

Appendix F

Watermans Hydraulic Modelling Technical Note

Mill Street and The Pippin, Calne

Hydraulic Modelling Technical Note

Date: July 2021

Client Name: Northhold Group

Document Reference: WIE14387-TN-3-1-3-HMR

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

Issue	Prepared by	Checked & Approved by
	Connor Henderson Flood Risk Engineer	Matthew Savill/Peter O'Flaherty Senior Flood Risk Engineer/Associate Director
First		

1. Introduction

- 1.1. Waterman Infrastructure and Environment (Waterman) has been commissioned by Northhold Group to undertake a Flood Risk Assessment (FRA) in relation to the proposed development at Mill Street (hereafter referred to as 'Plot 1') and The Pippin (hereafter referred to as 'Plot 2'), located in Calne, Wiltshire (Figure 1 overleaf).
- 1.2. During consultation with the Environment Agency (EA) in 2018, they stated that they would expect to see a site-specific FRA for the Site, which included improved Flood Zone outlines, including Flood Zones 3b, 3a, and 2 to inform the Sequential Test and Sequential Approach, therefore informing appropriate development locations. This suggested that the EA would require the catchment scale model to be improved to ensure its relevance for a site-specific FRA.
- 1.3. This Technical Note has been produced to document the improvements to the existing hydraulic model in support of a planning application at the Site.

Development Proposals

- 1.4. The development proposals (Appendix A) comprise part-demolition, part-conversion of the existing building at Plot 1 from retail to residential and the construction of eight new residential units on Plot 2.
- 1.5. The following flood mitigation protocols have been proposed for the Site:
 - All 'More Vulnerable' land uses have been raised to 69.60m AOD.
 - Existing ground levels have been retained across the majority of the Site to limit the impacts on the risk of flooding.

- A slope of 1:10 gradient has been applied between 69.60m AOD and existing levels at the rear of properties on Plot 1 to allow for access to the residential units.

Figure 1: Site Location Plan



 Site Boundary

Source: Google Maps

2. Modelling Approach

Existing Model

- 2.1. Waterman have obtained the existing model of the River Avon and Tributaries. The existing model was developed by CH2M and Edenvale Young on behalf of the Environment Agency in 2016 to map and model the risk of flooding throughout the Calne and Chippenham area, primarily from the River Avon, River Marden and various other tributaries.
- 2.2. The model consisted of a fully linked 1D/2D model using Flood Modeller Pro to represent the river channels and TUFLOW to route overland flows through a 2D grid representing the floodplain.

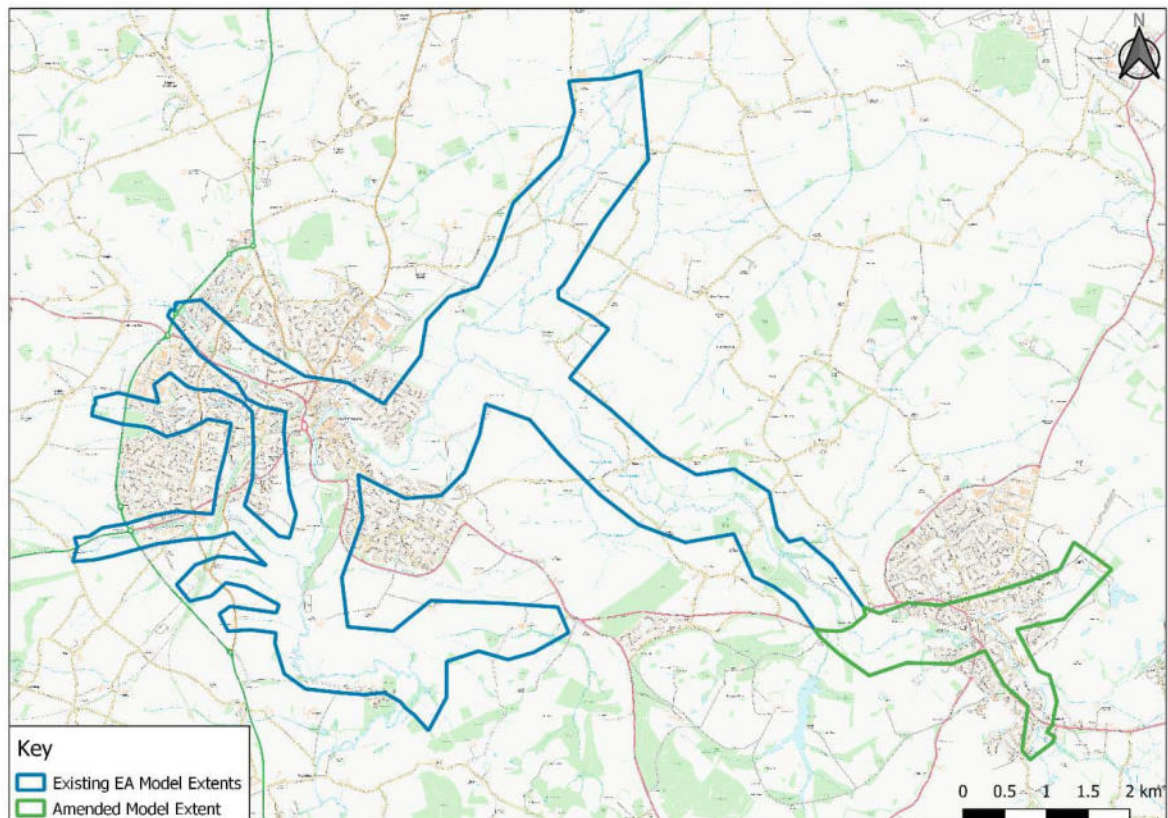
Modelling Approach

- 2.3. A 1D/2D model is considered the most appropriate methodology to represent the existing river network and overland flow interactions found in the area. WIE have used the existing model as a base and amended and improved it as necessary to improve the floodplain representation at the Site.

Model Extents

- 2.4. The existing model covered over 20km² of catchment area, including multiple 2D domains for various settlement areas throughout the catchment, and was run with a grid size of 10m. Due to the need to refine the grid to better represent conditions on-site, running the existing model extents would increase the model run times substantially. Therefore, it was decided to curtail the model at a suitable location on the River Marden to avoid modelling watercourses and substantial areas of floodplain that do not directly impact the Site.
- 2.5. The upstream extent of the model was located a short distance from the Site. Therefore, this was retained as existing. Downstream of the Site, the model was curtailed at the upstream face of the A4 crossing over the River Marden. See Figure 2 below for the original and new model extents.

Figure 2: Existing and Amended Model Extents



3. Model Simulations

Naming Conventions

- 3.1. The model has been given the following naming convention and the details of each specific scenario has been set out in Table 1 overleaf:

AVON_*****_###_\$\$\$\$

Table 1: Naming Convention

Scenario	Description
*****	Model version i.e. v50-A – model version 50 A
###	Scenario i.e. BSC – baseline case
\$\$\$\$	Event i.e. f100 – 1 in 100 year fluvial event

Scenarios

- 3.2. The scenarios modelled and provided for review are the baseline case (BSC) which represents the existing conditions within the catchment, the proposed case (PRP) which represents the proposed development at the Site and the sensitivity test (SENS) scenarios which assess the model's sensitivity to various modeller defined parameters.

Return Periods

- 3.3. The return periods simulated to support the proposed planning application are set out in Table 2 below. It was confirmed during consultation with the EA that the River Marden falls in the River Severn River Basin District and as such the climate change allowances from this catchment have been used to support the planning application. The consultation response is presented in Appendix B.

Table 2: Return periods run as part of this commission

Return Period	Model Naming Convention
1 in 25-year	0025
1 in 100-year	0100
1 in 100-year plus 35% climate change	0100cc35
1 in 100-year plus 70% climate change	0100cc70
1 in 1000-year	1000

Run Parameters

- 3.4. The model was run with a 2D grid size of 4m, which was considered suitable to represent the River Marden's channel width and provide an appropriate representation of topography within the floodplain. The model was run with a 2D timestep of 2s and a 1D timestep of 1s, as these were considered the most appropriate timesteps for a 2D domain with a grid size of 4m.
- 3.5. All other parameters were retained from the existing model.

Sensitivity Tests

- 3.6. As part of the modelling process, sensitivity tests were carried out to aid in the review of the model. The model roughness values were retained from the existing EA model. Therefore, these were not sensitivity tested. The downstream model boundary has been amended as part of this study. Therefore, a sensitivity test was carried out on this element of the model. Table 3 below lists the sensitivity tests provided.

Table 3: Sensitivity Tests

Sensitivity Parameter	Test	Run Title
Downstream Boundary	+ 20% stage for corresponding flow within the downstream boundary	SENS-A
	-20% stage for corresponding flow within the downstream boundary	SENS-B

- 3.7. The sensitivity to model inflows and hydraulic roughness were not assessed as part of this commission as they are unchanged from the hydraulic model provided by the EA.

4. Model Build Amendments

1D Model Build

1D Sections

- 4.1. The 1D cross sections in the area of interest were retained from the existing model. No amendments were made to these sections as following review they were considered to be still appropriate due to the short amount of time since the model was developed.

1D Structures

- 4.2. The 1D structures in the area of interest were retained from the existing model. No amendments were made to these 1D structures as following review they were considered to be still appropriate due to the short amount of time since the model was developed.

1D Roughness

- 4.3. The 1D roughness in the area of interest was retained from the existing model. No amendments were made to the roughness as following review it was deemed to be still appropriate.

Model Boundaries

- 4.4. The upstream inflow boundaries were retained from the existing model as following review they were deemed to be still appropriate. As the model was curtailed at the upstream face of the A4 crossing of the River Marden, a new downstream boundary was required. The downstream boundary was applied as a Flow-Head Boundary (QHBDY). This extracts flow from the model based on the water level upstream of the A4 embankment. This relationship between water level and flow extracted from

the model is based on the hydraulic model results from the EA model as received. This has been extrapolated to allow slightly increased flows to run the climate change scenarios.

2D Model Build

Base Topography

- 4.5. The 2D base topography in the model was retained from the existing model as following review it was deemed to be still appropriate. This was based on LiDAR with a 50cm resolution where available and 1m resolution where 50cm was not available.

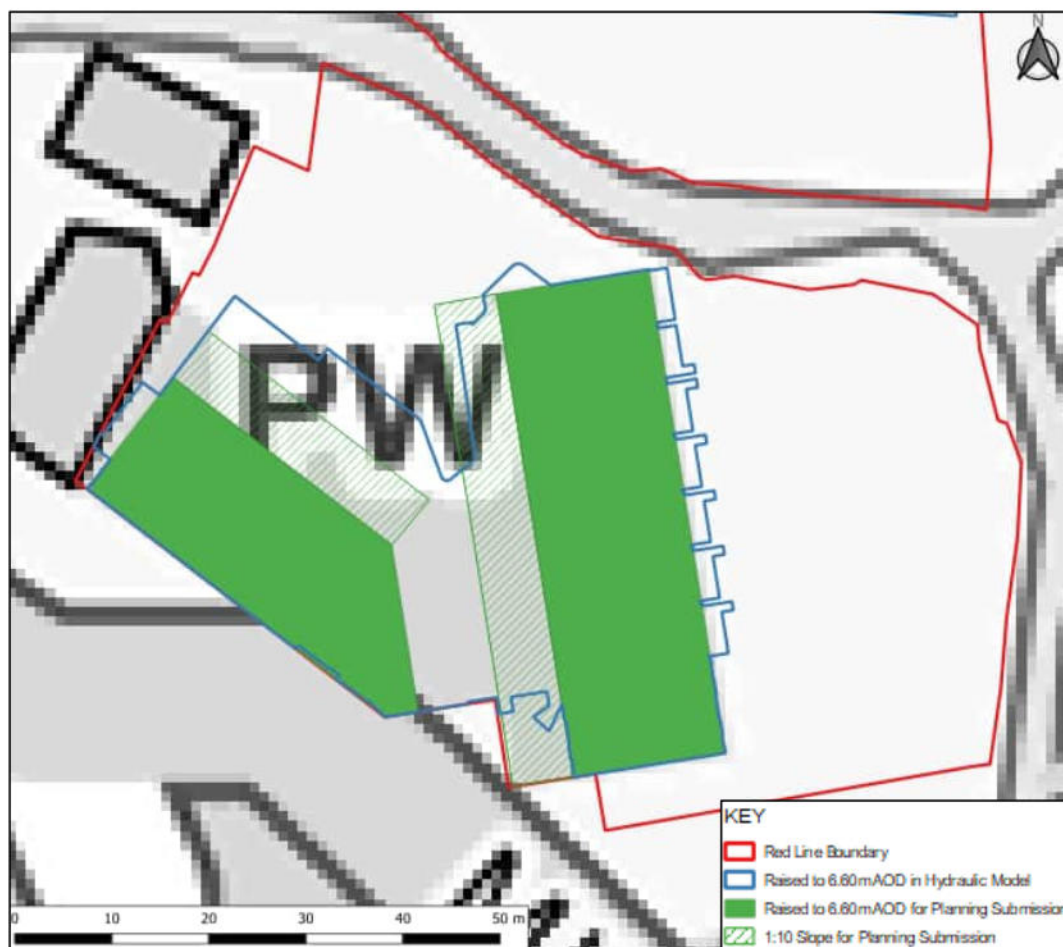
Topographic Modifications

- 4.6. To improve the representation of site-specific conditions, the base topography in the model was supplemented with topographic survey for the Site.
- 4.7. Within the hydraulic model provided, bank elevations had been enforced at the location of 1D/2D links with '2d_zln' features. These have been retained from the existing model. Where topographic survey was available, this has been added to the '2d_zln' files.

Proposed Case

- 4.8. The proposed case scenario (PRP) represents the post-development scenario at the Site. The scenario modelled is a previous iteration of the development proposals. The only difference between the iteration modelled and the iteration submitted for planning is the proportion of the southern site proposed for demolition and conversion.
- 4.9. Figure 3 shows a comparison between the areas raised to 69.60m AOD under both scenarios and the area covered by the 1:10 slope in the iteration taken forward to planning. In the modelled iteration the footprint of the 'More Vulnerable' land uses covers the entire area proposed for 'more vulnerable' land uses and also the majority of 1:10 slope in the iteration in the development proposals. As such, the scenario modelled provides a conservative estimate of the impacts of the development proposals on flood risk and should be considered sufficient to support the proposed development.

