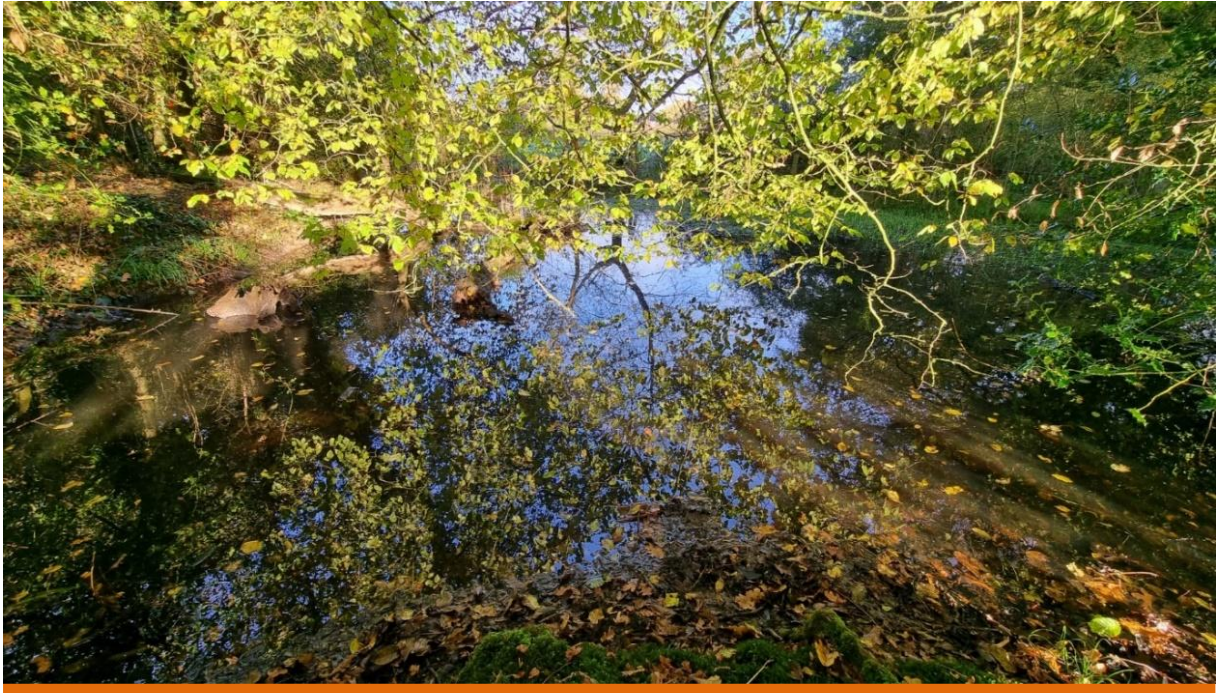




Flood Risk Assessment

Crescent Place, Storrington Road, Thakeham RH20 3ED

Client

Michael & Rosslyn Lowdell

Crescent Place

Storrington Road

Thakeham, RH20 3ED

Ref: 12303

Date: April 2023

Consulting Engineers

GTA Civils & Transport Ltd

Maple House

192 – 198 London Road

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West Sussex, RH15 9RD

Tel: 01444 871444

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2	Existing Site and Current Flood Conditions	3
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Schedule of Appendices

A	Site Location Map & Aerial Photo
B	Environment Agency Flood Data, SCALGO Live Maps & Groundwater Maps
C	Topographic Survey, Sewer Records & Architect's Scheme Drawings
D	Drainage Drawings
E	BRE Digest 365 Soil Soakage Test Report
F	Drainage Calculations
G	Drainage Maintenance and Management Plan

Issue	Issue date	Compiled	Checked
Preliminary Issue	15 February 2023	JP	MR
First Issue	02 March 2023	JP	MR
Updated to LLFA comments (2 nd)	24 April 2024	FVV	MR
Third Issue	06 June 2024	JP	FVV / MR
Fourth Issue	16 December 2025	JP	FVV / MR

1 Introduction

- 1.1 GTA Civils & Transport Limited was appointed by the client to provide a Flood Risk Assessment (FRA) as requested by the Environment Agency (EA) and Horsham District Council (HDC) in order to achieve Planning Approval at said property.
- 1.2 This FRA report has been prepared for Michael & Rosslyn Lowdell in relation to the proposed development at Crescent Place, Storrington Road, Thakeham RH20 3ED. No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.
- 1.3 This report has been prepared in accordance with the 2024 National Planning Policy Framework (NPPF) and the relevant latest planning practice guidance (PPG).
- 1.4 The 2nd issue has been prepared in response to the request for more information received from HDC's drainage officer dated 01st of April 2024. Further information has been provided on the following:
 - Surface water flooding in the existing and proposed scenario.
 - Existing watercourses.
 - Drainage strategy layout and details.
 - Drainage maintenance plan.
 - Groundwater considerations.
- 1.5 The 3rd issue has been prepared to clarify the Sequential Test issue. The LLFA and LPA have interpreted the flood risk policy (current NPPF) such that all sites affected by surface water flooding must pass the Sequential Test. There is evidence from a Court of Appeal ruling that this is not the case.
- 1.6 It is contended that the area where the new dwelling is due to be positioned is in FZ1 – Low Risk, well above the floodplain. The garage will be in the floodplain – so this will now be designed as a car port, ie completely open sided, just a roof supported on columns. It is contended that a Sequential Approach has been taken as regards the design of this proposal, with the More Vulnerable use (dwelling) set in FZ1 and the Less Vulnerable use (car port) placed in the surface water floodplain. It is contended that this scheme passes the second part of the Exception Test, as the development will be safe.
- 1.7 The fourth issue of this report has been prepared following a PPG update from September 2025. The Sequential Test does not have to be passed where a site-specific FRA shows there is no building or vulnerable elements placed in an area currently or predicted to be at risk of flooding. This is the contention made in previous version of this report. In addition, the drainage strategy has been revised following the introduction of the new National Standards for SuDS.

2 Existing Site and Current Flood Conditions

- 2.1 The application site lies in Thakeham, in the area administered by HDC. The site comprises two adjoining private properties, Little Snapes to the north and Crescent Place to the south, both with their respective private gardens. There is a swimming pool near the southern boundary. An existing site location map and aerial view are shown in Appendix A.
- 2.2 Two unnamed watercourses bisect the site, flowing in from the east – northeast. They join close to the centre of the site, where they flow into a 450-diameter culvert going west, crossing underneath Storrington Road. The unnamed watercourse then continues southwest, eventually discharging into the River Stor (Main River) 2km away. A watercourse plan is included in Appendix D. Lakes are located within the Sandgate Quarry approximately 1km to the south.
- 2.3 A topographic survey is shown in Appendix C. The site slopes from northeast to southwest with external levels ranging between 43.17mAOD and 41.51mAOD. Note the survey levels have been provided relative to an arbitrary site datum. This has been converted to Ordnance Datum based on publicly available information.
- 2.4 Geology: according to the BGS's online map, the site's solid geology is Fittleworth Member (sandstone and mudstone) with a superficial deposit of Head (clay, silt, sand and gravel) overlying.
- 2.5 Soil soakage testing was undertaken in accordance with BRE Digest 365 within the site. Testing of the sub soil, which was noted as Clay, did not produce a useable rate - as the water failed to drain more than **10mm** during the **3-hour** long test. The test was therefore declared a 'fail' (nil result). Refer to Appendix E for the full report.
- 2.6 The site is located within an area with Medium-High groundwater vulnerability; it is removed from any Source Protection Zones. Groundwater seepage was observed during the infiltration testing at approximately 0.9m depth.
- 2.7 Public Sewers: Southern Water's sewer records are shown in Appendix C. A 150mmØ foul sewer flows north-south under Storrington Road to the west of the site. There are no public surface water sewers in this vicinity.
- 2.8 Fluvial flooding: the Environment Agency's Flood Map in Appendix B shows the site is situated in Flood Zone 1 (FZ1) – Low Risk. Sites in FZ1 are susceptible to an annual exceedance probability of less than 1 in 1000 years (<0.1% AEP).
- 2.9 Surface water flooding occurs when excess rainwater does not infiltrate into the ground, or is not intercepted by urban drainage systems, and instead flows across the surface. The EA's surface water

flood map indicates that the site is bisected by an overland flow route, flowing from northeast to southwest, associated with the existing ditches. The flooding is mostly contained to the ditch itself in both the 'High Risk' (1 in 30 years storm event) and 'Medium Risk' (1 in 100 years storm event).

- 2.10 In a 'Low Risk Scenario' ('1 in 1000 years' storm event), the overland flow spills out from the ditch across the grassed area in front of Crescent Place, and onto Storrington Road. The depths of flooding range between 300mm and 900mm closest to the ditch line and is below 300mm across the rest of the site. A flood map illustrating this is included in Appendix B; this includes mapping generated with SCALGO Live, demonstrating the flood routes. The velocity of this is – predominantly – greater than 0.25 m/s.
- 2.11 Artificial sources: flooding from reservoirs, canals and docks. The EA's reservoir flooding map (in Appendix B) shows the site is clear from the risk of flooding from this source. There are no docks or canals in this area.
- 2.12 Historical records: the EA's historical flood map in Appendix B does not include any records of flooding at the site.
- 2.13 In conclusion, the flood risk profile of this site is High – limited to areas in the Surface Water floodplain away from the proposed development. In the rest of the site the flood risk is **Low**.

3 Proposed Development & Flood Mitigation

- 3.1 The proposal is to build one infill detached dwelling house – located to the north of the stream network. A new vehicular access and car port are included to the southwest. The proposed scheme drawings are shown in Appendix C.
- 3.2 As summarised in section 2.12 above, the flood risk of the areas that are due to be developed is Low – as these are limited to the surface water floodplain close to the northern stream.
- 3.3 The dwelling house will be located to the north of the floodplain. Its lowest floor level will be set at **42.77mAOD**, which is greater than 1m above the stream's north bank's levels at this point. The depth of flooding in the 1 in 1000 years scenario has been estimated at **42.15mAOD** closest to the proposed dwelling using SCALGO Live (based on 225mm flood depth over ground level 41.83mAOD). This means **>0.6m** of freeboard will be provided; this complies fully with the NPPF.
- 3.4 The proposed car port and associated drive will be encroaching slightly within the overland flow path as mapped by the EA. However, as outlined in Section 2.10, the main flow path is associated with the northeast-southeast ditch, spilling out at the location of the existing 450 diameter culvert. The car port and drive will not encroach on to this main flow mechanism and will therefore have limited impact on the overall flood risk. If any flooding were to impact the car port, there would be minimal impedance of said flows, with this being an open sided structure.
- 3.5 To demonstrate this, the proposed levels have been imported into SCALGO Live to review the potential impacts on the overland flow route. This confirmed that the main flow pathways through the site remain unchanged. This is included in Appendix B.
- 3.6 Additionally, the footpath from the proposed drive to the new dwelling crosses over the western branch of the ditch. As shown on the Watercourse Plan, this is a minor branch of the ditch issuing within the site itself. It is not expected that the footpath crossing will create any undue restrictions to flow. A minimum diameter of 450mm is proposed – to match the existing downstream culvert.
- 3.7 Placing a new dwelling unit in FZ1 is 'appropriate development', according to Tables 1, 2 and 3 of the NPPF. Refer to sections 1.5 and 1.6 regarding the Sequential Test: this site has been designed sequentially. As set out in section 1.7 above, there is no need to pass the Sequential Test in this case.
- 3.8 The dwelling house will be placed 4m north of the stream's north bank. This, together with the new outfall headwall, will be subject to Ordinary Watercourse Consent (OWC) from the LLFA (as within 8m of the existing bank). The watercourse plan in Appendix D demonstrates that maintenance access to the ditch will be maintained from the south. On this basis, there is no reason to suppose OWC would not be forthcoming, subject to details to be submitted during the OWC process.

