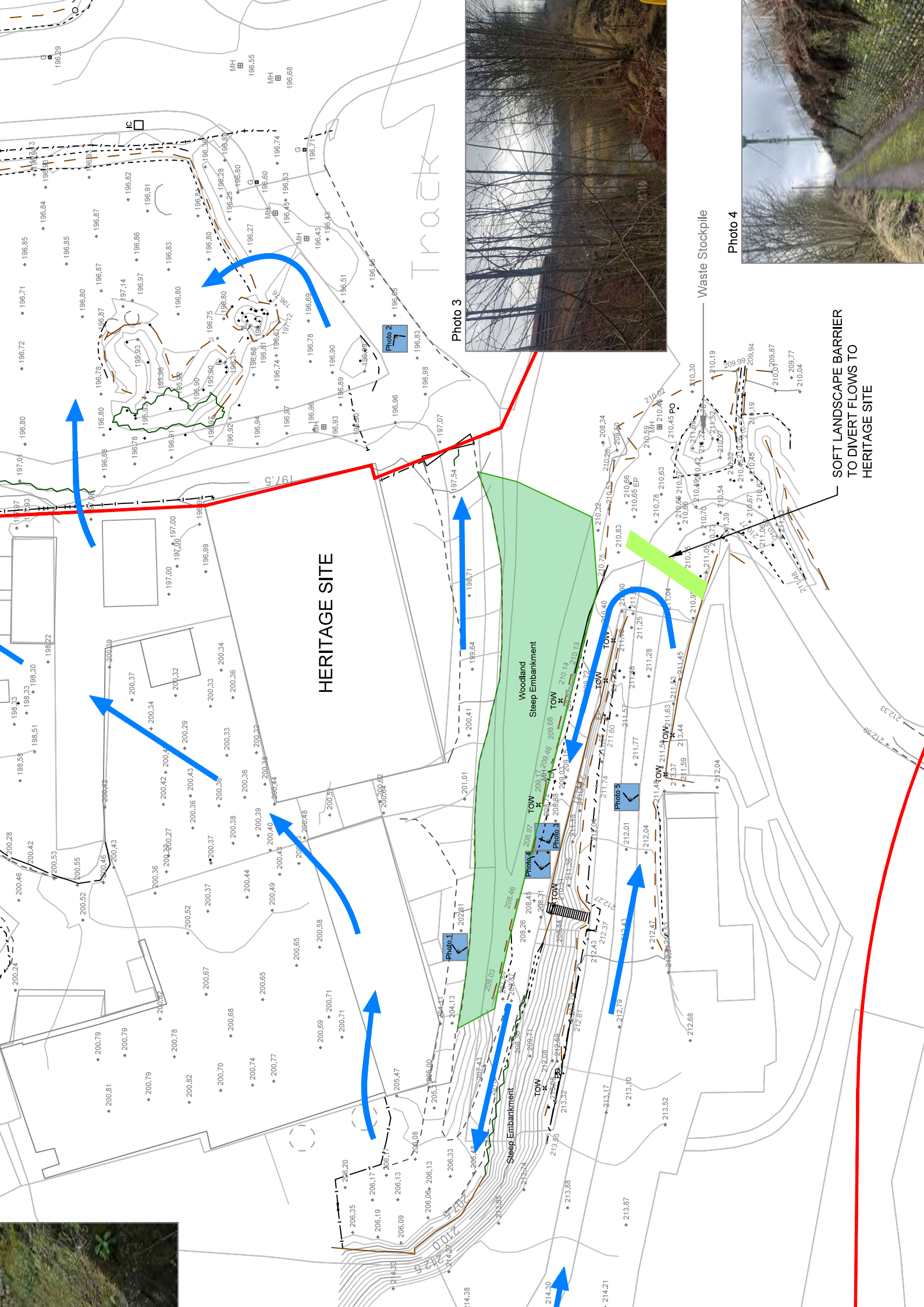
OUTFALL C
DISCHARGE RESTRICTED
TO 10 L/s (1 IN 100 YEAR
STORM EVENT)

APPROXIMATELY 679m³ OF
ATTENUATION TO BE PROVIDED
WITHIN **CATCHMENT B** USING
APPROPRIATE SOURCE
CONTROL FEATURES:
• BIORETENTION SYSTEMS
• PERMEABLE PAVING
• GEOCELLULAR STORAGE

OUTFALL B
DISCHARGE RESTRICTED
TO 39 L/s (1 IN 100 YEAR
STORM EVENT)

OUTFALL A
DISCHARGE RESTRICTED
TO 125 L/s (1 IN 100 YEAR
STORM EVENT)





