

Former Golden Grove Inn, Rossett

Hydraulic Modelling Report

May 2015



DOCUMENT VERIFICATION RECORD

**CLIENT:**

Urban Developments and Construction Ltd

INSTRUCTION:

The instruction to carry out this hydraulic modelling was received from Mr Glen Moody of Hardie Brack acting on behalf of the client.

SCHEME:

Former Golden Grove Inn, Rossett, Wrexham – Hydraulic Modelling Study

Detailed 1D/2D hydraulic modelling of the Golden Grove Drain, a small tributary of Pulford Brook, flowing adjacent to a proposed development site at the former Golden Grove Inn north west of Rossett village. Two smaller drains contacting to the Golden Grove Drain have also been considered. The output of the study will be used to establish the existing fluvial flood risk (from Golden Grove Drain) at the site and support the Flood Consequences Assessment (FCA) being prepared for a proposed development.

ISSUE HISTORY:

Issue Date	Comment
29/05/2015	First issue

DOCUMENT REVIEW & APPROVAL

Prepared by Chris Lewis MEng (Hons) (Civil)

Checked by David Hughes MEng (Hons)

Approved by Peter Jones BSc (Hons) CEng C.WEM MICE MCIWEM

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Abbreviations

1D	One Dimensional
2D	Two Dimensional
1D/2D	Combined 1D and 2D hydraulic model
AEP	Annual Exceedance Probability
CC	Climate Change
EA	Environment Agency
LiDAR	Light Detection and Ranging
NRW	Natural Resources Wales
mAOD	metres Above Ordnance Datum

1 Introduction

- 1.1 Waterco Consultants have been commissioned to undertake a detailed hydraulic modelling study of Golden Grove Drain, a small tributary of Pulford Brook, flowing adjacent to a proposed development site at the former Golden Grove Inn to the north west of Rossett village, Wrexham – NGR SJ 35360 58650. Two smaller drains connected to the Golden Grove Drain have also been considered.
- 1.2 The output of the study will be used to establish the existing fluvial flood risk (from Golden Grove Drain) at the site and support the Flood Consequences Assessment (FCA) being prepared for the proposed development. A location plan and an aerial photograph of the site are included in Appendix A. An extract of the location plan is included in Figure 1.
- 1.3 Fluvial flood risk from the nearby Pulford Brook is not specifically considered in the FCA, however the potentially significant influence of this watercourse on flood risk along Golden Grove Drain has been considered as part of this modelling study.

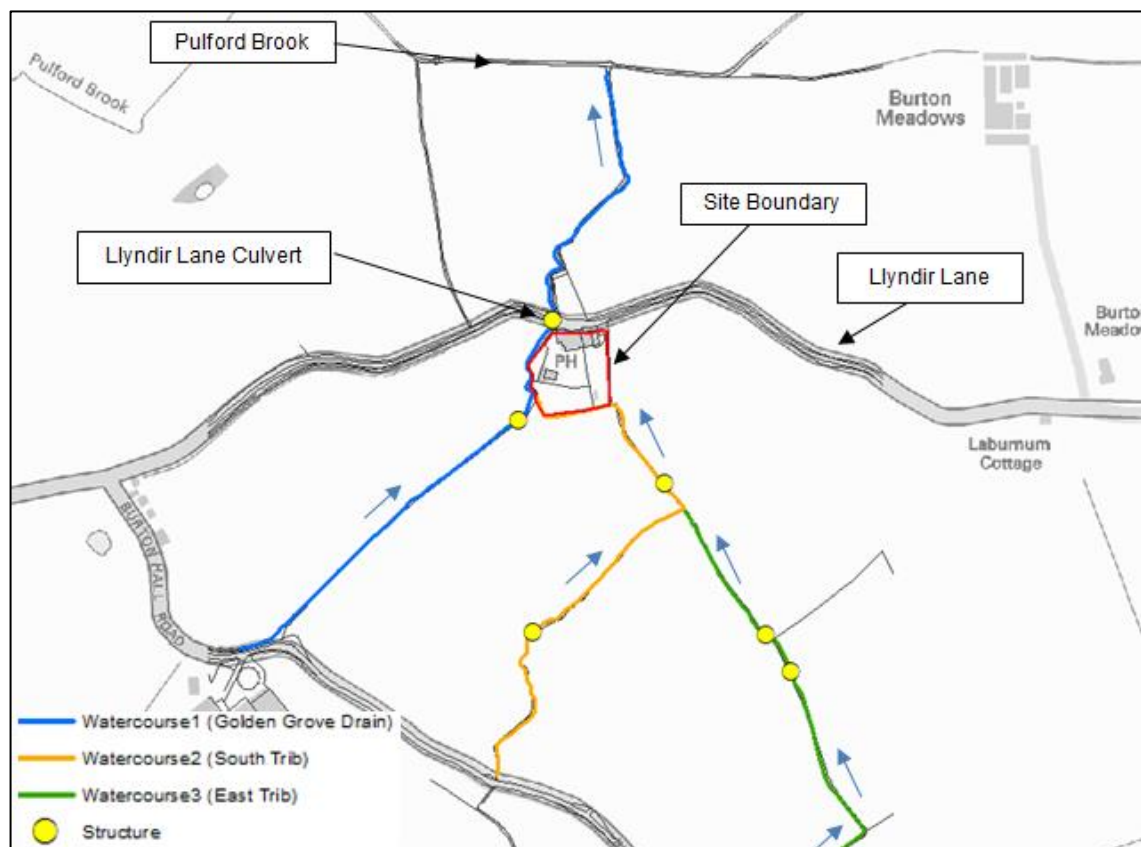


Figure 1 – Site Location Detail

Site Description & Proposed Development

- 1.4 The existing site consists of the Golden Grove Inn, a single dwelling and associated outbuildings. The site covers an area of approximately 6025m² and is bordered by Llyndir Lane and the former inn car park to the north, agricultural land to the east, Golden Grove Drain to the west and a small tributary of Golden Grove Drain to the south.
- 1.5 High resolution LiDAR data (1m) shows the site generally slopes east to west with levels of between 13.5mAOD (eastern boundary) and 13mAOD (adjacent to the watercourse). This data also shows a lower lying area at around 12.5mAOD in the southern portion of the site. Levels of Llyndir Lane adjacent to the site are around 12.5mAOD.
- 1.6 The proposed development consists of two detached dwellings with associated garages and landscaping. Proposed development plans are included in Appendix B.

Existing Flood Risk Data

- 1.7 The Welsh Government Development Advice (TAN15) Map included in Appendix C shows the majority of the site is currently located within Flood Zone A – an area considered to be at little or no risk of fluvial flooding, with a less than 1 in 1000 (0.1%) probability of flooding in any given year. However, there are two small areas along the sites' north and south boundaries which are shown to be located within Flood Zone C2 – at flood risk, without significant defence infrastructure, with a 0.1% (1 in 1000) chance or greater of flooding in any given year.
- 1.8 The current Environment Agency (EA) Flood Map, also given in Appendix C, show the majority of the site to be at low fluvial flood risk and located within Flood Zone 1 – an area considered to have the lowest probability of fluvial flooding. It is assessed as having a less than 0.1% annual probability of flooding. However, similar to the TAN15 Map, small areas along the north and south boundaries are located within Flood Zone 2 – at risk with between a 1% (1 in 100) and 0.1% chance or greater of flooding in any given year.
- 1.9 NRW have advised that they currently do not have any detailed flood levels for this area and that the current flood zones may not be representative of the true flood fluvial flood risk at the site. They offer the following comment:

'The site lies partially within Zone C2 as defined in TAN 15 Development & Flood Risk (2004) and shown on Welsh Government's Development Advice Map. This flood outline is based on Natural Resources Wales' 0.1% AEP present-day flood event outline. However, the existing flood outline (reflected in both the Floodmap and DAM) in the vicinity of the property is unlikely to reflect the true flood risk.'

This is because the upstream extent of the flood model on the Golden Grove Drain is at the site's north-west corner, where this watercourse is no longer a main river, and so the flood risk associated with the reach of the river which flows along the southern and western boundary of the site is unknown.

Any FCA should be supported by additional flood risk modelling of the 'ordinary' reaches of Golden Grove Drain in the vicinity of the site and upstream as far as necessary to capture any overland flow routes which may affect the site. The FCA should consider the flood risk associated with blockage at the culvert where the watercourse leaves the site, and the effects of climate change on the flood risks.'

- 1.10 To address NRW's comments and more accurately model the fluvial flood risk at the site, a detailed hydraulic model of Golden Grove Drain (referred to as Watercourse 1) and its two tributary drains (referred to as Watercourse 2 and 3) has been constructed. This model includes the existing culvert beneath Llyndir Lane (along with other structures along the watercourses) which NRW have requested a blockage be considered.
- 1.11 Although the site is not at direct risk of flooding from the downstream Pulford Brook, it may have a significant effect on flow within Golden Grove Drain. Therefore its influence has been considered.

2 Hydraulic Modelling

- 2.1 An integrated 1D/2D model¹ is considered the most appropriate model type in this instance due to the potential for out-of-bank flows reaching the site from the Golden Grove Drain. A new 1D/2D hydrodynamic model covering a total 2km stretch of the watercourses (800m of Watercourse 1, 600m of Watercourse 2 and 3) has been constructed using the latest version of hydraulic modelling software MIKE FLOOD (v2014; SP3). The extent of the model is presented in Appendix D.
- 2.2 The 1-Dimensional (1D) river network model has been constructed using river cross-section data surveyed by West Coast Geomatics in April 2015. The locations of the surveyed cross-sections are presented in Appendix E along with the section details.

¹ A 1D/2D hydrodynamic model is comprised of a 1-Dimensional (1D) river network model (based on surveyed river cross-sections) coupled with a 2-Dimensional (2D) Digital Terrain Model (DTM) of the potential floodplain (created from LiDAR).

- 2.3 All hydraulically significant structures along the surveyed watercourse and within the model extent have been included within the 1D model network. A total of six structures have been modelled as per the received survey; three wooden footbridge structures and three culverts.
- 2.4 The 900mm diameter Llyndir Lane pipe culvert is considered critical to potential flooding at the site given its relative proximity to the development and its potential for blockage. As such a blockage of this structure has been considered as part of these works. A conservative approach of investigating a 100% blockage of this structure has been modelled.
- 2.5 Channel roughness has been represented using a uniform Manning's n coefficient of 0.04. This value has been chosen based on survey observations. Sensitivity testing on this parameter has been performed with a significant variation in channel and floodplain roughness being considered i.e. +/-20%.
- 2.6 The downstream boundary of the 1D model has been established 320m downstream of site at the confluence with the Pulford Brook. This larger watercourse is likely to have a significant influence on flows within Golden Grove Drain, especially during times of flood. As such a conservative approach of assuming the Pulford Brook is in flood at the same time Golden Grove Drain has been adopted rather than a Q-h relationship as a worst case. To reflect this, the downstream boundary has been set using a constant water level of 10.9mAOD – a value chosen to represent a very significant flood within Pulford Brook (based on current NRW mapping). Sensitivity of this boundary condition has been completed.
- 2.7 The 2D digital terrain model (DTM) of the study area has been created from 1m resolution LiDAR (Light Detection and Ranging) data. The 2D model cell size has been set at 2m. This resolution is adequate to represent any potential flowpaths occurring across the floodplain, including the site, whilst maintaining reasonable simulation times and model stability.
- 2.8 Floodplain roughness has represented using Manning's n values for various land use types as presented in Table 1.

Table 1 – Floodplain roughness coefficients

Material	Manning's n coefficient (s/m ^{1/3})
Land (general surface)	0.04
Roads / Hardstanding	0.02
Buildings	1.00

Hydrology

- 2.9 In order to fully investigate the fluvial flood risk from the Golden Grove Drain, a range of fluvial events have been simulated; namely the 1% and 0.1% AEP events. The impact of climate change allowance (CCA) has also been investigated during the 1% AEP event by increasing flows by 20%. A list of simulations completed is given in Table 2.
- 2.10 To provide the required model inflows the Revitalised Rainfall Run-off method (ReFH) has been used. A copy of the completed calculations and design hydrographs are included in Appendix F along with the final design hydrographs used. Peak flow estimates are given in Table 2.
- 2.11 Flows for the entire catchment were calculated and flows for each watercourse (1, 2, 3) split on a pro-rata area basis. A lateral inflow accounting for the small catchment area between the confluence of Watercourse 1 and 2 was also included for completeness.

Table 2 – Primary Simulations & Peak Flows

Watercourse	Peak Flows (m ³ /s)		
	Q100	Q100CC	Q1000
1 (Golden Grove drain)	1.42	1.70	2.30
2 (South Trib)	1.18	1.41	1.91
3 (East Trib)	0.08	0.10	0.13
Lateral Inflow	0.07	0.08	0.11

- 2.12 Model inflows have been applied to the 1D model using a QT (Discharge-Time) boundary condition at the relevant upstream model nodes.
- 2.13 Although it is probable that ReFH flows will be higher than those calculated using alternative methods (e.g. FEH Statistical), the impact of using these figures has been investigated via flow sensitivity testing for completeness. An uncertainty factor of +20% has been added to the 0.1% AEP (Q1000) flow has been investigated.

Blockage Scenarios

- 2.14 A 100% total blockage of the Llyndir Lane 900mm diameter culvert (Model ID BL1) has been simulated as a worst case scenario for the development site.

Sensitivity Testing

- 2.15 To improve confidence in the model outputs and assess the sensitivity of the model parameters, increased significance has been placed on sensitivity testing. Four sensitivity tests have been carried out, ST1-4, with respect to the 0.1% AEP (Q1000) fluvial event.
- 2.16 Tests ST1 and ST2 investigate a significant variation (+/- 20%) of Manning's roughness coefficients in both the modelled channels and across the floodplain.
- 2.17 ST3 investigates the sensitivity of the modelled flood levels at the site to the flow calculation method adopted; namely the ReFH approach. To investigate this a significant uncertainty factor of +20% has been added to the 0.1% AEP flows and simulated.
- 2.18 ST4 considers model sensitivity to the downstream boundary condition i.e. using a constant water level in the Pulford Brook floodplain of 10.9mAOD. This boundary condition could be critical to the assessment of flood risk at the site. As such a this test investigates the impact of significantly raising the constant water level used by +400mm to 11.3mAOD.

3 Results & Conclusions

- 3.1 This section of the report documents the results obtained from the primary simulations Q100, Q100CC and Q1000, blockage scenario BL1 and sensitivity tests ST1-4.
- 3.2 Calculated maximum water levels were extracted at each node along the 1D network model and compared for each simulation. A table of this data has been provided in Appendix G. Maximum flood depth and velocity maps have been provided for each primary simulation in Appendix H.
- 3.3 The results of the hydraulic modelling show the entire development site to remain dry during all events up to and including the 0.1% AEP event. During this event, and all other considered, water is shown to exceed the channel capacity upstream of the Llyndir Lane culvert and spill into the adjacent fields to the west, before subsequently flowing north over Llyndir Lane itself.
- 3.4 The maximum water level adjacent to the site along the western boundary (i.e. the lowest point) during the 0.1% AEP event is 12.68mAOD (*node WATERCOURSE1 400.36*) – 400mm lower than the site ground levels at this location ($\approx 13\text{mAOD}$). An extract of the 0.1% AEP maximum flood depth plot is given in Figure 2 for information.

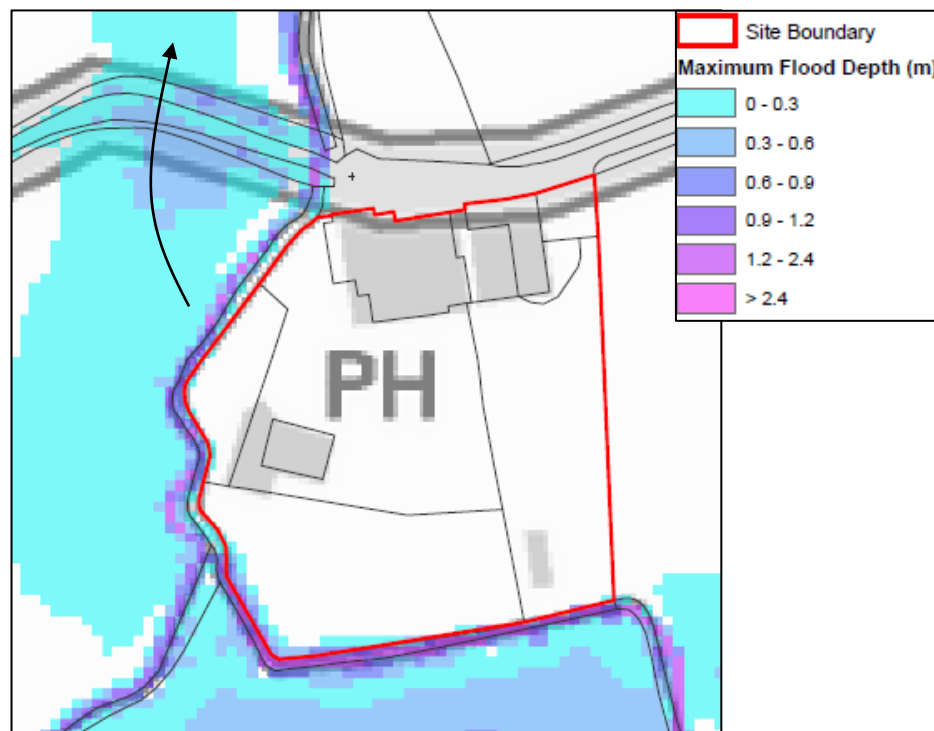


Figure 2 – Maximum Flood Depth – 0.1% AEP event (Q1000)

Blockage scenarios

- 3.5 A 100% blockage to the Llyndir Lane culvert during the 1% AEP + CCA event (BL1) causes levels within the channel upstream of the structure and adjacent to the site to increase by 950mm to a maximum 13.36mAOD – sufficient to cause localised shallow depth flooding of Llyndir Lane in front of the site and a small portion of the site in the north west corner. A small amount of shallow depth flooding is also shown in the low lying area in the southern portion of the site. An extract of these results is shown in Figure 3.
- 3.6 Although some shallow depth flooding of the site is shown during this extreme scenario, flood depths on site are small (up to a max of 170mm) and velocities are low (less than 0.1m/s). The maximum flood hazard rating during this event is also 'low'.

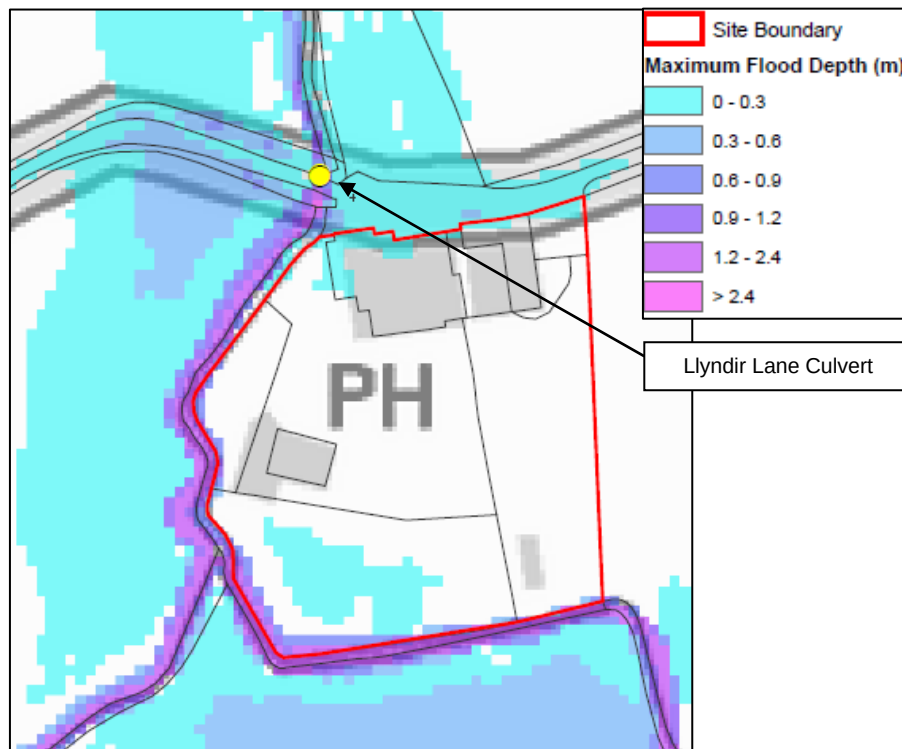


Figure 3 – Maximum Flood Depth – 1% AEP + CCA event; BL1 (100% Blockage)

Sensitivity Tests

- 3.7 Extracted water level data for each sensitivity test undertaken is provided in Appendix G and compared against the Q1000 model outputs. Maximum depth and velocity mapping for each test has also been included in Appendix I for completeness.
- 3.8 The results of sensitivity tests ST1 and ST2 show that varying the Manning's n coefficients within the channel and floodplain does not have any considerable effect on the maximum water levels

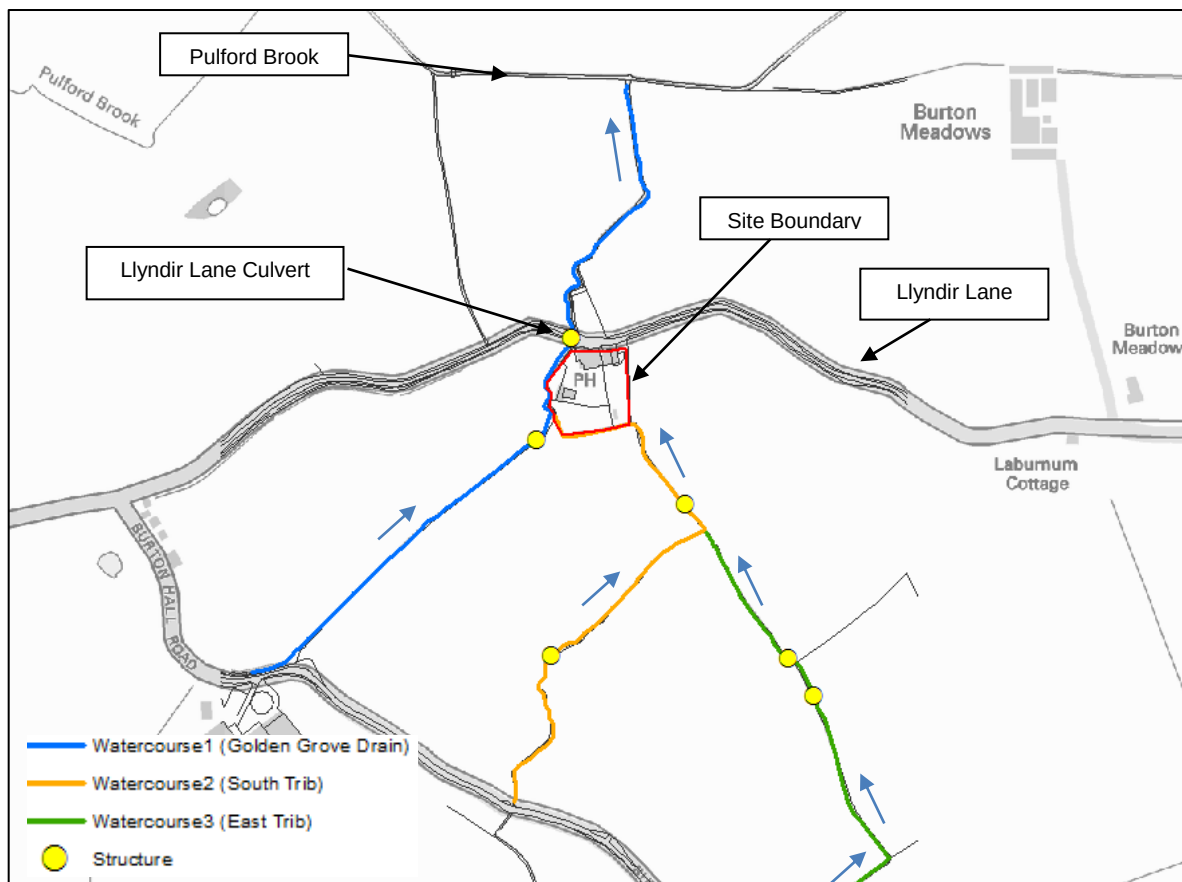
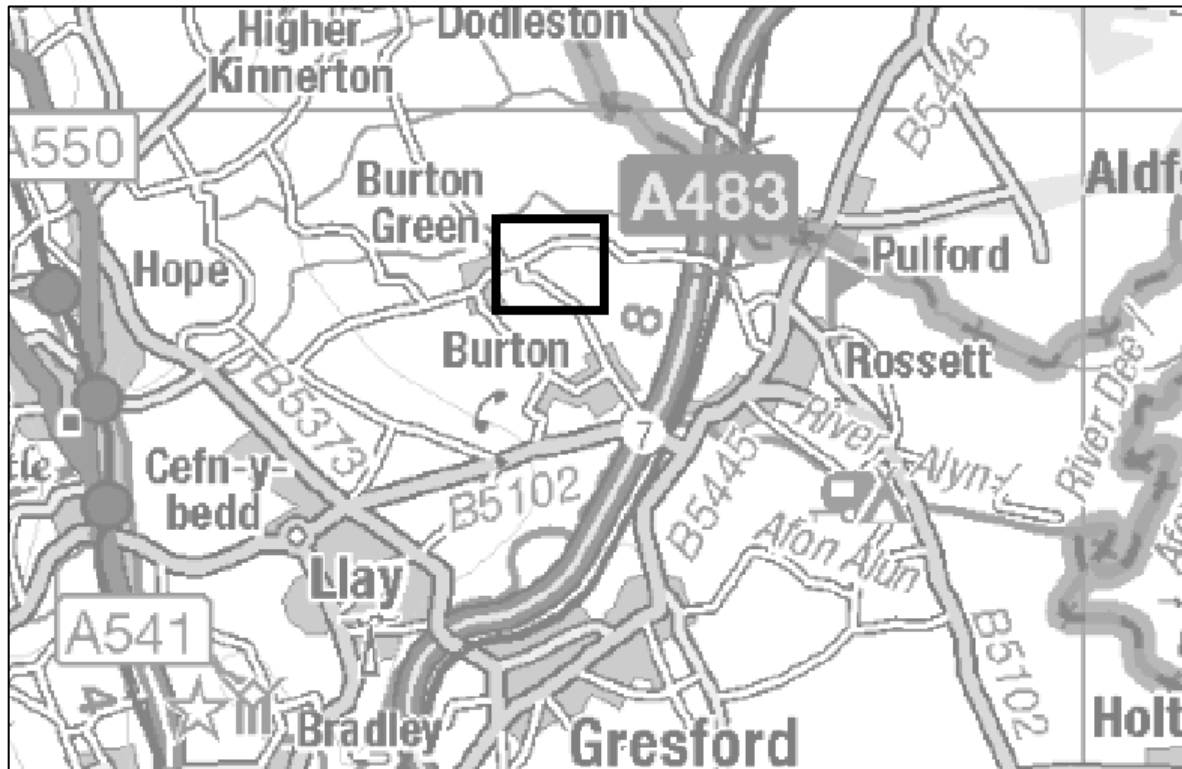
in the cross sections adjacent to the development area (differences of water levels +/-50mm). The site does not flood during these test scenarios.

- 3.9 Model outputs from ST3 show that the site remains flood free even when a +20% flow uncertainty has been added to the 0.1% AEP (Q1000) flows. This demonstrates that the use of the ReFH flow calculation method only to estimate fluvial inflows is not critical to the assessment of flood risk at the site.
- 3.10 Extracted maximum water level data from ST4 shows that, although water levels close to the downstream boundary of the 1D model vary by 400mm when a constant Pulford Brook flood level of 11.3mAOD is used, levels at the site vary by only a maximum of 5mm. The site remains unaffected by flooding.

4 Recommendations

- 4.1 The hydraulic model and associated report should be submitted to NRW for review and approval as a reasonable representation of the existing fluvial flood risk from Golden Grove Drain, and its tributary drains, at the proposed development site.

Appendix A – Location Plan and Aerial Image



Location Plan

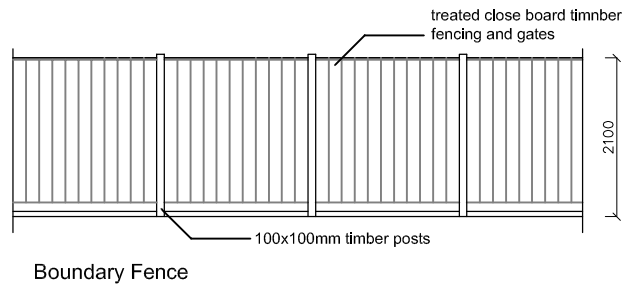
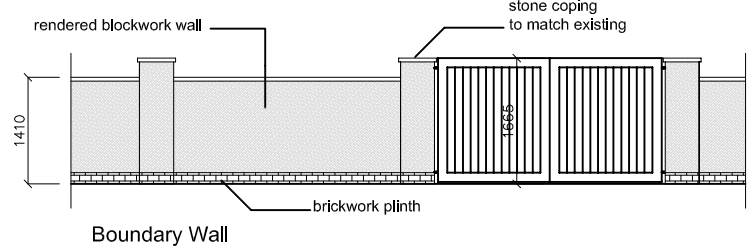


Aerial Photograph

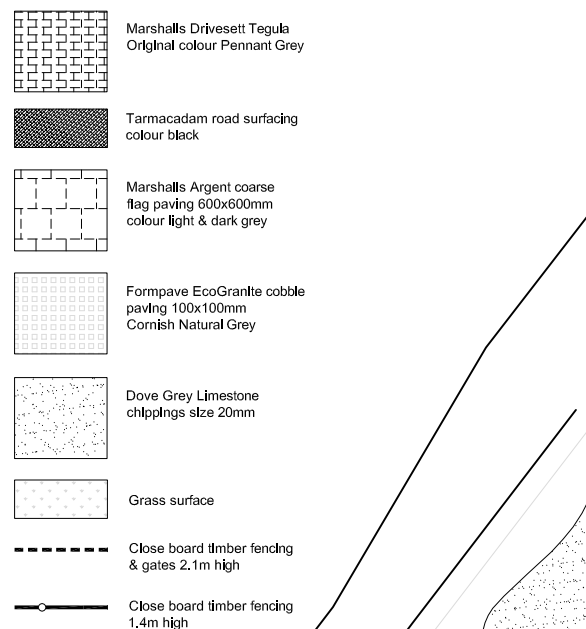
(Source: Bing Maps)

Appendix B – Proposed Development Layout

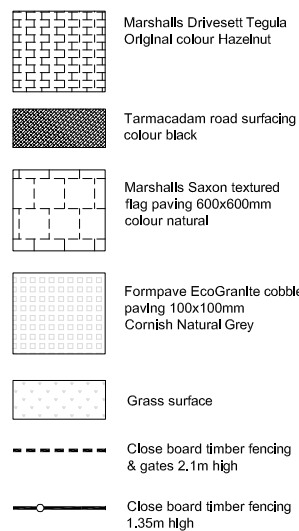
BOUNDARY TREATMENTS



LANDSCAPING KEY - PLOT 2



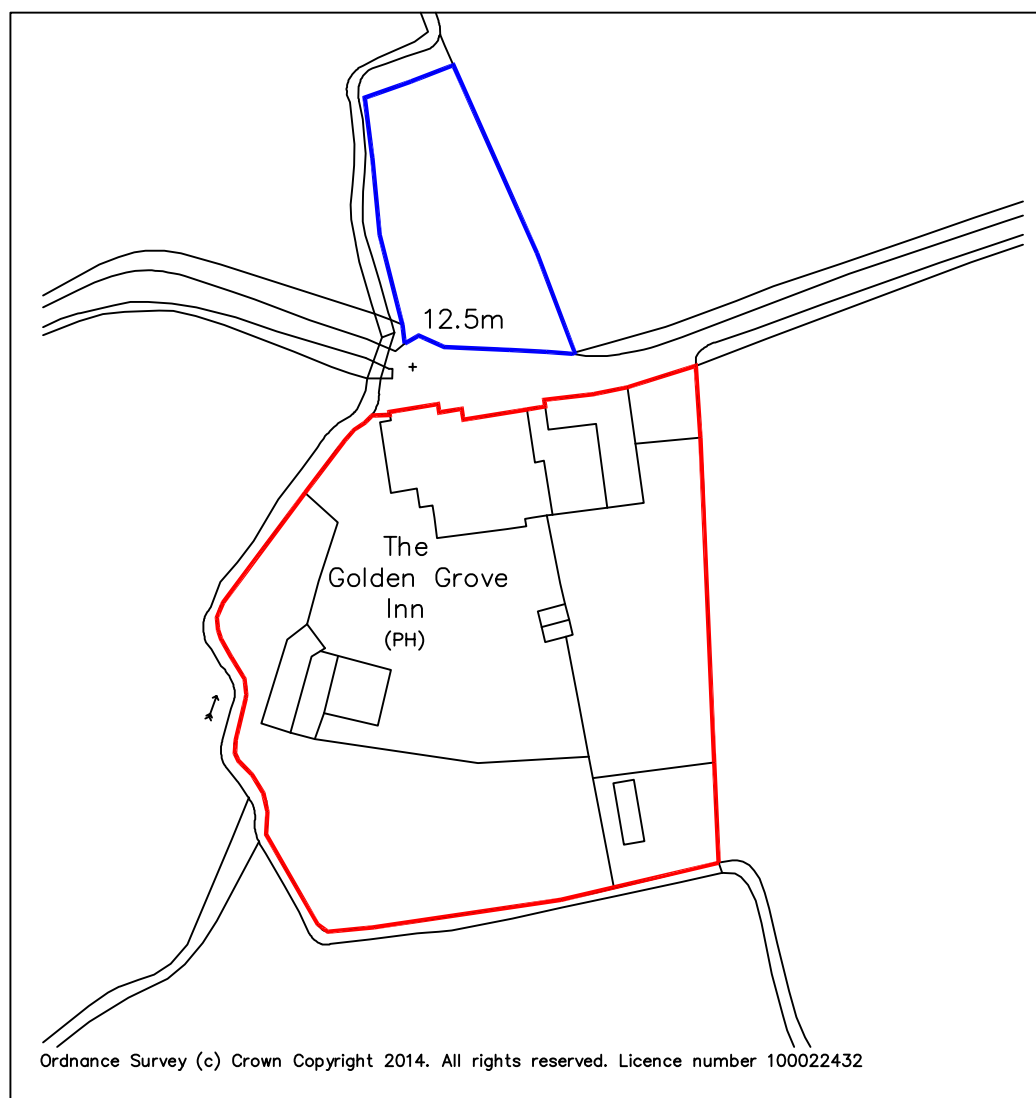
LANDSCAPING KEY - PLOT 1



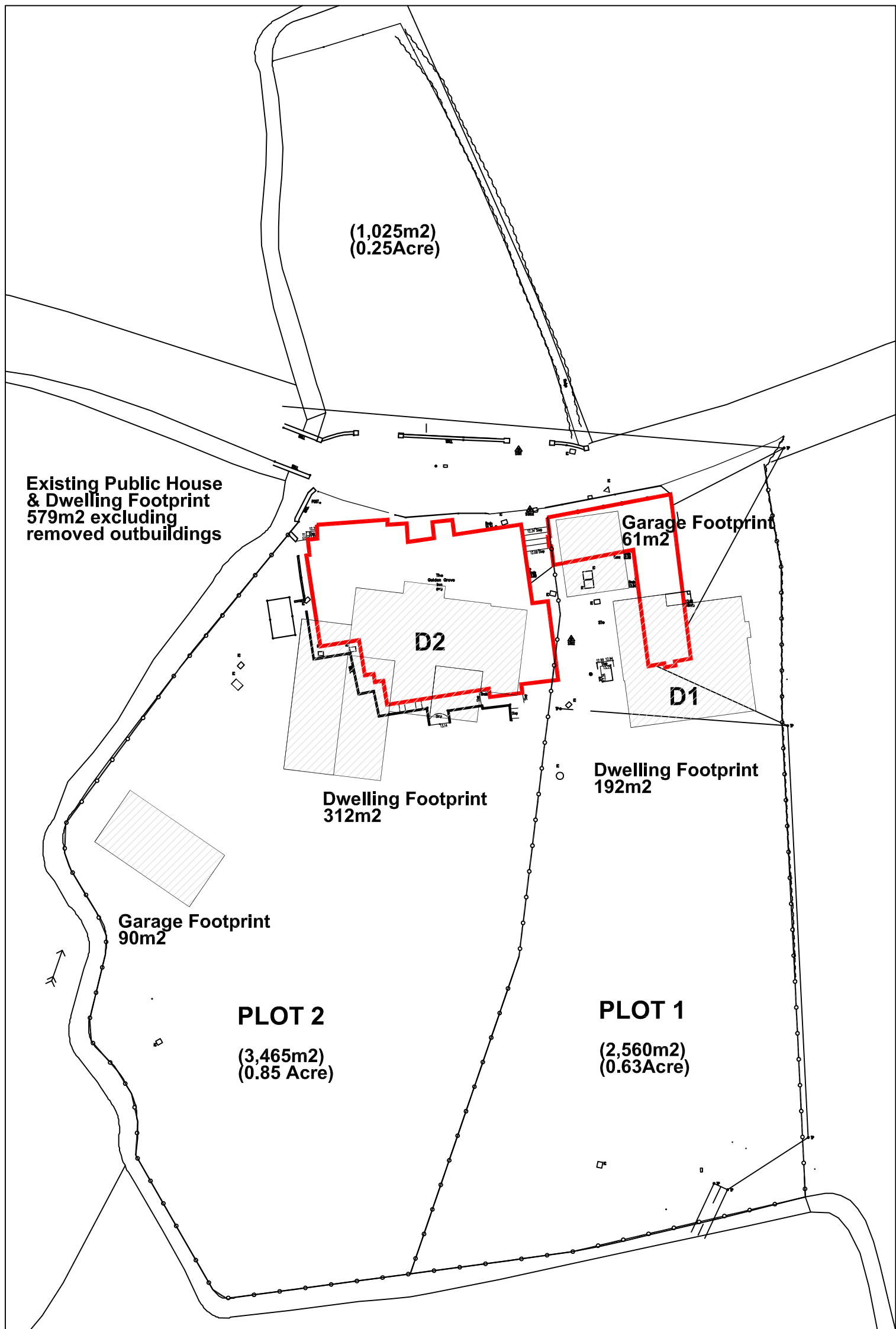
PLOT 1

PLOT 2

Site Plan [Scale 1:200]