4 Sustainable Surface Water Drainage Design

4.1 The SuDS hierarchy has been applied, this being:-

- Store rainwater for later use;
- Use infiltration techniques;
- Attenuate rainwater in ponds or open water features for gradual release;
- Attenuate rainwater by storing in tanks or sealed water features for gradual release;
- Discharge rainwater direct to a watercourse;
- Discharge rainwater to a surface water sewer/drain;
- Discharge rainwater to the combined sewer.

4.2 A water butt shall be provided in the new unit's garden. The harvested water shall be used for irrigation and so this shall reduce the demand for potable water between late spring and autumn.

4.3 As set out in section 2.5 and Appendix E, the soil possesses insufficient permeability for infiltration structures (eg soakaways, permeable pavings). This rules out the 2nd, 3rd and 4th items in the hierarchy.

4.4 The development's surface water will be drained to the stream within the site - via an area of rain garden and unlined porous pavings. The offsite flow rate will be restricted to 1.0l/s, which is the practical minimum limit of screened orifices / vortex devices.

4.5 A cellular attenuation tank is proposed to store the volume in the critical 1 in 100 years storm event + 45% allowance for climate change. The tank will be lined to protect groundwater from any contaminants. Drainage drawings and details of the tank and porous pavings are included in Appendix D. Hydraulic calculations are included in Appendix F.

4.6 Preliminary buoyancy calculations have been carried out to assess the risk of flotation from the shallow groundwater. These have been conducted for two scenarios: groundwater at 0.9m below ground, as observed during testing; and peaking groundwater at 0.5m below ground. In both cases, no ballast or additional reinforcement is required. The calculations are included in Appendix F.

4.7 The provision of a water butt meets Standard 1 of the new National Standards for SuDS. The rain garden and porous paved area shall intercept the first 5mm of rainfall and so Standard 2 is met, too.

4.8 Exceedance flows: an exceedance flow plan is included in Appendix D demonstrating that the water will be able to flow safely away from the dwellings and into the existing stream in the event of a system failure or extreme storm in excess of the design event.

4.9 Maintenance of the SuDS network will remain the responsibility of the Applicant. A preliminary Maintenance and Management Plan is included in Appendix G.

4.10 Conclusion:

This development will not increase the flood risk, either on this site or to neighbouring properties, and so complies fully with the NPPF and PPG.

- End of Report -

Appendix A

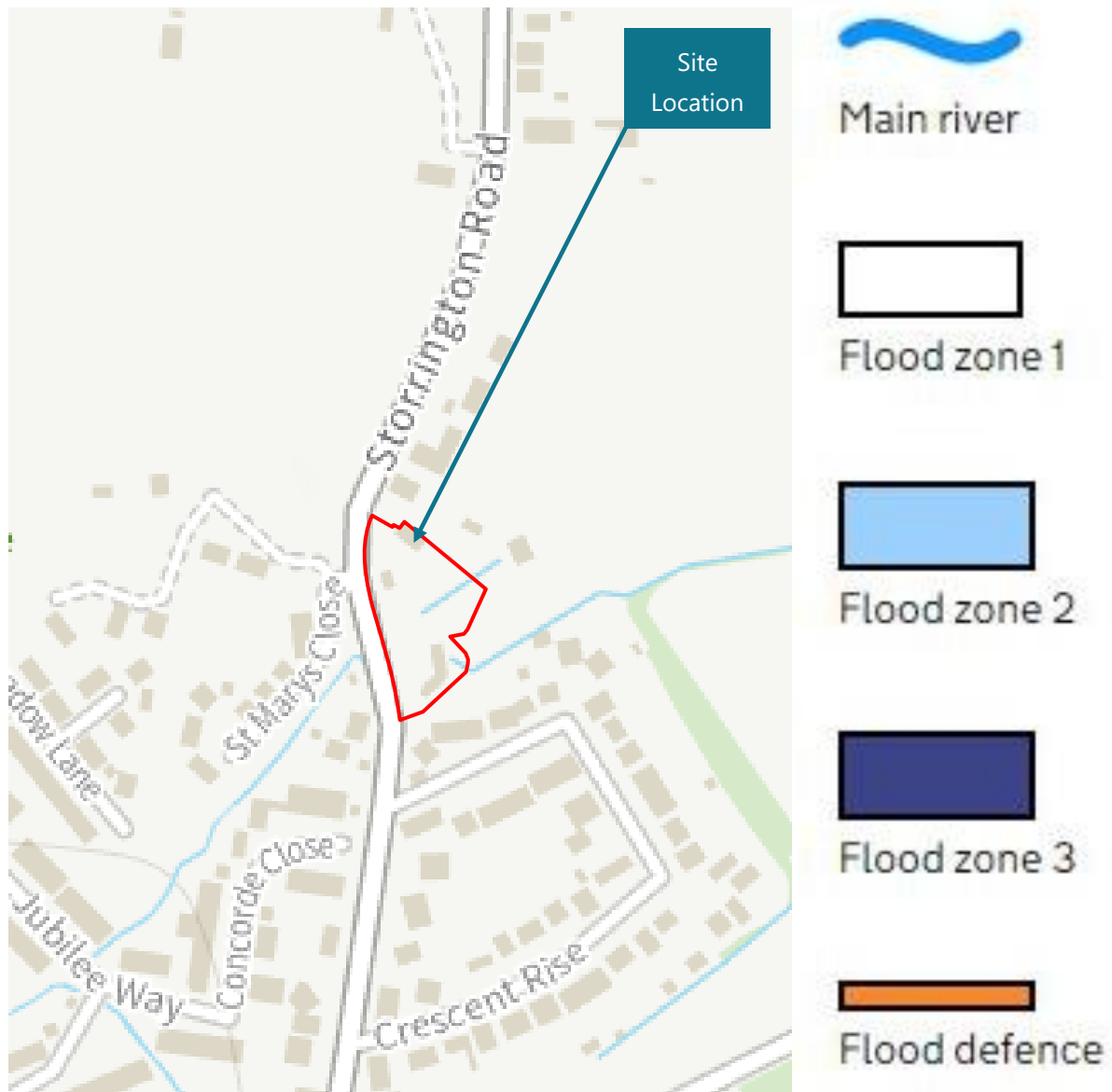
Site Location Map & Aerial Photo





Appendix B

Environment Agency Flood Data, SCALGO Live Maps & Groundwater Maps

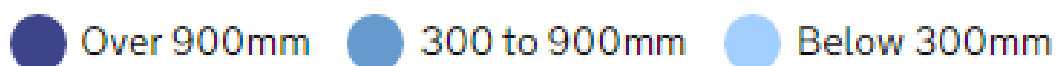


EA's Online Flood Map for Planning (Rivers and Seas)

The site is located in Flood Zone 1 (FZ1)

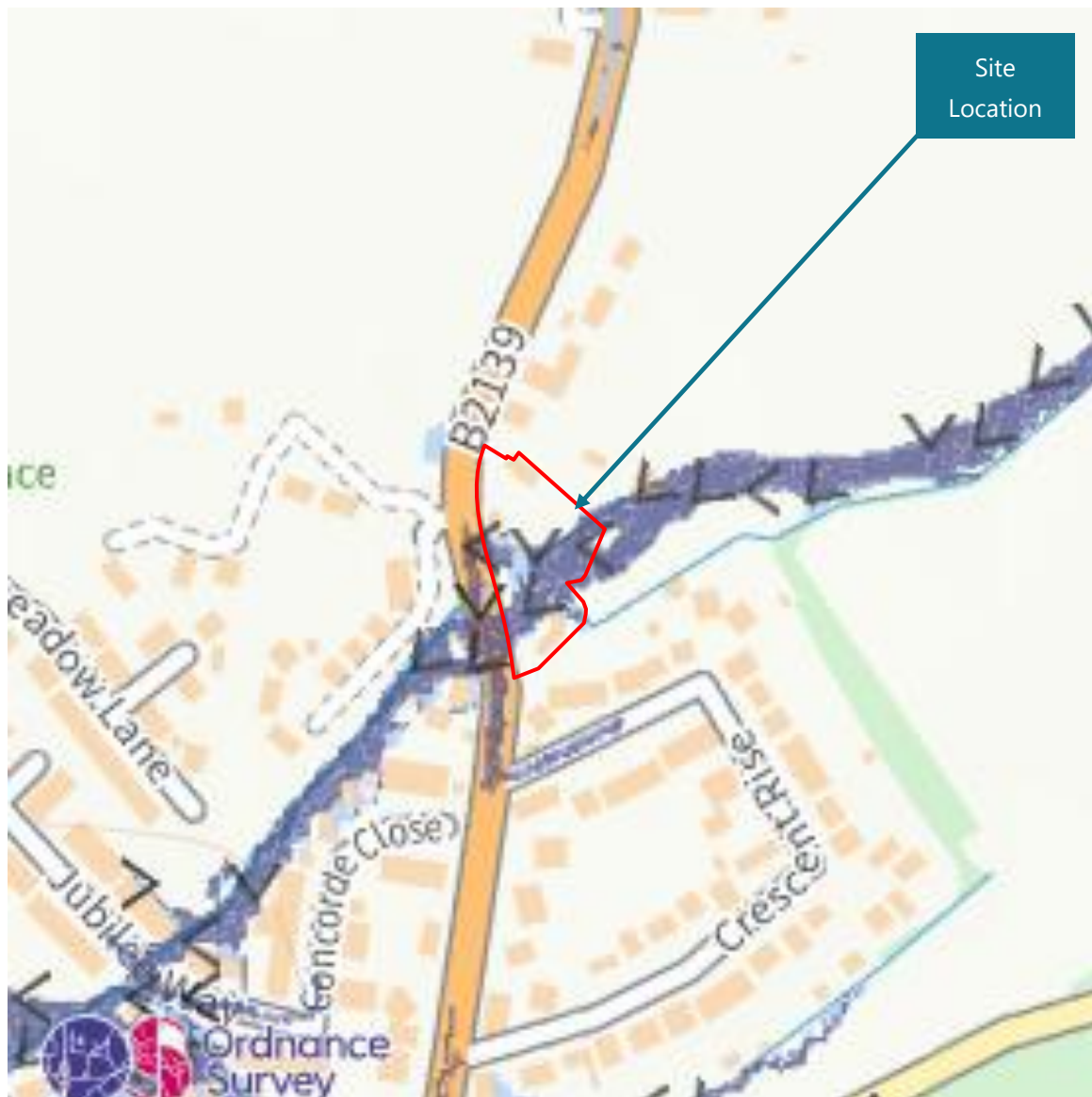


Surface water flood risk: water depth in a low risk scenario
Flood depth (millimetres)



EA's Online Surface Water Flood Depth Map in a 'Low Risk Scenario'
(1 in 1000 years storm event)

An overland flow route bisects the site from northeast-southwest causing potential flooding in the centre of the site between 300mm and 900mm and spilling into the site to a depth of below 300mm