HERITAGE SITE

Track

Woodland Steep Embankment

Waste Stockpile

Photo 1

Photo 2

Photo 3

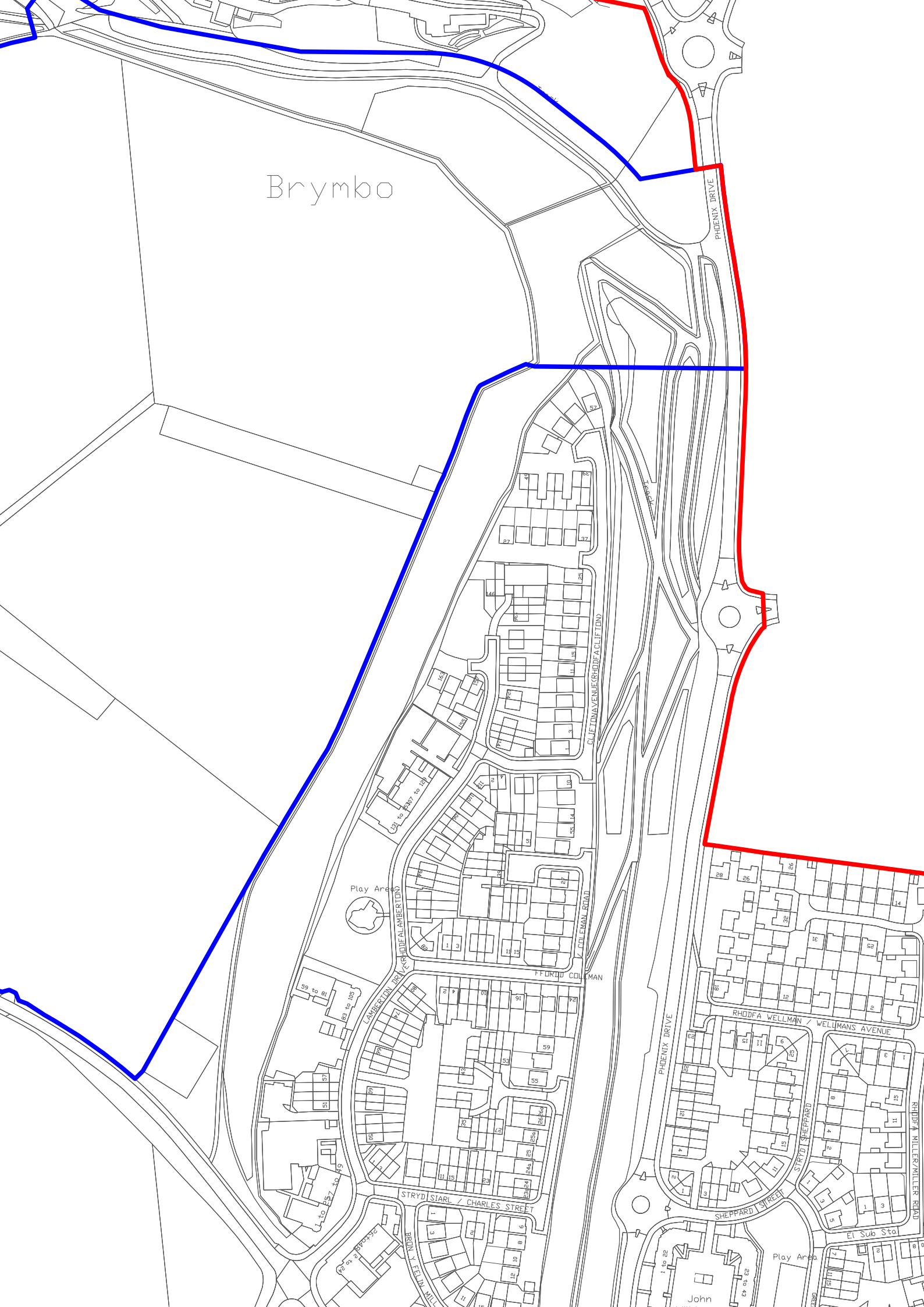
Photo 4

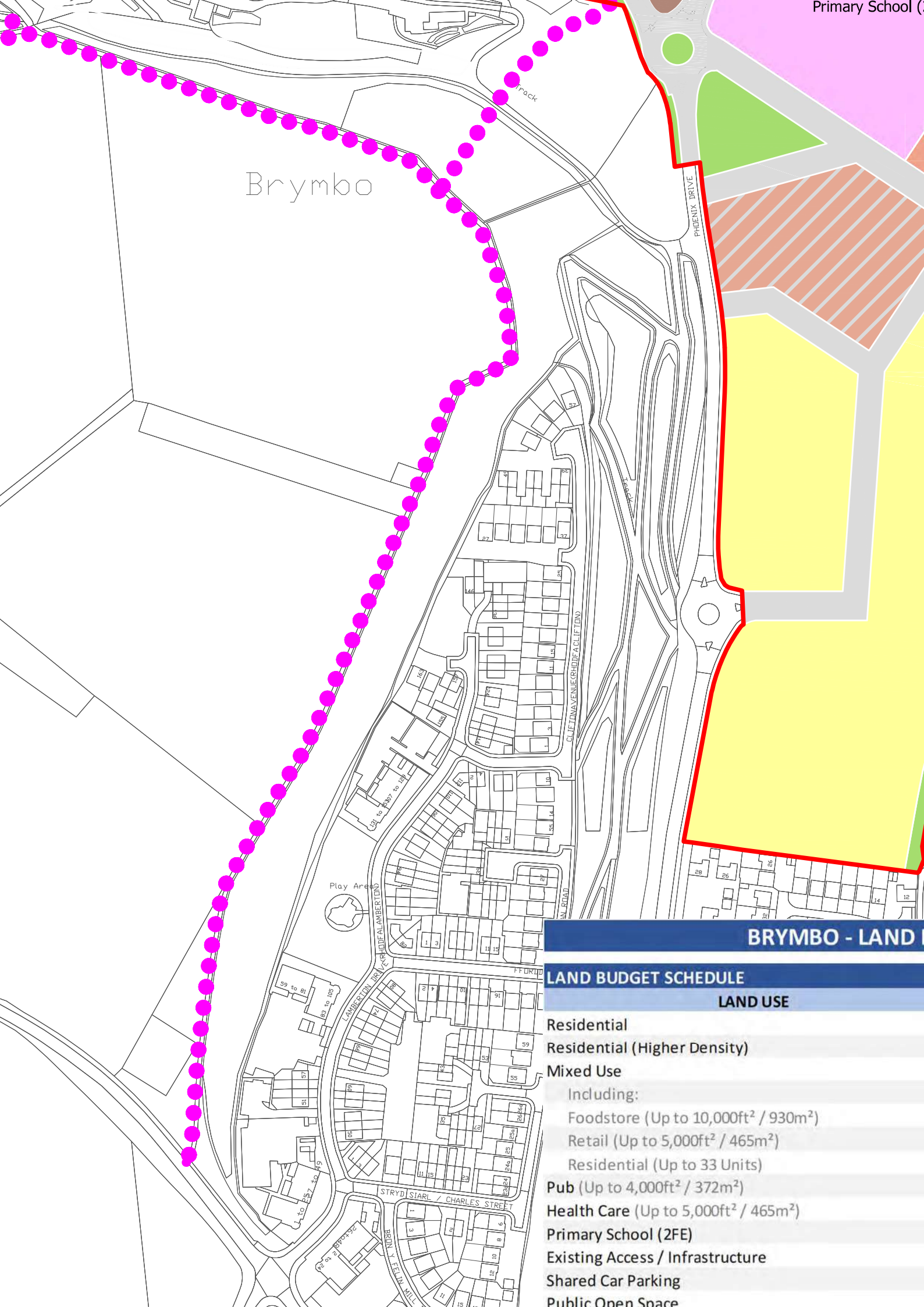
Photo 5

Photo 4

SOFT LANDSCAPE BARRIER
TO DIVERT FLOWS TO
HERITAGE SITE

Brymbo





BRYMBO - LAND

LAND BUDGET SCHEDULE

LAND USE

- Residential
- Residential (Higher Density)
- Mixed Use
 - Including:
 - Foodstore (Up to 10,000ft² / 930m²)
 - Retail (Up to 5,000ft² / 465m²)
 - Residential (Up to 33 Units)
- Pub (Up to 4,000ft² / 372m²)
- Health Care (Up to 5,000ft² / 465m²)
- Primary School (2FE)
- Existing Access / Infrastructure
- Shared Car Parking
- Public Open Space

'PHASE 2' DESIGN AND DEVELOPMENT MUST INCLUDE THE SURFACE WATER DESIGN FLOWS FROM 'PHASE 1' DEVELOPMENT AND PROVIDE ATTENUATION AND FLOW CONTROL DEVICE IN S46 TO CATER FOR THE COMBINED 'PHASE 1' AND 'PHASE 2' SURFACE WATER FLOWS. A MAXIMUM OF 769 L/S IS NOT TO BE EXCEEDED ON 1 IN 100 YEAR + 20% DESIGN STORM EVENT AT THE CONNECTION TO THE EXISTING CULVERT.