Figure 3: A comparison of the proposed case submitted for planning and represented in the hydraulic model



4.10. The amended/new files used to control the topography of the model are set out in Table 4 below.

Table 4: Topography Control Files

File Name	Description
2d_zln_banklines_mar_Calne_v50_L 2d_zln_banklines_mar_Calne_v50_P	Enforces bank elevations on the River Marden, taken from the existing model and supplemented with topographic survey where available
2d_zsh_Survey_CoOp_P.shp 2d_zsh_Survey_CoOp_P.shp	Enforces the elevations of the Site topographic survey
2d_zsh_co-op_R.shp	Enforces the location and finished floor level of the existing Co-Op supermarket building at the Site

2d_zsh_ProposedSlopes_001_R.shp 2d_zsh_ProposedSlopes_001_P.shp	Enforces the location and elevation of the proposed slopes at the Site
2d_zsh_ProposedBuildings_001_R.shp	Enforces the location and finished floor level of the proposed buildings at the Site

2D Roughness

- 4.11. Following review the 2D roughness was retained from the existing model as this was deemed to be still appropriate.

5. Model Results

Baseline Case

- 5.1. The model results for the baseline case are presented in Appendix B, depicting the out of bank flood depth mapping. The peak modelled flood levels are presented in

Return Period	Peak Modelled Flood Level (m AOD)
0025	68.17
0100	68.57
0100cc35	68.97
0100cc70	69.09
1000	69.10

- 5.2. During the 1 in 25 year event, both Plot 1 and Plot 2 would remain free of flooding. During the 1 in 100 year event, the River Marden is shown to overtop its banks along the eastern boundary of Plot 1, causing on-site flooding to a maximum depth of approximately 0.54m along the Site boundary and depths of around 0.15m within the car parking area in the east of Plot 1. Plot 2 would remain largely free of flooding, however, a small area to the southeast of the Site is shown to be at risk of flooding to depths of up to 0.25m (Appendix B).
- 5.3. Flooding in the 1 in 1000 year event is shown to cover the majority of Plot 1, with only isolated areas indicated to experience no flooding. Flood depths are likely to reach a maximum of 1.07m along the Sites eastern boundary to around 0.01m in the west of the Site. The existing building is indicated to flood to depths of up to 0.11m (Appendix B). Plot 2 would again remain largely free of flooding, however, the area of flooding to the southeast of the Site is shown to be more extensive with depths reaching up to 0.76m.
- 5.4. When accounting for the impacts of climate change up to the year 2115, flooding is shown to cover large parts of Plot 1 during the 'Higher Central' event (35% allowance). Flood depths could potentially reach a maximum of 0.92m along the eastern boundary of the Site and flooding to the north of the existing building could reach a maximum of 0.21m. The existing building would not experience any internal flooding during this event. Flooding at Plot 2 is shown to be slightly more extensive than during the present day 1 in 100 year event, and flood depths could reach a maximum of 0.60m in the south-eastern corner of the Site (Appendix B).

- 5.5. During the 'Upper End' climate change event (70% allowance) flood extents and depths are shown to be largely similar to those during the present day 1 in 1000 year event albeit slightly reduced, with depths across Plot 1 ranging from 1.05m along the eastern boundary to 0.01m in the west. The existing building is shown to flood to depths of up to 0.10m. Flooding at Plot 2 is shown to be contained to the south-eastern corner where depths could reach up to 0.75m.

Proposed Case

- 5.6. The model results for the proposed case are presented in Appendix C, depicting the out of bank flood depths and a depth difference mapping.
- 5.7. During the 1 in 25 year event, there is no flooding present at both Plot 1 and 2. Flooding during the 1 in 100 year event is shown to mirror that experienced in the 1 in 100 year baseline event, with flooding expected along the eastern boundary of Plot 1 and within the existing car parking area, and minimal flooding in the south-eastern corner of Plot 2. There would be no change in depths from the baseline to proposed cases (Appendix C).
- 5.8. During the 1 in 1000 year event, flooding is shown to be largely comparable with that expected during the baseline case. Flooding would again be contained within the south-eastern corner of Plot 2. The only significant change from the baseline case would be that the existing building at Plot 1 no longer experiences any internal flooding.
- 5.9. When accounting for the impacts of climate change up to the year 2115, flooding is shown to be comparable with the baseline case during the 'Higher Central' (35% allowance) and 'Upper End' (70% allowance) events. Flooding at Plot 2 is once again shown to be contained to the same area of the south-eastern corner, however, the existing building at Plot 1 no longer experiences internal flooding in either event (Appendix C).
- 5.10. The Change in Depth mapping (Appendix C) shows that there is very limited change in flood depths from the baseline to proposed scenario during the 1 in 100 plus 35% climate change event. Most of the change experienced would occur at Plot 1, where depths are shown to decrease by a maximum of 0.33m in a small area, and between 0.01m to 0.2m in larger areas. There would be some small changes in flood depth within Mill Street, adjacent to the Sites southern boundary. At this location, flood depths are shown to reduce by a maximum of 0.21m and increase by a maximum of 0.007m in small, isolated areas (Appendix C).
- 5.11. Plot 2 is predicted to experience a larger increase in flood depths, with a small area shown to increase by a maximum of 0.18m (Appendix C). However, this increase would occur in the gardens to the rear of the easternmost properties and no internal flooding would be expected.

Sensitivity Test

- 5.12. As part of this modelling study, no changes were made to the model roughness, therefore, a new sensitivity test has not been carried out on this model parameter.
- 5.13. The downstream boundary of the model has been updated as part of this study, therefore, a sensitivity test was carried out on this element to measure the impact of a 20% increase and decrease in downstream boundary stage on peak water levels in the model. Tabulated results of the sensitivity test are provided in Appendix D.

- 5.14. A 20% reduction in stage for the corresponding flow in the model resulted in no change in peak water levels in the model for all but four model cross sections. The affected sections were located at the downstream end of the model, directly upstream of the model boundary. The 20% reduction in stage resulted in a maximum reduction of 0.42m in one section and smaller reductions in the other three affected sections.
- 5.15. A 20% increase in stage for the corresponding flow in the model again resulted in no change to peak water levels for the majority of cross sections in the model. There was some impact on the peak water levels at the downstream end of the model again, which affected eight cross sections directly upstream of the model boundary. A 20% increase in downstream boundary stage resulting in a maximum increase of 0.42m in one model cross section, while the remaining sections experienced increases of 0.01m to 0.35m.
- 5.16. The observed sensitivity to downstream boundary is to be expected as a flow-head boundary can have a direct, albeit spatially limited, effect on water levels in the areas directly adjacent to the model boundary. The impacts on peak water levels in the model extend a maximum of 800m upstream of the boundary and no impact was observed in the vicinity of the Site. Therefore, peak water levels at the Site would not be affected by changes to the downstream boundary.

6. Summary

- 6.1. The purpose of this modelling study was to improve the existing hydraulic model to better represent site-specific conditions in order to assess the impact of the proposed development on flood risk on-site and in the vicinity of Plots 1 and 2. As part of the study, the existing model was trimmed to the areas surrounding Plots 1 and 2 and the model grid refined to provide a more accurate representation of ground levels in the area.
- 6.2. The model results show that during the proposed scenario, all units at Plot 1 and Plot 2 would remain free of flooding and therefore the risk to occupants would be minimal. The Change in Depth assessment indicates that raising the finished floor level of the existing building would have a minimal impact on flood depths at the Site and off-site in surrounding areas.
- 6.3. The model can therefore be considered fit for purpose and the proposed development can be considered suitable due to the negligible effect on flooding in the area.



APPENDICES

Appendices

Mill Street and The Pippin, Calne
WIE14387-TN-3-1-3-HMR
WIE14387



A. Development Proposals

Appendices

Mill Street and The Pippin, Calne
WIE14387-TN-3-1-3-HMR
WIE14387

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Location Plan

Scale 1:1250

Drawing Number:	Date:
1005-VE-X-S-P-A-001-RB	28.06.2021
Stage:	PLANNING
Scale:	1:200 + 1:250 @ A1
Drawn By:	Checked By:
HH	IJ
Client:	Northold Group
Drawing Title:	Proposed Site Plan + Location Plan

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W viewassociates.co.uk
View Associates Ltd
Greystone House, Moss Lane
Aldersham, Warrington, Cheshire WA15 8HW



Mill Street, Calne



B. Environment Agency Consultation

Appendices

Mill Street and The Pippin, Calne
WIE14387-TN-3-1-3-HMR
WIE14387

Mr Matt Savill
Waterman Group
Infrastructure & Environment
Pickfords Wharf
Clink Street
London
SE1 9DG

Our ref: WX/2018/132005/02-L01
Your ref: Land adj R. Marden, Calne
Date: 30 August 2018

Dear Mr Savill

FURTHER INFORMATION - ENVPAC/1/WSX/00034 - RETAIL AND RESIDENTIAL REDEVELOPMENT CHURCH ST SITE AND PIPPIN SITE, LAND ADJ RIVER MARDEN, CALNE, WILTS

Thank you for your email and submissions of 01 August 2018. Please note that I am responding on behalf of Ellie Challans who normally deals with your Authority area.

We maintain our position that at this time we are unable to provide an estimate for our charged (cost-recovered) pre-planning advice related to the above site. As stated previously we do not attempt to interpret the flood risk to a site before a Flood Risk Assessment (FRA) has been undertaken. Most of the questions posed in your form will be answered by a FRA, but we can offer the following preliminary advice in respect of the enquiry.

Southern Site

The FRA must meet the requirements set out in National Planning Policy Framework (NPPF) and its associated Guidance <https://www.gov.uk/guidance/flood-risk-and-coastal-change#Site-Specific-Flood-Risk-Assessment-checklist-section>. It must demonstrate the proposed re-development will be safe for future owners/occupiers for the lifetime of the development (assumed to be 100 years), including safe access/egress, use of car park for residential use etc.

We assume you have a copy of our most recent fluvial hydraulic model (2016), hence re-running it with more up-to-date site specific topographic data, as proposed, will be required to help demonstrate the above. If you do not, then please request it from wessexenquiries@environment-agency.gov.uk.

Given the uncertainties associated with river hydraulic modelling, for development planning purposes a 600mm freeboard allowance should be provided between the design flood level (1 in 100 year event plus appropriate allowance for climate change) and minimum finished floor level for 'more vulnerable' development such as residential;

Northern Site

Given the Flood Map is indicative in nature and based on catchment wide flood modelling, the FRA should demonstrate (by hydraulic model results – as noted above)

Environment Agency
Rivers House, Sunrise Business Park, Higher Shaftesbury Road, Blandford, Dorset, DT11 8ST.
Customer services line: 03708 506 506
www.gov.uk/environment-agency

Cont/d..

the site lies outside Flood Zones 3 & 2.

In addition, a check should be carried out to confirm the site lies outside the future Flood Zones 3 & 2, because if it does lie within the future flood zones please be mindful the recently updated NPPF requires applicant's to submit to the LPA evidence that the flood risk Sequential Test (and Exception Test for 'more vulnerable' development in Flood Zone 3), is passed.

In accordance with NPPF 'more vulnerable' development, in principle, should not be permitted in the functional floodplain (Flood Zone 3b);

Main River buffer

Historically, in this part of Calne, development has encroached within the river corridor. Hence, there is precious little space to allow access to the river corridor for maintenance and possible future improvement. For this reason, aside from the extent of the flood zones, we request a clear 8 metre wide strip measured from the top of the bank of the watercourse is kept clear of all development (no buildings, gardens, walls, fences etc.). Access from the highway to the clear 8 metre wide strip shall be provided.

The proposed site plan would appear to show development is proposed to encroach within the clear 8 metre wide strip; the FRA should include an amended proposed site plan superimposed onto the site topographic survey to demonstrate compliance with the above requirement.

It would be useful to include some photographic evidence in the FRA to confirm the position of the 'top of bank' of the watercourse. The submitted topographic site survey would appear to show the top of bank as a brown pecked line, but this should be confirmed by the applicant with supporting evidence.

In order to provide charged pre-planning advice we request that the full FRA is submitted to us setting out preferred development option, the flood risk to/from the development and proposed mitigation measures.

Please note that the views expressed in this letter is in response to an enquiry only and does not represent our final view in relation to any future planning application made in relation to this site. They are made entirely without prejudice and without liability accepted, implied or given by or on behalf of the Environment Agency. We reserve the right to review our position should new information be provided, or updates to guidance occur, in relation to any such application.

You should seek your own expert advice in relation to technical matters relevant to any planning application before submission

Yours sincerely

MICHAEL HOLM

Planning Advisor - Sustainable Places

Direct dial 02030 259358

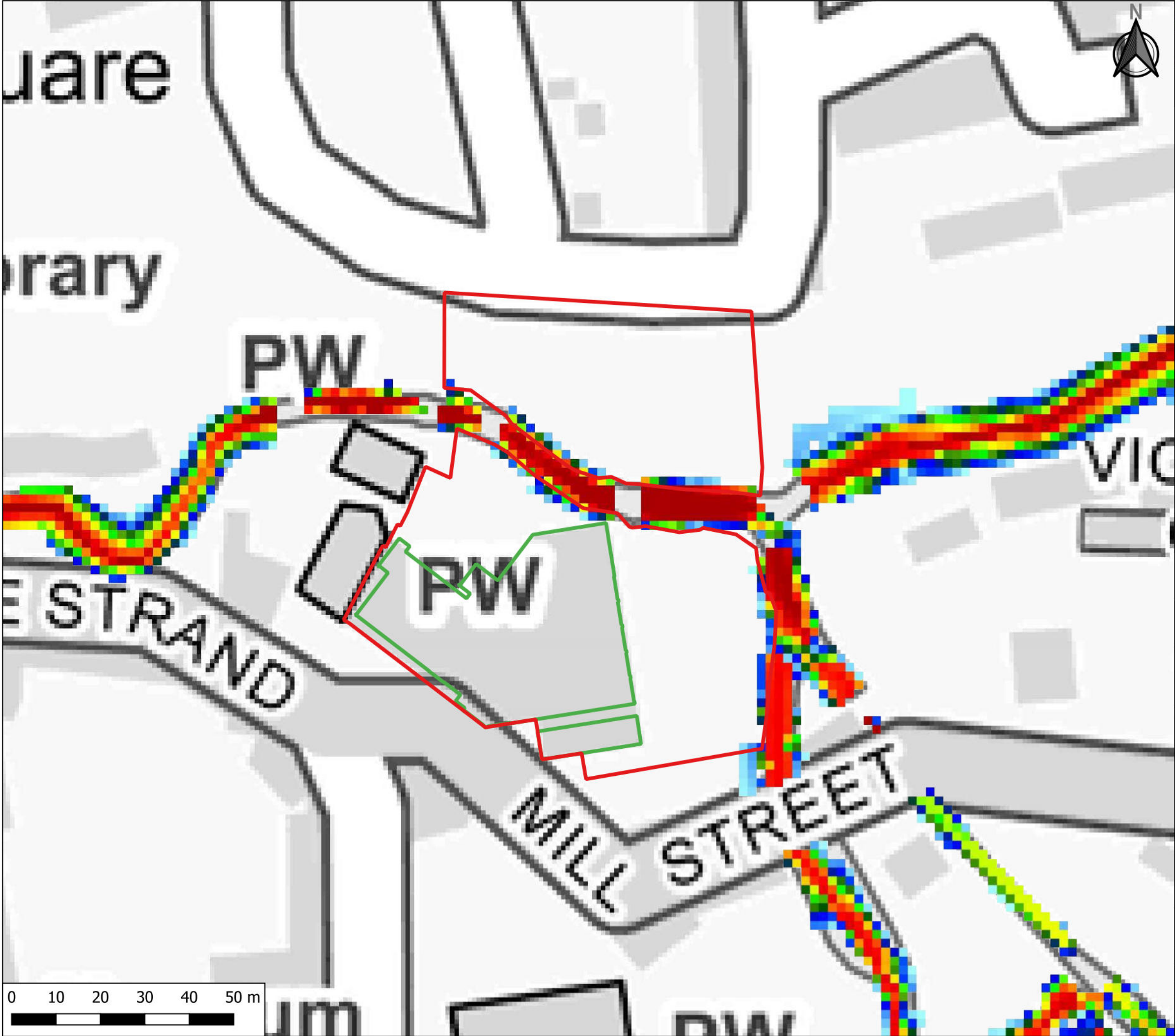
Direct e-mail swx.sp@environment-agency.gov.uk