Ordnance Survey Map [Scale 1:1250]



Site Plan Overlay Proposed Development - [Scale 1:500]

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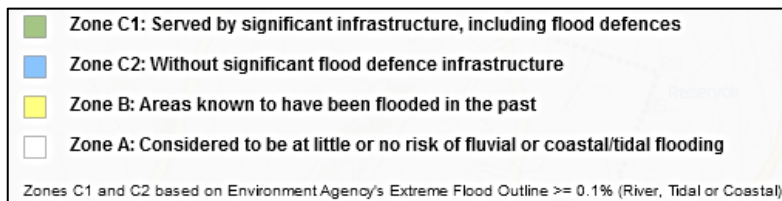
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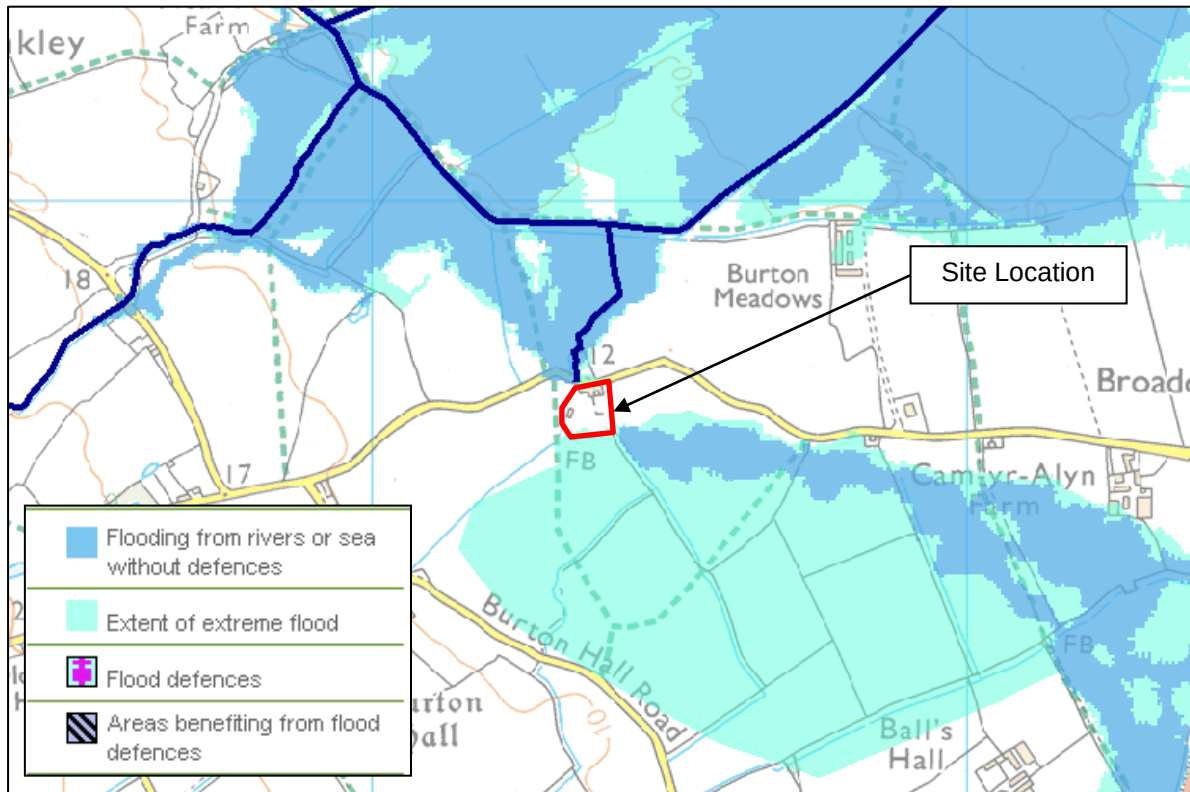
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Revision	Drawn by	Date	Details
Hardie Brack Peakin Building 23 Harrington Street Liverpool L2 9QA T: 0151 231 1056 www.dearbrack.co.uk			
HBA			
Client: Urban Developments			
Project Title: New Housing Development			
Site Location: Former Golden Grove Inn, Llyndir Lane, Rosset, Wrexham LL120AS			
Drawing Title: Site Layout & Landscaping as Proposed			
Scale: 1:200 / 500@ A1	Drawn: GLM	Issue: 06.10.14	Project No: PP14-1170
			DC-01
			-

Appendix C – TAN15 & EA Flood Maps

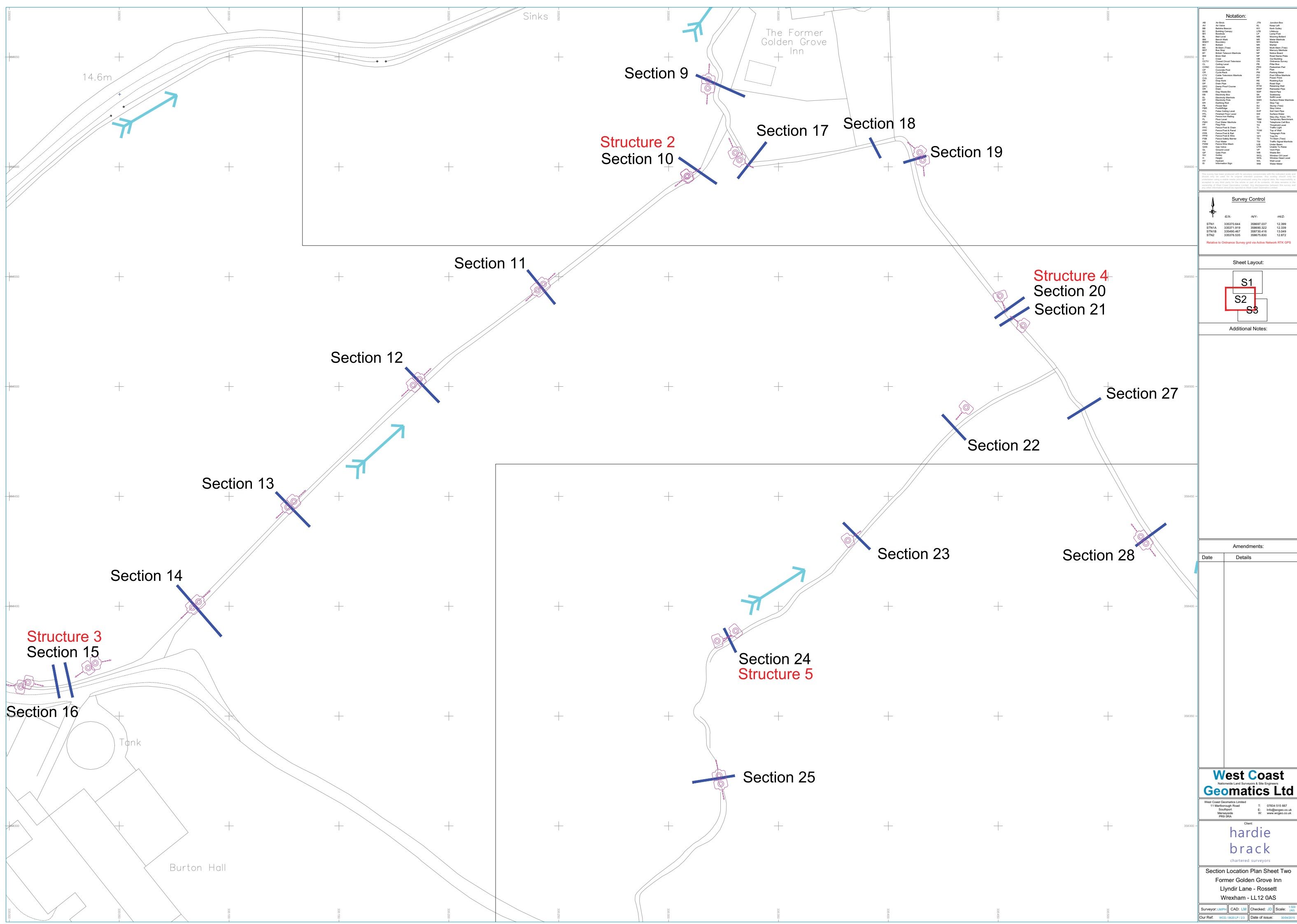


Welsh Government TAN15 Development Advice Map (May 2015)



EA Flood Map (May 2015)

Appendix D – Watercourse Survey Data

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Survey Control

	E/G	N/Y	H/Z
STN1	335370.644	358697.037	12.399
STN1A	335371.919	358696.322	12.339
STN1B	335490.467	358730.416	13.049
STN2	335373.535	358676.830	12.872

Relative to Ordnance Survey grid via Active Network RTK GPS

Diagram illustrating the intersection of three sets: S1, S2, and S3. The intersection of S2 and S3 is highlighted with a red rectangle.

Additional Notes:

Amendments:

[illegible]



West Coast
 Nationalistic Land Surveyors & Geo Engineers
Geomatics Ltd

West Coast Geomatics Limited
 11 Marlborough Road
 Scarborough
 Mayesville
 PPO Box 504

T: 07853 515 887
 E: info@wcgeo.co.uk
 W: www.wcgeo.co.uk

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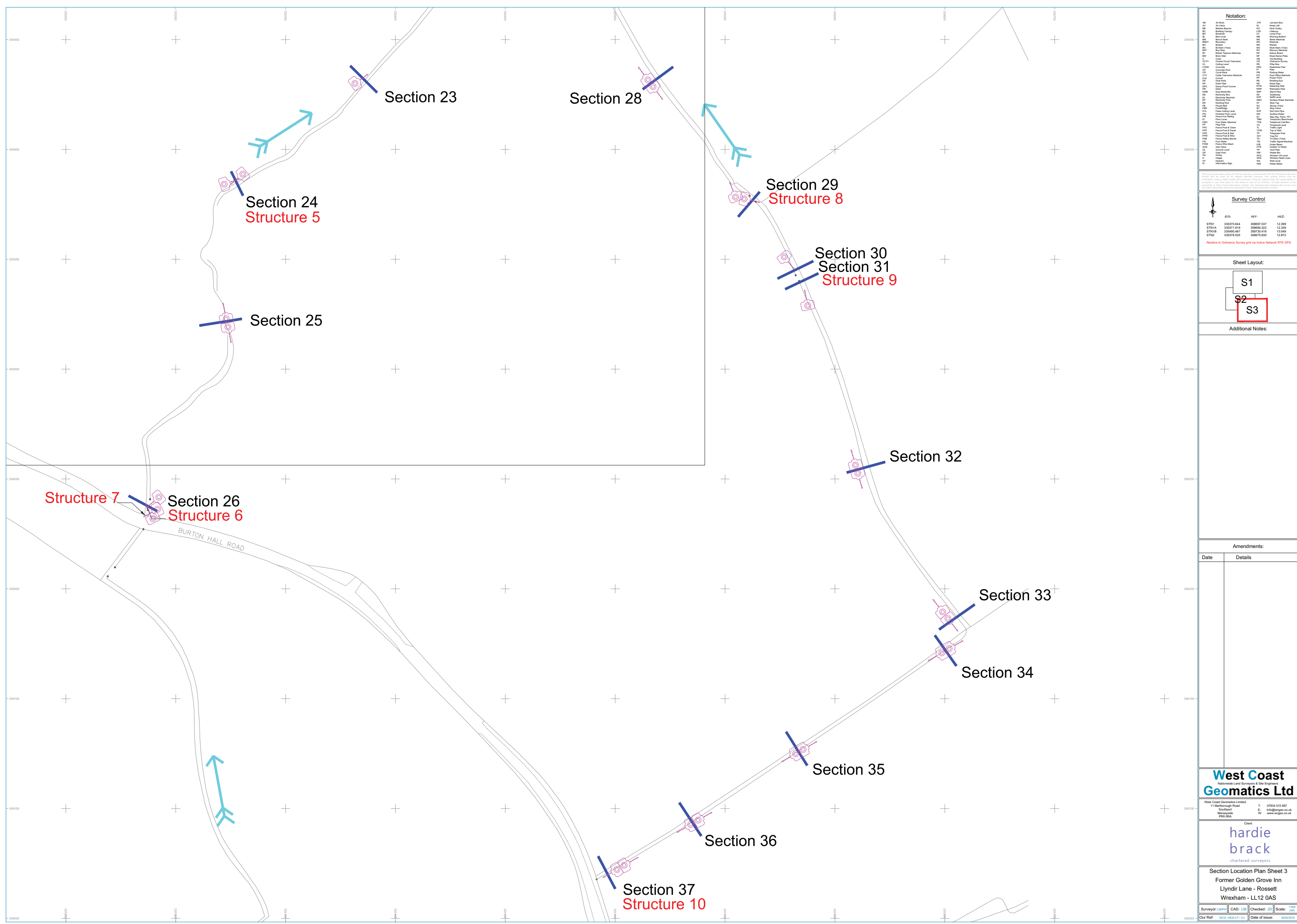
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Section Location Plan Sheet Two

Former Golden Grove Inn
Lyndir Lane - Rossett
Wrexham - LL12 0AS

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Our Ref: WCS/062019/23	Date of issue:		30/05/2019

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	<u>Survey Control</u>		
	-E-X-	-N-Y-	-H-Z-
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STN1A	335371.919	358690.322	12.339
STN1B	335490.467	358730.416	13.049
STN2	335676.535	358675.830	12.872

Sheet Layout:

S1

S2

SS

Additional Notes:

Amendments:

[illegible]

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West Coast Geomatics Limited
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T: 07834 515 667
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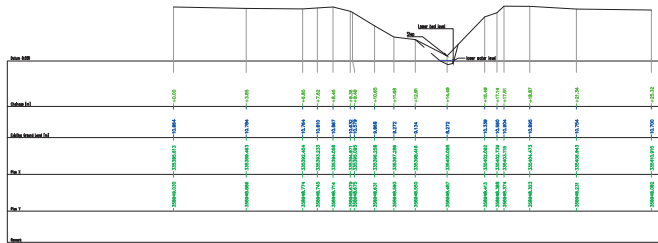
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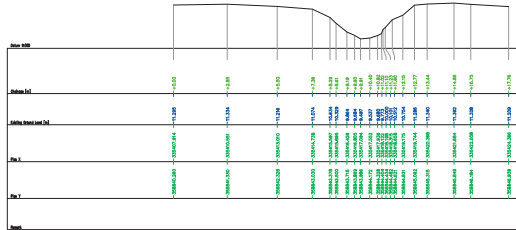
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Former Golden Grove Inn
Llyndir Lane - Rossett
Wrexham - LL12 0AS

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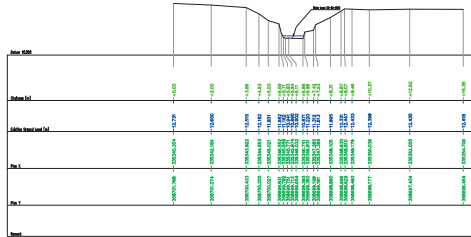
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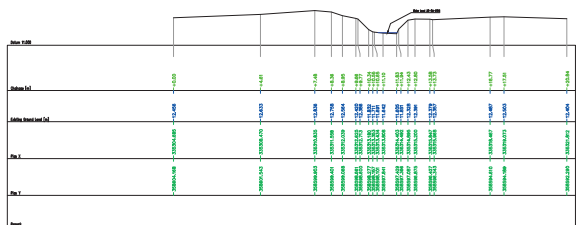
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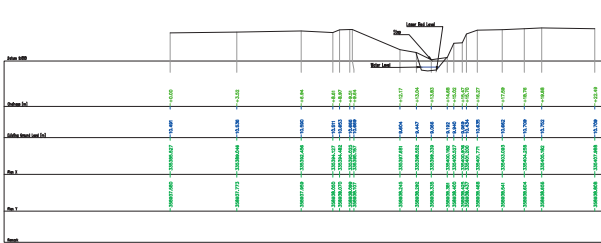
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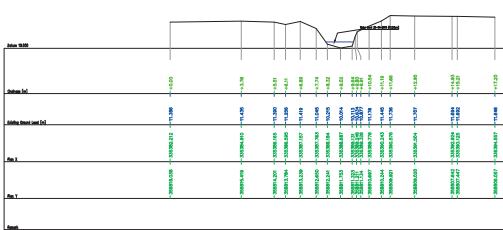
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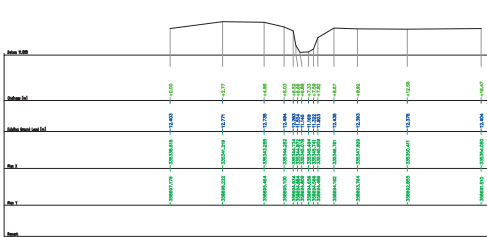
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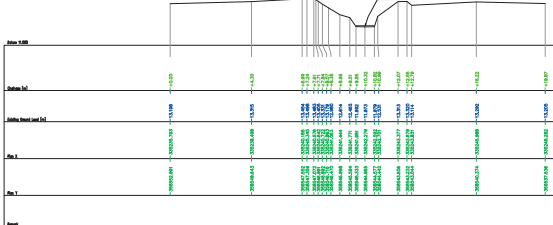
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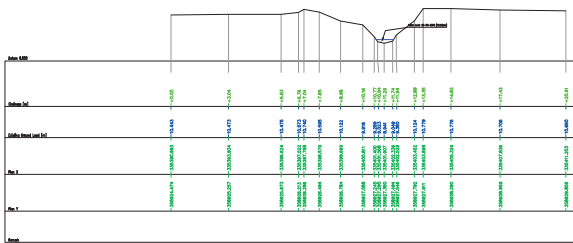
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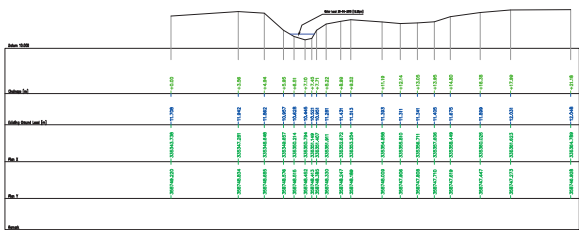
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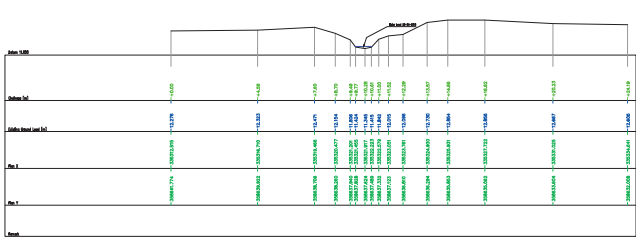
Section 3
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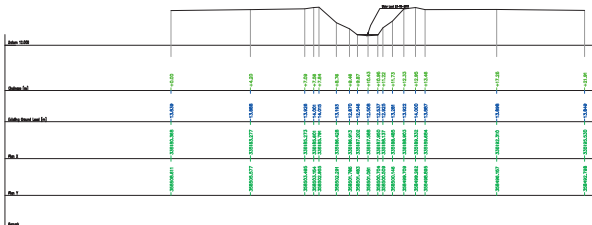
Section 6
[Download](#)



Section 9
[Download](#)



Section 12
[Download](#)



Notation:

AB	Air Brick	JTN	Junction Box
AV	Air Valve	KL	Keep Lift
BB	Building Beacon	KD	Keel Gully
BC	Building Canopy	LFB	Lifeguard
BH	Bonholes	LP	Lamp Post
BL	Bed Level	MB	Mooring Bollard
BM	Bench Mark	ME	Mermaid
BNDY	Boundary	MH	Manhole
BO	Bolt	MS	Multi-Stem (Tree)
BS	Bi-Stem (Tree)	MY	Mercury Manhole
BST	Bus Stop	NP	Noise Board
BT	British Telecom Manhole	NP	Road Name Plate
BW	Brick Wall	OB	Our Building
C	Crest	OS	Ordnance Survey
CCTV	Closed Circuit Television	PS	Pillar Box
CL	Ceiling Level	PI	Pipe
CONC	Concrete	PED	Pedestrian Pad
CP	Concrete Post	PM	Parking Meter
CR	Cycle Rack	PO	Post Office Manhole
CTV	Cable Television Manhole	PP	Power Point
CUL	Culvert	RE	Rodding Eye
DK	Drop Kerb	RS	Road Sign
DP	Drain Pipe	RTW	Retaining Wall
DPC	Damp Proof Course	RWP	Rainwater Pipe
DR	Drain	SDP	Stand Pipe
DWB	Dog Waste Bin	SK	Skateway
EB	Electricity Box	SOF	Soffit Level
EL	Electricity Manhole	SMH	Surface Water Manhole
EP	Electricity Pole	ST	Stop Top
ER	Earthing Rod	SU	Shump (Tree)
FB	Flow Bed	SU	Shump (Tree)
FBR	Footbridge	SVP	Soil Vent Pipe
FCL	False Ceiling Level	SW	Surface Water
FFL	Finished Floor Level	SY	Stay (Eg Pylon, TP)
FR	Fence Iron Railing	TBM	Temporary Benchmark
FRL	Foul Water Manhole	TCL	Telephone Call Box
FL	Floor Level	TL	Traffic Light
FP	Flag Pole	TH	Threshold Level
FPC	Fence Post & Chain	TL	Traffic Light
FPP	Fence Post & Panel	TOW	Top of Wall
FRF	Fence Post & Rail	TP	Telegraph Pole
FPW	Fence Post & Wire	TPT	Trail Pit
FSB	Fence Safety Barrier	TS	Tri-Stem (Tree)
FW	Foul Water	TSI	Traffic Signal Manhole
FWM	Fence Wire Mesh	UB	Under Beam
GAS	Gas Valve	UTS	Unable To Raise
GL	Ground Level	VP	Vent Pipe
GP	Gully	WB	Waste Bin
H	Height	WCL	Window Cill Level
HY	Hydrant	WL	Window Head Level
IS	Information Sign	WM	Water Meter

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Survey Control

	-E/X-	-N/Y-	-H/Z-
STN1	335370.644	358697.037	12.399
STN1A	335371.919	358690.322	12.339
STN1B	335490.467	358730.416	13.049
STN2	335376.535	358675.830	12.872

Relative to Ordnance Survey grid via Active Network RTK GPS

Sheet Layout:

A1

Additional Notes:

To be read in conjunction with
- WCGeo 0620 - Section Location Plan

Stream was heavily silted by a thickness of approximately 300-400mm affecting true bed level readings.
Sections indicate top of silt.

Amendments:

Date	Details
------	---------

West Coast Geomatics Ltd
Nationwide Land Surveyors & Site Engineers

West Coast Geomatics Limited
11 Marlborough Road
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Merseyside
PR9 6RA

T: 07834 515 667
E: info@wcgeo.co.uk
W: www.wcgeo.co.uk

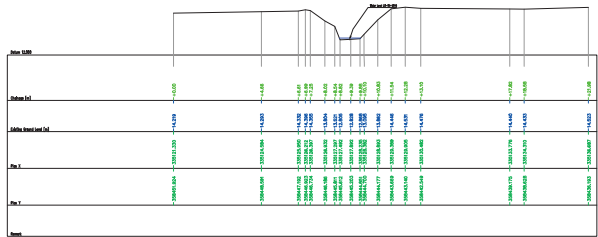
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hardie brack
chartered surveyors

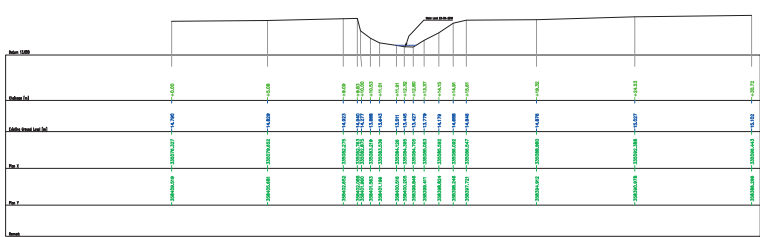
River Cross Sections Sheet 1 of 4
Former Golden Grove Inn
Llyndir Lane - Rossett
Wrexham - LL12 0AS

Surveyor: LMPH	CAD: LM	Checked: JD	Scale: 1:200 (A1)
Our Ref: WCG / 0620 X / 1:3	Date of issue: 30/04/2015		

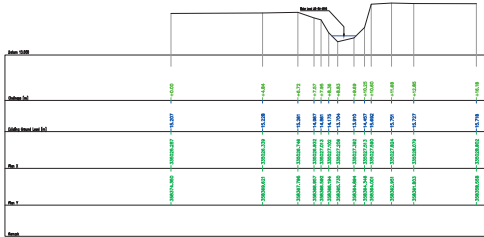
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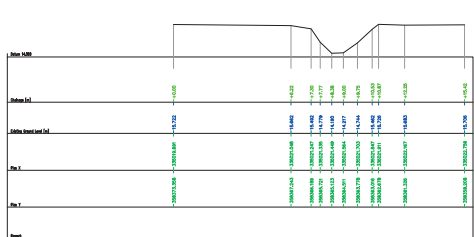
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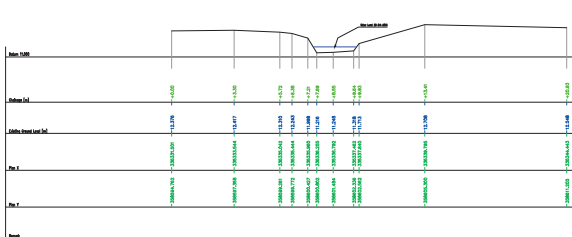
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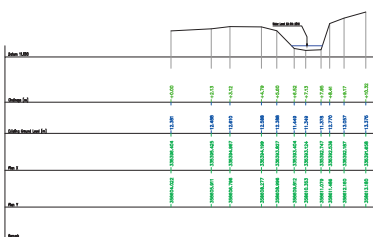
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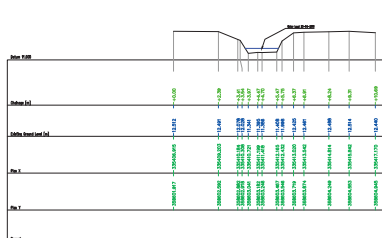
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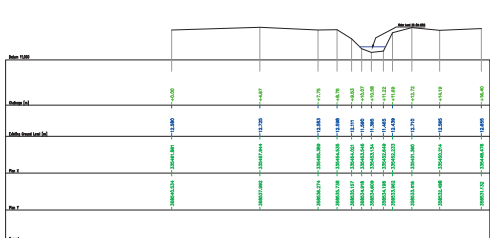
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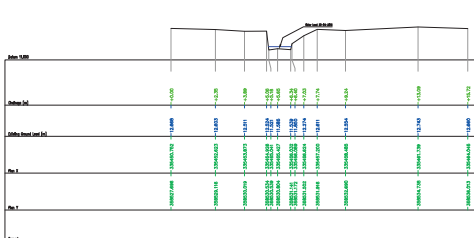
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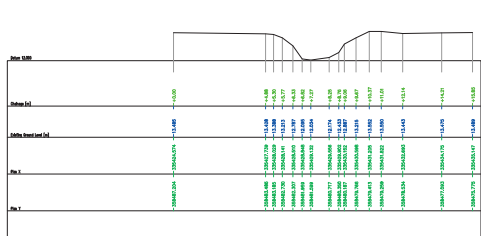
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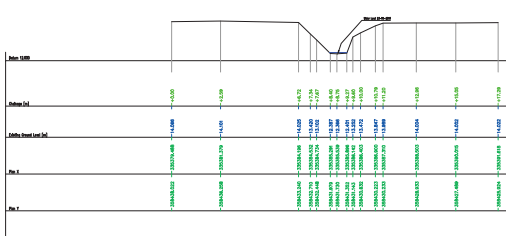
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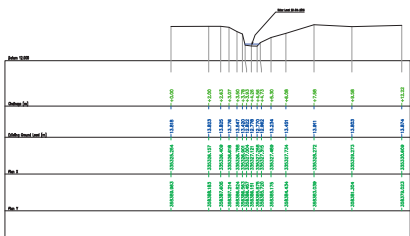
Section 22
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Section 23
[Download]



Section 24
[Download]



Notation:

AB	Air Brick	JTN	Junction Box
AV	Air Valve	KL	Keep Lift
BB	Building Beacon	KD	Keel Gully
BC	Building Canopy	LFB	Lifbury
BH	Bonholes	LP	Lamp Post
BL	Bed Level	MB	Mooring Bollard
BM	Bench Mark	ME	Meier Manhole
BNDY	Boundary	MH	Manhole
BO	Bolted	MK	Marker
BS	Bi-Stem (Tree)	MS	Multi-Stem (Tree)
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BT	British Telecom Manhole	NF	Noise Board
BW	Brick Wall	NP	Road Name Plate
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CP	Concrete Post	PI	Pipe
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CUL	Culvert	PP	Power Point
DK	Drop Kerb	RE	Rodding Eye
DP	Drain Pipe	RS	Road Sign
DPC	Damp Proof Course	RTW	Retaining Wall
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DWB	Dog Waste Bin	SDP	Stand Pipe
EB	Electricity Box	SK	Skateway
EL	Electricity Manhole	SOF	Soffit Level
EP	Electricity Pole	SMH	Surface Water Manhole
ER	Earthling Rod	ST	Stop Top
FB	Flower Bed	SU	Slump (Tree)
FBR	Footbridge	SV	Stop Valve
FCL	False Ceiling Level	SVP	Soil Vent Pipe
FFL	Finished Floor Level	SW	Surface Water
FL	Fence Iron Railing	SY	Stay (Eg Pylon, TP)
FLL	Floor Level	TBM	Temporary Benchmark
FL	Foul Water Manhole	TCH	Telephone Call Box
FP	Flag Pole	TL	Traffic Light
FPC	Fence Post & Chain	TP	Threshold Level
FPP	Fence Post & Panel	TOW	Top of Wall
FRF	Fence Post & Rail	TP	Telegraph Pole
FPW	Fence Post & Wire	TPT	Trial Pit
FSB	Fence Safety Barrier	TS	Ti-Stem (Tree)
FW	Foul Water	TSI	Traffic Signal Manhole
FWM	Fence Wire Mesh	UB	Under Beam
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STN2	335376.535	358675.830	12.872

Relative to Ordnance Survey grid via Active Network RTK GPS

Sheet Layout:

A1

Additional Notes:

To be read in conjunction with
- WCGeo 0620 - Section Location Plan

Stream was heavily silted by a thickness of approximately 300-400mm affecting true bed level readings.
Sections indicate top of silt.

Amendments:

Date	Details
------	---------

West Coast Geomatics Ltd
Nationwide Land Surveyors & Site Engineers

West Coast Geomatics Limited
11 Marlborough Road
Southport
Merseyside
PR9 6RA

T: 07834 515 667
E: info@wcgeo.co.uk
W: www.wcgeo.co.uk

Client:

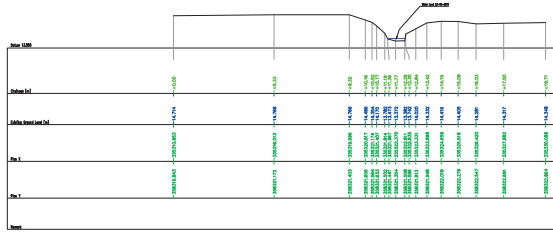
hardie brack
chartered surveyors

River Cross Sections Sheet 2 of 4
Former Golden Grove Inn
Llyndir Lane - Rossett
Wrexham - LL12 0AS

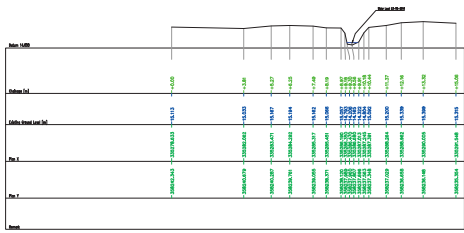
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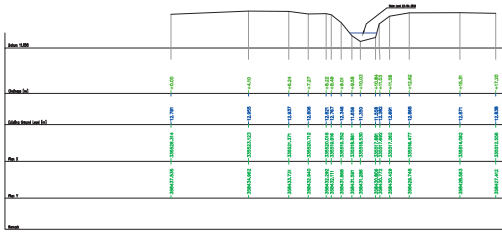
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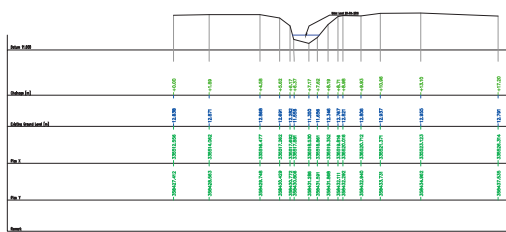
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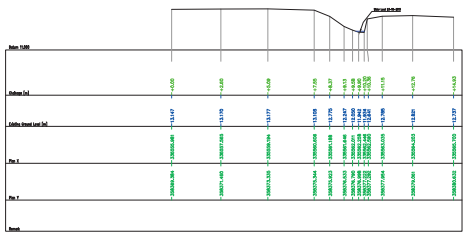
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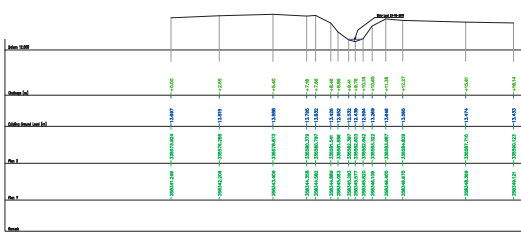
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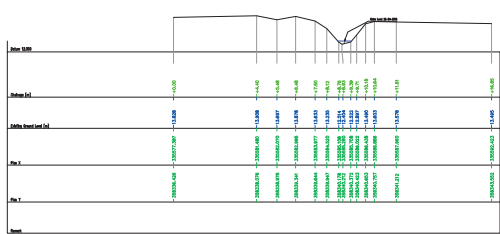
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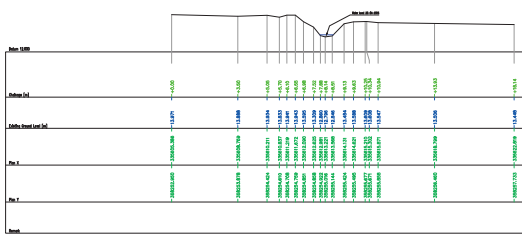
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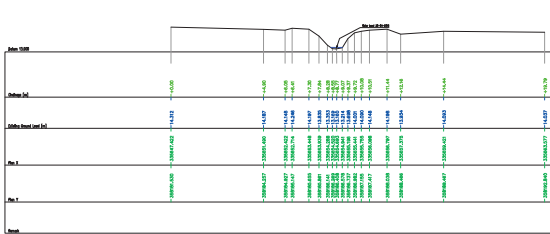
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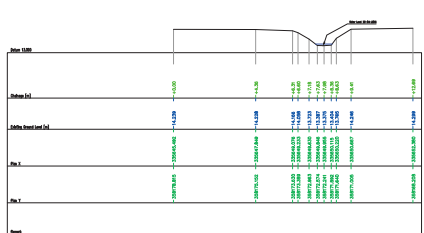
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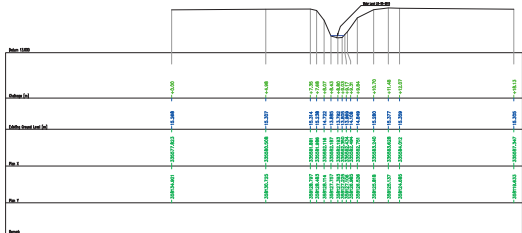
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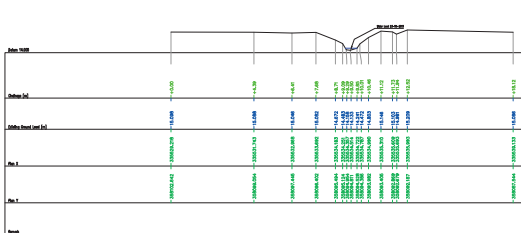
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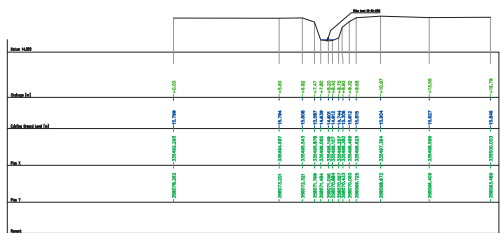
Section 35
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Section 36
[Download]



Section 37
[Download]



Notation:

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STN1B	335480.467	358730.416	13.049
STN2	335376.535	358675.830	12.872

Relative to Ordnance Survey grid via Active Network RTK GPS

Sheet Layout:

A1

Additional Notes:

To be read in conjunction with
- WCGeo 0620 - Section Location Plan

Stream was heavily silted by a thickness of approximately 300-400mm affecting true bed level readings.
Sections indicate top of silt.