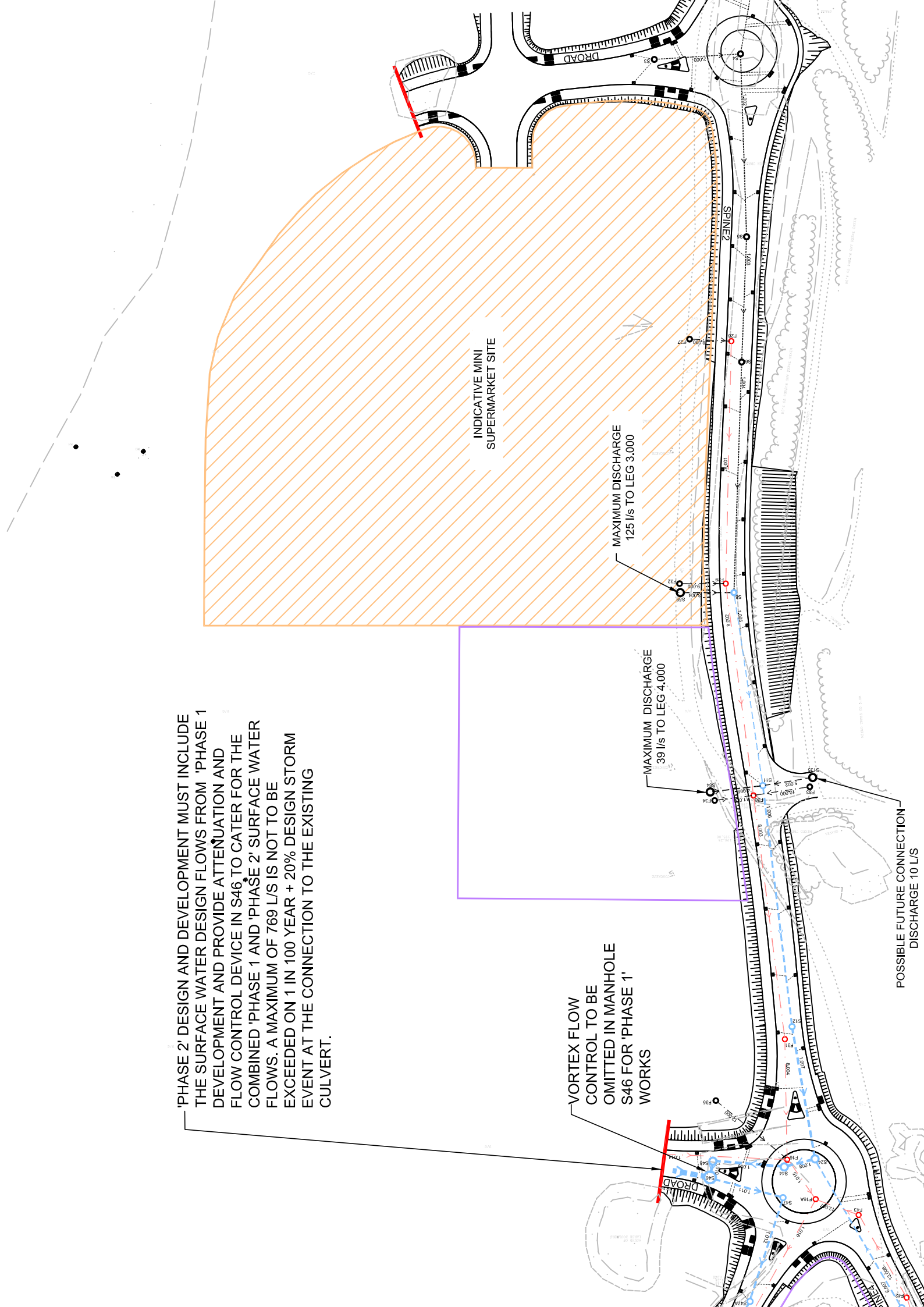
VORTEX FLOW CONTROL TO BE OMITTED IN MANHOLE S46 FOR 'PHASE 1' WORKS

MAXIMUM DISCHARGE
125 l/s TO LEG 3,000

MAXIMUM DISCHARGE
39 l/s TO LEG 4,000

POSSIBLE FUTURE CONNECTION
DISCHARGE 10 L/S

INDICATIVE MINI
SUPERMARKET SITE



STOKE-ON-TRENT

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Etruria
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International offices:

ALMATY

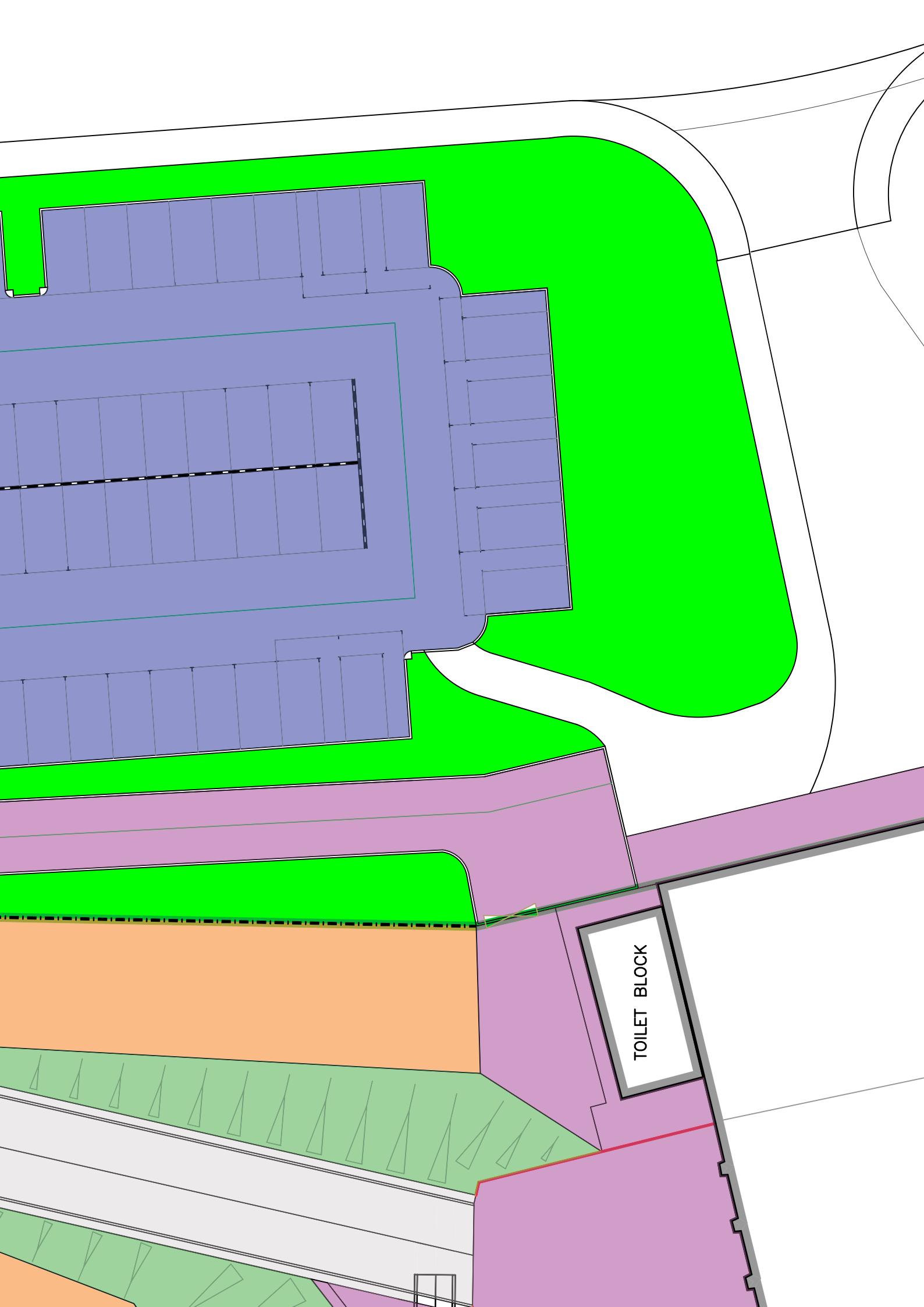
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APPENDIX J

