

**Proposed Development on
Land Rear of 2-4 Church
Street, Caversham, Reading
RG4 8AT**

Flood Risk Assessment

On behalf of **Krish Food & Leisure Ltd**

Project Ref: 39232/4001 | Rev: - | Date: January 2018



Document Control Sheet

Project Name: Proposed Development on Land Rear of 2-4 Church Street, Caversham, Reading RG4 8AT

Project Ref: 39232/4001

Report Title: Flood Risk Assessment

Doc Ref: -

Date: January 2018

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For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved

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Executive Summary

This Flood Risk Assessment (FRA) has been prepared by Peter Brett Associates LLP (PBA) to support a planning application to Reading Borough Council (RBC) for proposed new development on land at the rear of 2-4 Church Street, Caversham, Reading RG4 8AT.

The Environment Agency (EA) and the GOV.UK current Flood Zone maps shows the site lies within Flood Zone 2 with some of the site in Flood Zone 1.

The proposed development use is classified as “*More vulnerable*” development in accordance with the Planning Practice Guidance (PPG) Table 2.

The existing ground floor level is higher than the 1 in 100 EA Thames Area basic climate change allowance annual probability flood level and the EA advised 1 in 1,000 (0.1%) annual probability flood level.

This FRA confirms that the proposed development is safe, it does not increase flood risk and does not detrimentally affect third parties, all in accordance with the objectives of the NPPF.

1 Introduction

1.1 Scope of Report

- 1.1.1 This Flood Risk Assessment (FRA) has been prepared by Peter Brett Associates LLP (PBA), on behalf of Krish Food & Leisure Ltd, to support a planning application to Reading Borough Council (RBC)'s for the proposed new development on land to the rear of 2-4 Church Street, Caversham, Reading RG4 8AT.
- 1.1.2 The report is based on the available flood risk information for the site as detailed in Section 1.2, and prepared in accordance with the planning policy requirements set out in Section 1.3.

1.2 Sources of Information

- 1.2.1 The FRA has been prepared based on the following sources of flood risk information:
- **The GOV.UK current online flood map for planning;**
 - **The Environment Agency current product 4 data;**
 - **The Reading Borough Council (RBC) Level 1 Strategic Flood Risk Assessment 2008 (SFRA), Level 1 SFRA Update 2015 and Preliminary Flood Risk Assessment 2011 (PFRA).**

1.3 Policy Context

- 1.3.1 This FRA has been prepared in accordance with the relevant national, regional and local planning policy and statutory authority guidance as follows:
- National policy contained within the **National Planning Policy Framework (NPPF)** dated March 2012, issued by Communities and Local Government;
 - The **NPPF Planning Practice Guidance (PPG)** released in March 2014, updated April 2015 ('Flood Risk and Coastal Change' section);
 - **GOV.UK Guidance Flood risk assessment for planning applications**, February 2017
 - **GOV.UK Guidance Flood Risk Allowances: Climate Change Allowances**, February 2017;
 - **Environment Agency Thames Area Climate Change Allowances Guidance for their use in flood risk assessments** January 2017;
 - Local planning policy contained within the **RBC Local Development Framework** with specific reference to Policy NE10 'Surface Water Run-off' and WAT7 'Development in the Floodplain'.

1.4 Caveats/Exclusions

- 1.4.1 This FRA has been prepared in accordance with the NPPF and Local Planning Policy. Any recommendations regarding floor levels are based on the relevant British Standards (BS8533), the standing advice provided by the GOV.UK or based on common practice.
- 1.4.2 It should be noted that the insurance market applies its own tests to properties in terms of determining premiums and the insurability of properties for flood risk. Those undertaking

Flood Risk Assessment

Proposed Development on Land Rear of 2-4 Church Street, Caversham,
Reading RG4 8AT



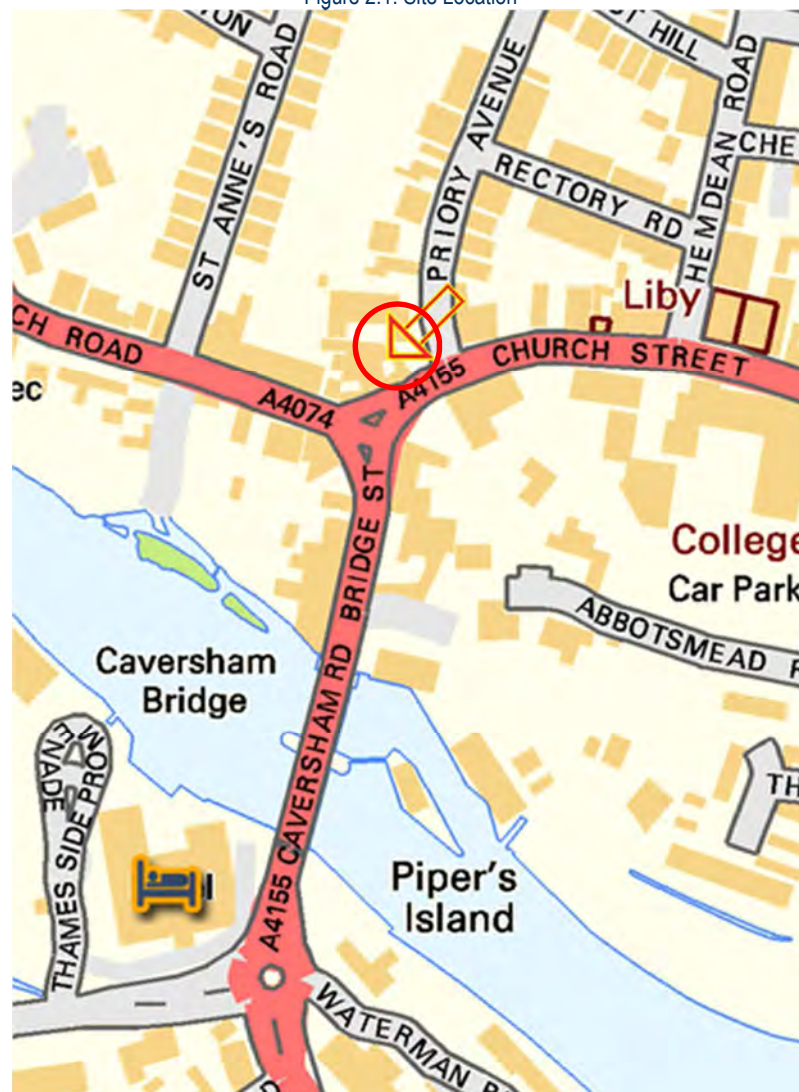
development in areas which may be at risk of flooding are advised to contact their insurers or the Association of British Insurers (ABI) to seek further guidance prior to commencing development. PBA do not warrant that the advice in this report will guarantee the availability of flood insurance either now or in the future.

2 Site Setting

2.1 Site Description

- 2.1.1 The site, land rear of 2-4 Church Street, Caversham, Reading RG4 8AT, is centred on OS grid reference 471,188m E, 174,685m N. The site lies within the administrative boundary of Reading Borough Council (RBC).
- 2.1.2 The site is accessed off Priory Avenue.
- 2.1.3 The redline planning application site boundary is shown on The Keen Partnership drawings, A.11, a copy is attached in Appendix A, and 8636-PL-04NDev, a copy is attached in Appendix B..

Figure 2.1: Site Location



2.2 Topography

- 2.2.1 The Keen Partnership Drawing A.11 'Topo', a copy of which is attached in Appendix A, shows the existing ground levels within the redline site. The Warner Surveys Drawing

S517/0569/P/0001, copy of which is also attached in Appendix A, shows some further Priory Avenue west side footpath levels going north from the site.

- 2.2.2 The existing levels of the site vary from 38.30m AOD to 39.20m AOD. Existing public footpath levels have been provided on Priory Avenue, these vary from 38.47m AOD to 38.78m AOD.

2.3 Watercourses and Flood Defences

- 2.3.1 The site is north of the River Thames.

- 2.3.2 The Environment Agency Product 4 Data, a copy is attached in Appendix C, confirms that the site is not currently protected by any formal defences, nor are there any planned for the area.