Amendments:

Date	Details
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West Coast Geomatics Ltd
Nationwide Land Surveyors & Site Engineers

West Coast Geomatics Limited
11 Marlborough Road
Southport
Merseyside
PR9 6RA

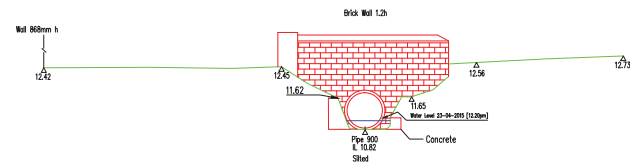
T: 07834 515 667
E: info@wcgeo.co.uk
W: www.wcgeo.co.uk

Client:
hardie brack
chartered surveyors

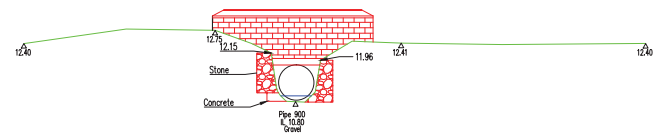
River Cross Sections Sheet 2 of 4
Former Golden Grove Inn
Llyndir Lane - Rossett
Wrexham - LL12 0AS

Surveyor: LMPH CAD: LM Checked: JD Scale: 1:200 (A1)

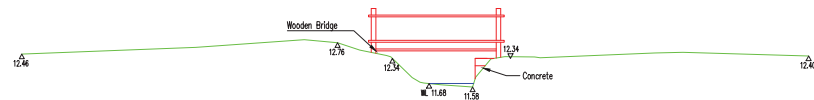
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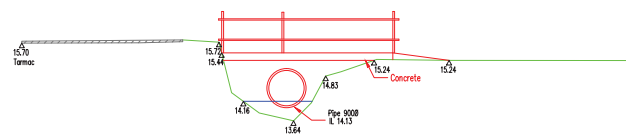
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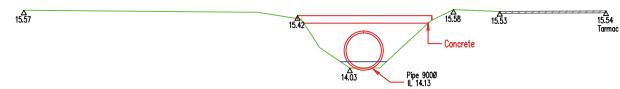
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Structure 2 D/S



Structure 3 U/S



Structure 3 D/S

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Sheet Layout:

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Geomatics Ltd

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T: 07834 515 667
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W: www.wcgeo.co.uk

hardie
brack
chartered surveyors

chartered surveyors

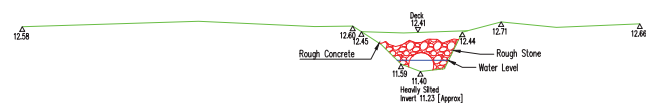
River Structure Sections Sheet 1 of 2
Former Golden Grove Inn
Llyndir Lane - Rossett
Wrexham - LL12 0AS

Former Golden Grove Inn

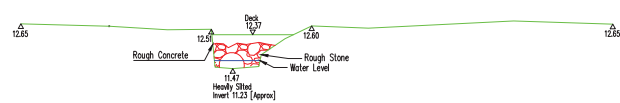
Lyndir Lane - Rossett

Wrexham - LL12 0AS

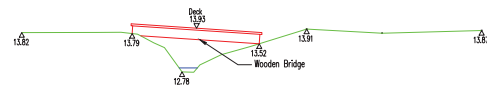
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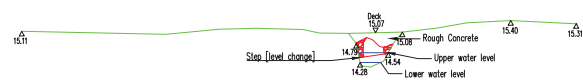
Structure 4 U/S



Structure 4 D/S

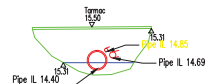


Structure 5 D/S



Structure 6 D/S

Unable to accurately survey the upstream side of this section



Structure 7 U/S

Notation:

AB	Air Brick	JTN	Junction Box
AV	Auto Valve	KK	Keyp Link
B&B	Belted Borehole	KB	Keep Battery
BS	Building Company	LFB	Locking
BN	Bonobole	LP	Lump Lead
BM	Bomb	M	Manhole
BCW	Bench Mark & Wink	ME	Main Manhole
BDY	Boundary	MH	Manhole
BO	Bottom	Mor	Mortar
B-S	B-S Stem (Tree)	MS	Multi-Store (Noise)
BST	Belt Stop	MC	Memory Machine
BT	British Telecom Mainline	NP	Noise Plate
BM	Bomb	NS	Name Plate
C	Crest	OB	Out Building
CCTV	Closed Circuit Telexual Television	S	Surface Space
CL	Ceiling Level	PB	Pillar Box
CONC	Concrete	PD	Pipe Drive
CR	Cycle	PI	Pipe
CP	Concrete Pervious	PK	Pinking Material
CTV	Cable TV	PO	Post Office Mainline
D	Curlew	PP	Power Point
D&L	Dredge	R	Rooming Eye
DP	Drain Pipe	RS	Road Sign
DC	Drainage Control Course	RTW	Right Turn
DS	Drain	RWP	Ranwater Pipe
DWB	Drain Waste Bin	SW	Stand Pipe
E	Electricity Box	SK	Sockaway
EL	Electricity Manhole	SCF	Soft Ceiling
F	Electricity Flow	SM	Surface Water Manhole
ER	Earring Road	SP	Stop Pipe
FB	Flow Box	SV	Stop Valve
FF	Footbridge	SW	Surface Water
FCL	Final Ceiling Level	SY	Shy (Ex. Pylon) Trip
FL	Fl Floor Level	TBM	Temporary Benchmark
FMB	Final Manhole	TCB	Temporary Call Box
FP	Flag Pole	TH	Threshold Level
FPC	Fence Post & Chain	TL	Traffic Light
FPR	Fence Post & Rail	TW	Two Way
FPM	Fence Post & Mesh	TP	Trapping Pole
FW	Fence Wire Barrier	TT	Total Trip
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GL	Ground Level	UR	Unable To Raise
GP	Gate Post	VB	Vest Pipe
GU	Gully	WL	Window Cell Wall
H	Height	WHL	Window Head Level
HY	Hydrant	WL	Wall Level
IS	Information Signs	WM	Water Meter

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Survey Control

	-E/X-	-N/Y-	-H/Z-
STN1	335370.644	358697.037	12.399
STN1A	335371.919	358690.322	12.339
STN1B	335490.467	358730.416	13.049
STN2	335376.535	358675.830	12.872

Relative to Ordnance Survey grid via Active Network RTK GPS

Sheet Layout:

A1

Additional Notes:

To be read in conjunction with
- WCGeo 0620 - Section Location Plan

Stream was heavily silted by a thickness of approximately 300-400mm affecting true bed level readings.
Sections indicate top of silt.

Amendments:

Date	Details

West Coast
Nationwide Land Surveyors & Site Engineers
Geomatics Ltd

West Coast Geomatics Limited
11 Marlborough Road
Southport
Merseyside
PR9 0RA

T: 07834 515 667
E: Info@wcgeo.co.uk
W: www.wcgeo.co.uk

Client:

hardie
brack

chartered surveyors

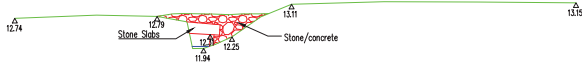
River Structure Sections Sheet 1 of 2
Former Golden Grove Inn
Llyndir Lane - Rossett
Wrexham - LL12 0AS

Former Golden Grove Inn

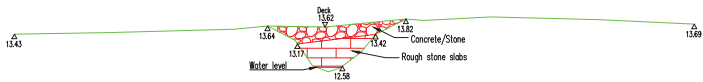
Llyndir Lane - Rossett

Wrexham - LL12 0AS

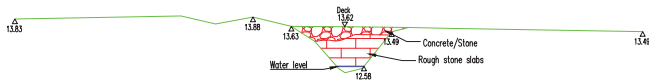
Surveyor: LM/PH	CAD: LM	Checked: JD	Scale: 1:100 (A1)
Our Ref: WCG / 0620 STR / 2:3		Date of issue: 30/04/2015	



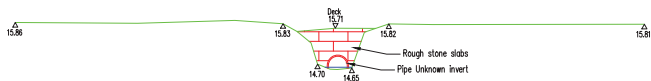
Datum 10.00m
Structure 8 U/S



Datum 10.00m
Structure 9 U/S



Datum 10.00m
Structure 9 D/S



Datum 12.00m
Structure 10 U/S

Notation:			
AB	Air Brick	JTN	Junction Box
AV	Air Valve	KL	Keep Lift
BB	Bellina Beacon	KD	Keel Gully
BC	Building Canopy	LFB	Lifebury
BH	Bonholes	LP	Lamp Post
BL	Bed Level	MB	Mooring Bollard
BM	Bench Mark	ME	Merse Manhole
BNDY	Boundary	MH	Manhole
BO	Bollard	MK	Marker
BS	Bi-Stem (Tree)	MS	Multi-Stem (Tree)
BST	Bus Stop	MY	Mercury Manhole
BT	British Telecom Manhole	NF	Notice Board
BW	Brick Wall	NP	Road Name Plate
C	Crest	OB	Our Building
CCTV	Closed Circuit Television	OS	Ordnance Survey
CL	Ceiling Level	PS	Pillar Box
CONC	Concrete	PED	Pedestrian Pad
CP	Concrete Post	PI	Pipe
CR	Cycle Rack	PM	Parking Meter
CTV	Cable Television Manhole	PO	Post Office Manhole
CUL	Culvert	PP	Power Point
DK	Drop Kerb	RE	Rodding Eye
DP	Drain Pipe	RS	Road Sign
DPC	Damp Proof Course	RTW	Retaining Wall
DR	Drain	RWP	Rainwater Pipe
DWB	Dog Waste Bin	SDP	Stand Pipe
EB	Electricity Box	SK	Skewway
EL	Electricity Manhole	SOF	Soffit Level
EP	Electricity Pole	SMH	Surface Water Manhole
ER	Earthling Rod	ST	Stop Top
FB	Flower Bed	SU	Shump (Tree)
FBR	Footbridge	SV	Stop Valve
FCL	False Ceiling Level	SVP	Soil Vent Pipe
FFL	Finished Floor Level	SW	Surface Water
FL	Fence Iron Railing	SY	Stay (Eg Pylon, TP)
FLH	Floor Level	TBM	Temporary Benchmark
FW	Foul Water Manhole	TGB	Telephone Call Box
FP	Flag Pole	TH	Threshold Level
FPC	Fence Post & Chain	TL	Traffic Light
FPP	Fence Post & Panel	TOW	Top of Wall
FPR	Fence Post & Rail	TP	Telegraph Pole
FPW	Fence Post & Wire	TPT	Trial Pit
FSB	Fence Safety Barrier	TS	Tr-Stem (Tree)
FW	Foul Water	TSI	Traffic Signal Manhole
FWM	Fence Wire Mesh	UB	Under Beam
GAS	Gas Valve	UTS	Unable To Raise
GL	Ground Level	VP	Vent Pipe
GP	Gate Post	WB	Waste Bin
GU	Gully	WCL	Window Cill Level
H	Height	WHL	Window Head Level
HY	Hydrant	WL	Wall Level
IS	Information Sign	WM	Water Meter

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	-E/X-	-N/Y-	-H/Z-
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Relative to Ordnance Survey grid via Active Network RTK GPS			

Sheet Layout:

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Additional Notes:

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Stream was heavily silted by a thickness of approximately 300-400mm affecting true bed level readings.
Sections indicate top of silt.

Amendments:	
Date	Details

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PR9 6RA

T: 07834 515 667
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River Structure Sections Sheet 1 of 2

Former Golden Grove Inn

Llyndir Lane - Rossett

Wrexham - LL12 0AS

Surveyor: LMPH

CAD: LM

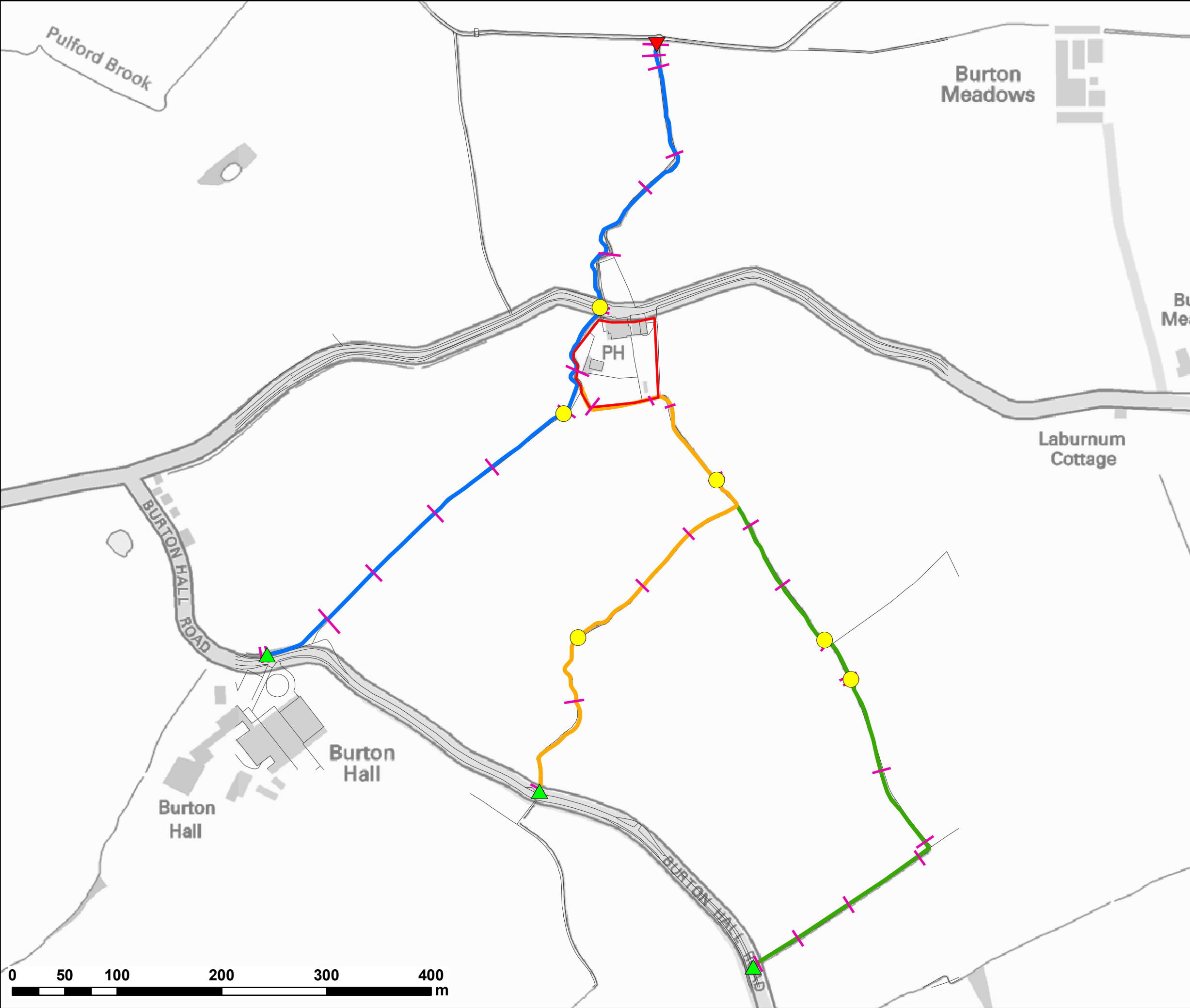
Checked: JD

Scale: 1:100 (A1)

Our Ref: WCG / 0620 STR / 3.3

Date of issue: 30/04/2015

Appendix E – 1D/2D Model Extents



LEGEND

- Site Boundary
- Watercourse1 (Golden Grove Drain)
- Watercourse2 (South Trib)
- Watercourse3 (East Trib)
- Fluvial Inflow
- Downstream Boundary (WL)
- Structure
- XSections



CLIENT:

URBAN DEVELOPMENTS

waterco
consultants

Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

1D/2D MODEL EXTENT

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,500 (UNLESS STATED OTHERWISE)
DATE: 27/05/2015	PLOT NAME: W3178-Model_Extent		REV: -

Appendix F – Hydrology

UK Design Flood Estimation

Generated on Tuesday, May 12, 2015 7:41:09 AM by Bethan Young
Printed from the RefH Flood Modelling software package, version 2.0.5531.36183

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (RefH)

Site details		Checksum: 7CE6-9F5F
Site name: Golden Grove Inn, Rossett		
Easting: 335400		
Northing: 358900		
Country: England, Wales or Northern Ireland		
Catchment Area (km²): 3.41		
Using plotscale calculations: No		
Site description: None		

Model run: 1000 year

Summary of results

FEH DDF Rainfall (mm):	103.66	Total runoff (ML):	69.58
Total Rainfall (mm):	68.93	Total flow (ML):	168.00
Peak Rainfall (mm):	18.75	Peak flow (m³/s):	4.45

Parameters

* Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.

Rainfall parameters

Name	Value	User-defined?
Duration (hr)	4.5	No
Timestep (hr)	0.5	No
SCF(Seasonal correction factor)	0.69	No
ARF(Areal reduction factor)	0.97	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	114.04	No
Cmax (mm)	378.92	No
Use alpha correction factor	Yes	No
Alpha correction factor	0.67	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	2.44	No
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m³/s)	0.13	No
BL (hr)	35	No
BR	1.46	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km²)	0.07	No
Urbext 2000	0.01	No
Urban runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km²)	0.00	Yes
Sewer capacity (m³/s)	0.00	Yes

Time series data						
Time (hh:mm)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
00:00	1.970	0.000	0.410	0.000	0.126	0.126
00:30	3.696	0.000	0.797	0.012	0.124	0.136
01:00	6.872	0.000	1.577	0.058	0.123	0.182
01:30	12.553	0.000	3.201	0.172	0.124	0.296
02:00	18.745	0.000	5.549	0.417	0.127	0.544
02:30	12.553	0.000	4.231	0.900	0.138	1.037
03:00	6.872	0.000	2.491	1.619	0.159	1.778
03:30	3.696	0.000	1.391	2.441	0.196	2.636
04:00	1.970	0.000	0.756	3.221	0.248	3.469
04:30	0.000	0.000	0.000	3.823	0.313	4.136
05:00	0.000	0.000	0.000	4.062	0.387	4.450
05:30	0.000	0.000	0.000	3.928	0.462	4.390
06:00	0.000	0.000	0.000	3.557	0.531	4.088
06:30	0.000	0.000	0.000	3.072	0.591	3.664
07:00	0.000	0.000	0.000	2.564	0.641	3.205
07:30	0.000	0.000	0.000	2.121	0.680	2.800
08:00	0.000	0.000	0.000	1.755	0.710	2.465
08:30	0.000	0.000	0.000	1.441	0.733	2.174
09:00	0.000	0.000	0.000	1.156	0.749	1.905
09:30	0.000	0.000	0.000	0.891	0.760	1.651
10:00	0.000	0.000	0.000	0.641	0.765	1.406
10:30	0.000	0.000	0.000	0.412	0.765	1.177
11:00	0.000	0.000	0.000	0.227	0.761	0.987
11:30	0.000	0.000	0.000	0.107	0.753	0.860
12:00	0.000	0.000	0.000	0.043	0.744	0.787
12:30	0.000	0.000	0.000	0.012	0.734	0.747
13:00	0.000	0.000	0.000	0.001	0.724	0.725
13:30	0.000	0.000	0.000	0.000	0.714	0.714
14:00	0.000	0.000	0.000	0.000	0.703	0.703
14:30	0.000	0.000	0.000	0.000	0.694	0.694
15:00	0.000	0.000	0.000	0.000	0.684	0.684
15:30	0.000	0.000	0.000	0.000	0.674	0.674
16:00	0.000	0.000	0.000	0.000	0.664	0.664
16:30	0.000	0.000	0.000	0.000	0.655	0.655
17:00	0.000	0.000	0.000	0.000	0.646	0.646

Page 3 of 8

Time (hh:mm)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
17:30	0.000	0.000	0.000	0.000	0.637	0.637
18:00	0.000	0.000	0.000	0.000	0.628	0.628
18:30	0.000	0.000	0.000	0.000	0.619	0.619
19:00	0.000	0.000	0.000	0.000	0.610	0.610
19:30	0.000	0.000	0.000	0.000	0.601	0.601
20:00	0.000	0.000	0.000	0.000	0.593	0.593
20:30	0.000	0.000	0.000	0.000	0.584	0.584
21:00	0.000	0.000	0.000	0.000	0.576	0.576
21:30	0.000	0.000	0.000	0.000	0.568	0.568
22:00	0.000	0.000	0.000	0.000	0.560	0.560
22:30	0.000	0.000	0.000	0.000	0.552	0.552
23:00	0.000	0.000	0.000	0.000	0.544	0.544
23:30	0.000	0.000	0.000	0.000	0.536	0.536
24:00	0.000	0.000	0.000	0.000	0.529	0.529
24:30	0.000	0.000	0.000	0.000	0.521	0.521
25:00	0.000	0.000	0.000	0.000	0.514	0.514
25:30	0.000	0.000	0.000	0.000	0.507	0.507
26:00	0.000	0.000	0.000	0.000	0.499	0.499
26:30	0.000	0.000	0.000	0.000	0.492	0.492
27:00	0.000	0.000	0.000	0.000	0.485	0.485
27:30	0.000	0.000	0.000	0.000	0.478	0.478
28:00	0.000	0.000	0.000	0.000	0.472	0.472
28:30	0.000	0.000	0.000	0.000	0.465	0.465
29:00	0.000	0.000	0.000	0.000	0.458	0.458
29:30	0.000	0.000	0.000	0.000	0.452	0.452
30:00	0.000	0.000	0.000	0.000	0.445	0.445
30:30	0.000	0.000	0.000	0.000	0.439	0.439
31:00	0.000	0.000	0.000	0.000	0.433	0.433
31:30	0.000	0.000	0.000	0.000	0.427	0.427
32:00	0.000	0.000	0.000	0.000	0.421	0.421
32:30	0.000	0.000	0.000	0.000	0.415	0.415
33:00	0.000	0.000	0.000	0.000	0.409	0.409
33:30	0.000	0.000	0.000	0.000	0.403	0.403
34:00	0.000	0.000	0.000	0.000	0.397	0.397
34:30	0.000	0.000	0.000	0.000	0.392	0.392
35:00	0.000	0.000	0.000	0.000	0.386	0.386

Page 4 of 8

Time (hh:mm)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
35:30	0.000	0.000	0.000	0.000	0.381	0.381
36:00	0.000	0.000	0.000	0.000	0.375	0.375
36:30	0.000	0.000	0.000	0.000	0.370	0.370
37:00	0.000	0.000	0.000	0.000	0.365	0.365
37:30	0.000	0.000	0.000	0.000	0.359	0.359
38:00	0.000	0.000	0.000	0.000	0.354	0.354
38:30	0.000	0.000	0.000	0.000	0.349	0.349
39:00	0.000	0.000	0.000	0.000	0.344	0.344
39:30	0.000	0.000	0.000	0.000	0.340	0.340
40:00	0.000	0.000	0.000	0.000	0.335	0.335
40:30	0.000	0.000	0.000	0.000	0.330	0.330
41:00	0.000	0.000	0.000	0.000	0.325	0.325
41:30	0.000	0.000	0.000	0.000	0.321	0.321
42:00	0.000	0.000	0.000	0.000	0.316	0.316
42:30	0.000	0.000	0.000	0.000	0.312	0.312
43:00	0.000	0.000	0.000	0.000	0.307	0.307
43:30	0.000	0.000	0.000	0.000	0.303	0.303
44:00	0.000	0.000	0.000	0.000	0.299	0.299
44:30	0.000	0.000	0.000	0.000	0.294	0.294
45:00	0.000	0.000	0.000	0.000	0.290	0.290
45:30	0.000	0.000	0.000	0.000	0.286	0.286
46:00	0.000	0.000	0.000	0.000	0.282	0.282
46:30	0.000	0.000	0.000	0.000	0.278	0.278
47:00	0.000	0.000	0.000	0.000	0.274	0.274
47:30	0.000	0.000	0.000	0.000	0.270	0.270
48:00	0.000	0.000	0.000	0.000	0.266	0.266
48:30	0.000	0.000	0.000	0.000	0.263	0.263
49:00	0.000	0.000	0.000	0.000	0.259	0.259
49:30	0.000	0.000	0.000	0.000	0.255	0.255
50:00	0.000	0.000	0.000	0.000	0.252	0.252
50:30	0.000	0.000	0.000	0.000	0.248	0.248
51:00	0.000	0.000	0.000	0.000	0.244	0.244
51:30	0.000	0.000	0.000	0.000	0.241	0.241
52:00	0.000	0.000	0.000	0.000	0.238	0.238
52:30	0.000	0.000	0.000	0.000	0.234	0.234
53:00	0.000	0.000	0.000	0.000	0.231	0.231

Time (hh:mm)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
53:30	0.000	0.000	0.000	0.000	0.228	0.228
54:00	0.000	0.000	0.000	0.000	0.224	0.224
54:30	0.000	0.000	0.000	0.000	0.221	0.221
55:00	0.000	0.000	0.000	0.000	0.218	0.218
55:30	0.000	0.000	0.000	0.000	0.215	0.215
56:00	0.000	0.000	0.000	0.000	0.212	0.212
56:30	0.000	0.000	0.000	0.000	0.209	0.209
57:00	0.000	0.000	0.000	0.000	0.206	0.206
57:30	0.000	0.000	0.000	0.000	0.203	0.203
58:00	0.000	0.000	0.000	0.000	0.200	0.200
58:30	0.000	0.000	0.000	0.000	0.197	0.197
59:00	0.000	0.000	0.000	0.000	0.195	0.195
59:30	0.000	0.000	0.000	0.000	0.192	0.192
60:00	0.000	0.000	0.000	0.000	0.189	0.189
60:30	0.000	0.000	0.000	0.000	0.186	0.186
61:00	0.000	0.000	0.000	0.000	0.184	0.184
61:30	0.000	0.000	0.000	0.000	0.181	0.181
62:00	0.000	0.000	0.000	0.000	0.179	0.179
62:30	0.000	0.000	0.000	0.000	0.176	0.176
63:00	0.000	0.000	0.000	0.000	0.174	0.174
63:30	0.000	0.000	0.000	0.000	0.171	0.171
64:00	0.000	0.000	0.000	0.000	0.169	0.169
64:30	0.000	0.000	0.000	0.000	0.166	0.166
65:00	0.000	0.000	0.000	0.000	0.164	0.164
65:30	0.000	0.000	0.000	0.000	0.162	0.162
66:00	0.000	0.000	0.000	0.000	0.159	0.159
66:30	0.000	0.000	0.000	0.000	0.157	0.157
67:00	0.000	0.000	0.000	0.000	0.155	0.155
67:30	0.000	0.000	0.000	0.000	0.153	0.153
68:00	0.000	0.000	0.000	0.000	0.150	0.150
68:30	0.000	0.000	0.000	0.000	0.148	0.148
69:00	0.000	0.000	0.000	0.000	0.146	0.146
69:30	0.000	0.000	0.000	0.000	0.144	0.144
70:00	0.000	0.000	0.000	0.000	0.142	0.142
70:30	0.000	0.000	0.000	0.000	0.140	0.140
71:00	0.000	0.000	0.000	0.000	0.138	0.138

Time (hh:mm)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
71:30	0.000	0.000	0.000	0.000	0.136	0.136
72:00	0.000	0.000	0.000	0.000	0.134	0.134
72:30	0.000	0.000	0.000	0.000	0.132	0.132
73:00	0.000	0.000	0.000	0.000	0.130	0.130
73:30	0.000	0.000	0.000	0.000	0.129	0.129
74:00	0.000	0.000	0.000	0.000	0.127	0.127

Appendix		
Catchment descriptors		
Name	Value	User-defined value used?
Area (km ²)	3.41	No
ALTBAR	56	No
ASPBAR	48	No
ASPVAR	0.74	No
BFIHOST	0.5	No
DPLBAR (km)	2.84	No
DPSBAR (mkm ⁻¹)	34.7	No
FARL	0.97	No
LDP	4.82	No
PROPWET (mm)	0.51	No
RMED1H	9.9	No
RMED1D	31.2	No
RMED2D	39.4	No
SAAR (mm)	745	No
SAAR4170 (mm)	755	No
SPRH0ST	34.56	No
Urbext2000	0.01	No
Urbext1990	0.01	No
URBCONC	0.71	No
URBLOC	1.52	No
Urban Area (km ²)	0.07	No
DDF parameter C	-0.02	No
DDF parameter D1	0.33	No
DDF parameter D2	0.4	No
DDF parameter D3	0.29	No
DDF parameter E	0.29	No
DDF parameter F	2.42	No
DDF parameter C (1km grid value)	-0.02	No
DDF parameter D1 (1km grid value)	0.32	No
DDF parameter D2 (1km grid value)	0.39	No
DDF parameter D3 (1km grid value)	0.28	No
DDF parameter E (1km grid value)	0.29	No
DDF parameter F (1km grid value)	2.42	No

UK Design Flood Estimation

Generated on Tuesday, May 12, 2015 7:41:28 AM by Bethan Young
Printed from the RefH Flood Modelling software package, version 2.0.5531.36183

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (RefH)

Site details	Checksum: 7CE6-9F5F
Site name: Golden Grove Inn, Rossett	
Easting: 335400	
Northing: 358900	
Country: England, Wales or Northern Ireland	
Catchment Area (km²): 3.41	
Using plotscale calculations: No	
Site description: None	

Model run: 100 year

Summary of results

FEH DDF Rainfall (mm):	58.23	Total runoff (ML):	42.19
Total Rainfall (mm):	38.72	Total flow (ML):	101.94
Peak Rainfall (mm):	10.53	Peak flow (m³/s):	2.74

Parameters

* Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.