Catchment Area Plan



TOILET BLOCK

APPENDIX K

Porosity Test



POROSITY REPORT

BRYMBO HERITAGE PROJECT

Dec 2023
Suitability S2
Revision P01

Prepared on Behalf of:
TACP Architects

Pembroke House
Ellis Way,
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SUITABILITY	REV	DATE	DESCRIPTION	Org.	Chk'd	App'd
S2	P01	13/12/2023	First Issue.			

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1.1 Project Background.....	4
1.2 Scope of Porosity Report	4
2.0 General Overview	5
3.0 Design Criteria.....	6
3.1 Test Results	6
3.2 Result Discussion.....	6
4.0 Conclusion.....	7

APPENDICES

A	Site Location Plan
B	DCWW Apparatus Map
C	Trial Pit Location Plan
D	Trial Pit Log
E	Porosity Test Calculations

1.0 Introduction

1.1 Project Background

1.1.1 Bingham Rawlings Partnership have been appointed to provide a drainage strategy, for surface water for the proposal to improve the existing facilities at Brymbo Heritage Project , LL11 5BT (National Grid Reference: (SJ 29500 53576), the site location plan is contained within **Appendix A**.

1.1.2 As part of the surface water drainage design the method of surface water disposal should be undertaken in line with the SuDS Hierarchy outlined within CIRIA C753 ‘The SuDS Manual 2015’ and the Statutory standards for sustainable drainage systems in Wales 2018. This hierarchy indicates that disposal into the ground via a soakaway structure must be the first method of surface water disposal considered. In order to determine whether this is a viable means of surface water disposal infiltration testing on site is required. This report contains the results and findings of the testing undertaken on site.

1.2 Scope of Porosity Report

1.2.1 This porosity report aims to provide knowledge and understanding of the soil infiltration characteristics encountered on site.

1.2.2 The purpose of the calculations and accompanying details provided are to determine the infiltration value for the soil to produce a drainage layout that complies with the relevant legislation of TAN 15, SuDS hierarchy and Approved Document H of the Building Regulations.

2.0 General Overview

- 2.1.1 The main purpose of the investigation was to undertake soil infiltration tests, in accordance with BRE Digest 365 and Approved Document H of the Building Regulations 2010, to determine if the underlying strata is suitable for utilising infiltration systems for the disposal of surface water run-off.
- 2.1.2 On the 5th of December 2023, an intrusive site investigation was carried out to undertake 3No. porosity tests, which consisted of a 3 trial holes, taken to a maximum depth of 1.90m. Infiltration testing was conducted within the trial hole to assess the infiltration characteristics of the ground.
- 2.1.3 The trial pits were located as per the attached trial pit location plan drawing contained within **Appendix C**.
- 2.1.4 Trial pit logs containing information on the depths of strata encountered on site for TP-1, TP-2 & TP-3 are contained within **Appendix D**.

3.0 Design Criteria

3.1 Test Results

3.1.1 The soil infiltration calculations are summarised within **Table 1** below. Refer to the porosity test calculation sheet contained within **Appendix E** for further information.

Table 1 – Test Results

<u>Ref</u>	Test N ^o	Depth	Ground Water Depth	Soil Infiltration Rate
TP-1	01	1.90m	N/A	N/A
TP-2	01	0.75m	Immediately	N/A
TP-3	01	1.20m	1.20	N/A

3.2 Result Discussion

As part of the test, TP-1 & TP-3 were filled with water to within 500mm and 190mm of the existing surface level respectively, and the rate of which the water dropped was recorded until the hole stopped emptying. During the porosity testing, the hole did not empty in either hole. TP-1 didn't drop at all and eventually started taking in surface water. TP-3 initially began to drop until 110 minutes, where it remained unchanged for a further 40 minutes before the test was abandoned. TP-2 encountered surface water immediately after breaking ground. Thus, concluding that the site is not suitable for the use of infiltration systems, therefore an alternative method of disposal should be considered.