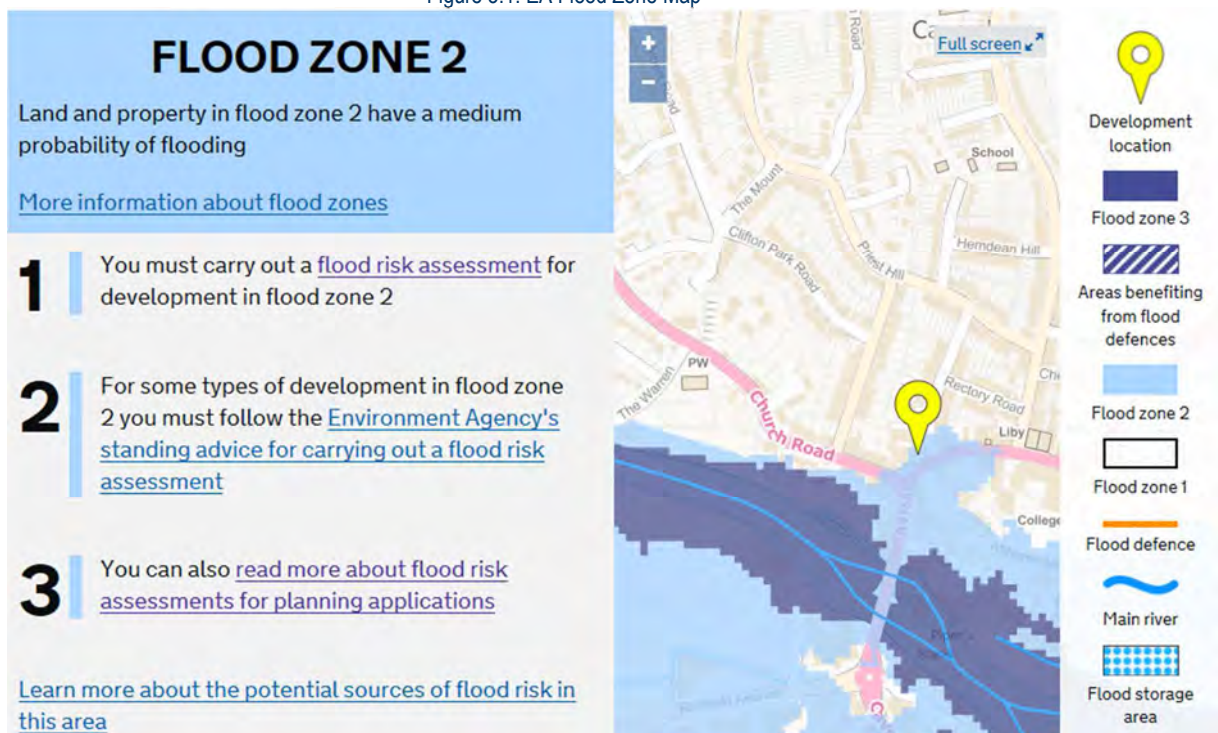
3 Overview of Flood Risk

3.1 EA Flood Maps

Flood Zone Map

- 3.1.1 The first phase in identifying whether a site is potentially at risk of flooding is to consult the EA's Flood Zone maps, available on the EA's website. This provides an initial indication of the extent of the Flood Zones, which is refined by the use of more detailed site-specific level survey and modelled flood levels.

Figure 3.1: EA Flood Zone Map

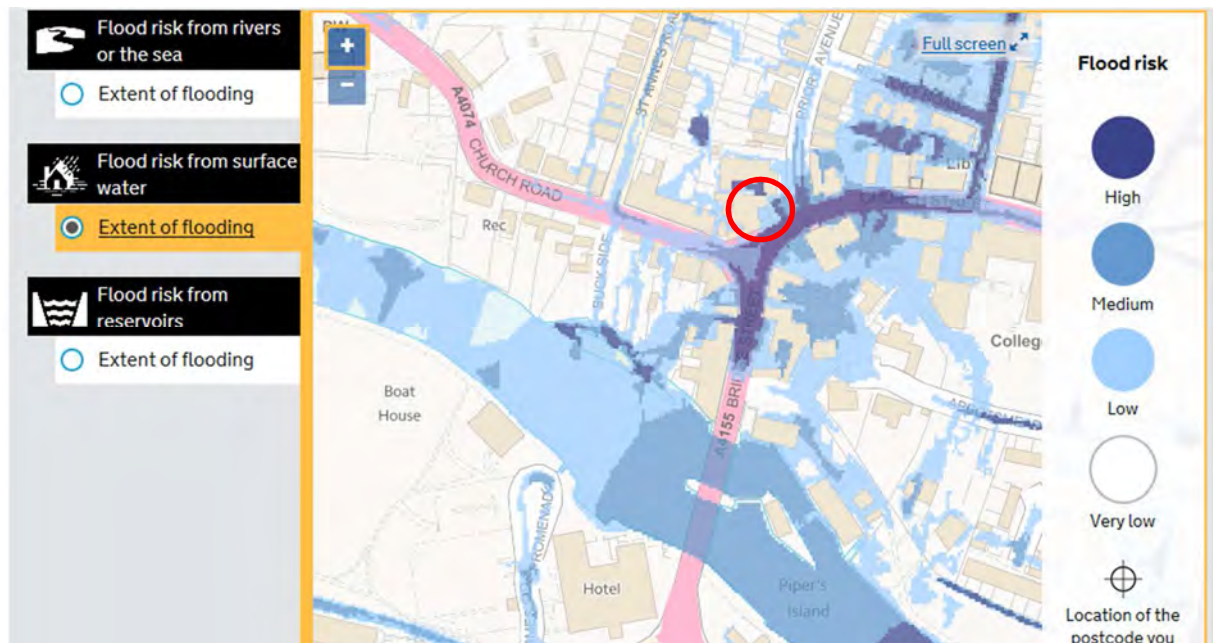


- 3.1.2 The EA Flood Zone map indicates that part of the site is in **Flood Zone 2 – land having between 1 in 100 (1%) and 1 in 1,000 (0.1%) annual probability of river flooding**. The other part of the site is in **Flood Zone 1 – land having a less than 1 in 1,000 annual probability of river flooding**.

EA Flood Risk from Surface Water

- 3.1.3 The EA 'Surface Water Flood Risk Map' shows where areas could be potentially susceptible to surface water flooding in an extreme rainfall event.
- 3.1.4 It should be noted that these are generated using a relatively coarse methodology whereby rainfall inflows are routed over a ground surface model. As such, the analysis does not take account of any below-ground drainage infrastructure, but does provide a guide to potentially vulnerable areas based on the general topography of an area.

Figure 3.2: GOV.UK Surface Water Flood Risk Map



3.1.5 Figure 3.2 indicates that the site, the land to the rear of 2-4 Church Street is generally at a 'Very Low' risk of surface water flooding, however parts of Church Street and Priory Avenue are high risk.

3.2 EA Modelled Flood Data (Product 4)

3.2.1 The Product 4 data (THM25317) 16th November 2016 has been obtained. The subsequent e-mail from the Environment Agency of the 19th December 2017, copy in Appendix C, confirms that their November 2016 data is still current.

3.2.2 The EA advised modelled flood levels for the land to the rear of 2-4 Church Street are as follows:-

Flood Event (Annual Probability)	Modelled Flood Level (m AOD)
1 in 5 (20%)	37.22
1 in 20 (5%)	37.62
1 in 100 (1%)	38.10
1 in 100 (1%) plus allowance for climate change (+20%)	38.31
1 in 1000 (0.1%)	38.59

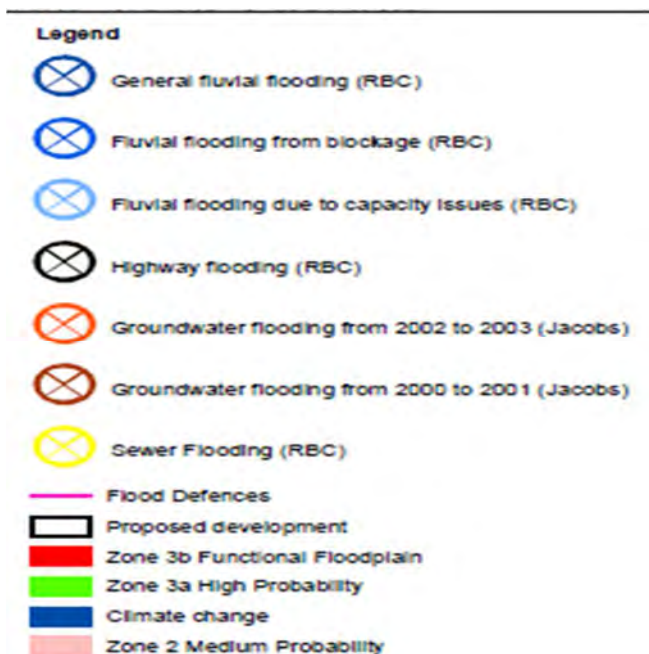
Comparing these EA advised modelled flood levels with the topographic survey, the site is in Flood Zones 2 and 1.