C. Baseline Scenario Model Results

Appendices

Mill Street and The Pippin, Calne
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Pickfords Wharf, Clink Street, London SE1 9DG
t 020 7928 7888 f 03333 444 501

GENERAL NOTES

KEY

Red Line Boundary

Existing Buildings

Maximum Depth (m)

0.00

0.15

0.30

0.45

0.60

0.75

0.90

1.05

1.20

1.35

>1.50

Project

CHURCH STREET, CALNE

Title

1 IN 25 YEAR - MAXIMUM DEPTH
BASELINE SCENARIO

Client

NORTHOLD GROUP

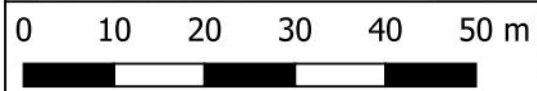
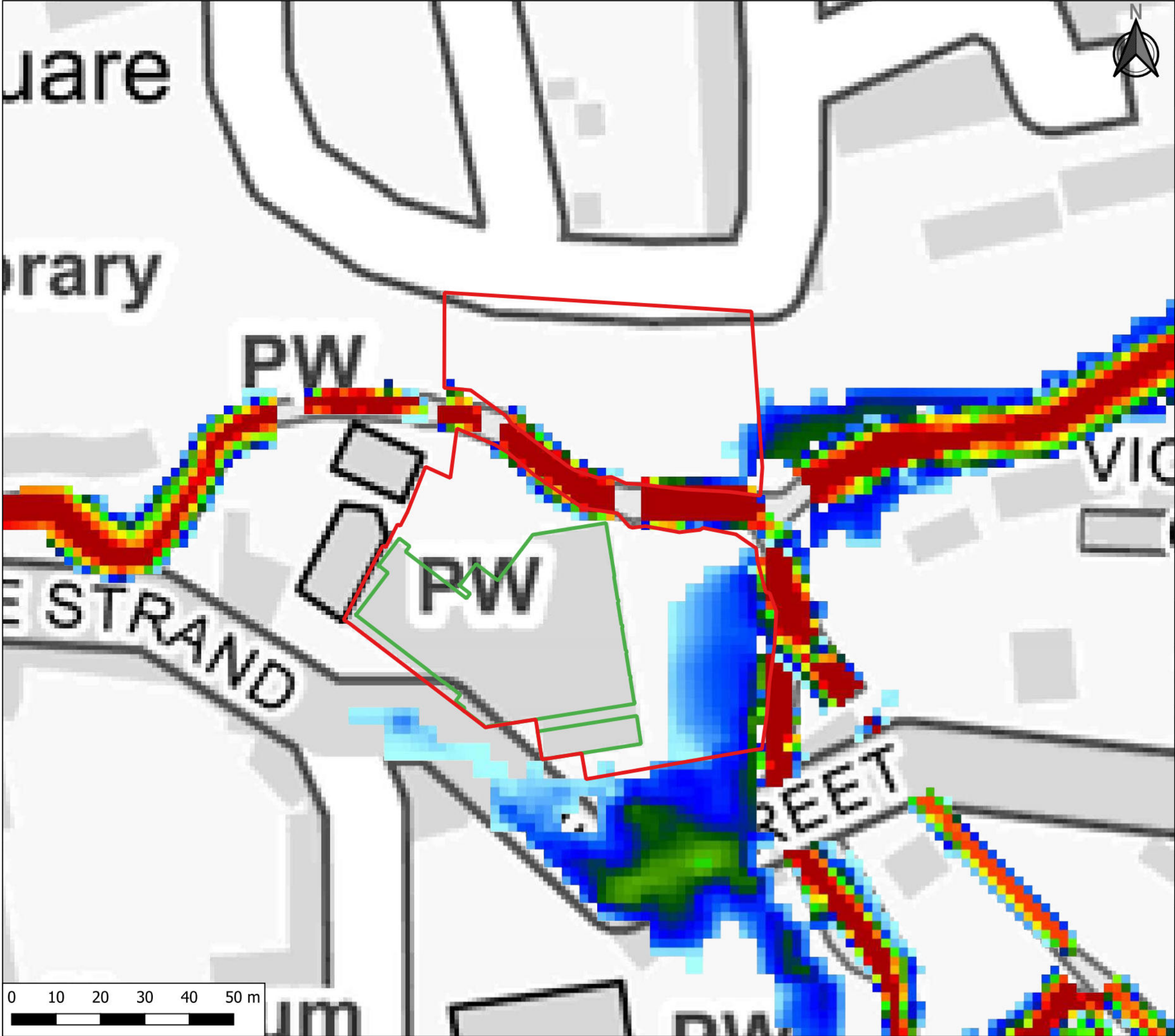


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Status

PRELIMINARY

Model Ref	AVON	Run No.	050	Scenario	BSC
Drawn By	CH	Checked By	MS	Date	23.09.20
Project Originator Volume Level Type Role Number					Revision
14387-WIE-ZZ-XX-FR-D-92001					P01



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GENERAL NOTES

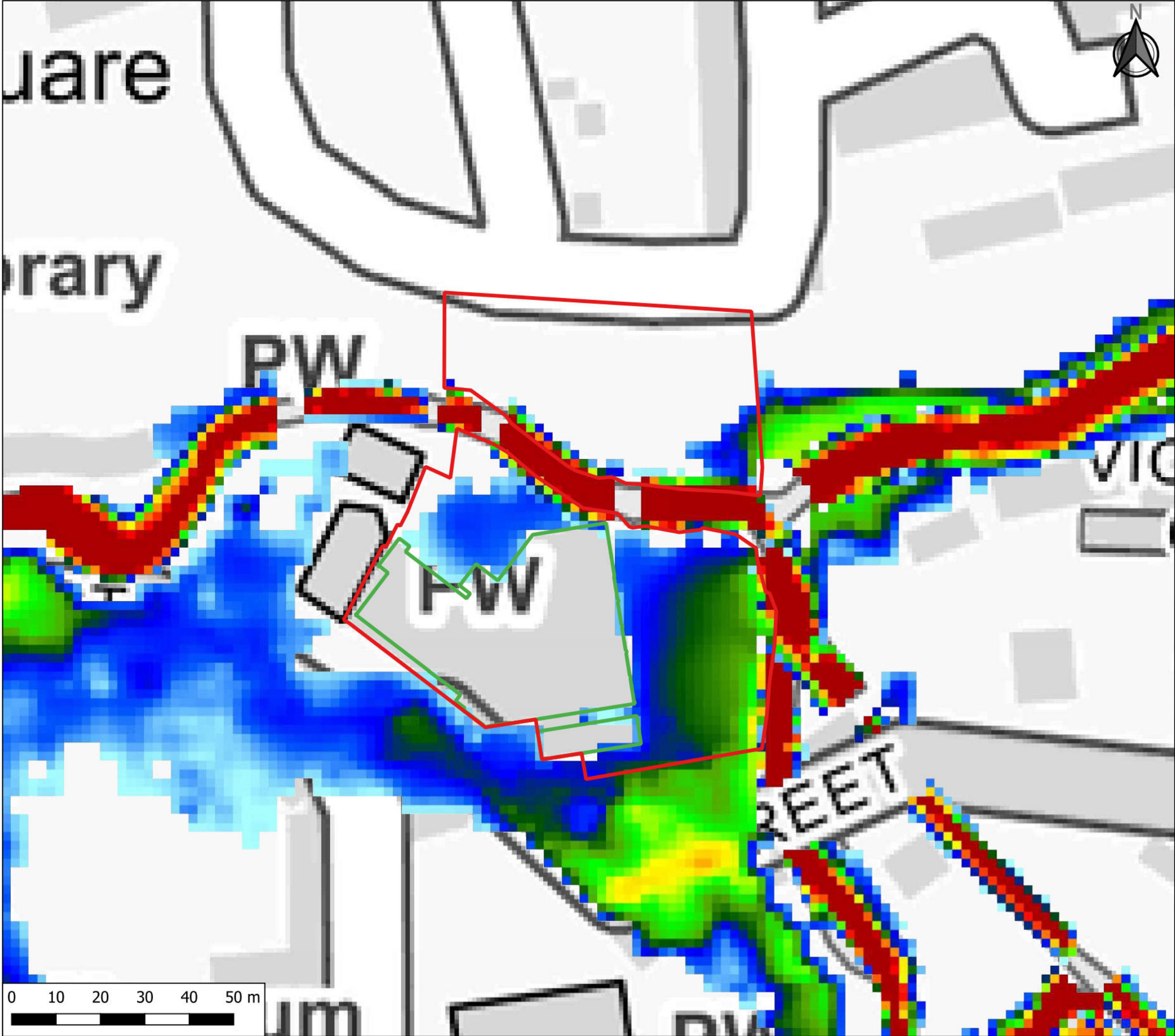
KEY

- Red Line Boundary
- Existing Buildings

Maximum Depth (m)

0.00
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Project	CHURCH STREET, CALNE				
Title	1 IN 100 YEAR - MAXIMUM DEPTH BASELINE SCENARIO				
Client	NORTHOLD GROUP				
					
	Pickfords Wharf Clink Street London SE1 9DG t 020 7928 7888				
Status	PRELIMINARY				
Model Ref	AVON	Run No.	050	Scenario	BSC
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Project Originator Volume Level Type Role Number					Revision
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Project