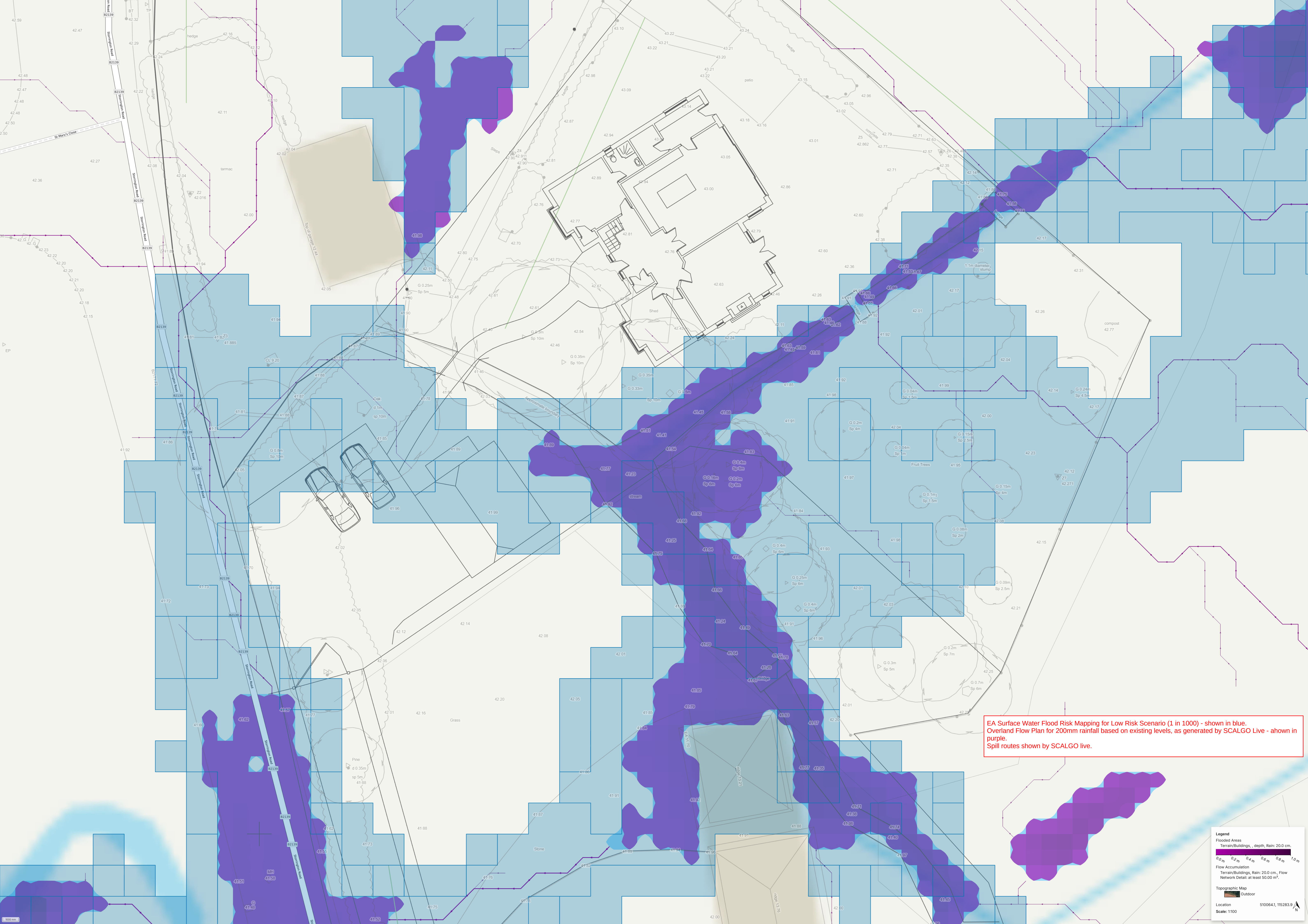


Surface water flood risk: water velocity in a low risk scenario
Flood velocity (metres/second)

● Over 0.25 m/s ● Less than 0.25 m/s ↖ Direction of water flow

EA's Online Surface Water Flood Velocity Map in a 'Low Risk Scenario'
(1 in 1000 years storm event)

An overland flow route bisects the site from northeast-southwest predominantly over 0.25 m/s



EA Surface Water Flood Risk Mapping for Low Risk Scenario (1 in 1000) - shown in blue.
Overland Flow Plan for 200mm rainfall based on existing levels, as generated by SCALGO Live - ahown in purple.
Spill routes shown by SCALGO live.

Legend

Flooded Areas
Terrain/Buildings , depth, Rain: 20.0 cm.
0.0m 0.2m 0.4m 0.6m 0.8m 1.0m

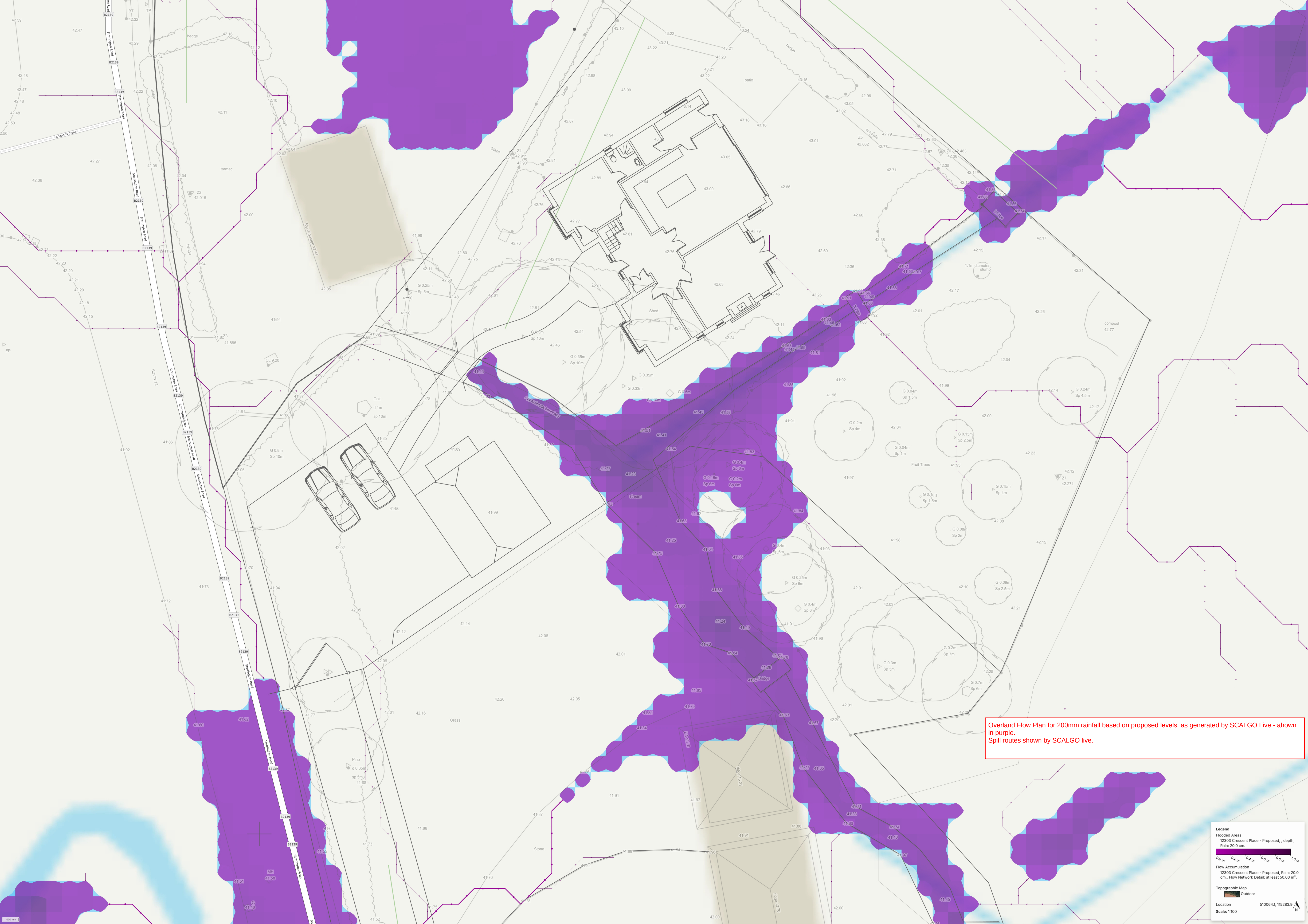
Flow Accumulation
Terrain/Buildings, Rain: 20.0 cm., Flow
Network Detail: at least 50.00 m².

Topographic Map
Outdoor

Location
Scale: 1:100

5100641, 115283.9

1000 mm



Overland Flow Plan for 200mm rainfall based on proposed levels, as generated by SCALGO Live - ahown in purple.
Spill routes shown by SCALGO live.

Legend

Flooded Areas
12303 Crescent Place - Proposed, , depth, Rain: 20.0 cm.

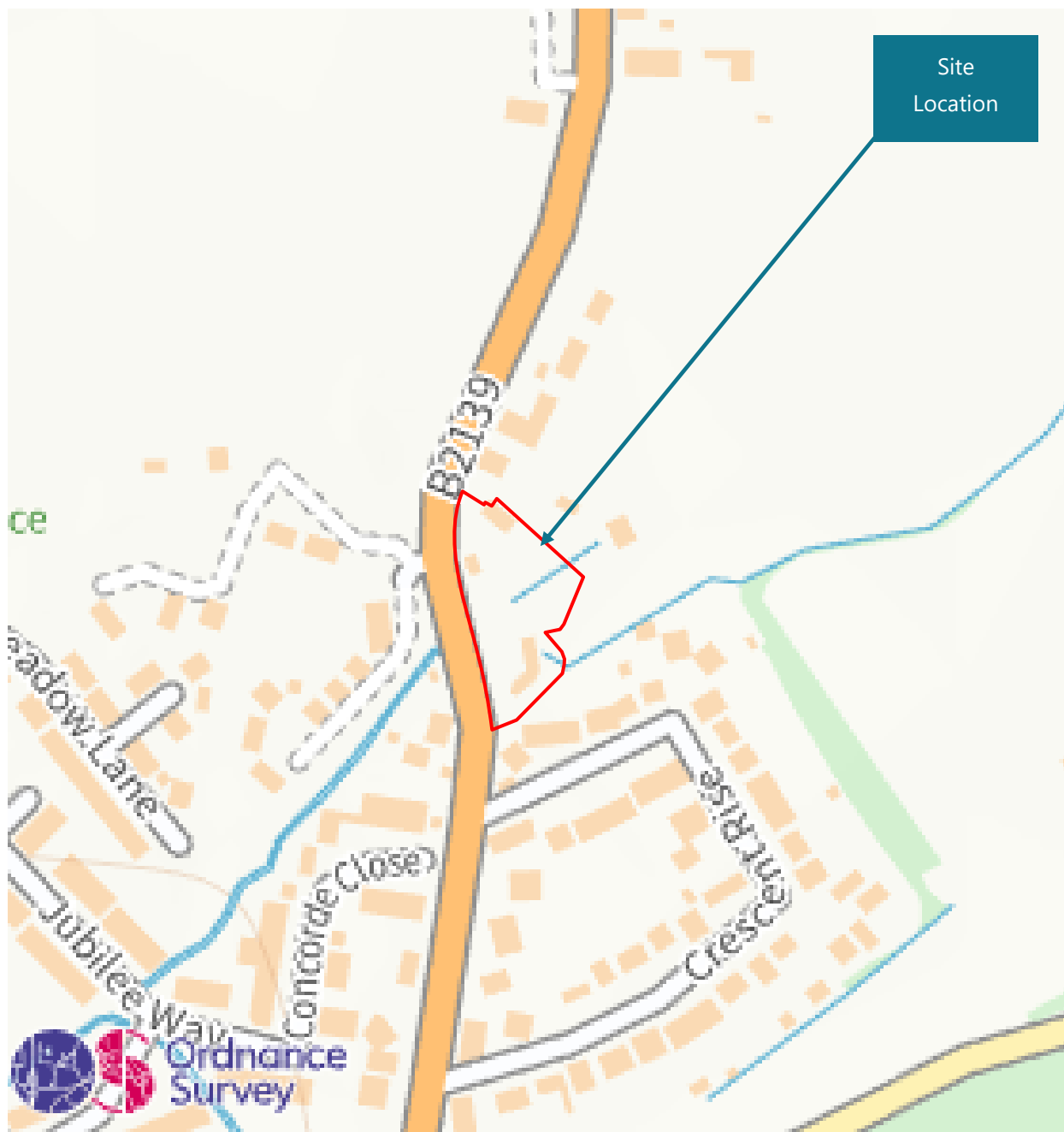
0.0m 0.2m 0.4m 0.6m 0.8m 1.0m

Flow Accumulation
12303 Crescent Place - Proposed, Rain: 20.0 cm., Flow Network Detail: at least 50.00 m².