3.3 Reading Borough Council Strategic Flood Risk Assessment

- 3.3.1 Reading Borough Council (RBC) Strategic Flood Risk Assessment (SFRA) Level 1, March 2009 supports RBC's Local Development Framework (LDF). The SFRA was prepared to establish the flood risk to the area, including the potential impact of flood defence failure and the implications of climate change.



3.3.2



3.3.3

- 3.3.4 The above is part of SFRA Figure 3. It shows a part of the land to the rear of 2-4 Church Street in Flood Zone 3a with the remainder in Flood Zone 1 and that there are no fluvial, highway, groundwater nor sewer flooding issues. However, when comparing the current EA advised flood levels with the topographic survey, the site is shown as being in Flood Zones 2 and 1.

3.4 Historic Flooding Records – Environment Agency

- 3.4.1 The EA have provided a historic flood map within their Product 4 data, a copy is attached in Appendix C.
- 3.4.2 This map indicates that for the area of the land to the rear of 2-4 Church Street, there is no record of flooding.

3.5 Historic Flooding Records – Thames Water

- 3.5.1 Thames Water (TW) have confirmed on the 14th October 2016, copy attached in Appendix D, *'The flooding records held by Thames Water indicate that there have been no incidents of flooding as a result of surcharging of public sewers in the area.'*

3.6 Historic Flooding Records – Reading Borough Council

- 3.6.1 Reading Borough Council (RBC) has confirmed in their e-mails of the 7th December 2016, copy attached in Appendix D, that they don't have any record of flooding.

3.7 Impact of Climate Change

- 3.7.1 In considering flood risk to the site, it is necessary to fully consider the potential impacts of climate change for the lifetime of the development within the mitigation measures.
- 3.7.2 The EA's 'Thames Area Climate Change Allowances Guidance for their use in flood risk assessments' January 2017 'Local allowances for potential climate change impacts', for More Vulnerable in flood zone 2, confirms the central climate change allowance is the minimum benchmark for flood risk mitigation. The Guidance Table A recommends the 'Basic' approach for the site – Minor 1-9 dwellings, More vulnerable in Flood Zone 2. The Local allowance for potential climate change impact is a 500mm increase over the 1 in 100 (1%) flood level as a benchmark climate change flood level for flood risk mitigation. This is a flood level of 38.60 (38.10 + 0.5).
- 3.7.3 The proposed development of the site fully considers the impact of climate change.

4 Proposed Development and Sequential Test

4.1 Proposed Development

- 4.1.1 The proposal is for the demolition of the existing single storey building on the land to the rear of 2-4 Church Street and the erection of part three, part two and part single storey (with rooms in the roof space) building containing 5 self-contained flats, with associated amenities, parking spaces, bicycle store and bin store.
- 4.1.2 The proposals are detailed on the drawings by The Keen Partnership, copies of which are attached in Appendix B.

4.2 Flood Risk Vulnerability

- 4.2.1 NPPF PPG 'Flood Risk and Coastal Change' Table 2 confirms the '*Flood risk vulnerability classification*' of a site, depending upon the proposed usage. This classification is subsequently applied to PPG Table 3 to determine whether:
- The proposed development is suitable for the flood zone in which it is located, and;
 - Whether an Exception Test is required for the proposed development.
- 4.2.2 The proposals are for residential units which are classified as '*More vulnerable*' development in accordance with PPG Table 2.

4.3 NPPF Sequential Test

- 4.3.1 The NPPF follows a sequential risk-based approach in determining the suitability of land for development in flood risk areas, with the intention of steering all new development to the lowest flood risk areas.
- 4.3.2 As part of the site is in Flood Zone 2, the proposals are subject to the NPPF Sequential Test.

4.4 NPPF Exception Test

- 4.4.1 PPG Table 3 confirms that '*More vulnerable*' development is considered appropriate in Flood Zones 2 and 1.
- 4.4.2 The Exception Test is therefore not required.

5 Flood Mitigation Strategy

5.1 Building Design

- 5.1.1 The proposed residential building ground floor level is 38.90m AOD, as confirmed on The Keen Partnership drawing 8636-PL-05NDev, a copy is attached in Appendix B. This is 300mm above the EA advised 1 in 100 plus the basic Thames Area climate change annual probability flood level of 38.60m AOD and 310mm above the 1 in 1000 (0.1%) annual probability flood level of 38.59m AOD. The proposed ground floor level meets the requirement of the current GOV.UK guidance and BS8533.

5.2 Floodplain Compensation Scheme

- 5.2.1 The proposed development does not impact on the flood flow routes into the site from Priory

5.3 Safe Access

- 5.3.1 The site pedestrian access/egress is to/from Priory Avenue going north to where there are areas of Flood Zone 1 as shown on the EA's flood zone map section 3.1.1 and within the EA data, copy in Appendix C.
- 5.3.2 The topo survey information provided, copies in Appendix A, show that there are parts of the site and going north along the west side Priory Avenue public footpath, that are slightly below the 38.60m AOD EA advised 1 in 100 plus the basic Thames Area climate change annual probability flood level. The lowest levels along the access/egress route are between 38.32 and 38.42m AOD, between 180mm and 280mm below the 38.60m AOD level.
- 5.3.3 DEFRA and the EA to assess the risk posed by floodwaters, have produced a Flood Hazard equation within two guidance documents, FD2320 and FD2321, and a EA/HR Wallingford note clarifying table 13.1 of FD2320 and Figure 3.2 of FD2321. A copy is attached in Appendix C.
- 5.3.4 The Flood Hazard equation provides criteria for determining the degree of danger that is posed to life, assessed as a product of flood depth and flow velocity with an additional debris factor factored in.
- 5.3.5 For flood depths up to 260mm, the Flood Hazard Rating is 'less than 0.75' where the velocity is no greater than 0.3m/second. The Hazard to People Classification is then defined as 'Very low hazard – Caution'. If the velocity is greater than 0.3m/second, then the Flood to People Classification rises to between 0.75 to 1.25, and the Hazard to People Classification indicates 'Danger for some'.
- 5.3.6 The Environment Agency Thames Guidance Statement 'Safe Access/Egress for LPAs, recommends that where a route with a 'very low' hazard rating is not possible, local authorities will require an evacuation plan, as a suitable approach to the mitigate the risk posed. BS 8533 has a scope for such a plan. The Client is recommended to take advice from the emergency services when the plan is required by Reading Borough Council to be produced.
- 5.3.7 Resident actions should be in consultation with local flood warden, the police and Reading Borough Council as the Local Authority.

5.4 Surface Water and SuDS

- 5.4.1 With the proposals for the land at the reasom2-4 Church Street there is no increase to the impermeable ground surface and roof areas.

- 5.4.2 The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface runoff from development sites, and recommends that priority is given to the use of Sustainable Drainage Systems (SuDS) in new development, this being complementary to the control of development within the floodplain.
- 5.4.3 The Building Regulations Requirement H3 stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:
- a. an adequate soakaway or some other adequate infiltration system,
 - b. a watercourse, or where that is not practicable,
 - c. a sewer.
- 5.4.4 The ability of the site rainwater to infiltrate into the ground should be investigated, subject to the suitability of the natural soils and the groundwater and contamination levels allowing.

6 Residual Risk

- 6.1.1 It is difficult to completely guard against flooding since extreme events greater than the design standard event are always possible, however, it is practicable to minimise the risk by using suitable appropriate flood resistance and resilience methods.
- 6.1.2 The proposed new residential build ground floor level is 300mm above the EA advised 1 in 100 plus the Thames Area basic climate change allowance (38.60m AOD) and 310mm above the 1 in 1,000 (0.1%) flood level. There will be no detrimental impact on floodplain storage.
- 6.1.3 The proposals will not impact on the rate or volume of surface water runoff generated by the area.
- 6.1.4 As the proposed ground floor level is higher than the external ground levels, it mitigates the risk of surface water rainfall flooding.