CHURCH STREET, CALNE

Title

1 IN 100 YEAR +35% CC - MAXIMUM DEPTH
BASELINE SCENARIO

Client

NORTHOLD GROUP

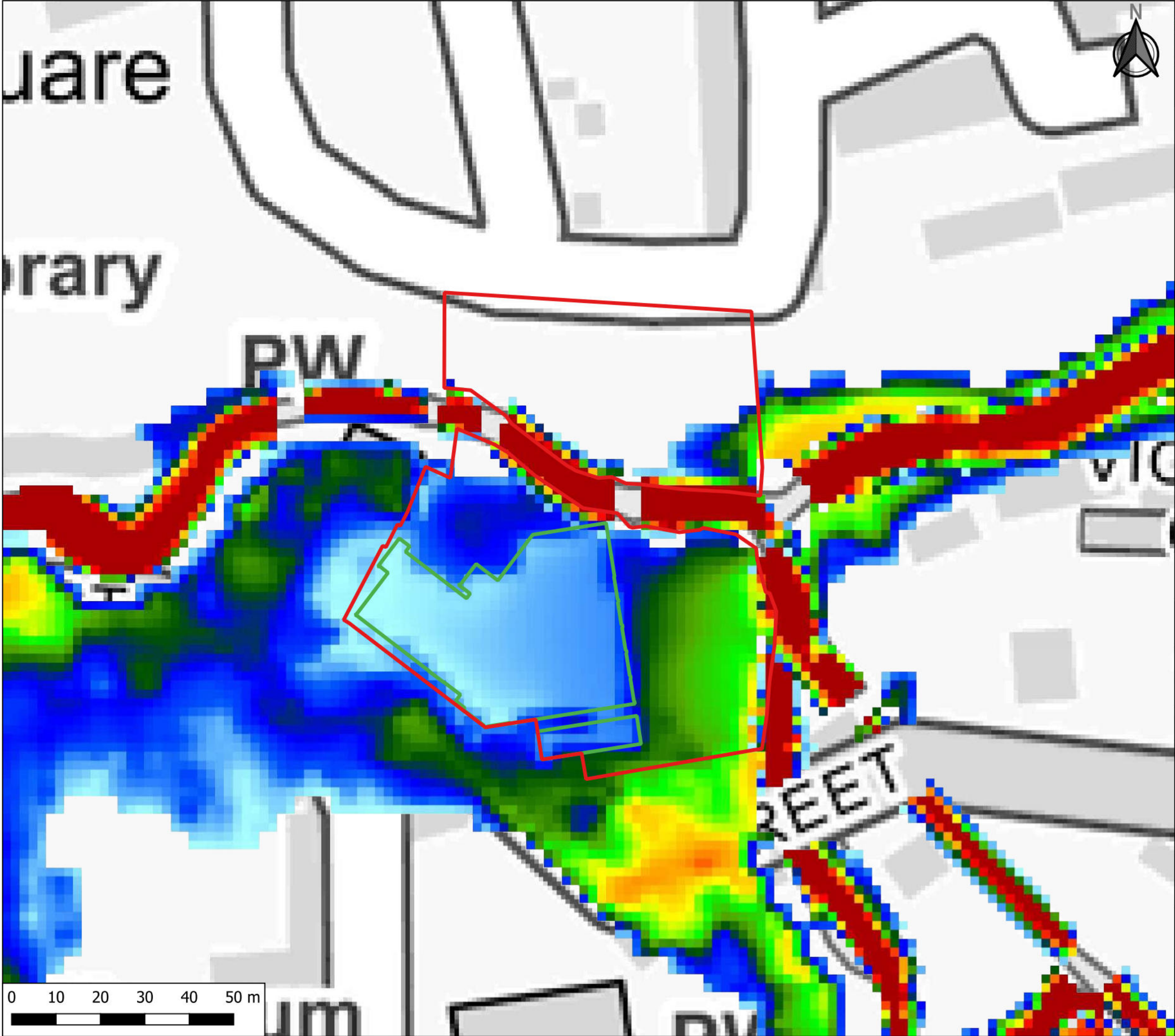


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GENERAL NOTES

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Red Line Boundary

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0.45

0.60

0.75

0.90

1.05

1.20

1.35

>1.50

Project

CHURCH STREET, CALNE

Title

1 IN 100 YEAR +70% CC - MAXIMUM DEPTH
BASELINE SCENARIO

Client

NORTHOLD GROUP

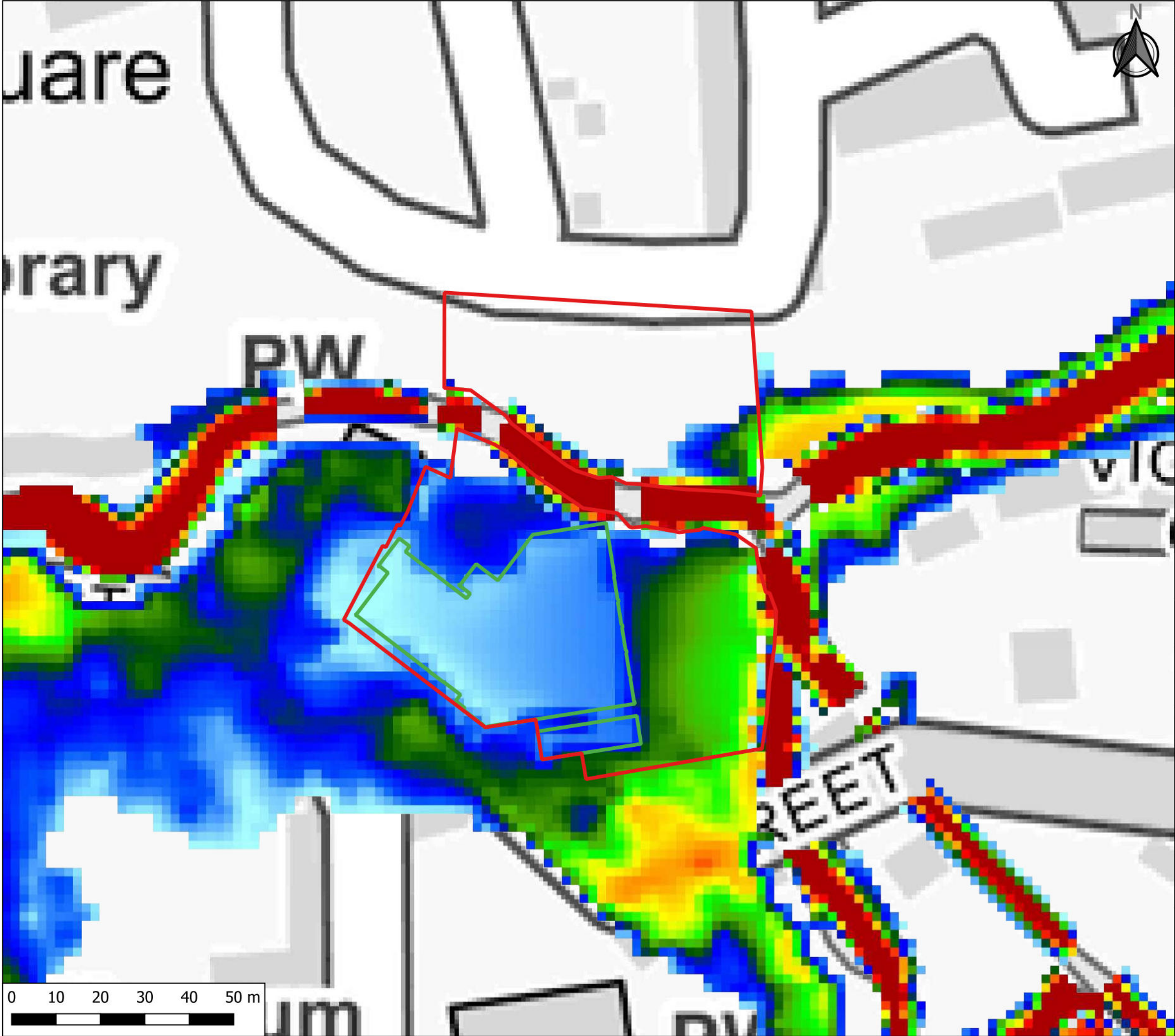


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Status

PRELIMINARY

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Red Line Boundary

Existing Buildings

Maximum Depth (m)

0.00

0.15

0.30

0.45

0.60

0.75

0.90

1.05

1.20

1.35

>1.50

Project

CHURCH STREET, CALNE

Title

1 IN 1000 YEAR - MAXIMUM DEPTH
BASELINE SCENARIO

Client

NORTHOLD GROUP



Pickfords Wharf Clink Street London SE1 9DG
t 020 7928 7888

Status

PRELIMINARY

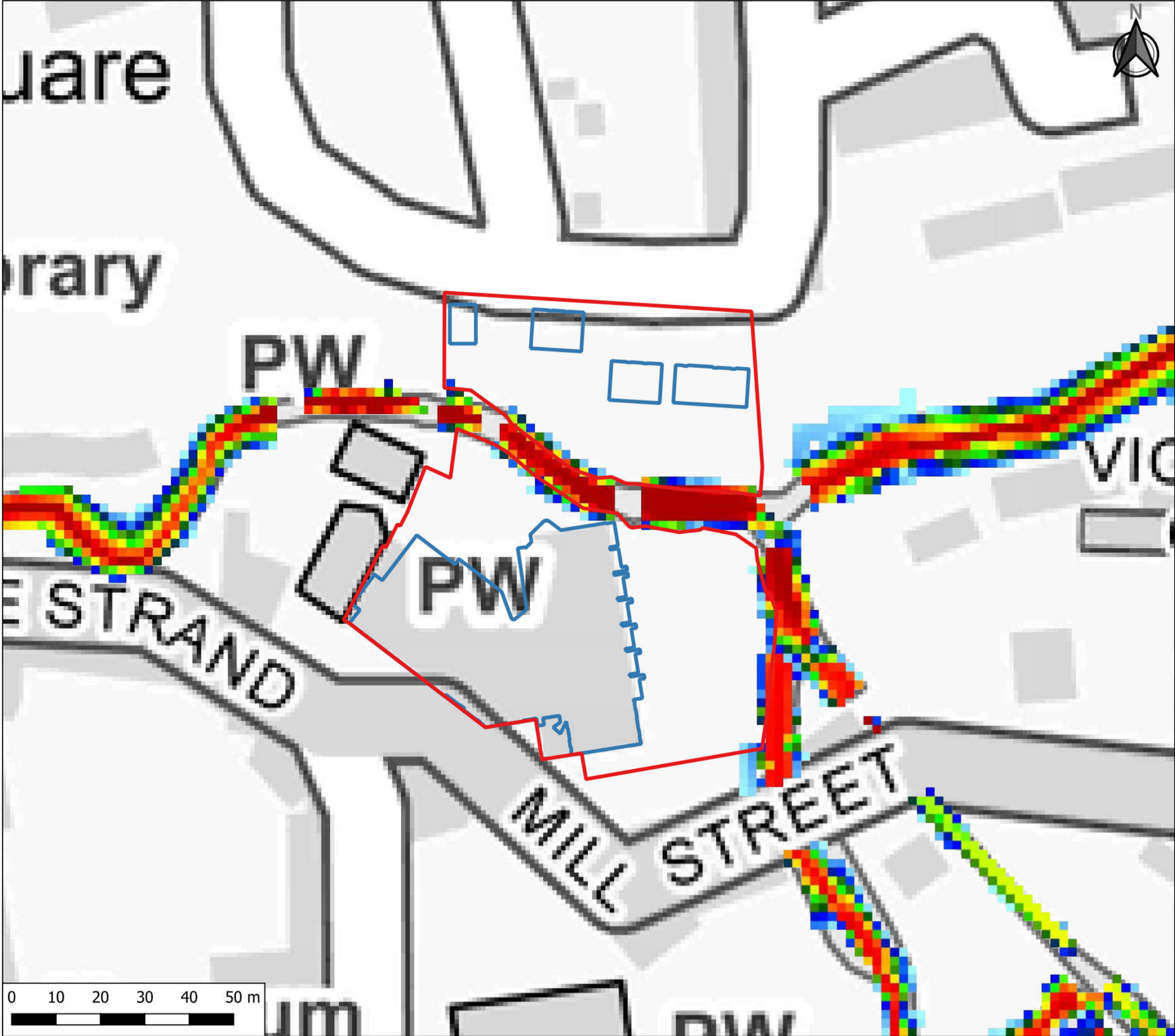
Model Ref	AVON	Run No.	050	Scenario	BSC
Drawn By	CH	Checked By	MS	Date	23.09.20
Project Originator Volume Level Type Role Number					Revision
14387-WIE-ZZ-XX-FR-D-92005					P01



D. Proposed Scenario Model Results

Appendices

Mill Street and The Pippin, Calne
WIE14387-TN-3-1-3-HMR
WIE14387



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Pickfords Wharf, Clink Street, London SE1 9DG
t 020 7928 7888 f 03333 444 501

GENERAL NOTES

KEY

 Red Line Boundary

 Proposed Buildings

Maximum Depth (m)

	0.00
	0.15
	0.30
	0.45
	0.60
	0.75
	0.90
	1.05
	1.20
	1.35
	>1.50

Project

CHURCH STREET, CALNE

Title

1 IN 25 YEAR - MAXIMUM DEPTH
PROPOSED SCENARIO

Client

NORTHOLD GROUP



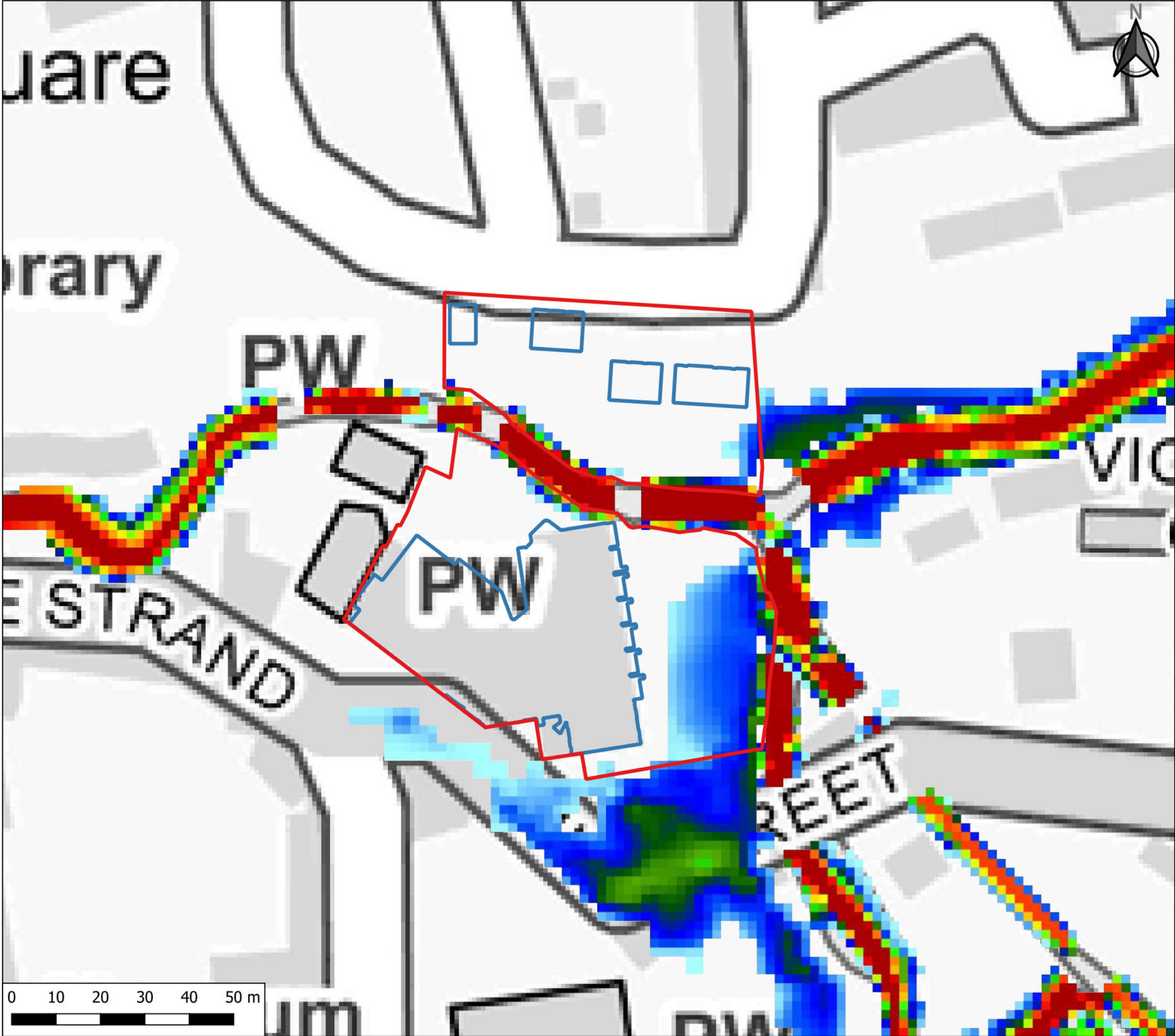
Pickfords Wharf Clink Street London SE1 9DG
t 020 7928 7888

Status

PRELIMINARY

Model Ref	AVON	Run No.	050	Scenario	PRP
Drawn By	CH	Checked By	MS	Date	23.09.20
Project Originator Volume Level Type Role Number					Revision
14387-WIE-ZZ-XX-FR-D-92101					P01





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Pickfords Wharf, Clink Street, London SE1 9DG
t 020 7928 7888 f 03333 444 501

GENERAL NOTES

KEY

Red Line Boundary

Proposed Buildings

Maximum Depth (m)