Rainfall parameters

Name	Value	User-defined?
Duration (hr)	4.5	No
Timestep (hr)	0.5	No
SCF(Seasonal correction factor)	0.69	No
ARF(Areal reduction factor)	0.97	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	114.04	No
Cmax (mm)	378.92	No
Use alpha correction factor	Yes	No
Alpha correction factor	0.88	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	2.44	No
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m³/s)	0.13	No
BL (hr)	35	No
BR	1.46	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km²)	0.07	No
Urbext 2000	0.01	No
Urban runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km²)	0.00	Yes
Sewer capacity (m³/s)	0.00	Yes

Time series data						
Time (hh:mm)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
00:00	1.106	0.000	0.299	0.000	0.126	0.126
00:30	2.076	0.000	0.570	0.008	0.124	0.133
01:00	3.860	0.000	1.089	0.042	0.123	0.165
01:30	7.051	0.000	2.091	0.121	0.123	0.244
02:00	10.530	0.000	3.365	0.288	0.125	0.413
02:30	7.051	0.000	2.416	0.602	0.131	0.733
03:00	3.860	0.000	1.378	1.052	0.145	1.197
03:30	2.076	0.000	0.757	1.551	0.168	1.719
04:00	1.106	0.000	0.408	2.010	0.200	2.210
04:30	0.000	0.000	0.000	2.347	0.240	2.587
05:00	0.000	0.000	0.000	2.459	0.285	2.743
05:30	0.000	0.000	0.000	2.353	0.329	2.682
06:00	0.000	0.000	0.000	2.115	0.370	2.485
06:30	0.000	0.000	0.000	1.819	0.405	2.224
07:00	0.000	0.000	0.000	1.516	0.433	1.949
07:30	0.000	0.000	0.000	1.254	0.455	1.710
08:00	0.000	0.000	0.000	1.038	0.473	1.510
08:30	0.000	0.000	0.000	0.850	0.485	1.335
09:00	0.000	0.000	0.000	0.678	0.494	1.172
09:30	0.000	0.000	0.000	0.519	0.500	1.018
10:00	0.000	0.000	0.000	0.368	0.502	0.870
10:30	0.000	0.000	0.000	0.233	0.501	0.734
11:00	0.000	0.000	0.000	0.126	0.497	0.623
11:30	0.000	0.000	0.000	0.059	0.492	0.551
12:00	0.000	0.000	0.000	0.023	0.486	0.509
12:30	0.000	0.000	0.000	0.007	0.479	0.486
13:00	0.000	0.000	0.000	0.001	0.473	0.473
13:30	0.000	0.000	0.000	0.000	0.466	0.466
14:00	0.000	0.000	0.000	0.000	0.459	0.459
14:30	0.000	0.000	0.000	0.000	0.453	0.453
15:00	0.000	0.000	0.000	0.000	0.447	0.447
15:30	0.000	0.000	0.000	0.000	0.440	0.440
16:00	0.000	0.000	0.000	0.000	0.434	0.434
16:30	0.000	0.000	0.000	0.000	0.428	0.428
17:00	0.000	0.000	0.000	0.000	0.422	0.422

Time (hh:mm)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
17:30	0.000	0.000	0.000	0.000	0.416	0.416
18:00	0.000	0.000	0.000	0.000	0.410	0.410
18:30	0.000	0.000	0.000	0.000	0.404	0.404
19:00	0.000	0.000	0.000	0.000	0.398	0.398
19:30	0.000	0.000	0.000	0.000	0.393	0.393
20:00	0.000	0.000	0.000	0.000	0.387	0.387
20:30	0.000	0.000	0.000	0.000	0.382	0.382
21:00	0.000	0.000	0.000	0.000	0.376	0.376
21:30	0.000	0.000	0.000	0.000	0.371	0.371
22:00	0.000	0.000	0.000	0.000	0.366	0.366
22:30	0.000	0.000	0.000	0.000	0.360	0.360
23:00	0.000	0.000	0.000	0.000	0.355	0.355
23:30	0.000	0.000	0.000	0.000	0.350	0.350
24:00	0.000	0.000	0.000	0.000	0.345	0.345
24:30	0.000	0.000	0.000	0.000	0.340	0.340
25:00	0.000	0.000	0.000	0.000	0.336	0.336
25:30	0.000	0.000	0.000	0.000	0.331	0.331
26:00	0.000	0.000	0.000	0.000	0.326	0.326
26:30	0.000	0.000	0.000	0.000	0.321	0.321
27:00	0.000	0.000	0.000	0.000	0.317	0.317
27:30	0.000	0.000	0.000	0.000	0.312	0.312
28:00	0.000	0.000	0.000	0.000	0.308	0.308
28:30	0.000	0.000	0.000	0.000	0.304	0.304
29:00	0.000	0.000	0.000	0.000	0.299	0.299
29:30	0.000	0.000	0.000	0.000	0.295	0.295
30:00	0.000	0.000	0.000	0.000	0.291	0.291
30:30	0.000	0.000	0.000	0.000	0.287	0.287
31:00	0.000	0.000	0.000	0.000	0.283	0.283
31:30	0.000	0.000	0.000	0.000	0.279	0.279
32:00	0.000	0.000	0.000	0.000	0.275	0.275
32:30	0.000	0.000	0.000	0.000	0.271	0.271
33:00	0.000	0.000	0.000	0.000	0.267	0.267
33:30	0.000	0.000	0.000	0.000	0.263	0.263
34:00	0.000	0.000	0.000	0.000	0.259	0.259
34:30	0.000	0.000	0.000	0.000	0.256	0.256
35:00	0.000	0.000	0.000	0.000	0.252	0.252

Time (h:mm)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
35:30	0.000	0.000	0.000	0.000	0.249	0.249
36:00	0.000	0.000	0.000	0.000	0.245	0.245
36:30	0.000	0.000	0.000	0.000	0.242	0.242
37:00	0.000	0.000	0.000	0.000	0.238	0.238
37:30	0.000	0.000	0.000	0.000	0.235	0.235
38:00	0.000	0.000	0.000	0.000	0.231	0.231
38:30	0.000	0.000	0.000	0.000	0.228	0.228
39:00	0.000	0.000	0.000	0.000	0.225	0.225
39:30	0.000	0.000	0.000	0.000	0.222	0.222
40:00	0.000	0.000	0.000	0.000	0.219	0.219
40:30	0.000	0.000	0.000	0.000	0.216	0.216
41:00	0.000	0.000	0.000	0.000	0.212	0.212
41:30	0.000	0.000	0.000	0.000	0.209	0.209
42:00	0.000	0.000	0.000	0.000	0.206	0.206
42:30	0.000	0.000	0.000	0.000	0.204	0.204
43:00	0.000	0.000	0.000	0.000	0.201	0.201
43:30	0.000	0.000	0.000	0.000	0.198	0.198
44:00	0.000	0.000	0.000	0.000	0.195	0.195
44:30	0.000	0.000	0.000	0.000	0.192	0.192
45:00	0.000	0.000	0.000	0.000	0.190	0.190
45:30	0.000	0.000	0.000	0.000	0.187	0.187
46:00	0.000	0.000	0.000	0.000	0.184	0.184
46:30	0.000	0.000	0.000	0.000	0.182	0.182
47:00	0.000	0.000	0.000	0.000	0.179	0.179
47:30	0.000	0.000	0.000	0.000	0.176	0.176
48:00	0.000	0.000	0.000	0.000	0.174	0.174
48:30	0.000	0.000	0.000	0.000	0.171	0.171
49:00	0.000	0.000	0.000	0.000	0.169	0.169
49:30	0.000	0.000	0.000	0.000	0.167	0.167
50:00	0.000	0.000	0.000	0.000	0.164	0.164
50:30	0.000	0.000	0.000	0.000	0.162	0.162
51:00	0.000	0.000	0.000	0.000	0.160	0.160
51:30	0.000	0.000	0.000	0.000	0.157	0.157
52:00	0.000	0.000	0.000	0.000	0.155	0.155
52:30	0.000	0.000	0.000	0.000	0.153	0.153
53:00	0.000	0.000	0.000	0.000	0.151	0.151

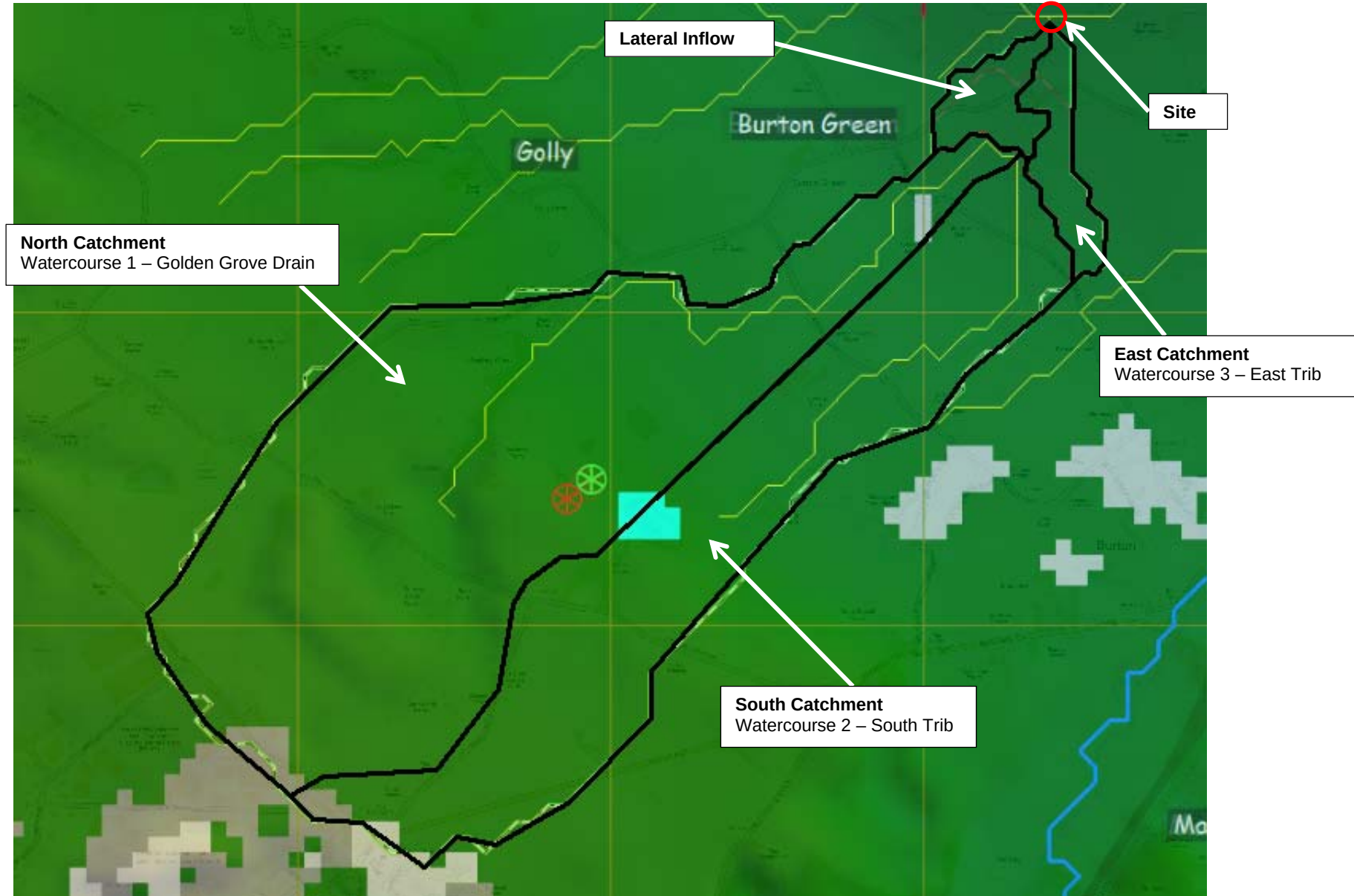
Time (h:mm)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
53:30	0.000	0.000	0.000	0.000	0.149	0.149
54:00	0.000	0.000	0.000	0.000	0.147	0.147
54:30	0.000	0.000	0.000	0.000	0.144	0.144
55:00	0.000	0.000	0.000	0.000	0.142	0.142
55:30	0.000	0.000	0.000	0.000	0.140	0.140
56:00	0.000	0.000	0.000	0.000	0.138	0.138
56:30	0.000	0.000	0.000	0.000	0.136	0.136
57:00	0.000	0.000	0.000	0.000	0.135	0.135
57:30	0.000	0.000	0.000	0.000	0.133	0.133
58:00	0.000	0.000	0.000	0.000	0.131	0.131
58:30	0.000	0.000	0.000	0.000	0.129	0.129
59:00	0.000	0.000	0.000	0.000	0.127	0.127

Appendix

Catchment descriptors

Name	Value	User-defined value used?
Area (km ²)	3.41	No
ALTBAR	56	No
ASPBAR	48	No
ASPVAR	0.74	No
BEIHOST	0.5	No
DPLBAR (km)	2.84	No
DPSBAR (mkm ⁻¹)	34.7	No
FARL	0.97	No
LDP	4.82	No
PROPWET (mm)	0.51	No
RMED1H	9.9	No
RMED1D	31.2	No
RMED2D	39.4	No
SAAR (mm)	745	No
SAAR4170 (mm)	755	No
SPRH0ST	34.56	No
Urbext2000	0.01	No
Urbext1990	0.01	No
URBCONC	0.71	No
URBLOC	1.52	No
Urban Area (km ²)	0.07	No
DDF parameter C	-0.02	No
DDF parameter D1	0.33	No
DDF parameter D2	0.4	No
DDF parameter D3	0.29	No
DDF parameter E	0.29	No
DDF parameter F	2.42	No
DDF parameter C (1km grid value)	-0.02	No
DDF parameter D1 (1km grid value)	0.32	No
DDF parameter D2 (1km grid value)	0.39	No
DDF parameter D3 (1km grid value)	0.28	No
DDF parameter E (1km grid value)	0.29	No
DDF parameter F (1km grid value)	2.42	No

Catchment Boundaries



Date: 12/05/15

ReFH Hydrographs Whole catchment			
	1 in 100	1 in 100	1 in 1000
Time (Hrs)	1%	1% + CCA	0.10%
0	0.126	0.151	0.126
0.5	0.133	0.159	0.136
1	0.165	0.198	0.182
1.5	0.244	0.293	0.296
2	0.413	0.495	0.544
2.5	0.733	0.880	1.037
3	1.197	1.436	1.778
3.5	1.719	2.062	2.636
4	2.210	2.652	3.469
4.5	2.587	3.104	4.136
5	2.743	3.292	4.450
5.5	2.682	3.218	4.390
6	2.485	2.982	4.088
6.5	2.224	2.669	3.664
7	1.949	2.339	3.205
7.5	1.710	2.051	2.800
8	1.510	1.813	2.465
8.5	1.335	1.602	2.174
9	1.172	1.407	1.905
9.5	1.018	1.222	1.651
10	0.870	1.044	1.406
10.5	0.734	0.881	1.177
11	0.623	0.748	0.987
11.5	0.551	0.661	0.860
12	0.509	0.611	0.787
12.5	0.486	0.583	0.747
13	0.473	0.568	0.725
13.5	0.466	0.559	0.714
14	0.459	0.551	0.703
14.5	0.453	0.544	0.694
15	0.447	0.536	0.684
15.5	0.440	0.528	0.674
16	0.434	0.521	0.664
16.5	0.428	0.513	0.655
17	0.422	0.506	0.646
17.5	0.416	0.499	0.637
18	0.410	0.492	0.628
18.5	0.404	0.485	0.619
19	0.398	0.478	0.610
19.5	0.393	0.471	0.601
20	0.387	0.464	0.593
20.5	0.382	0.458	0.584
21	0.376	0.451	0.576
21.5	0.371	0.445	0.568
22	0.366	0.439	0.560
22.5	0.360	0.432	0.552
23	0.355	0.426	0.544
23.5	0.350	0.420	0.536
24	0.345	0.414	0.529
24.5	0.340	0.408	0.521
25	0.336	0.403	0.514
25.5	0.331	0.397	0.507
26	0.326	0.391	0.499
26.5	0.321	0.386	0.492
27	0.317	0.380	0.485
27.5	0.312	0.375	0.478
28	0.308	0.370	0.472
28.5	0.304	0.364	0.465
29	0.299	0.359	0.458
29.5	0.295	0.354	0.452
30	0.291	0.349	0.445
30.5	0.287	0.344	0.439
31	0.283	0.339	0.433
31.5	0.279	0.334	0.427
32	0.275	0.330	0.421
32.5	0.271	0.325	0.415
33	0.267	0.320	0.409
33.5	0.263	0.316	0.403
34	0.259	0.311	0.397
34.5	0.256	0.307	0.392
35	0.252	0.303	0.386
35.5	0.249	0.298	0.381
36	0.245	0.294	0.375
36.5	0.242	0.290	0.370
37	0.238	0.286	0.365
37.5	0.235	0.282	0.359
38	0.231	0.278	0.354
38.5	0.228	0.274	0.349
39	0.225	0.270	0.344
39.5	0.222	0.266	0.340
40	0.219	0.262	0.335
40.5	0.216	0.259	0.330
41	0.212	0.255	0.325
41.5	0.209	0.251	0.321
42	0.206	0.248	0.316
42.5	0.204	0.244	0.312
43	0.201	0.241	0.307
43.5	0.198	0.237	0.303
44	0.195	0.234	0.299
44.5	0.192	0.231	0.294
45	0.190	0.227	0.290
45.5	0.187	0.224	0.286
46	0.184	0.221	0.282
46.5	0.182	0.218	0.278
47	0.179	0.215	0.274
47.5	0.176	0.212	0.270
48	0.174	0.209	0.266
48.5	0.171	0.206	0.263

Peak

North Catchment - Watercourse 1 (Golden Grove Drain)			
	1 in 100	1 in 100	1 in 1000
Time (Hrs)	1%	1% + CCA	0.10%
0	0.065	0.078	0.065
0.5	0.069	0.082	0.070
1	0.085	0.102	0.094
1.5	0.126	0.151	0.153
2	0.213	0.256	0.281
2.5	0.379	0.455	0.536
3	0.619	0.742	0.919
3.5	0.888	1.066	1.362
4	1.142	1.371	1.793
4.5	1.337	1.604	2.138
5	1.418	1.701	2.300
5.5	1.386	1.663	2.269
6	1.284	1.541	2.113
6.5	1.149	1.379	1.893
7	1.007	1.209	1.656
7.5	0.884	1.060	1.447
8	0.781	0.937	1.274
8.5	0.690	0.828	1.124
9	0.606	0.727	0.985
9.5	0.526	0.631	0.853
10	0.450	0.540	0.727
10.5	0.379	0.455	0.608
11	0.322	0.386	0.510
11.5	0.285	0.342	0.445
12	0.263	0.316	0.407
12.5	0.251	0.302	0.386
13	0.245	0.294	0.375
13.5	0.241	0.289	0.369
14	0.237	0.285	0.364
14.5	0.234	0.281	0.358
15	0.231	0.277	0.353
15.5	0.227	0.273	0.348
16	0.224	0.269	0.343
16.5	0.221	0.265	0.339
17	0.218	0.262	0.334
17.5	0.215	0.258	0.329
18	0.212	0.254	0.324
18.5	0.209	0.251	0.320
19	0.206	0.247	0.315
19.5	0.203	0.244	0.311
20	0.200	0.240	0.306
20.5	0.197	0.237	0.302
21	0.194	0.233	0.298
21.5	0.192	0.230	0.293
22	0.189	0.227	0.289
22.5	0.186	0.224	0.285
23	0.184	0.220	0.281
23.5	0.181	0.217	0.277
24	0.178	0.214	0.273
24.5	0.176	0.211	0.269
25	0.173	0.208	0.266
25.5	0.171	0.205	0.262
26	0.169	0.202	0.258
26.5	0.166	0.199	0.254
27	0.164	0.197	0.251
27.5	0.161	0.194	0.247
28	0.159	0.191	0.244
28.5	0.157	0.188	0.240
29	0.155	0.186	0.237
29.5	0.152	0.183	0.233
30	0.150	0.180	0.230
30.5	0.148	0.178	0.227
31	0.146	0.175	0.224
31.5	0.144	0.173	0.221
32	0.142	0.170	0.217
32.5	0.140	0.168	0.214
33	0.138	0.166	0.211
33.5	0.136	0.163	0.208
34	0.134	0.161	0.205
34.5	0.132	0.159	0.202
35	0.130	0.156	0.200
35.5	0.128	0.154	0.197
36	0.127	0.152	0.194
36.5	0.125	0.150	0.191
37	0.123	0.148	0.188
37.5	0.121	0.146	0.186
38	0.120	0.144	0.183
38.5	0.118	0.142	0.181
39	0.116	0.140	0.178
39.5	0.115	0.138	0.175
40	0.113	0.136	0.173
40.5	0.111	0.134	0.171
41	0.110	0.132	0.168
41.5	0.108	0.130	0.166
42	0.107	0.128	0.163
42.5	0.105	0.126	0.161
43	0.104	0.124	0.159
43.5	0.102	0.123	0.157
44	0.101	0.121	0.154
44.5	0.099	0.119	0.152
45	0.098	0.118	0.150
45.5	0.097	0.116	0.148
46	0.095	0.114	0.146
46.5	0.094	0.113	0.144
47	0.093	0.111	0.142
47.5	0.091	0.109	0.140
48	0.090	0.108	0.138
48.5	0.089	0.106	0.136

Peak

South Catchment - Watercourse 2 (South Trib.)			
	1 in 100	1 in 100	1 in 1000
Time (Hrs)	1%	1% + CCA	0.10%
0	0.054	0.065	0.054
0.5	0.057	0.068	0.058
1	0.071	0.085	0.078
1.5	0.105	0.126	0.127
2	0.177	0.212	0.233
2.5	0.314	0.377	0.445
3	0.513	0.616	0.762
3.5	0.737	0.884	1.130
4	0.948	1.137	1.487
4.5	1.109	1.331	1.773
5	1.176	1.411	1.908
5.5	1.150	1.380	1.882
6	1.065	1.278	1.753
6.5	0.953	1.144	1.571
7	0.836	1.003	1.374
7.5	0.733	0.880	1.201
8	0.648	0.777	1.057
8.5	0.572	0.687	0.932
9	0.503	0.603	0.817
9.5	0.436	0.524	0.708
10	0.373	0.448	0.603
10.5	0.315	0.378	0.505
11	0.267	0.321	0.423
11.5	0.236	0.283	0.369
12	0.218	0.262	0.337
12.5	0.208	0.250	0.320
13	0.203	0.244	0.311
13.5	0.200	0.240	0.306
14	0.197	0.236	0.302
14.5	0.194	0.233	0.297
15	0.191	0.230	0.293
15.5	0.189	0.226	0.289
16	0.186	0.223	0.285
16.5	0.183	0.220	0.281
17	0.181	0.217	0.277
17.5	0.178	0.214	0.273
18	0.176	0.211	0.269
18.5	0.173	0.208	0.265
19	0.171	0.205	0.261
19.5	0.168	0.202	0.258
20	0.166	0.199	0.254
20.5	0.164	0.196	0.250
21	0.161	0.194	0.247
21.5	0.159	0.191	0.243
22	0.157	0.188	0.240
22.5	0.155	0.185	0.237
23	0.152	0.183	0.233
23.5	0.150	0.180	0.230
24	0.148	0.178	0.227
24.5	0.146	0.175	0.223
25	0.144	0.173	0.220
25.5	0.142	0.170	0.217
26	0.140	0.168	0.214
26.5	0.138	0.165	0.211
27	0.136	0.163	0.208
27.5	0.134	0.161	0.205
28	0.132	0.158	0.202
28.5	0.130	0.156	0.199
29	0.128	0.154	0.196
29.5	0.127	0.152	0.194
30	0.125	0.150	0.191
30.5	0.123	0.148	0.188
31	0.121	0.145	0.186
31.5	0.119	0.143	0.183
32	0.118	0.141	0.180
32.5	0.116	0.139	0.178
33	0.114	0.137	0.175
33.5	0.113	0.135	0.173
34	0.111	0.133	0.170
34.5	0.110	0.132	0.168
35	0.108	0.130	0.166
35.5	0.107	0.128	0.163
36	0.105	0.126	0.161
36.5	0.104	0.124	0.159
37	0.102	0.123	0.156
37.5	0.101	0.121	0.154
38	0.099	0.119	0.152
38.5	0.098	0.117	0.150
39	0.096	0.116	0.148
39.5	0.095	0.114	0.146
40	0.094	0.112	0.143
40.5	0.092	0.111	0.141
41	0.091	0.109	0.139
41.5	0.090	0.108	0.137
42	0.089	0.106	0.136
42.5	0.087	0.105	0.134
43	0.086	0.103	0.132
43.5	0.085	0.102	0.130
44	0.084	0.100	0.128
44.5	0.082	0.099	0.126
45	0.081	0.097	0.124
45.5	0.080	0.096	0.123
46	0.079	0.095	0.121
46.5	0.078	0.093	0.119
47	0.077	0.092	0.117
47.5	0.076	0.091	0.116
48	0.075	0.089	0.114
48.5	0.074	0.088	0.113

49	0.169	0.203	0.259
49.5	0.167	0.200	0.255
50	0.164	0.197	0.252
50.5	0.162	0.194	0.248
51	0.160	0.192	0.244
51.5	0.157	0.189	0.241
52	0.155	0.186	0.238
52.5	0.153	0.184	0.234
53	0.151	0.181	0.231
53.5	0.149	0.178	0.228
54	0.147	0.176	0.224
54.5	0.144	0.173	0.221
55	0.142	0.171	0.218
55.5	0.140	0.168	0.215
56	0.138	0.166	0.212
56.5	0.136	0.164	0.209
57	0.135	0.161	0.206
57.5	0.133	0.159	0.203
58	0.131	0.157	0.200
58.5	0.129	0.155	0.197
59	0.127	0.152	0.195
59.5	0.127	0.152	0.192
60	0.127	0.152	0.189
60.5	0.127	0.152	0.186
61	0.127	0.152	0.184
61.5	0.127	0.152	0.181
62	0.127	0.152	0.179
62.5	0.127	0.152	0.176
63	0.127	0.152	0.174
63.5	0.127	0.152	0.171
64	0.127	0.152	0.169
64.5	0.127	0.152	0.166
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65.5	0.127	0.152	0.162
66	0.127	0.152	0.159
66.5	0.127	0.152	0.157
67	0.127	0.152	0.155
67.5	0.127	0.152	0.153
68	0.127	0.152	0.150
68.5	0.127	0.152	0.148
69	0.127	0.152	0.146
69.5	0.127	0.152	0.144
70	0.127	0.152	0.142
70.5	0.127	0.152	0.140
71	0.127	0.152	0.138
71.5	0.127	0.152	0.136
72	0.127	0.152	0.134
72.5	0.127	0.152	0.132
73	0.127	0.152	0.130
73.5	0.127	0.152	0.129
74	0.127	0.152	0.127

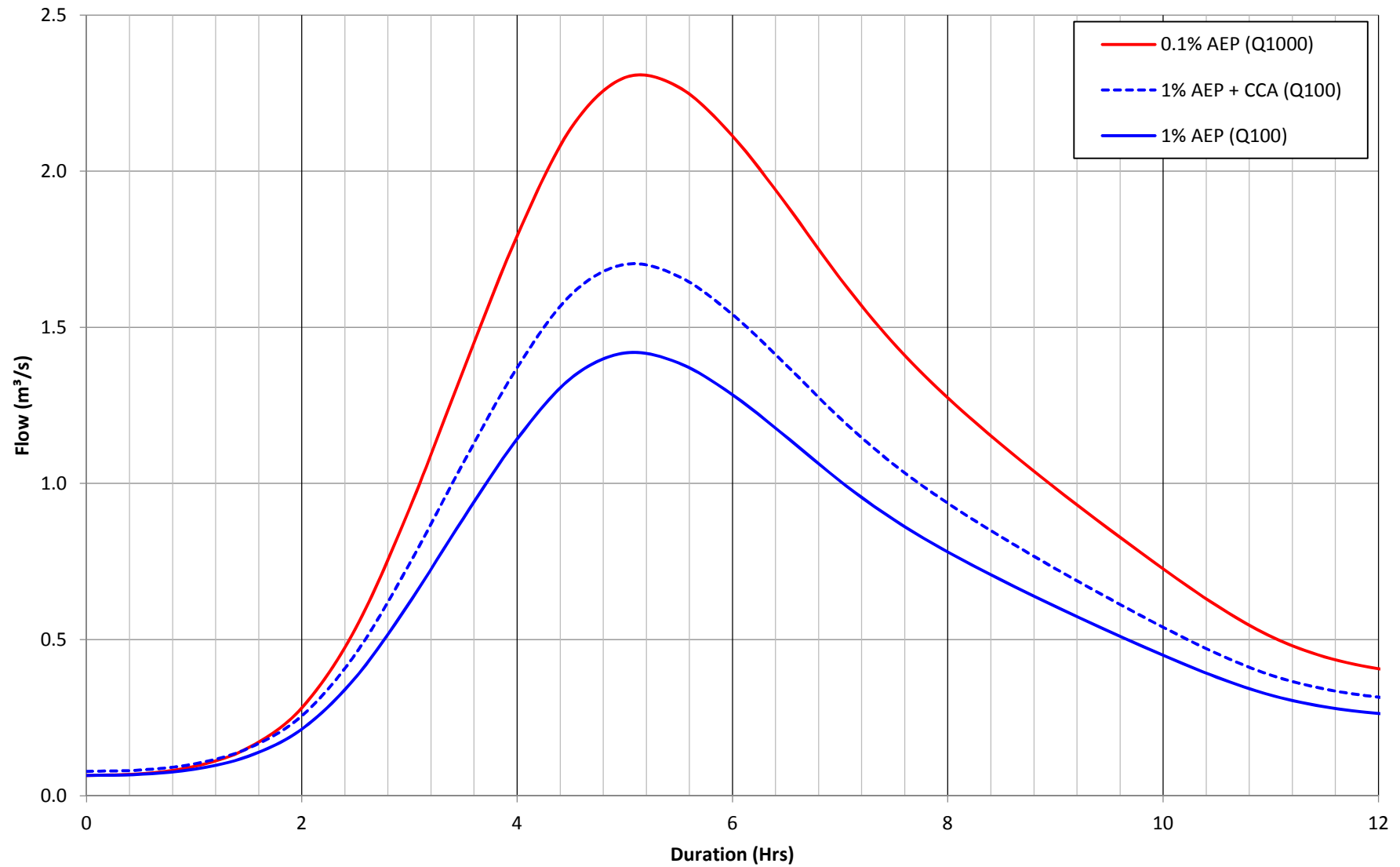
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51	0.083	0.099	0.126
51.5	0.081	0.098	0.125
52	0.080	0.096	0.123
52.5	0.079	0.095	0.121
53	0.078	0.094	0.119
53.5	0.077	0.092	0.118
54	0.076	0.091	0.116
54.5	0.075	0.090	0.114
55	0.074	0.088	0.113
55.5	0.073	0.087	0.111
56	0.072	0.086	0.110
56.5	0.071	0.085	0.108
57	0.070	0.083	0.106
57.5	0.069	0.082	0.105
58	0.068	0.081	0.103
58.5	0.067	0.080	0.102
59	0.066	0.079	0.101
59.5	0.066	0.079	0.099
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61	0.066	0.079	0.095
61.5	0.066	0.079	0.094
62	0.066	0.079	0.092
62.5	0.066	0.079	0.091
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67	0.066	0.079	0.080
67.5	0.066	0.079	0.079
68	0.066	0.079	0.078
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69	0.066	0.079	0.076
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70.5	0.066	0.079	0.072
71	0.066	0.079	0.071
71.5	0.066	0.079	0.070
72	0.066	0.079	0.069
72.5	0.066	0.079	0.068
73	0.066	0.079	0.067
73.5	0.066	0.079	0.066
74	0.066	0.079	0.065

49	0.072	0.087	0.111
49.5	0.071	0.086	0.109
50	0.070	0.085	0.108
50.5	0.069	0.083	0.106
51	0.068	0.082	0.105
51.5	0.067	0.081	0.103
52	0.067	0.080	0.102
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53	0.065	0.078	0.099
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57	0.058	0.069	0.088
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58.5	0.055	0.066	0.085
59	0.054	0.065	0.083
59.5	0.054	0.065	0.082
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61	0.054	0.065	0.079
61.5	0.054	0.065	0.078
62	0.054	0.065	0.077
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63.5	0.054	0.065	0.073
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68.5	0.054	0.065	0.064
69	0.054	0.065	0.063
69.5	0.054	0.065	0.062
70	0.054	0.065	0.061
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71	0.054	0.065	0.059
71.5	0.054	0.065	0.058
72	0.054	0.065	0.058
72.5	0.054	0.065	0.057
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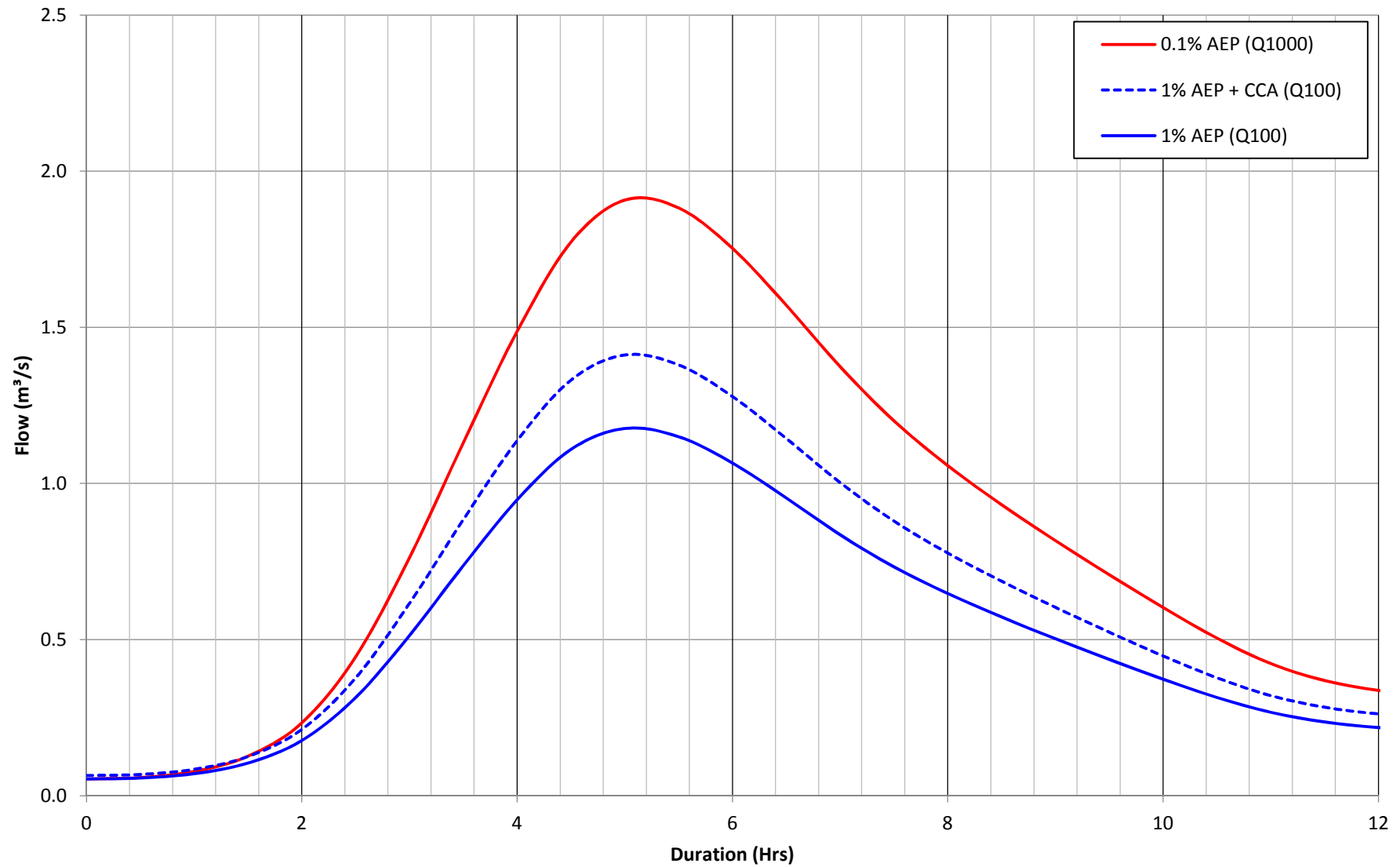
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70.5	0.004	0.004	0.004
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71.5	0.004	0.004	0.004
72	0.004	0.004	0.004
72.5	0.004	0.004	0.004
73	0.004	0.004	0.004
73.5	0.004	0.004	0.004
74	0.004	0.004	0.004

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69.5	0.003	0.004	0.004
70	0.003	0.004	0.004
70.5	0.003	0.004	0.004
71	0.003	0.004	0.004
71.5	0.003	0.004	0.003
72	0.003	0.004	0.003
72.5	0.003	0.004	0.003
73	0.003	0.004	0.003
73.5	0.003	0.004	0.003
74	0.003	0.004	0.003

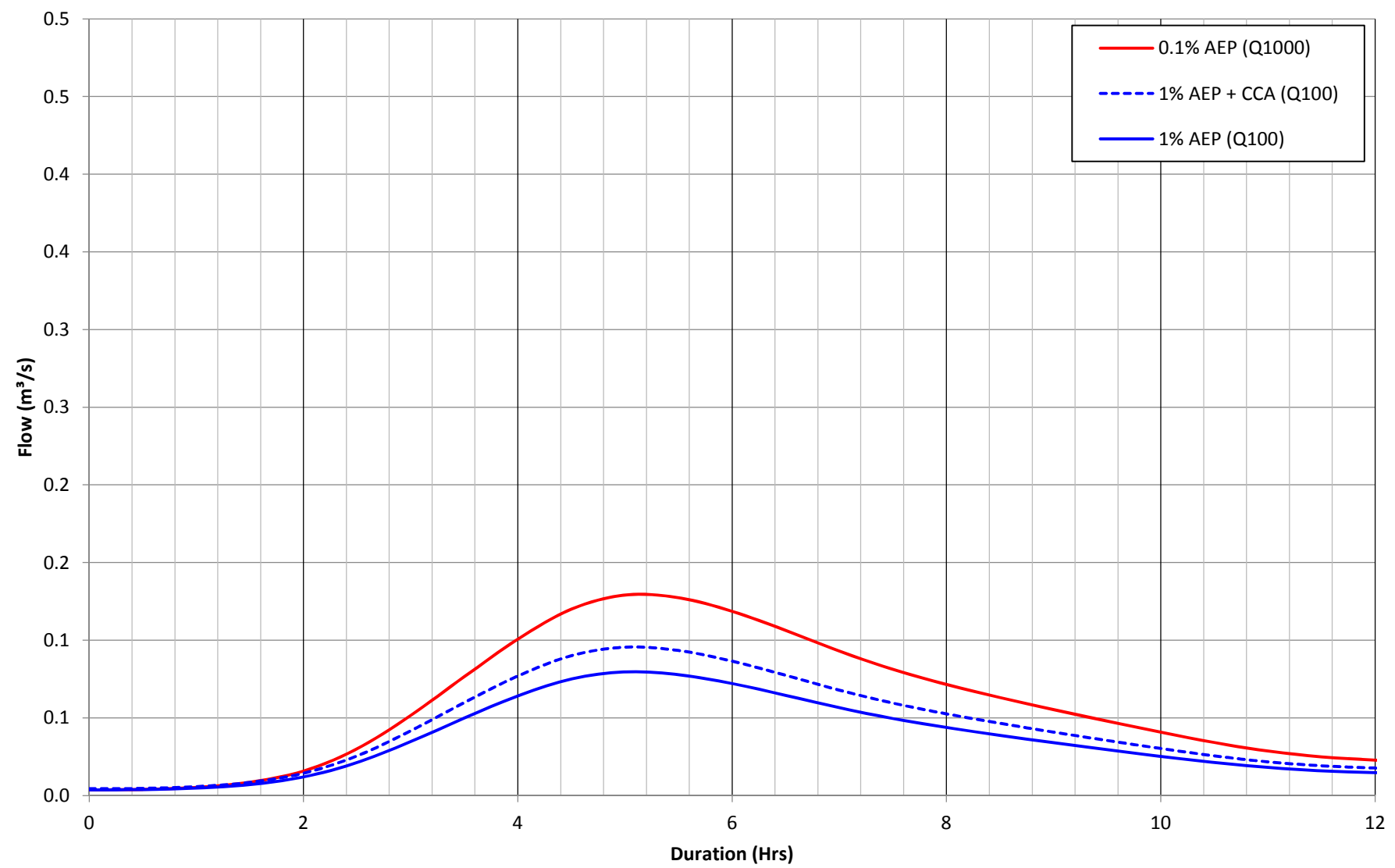
Design Hydrographs - Watercourse 1 (Golden Grove Drain)