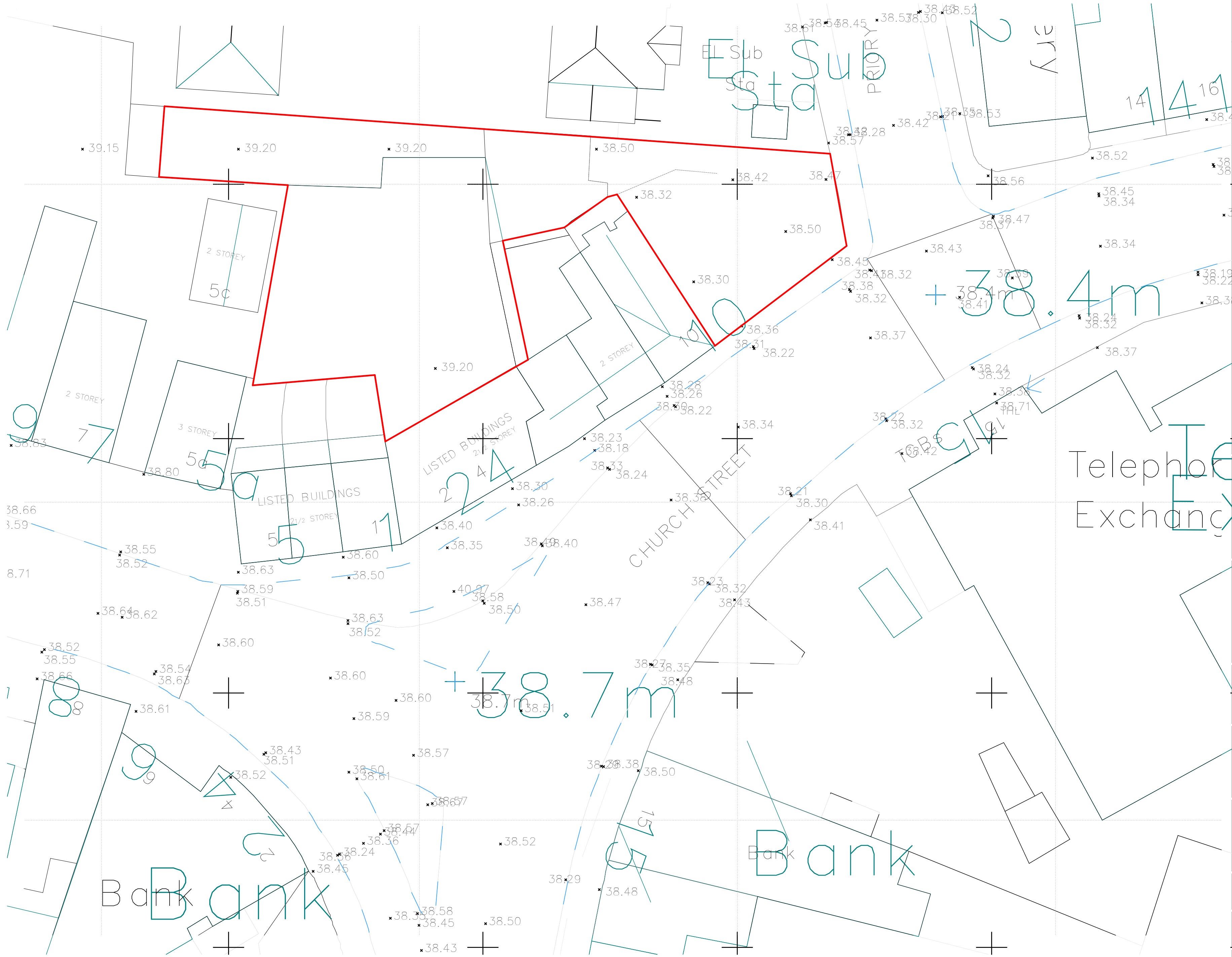
7 Conclusions

- 7.1.1 This Flood Risk Assessment (FRA) has been prepared by Peter Brett Associates LLP (PBA) to support a planning application for proposed residential development of land to the rear of 2-4 Church Street, Caversham, Reading RG4 8AT.
- 7.1.2 This FRA concludes the following:
- based on the detailed modelling outputs provided by the Environment Agency (EA), the site lies in Flood Zone 2 'Medium Probability' and Flood Zone 1 'Low Probability of the River Thames';
 - the proposed mitigation strategy demonstrates the development is safe by the proposed ground floor level being 300mm above the EA advised 1 in 100 plus the basic Thames Area annual probability flood level (38.60m AOD), and 310mm above the EA advised 1 in 1000 (0.1%) annual probability flood level (38.59m AOD);
 - safe access away from to Priory Avenue.
- 7.1.3 The proposed development does require the NPPF Sequential Test but does not require the Exception Test to be applied.
- 7.1.4 In conclusion, the future users of the proposed development will be safe from flooding. The proposal complies with the National Planning Policy Framework (NPPF) and RBC local planning policies NE10 with respect to surface water run-off and WAT7 respect to flood risk, and is an appropriate development at this location in managing flood risk.

Appendix A Topographic Survey

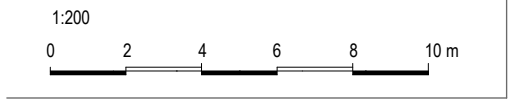
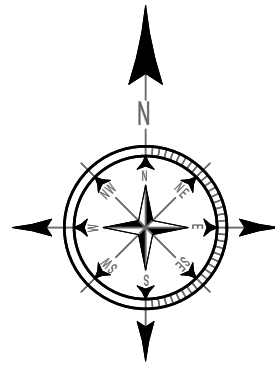
- The Keen Partnership Drawing No: A.11 'Topo'
- Warner Surveys Drawing S517/0569/P/0001 'Topographical Survey'

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Notes:



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Mr. Parihar

Job Title:

2-4 Church Street, Caversham
Reading RG4 -8AT

Drawing Title:

Topo

Status:

Planning

Date Drawn:

15-11-2017

Drawn By:

L.Lample

Scale:

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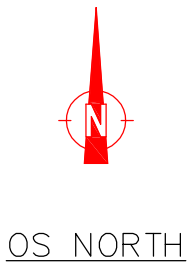
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Rev:



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Level Survey, Priory Avenue
Caversham, Reading

TOPOGRAPHICAL SURVEY

JOB No	DRAWING NUMBER
S517/0569	S517/0569/P/0001

A0 Sheet - 1,189mm X 841mm

Appendix B Proposals

The Keen Partnership Drawings

- 8636-PL-04NDev Proposed Block Plan
- 8636-PL-05NDev Ground Floor Flats Street Scene
- 8636-PL-07NDev Roof Plan Flat & 3D views
- 8636-PL-11 3D Comparison Existing & Proposal Site

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Comun areas :
Bin Store for 5x1100lts
& 2x240lts
Parking area : 4 parking spaces
Cycle Store: 6 bicycles
External amenities : 25m2
FLATS areas :
Ground Floor:
Flat 1: 47 m2
garden: 19m2
First & Second Floor:
Flat 2: 58m2
Flat 3:61m2
amenities: balcony

Houses areas:
House 1: 48m2 with
garden: 25m2
House2: 48m2 with
garden: 25m2

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Krish Food & Leisure Ltd
Mr. Parihar

Job Title:

New Development rear to
2-4 Church Street, Caversham
Reading RG4 -8AT

Drawing Title:

Proposed Block Plan

Status:

Planning

Date Drawn:

15-11-2017

Drawn By:

L.Lample

Scale:

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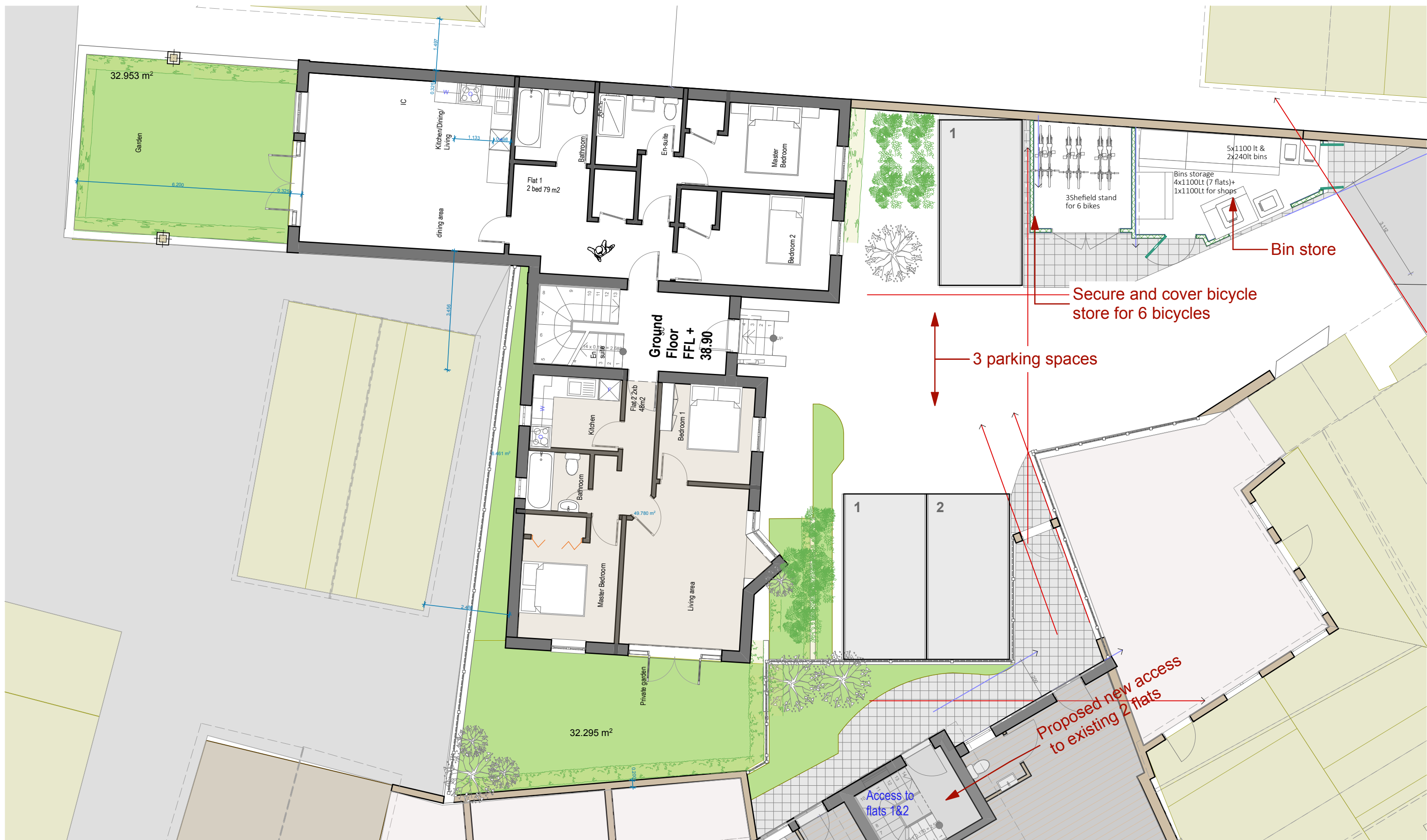
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8636-16

Drg No:

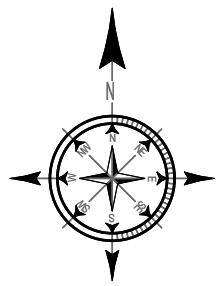
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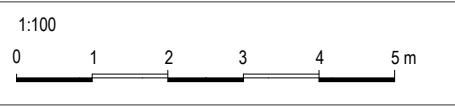
GROUND FLOOR PLAN FLATS & HOUSES
LAND TO REAR AT 2-4 CHURCH STREET CAVERSHAM, READING

STREET SCENE FLAT & HOUSES
LAND TO REAR AT 2-4 CHURCH STREET CAVERSHAM, READING



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Notes:



FLATS areas :
Ground Floor:
Flat 1: 79 m2
garden: 32m2
Flat 2: 50m2
First & Second Floor:
Flat 3:79 m2
Flat 4: 50m2
amenities: balcony

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Job Title:

New Development rear to
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Reading RG4 -8AT

Drawing Title:

Ground Floor Flats Street
Scene

Status:

Planning

Date Drawn:

15-11-2017

Drawn By:

L.Lample

Scale:

1:100 @A2

Job No:

8636-16

Drg No:

8636-PL-05NDev

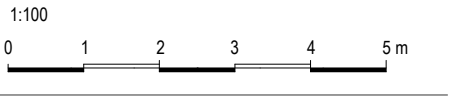
Rev:



NEW DEVELOPMENT FLATS 1-3 & 5 FRONT & SIDE VIEWS
LAND TO REAR AT 2-4 CHURCH STREET CAVERSHAM, READING

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NEW DEVELOPMENT FLATS ROOF PLAN
LAND TO REAR AT 2-4 CHURCH STREET CAVERSHAM, READING

NEW DEVELOPMENT FLATS
LAND TO REAR AT 2-4 CHURCH STREET CAVERSHAM, READING

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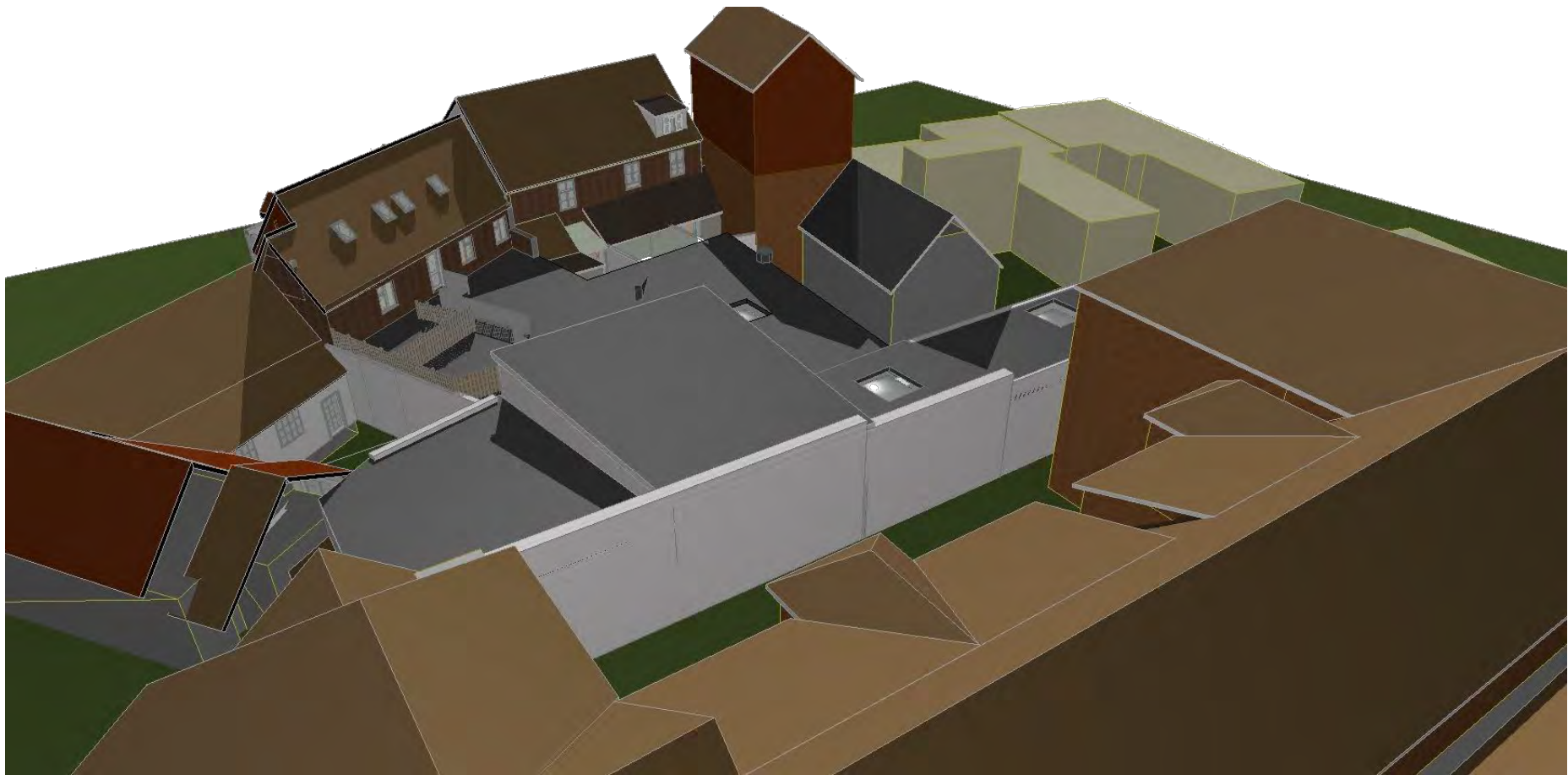
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Drawing Title:
Roof Plan Flat & 3D views

Status:
Planning

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EXISTING REAR ELEVATION 3D

2-4 CHURT STREET CAVERSHAM READING READING



PROPOSED REAR ELEVATION 3D

2-4 CHURT STREET CAVERSHAM READING READING

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All dimensions to be checked on site and any discrepancies to be reported before work commences.