	0.00
	0.15
	0.30
	0.45
	0.60
	0.75
	0.90
	1.05
	1.20
	1.35
	>1.50

Project

CHURCH STREET, CALNE

Title

1 IN 100 YEAR - MAXIMUM DEPTH PROPOSED SCENARIO

Client

NORTHOLD GROUP

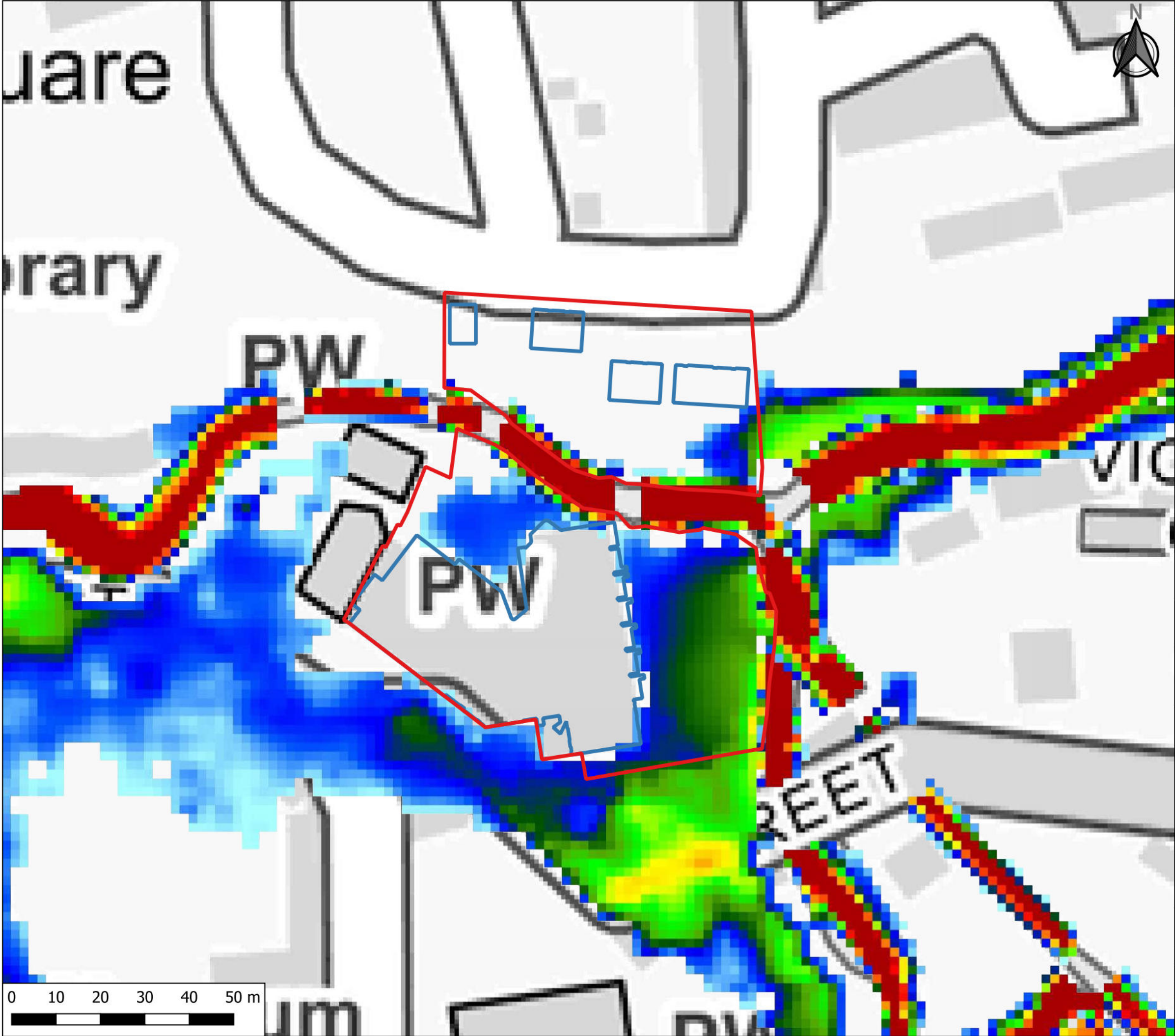


Pickfords Wharf Clink Street London SE1 9DG
t 020 7928 7888

Status

PRELIMINARY

Model Ref	AVON	Run No.	050	Scenario	PRP
Drawn By	CH	Checked By	MS	Date	23.09.20
Project Originator Volume Level Type Role Number					Revision
14387-WIE-ZZ-XX-FR-D-92102					P01



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Pickfords Wharf, Clink Street, London SE1 9DG
t 020 7928 7888 f 03333 444 501

GENERAL NOTES

KEY

Red Line Boundary

Proposed Buildings

Maximum Depth (m)

0.00

0.15

0.30

0.45

0.60

0.75

0.90

1.05

1.20

1.35

>1.50

Project

CHURCH STREET, CALNE

Title

1 IN 100 YEAR +35% CC - MAXIMUM DEPTH PROPOSED SCENARIO

Client

NORTHOLD GROUP

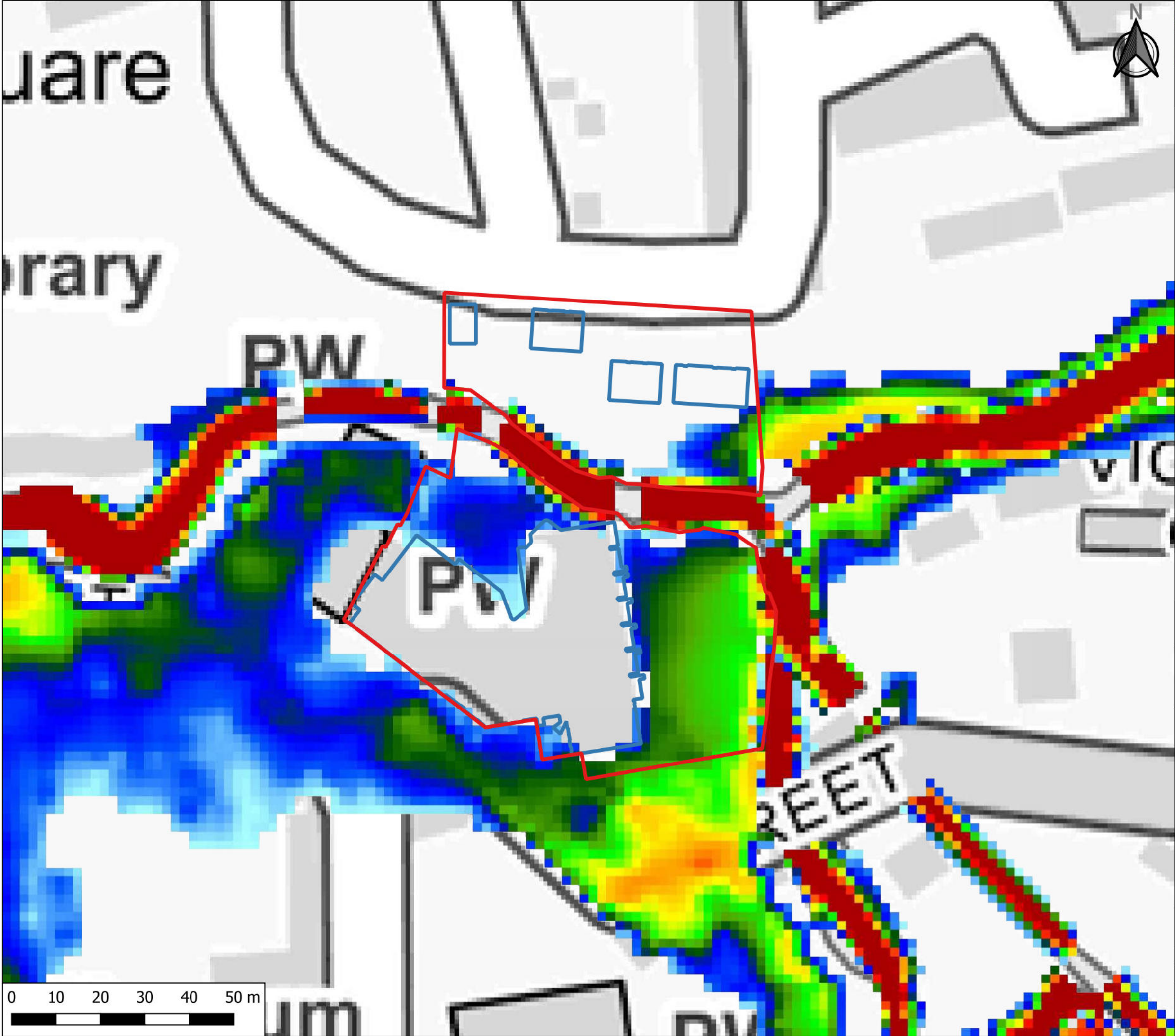


Pickfords Wharf Clink Street London SE1 9DG
t 020 7928 7888

Status

PRELIMINARY

Model Ref	AVON	Run No.	050	Scenario	PRP
Drawn By	CH	Checked By	MS	Date	23.09.20
Project Originator Volume Level Type Role Number					Revision
14387-WIE-ZZ-XX-FR-D-92103					P01



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Pickfords Wharf, Clink Street, London SE1 9DG
t 020 7928 7888 f 03333 444 501

GENERAL NOTES

KEY

Red Line Boundary

Proposed Buildings

Maximum Depth (m)

 0.00
 0.15
 0.30
 0.45
 0.60
 0.75
 0.90
 1.05
 1.20
 1.35
 >1.50

Project

CHURCH STREET, CALNE

Title

1 IN 100 YEAR +70% CC - MAXIMUM DEPTH
PROPOSED SCENARIO

Client

NORTHOLD GROUP



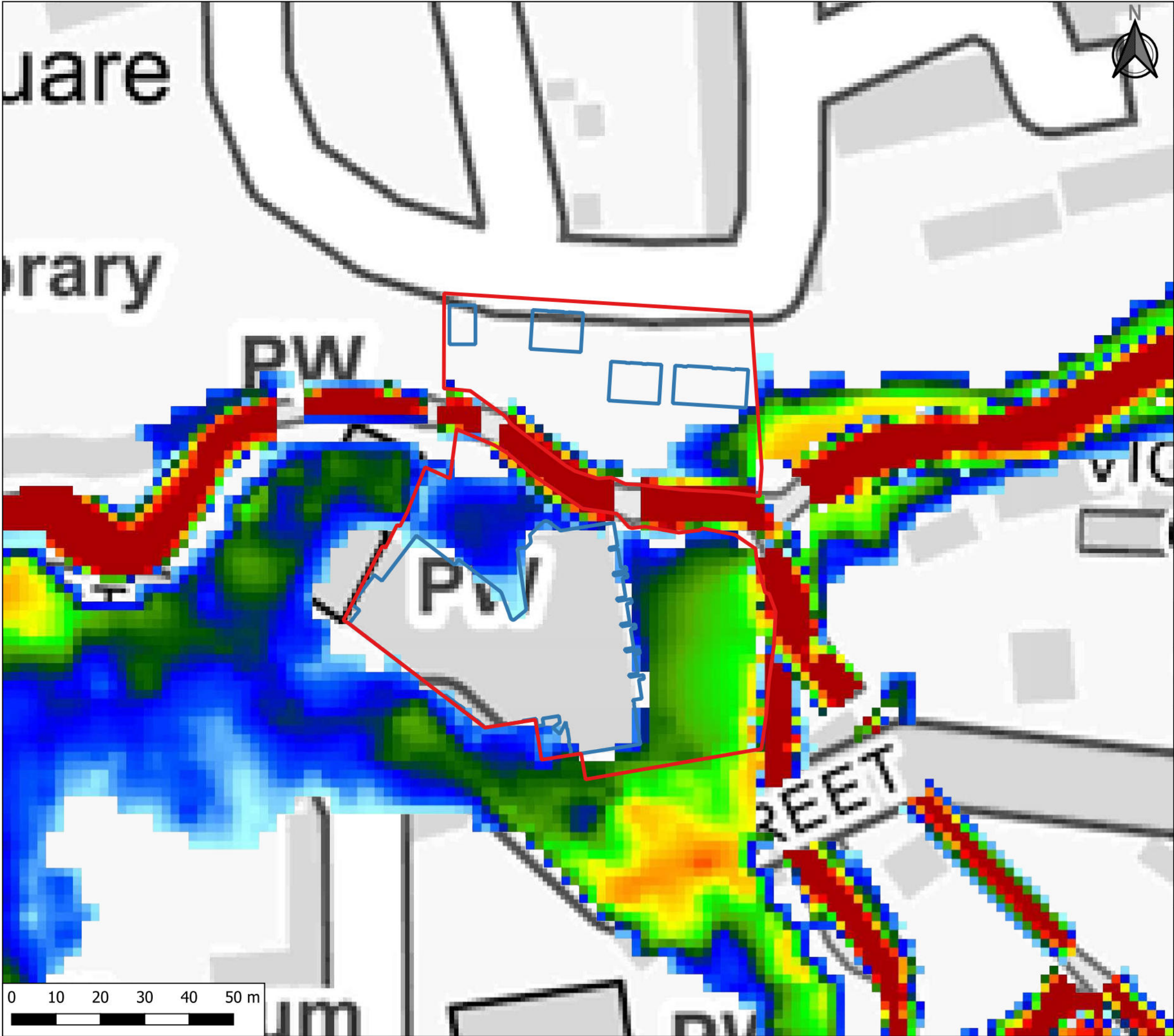
Pickfords Wharf Clink Street London SE1 9DG

t 020 7928 7888

Status

PRELIMINARY

Model Ref	AVON	Run No.	050	Scenario	PRP
Drawn By	CH	Checked By	MS	Date	23.09.20
Project Originator Volume Level Type Role Number					Revision
14387-WIE-ZZ-XX-FR-D-92104					P01



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Pickfords Wharf, Clink Street, London SE1 9DG
t 020 7928 7888 f 03333 444 501

GENERAL NOTES

KEY

Red Line Boundary

Proposed Buildings

Maximum Depth (m)

0.00

0.15

0.30

0.45

0.60

0.75

0.90

1.05

1.20

1.35

>1.50

Project

CHURCH STREET, CALNE

Title

1 IN 1000 YEAR - MAXIMUM DEPTH
PROPOSED SCENARIO

Client

NORTHOLD GROUP



Pickfords Wharf Clink Street London SE1 9DG
t 020 7928 7888

Status

PRELIMINARY

Model Ref	AVON	Run No.	050	Scenario	PRP
Drawn By	CH	Checked By	MS	Date	23.09.20
Project Originator Volume Level Type Role Number					Revision
14387-WIE-ZZ-XX-FR-D-92105					P01



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Pickfords Wharf, Clink Street, London SE1 9DG
t 020 7928 7888 f 03333 444 501

GENERAL NOTES

KEY

Red Line Boundary

Proposed Buildings

Depth Difference (m)

<-2.000

-2.000 to -1.000

-1.000 to -0.500

-0.500 to -0.100

-0.100 to -0.050

-0.050 to -0.025

-0.025 to -0.005

-0.005 to +0.005

+0.005 to +0.025

+0.025 to +0.050

+0.050 to +0.100

+0.100 to +0.500

+0.500 to +1.000

+1.000 to +2.000

>+2.000

Project

CHURCH STREET, CALNE

Title

1 IN 100 YEAR +35% CC - CHANGE IN DEPTH
PROPOSED SCENARIO

Client

NORTHOLD GROUP



Pickfords Wharf Clink Street London SE1 9DG
t 020 7928 7888

Status

PRELIMINARY

Model Ref	AVON	Run No.	050	Scenario	PRP
Drawn By	CH	Checked By	MS	Date	23.09.20
Project Originator Volume Level Type Role Number					Revision
14387-WIE-ZZ-XX-FR-D-92110					P01