Topographic Map
Outdoor

Location
Scale: 1:100

S100641, 115283.9

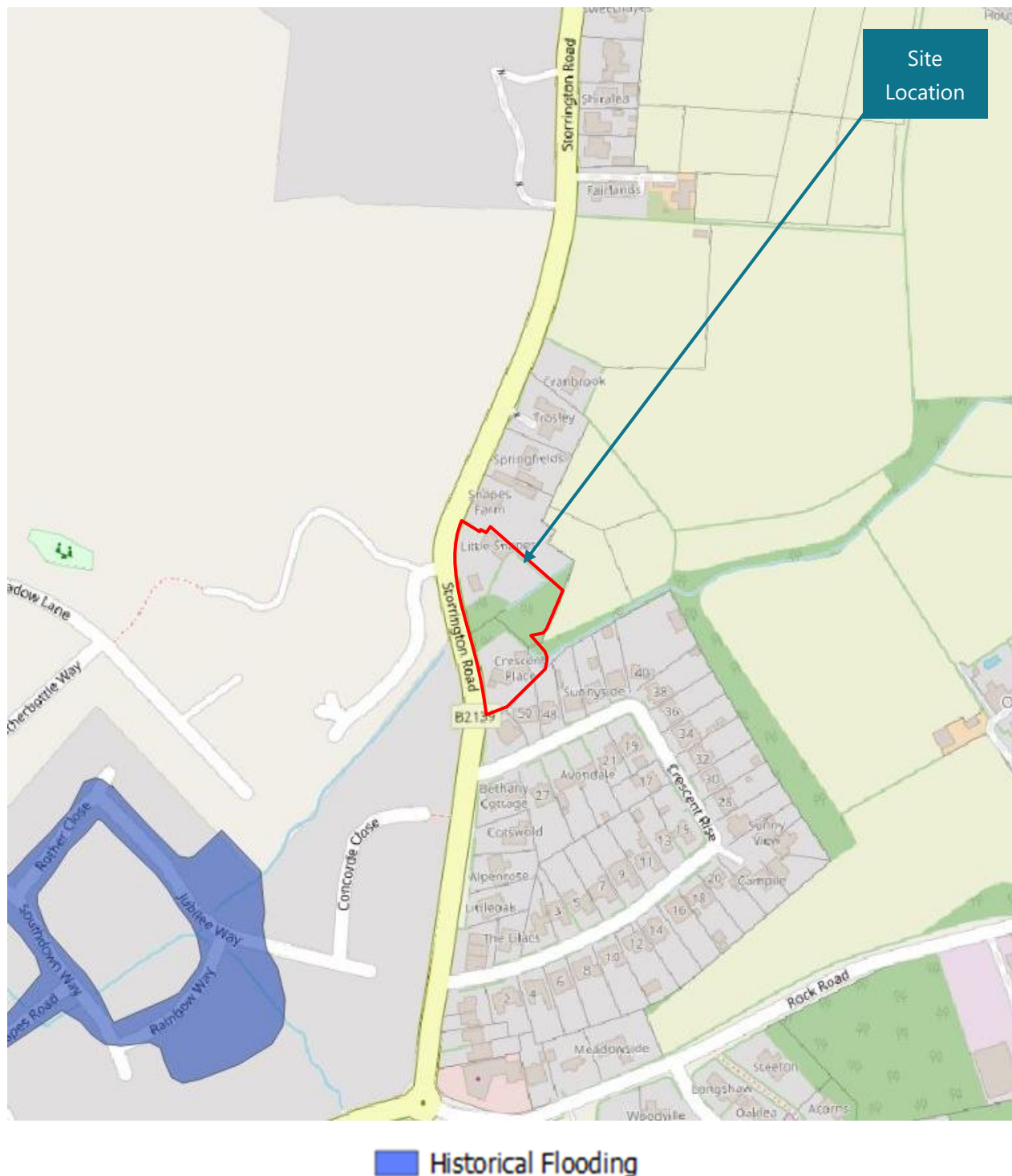


Maximum extent of flooding from reservoirs:

● when river levels are normal ● when there is also flooding from rivers

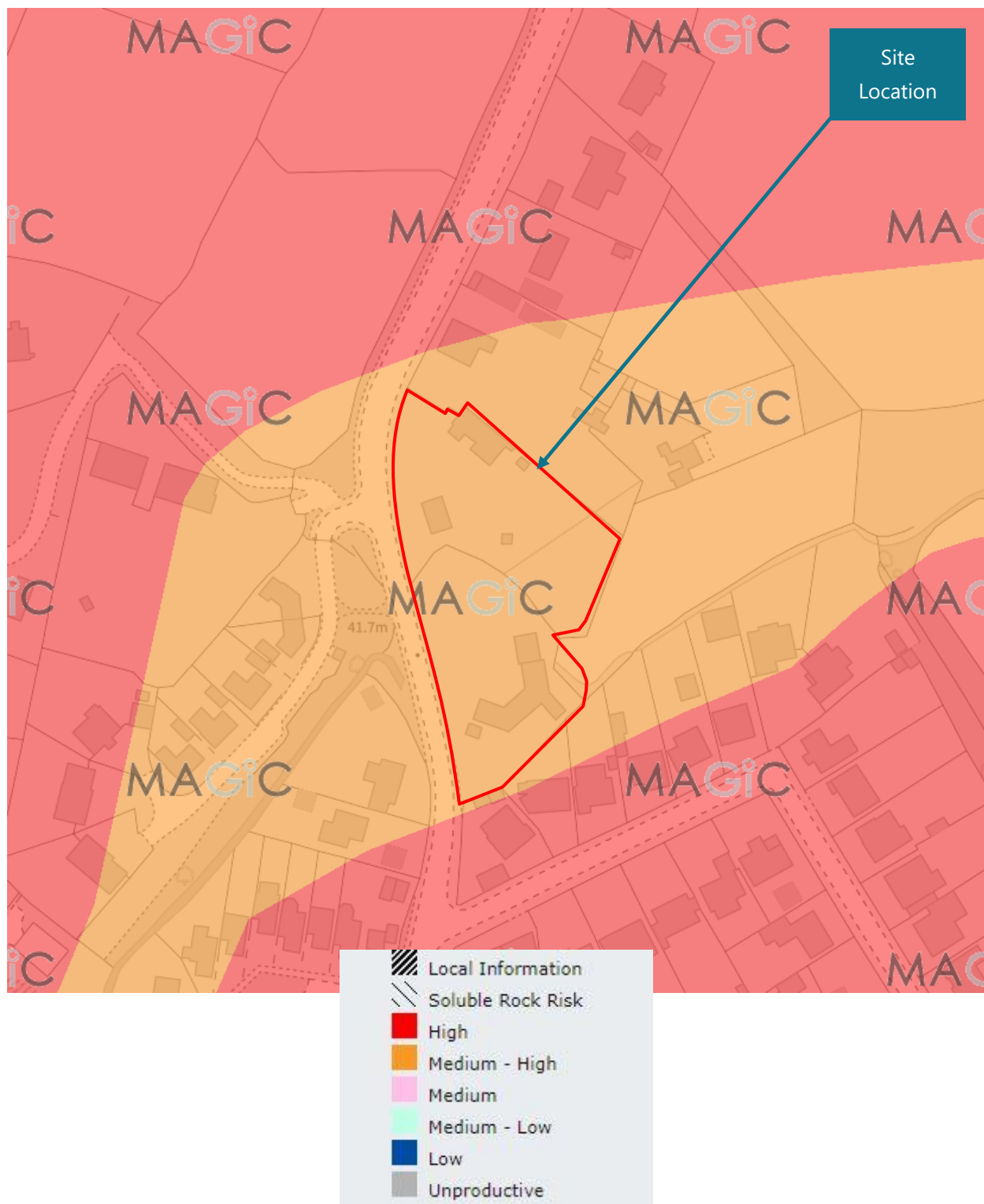
EA's Online Flood Risk from Reservoirs – Flood Depth - Map

The site is clear from the risk of flooding from this source



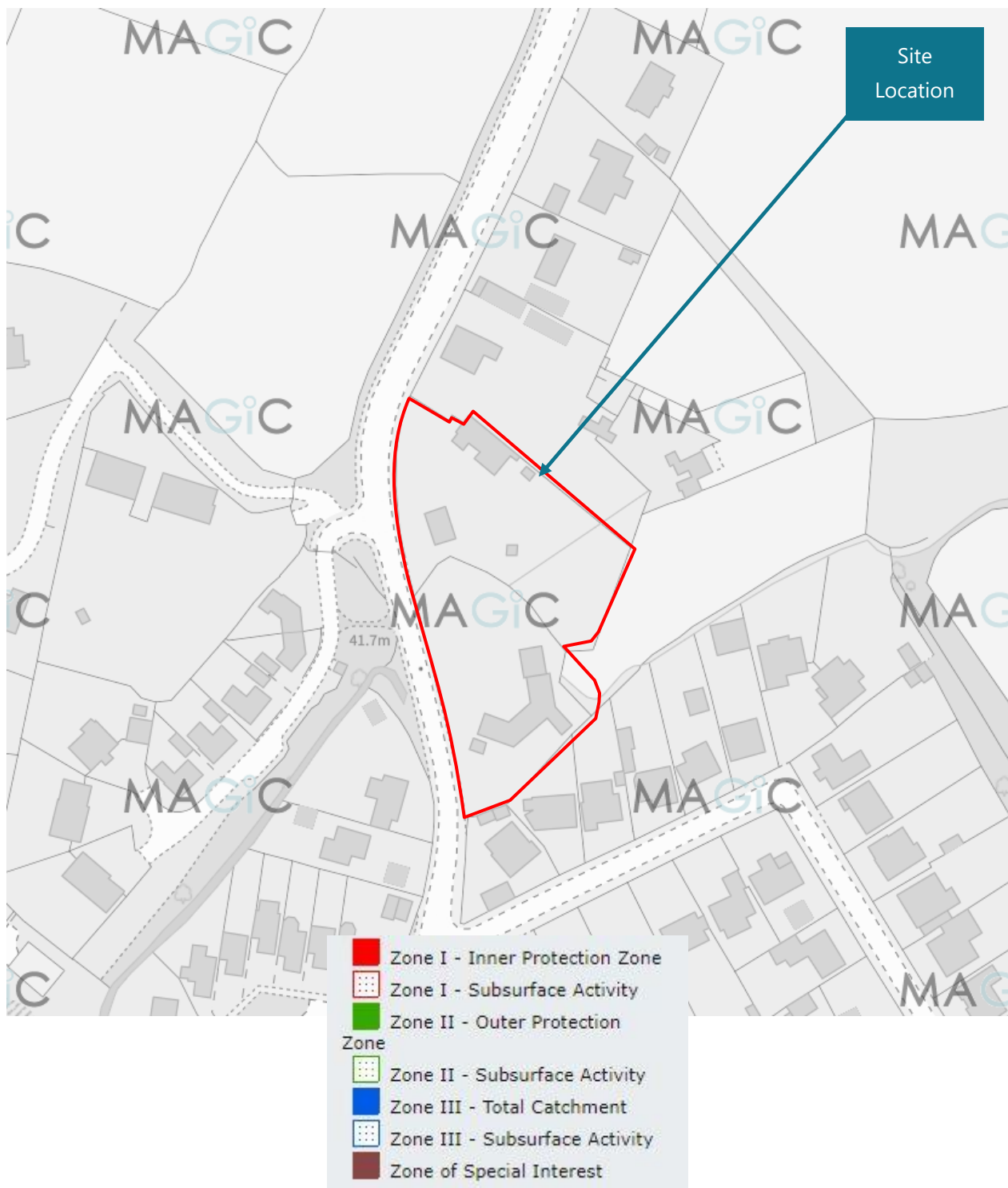
DEFRA's Online 'Historical Flooding' Map