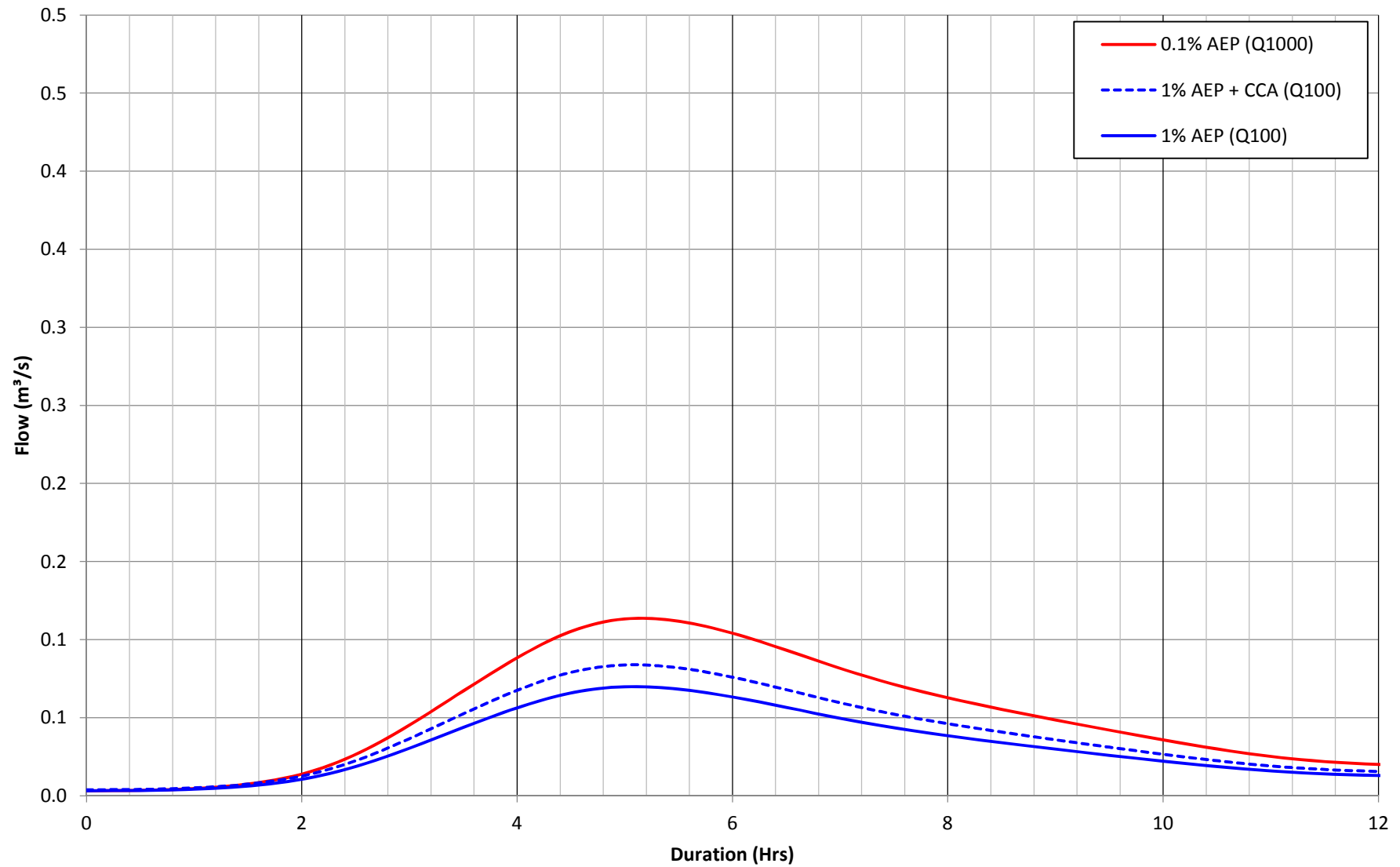
Design Hydrographs - Watercourse 2 (South Trib)



Design Hydrographs - Watercourse 3 (East Trib)



Design Hydrographs - Lateral Inflow



Appendix G – Tabulated 1D Model Results Data

Hydraulic Model Results - Tributaries of Pulford Brook @ Llyndir Ln, Rossett



1D Model Results - Maximum Water Levels (mAOD)

Job Name: Former Golden Groves Inn, Rossett
Job Number: w3178
Date: 26/05/15
Model Type: MIKEFLOOD (2014 SP3)

Primary Models	
Model Ref	Event Details
Q100	1% AEP
Q100CC	1% AEP + CCA
Q1000	0.1% AEP

Blockage Scenarios & Sensitivity Tests		
Model Ref	Event Details	Scenario
BL1-100	1% AEP + CCA	100% Blockage Llyndir Lane Culvert
ST1	0.1% AEP	+20% Roughness (Channel and Floodplain)
ST2		-20% Roughness (Channel and Floodplain)
ST3		Inflow sensitivity test - +20% uncertainty test
ST4		DS Bnd set as 11.3m AOD (increased by 400mm)

		Q100	Q100CC	Q1000	BL1-100		ST1		ST2		ST3		ST4	
1D Node Label	Features	Max WL (mAOD)	Max WL (mAOD)	Max WL (mAOD)	Max WL (mAOD)	WL Diff vs Q200CC (m)	Max WL (mAOD)	WL Diff vs Q100CC (m)	Max WL (mAOD)	WL Diff vs Q100CC (m)	Max WL (mAOD)	WL Diff vs Q100CC (m)	Max WL (mAOD)	WL Diff vs Q100CC (m)
WATERCOURSE1 0		14.539	14.606	14.730	14.606	0.000	14.815	0.085	14.638	-0.092	14.815	0.085	14.730	0.000
WATERCOURSE1 17.175		14.405	14.467	14.583	14.467	0.000	14.662	0.079	14.497	-0.086	14.661	0.078	14.583	0.000
WATERCOURSE1 34.35		14.275	14.334	14.444	14.334	0.000	14.520	0.076	14.362	-0.082	14.519	0.075	14.444	0.000
WATERCOURSE1 51.525		14.149	14.208	14.320	14.208	0.000	14.397	0.077	14.237	-0.083	14.396	0.076	14.320	0.000
WATERCOURSE1 68.7		14.035	14.101	14.223	14.101	0.000	14.305	0.082	14.132	-0.091	14.306	0.083	14.223	0.000
WATERCOURSE1 84.375		13.939	14.012	14.143	14.012	0.000	14.229	0.086	14.045	-0.098	14.230	0.087	14.143	0.000
WATERCOURSE1 100.05		13.852	13.928	14.065	13.929	0.001	14.154	0.089	13.964	-0.101	14.155	0.090	14.065	0.000
WATERCOURSE1 115.725		13.769	13.847	13.985	13.847	0.000	14.074	0.089	13.883	-0.102	14.075	0.090	13.985	0.000
WATERCOURSE1 131.4		13.687	13.762	13.896	13.762	0.000	13.984	0.088	13.796	-0.100	13.984	0.088	13.896	0.000
WATERCOURSE1 147.74		13.603	13.675	13.804	13.675	0.000	13.890	0.086	13.707	-0.097	13.890	0.086	13.804	0.000
WATERCOURSE1 164.08		13.518	13.587	13.712	13.587	0.000	13.796	0.084	13.618	-0.094	13.796	0.084	13.712	0.000
WATERCOURSE1 180.42		13.432	13.498	13.620	13.498	0.000	13.702	0.082	13.528	-0.092	13.702	0.082	13.620	0.000
WATERCOURSE1 196.76		13.343	13.408	13.528	13.409	0.001	13.609	0.081	13.438	-0.090	13.609	0.081	13.528	0.000
WATERCOURSE1 213.1		13.249	13.316	13.437	13.366	0.050	13.517	0.080	13.345	-0.092	13.517	0.080	13.437	0.000
WATERCOURSE1 230.7		13.149	13.217	13.339	13.366	0.149	13.420	0.081	13.247	-0.092	13.419	0.080	13.339	0.000
WATERCOURSE1 248.3		13.053	13.123	13.244	13.366	0.243	13.323	0.079	13.152	-0.092	13.322	0.078	13.244	0.000
WATERCOURSE1 265.9		12.963	13.033	13.150	13.366	0.333	13.226	0.076	13.061	-0.089	13.226	0.076	13.150	0.000
WATERCOURSE1 283.5		12.881	12.948	13.058	13.366	0.418	13.129	0.071	12.975	-0.083	13.128	0.070	13.058	0.000
WATERCOURSE1 300.74		12.810	12.871	12.972	13.366	0.495	13.036	0.064	12.896	-0.076	13.035	0.063	12.972	0.000
WATERCOURSE1 317.98		12.750	12.802	12.892	13.366	0.564	12.946	0.054	12.824	-0.068	12.945	0.053	12.892	0.000
WATERCOURSE1 335.22		12.701	12.746	12.823	13.366	0.620	12.865	0.042	12.767	-0.056	12.864	0.041	12.823	0.000
WATERCOURSE1 352.46		12.665	12.705	12.771	13.366	0.661	12.805	0.034	12.725	-0.046	12.806	0.035	12.771	0.000
WATERCOURSE1 369.7		12.644	12.679	12.739	13.366	0.687	12.768	0.029	12.701	-0.038	12.773	0.034	12.739	0.000
WATERCOURSE1 371.7	Struc2 (Footbridge) US	12.640	12.673	12.732	13.366	0.693	12.761	0.029	12.693	-0.039	12.765	0.033	12.732	0.000
WATERCOURSE1 375.7	Struc2 (Footbridge) DS	12.631	12.664	12.716	13.365	0.701	12.750	0.034	12.676	-0.040	12.744	0.028	12.716	0.000
WATERCOURSE1 388.03		12.620	12.650	12.696	13.364	0.714	12.726	0.030	12.662	-0.034	12.722	0.026	12.696	0.000
WATERCOURSE1 400.36	Adjacent to Site	12.611	12.638	12.678	13.363	0.725	12.705	0.027	12.650	-0.028	12.701	0.023	12.678	0.000
WATERCOURSE1 400.36		12.611	12.638	12.678	13.363	0.725	12.705	0.027	12.650	-0.028	12.701	0.023	12.678	0.000
WATERCOURSE1 418.9		12.581	12.604	12.628	13.363	0.759	12.635	0.007	12.624	-0.004	12.638	0.010	12.629	0.001
WATERCOURSE1 434.55		12.564	12.593	12.625	13.363	0.770	12.625	0.000	12.627	0.002	12.637	0.012	12.625	0.000
WATERCOURSE1 450.2		12.532	12.565	12.605	13.363	0.798	12.599	-0.006	12.616	0.011	12.622	0.017	12.606	0.001
WATERCOURSE1 465.85		12.474	12.512	12.561	13.363	0.851	12.548	-0.013	12.584	0.023	12.585	0.024	12.564	0.003
WATERCOURSE1 481.5		12.358	12.407	12.471	13.363	0.956	12.432	-0.039	12.524	0.053	12.504	0.033	12.476	0.005
WATERCOURSE1 486.5	Struc1 (Llyndir Ln Cul) US	12.364	12.415	12.483	13.362	0.947	12.435	-0.048	12.544	0.061	12.517	0.034	12.488	0.005
WATERCOURSE1 491.4	Struc1 (Llyndir Ln Cul) DS	11.745	11.778	11.834	11.652	-0.126	11.888	0.054	11.760	-0.074	11.865	0.031	11.848	0.014
WATERCOURSE1 510.2		11.719	11.755	11.815	11.652	-0.103	11.869	0.054	11.741	-0.074	11.849	0.034	11.831	0.016
WATERCOURSE1 529		11.677	11.714	11.775	11.644	-0.070	11.833	0.058	11.696	-0.079	11.809	0.034	11.793	0.018
WATERCOURSE1 547.8		11.589	11.624	11.681	11.528	-0.096	11.743	0.062	11.596	-0.085	11.712	0.031	11.708	0.027
WATERCOURSE1 564.8		11.511	11.548	11.608	11.450	-0.098	11.672	0.064	11.518	-0.090	11.641	0.033	11.648	0.040
WATERCOURSE1 581.8		11.424	11.463	11.525	11.364	-0.099	11.592	0.067	11.431	-0.094	11.560	0.035	11.584	0.059
WATERCOURSE1 598.8		11.326	11.365	11.428	11.266	-0.099	11.497	0.069	11.331	-0.097	11.463	0.035	11.517	0.089
WATERCOURSE1 615.8		11.214	11.250	11.310	11.162	-0.088	11.379	0.069	11.217	-0.093	11.344	0.034	11.446	0.136
WATERCOURSE1 632.8		11.083	11.111	11.160	11.045	-0.066	11.221	0.061	11.085	-0.075	11.189	0.029	11.372	0.212
WATERCOURSE1 648.9		10.999	11.016	11.048	10.977	-0.039	11.099	0.051	10.988	-0.060	11.069	0.021	11.337	0.289
WATERCOURSE1 665		10.961	10.972	10.993	10.947	-0.025	11.031	0.038	10.950	-0.043	11.007	0.014	11.323	0.330
WATERCOURSE1 681.1		10.946	10.954	10.970	10.936	-0.018	10.999	0.029	10.939	-0.031	10.981	0.011	11.318	0.348
WATERCOURSE1 698.32		10.931	10.937	10.949	10.924	-0.013	10.971	0.022	10.925	-0.024	10.956	0.007	11.311	0.362

		Q100	Q100CC	Q1000
1D Node Label	Features	Max WL (mAOD)	Max WL (mAOD)	Max WL (mAOD)
WATERCOURSE1 715.54		10.920	10.924	10.931
WATERCOURSE1 732.76		10.911	10.913	10.918
WATERCOURSE1 749.98		10.904	10.905	10.907
WATERCOURSE1 767.2		10.901	10.901	10.901
WATERCOURSE1 778.75		10.901	10.901	10.901
WATERCOURSE1 789.15		10.900	10.900	10.900
WATERCOURSE2 0		15.207	15.255	15.316
WATERCOURSE2 17.2333		14.996	15.075	15.140
WATERCOURSE2 34.4667		14.792	14.876	14.999
WATERCOURSE2 51.7		14.625	14.684	14.819
WATERCOURSE2 68.9333		14.464	14.521	14.643
WATERCOURSE2 86.1667		14.310	14.365	14.470
WATERCOURSE2 103.4		14.161	14.216	14.318
WATERCOURSE2 121.35		14.011	14.065	14.167
WATERCOURSE2 139.3		13.866	13.919	14.016
WATERCOURSE2 157.25		13.734	13.787	13.879
WATERCOURSE2 175.2	Struc5 (Footbridge) US	13.634	13.688	13.779
WATERCOURSE2 179.2	Struc5 (Footbridge) DS	13.516	13.581	13.698
WATERCOURSE2 197.575		13.450	13.517	13.637
WATERCOURSE2 215.95		13.371	13.439	13.560
WATERCOURSE2 234.325		13.278	13.344	13.464
WATERCOURSE2 252.7		13.168	13.228	13.338
WATERCOURSE2 269.275		13.081	13.135	13.233
WATERCOURSE2 285.85		13.017	13.065	13.150
WATERCOURSE2 302.425		12.976	13.018	13.090
WATERCOURSE2 319		12.951	12.989	13.050
WATERCOURSE2 336.993		12.929	12.961	13.012
WATERCOURSE2 354.987		12.909	12.937	12.976
WATERCOURSE2 372.98		12.891	12.916	12.947
WATERCOURSE2 372.98		12.891	12.916	12.947
WATERCOURSE2 387.89		12.880	12.904	12.932
WATERCOURSE2 402.8	Struc4 (Culvert) US	12.873	12.897	12.926
WATERCOURSE2 408.1	Struc4 (Culvert) DS	12.676	12.704	12.746
WATERCOURSE2 424.58		12.668	12.697	12.739
WATERCOURSE2 441.06		12.660	12.688	12.730
WATERCOURSE2 457.54		12.653	12.681	12.723
WATERCOURSE2 474.02		12.647	12.675	12.717
WATERCOURSE2 490.5		12.641	12.669	12.712
WATERCOURSE2 502.35		12.636	12.664	12.707
WATERCOURSE2 514.2		12.631	12.659	12.703
WATERCOURSE2 533.567		12.626	12.654	12.698
WATERCOURSE2 552.933	Adjacent to Site	12.623	12.651	12.695
WATERCOURSE2 572.3		12.621	12.649	12.693
WATERCOURSE2 585.325		12.618	12.646	12.688
WATERCOURSE2 598.35		12.611	12.638	12.678
WATERCOURSE3 0		14.516	14.548	14.604
WATERCOURSE3 15.0333		14.492	14.521	14.575
WATERCOURSE3 30.0667		14.458	14.485	14.534
WATERCOURSE3 45.1		14.390	14.414	14.460
WATERCOURSE3 64.4		14.268	14.293	14.337
WATERCOURSE3 83.7		14.150	14.174	14.218
WATERCOURSE3 103		14.035	14.059	14.103
WATERCOURSE3 119.24		13.943	13.966	14.008
WATERCOURSE3 135.48		13.849	13.872	13.912
WATERCOURSE3 151.72		13.755	13.776	13.815
WATERCOURSE3 167.96		13.657	13.678	13.715
WATERCOURSE3 184.2		13.552	13.572	13.609

BL1-100	
Max WL (mAOD)	WL Diff vs Q200CC (m)
10.916	-0.008
10.915	0.002
10.912	0.007
10.906	0.005
10.903	0.002
10.900	0.000
15.255	0.000
15.075	0.000
14.876	0.000
14.684	0.000
14.521	0.000
14.365	0.000
14.216	0.000
14.065	0.000
13.919	0.000
13.787	0.000
13.688	0.000
13.582	0.001
13.517	0.000
13.439	0.000
13.365	0.021
13.365	0.137
13.365	0.230
13.365	0.300
13.365	0.347
13.365	0.376
13.365	0.404
13.365	0.428
13.365	0.449
13.365	0.449
13.365	0.461
13.365	0.468
13.363	0.659
13.363	0.666
13.363	0.675
13.363	0.682
13.363	0.688
13.363	0.694
13.363	0.699
13.363	0.704
13.363	0.709
13.363	0.712
13.363	0.714
13.363	0.717
13.363	0.725
14.548	0.000
14.521	0.000
14.485	0.000
14.414	0.000
14.293	0.000
14.174	0.000
14.059	0.000
13.966	0.000
13.872	0.000
13.776	0.000
13.678	0.000
13.572	0.000

ST1		ST2		ST3		ST4	
Max WL (mAOD)	WL Diff vs Q100CC (m)	Max WL (mAOD)	WL Diff vs Q100CC (m)	Max WL (mAOD)	WL Diff vs Q100CC (m)	Max WL (mAOD)	WL Diff vs Q100CC (m)
10.948	0.017	10.915	-0.016	10.937	0.006	11.306	0.375
10.929	0.011	10.907	-0.011	10.921	0.003	11.303	0.385
10.913	0.006	10.902	-0.005	10.908	0.001	11.302	0.395
10.901	0.000	10.902	0.001	10.901	0.000	11.302	0.401
10.901	0.000	10.901	0.000	10.901	0.000	11.301	0.400
10.900	0.000	10.900	0.000	10.900	0.000	11.300	0.400
15.355	0.039	15.272	-0.044	15.356	0.040	15.316	0.000
15.168	0.028	15.097	-0.043	15.172	0.032	15.140	0.000
15.053	0.054	14.908	-0.091	15.052	0.053	14.999	0.000
14.884	0.065	14.718	-0.101	14.883	0.064	14.819	0.000
14.716	0.073	14.549	-0.094	14.715	0.072	14.643	0.000
14.552	0.082	14.393	-0.077	14.551	0.081	14.470	0.000
14.390	0.072	14.244	-0.074	14.389	0.071	14.318	0.000
14.227	0.060	14.099	-0.068	14.228	0.061	14.167	0.000
14.066	0.050	13.964	-0.052	14.072	0.056	14.016	0.000
13.919	0.040	13.855	-0.024	13.939	0.060	13.879	0.000
13.799	0.020	13.789	0.010	13.842	0.063	13.779	0.000
13.769	0.071	13.616	-0.082	13.771	0.073	13.698	0.000
13.712	0.075	13.550	-0.087	13.714	0.077	13.637	0.000
13.637	0.077	13.470	-0.090	13.637	0.077	13.560	0.000
13.542	0.078	13.373	-0.091	13.540	0.076	13.464	0.000
13.414	0.076	13.255	-0.083	13.410	0.072	13.338	0.000
13.303	0.070	13.158	-0.075	13.299	0.066	13.233	0.000
13.210	0.060	13.086	-0.064	13.207	0.057	13.150	0.000
13.140	0.050	13.038	-0.052	13.138	0.048	13.090	0.000
13.090	0.040	13.011	-0.039	13.091	0.041	13.050	0.000
13.042	0.030	12.984	-0.028	13.045	0.033	13.012	0.000
12.995	0.019	12.960	-0.016	12.999	0.023	12.976	0.000
12.953	0.006	12.942	-0.005	12.961	0.014	12.947	0.000
12.953	0.006	12.942	-0.005	12.961	0.014	12.947	0.000
12.932	0.000	12.932	0.000	12.945	0.013	12.932	0.000
12.922	-0.004	12.932	0.006	12.941	0.015	12.926	0.000
12.783	0.037	12.703	-0.043	12.767	0.021	12.746	0.000
12.775	0.036	12.698	-0.041	12.762	0.023	12.739	0.000
12.766	0.036	12.691	-0.039	12.754	0.024	12.730	0.000
12.757	0.034	12.686	-0.037	12.747	0.024	12.724	0.001
12.750	0.033	12.681	-0.036	12.741	0.024	12.717	0.000
12.744	0.032	12.677	-0.035	12.736	0.024	12.712	0.000
12.738	0.031	12.673	-0.034	12.732	0.025	12.707	0.000
12.734	0.031	12.669	-0.034	12.729	0.026	12.703	0.000
12.728	0.030	12.666	-0.032	12.724	0.026	12.698	0.000
12.724	0.029	12.664	-0.031	12.721	0.026	12.695	0.000
12.721	0.028	12.663	-0.030	12.718	0.025	12.693	0.000
12.716	0.028	12.659	-0.029	12.713	0.025	12.688	0.000
12.705	0.027	12.650	-0.028	12.701	0.023	12.678	0.000
14.639	0.035	14.563	-0.041	14.641	0.037	14.604	0.000
14.610	0.035	14.536	-0.039	14.611	0.036	14.575	0.000
14.568	0.034	14.498	-0.036	14.569	0.035	14.534	0.000
14.493	0.033	14.425	-0.035	14.493	0.033	14.460	0.000
14.369	0.032	14.303	-0.034	14.369	0.032	14.337	0.000
14.249	0.031	14.184	-0.034	14.249	0.031	14.218	0.000
14.133	0.030	14.069	-0.034	14.133	0.030	14.103	0.000
14.038	0.030	13.976	-0.032	14.038	0.030	14.008	0.000
13.941	0.029	13.881	-0.031	13.941	0.029	13.912	0.000
13.842	0.027	13.785	-0.030	13.842	0.027	13.815	0.000
13.741	0.026	13.687	-0.028	13.744	0.029	13.715	0.000
13.635	0.026	13.582	-0.027	13.653	0.044	13.609	0.000

1D Node Label	Features	Q100	Q100CC	Q1000
		Max WL (mAOD)	Max WL (mAOD)	Max WL (mAOD)
WATERCOURSE3 204		13.406	13.431	13.493
WATERCOURSE3 220.28		13.334	13.361	13.444
WATERCOURSE3 236.56		13.264	13.296	13.410
WATERCOURSE3 252.84		13.198	13.243	13.389
WATERCOURSE3 269.12		13.145	13.206	13.377
WATERCOURSE3 285.4		13.109	13.185	13.369
WATERCOURSE3 303.36		13.085	13.171	13.364
WATERCOURSE3 321.32		13.072	13.163	13.360
WATERCOURSE3 339.28		13.065	13.158	13.358
WATERCOURSE3 357.24		13.061	13.155	13.356
WATERCOURSE3 375.2	Struc9 (Pipe) US	13.058	13.153	13.355
WATERCOURSE3 381.5	Struc9 (Pipe) DS	12.902	12.927	12.958
WATERCOURSE3 400.75		12.899	12.924	12.954
WATERCOURSE3 420	Struc8 (StoneCul) US	12.899	12.923	12.953
WATERCOURSE3 426	Struc8 (StoneCul) DS	12.892	12.917	12.947
WATERCOURSE3 442.2		12.892	12.917	12.947
WATERCOURSE3 458.4		12.892	12.917	12.947
WATERCOURSE3 474.6		12.891	12.917	12.947
WATERCOURSE3 490.8		12.891	12.917	12.947
WATERCOURSE3 507.125		12.891	12.917	12.947
WATERCOURSE3 523.45		12.891	12.916	12.947
WATERCOURSE3 539.775		12.891	12.916	12.947
WATERCOURSE3 556.1		12.891	12.916	12.947
WATERCOURSE3 567.05		12.891	12.916	12.947
WATERCOURSE3 578		12.891	12.916	12.947

BL1-100	
Max WL (mAOD)	WL Diff vs Q200CC (m)
13.431	0.000
13.369	0.008
13.369	0.073
13.369	0.126
13.369	0.163
13.369	0.184
13.369	0.198
13.369	0.206
13.369	0.211
13.369	0.214
13.369	0.216
13.365	0.438
13.365	0.441
13.365	0.442
13.365	0.448
13.365	0.448
13.365	0.448
13.365	0.448
13.365	0.448
13.365	0.449
13.365	0.449
13.365	0.449
13.365	0.449

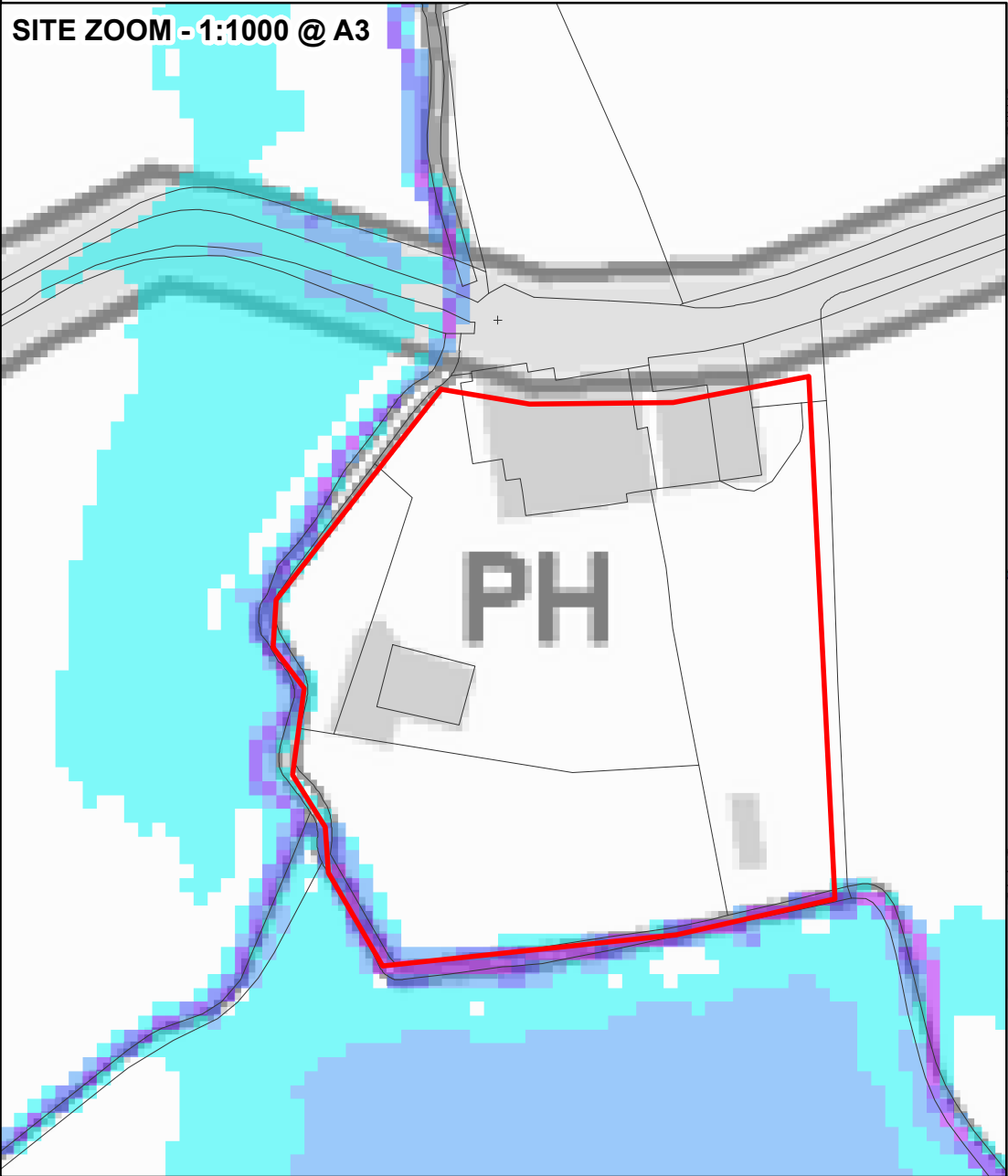
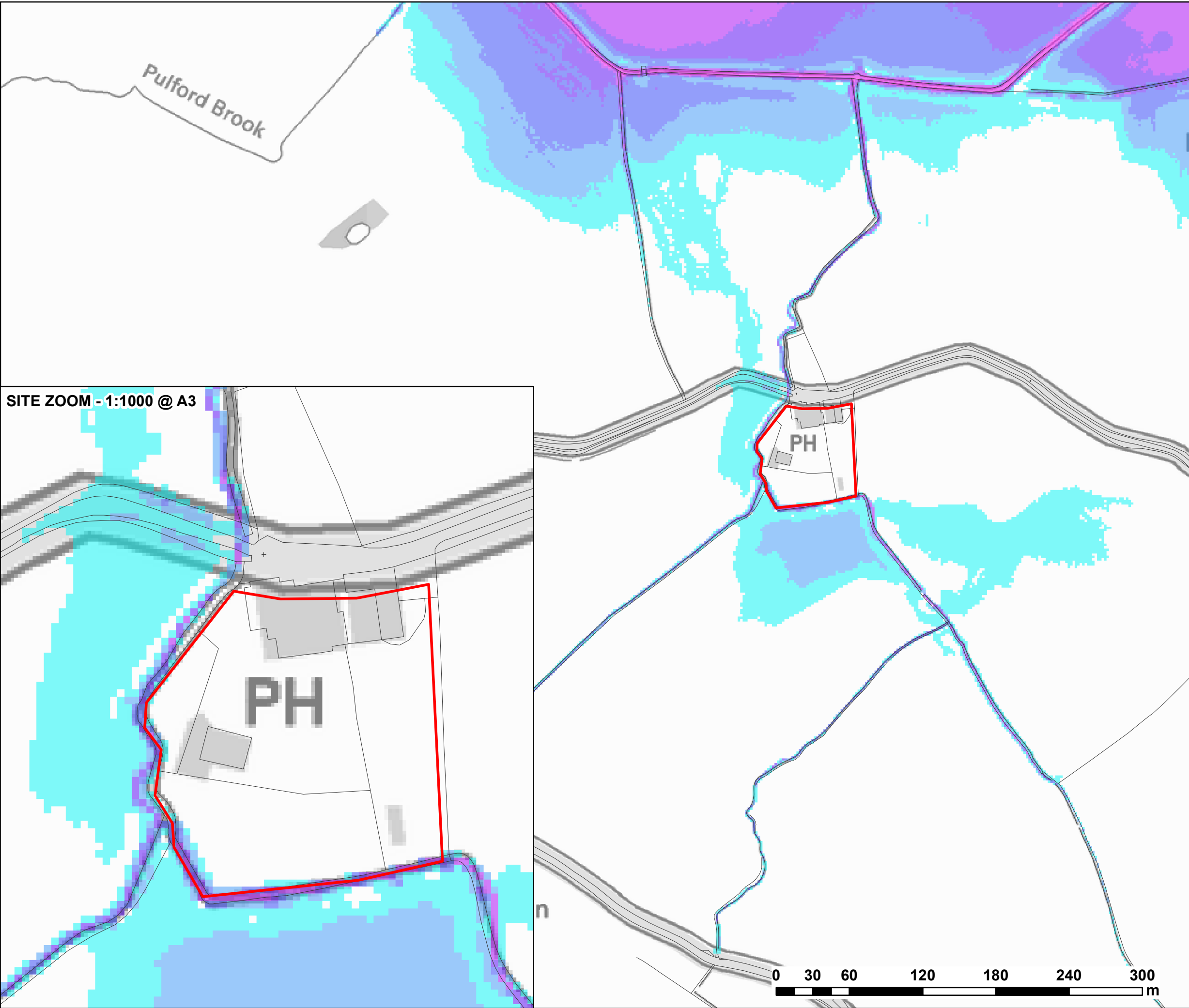
ST1		ST2		ST3		ST4	
Max WL (mAOD)	WL Diff vs Q100CC (m)	Max WL (mAOD)	WL Diff vs Q100CC (m)	Max WL (mAOD)	WL Diff vs Q100CC (m)	Max WL (mAOD)	WL Diff vs Q100CC (m)
13.525	0.032	13.459	-0.034	13.587	0.094	13.493	0.000
13.473	0.029	13.414	-0.030	13.564	0.120	13.444	0.000
13.435	0.025	13.385	-0.025	13.550	0.140	13.410	0.000
13.410	0.021	13.369	-0.020	13.542	0.153	13.389	0.000
13.394	0.017	13.361	-0.016	13.536	0.159	13.377	0.000
13.384	0.015	13.356	-0.013	13.533	0.164	13.369	0.000
13.377	0.013	13.352	-0.012	13.530	0.166	13.364	0.000
13.372	0.012	13.350	-0.010	13.528	0.168	13.360	0.000
13.369	0.011	13.349	-0.009	13.527	0.169	13.358	0.000
13.366	0.010	13.348	-0.008	13.526	0.170	13.356	0.000
13.364	0.009	13.347	-0.008	13.525	0.170	13.355	0.000
12.967	0.009	12.951	-0.007	12.974	0.016	12.958	0.000
12.960	0.006	12.948	-0.006	12.969	0.015	12.954	0.000
12.959	0.006	12.948	-0.005	12.968	0.015	12.953	0.000
12.953	0.006	12.942	-0.005	12.962	0.015	12.947	0.000
12.953	0.006	12.942	-0.005	12.962	0.015	12.947	0.000
12.953	0.006	12.942	-0.005	12.962	0.015	12.947	0.000
12.953	0.006	12.942	-0.005	12.962	0.015	12.947	0.000
12.953	0.006	12.942	-0.005	12.962	0.015	12.947	0.000
12.953	0.006	12.942	-0.005	12.962	0.015	12.947	0.000
12.953	0.006	12.942	-0.005	12.962	0.015	12.947	0.000
12.953	0.006	12.942	-0.005	12.962	0.015	12.947	0.000
12.953	0.006	12.942	-0.005	12.962	0.015	12.947	0.000
12.953	0.006	12.942	-0.005	12.962	0.015	12.947	0.000
12.953	0.006	12.942	-0.005	12.961	0.014	12.947	0.000