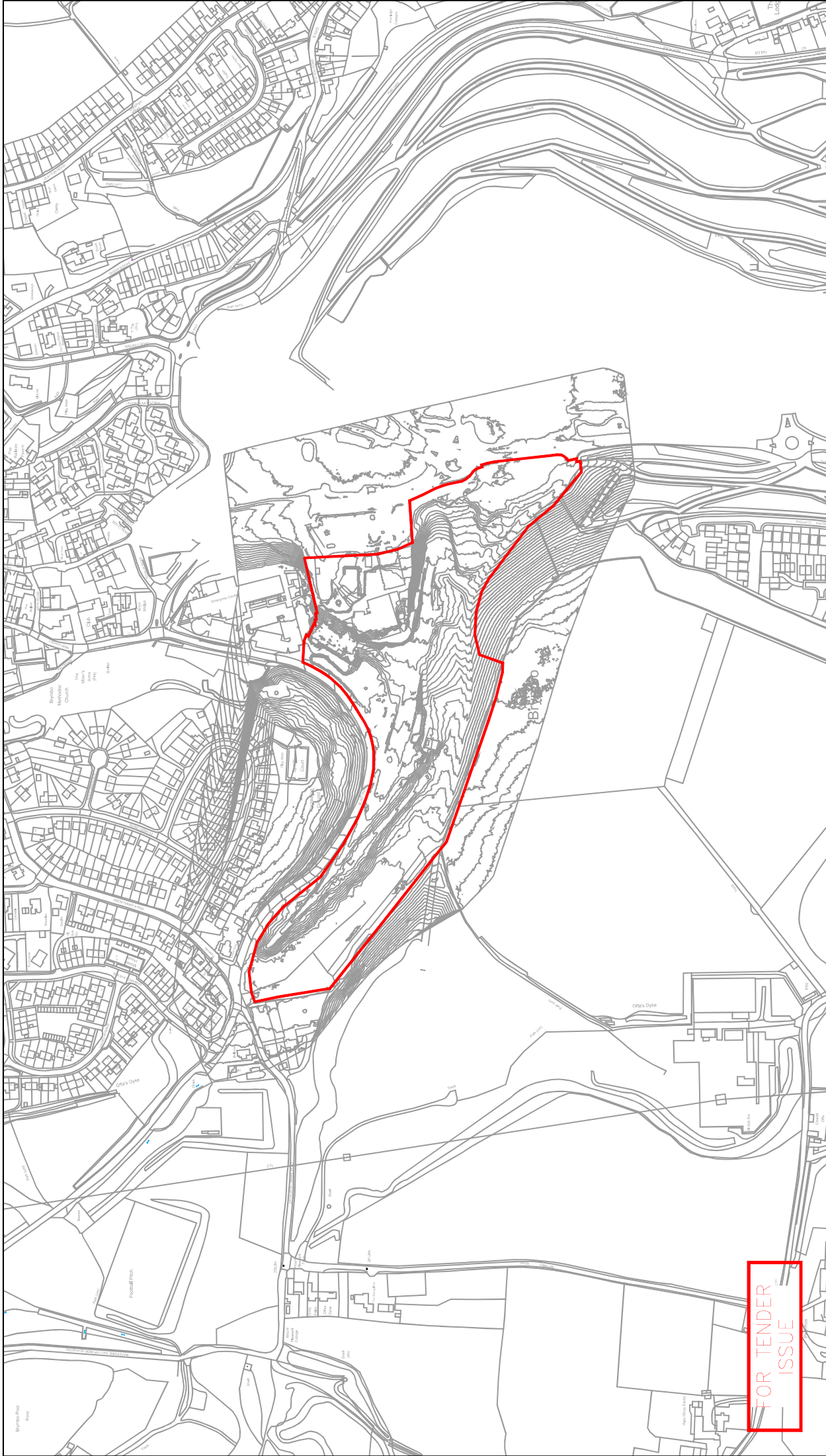
4.0 Conclusion

- 4.1.1 The results of the test undertaken on the 5th December 2023 indicate that the use of soakaways as a method of surface water disposal cannot be considered as a suitable method of discharge, therefore an alternative method of disposal should be considered.

APPENDICES

APPENDIX A

Site Location Plan



This drawing is to be read in conjunction with all relevant architects drawings and specifications.

Do not scale – use written dimensions only !

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brp
Bingham
Rawlings
Partnership
Limited