The site has not been affected by flooding in the past



Environment Agency's Online Groundwater Vulnerability Zones Map

The site overlies a 'Medium - High' Groundwater Vulnerability Zone

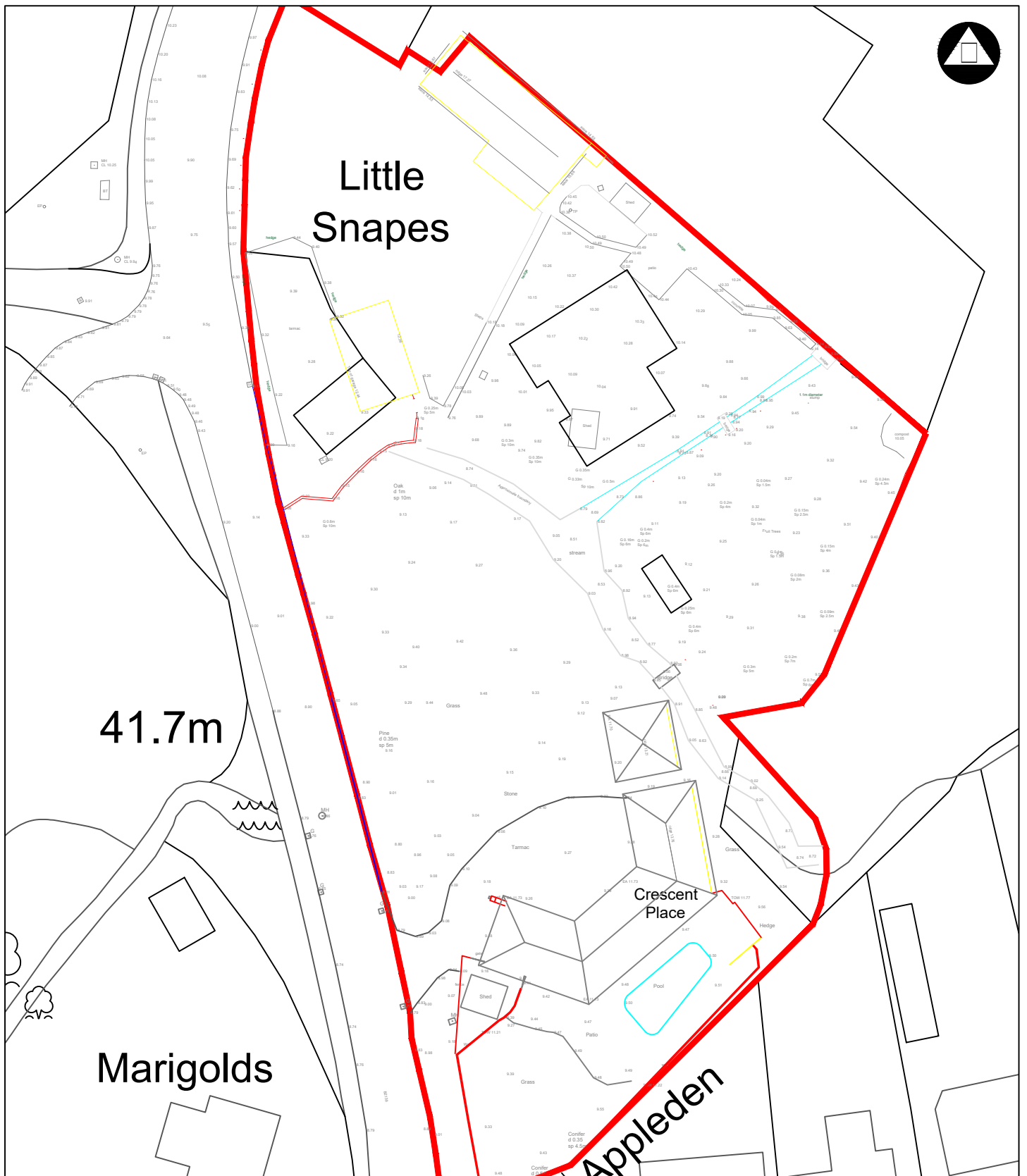


Environment Agency's Online Groundwater Source Protection Zones Map

The site is removed from the nearest Source Protection Zone

Appendix C

Topographic Survey, Sewer Records & Architect's Scheme Drawings



Scale Bar (1:500)

0m 10m 20m 30m 40m 50m

revision			
address	Crescent Place, Storrington Road, Thakeham, RH20 3ED		
project	Proposed development of rear garden		
title	Topo		
scale	date	dwg no.	revision
1@500 @A4	July 2022	2022.351.01	

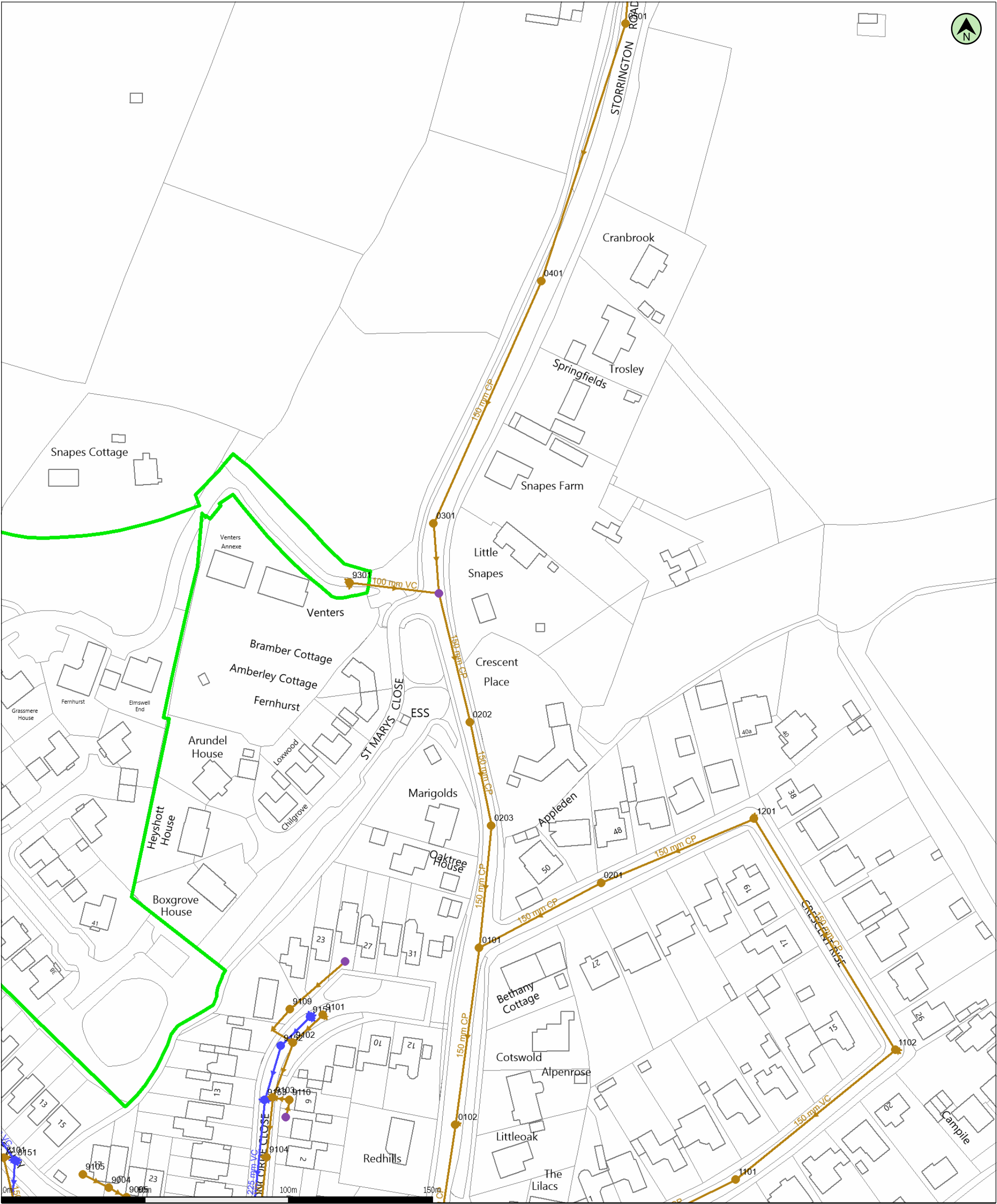
DOWNSVIEW
ASSOCIATES
Chartered Surveyors

Little Acorns
Hampers Lane
Storrington
West Sussex
RH20 3HZ

Tel:
07525 844965

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matt@downsview-surveyors.co.uk





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Data updated: 06/01/23

Scale: 1:1250
Map Centre: 510050,115302

Date: 12/01/23
Our Ref: 1055854 - 1

Wastewater Plan A3
Powered by digdat

cfagan@gtacivils.co.uk

12303 Crescent Place



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2023 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



1) Porous gravel grid system for driveway



2) Five bar gate to entrance to both properties



3) Chestnut cleft post and rail fencing dividing front of properties



4) Heritage paving to rear of property



5) 1800mm high closeboard fencing dividing rear gardens



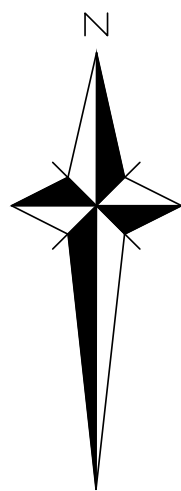
Proposed Site Plan (Scale 1:500)

versions		
DOWNSVIEW ASSOCIATES Chartered Surveyors		
Little Acorns, Hangers Lane, Berrington, West Sussex, BN20 3PD Tel: 01323 856881 Mob: 07529 844881 Email: info@downsview-associates.co.uk		
Client Crescent Place Berrington Road Berrington West Sussex		
Project Proposed construction of 4 bedroom detached dwelling with detached oak framed garage		
Site Proposed site plan		
scale As noted @ A3	date October 25	revision
drawing number 2022.351b.05		