E. Sensitivity Test Results

Appendices

Mill Street and The Pippin, Calne
WIE14387-TN-3-1-3-HMR
WIE14387

Model Node	Downstream Boundary Sensitivity				
	-20% DSBDY	Difference	Baseline	Difference	+20% DSBDY
1221_12243	76.87	0.00	76.87	0.00	76.87
1221_12232	76.87	0.00	76.87	0.00	76.87
1221_12214	76.82	0.00	76.82	0.00	76.82
1221_12214d	76.77	0.00	76.77	0.00	76.77
1221_12208	76.75	0.00	76.75	0.00	76.75
1221_12208d	76.42	0.00	76.42	0.00	76.42
1221_12203	76.40	0.00	76.40	0.00	76.40
1221_12177	76.38	0.00	76.38	0.00	76.38
1221_12114	76.34	0.00	76.34	0.00	76.34
1221_12044	76.32	0.00	76.32	0.00	76.32
1221_12022u	76.32	0.00	76.32	0.00	76.32
1221r_00267	77.08	0.00	77.08	0.00	77.08
1221r_00192	76.75	0.00	76.75	0.00	76.75
1221r_00144	76.52	0.00	76.52	0.00	76.52
1221r_00100	76.42	0.00	76.42	0.00	76.42
1221r_00066	76.37	0.00	76.37	0.00	76.37
1221r_00000	76.32	0.00	76.32	0.00	76.32
1221_12022	76.32	0.00	76.32	0.00	76.32
1221_11970	76.28	0.00	76.28	0.00	76.28
1221n_00132d	75.73	0.00	75.73	0.00	75.73
1221n_00116	75.65	0.00	75.65	0.00	75.65
1221n_00088	75.46	0.00	75.46	0.00	75.46
1221n_00053	75.10	0.00	75.10	0.00	75.10
1221n_00000	74.90	0.00	74.90	0.00	74.90
1221_11970d	76.28	0.00	76.28	0.00	76.28
1221_11937	76.28	0.00	76.28	0.00	76.28
1221_11910	76.28	0.00	76.28	0.00	76.28
1221_11910d	76.26	0.00	76.26	0.00	76.26
1221_11907	76.26	0.00	76.26	0.00	76.26
1221_11907d	76.25	0.00	76.25	0.00	76.25
1221_11899	76.25	0.00	76.25	0.00	76.25
1221_11895	76.24	0.00	76.24	0.00	76.24
1221_11883	76.24	0.00	76.24	0.00	76.24
1221_11866u	76.24	0.00	76.24	0.00	76.24
1221_11866d	74.90	0.00	74.90	0.00	74.90
1221_11862	74.90	0.00	74.90	0.00	74.90
1221_11841	74.90	0.00	74.90	0.00	74.90
1221_11841d	74.82	0.00	74.82	0.00	74.82
1221_11829	74.84	0.00	74.84	0.00	74.84
1221_11829d	74.84	0.00	74.84	0.00	74.84
1221_11821	74.82	0.00	74.82	0.00	74.82
1221_11772	74.72	0.00	74.72	0.00	74.72
1221_11717	74.63	0.00	74.63	0.00	74.63
1221_11665	74.44	0.00	74.44	0.00	74.44
1221_11627	74.30	0.00	74.30	0.00	74.30
1221_11569	74.12	0.00	74.12	0.00	74.12
1221_11526	74.01	0.00	74.01	0.00	74.01
1221_11526d	74.00	0.00	74.00	0.00	74.00

1221_11473	73.85	0.00	73.85	0.00	73.85
1221_11410	73.73	0.00	73.73	0.00	73.73
1221_11410d	73.73	0.00	73.73	0.00	73.73
1221_11396	73.66	0.00	73.66	0.00	73.66
1221_11338	73.47	0.00	73.47	0.00	73.47
1221_11338d	73.47	0.00	73.47	0.00	73.47
1221_11304	73.49	0.00	73.49	0.00	73.49
1221_11304d	73.49	0.00	73.49	0.00	73.49
1221_11272	73.37	0.00	73.37	0.00	73.37
1221_11272d	72.87	0.00	72.87	0.00	72.87
1221_11265	72.87	0.00	72.87	0.00	72.87
1221_11252	72.87	0.00	72.87	0.00	72.87
1221_11224	72.84	0.00	72.84	0.00	72.84
1221_11219	72.84	0.00	72.84	0.00	72.84
1221_11204	72.83	0.00	72.83	0.00	72.83
1221_11150	72.81	0.00	72.81	0.00	72.81
1221_11088	72.80	0.00	72.80	0.00	72.80
1221_11088d	72.76	0.00	72.76	0.00	72.76
1221_11034	72.74	0.00	72.74	0.00	72.74
1221_10966	72.71	0.00	72.71	0.00	72.71
1221_10948u	72.71	0.00	72.71	0.00	72.71
1221k_00140d	71.58	0.00	71.58	0.00	71.58
1221k_00133	71.55	0.00	71.55	0.00	71.55
1221k_00046	71.36	0.00	71.36	0.00	71.36
1221k_00046d	70.96	0.00	70.96	0.00	70.96
1221k_00000	70.94	0.00	70.94	0.00	70.94
1221_10948	72.71	0.00	72.71	0.00	72.71
1221_10867	72.65	0.00	72.65	0.00	72.65
1221_10867d	71.55	0.00	71.55	0.00	71.55
1221_10861	71.55	0.00	71.55	0.00	71.55
1221_10828	71.42	0.00	71.42	0.00	71.42
1221_10828d	71.06	0.00	71.06	0.00	71.06
1221_10769	70.93	0.00	70.93	0.00	70.93
1221_10769d	70.93	0.00	70.93	0.00	70.93
1221_10702	70.83	0.00	70.83	0.00	70.83
1221_10649	70.77	0.00	70.77	0.00	70.77
1221_10616	70.75	0.00	70.75	0.00	70.75
1221_10543	70.67	0.00	70.67	0.00	70.67
1221_10543d	70.67	0.00	70.67	0.00	70.67
1221_10539	70.71	0.00	70.71	0.00	70.71
1221_10535	70.70	0.00	70.70	0.00	70.70
1221_10532	70.67	0.00	70.67	0.00	70.67
1221_10532d	70.37	0.00	70.37	0.00	70.37
1221_10459	70.25	0.00	70.25	0.00	70.25
1221_10459d	70.08	0.00	70.08	0.00	70.08
1221_10450	70.01	0.00	70.01	0.00	70.01
1221_10450d	70.01	0.00	70.01	0.00	70.01
1221_10441	69.97	0.00	69.97	0.00	69.97
1221_10407	69.81	0.00	69.81	0.00	69.81
1221_10332	69.48	0.00	69.48	0.00	69.48

1221_10277	69.30	0.00	69.30	0.00	69.30
1221_10219	69.02	0.00	69.02	0.00	69.02
1221h_00078	69.02	0.00	69.02	0.00	69.02
1221h_00037	68.80	0.00	68.80	0.00	68.80
1221h_00032	68.78	0.00	68.78	0.00	68.78
1221h_00028	68.77	0.00	68.77	0.00	68.77
1221h_00000	68.76	0.00	68.76	0.00	68.76
1221_10219d	69.02	0.00	69.02	0.00	69.02
1221_10173	68.94	0.00	68.94	0.00	68.94
1221_10118u	68.79	0.00	68.79	0.00	68.79
1221f_00168	68.76	0.00	68.76	0.00	68.76
1221f_00157	68.76	0.00	68.76	0.00	68.76
1221f_00142	68.74	0.00	68.74	0.00	68.74
1221f_00115	68.71	0.00	68.71	0.00	68.71
1221f_00095	68.71	0.00	68.71	0.00	68.71
1221f_00086	68.70	0.00	68.70	0.00	68.70
1221f_00052	68.68	0.00	68.68	0.00	68.68
1221f_00052d	68.59	0.00	68.59	0.00	68.59
1221f_00046	68.59	0.00	68.59	0.00	68.59
1221f_00046d	68.59	0.00	68.59	0.00	68.59
1221f_00035	68.58	0.00	68.58	0.00	68.58
1221f_00000	68.56	0.00	68.56	0.00	68.56
1221_10118	68.79	0.00	68.79	0.00	68.79
1221_10071	68.75	0.00	68.75	0.00	68.75
1221_10061	68.63	0.00	68.63	0.00	68.63
1221_10060	68.63	0.00	68.63	0.00	68.63
1221_10051	68.56	0.00	68.56	0.00	68.56
1221_10033	68.59	0.00	68.59	0.00	68.59
1221_10015	68.56	0.00	68.56	0.00	68.56
1222_1618	74.98	0.00	74.98	0.00	74.98
1222_1530	74.78	0.00	74.78	0.00	74.78
1222_1509	74.56	0.00	74.56	0.00	74.56
1222_1216	72.79	0.00	72.79	0.00	72.79
1222_0836	70.76	0.00	70.76	0.00	70.76
1222_0759	70.44	0.00	70.44	0.00	70.44
1222_0680	70.20	0.00	70.20	0.00	70.20
1222_0678	70.20	0.00	70.20	0.00	70.20
1222_0641	70.12	0.00	70.12	0.00	70.12
1222_0596	70.07	0.00	70.07	0.00	70.07
1222_0561	70.02	0.00	70.02	0.00	70.02
1222_0561d	69.92	0.00	69.92	0.00	69.92
1222_0544	69.84	0.00	69.84	0.00	69.84
1222_0544d	69.83	0.00	69.83	0.00	69.83
1222_0531	69.75	0.00	69.75	0.00	69.75
1222_0531d	69.75	0.00	69.75	0.00	69.75
1222_0527	69.77	0.00	69.77	0.00	69.77
1222_0527d	69.67	0.00	69.67	0.00	69.67
1222_0519	69.61	0.00	69.61	0.00	69.61
1222_0451	69.43	0.00	69.43	0.00	69.43
1222_0451d	69.21	0.00	69.21	0.00	69.21

1222_0433	69.13	0.00	69.13	0.00	69.13
1222_0370	68.92	0.00	68.92	0.00	68.92
1222_0370d	68.92	0.00	68.92	0.00	68.92
1222_0191	68.69	0.00	68.69	0.00	68.69
1222_0191d	68.66	0.00	68.66	0.00	68.66
1222_0180	68.64	0.00	68.64	0.00	68.64
1222_0180d	68.61	0.00	68.61	0.00	68.61
1222_0137	68.60	0.00	68.60	0.00	68.60
1222_0120	68.60	0.00	68.60	0.00	68.60
1222_0007	68.58	0.00	68.58	0.00	68.58
1222_0007d	68.56	0.00	68.56	0.00	68.56
1222_0000	68.56	0.00	68.56	0.00	68.56
1221_10015d	68.56	0.00	68.56	0.00	68.56
1221_9989	68.56	0.00	68.56	0.00	68.56
1221_9976	68.56	0.00	68.56	0.00	68.56
1221_9976d	68.55	0.00	68.55	0.00	68.55
1221_9974	68.53	0.00	68.53	0.00	68.53
1221_9974d	68.53	0.00	68.53	0.00	68.53
1221_9964	68.52	0.00	68.52	0.00	68.52
1221_9940	68.47	0.00	68.47	0.00	68.47
1221_9940d	68.45	0.00	68.45	0.00	68.45
1221_9933	68.42	0.00	68.42	0.00	68.42
1221_9933d	68.42	0.00	68.42	0.00	68.42
1221_9926	68.41	0.00	68.41	0.00	68.41
1221_9926d	68.09	0.00	68.09	0.00	68.09
1221_9922	68.06	0.00	68.06	0.00	68.06
1221_9922d	68.06	0.00	68.06	0.00	68.06
1221_9890	67.87	0.00	67.87	0.00	67.87
1221_9890d	67.87	0.00	67.87	0.00	67.87
1221_9887	67.97	0.00	67.97	0.00	67.97
1221_9887d	67.97	0.00	67.97	0.00	67.97
1221_9843	67.60	0.00	67.60	0.00	67.60
1221_9796	67.46	0.00	67.46	0.00	67.46
1221_9743	67.43	0.00	67.43	0.00	67.43
1221_9703	67.17	0.00	67.17	0.00	67.17
1221_9605	67.01	0.00	67.01	0.00	67.01
1221_9605d	67.02	0.00	67.02	0.00	67.02
1221_9599u	66.99	0.00	66.99	0.00	66.99
1221_9599d	66.99	0.00	66.99	0.00	66.99
1221_9560	66.90	0.00	66.90	0.00	66.90
1221_9552u	66.87	0.00	66.87	0.00	66.87
1221_9552d	66.60	0.00	66.60	0.00	66.60
1221_9522	66.52	0.00	66.52	0.00	66.52
1221_9492	66.46	0.00	66.46	0.00	66.46
1221_9492d	66.30	0.00	66.30	0.00	66.30
1221_9490u	66.30	0.00	66.30	0.00	66.30
1221_9490d	66.30	0.00	66.30	0.00	66.30
1221_9476	66.29	0.00	66.29	0.00	66.29
1221_9476d	66.29	0.00	66.29	0.00	66.29
1221_9447	66.15	0.00	66.15	0.00	66.15

1221_9386	66.08	0.00	66.08	0.00	66.08
1221_9375u	66.06	0.00	66.06	0.00	66.06
1221_9375d	65.96	0.00	65.96	0.00	65.96
1221_9324	65.83	0.00	65.83	0.00	65.83
1221_9229	65.70	0.00	65.70	0.00	65.70
1221_9211	65.72	0.00	65.72	0.00	65.72
1221_9211d	65.68	0.00	65.68	0.00	65.68
1221_9165	65.55	0.00	65.55	0.00	65.55
1221_9165d	65.33	0.00	65.33	0.00	65.33
1221_9161u	65.31	0.00	65.31	0.00	65.31
1221_9161d	65.31	0.00	65.31	0.00	65.31
1221_9095	65.24	0.00	65.24	0.00	65.24
1221_8983	65.17	0.00	65.17	0.00	65.17
1221_8882	64.93	0.00	64.93	0.00	64.93
1221_8831	64.81	0.00	64.81	0.00	64.81
1221_8729	64.68	0.00	64.68	0.00	64.68
1221_8561	64.29	0.00	64.29	0.00	64.29
1221_8541u	64.21	0.00	64.21	0.00	64.21
1221_8541d	63.83	0.00	63.83	0.00	63.83
1221_8515	63.83	0.00	63.83	0.00	63.83
1221_8493	63.79	0.00	63.79	0.00	63.79
1221_8185	63.44	0.00	63.44	0.01	63.44
1221_8185d	63.02	0.00	63.02	0.01	63.04
1221_8181u	63.00	0.00	63.01	0.01	63.02
1221_8181d	63.00	0.00	63.01	0.01	63.02
1221_7874	62.20	-0.02	62.23	0.08	62.31
1221_7559	61.65	-0.07	61.72	0.19	61.92
1221_7391	61.13	-0.24	61.37	0.35	61.72
1221_7331	60.80	-0.42	61.22	0.42	61.64
1221e_0014	66.46	0.00	66.46	0.00	66.46
1221e_0000u	66.29	0.00	66.29	0.00	66.29

Appendix G

Environment Agency Flood Map for Planning

Flood map for planning

Your reference
IMA-24-110

Location (easting/northing)
399910/171016

Created
21 November 2025 12:01

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see <https://www.gov.uk/guidance/flood-risk-assessment-standing-advice>)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2025 AC0000807064. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference

IMA-24-110

Location (easting/northing)