Project:
BRYMBO HERITAGE PROJECT

Detail:
SITE LOCATION PLAN

Project No.	Drawing No.	Scale	By	Rev.
4866	0001	1:5000	M.J	C01

APPENDIX B

DCWW Apparatus Map

EXACT LOCATION OF
ALL APPARATUS TO
BE DETERMINED ON
SITE

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APPENDIX C

Trial Pit Location Plan



APPENDIX D

Trial Pit Log

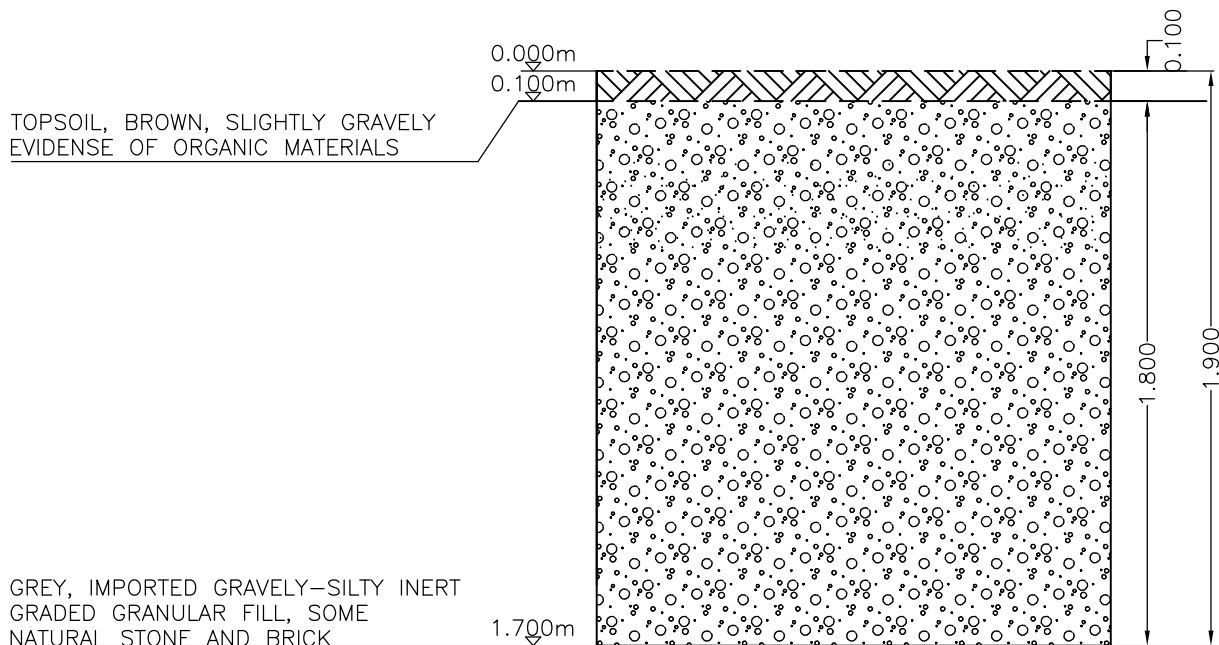
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Project
BRYMBO HERITAGE PROJECT?

Detail
TP1 TRAIL PIT LOG

Project No.	Drawing No.	Scale	By	Rev.
4866	EW01	1:25	I.G	A



This drawing is to be read in conjunction with all relevant architects drawings and specifications.
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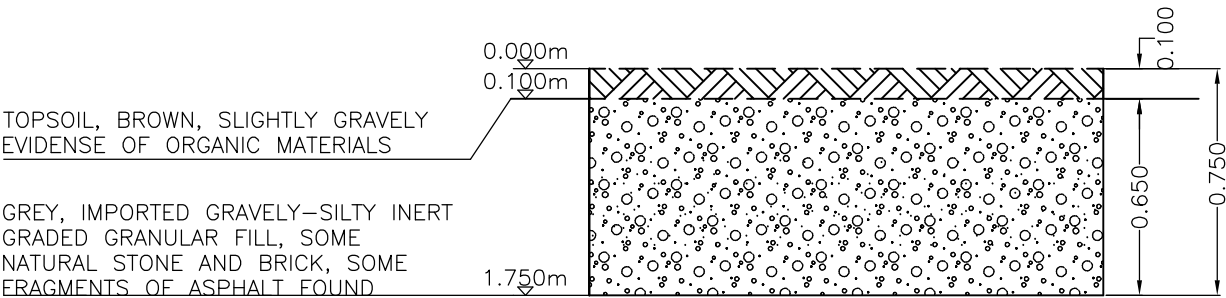
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Project
BRYMBO HERITAGE PROJECT

Detail
TP2 TRAIL PIT LOG

Project No.	Drawing No.	Scale	By	Rev.
4866	EW01	1:25	I.G	A



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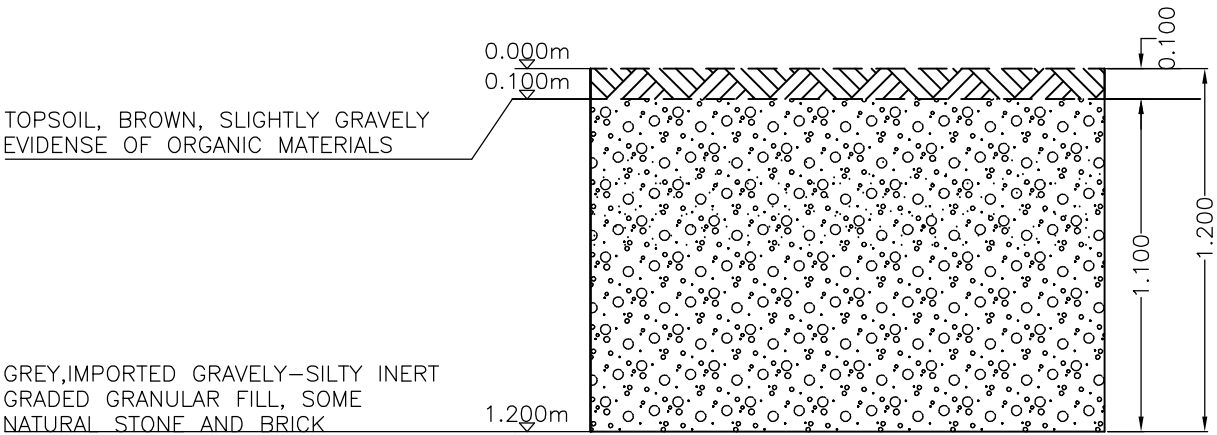
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Project
BRYMBO HERITAGE PROJECT