Appendix D

Drainage Drawings

BM 44.73m



Snapes Farm

Little Snapes

Garage

Crescent Place

Apploden

Marigolds

Oaktree House

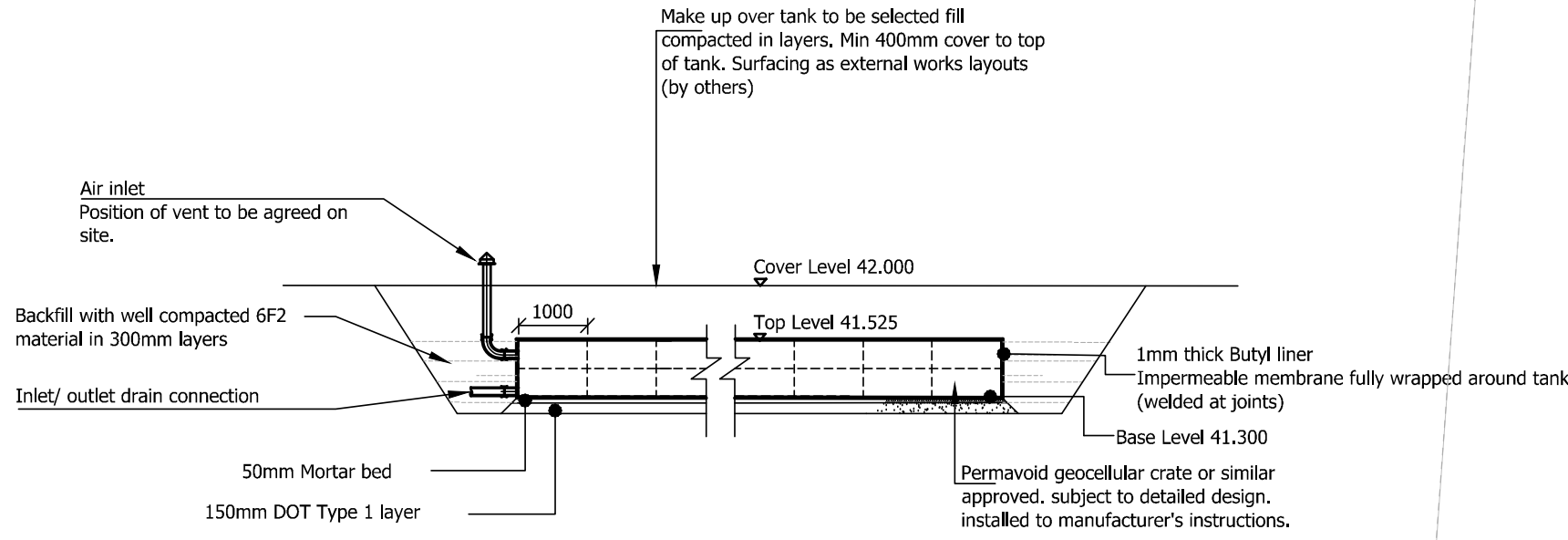
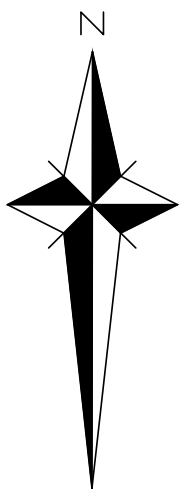
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LEGEND

- 8m Watercourse buffer
- Site Boundary
- Existing Flow Direction
- Existing 450mm Culvert

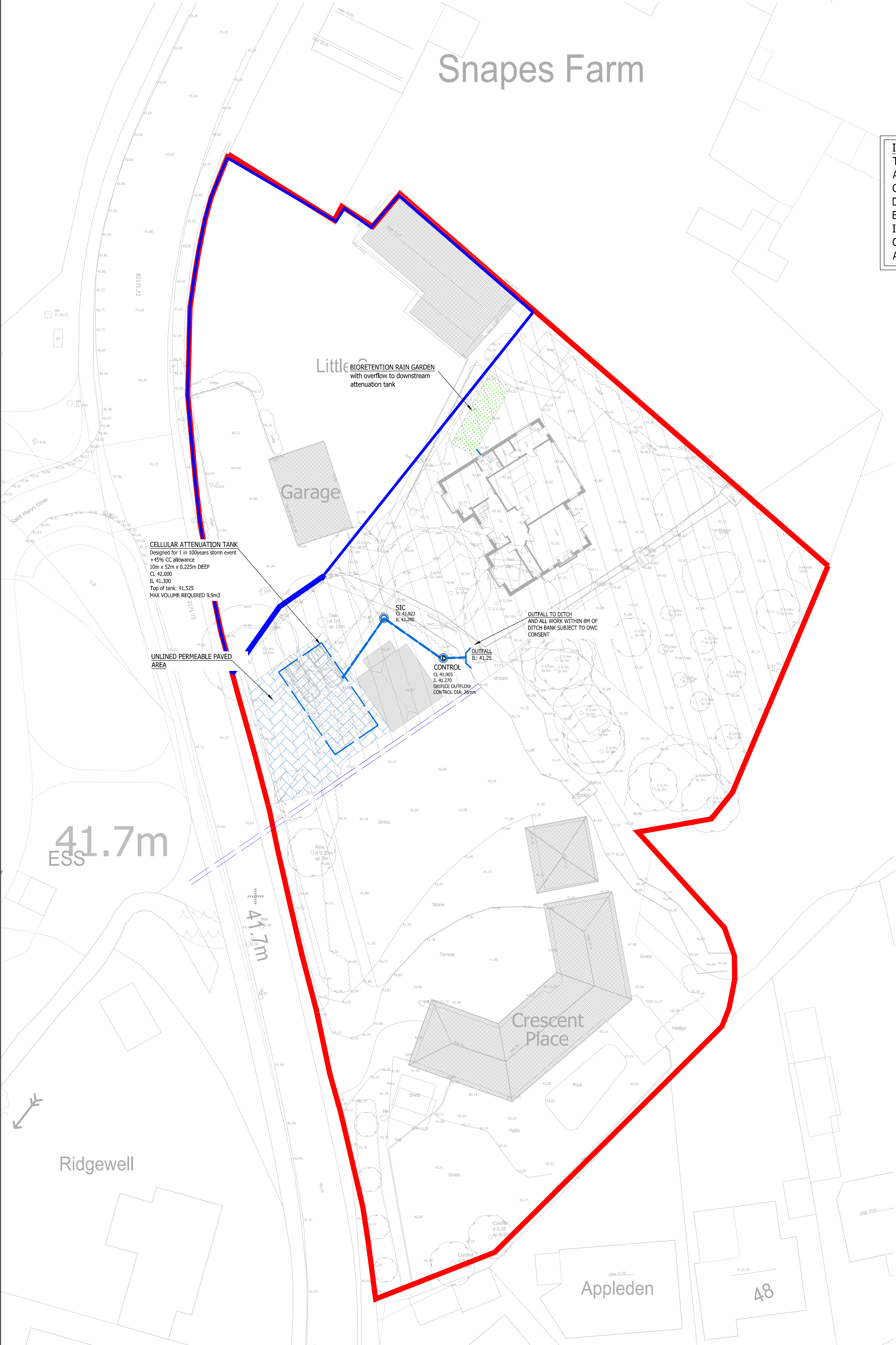
P2	Updated to latest layout	16/12/25	NG	PW
P1	INITIAL ISSUE	24/04/24	NG	PV
Rev	Amendments	Date	Dsn	Chk
Status				
PRELIMINARY				
Client				
MICHAEL & ROSSLYN LOWDELL				
Architect				
Project				
CRESCENT PLACE THAKEHAM, RH20 3ED				
Title				
WATERCOURSE PLAN				
Date		Scale @ A1	1:200	
APRIL 2024		Project Ref	12303	
Clients Ref				
 Maple House, 192-198 London Road, Burgess Hill, West Sussex, RH15 9RD Tel:01444 871444 Web: www.gtacivils.co.uk				
Drawing Number			Rev.	
12303-1000			P2	



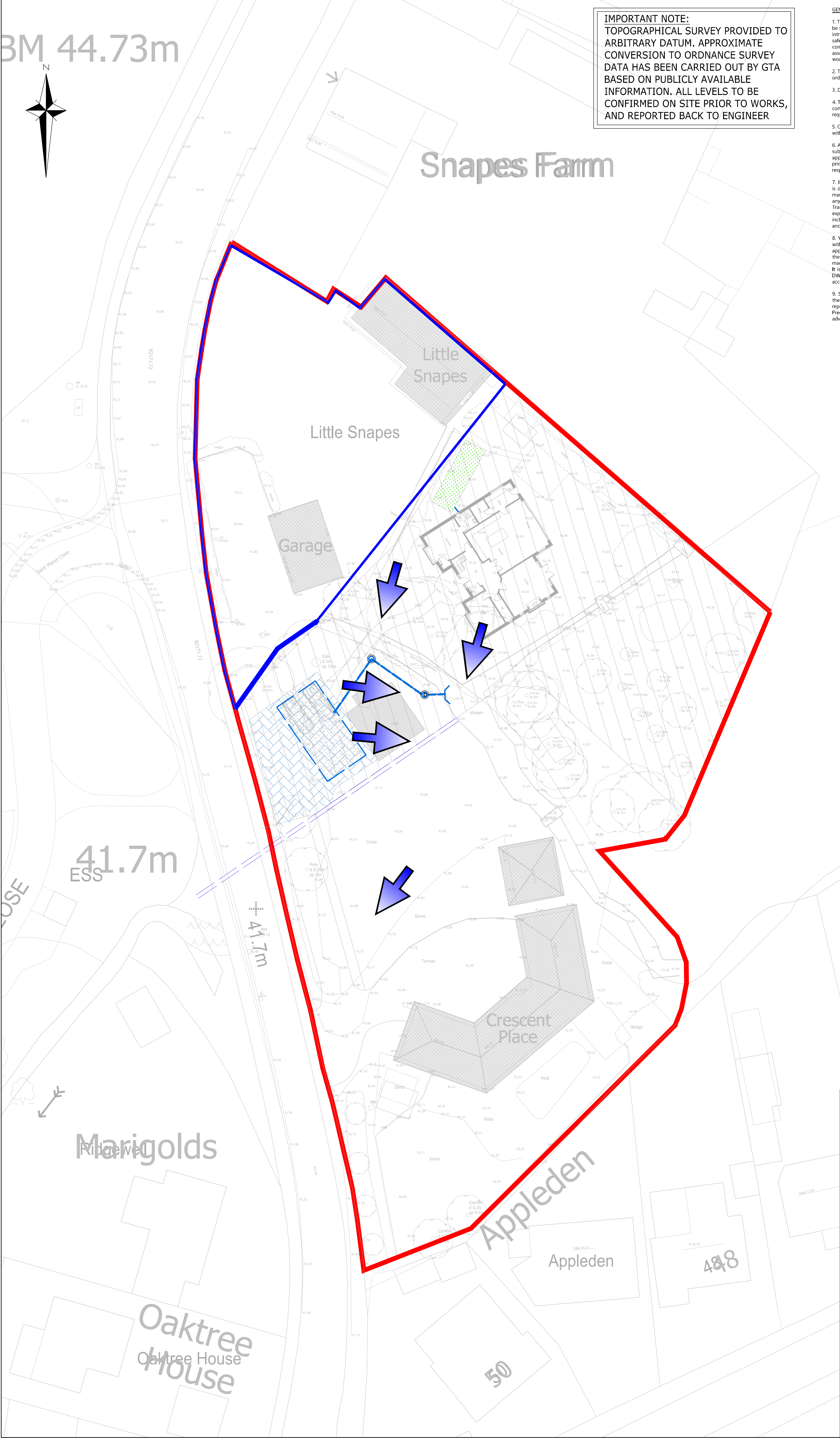
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Scale 1 :100

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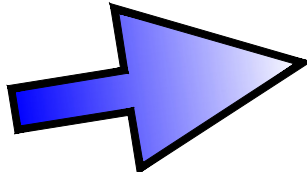
P3	Updated to latest layout		16/12/25	NG	PW
P2	Rain garden & permeable paving added		02/12/25	NG	PW
P1	INITIAL ISSUE		24/04/24	NG	PW
Rev	Amendments		Date	Dsn	Chk
Status PRELIMINARY					
Client MICHAEL & ROSSLYN LOWDELL					
Architect					
Project CRESCENT PLACE THAKEHAM, RH20 3ED					
Title DRAINAGE STRATEGY					
Date APRIL 2024			Scale @ A1 1:200		
Clients Ref.			Project Ref. 12303		
 Civils & Transport Maple House, 192-198 London Road, Burgess Hill, West Sussex, RH15 9RD Tel.01444 871444 Web: www.gtacivils.co.uk					
Drawing Number 12303-1600				Rev. P3	



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 3. Do not scale. All dimensions and levels to be site confirmed.
 4. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements.
 5. Copyright: This drawing must not be copied, amended nor reproduced without the prior written agreement of gta.
 6. All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.
 7. If viewing this drawing as an Autocad file (.dwg) in digital format then it is done so with this Disclaimer due to the fact that it can be altered and manipulated following its issue by GTA Civils & Transport and therefore, any alteration or modification of DWG data files provided by GTA Civils & Transport, by you or a third party, without GTA Civils and Transport's express written approval, is done so entirely at your own risk. Modification includes (but is not limited to) turning layers on and off, unfreezing layers and reloading, turning on and off print functions and unloading x-refs.
 8. Your attention is also drawn to the fact that the information contained within this file may be subject to alteration at any time, pending technical approval from an approving authority or at the client's instruction. It is therefore strongly recommended that multiple and regular cross checks are made against the current contract drawings.
 9. Should any apparent discrepancies between the data contained within the DWG file and the current contract drawings become evident, it must be reported back to GTA Civils & Transport as soon as reasonably practicable. Precedence should be given to the current contract drawings (PDF) unless advised otherwise.