399910/171016

Scale

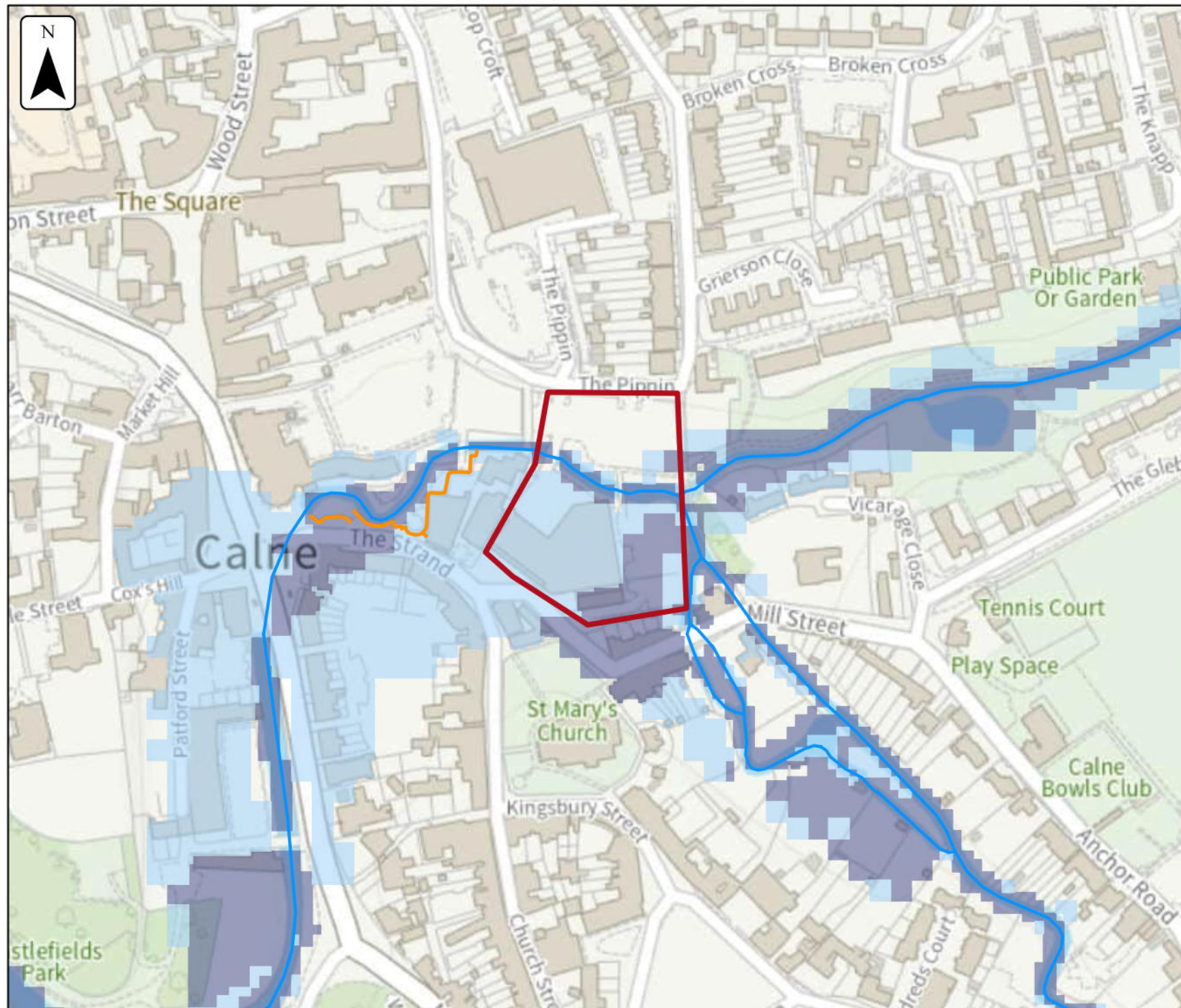
1:2,500

Created

21 Nov 2025 12:01

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area


0 20 40 60m



Appendix H

Greenfield Runoff Rate Calculation

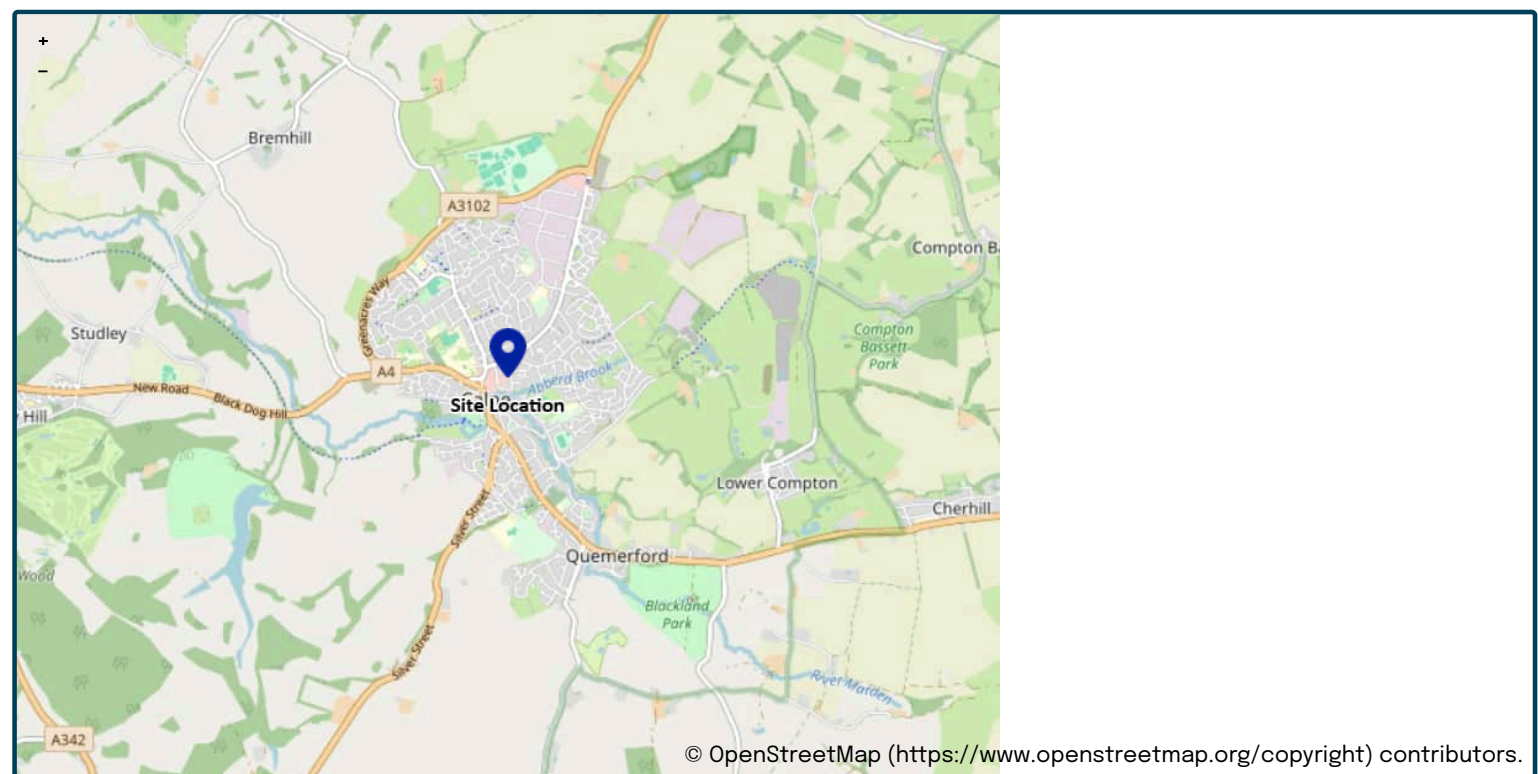
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	11/12/2025
Calculated by	CB
Reference	IMA-24-110
Model version	2.2.2

Location

Site name	Mill Street, Calne
Site location	



Site easting (British National Grid)	399917
Site northing (British National Grid)	170999

Site details

Total site area (ha)	1	ha
----------------------	--------------------------------	----

Greenfield runoff

Method

Method	FEH statistical (2025)
--------	------------------------

FEH statistical (2025)

	<u>My value</u>	<u>Map value</u>
SAAR9120 (mm)	806	mm
BFIHOST19scaled	0.268	
QMed-QBar conversion	1.075	1.075
QMed (l/s)	7	l/s
QBar (FEH statistical 2025) (l/s)	7.5	l/s

Growth curve factors

	<u>My value</u>	<u>Map value</u>
Hydrological region	8	8
1 year growth factor	0.78	
2 year growth factor	0.93	
10 year growth factor	1.49	
30 year growth factor	1.95	
100 year growth factor	2.43	
200 year growth factor	2.78	

Results

Method	FEH statistical (2025)	
Flow rate 1 year (l/s)	5.8	l/s
Flow rate 2 year (l/s)	7.0	l/s
Flow rate 10 years (l/s)	11.1	l/s
Flow rate 30 years (l/s)	14.6	l/s
Flow rate 100 years (l/s)	18.2	l/s
Flow rate 200 years (l/s)	20.8	l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.2) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Appendix I

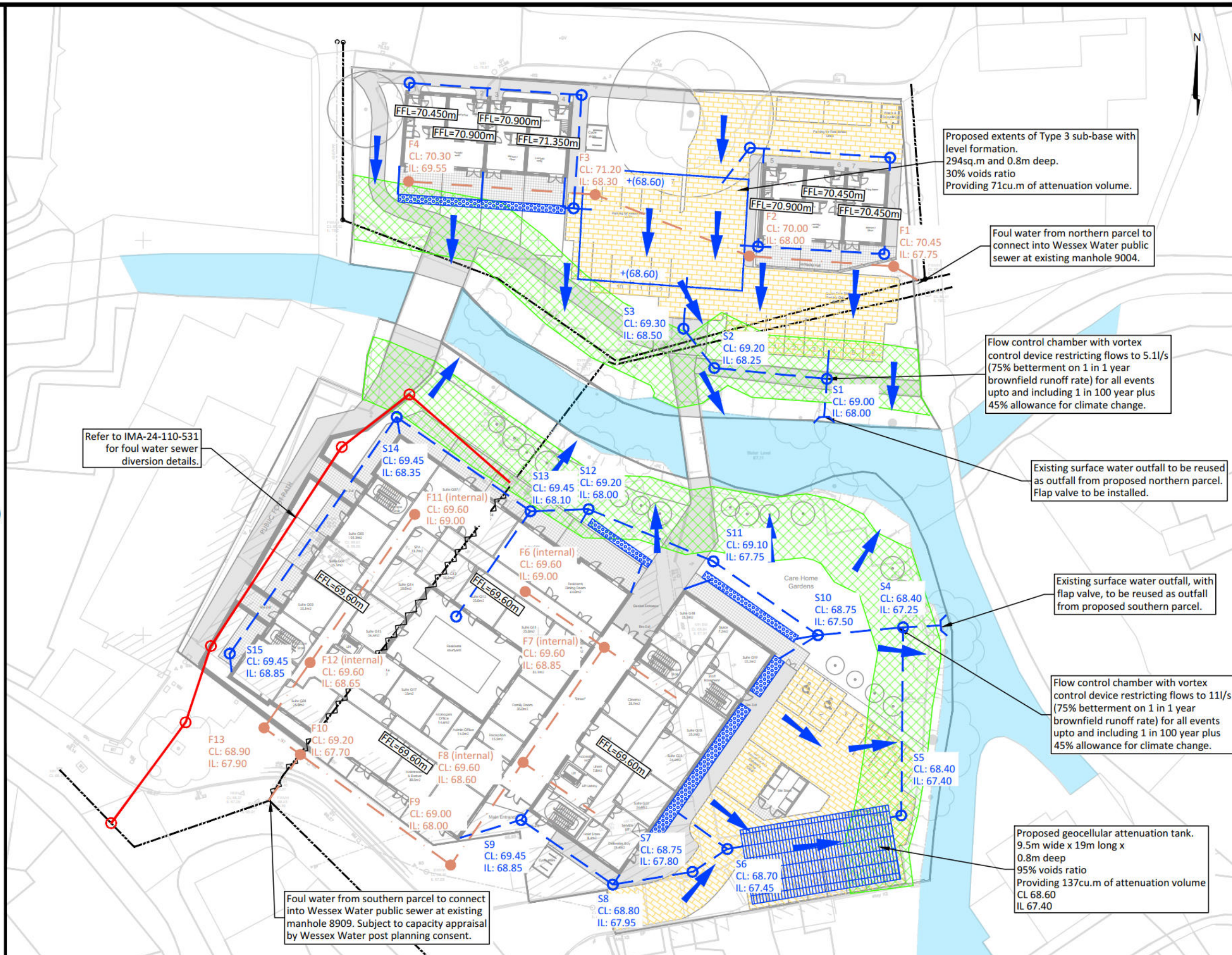
Proposed Drainage Strategy Plan

Legend:

- Site Boundary
- Existing River Marden/Doctors Pond
- Existing Foul Water Sewer
- ~ Proposed Abandoned Foul Sewer
- Proposed Foul Water Diversion
- Proposed Foul Water Sewer
- Proposed Surface Water Sewer
- Proposed Attenuation Tank
- Proposed Raingarden
- Proposed Permeable Paving
- Area of permeable paving with level sub-base
- ← Indicative Exceedance Flow Path
- 8m buffer to top of existing river bank (free from structures to facilitate access to river by Environment Agency)