Detail
TP2 TRAIL PIT LOG

Project No.	Drawing No.	Scale	By	Rev.
4866	EW01	1:25	I.G	A



This drawing is to be read in conjunction with all relevant architects drawings and specifications.
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APPENDIX E

Porosity Test Calculations

TP1 - INFILTRATION CALCUALTIONS

Site: Brymbo
Doc Ref: Job Ref - 4866

Trial Pit Dimensions: Length (m) 2.400 Width (m) 0.700 Depth (m) 1.900

Depth of Groundwater from GL (m): N/A Thus Effective depth (m) = 1.400

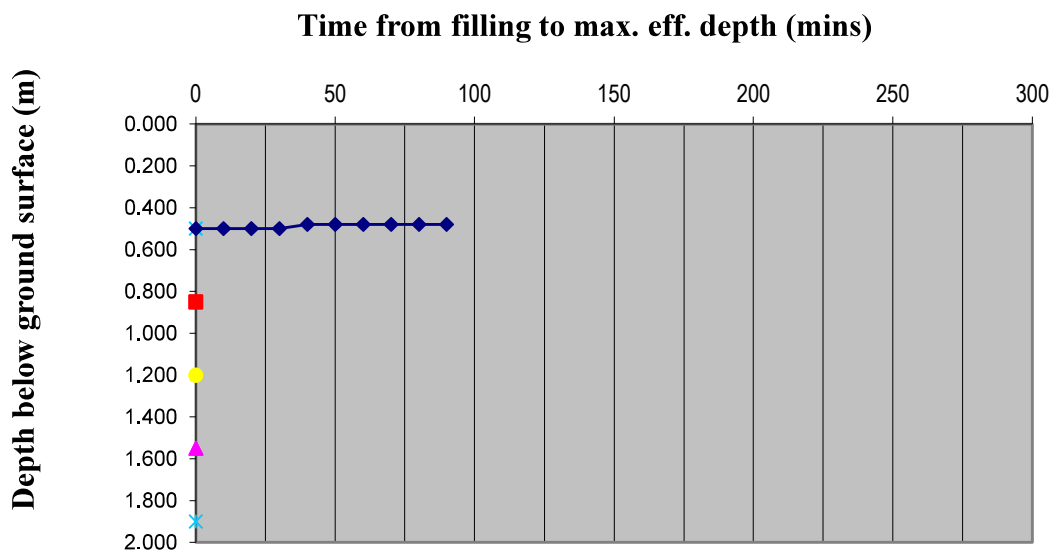
Time (mins)	Depth of water from (m)	Rate of change (m/min)
0	0.500	
10	0.500	0.0000
20	0.500	0.0000
30	0.500	0.0000
40	0.480	-0.0020
50	0.480	0.0000
60	0.480	0.0000
70	0.480	0.0000
80	0.480	0.0000
90	0.480	0.0000

Volume Outflow, Vp75-25	1.176 m ³
Surface Area, ap50	6.795 m ²
Time Taken, tp75-25	#DIV/0! min

Soil Infiltration Rate, f	N/A
Over Effective depth of	1.400 m
Part H Vp	#DIV/0! s/mm

depth (%Full)	depth (m)	time (min)
0	1.900	0
	1.900	0.00
25	1.550	0.00
	1.550	#DIV/0!
50	1.200	0
	1.200	#DIV/0!
75	0.850	0
	0.850	#DIV/0!
100	0.500	0
	0.500	0.00

TEST ABANDONED



TP1 - INFILTRATION CALCUALTIONS

Site: Brymbo
Doc Ref: Job Ref - 4866

Trial Pit Dimensions: Length (m) 1.200 Width (m) 0.400 Depth (m) 1.300

Depth of Groundwater from GL (m): N/A **Thus Effective depth (m) =** 1.110

Time (mins)	Depth of water from (m)	Rate of change (m/min)
0	0.190	
10	0.190	0.0000
20	0.350	0.0160
30	0.400	0.0050
40	0.430	0.0030
50	0.460	0.0030
60	0.480	0.0020
70	0.500	0.0020
80	0.530	0.0030
90	0.530	0.0000
100	0.550	0.0020
110	0.560	0.0010
120	0.560	0.0000
130	0.560	0.0000
140	0.560	0.0000
150	0.560	0.0000

Volume Outflow, Vp75-25	0.266 m ³
Surface Area, ap50	1.960 m ²
Time Taken, tp75-25	278.75 min

Soil Infiltration Rate, f	N/A
Over Effective depth of	1.110 m
Part H Vp	90.41 s/mm

depth (%Full)	depth (m)	time (min)
0	1.300	0
	1.300	150.00
25	1.023	0.00
	1.023	331.25
50	0.745	0
	0.745	192.50
75	0.468	0
	0.468	52.50
100	0.190	0
	0.190	0.00

TEST ABANDONED