LEGEND



Overland Flow Route

P2	Updated to latest layout		16/12/25	NG	FW
P1	INITIAL ISSUE		24/04/24	NG	FW
Rev	Amendments		Date	Dsn	Chk
Status					
PRELIMINARY					
Client					
MICHAEL & ROSSLYN LOWDELL					
Architect					
Project					
CRESCENT PLACE THAKEHAM, RH20 3ED					
Title					
EXCEEDANCE FLOW PLAN					
Date		APRIL 2024		Scale @ A1	
Clients Ref		Project Ref.		1:200	
				12303	
 Civils & Transport Maple House, 192-198 London Road, Burgess Hill, West Sussex, RH15 9RD Tel:01444 871444 Web: www.gtacivils.co.uk					
Drawing Number				Rev.	
12303-1001				P2	

Appendix E

BRE Digest 365 Soil Soakage Test Report

Ref: C2531

John Pakenham
GTA Civils24th January 2023**Re: Crescent Place, Thakeham – Soakaway Testing – Infiltration Test Result Summary**

Dear John

The following investigation was carried out at the above location in accordance with our quotation.

1. Site Works

The purpose of the investigation was to supply soakaway test data in general accordance with BRE document 365 (Soakaway Design) at one location which would be the approximate intended location for a possible infiltration device to serve a new development site.

The appended drawing illustrates the position of the test pit. The BRE365 pit was excavated to a depth of 1.2m in line with the approximate depth of the proposed soakaway.

The testing commenced on 20th January 2023 with three tests being undertaken in accordance with BRE 365.

2. BRE 365 Soakaway Test Findings

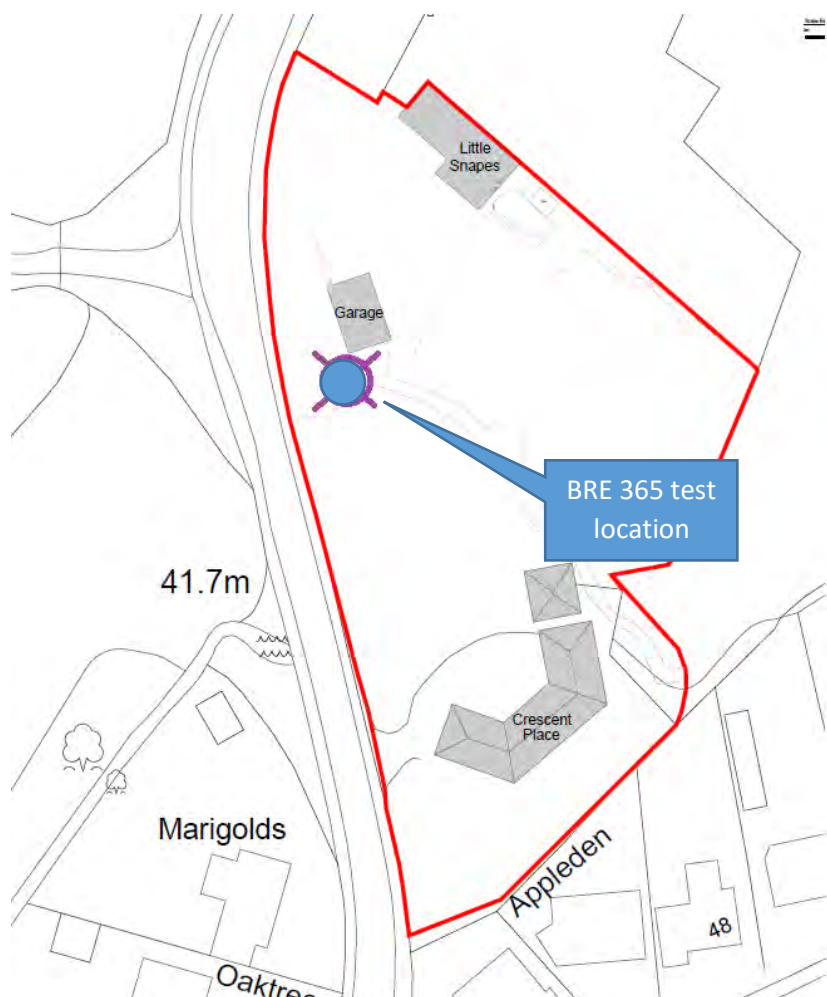
Testing of the sub soils which was noted as clay failed to produce a useable rate as the water failed to drain more than 10mm during 3 hours. The test was therefore declared a **FAIL**.

During the testing it was noted that there was groundwater seepage at approximately 0.9m deep and this should be taken into consideration during the design.

3. BRE 365 Soakaway Test Results

Test Pit No	Infiltration Rate (1-3 Tests)			Depth of Test	Soil Type
SAT1	N/A	N/A	N/A	1.2m	Clay

Appendix A – Soakaway Test Location Plan



Appendix B – Site Photographs



Appendix F

Drainage Calculations

GTA Civils Ltd							Page 1
Gloucester House 66a Church Walk Burgess Hill RH15 9AS				Crescent Place Thakeham Tank			
Date 24/04/2024 16:34 File tank 100yrs 45CC NG.SRCX				Designed by JP Checked by			
Micro Drainage				Source Control 2020.1.3			
Summary of Results for 100 year Return Period (+45%)							
Half Drain Time : 137 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.215	0.115	0.0	0.6	0.6	5.7	O K
30 min Summer	8.249	0.149	0.0	0.6	0.6	7.3	O K
60 min Summer	8.275	0.175	0.0	0.7	0.7	8.7	O K
120 min Summer	8.286	0.186	0.0	0.7	0.7	9.2	O K
180 min Summer	8.283	0.183	0.0	0.7	0.7	9.1	O K
240 min Summer	8.278	0.178	0.0	0.7	0.7	8.8	O K
360 min Summer	8.268	0.168	0.0	0.7	0.7	8.3	O K
480 min Summer	8.258	0.158	0.0	0.7	0.7	7.8	O K
600 min Summer	8.249	0.149	0.0	0.6	0.6	7.3	O K
720 min Summer	8.240	0.140	0.0	0.6	0.6	6.9	O K
960 min Summer	8.223	0.123	0.0	0.6	0.6	6.1	O K
1440 min Summer	8.195	0.095	0.0	0.5	0.5	4.7	O K
2160 min Summer	8.164	0.064	0.0	0.5	0.5	3.1	O K
2880 min Summer	8.142	0.042	0.0	0.4	0.4	2.1	O K
4320 min Summer	8.115	0.015	0.0	0.4	0.4	0.7	O K
5760 min Summer	8.102	0.002	0.0	0.3	0.3	0.1	O K
7200 min Summer	8.100	0.000	0.0	0.3	0.3	0.0	O K
8640 min Summer	8.100	0.000	0.0	0.3	0.3	0.0	O K
10080 min Summer	8.100	0.000	0.0	0.2	0.2	0.0	O K
15 min Winter	8.230	0.130	0.0	0.6	0.6	6.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Summer	144.024	0.0	6.2	18			
30 min Summer	96.415	0.0	8.3	32			
60 min Summer	61.440	0.0	10.6	62			
120 min Summer	37.674	0.0	13.0	106			
180 min Summer	27.822	0.0	14.4	138			
240 min Summer	22.363	0.0	15.4	172			
360 min Summer	16.430	0.0	17.0	240			
480 min Summer	13.179	0.0	18.1	310			
600 min Summer	11.098	0.0	19.1	378			
720 min Summer	9.638	0.0	19.9	446			
960 min Summer	7.709	0.0	21.2	578			
1440 min Summer	5.616	0.0	23.2	836			
2160 min Summer	4.082	0.0	25.3	1192			
2880 min Summer	3.251	0.0	26.9	1556			
4320 min Summer	2.355	0.0	29.2	2252			
5760 min Summer	1.871	0.0	31.0	2936			
7200 min Summer	1.568	0.0	32.5	0			
8640 min Summer	1.357	0.0	33.7	0			
10080 min Summer	1.200	0.0	34.8	0			
15 min Winter	144.024	0.0	6.9	18			
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GTA Civils Ltd							Page 2
Gloucester House 66a Church Walk Burgess Hill RH15 9AS				Crescent Place Thakeham Tank			
Date 24/04/2024 16:34 File tank 100yrs 45CC NG.SRCX				Designed by JP Checked by			
Micro Drainage				Source Control 2020.1.3			
Summary of Results for 100 year Return Period (+45%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	8.269	0.169	0.0	0.7	0.7	8.3	O K
60 min Winter	8.301	0.201	0.0	0.7	0.7	9.9	O K
120 min Winter	8.316	0.216	0.0	0.7	0.7	10.7	O K
180 min Winter	8.313	0.213	0.0	0.7	0.7	10.5	O K
240 min Winter	8.307	0.207	0.0	0.7	0.7	10.2	O K
360 min Winter	8.292	0.192	0.0	0.7	0.7	9.5	O K
480 min Winter	8.276	0.176	0.0	0.7	0.7	8.7	O K
600 min Winter	8.262	0.162	0.0	0.7	0.7	8.0	O K
720 min Winter	8.249	0.149	0.0	0.6	0.6	7.4	O K
960 min Winter	8.225	0.125	0.0	0.6	0.6	6.2	O K
1440 min Winter	8.186	0.086	0.0	0.5	0.5	4.2	O K
2160 min Winter	8.146	0.046	0.0	0.5	0.5	2.3	O K
2880 min Winter	8.121	0.021	0.0	0.4	0.4	1.0	O K
4320 min Winter	8.100	0.000	0.0	0.3	0.3	0.0	O K
5760 min Winter	8.100	0.000	0.0	0.3	0.3	0.0	O K
7200 min Winter	8.100	0.000	0.0	0.2	0.2	0.0	O K
8640 min Winter	8.100	0.000	0.0	0.2	0.2	0.0	O K
10080 min Winter	8.100	0.000	0.0	0.2	0.2	0.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	96.415	0.0	9.3	32			
60 min Winter	61.440	0.0	11.9	60			
120 min Winter	37.674	0.0	14.5	116			
180 min Winter	27.822	0.0	16.1	146			
240 min Winter	22.363	0.0	17.3	184			
360 min Winter	16.430	0.0	19.0	260			
480 min Winter	13.179	0.0	20.4	336			
600 min Winter	11.098	0.0	21.4	408			
720 min Winter	9.638	0.0	22.3	478			
960 min Winter	7.709	0.0	23.8	616			
1440 min Winter	5.616	0.0	26.0	878			
2160 min Winter	4.082	0.0	28.4	1236			
2880 min Winter	3.251	0.0	30.1	1588			
4320 min Winter	2.355	0.0	32.8	0			
5760 min Winter	1.871	0.0	34.7	0			
7200 min Winter	1.568	0.0	36.3	0			
8640 min Winter	1.357	0.0	37.7	0			
10080 min Winter	1.200	0.0	39.0	0			
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GTA Civils Ltd		Page 3																														
Gloucester House 66a Church Walk Burgess Hill RH15 9AS	Crescent Place Thakeham Tank																															
Date 24/04/2024 16:34 File tank 100yrs 45CC NG.SRCX	Designed by JP Checked by																															
Micro Drainage		Source Control 2020.1.3																														
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</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>20.900</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.355</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+45</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.023 <table> <tr> <td>Time (mins)</td> <td>Area</td> </tr> <tr> <td>From: To:</td> <td>(ha)</td> </tr> <tr> <td>0</td> <td>4 0.023</td> </tr> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.900	Shortest Storm (mins)	15	Ratio R	0.355	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+45	Time (mins)	Area	From: To:	(ha)	0	4 0.023
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GTA Civils Ltd		Page 4																		
Gloucester House 66a Church Walk Burgess Hill RH15 9AS	Crescent Place Thakeham Tank																			
Date 24/04/2024 16:34 File tank 100yrs 45CC NG.SRCX	Designed by JP Checked by																			
Micro Drainage		Source Control 2020.1.3																		
<u>Model Details</u> Storage is Online Cover Level (m) 9.200 <u>Cellular Storage Structure</u> Invert Level (m) 8.100 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Depth (m)</th> <th>Area (m²)</th> <th>Inf. Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Inf. Area (m²)</th> </tr> </thead> <tbody> <tr> <td>0.000</td> <td>52.0</td> <td>52.0</td> <td>0.400</td> <td>0.0</td> <td>62.2</td> </tr> <tr> <td>0.300</td> <td>52.0</td> <td>62.2</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <u>Orifice Outflow Control</u> Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 8.030			Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	52.0	52.0	0.400	0.0	62.2	0.300	52.0	62.2			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)															
0.000	52.0	52.0	0.400	0.0	62.2															
0.300	52.0	62.2																		
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Project Crescent Place, Storrington Road