Notes:

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Client:
Krish Food & Leisure Ltd
Mr. Parihar

Job Title:

2-4 Church Street, Caversham
Reading RG4 -8AT

Drawing Title:
**3D Comparison Existing &
Proposal Site**

Status:
Planning

Date Drawn:
15-11-2017

Drawn By:
L.Lample

Scale:
@A3

Job No:
8636-16

Drg No:
8663-PL-11

Rev:

Appendix C EA Product 4 Data (Ref THM25317) and other information

- Detailed Flood Zone Map
- Modelled Flood Levels
- Historic Flood Information
- E-mail 19th December 2017
- Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose May 2008

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**Product 4 (Detailed Flood Risk) for Flood Map centred on Bridge St, Church St, Caversham.
Our Ref:THM25317 Created on 16/11/16.**

Product 4 is designed for developers where Flood Risk Standing Advice FRA (Flood Risk Assessment) Guidance Note 3 Applies. This is:

- i) "all applications in Flood Zone 3, other than non-domestic extensions less than 250 sq metres; and all domestic extensions", and
- ii) "all applications with a site area greater than 1 ha" in Flood Zone 2.

Product 4 includes the following information:

Ordnance Survey 1:25k colour raster base mapping;
Flood Zone 2 and Flood Zone 3;
Relevant model node locations and unique identifiers (for cross referencing to the water levels, depths and flows table);

Model extents showing *defended* scenarios;
FRA site boundary (where a suitable GIS layer is supplied);
Flood defence locations (where available/relevant) and unique identifiers; (supplied separately)

Flood Map areas benefiting from defences (where available/relevant);
Flood Map flood storage areas (where available/relevant);
Historic flood events outlines (where available/relevant, not the Historic Flood Map) and unique identifiers;

Statutory (Sealed) Main River (where available within map extents);

A table showing:

- i) Model node X/Y coordinate locations, unique identifiers, and levels and flows for *defended* scenarios.
- ii) Flood defence locations unique identifiers and attributes; (supplied separately)
- iii) Historic flood events outlines unique identifiers and attributes; and
- iv) Local flood history data (where available/relevant).

Please note:

If you will be carrying out computer modelling as part of your Flood Risk Assessment, please read the enclosed guidance which sets out our requirements and best practice for computer river modelling.

This information is based on that currently available as of the date of this letter. You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements have been made. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

This information is provided subject to the enclosed notice which you should read.

This letter is not a Flood Risk Assessment. The information supplied can be used to form part of your Flood Risk Assessment. Further advice and guidance regarding Flood Risk Assessments can be found on our website at

<http://www.environment-agency.gov.uk/research/planning/82584.aspx>

If you would like advice from us regarding your development proposals you can complete our pre application enquiry form which can be found at

<http://www.environment-agency.gov.uk/research/planning/33580.aspx>

Defence information

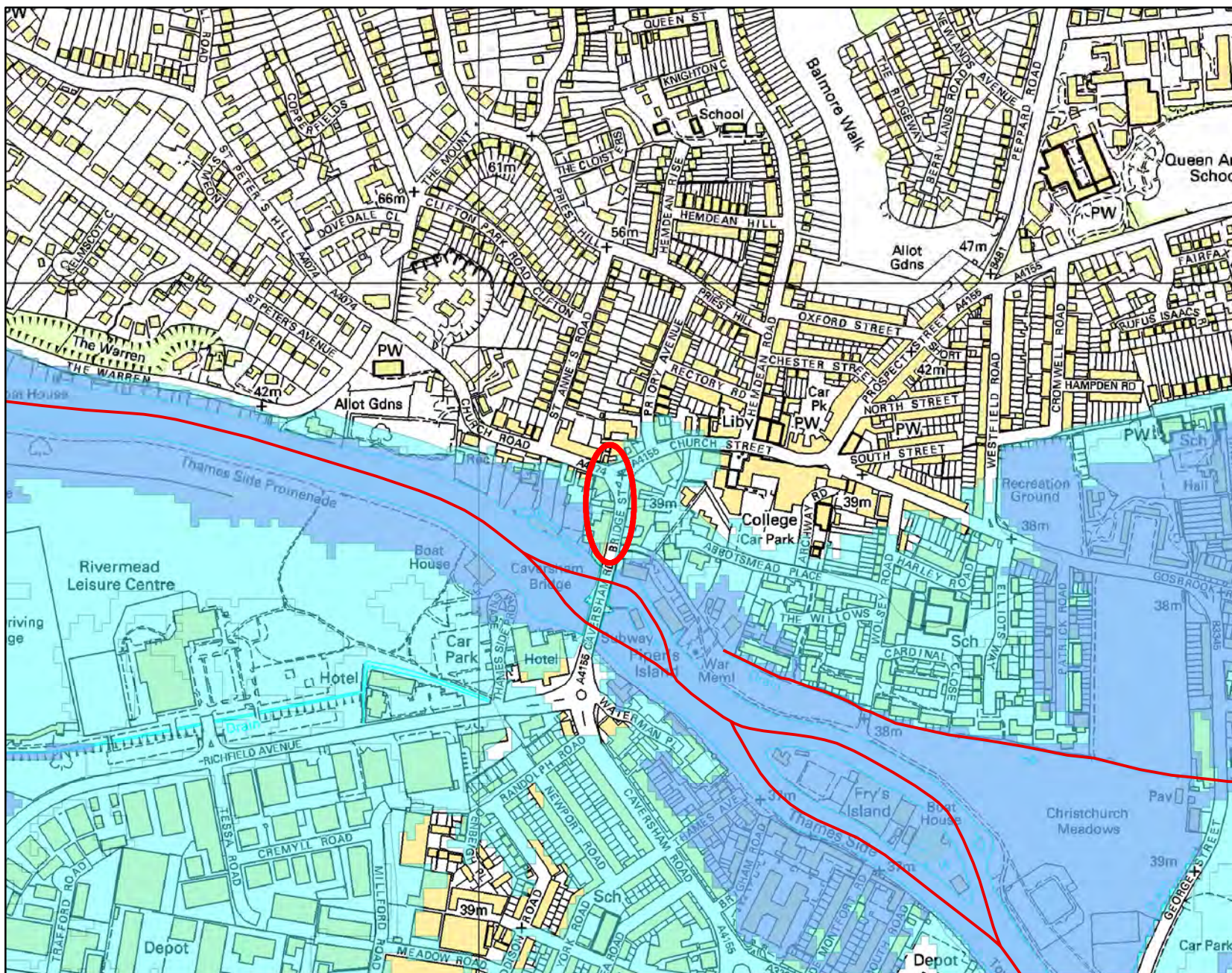
Created on 16/11/16.

Defence Location: No defences on Main River

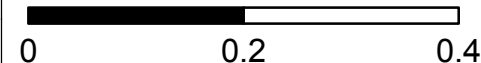
Description: This location is not currently protected by any formal defences and we do not currently have any flood alleviation works planned for the area. However we continue to maintain certain watercourses and the schedule of these can be found on our internet pages.

Flood Map centred on Bridge St, Church St, Caversham.

Created on 16/11/16 REF:THM25317



Kilometres



Legend

- Main River
- Flood defences
- Areas benefiting from flood defences
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)
- Flood Map - flood storage areas

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Model information

Created on 16/11/16.

Model: Thames (Mapledurham to Sonning) 2011

Description: The information provided is taken from the Thames (Reading Complex Change) Flood Alleviation Study completed in June 2011. The study was carried out using 2D modelling software (ISIS-Tuflow).

Model design runs:

1 in 5 / 20% AEP; 1 in 20 / 5% AEP; 1 in 50 / 2% AEP; 1 in 100 / 1% AEP; 1 in 1000 / 0.1% AEP and 1 in 100+20% / 1% AEP with climate change

Mapped Outputs:

1 in 5 / 20% AEP; 1 in 20 / 5% AEP; 1 in 50 / 2% AEP; 1 in 100 / 1% AEP; 1 in 1000 / 0.1% AEP and 1 in 100+20% / 1% AEP with climate change

Model accuracy:

Levels $\pm$ 250mm

Modelled in-channel flood flows and levels

Created on 16/11/16.