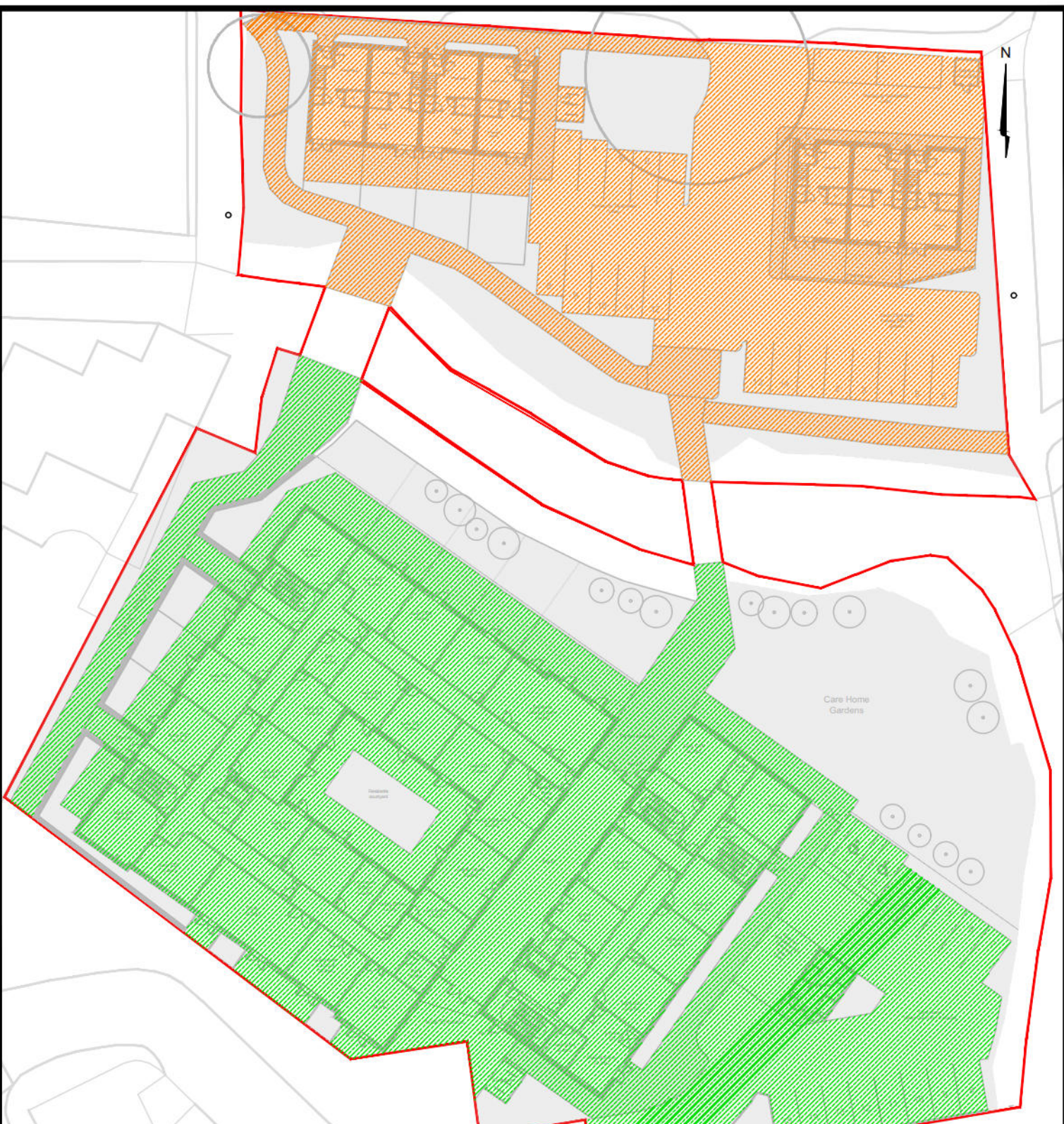
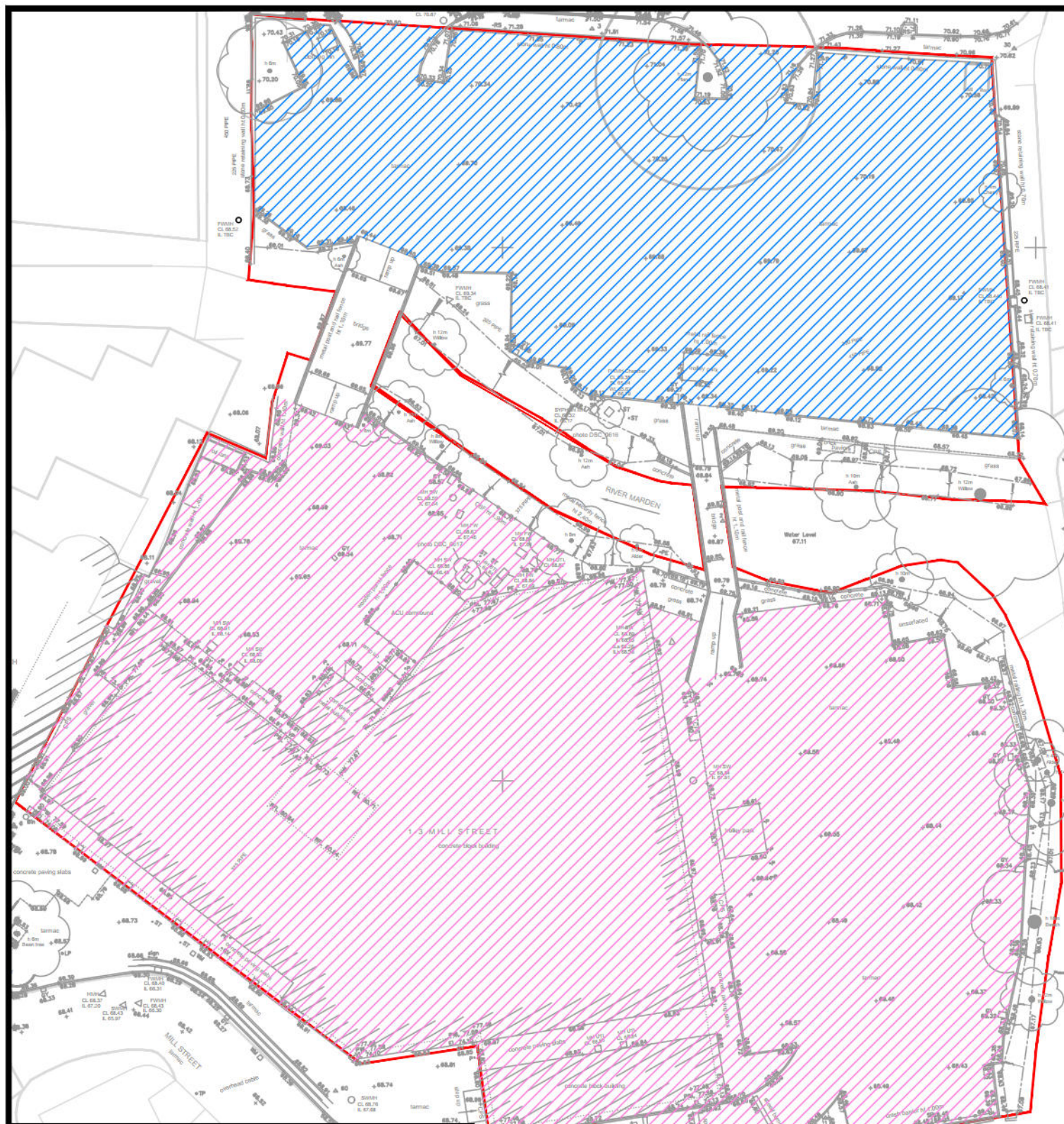
Notes

1. Site layout shown is 4473-3-005F Proposed Site Plan by BBA Architects.
2. Design proposals are conceptual for planning purposes only and do not purport to be a detailed design.
3. The permeable paving and attenuation tank have been sized based on preliminary catchment areas plan. Final sizing is subject to detailed catchments.
4. Refer to IMA-24-110-531 for foul sewer diversion and easement details.



Appendix J

Proposed Drainage Catchment Plan



Existing Drainage Catchments		
	Parcel	Hardstanding and Roof Area (ha)
	Northern	0.200
	Southern	0.430

Proposed Drainage Catchments						
	Parcel	Drained Area (ha)	Greenfield Runoff Rate, QBar (l/s)	Brownfield Runoff Rate, 1in1yr (l/s)	Betterment on Brownfield Runoff Rate (%)	Proposed Discharge Rate (l/s)
	Northern	0.171	1.1	20.4	75	5.1
	Southern	0.331	2.4	43.9	75	11.0

I

M

A

TRANSPORT PLANNING

MONTREUX HOUSE, 18A JAMES STREET WEST

BATH BA1 2BT

T: 01225 444 011

www.ima-tp.com

CLIENT:
Cedar Care Ltd

PROJECT:
1-3 Mill Street, Calne

TITLE:
Drainage Strategy
Existing and Proposed Catchments

SCALE: (A3) 1:500	CHECKED: CB	APPROVED: DS
CAD FILE: IMA-24-110-551.dwg	DESIGN/DRAWN: CB	DATE: June 2026
PROJECT No: IMA-24-110	DRAWING No: 551	REV: C

Appendix K

Surface Water Attenuation Volume Calculations & Brownfield Runoff Rates

Design Settings

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

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
Permeable paving	0.171	5.00	100.000	26.373	57.598	1.000	99.000

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	1 year (l/s)	5.1
Rainfall Events	Singular	Drain Down Time (mins)	240	30 year (l/s)	19.5
Summer CV	0.750	Additional Storage (m³/ha)	0.0	100 year (l/s)	24.4
Winter CV	0.840	Starting Level (m)		Check Discharge Volume	x
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Brownfield	Time of Concentration (mins)	5.00
Brownfield Method	MRM	Betterment (%)	75
Contributing Area (ha)	0.200	Q 1 year (l/s)	5.1
PIMP (%)	100	Q 30 year (l/s)	19.5
CV	0.840	Q 100 year (l/s)	24.4

Node Permeable paving Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	99.000	Product Number	CTL-SHE-0110-5100-0800-5100
Design Depth (m)	0.800	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.1	Min Node Diameter (mm)	1200

Node Permeable paving Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	99.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	148

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	294.0	0.0	0.900	294.0	0.0	0.901	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute summer	Permeable paving	108	99.089	0.089	5.9	7.8902	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
180 minute summer	Permeable paving	Hydro-Brake®	3.3	17.0

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Permeable paving	57	99.354	0.354	29.5	31.2415	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
60 minute winter	Permeable paving	Hydro-Brake®	5.1	42.1

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
120 minute winter	Permeable paving	116	99.803	0.803	34.0	70.8551	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
120 minute winter	Permeable paving	Hydro-Brake®	5.1	93.3

Design Settings

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

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
Attenuation Tank	0.331	5.00	100.000	26.373	57.598	1.000	99.000

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	1 year (l/s)	11.0
Rainfall Events	Singular	Drain Down Time (mins)	240	30 year (l/s)	42.0
Summer CV	0.750	Additional Storage (m³/ha)	0.0	100 year (l/s)	52.4
Winter CV	0.840	Starting Level (m)		Check Discharge Volume	x
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Brownfield	Time of Concentration (mins)	5.00
Brownfield Method	MRM	Betterment (%)	75
Contributing Area (ha)	0.430	Q 1 year (l/s)	11.0
PIMP (%)	100	Q 30 year (l/s)	42.0
CV	0.840	Q 100 year (l/s)	52.4

Node Attenuation Tank Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	99.000	Product Number	CTL-SHE-0155-1100-0800-1100
Design Depth (m)	0.800	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	11.0	Min Node Diameter (mm)	1200

Node Attenuation Tank Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	99.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	126



Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	180.5	0.0	0.800	180.5	0.0	0.801	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
180 minute winter	Attenuation Tank	116	99.102	0.102	8.9	17.5436	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
180 minute winter	Attenuation Tank	Hydro-Brake®	5.8	36.2

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Attenuation Tank	52	99.348	0.348	57.1	59.6245	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
60 minute winter	Attenuation Tank	Hydro-Brake®	11.0	80.3

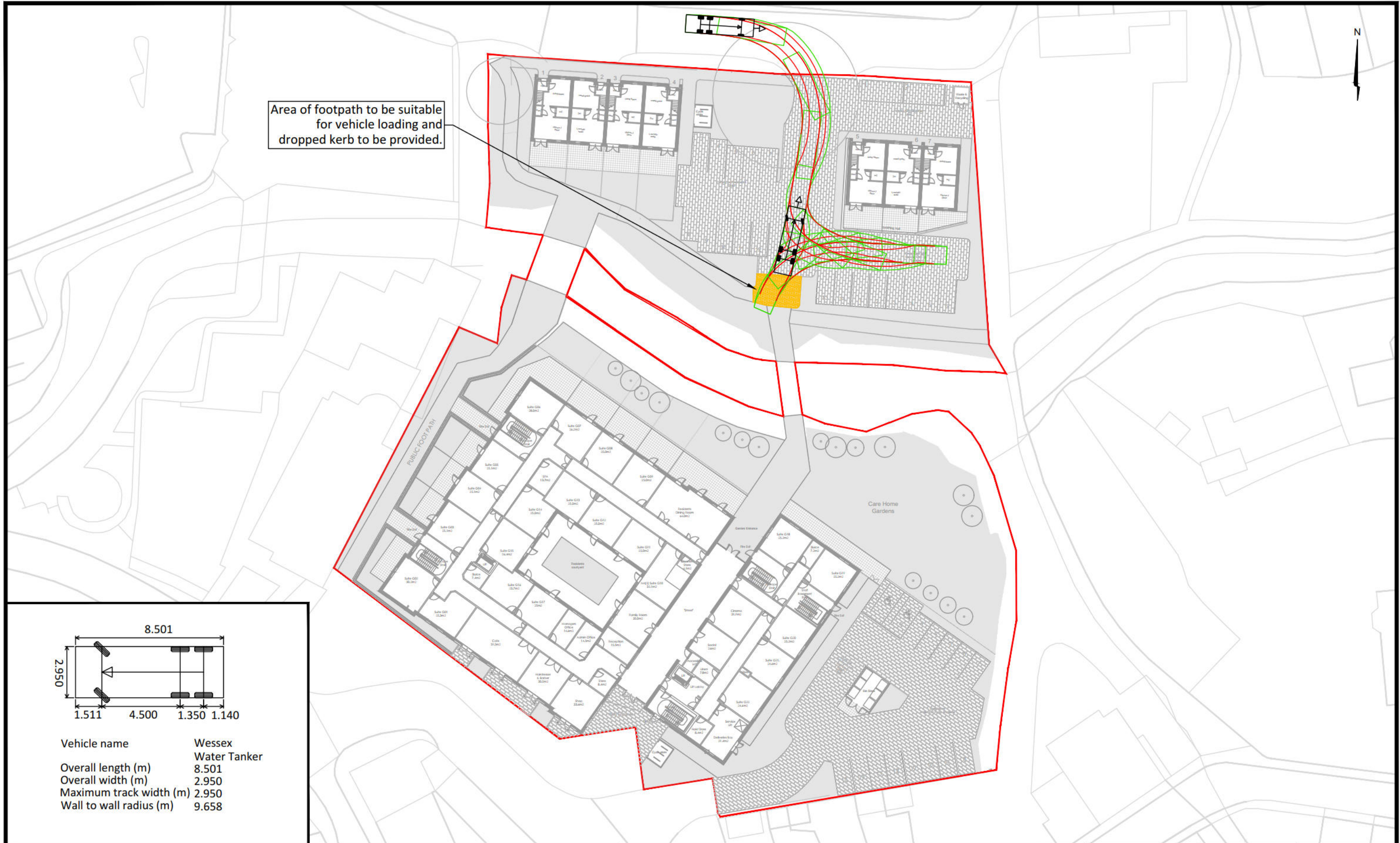
Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
120 minute winter	Attenuation Tank	114	99.782	0.782	65.9	134.0613	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
120 minute winter	Attenuation Tank	Hydro-Brake®	11.0	182.0

Appendix L

Proposed Wessex Water Tanker Access Plan



Appendix M

Proposed Foul Water Sewer Diversion Plan