Project ref 12303

Revision A

Date 24.04.24

Tank - Anti-Flotation Calculation

Tank	Calc 1	Calc 2
Tank Area at base (m2)	52.400	52.400
Ground Level (mAOD)	42.000	42.000
Top GW level(m AOD)	41.100	41.500
Top of Tank Level (mAOD)	41.525	41.525
Base of Tank level(m AOD)	41.300	41.300
Depth of water table above tank (m)	0.000	0.000
Depth of Tank within Water table (m)	-0.200	0.200
Depth of Tank (m)	0.225	0.225
Ballast thickness below tank(m)	0.000	0.000
Depth of cover over tank (m)	0.475	0.475
Displacement depth below water table(m)	-0.200	0.200
Volume for buoyancy (m³)	-10.480	10.480
Tank Buoyancy force (kN)	-102.809	102.809
Ballast construction depth (m)	0.000	0.000
Ballast downward force (kN)	0.000	0.000
Total depth over tank (m)	0.475	0.475
Topsoil downward force (kN)	123.402	123.402
Fill soil downward force (kN)	267.371	267.371
Downward anchor forces (kN)	390.773	390.773
Net Buoyancy Force	493.582	287.964
Factor of safety	N/A	3.8
	N/A	OK

Obtain groundwater level from soil report

Indicates field to be completed

Start with an assumed ballast depth, then adjust if FoS is less than 1.1

9.81kN/m³ for water. Positive figure denotes uplift force, negative figure denotes downward force

Note: If a negative figure is shown above for tank buoyancy then no ballast is required

Unsaturated Clay = 1900Kg/m³ or 18.64kN/m³ (Engineering Toolbox.com) - Adjust if different ballast used

Density of Dry Topsoil = 1600 Kg/m³ = 15.7kn/m³. Nominal 150mm depth (Adjust if different surfacing)

Density of Dry soil = 1600 Kg/m³ = 15.7kn/m³ (Adjust if different backfill)

Negative figure denotes uplift force, positive figure denotes downward force

minimum acceptable value: 1.1

Assumed dry (liner below ballast)

Appendix G

Drainage Maintenance and Management Plan

Maintenance Responsibilities

It is the overarching responsibility of the **site owner** to ensure the Drainage Infrastructure is maintained in accordance with this Maintenance Plan.

The responsibility of maintenance, repair, renewal and replacement of the surface water drainage system will be the property owner's. These arrangements will be administered in the Transfer Document TP1 at the point of sale with the responsibilities transferring to the successors in title.

Contamination or Dilution of Spillage

The Environment Agency would prefer all spillages to be contained to prevent any downstream contamination. However, this cannot always be achieved, depending on the nature of the spillage. In all circumstances involving the spillage of substances it is important that the Environment Agency are notified as soon as possible so that they can provide advice and take appropriate action.

Prompt action following a spillage can prevent or reduce its effects, whilst inappropriate action may cause or worsen the pollution effects.

In the event of a spillage on site it is the responsibility of the freeholders to clear up any spillage before it enters the drainage system. The primary method of dealing with any spillage of Hydrocarbons should be to use sand to soak up the leak and prevent any Hydrocarbons entering the drainage system. Once sand has been contaminated it should not be washed into the drainage system but disposed of by a Licensed Contractor.

Environment Agency – Emergency Contact Number

In the event of a spillage the Environment Agency should be contacted to notify the event and seek advice. The Environment Agency's Incident Hotline is **0800 80 70 60** (Freephone 24hrs).

Health and Safety

All those responsible for and involved in the maintenance of the site drainage systems should be safety-conscious and comply with the relevant health and safety legislation. This includes:

- The Health and Safety at Work etc Act 1974
- The Management of Health and Safety at Work Regulations 1999
- The Workplace (Health, Safety and Welfare) Regulations 1992

The freeholder is responsible for suitable risk assessment and management to ensure safe working conditions and practices. Measures to protect potential visitors also need to be considered.

Specialist contractors used should work to industry guidelines and be able to demonstrate safe working practices.

Employers have a duty to employees to inform them about the risks of their work environment and to decrease the risk as far as reasonably practicable. Appropriate personal protective equipment (PPE) should be provided and policies implemented based on risk assessment.

Operatives should be trained for working near water. Risks of contaminated water should be considered. Checking for open cuts and using nitrile gloves, waterproof plasters etc is advised.

Entry of pipes, chambers, tanks and culverts should be avoided wherever possible. Work should be carried out from the surface using appropriate equipment. In the event that entry cannot be avoided to perform a critical task, the required safety training, protection measures and precautions must be implemented prior to entry. Lone working should never be attempted.

For further information refer to Section 36 of The SuDS Manual (CIRIA C753).

Riparian Responsibilities – Maintenance of the Ordinary Watercourse

There are legal duties regarding Ordinary Watercourses that should be reviewed and understood.

Inspection Frequency and Maintenance Requirements: as per table below.

Schedule	Action	Frequency
Regular Maintenance	Litter and debris removal	Monthly
	Cut back vegetation, remove cuttings	Annually between September and March; trim alternate banks each year
Occasional Maintenance	Silt removal from ditch bed including culverts	Rolling programme over 3 years
Remedial Actions	Repair erosion damage, re-seed bare patches on banks	As required
	Clear blockages	As required
	Repair culverts and headwall structures	As required

Monitoring	Inspect culverts for blockages and any damage	Monthly
	CCTV survey of long or multi-directional culverts	5 years

Safety: The dynamic nature of open and culverted watercourses means that risk should be assessed on a case-by-case basis. Appropriate clothing and protective wear should be worn by all involved in the maintenance. High visibility jackets are recommended when carrying out maintenance near a road.

Works that affect the highway require a temporary Traffic Regulation Order (TRO) from the local Highway Authority Council and adequate notice to be given to the travelling public. The increased risk of working near a road will need to be considered.

Culvert entry should be avoided. Works should be carried out from the surface using appropriate equipment.

Environmental laws may also apply depending on the habitat at each location.

The riparian ownership boundaries of this watercourse should also be understood so that work does not take place on 3rd party land without prior agreement.

Drains, Manholes, Gullies, Silt Catchpits

Regular inspection/maintenance is required to ensure the effective long-term operation of private drains, manholes, gullies & silt pits.

Check hydrobrake orifice is clear and retention tank door is closed. Check function of retention tank door and oil if necessary.

Operation and maintenance requirements for drains, gullies and silt pits are described in the following table:

Schedule	Action	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	6 Monthly intervals
	Debris removal from gullies & silt pits, channel drains (where may cause risks to performance).	Weekly
	Lift and inspect receiving manholes to check for any blockages. Particular attention should be given to the control manhole containing the flow control device	Six-monthly

Remedial Actions	Repair any damaged gully gratings or manhole covers	As required
	Replace / fix any loose channel drain covers	As required
Monitoring	Carry out full CCTV survey to confirm ongoing integrity of all drains. Inspect all gullies and silt pits & drainage channels during the survey	10-yearly intervals

Inspection of manholes and removal of silt from silt catchpits should be undertaken by a specialist contractor.

Permeable Pavings

Regular inspection and maintenance are important for the effective operation of porous paved areas.

The surfaces should be kept clear of debris and/or cleaned as necessary.

Damaged surfaces should be repaired as soon as possible. Please contact the contractor who installed the surfacing.

Areas subject to snow, ice and frost can be treated using Rock Salt; however, this may be harmful to plants and can damage surrounding metal or concrete surfaces. Excessive snow should be shovelled away using a plastic snow shovel, taking care not to damage the surfacing. Do not use a wire brush ice remover.

Permeable paving maintenance and monitoring requirements are described in the following table:

Schedule	Action	Frequency
Regular Maintenance	Brushing and vacuuming	Three times per year at end of winter, mid-summer, after autumn leaf fall, or as required based on specific observations
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
Remedial Actions	Remedial work to any depressions, rutting and cracked or broken blocks or deformations in the permeable paving (if applicable) considered detrimental to the structural performance	As required
	Rehabilitation of surface and upper structure	As required
Monitoring	Initial Inspection	Monthly for 3 months after installation

	Inspect for evidence of poor operation and / or weed growth	3 monthly & 48hrs. after large storms
	Inspect silt accumulation rates and establish appropriate brushing techniques	Annually

Schedule C – Rain Garden

Inspection Frequency and Maintenance Requirements: as per table below.

Schedule	Action	Frequency
Regular Inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time and assess standing water levels in underdrain	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly; monthly for tree pits
Regular Maintenance	Remove litter, debris and weeds	At least quarterly; monthly for tree pits
	Replace any plants, to maintain planting density	As required
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Remove sediment, build-up from around inlets and forebays	Quarterly to biannually
Occasional Maintenance	Infill any holes or scour, improve erosion protection	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of filter medium and replacing mulch	As required
	Check trees' and shrubs' health and manage appropriately	Annually

Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly
Remedial Actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Attenuation Cellular Storage Tank

Make: Modular tanks – manufacturer to be determined

Inspection Frequency: Annually

Product Function: Rainwater storage.

Maintenance Requirements: Carry out periodic removal of particulate material from connecting catchpit and channel outlet sumps in accordance with manufacturer's Technical Data to ensure the crates do not become blocked and ineffective.



Civil Engineering - Transport Planning - Flood Risk

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