Appendix H – Flood Maps – Primary Models

Maximum Flood Depth

Maximum Velocity

Flood Hazard Rating



LEGEND

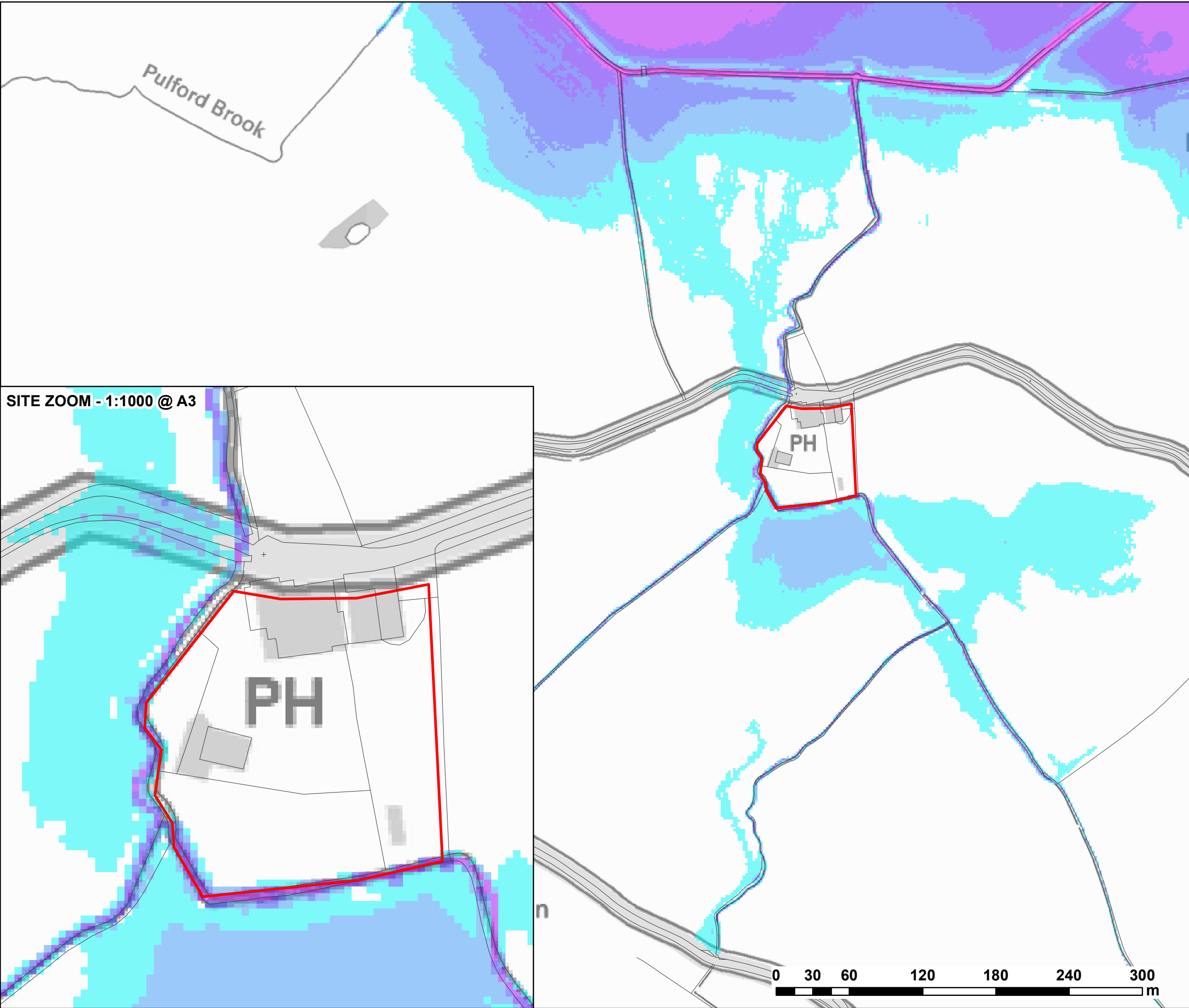
 Site Boundary

Maximum Flood Depth (m)

-  0 - 0.3
-  0.3 - 0.6
-  0.6 - 0.9
-  0.9 - 1.2
-  1.2 - 2.4
-  > 2.4



CLIENT:			
URBAN DEVELOPMENTS			
 Waterco Ltd Eden Court, Ruthin, LL15 1NJ 01824 702220 www.waterco.co.uk			
SCHEME:			
FORMER GOLDEN GROVES INN, LLYNDIR LANE, ROSSETT			
PLOT TITLE:			
MAXIMUM FLOOD DEPTH 1% AEP FLUVIAL EVENT EXISTING SITE LEVELS			
PLOT STATUS:			
ISSUE			
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
RCL	JJ	RCL	1:3,000 (UNLESS STATED OTHERWISE)
DATE:	PLOT NAME:		REV:
28/05/2015	W3178-Q100-EXT-D		-



SITE ZOOM - 1:1000 @ A3

LEGEND

Site Boundary

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT

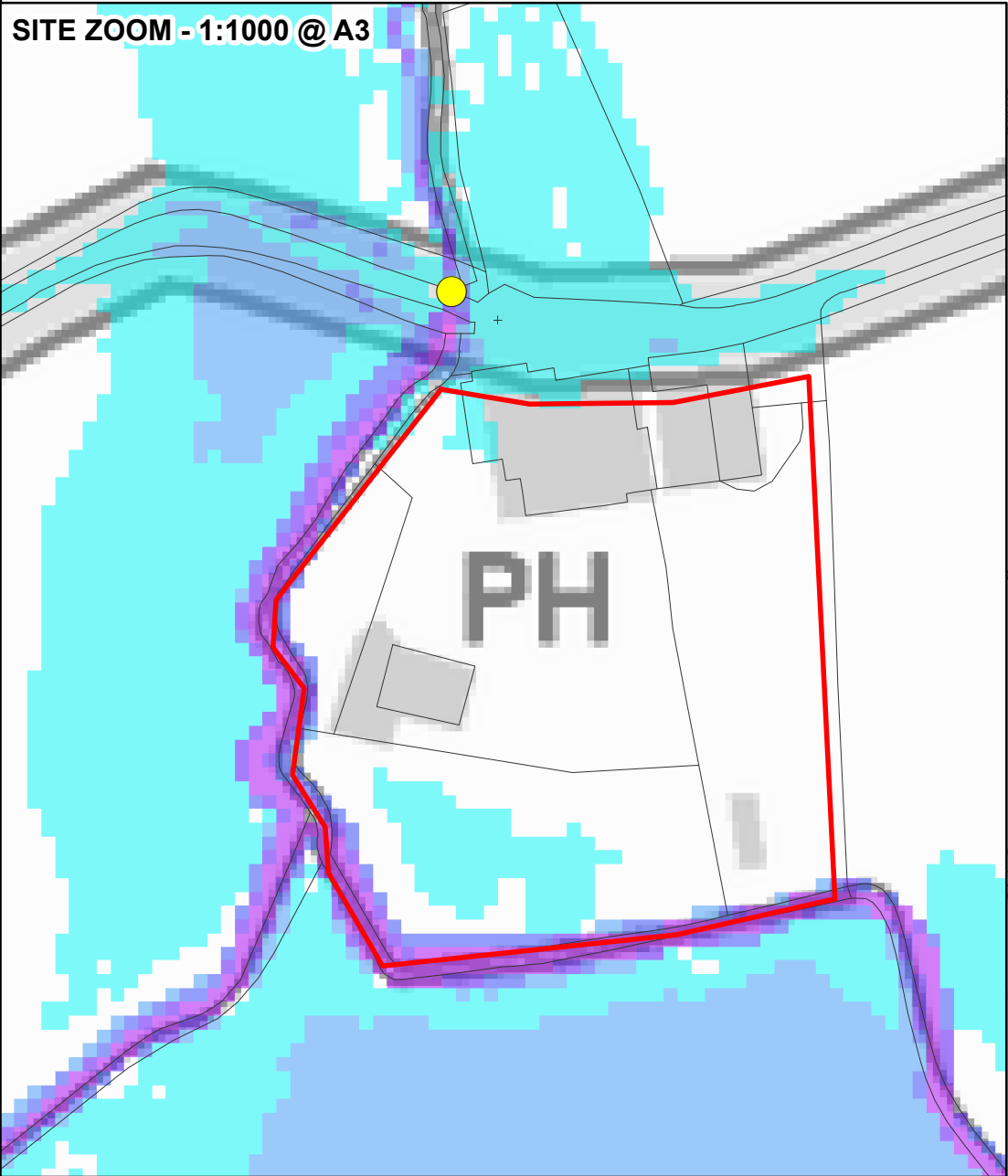
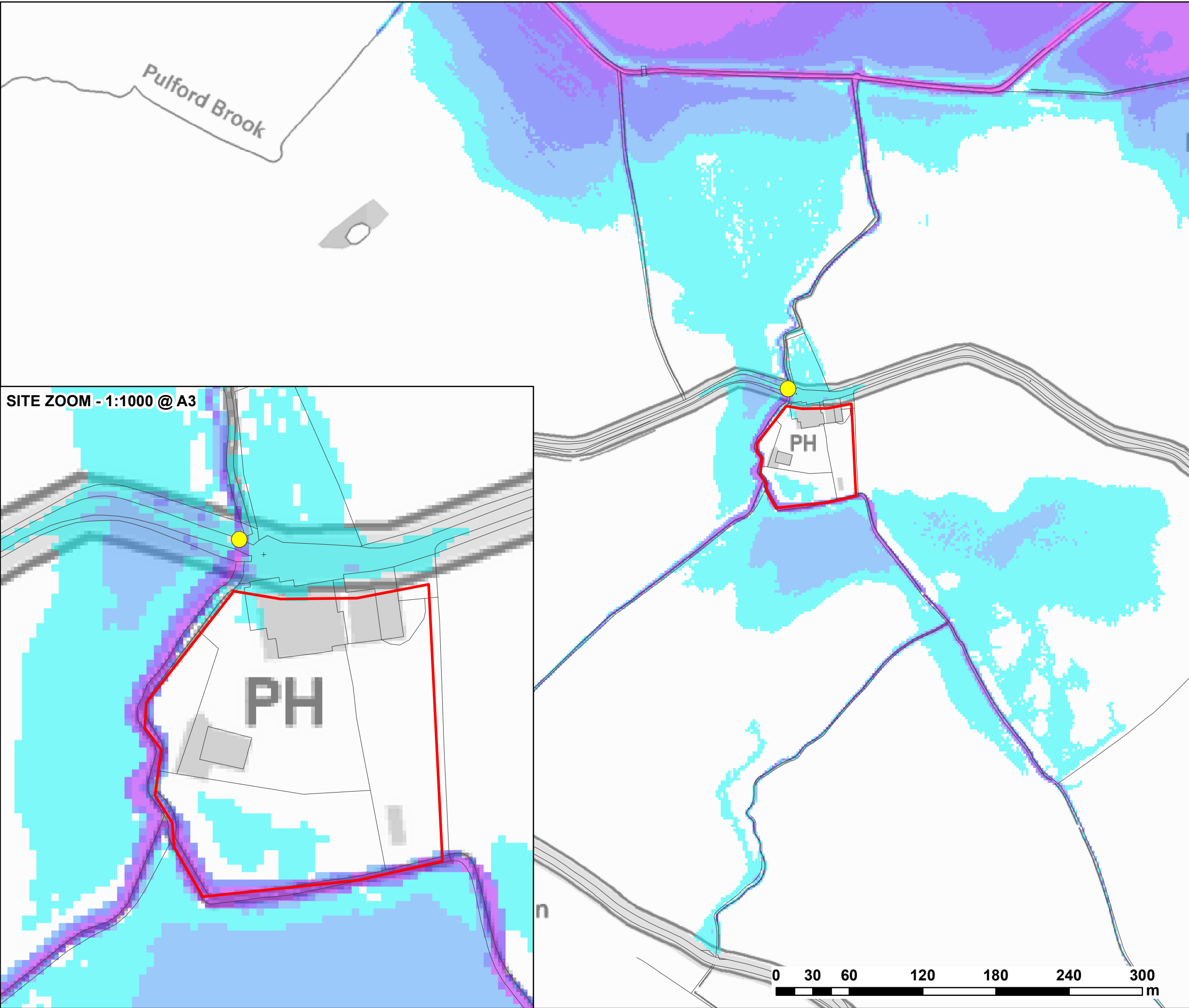
PLOT TITLE:

MAXIMUM FLOOD DEPTH
1% AEP + CCA FLUVIAL EVENT
EXISTING SITE LEVELS

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q100CC-EXT-D	REV: -	



LEGEND

Site Boundary

● Blockage Location (BL1)

Maximum Flood Depth (m)

	0 - 0.3
	0.3 - 0.6
	0.6 - 0.9
	0.9 - 1.2
	1.2 - 2.4
	> 2.4

CLIENT:

URBAN DEVELOPMENTS

Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

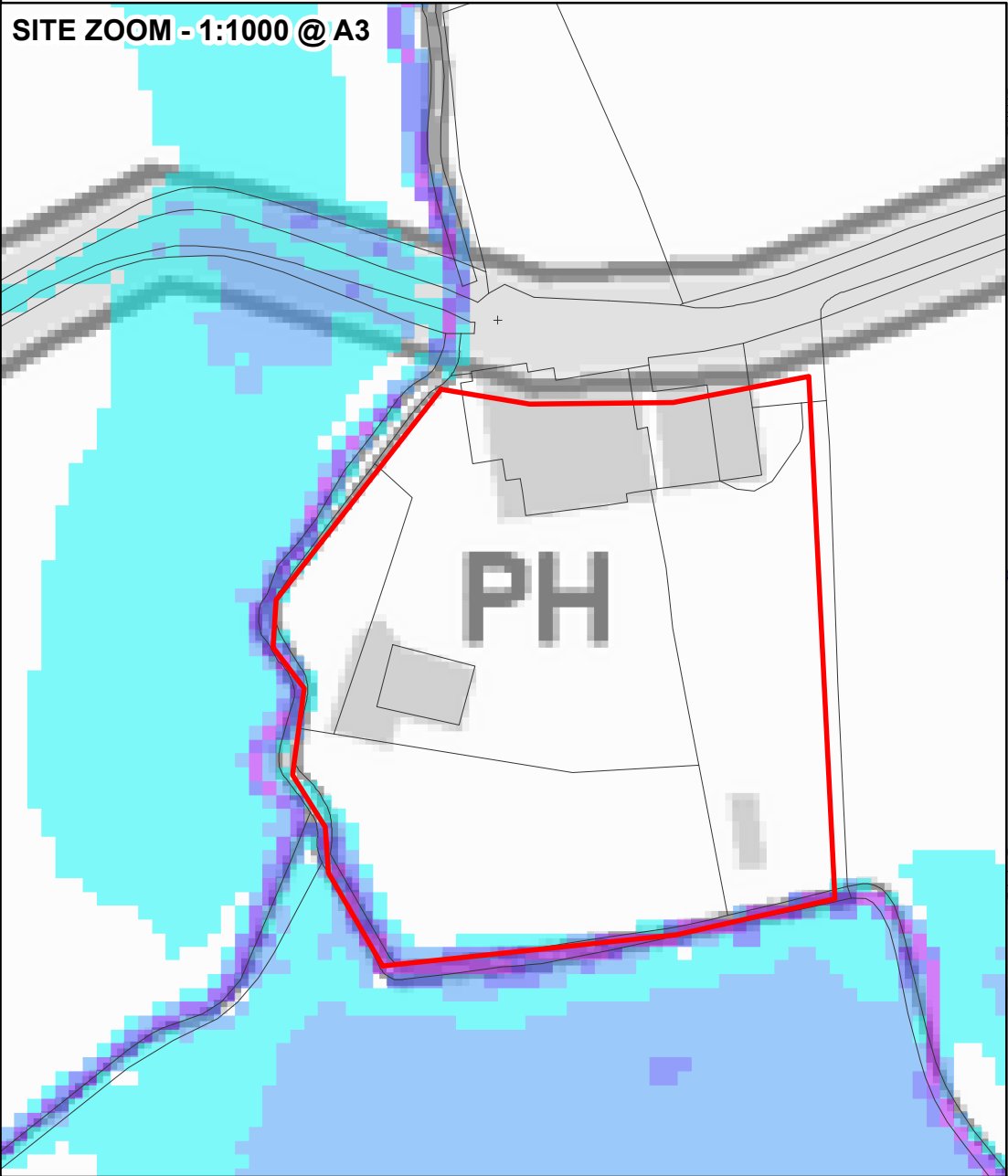
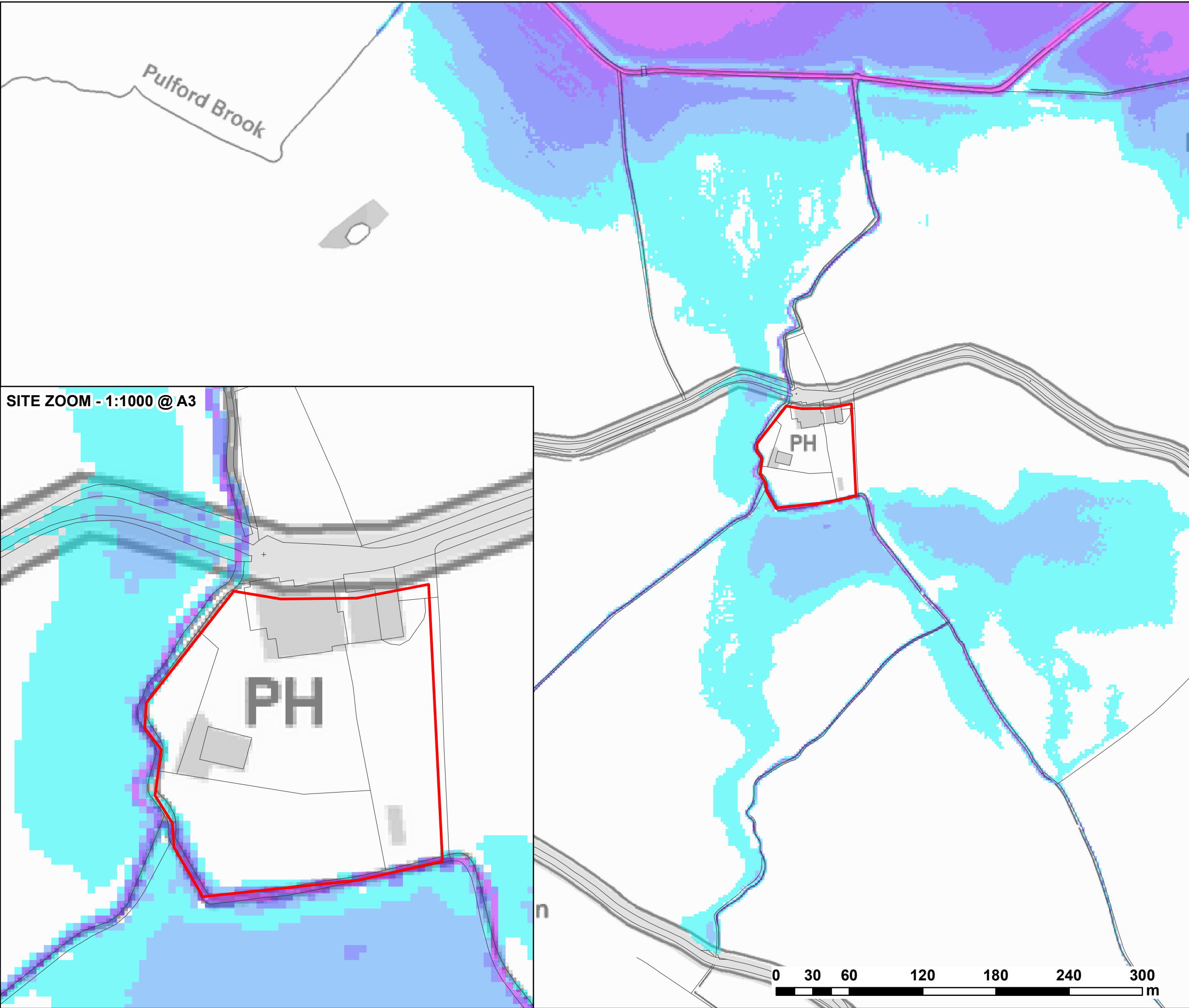
**MAXIMUM FLOOD DEPTH
1% AEP + CCA FLUVIAL EVENT
LLYNDIR LN CULVERT BLOCKAGE (100%)**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
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DATE: 28/05/2015	PLOT NAME: W3178-Q100CC-BL1-100-D	REV: -
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LEGEND

 Site Boundary

Maximum Flood Depth (m)

-  0 - 0.3
-  0.3 - 0.6
-  0.6 - 0.9
-  0.9 - 1.2
-  1.2 - 2.4
-  > 2.4



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

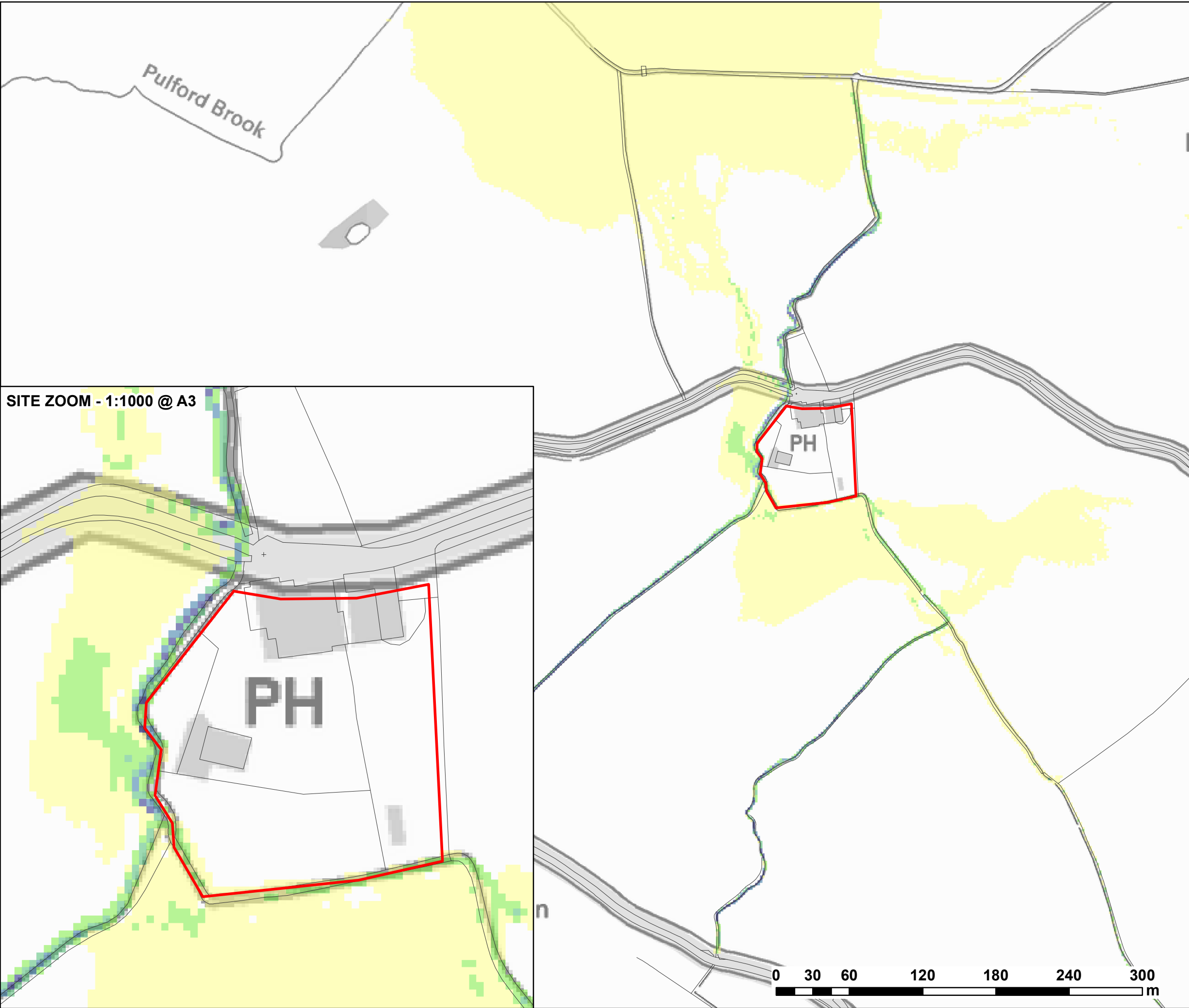
PLOT TITLE:

**MAXIMUM FLOOD DEPTH
0.1% AEP FLUVIAL EVENT
EXISTING SITE LEVELS**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q1000-EXT-D		REV: -



LEGEND

Site Boundary

Maximum Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT

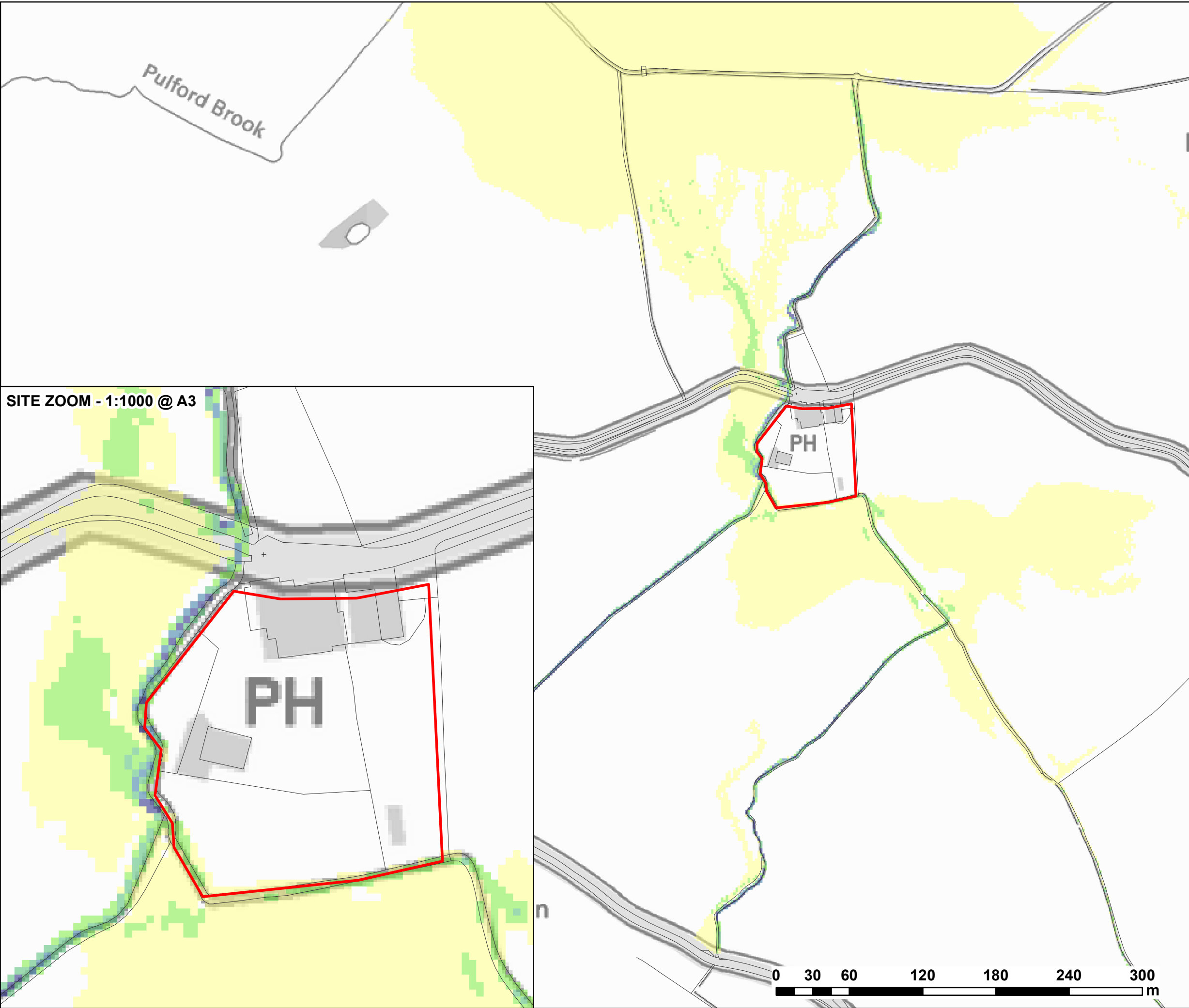
PLOT TITLE:

MAXIMUM VELOCITY
1% AEP FLUVIAL EVENT
EXISTING SITE LEVELS

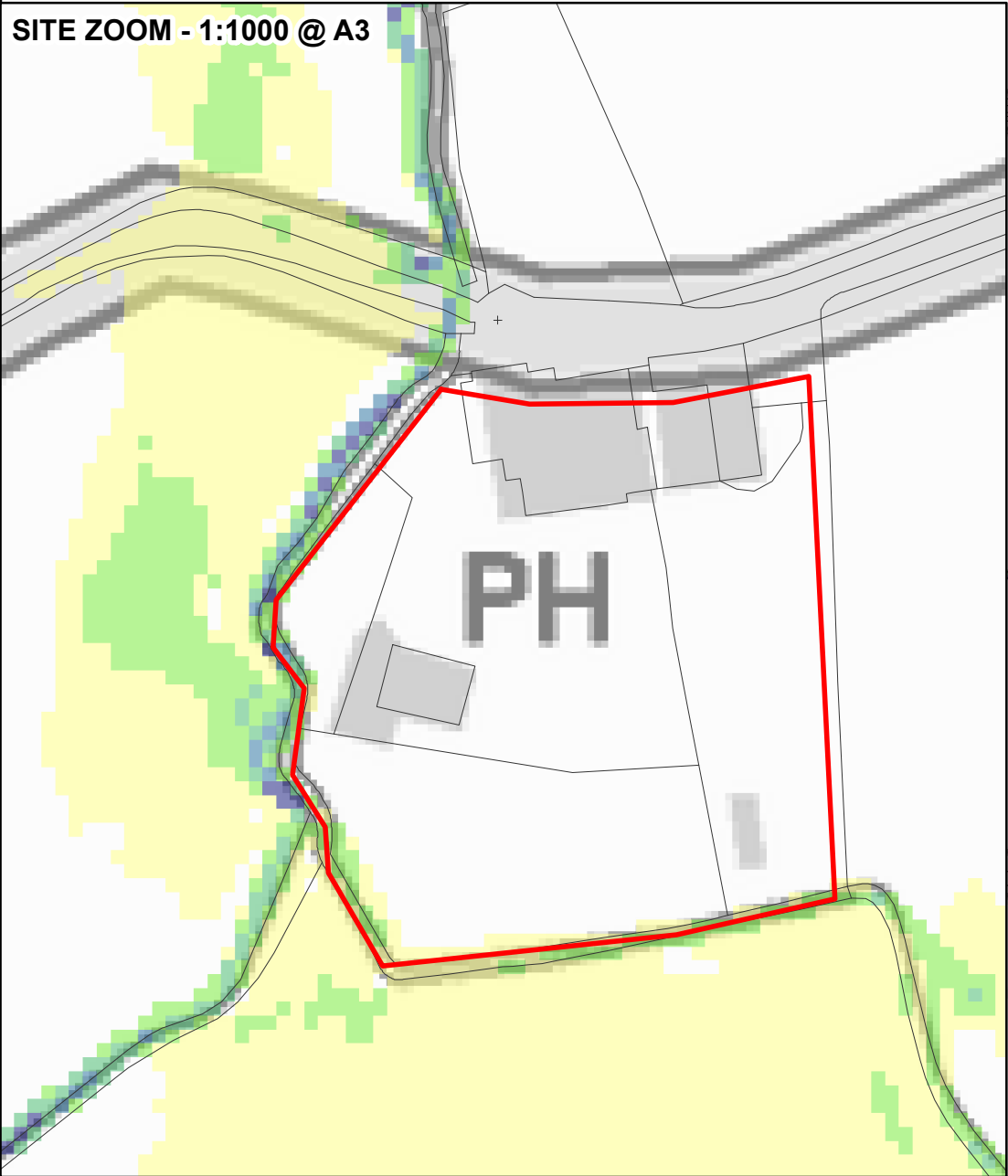
PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q100-EXT-V	REV: -	



SITE ZOOM - 1:1000 @ A3



LEGEND

Site Boundary

Maximum Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT

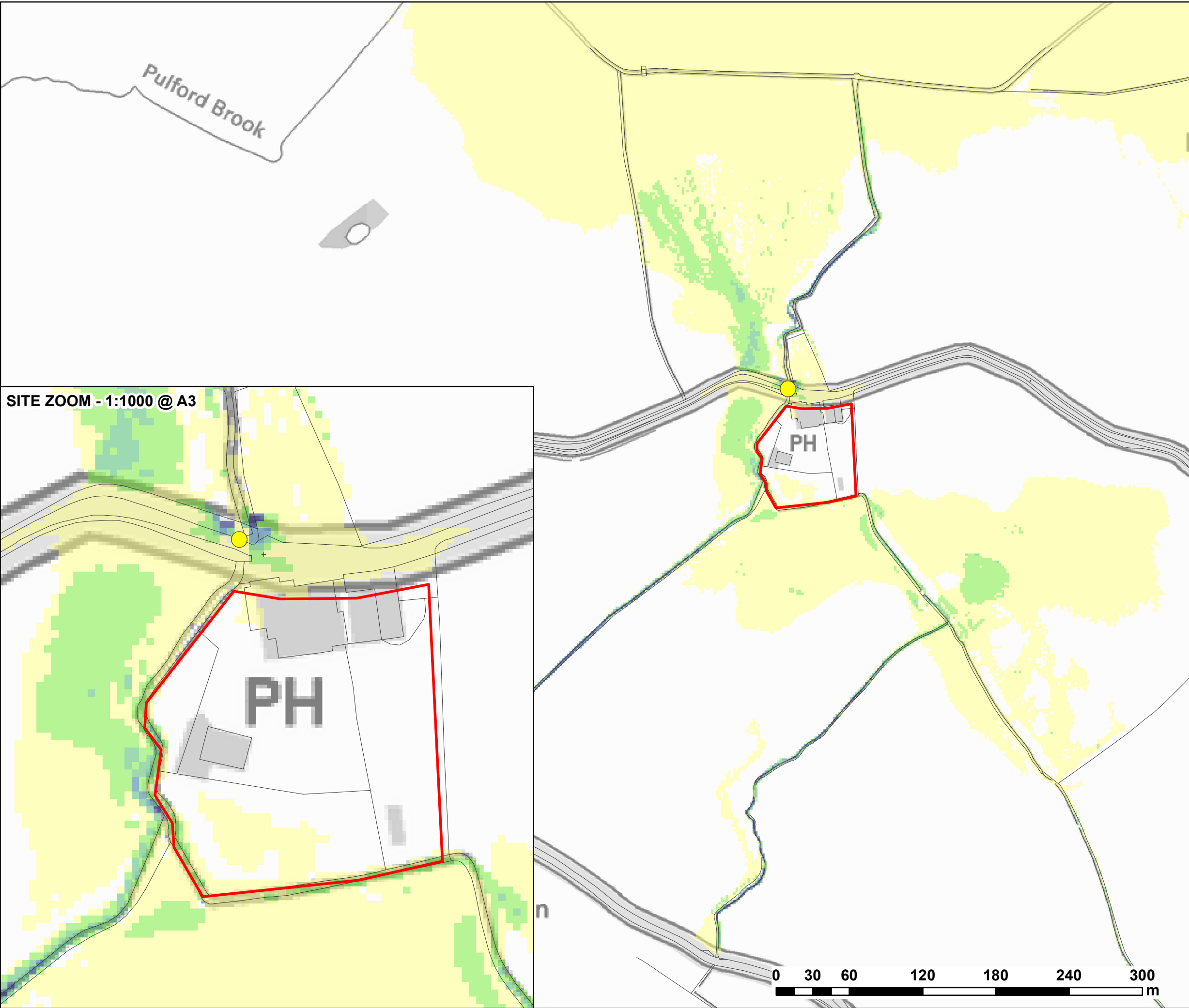
PLOT TITLE:

MAXIMUM VELOCITY
1% AEP + CCA FLUVIAL EVENT
EXISTING SITE LEVELS

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q100CC-EXT-V	REV: -	



LEGEND

Site Boundary

Blockage Location (BL1)

Maximum Velocity (m/s)

0.0 - 0.3

0.3 - 0.6

0.6 - 0.9

0.9 - 1.2

> 1.2

CLIENT:

URBAN DEVELOPMENTS

Waterco Ltd

Eden Court, Ruthin, LL15 1NJ

01824 702220

www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

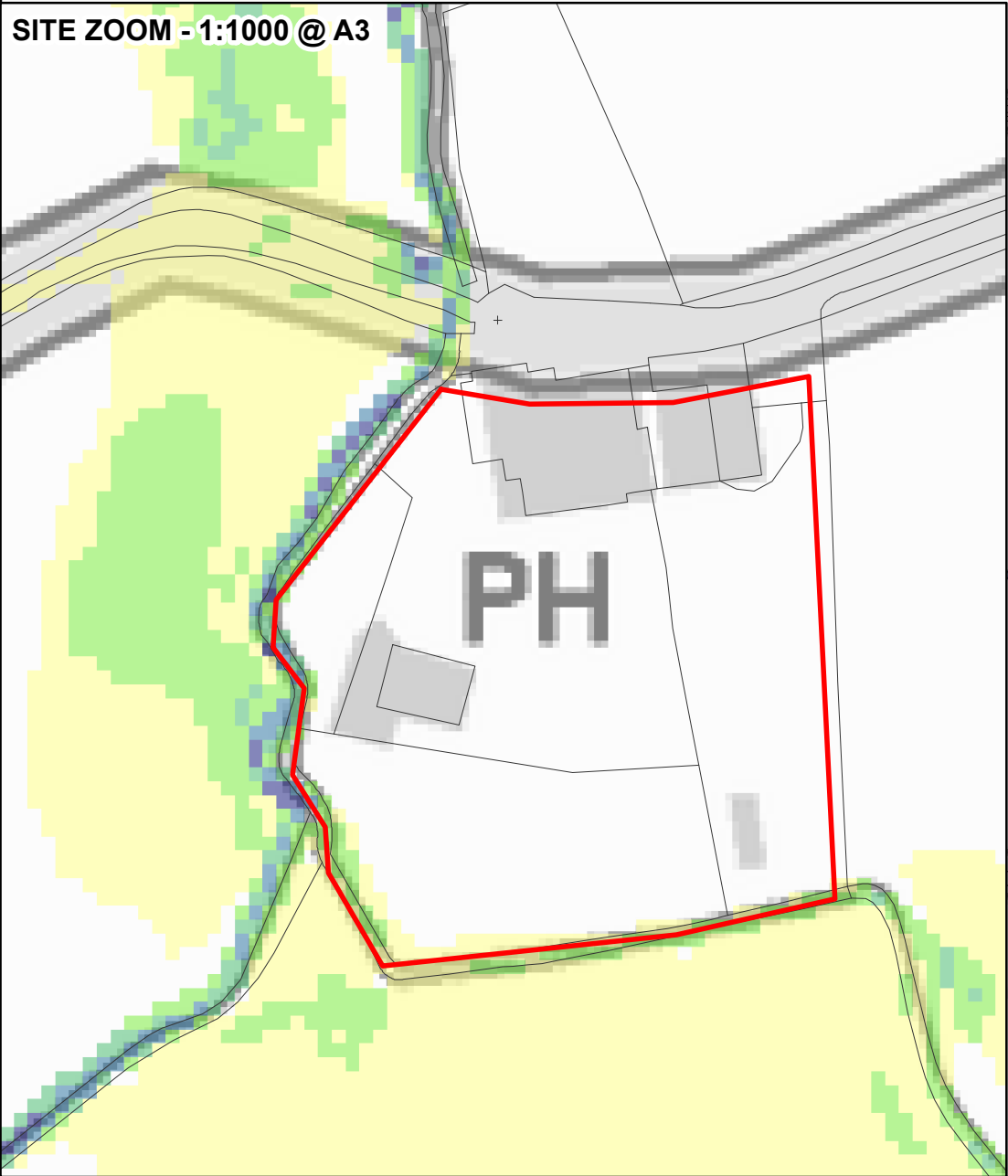
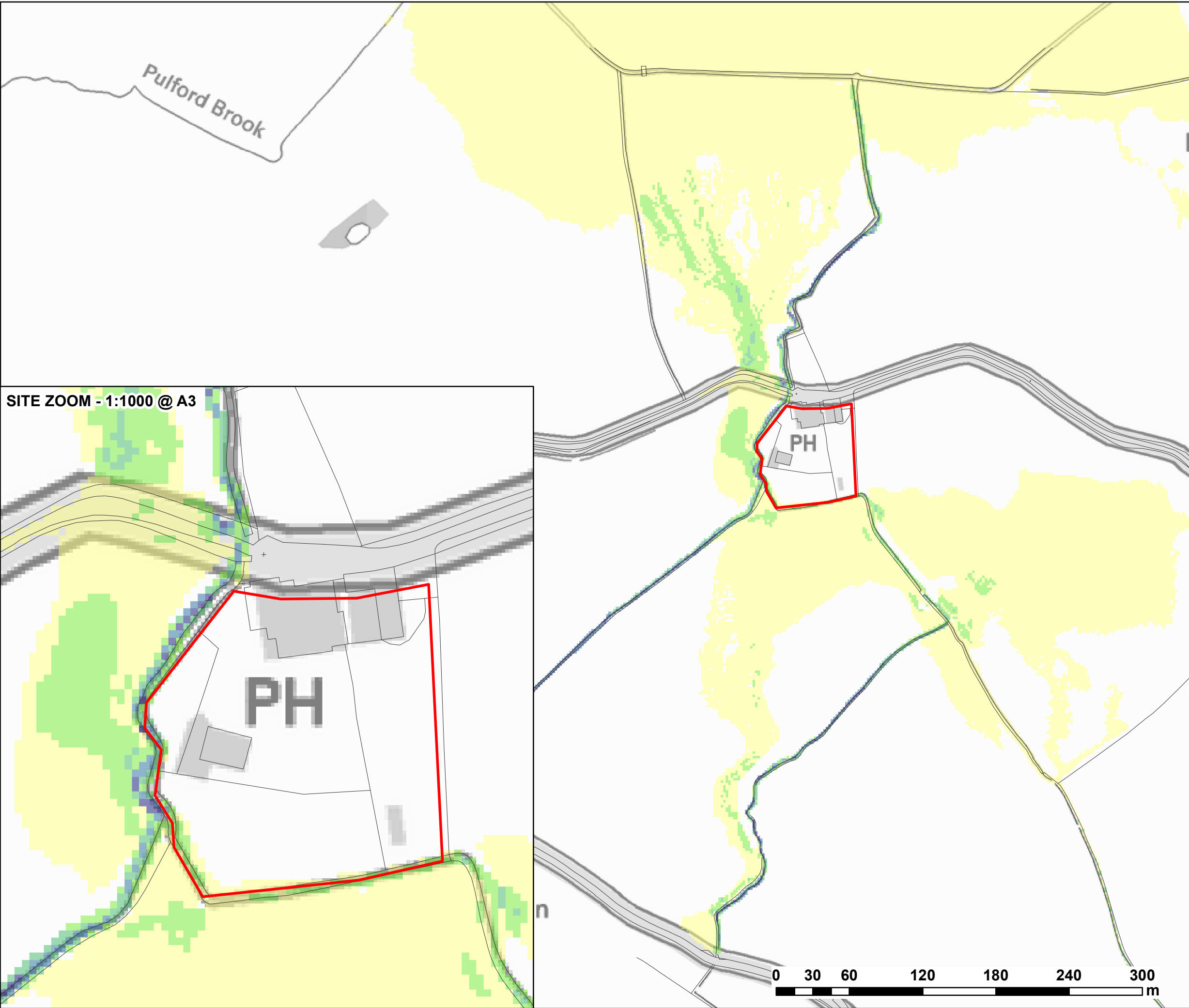
PLOT TITLE:

MAXIMUM VELOCITY
1% AEP + CCA FLUVIAL EVENT
LLYNDIR LN CULVERT BLOCKAGE (100%)

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q100CC-BL1-100-V		REV: -



LEGEND

 Site Boundary

Maximum Velocity (m/s)

 0.0 - 0.3

 0.3 - 0.6

 0.6 - 0.9

 0.9 - 1.2

 > 1.2



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
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SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

**MAXIMUM VELOCITY
0.1% AEP FLUVIAL EVENT
EXISTING SITE LEVELS**

PLOT STATUS:

ISSUE

DRAWN:

RCL

CHECKED:

JJ

APPROVED:

RCL

PLOT SCALE @ A3:

1:3,000

(UNLESS STATED OTHERWISE)

DATE:

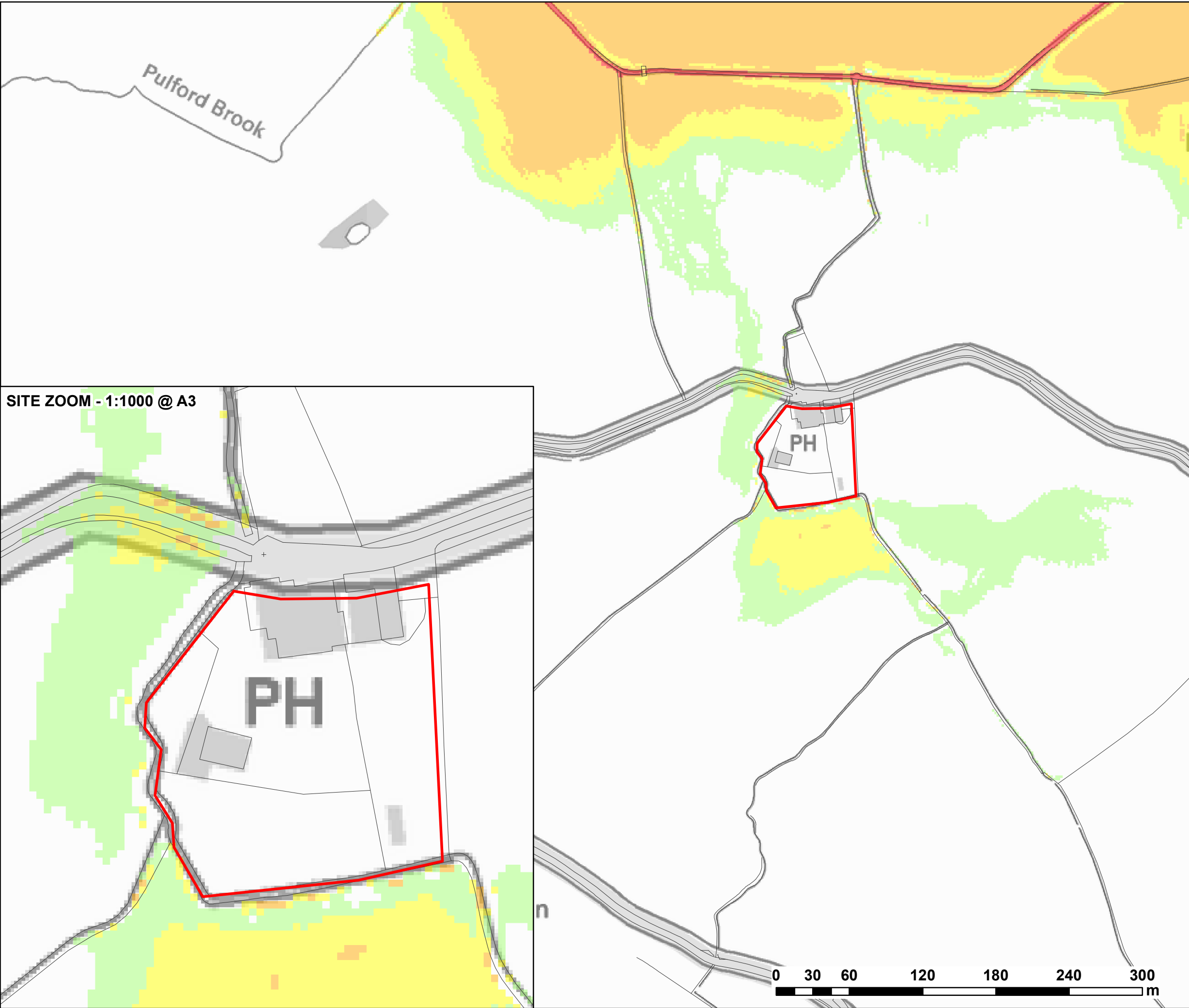
28/05/2015

PLOT NAME:

W3178-Q1000-EXT-V

REV:

-



SITE ZOOM - 1:1000 @ A3

LEGEND



Site Boundary

Maximum Flood Hazard Rating (FD2320)



< 0.75 (Caution)



0.75 - 1.25 (Danger for Some)



1.25 - 2 (Danger for Most)



> 2.0 (Danger for All)



CLIENT:

URBAN DEVELOPMENTS



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01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

**FLOOD HAZARD RATING
1% AEP FLUVIAL EVENT
EXISTING SITE LEVELS**

PLOT STATUS:

ISSUE

DRAWN:

RCL

CHECKED:

JJ

APPROVED:

RCL

PLOT SCALE @ A3:

1:3,000

(UNLESS STATED OTHERWISE)

DATE:

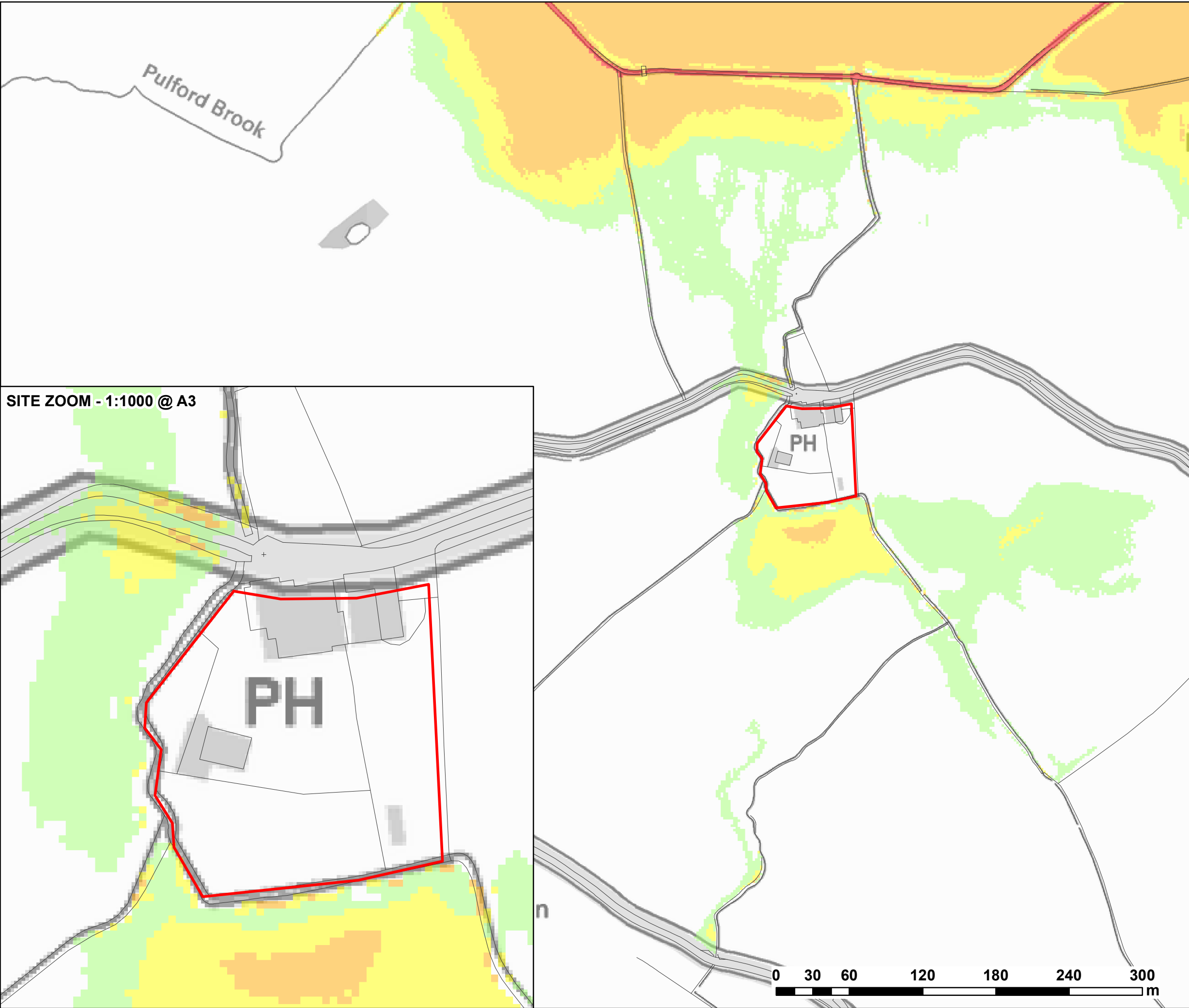
28/05/2015

PLOT NAME:

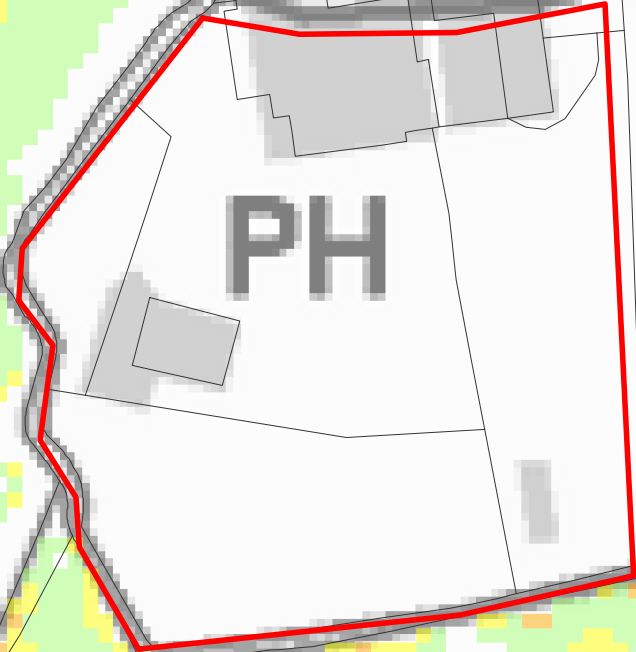
W3178-Q100-EXT-H

REV:

-



SITE ZOOM - 1:1000 @ A3



LEGEND



Site Boundary

Maximum Flood Hazard Rating (FD2320)



< 0.75 (Caution)



0.75 - 1.25 (Danger for Some)



1.25 - 2 (Danger for Most)



> 2.0 (Danger for All)



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
www.waterco.co.uk

SCHEME:

FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT

PLOT TITLE:

FLOOD HAZARD RATING
1% AEP + CCA FLUVIAL EVENT
EXISTING SITE LEVELS

PLOT STATUS:

ISSUE

DRAWN:

RCL

CHECKED:

JJ

APPROVED:

RCL

PLOT SCALE @ A3:

1:3,000

(UNLESS STATED OTHERWISE)

DATE:

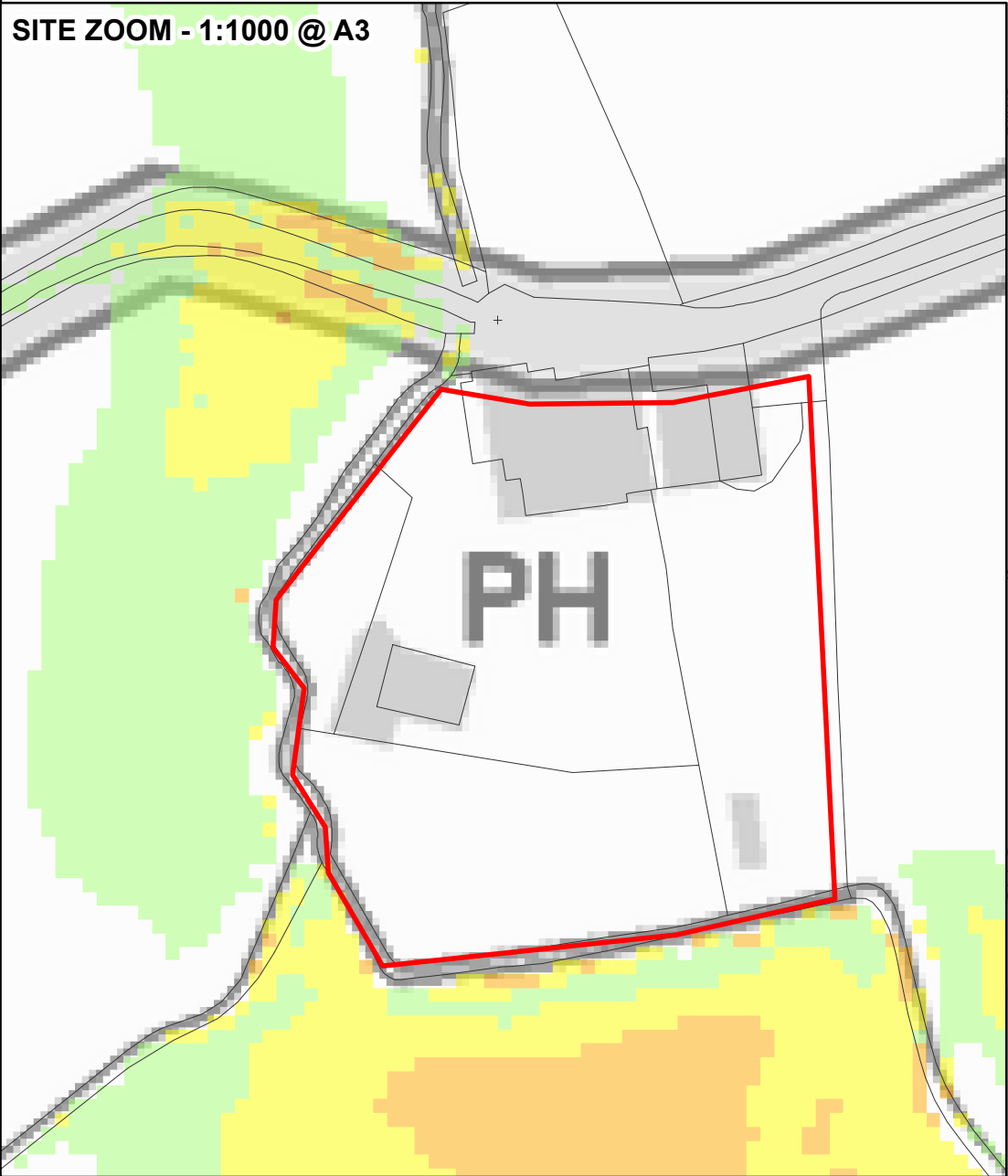
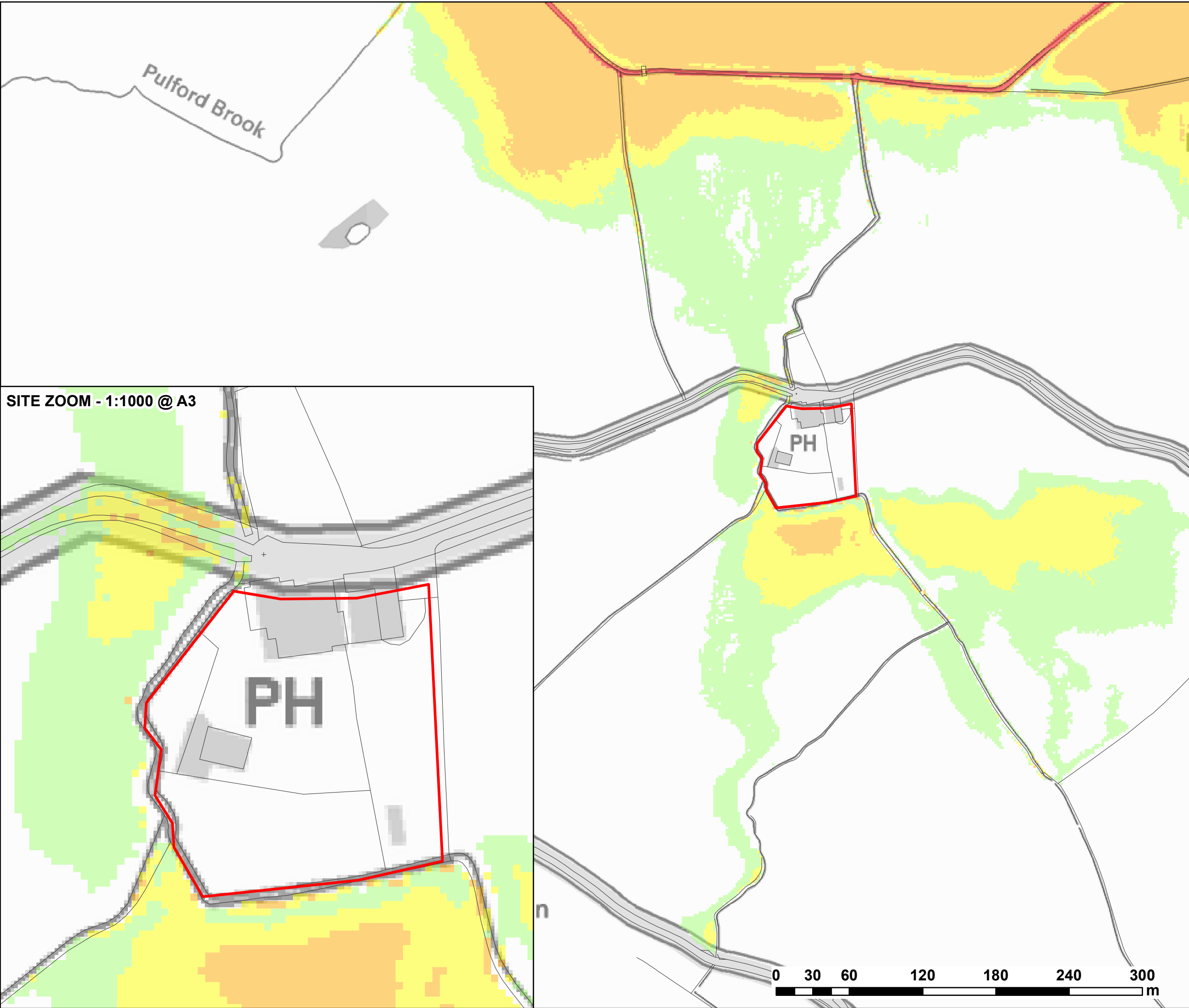
28/05/2015

PLOT NAME:

W3178-Q100CC-EXT-H

REV:

-



LEGEND

-  Site Boundary
- Maximum Flood Hazard Rating (FD2320)**
-  < 0.75 (Caution)
 -  0.75 - 1.25 (Danger for Some)
 -  1.25 - 2 (Danger for Most)
 -  > 2.0 (Danger for All)



CLIENT:

URBAN DEVELOPMENTS



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Eden Court, Ruthin, LL15 1NJ
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SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

**FLOOD HAZARD RATING
0.1% AEP FLUVIAL EVENT
EXISTING SITE LEVELS**

PLOT STATUS:

ISSUE

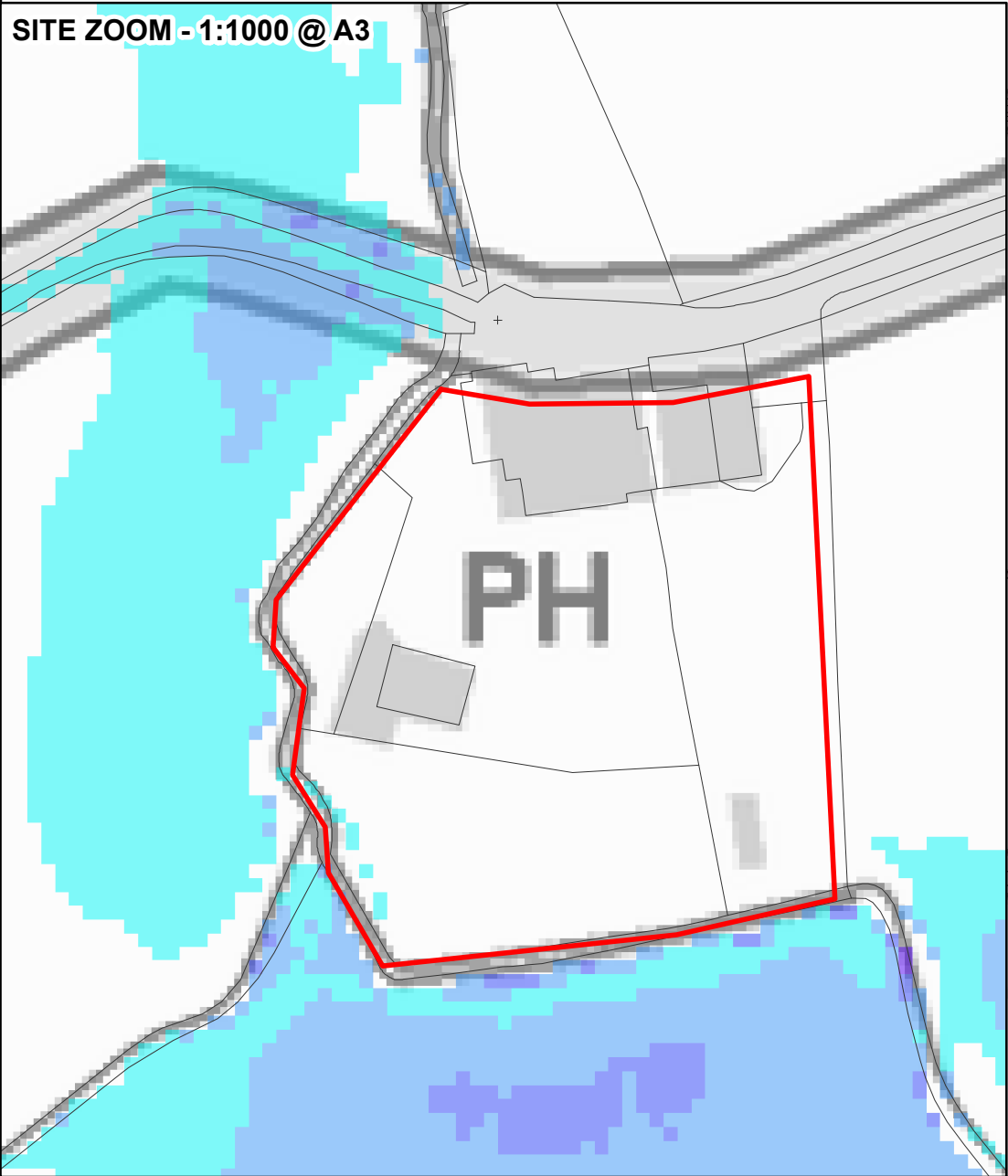
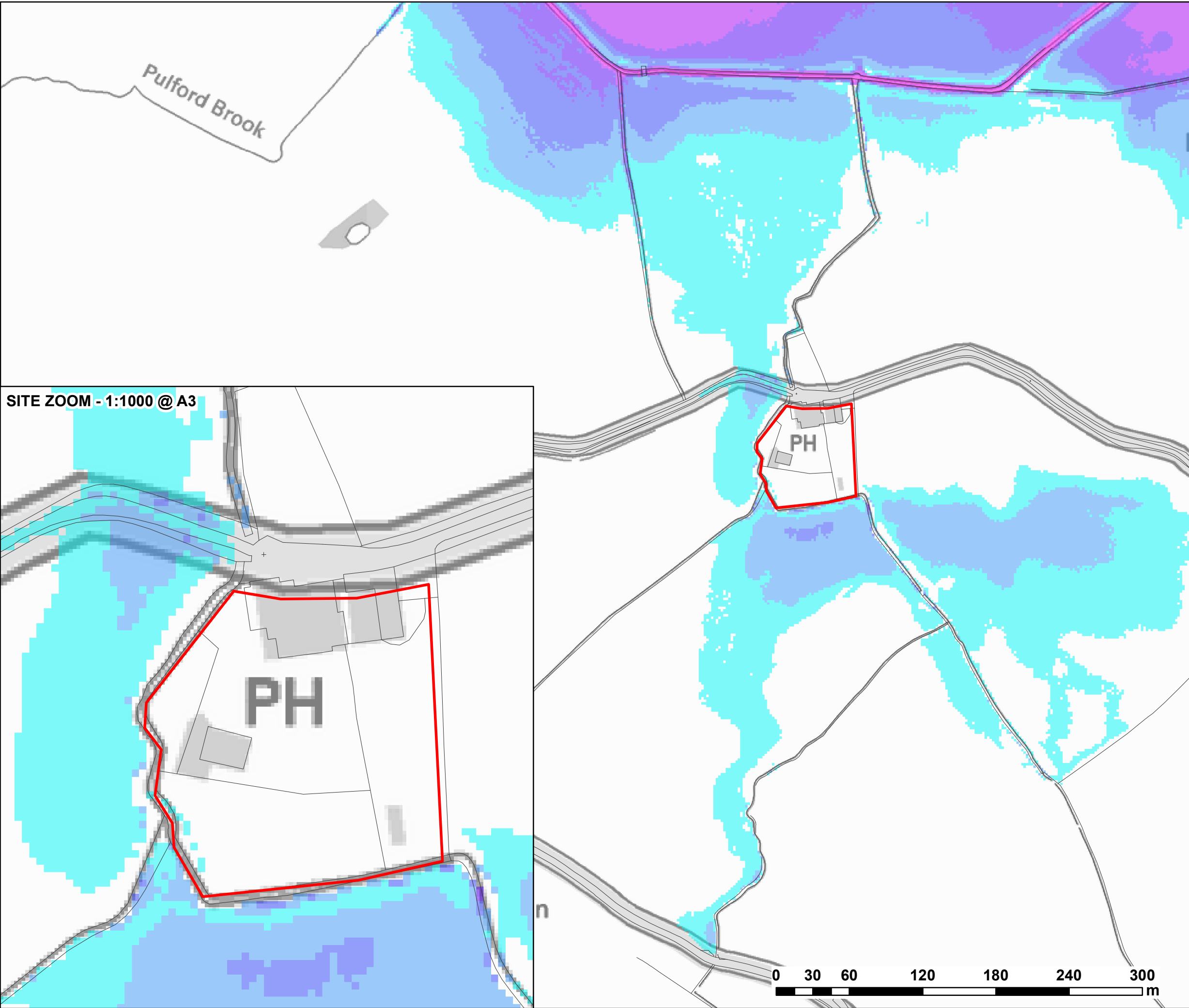
DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
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DATE: 28/05/2015	PLOT NAME: W3178-Q1000-EXT-H	REV: -
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Appendix I – Flood Maps – Sensitivity Tests

Maximum Flood Depth

Maximum Velocity



LEGEND

 Site Boundary

Maximum Flood Depth (m)

	0 - 0.3
	0.3 - 0.6
	0.6 - 0.9
	0.9 - 1.2
	1.2 - 2.4
	> 2.4



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

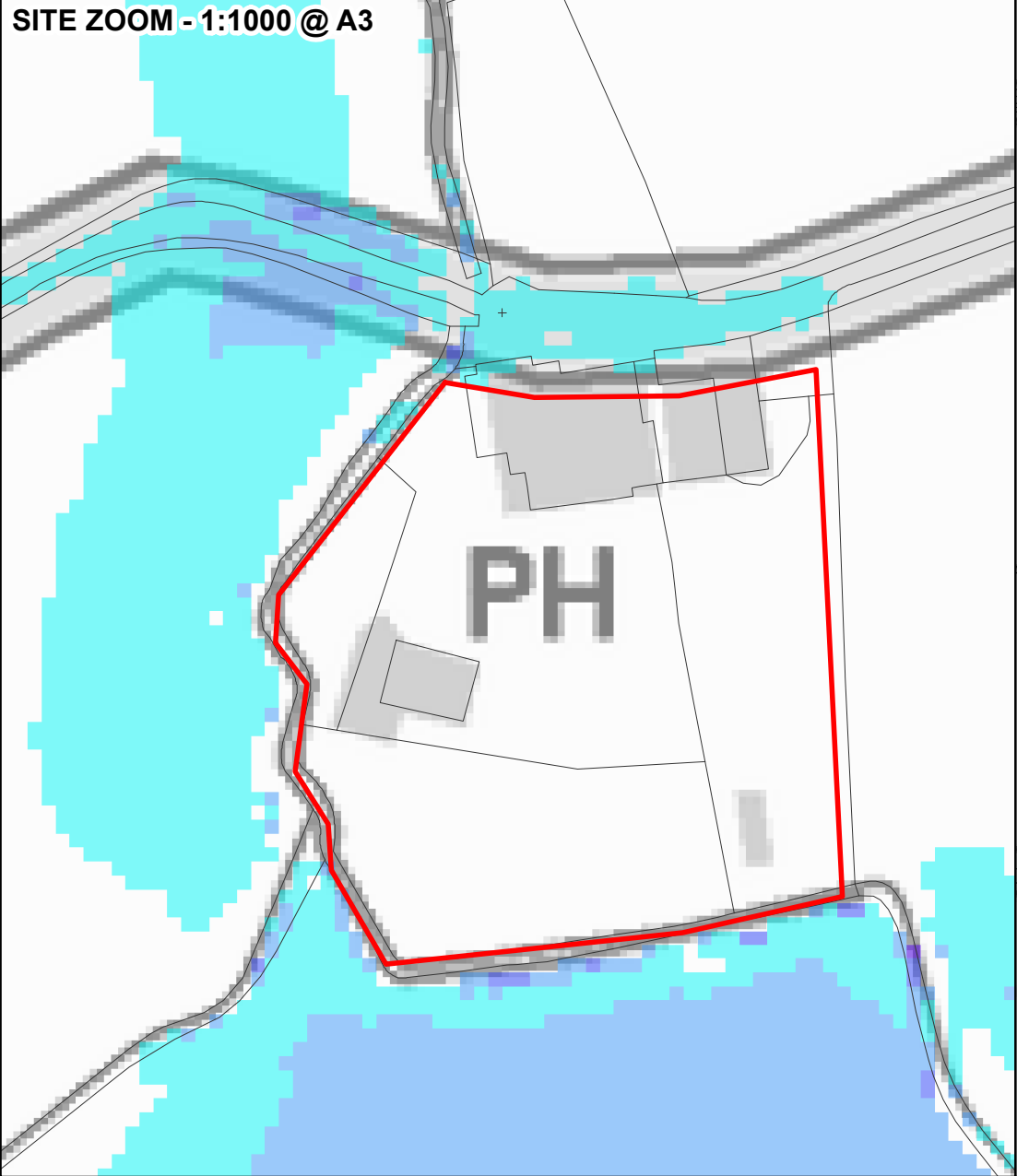
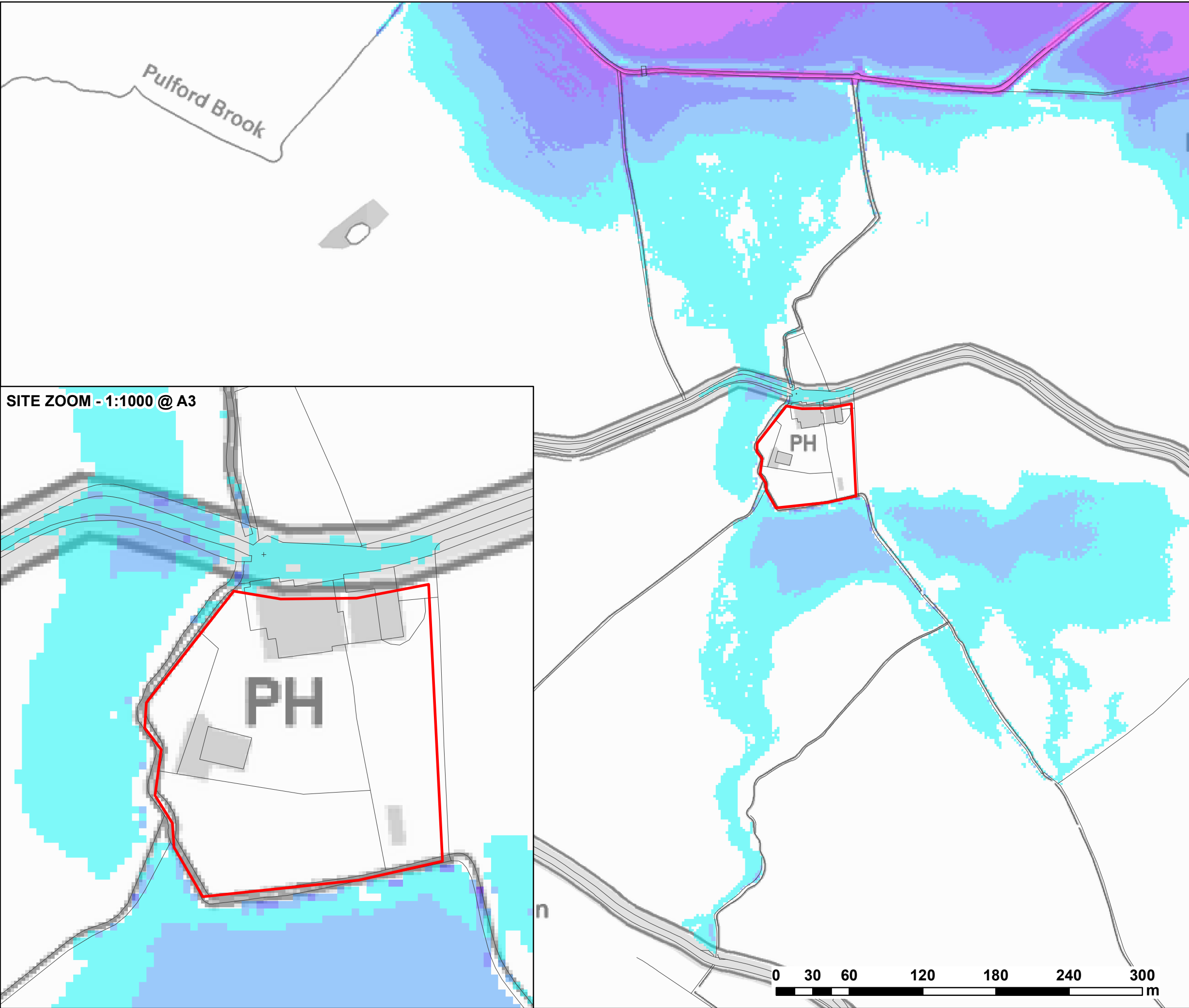
**MAXIMUM FLOOD DEPTH
0.1% AEP FLUVIAL EVENT
ST1 +20% ROUGHNESS**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
---------------	----------------	------------------	--

DATE: 28/05/2015	PLOT NAME: W3178-Q1000-ST1-D	REV: -
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LEGEND

Site Boundary

Maximum Flood Depth (m)

	0 - 0.3
	0.3 - 0.6
	0.6 - 0.9
	0.9 - 1.2
	1.2 - 2.4
	> 2.4

CLIENT:

URBAN DEVELOPMENTS

Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

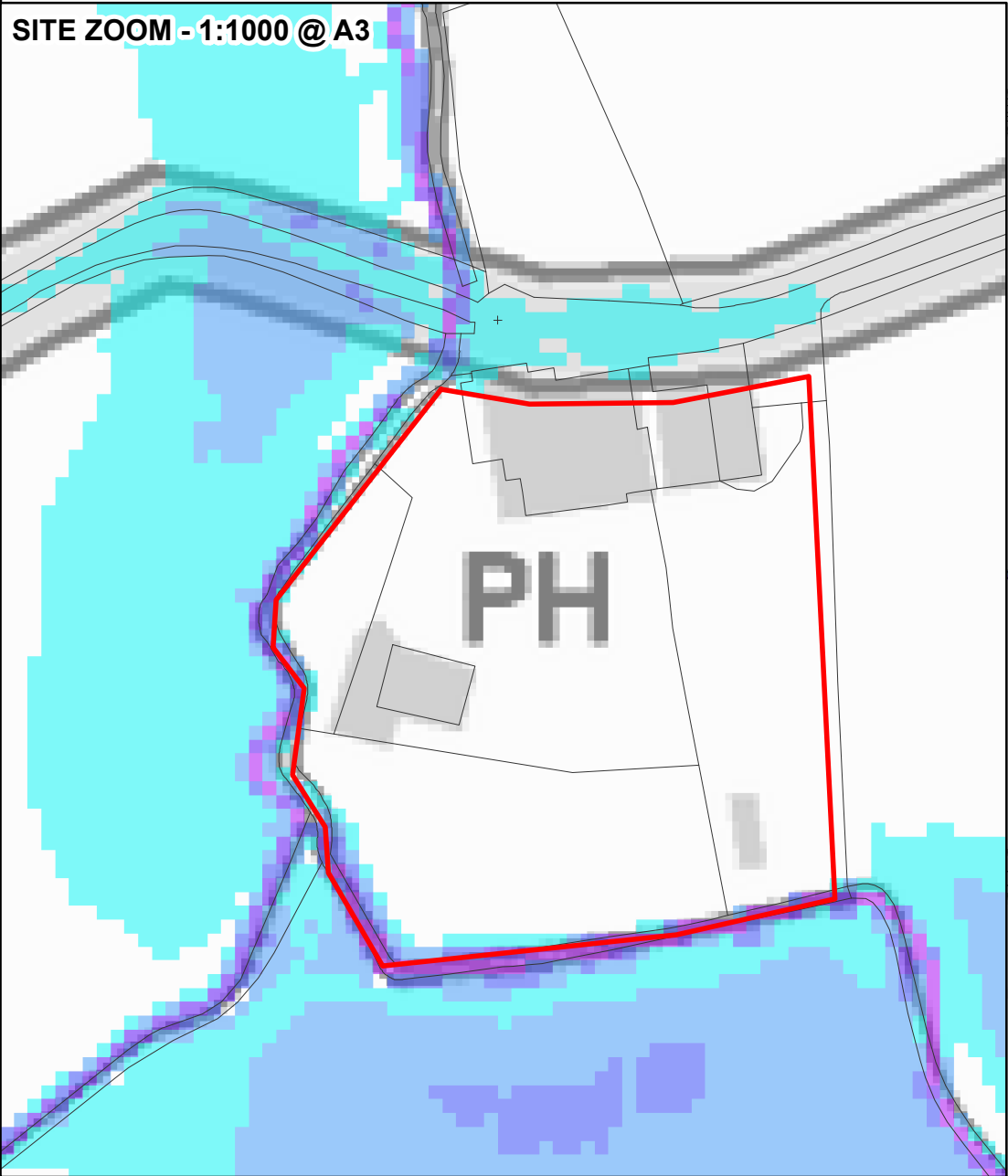
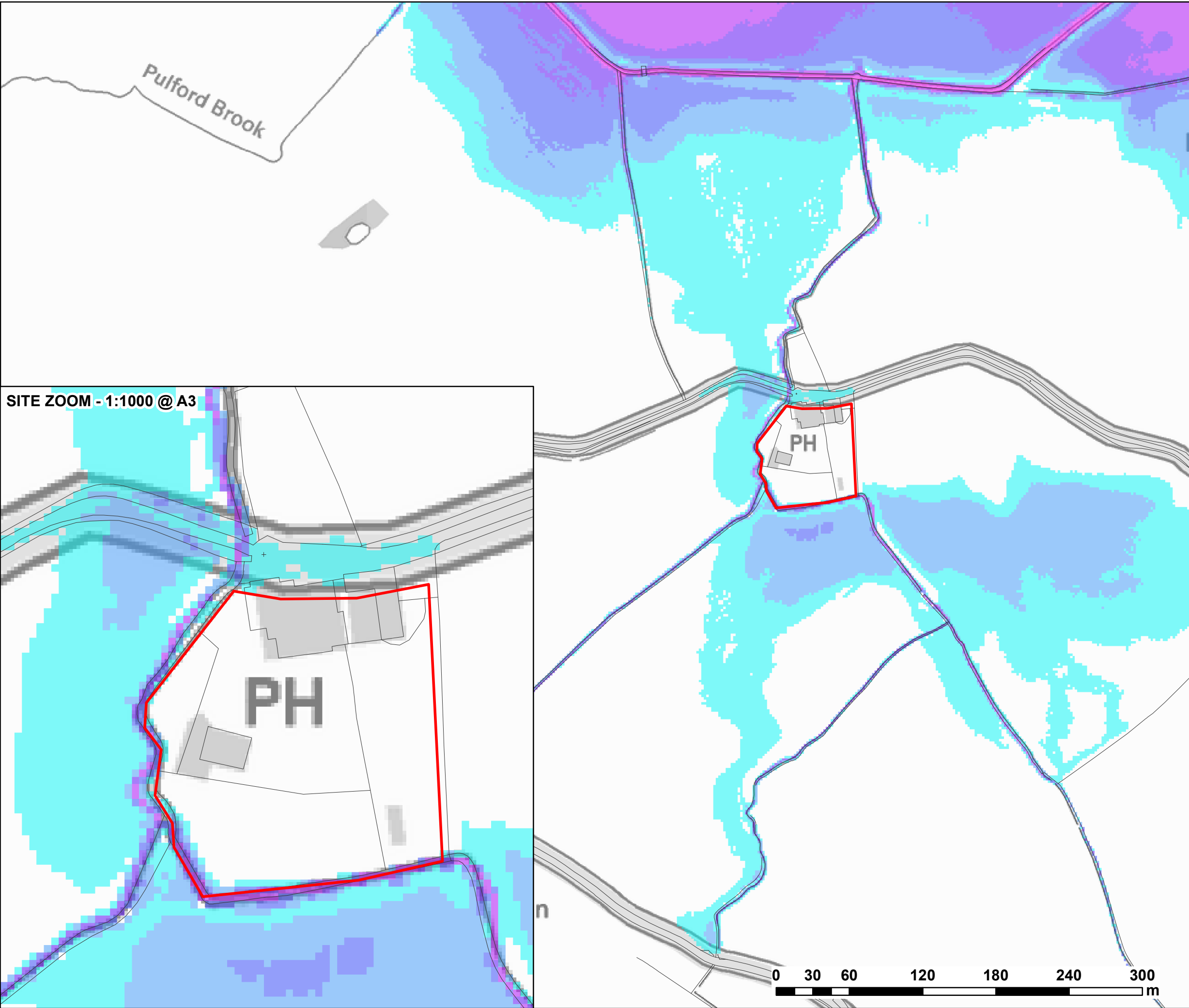
**MAXIMUM FLOOD DEPTH
0.1% AEP FLUVIAL EVENT
ST2 -20% ROUGHNESS**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
---------------	----------------	------------------	--

DATE: 28/05/2015	PLOT NAME: W3178-Q1000-ST2-D	REV: -
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LEGEND

Site Boundary

Maximum Flood Depth (m)

	0 - 0.3
	0.3 - 0.6
	0.6 - 0.9
	0.9 - 1.2
	1.2 - 2.4
	> 2.4

CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
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SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

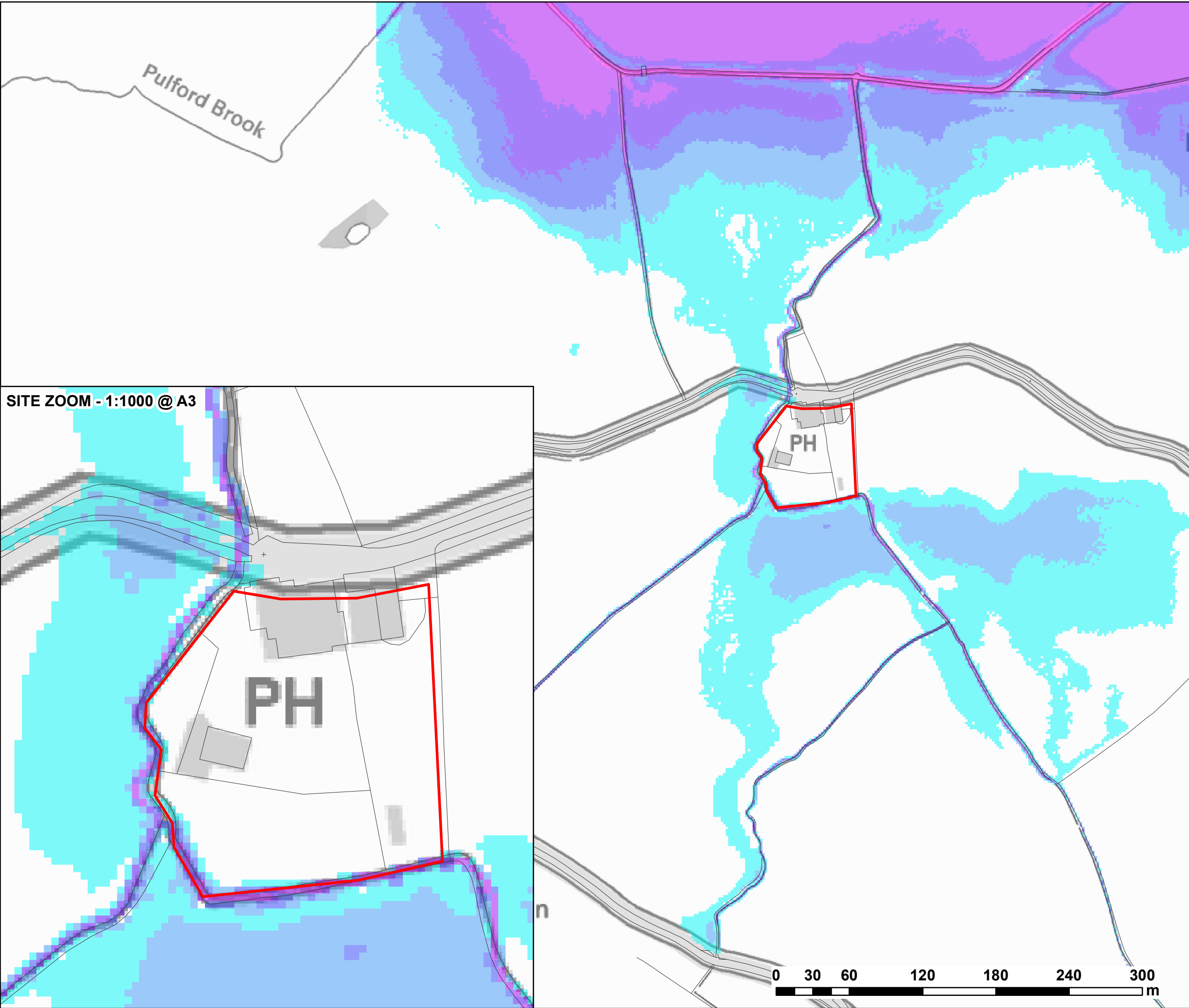
**MAXIMUM FLOOD DEPTH
0.1% AEP FLUVIAL EVENT
ST3 +20% FLOW UNCERTAINTY**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
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DATE: 28/05/2015	PLOT NAME: W3178-Q1000-ST3-D	REV: -
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SITE ZOOM - 1:1000 @ A3

LEGEND

Site Boundary

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT:

URBAN DEVELOPMENTS



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01824 702220
www.waterco.co.uk

SCHEME:

FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT

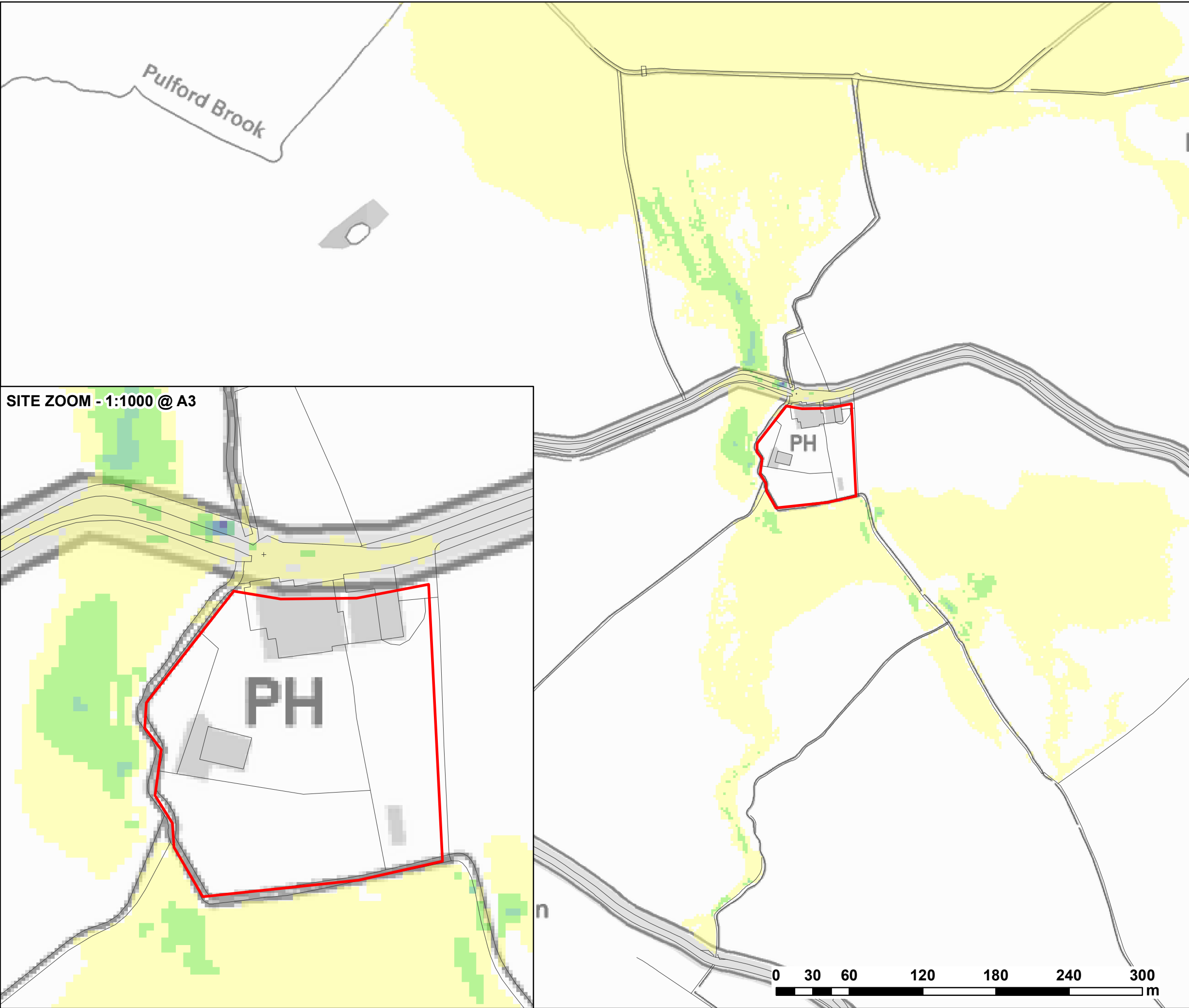
PLOT TITLE:

MAXIMUM FLOOD DEPTH
0.1% AEP FLUVIAL EVENT
ST4 DS BOUNDARY CHECK (11.3 mAOD)

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q1000-ST4-D	REV: -	



LEGEND

Site Boundary

Maximum Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:

URBAN DEVELOPMENTS



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01824 702220
www.waterco.co.uk

SCHEME:

FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT

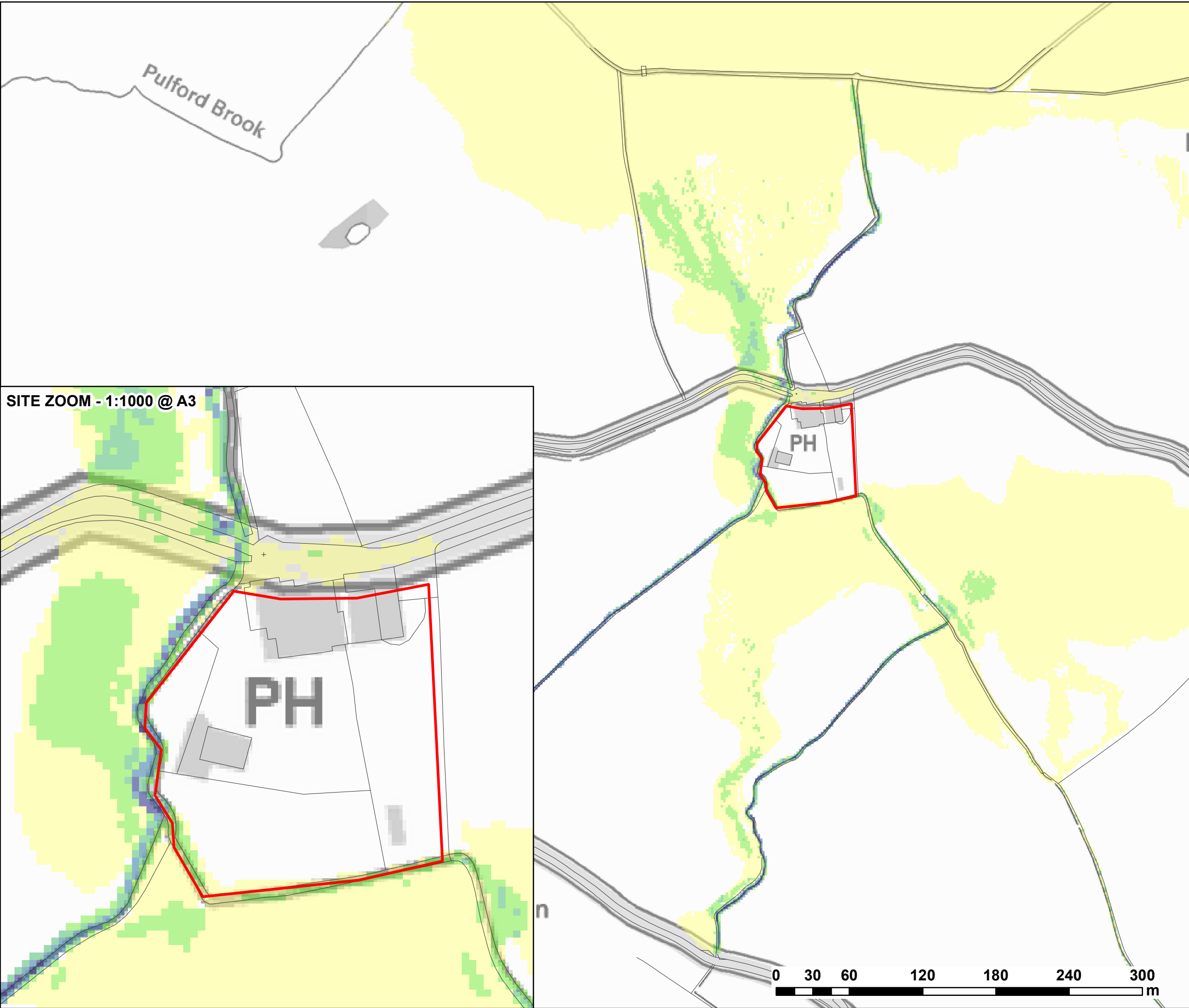
PLOT TITLE:

MAXIMUM VELOCITY
0.1% AEP FLUVIAL EVENT
ST2 -20% ROUGHNESS

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q1000-ST2-V	REV: -	



SITE ZOOM - 1:1000 @ A3

LEGEND

Site Boundary

Maximum Velocity (m/s)

0.0 - 0.3

0.3 - 0.6

0.6 - 0.9

0.9 - 1.2

> 1.2



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

MAXIMUM VELOCITY
0.1% AEP FLUVIAL EVENT
ST3 +20% FLOW UNCERTAINTY

PLOT STATUS:

ISSUE

DRAWN:

RCL

CHECKED:

JJ

APPROVED:

RCL

PLOT SCALE @ A3:

1:3,000

(UNLESS STATED OTHERWISE)

DATE:

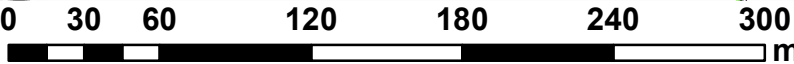
28/05/2015

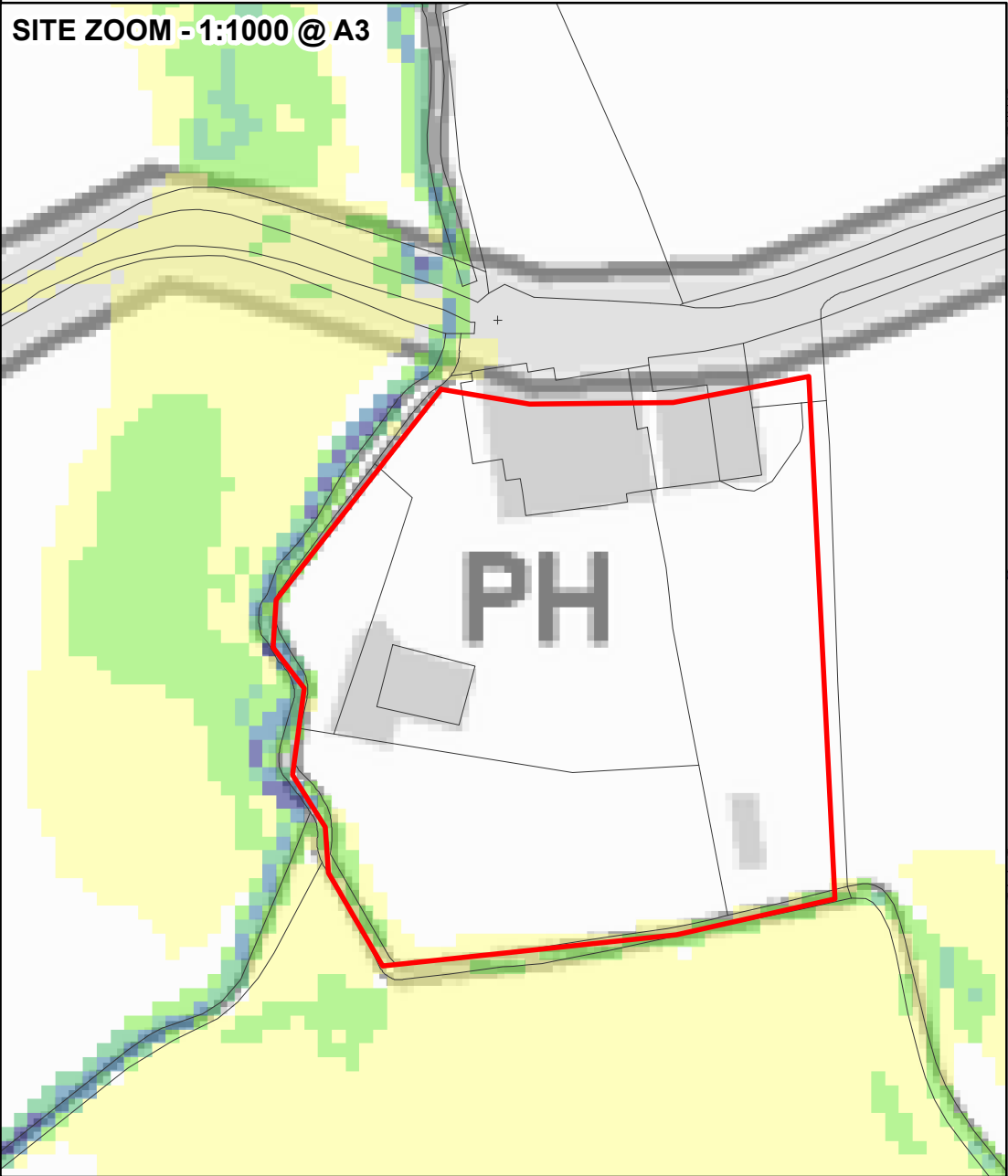
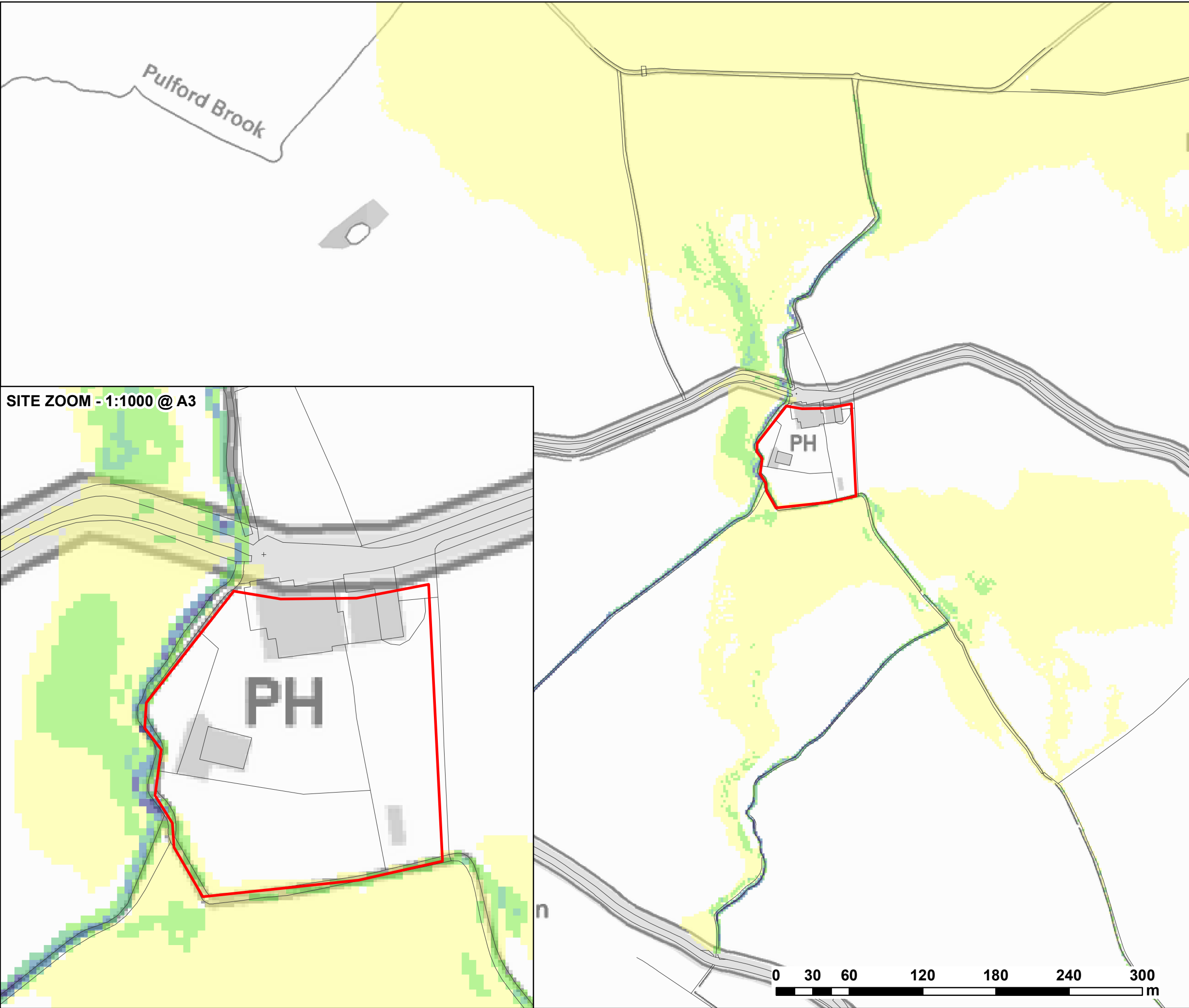
PLOT NAME:

W3178-Q1000-ST3-V

REV:

-





LEGEND

 Site Boundary

Maximum Velocity (m/s)

 0.0 - 0.3

 0.3 - 0.6

 0.6 - 0.9

 0.9 - 1.2

 > 1.2



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

MAXIMUM VELOCITY

0.1% AEP FLUVIAL EVENT

ST4 DS BOUNDARY CHECK (11.3 mAOD)

PLOT STATUS:

ISSUE

DRAWN:

RCL

CHECKED:

JJ

APPROVED:

RCL

PLOT SCALE @ A3:

1:3,000

(UNLESS STATED OTHERWISE)

DATE:

28/05/2015

PLOT NAME:

W3178-Q1000-ST4-V

REV:

-