The modelled flood levels and flows for the closest most appropriate model node points for your site that are within the river channel are provided below:

Node label	Model	Easting	Northing	Flood Levels (mAOD)				
				20% AEP	5% AEP	1% AEP	1% AEP (+20% on river flows)	0.1% AEP
06100_MN_36.049	Thames (Mapledurham to Sonning) 2011	470376	174879	37.39	37.81	38.34	38.62	39.01
06100_MN_36.048	Thames (Mapledurham to Sonning) 2011	470717	174807	37.31	37.71	38.22	38.48	38.83
06100_MN_36.032	Thames (Mapledurham to Sonning) 2011	471148	174609	37.23	37.64	38.15	38.39	38.71
06100_MN_36.031A	Thames (Mapledurham to Sonning) 2011	471220	174537	37.20	37.59	38.06	38.26	38.51
06100_MN_36.028	Thames (Mapledurham to Sonning) 2011	471294	174484	37.18	37.58	38.05	38.25	38.50
06100_MN_36.024	Thames (Mapledurham to Sonning) 2011	471380	174382	37.15	37.55	38.02	38.23	38.47
06100_MN_36.022	Thames (Mapledurham to Sonning) 2011	471429	174347	37.14	37.54	38.02	38.22	38.46

Node label	Model	Easting	Northing	Flood Flows (m3/s)				
				20% AEP	5% AEP	1% AEP	1% AEP (+20% on river flows)	0.1% AEP
06100_MN_36.049	Thames (Mapledurham to Sonning) 2011	470376	174879	221.54	276.19	349.16	413.30	487.94
06100_MN_36.048	Thames (Mapledurham to Sonning) 2011	470717	174807	223.02	281.86	361.50	426.96	520.55
06100_MN_36.032	Thames (Mapledurham to Sonning) 2011	471148	174609	223.10	284.45	374.33	450.03	571.71
06100_MN_36.031A	Thames (Mapledurham to Sonning) 2011	471220	174537	223.10	284.45	374.33	450.03	571.71
06100_MN_36.028	Thames (Mapledurham to Sonning) 2011	471294	174484	223.09	282.98	368.24	440.77	557.55
06100_MN_36.024	Thames (Mapledurham to Sonning) 2011	471380	174382	223.09	283.73	369.35	440.90	555.83
06100_MN_36.022	Thames (Mapledurham to Sonning) 2011	471429	174347	223.10	284.32	371.74	444.86	565.00

Note:

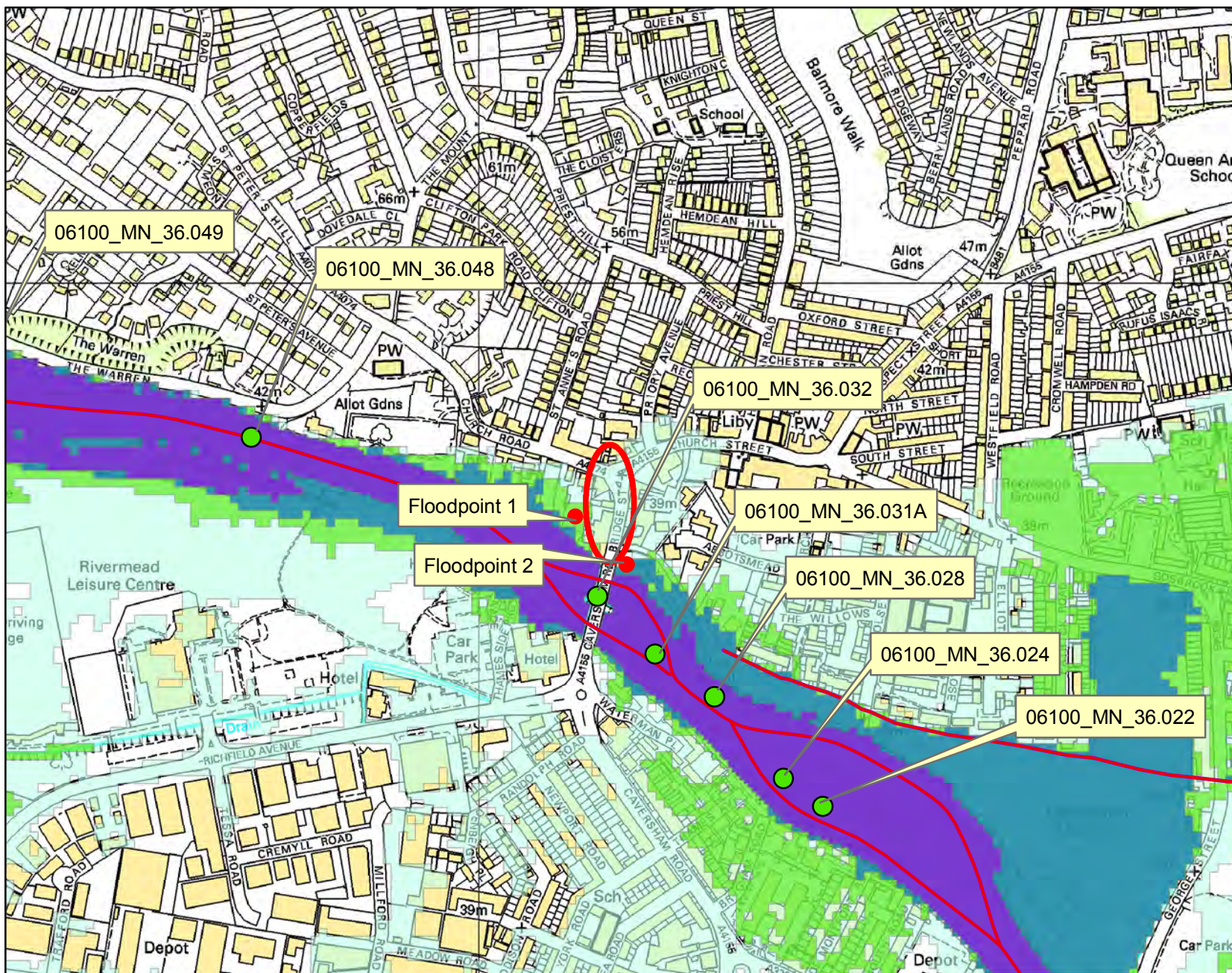
Due to recent changes in guidance on the allowances for climate change, the 20% increase in river flows should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an Intermediate level assessment.

For further advice on the new allowances please visit

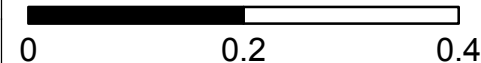
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Flood Risk Assessment Map centred on Bridge St, Church St, Caversham.

Created on 16/11/16 REF:THM25317



Kilometres



Legend

- Nodes
- Main River
- 20% AEP Flood Outline
- 5% AEP Flood Outline
- 1% AEP Flood Outline
- 0.1% AEP Flood Outline

AEP = Annual Exceedance Probability
The probability of a flood of a particular magnitude, or greater, occurring in any given year

1%CC = 1% Climate Change extent
This is the 1% AEP event with an allowance for climate change (+20% on river flows)

Modelled floodplain flood levels

Created on 16/11/16.

The modelled flood levels for the closest most appropriate model grid cells for your site are provided below:

2D grid cell reference	Model	Easting	Northing	flood levels (mAOD)				
				20% AEP	5% AEP	1% AEP	1% AEP (+20% on river flows)	0.1% AEP
Floodpoint 1	Thames (Mapledurham to Sonning) 2013	471,117	174,659	37.22	37.62	38.10	38.31	38.59
Floodpoint 2	Thames (Mapledurham to Sonning) 2013	471,178	174,642	No data	37.59	38.05	38.25	38.5

This flood model has represented the floodplain as a grid.
The flood water levels have been calculated for each grid cell.

Historic flood data

Created on 16/11/16.

Our records show that the area of your site has been affected by flooding. Information on the floods that have affected your site is provided in the table below:

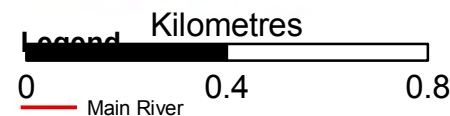
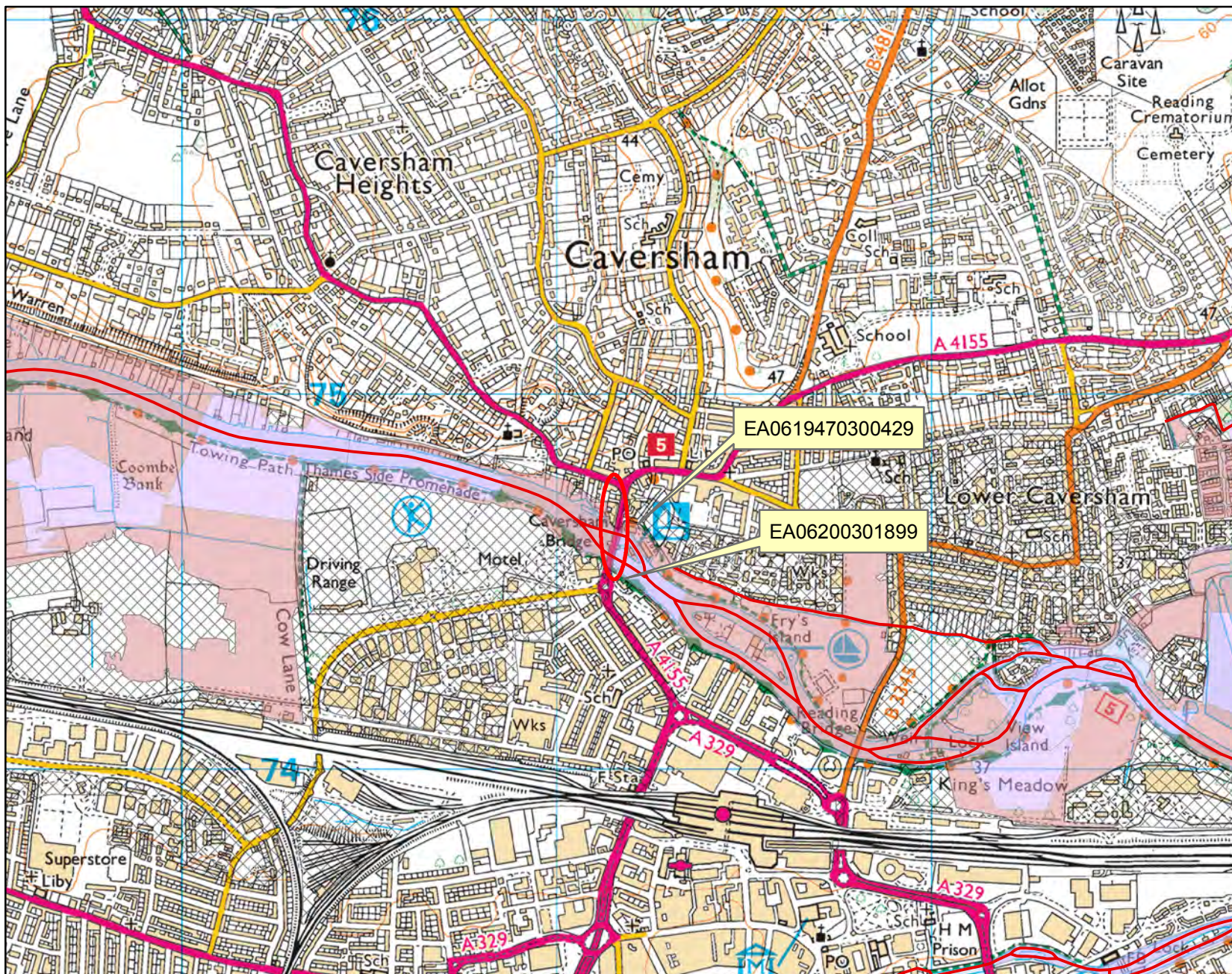
[illegible]

Please note the Environment Agency maps flooding to land not individual properties. Floodplain extents are an indication of the geographical extent of a historic flood. They do not provide information regarding levels of individual properties, nor do they imply that a property has flooded internally.

Start and End Dates shown above may represent a wider range where the exact dates are not available.

Historic Flood Map centred on Bridge St, Church St, Caversham.

Created on 11/11/16 REF:THM25317



Historic Flood Outline

year

- 1706
- 1925
- 1947
- 1974
- 1981
- 1990
- 2000
- 2001
- 2002
- 2009

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

SUPPLEMENTARY NOTE ON FLOOD HAZARD RATINGS AND THRESHOLDS
FOR DEVELOPMENT PLANNING AND CONTROL PURPOSE
- Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1.

Suresh Surendran and Geoff Gibbs (Environment Agency),
Steven Wade and Helen Udale-Clarke (HR Wallingford)
May 2008

Introduction

This document is a supplementary note to reconcile information provided in the 'Flood Risks to People Methodology' (FD2321/TR1¹) and the 'Framework and Guidance for Assessing and Managing Flood Risk for New Development' (FD2320/TR2²) reports about the Flood Hazard Rating. It has been produced because both PPS25 in England and TAN15 in Wales require that people should be appropriately safe around new development. The document emphasises that for FRAs and FCAs at all levels to inform development allocations and proposals the simplified approach of FD2320 with regard to flood hazard rating should be used rather than the approach in FD2321. Although the final version of FD2321/TR1 post-dates FD2320/TR2, the work presented actually pre-dates the guidance in FD2320/TR2. This supplementary guidance is issued for those involved in development planning and control and to clarify the detail or difference of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1.

FD2321/TR1 was a research project based on the detailed literature review and analysis of empirical evidence related to flood hazard, derived mainly from theoretical assumptions and some basic laboratory experiments. Factors that affected flood hazard and vulnerability were combined in a form of multi-criteria analysis that was used to identify the hot-spots and broadly estimate the probability of people seriously harmed and fatalities during the event of a flood. The multi-criteria method was calibrated to actual events, validated using data from seven flood events and shown to work well. The FD2321 (Risk to people) methodology illustrates the fundamental concepts and demonstrate how the approach could be used for different applications - it did not set a policy for flood hazard thresholds.

(Nevertheless there are a number of assumptions used in the FD2321 methodology, particularly with respect to the impact of debris and people's behaviour during flood events. There is a requirement for further research to collate more evidence on flood hazard, particularly the impacts of debris, and vulnerability in order to refine assumptions made in the flood hazard calculations, flood hazard thresholds and risks to people guidance. The study recommend more laboratory and field based tests on the impact of physical water quality aspect such as debris, mudflow; chemical and biological water quality that cause seriously harm or fatalities to people.)

¹ Defra and Agency (2006) *The Flood Risks to People Methodology*, Flood Risks to People Phase 2, FD2321 Technical Report 1, HR Wallingford et al. did the report for Defra/EA Flood and Coastal Defence R&D Programme, March 2006.

(http://sciencesearch.defra.gov.uk/Document.aspx?Document=FD2321_3436_TRP.pdf)

² Defra and Agency (2005) *Framework and Guidance for Assessing and Managing Flood Risk for New Development*, Flood Risk Assessment Guidance for New Development, FD2320 Technical Report 2, HR Wallingford et al. did the report for Defra/EA Flood and Coastal Defence R&D Programme, October 2005. (http://sciencesearch.defra.gov.uk/Document.aspx?Document=FD2320_3364_TRP.pdf)

FD2320/TR2 (FRA guidance for new development) provides guidance that is a specific interpretation of the methodology developed under FD2321, within the context of development planning and control. Based on FD2320 consultation workshops, the project board (key users and experts) advised the project team to provide a simple methodology. Due to uncertainties and limitations related to estimating risks to people, FD2320 adopted a precautionary approach, particularly with respect to the selection of debris factors and flood hazard thresholds

Risk to People (Ninj)

$$\text{Ninj} = \text{Nz} \times \text{Flood Hazard Rating} \times \text{Area Vulnerability} \times \text{People Vulnerability}$$

where,

Ninj (Risk to People) = number of injuries within a particular hazard 'zone';

Nz = number of people within the hazard zone (at ground/basement level);

Flood Hazard Rating = HR = function of flood depth/velocity (within the hazard zone being considered) and debris factor;

Area Vulnerability = function of effectiveness of flood warning, speed of onset of flooding and nature of area (including types of buildings); and

People Vulnerability = function of presence of people who are very old and/or infirm/disabled/long-term sick

Flood Hazard Rating (HR) and thresholds

The revised 'hazard rating' expression based primarily, on consideration to the direct risks of people exposed to floodwaters.

$$\text{HR} = d \times (v + n) + \text{DF}$$

where, HR = (flood) hazard rating;

d = depth of flooding (m);

v = velocity of floodwaters (m/sec); and

DF = debris factor (0, 0.5, 1 depending on probability that debris will lead to a hazard)

n = a constant of 0.5

This final revised Flood Hazard Rating formula from the Flood Risks to People project is presented on page 10 (section 3.5) of FD2321/TR1. The formula is identical in both FD2320 and FD2321 reports.

Based on Table 3.2 of FD2321, the Figure 3.2 of FD2321 illustrates the "Hazard to People Classifications" as a function of depth, velocity and debris factor. Such categorisation and the look-up table with flood hazard threshold could be useful for a range of application as an initial indication of Risks to People.

In this case (Figure 3.2 of FD2321) the calculation takes a debris factor as zero ($\text{HR} = d \times (v + 0.5) + 0$).

However FD2321 strongly recommends the use of the debris factor and the formulas described in the Guidance Document for further calculation. The Table 3.1 of FD2321/TR1 (Table 1 of this note) suggests appropriate debris factors for different depths, velocities and the dominant land use.

Table 1: Guidance on debris factors for different flood depths, velocities and dominant land uses. (Source FD2321 Table 3.1):

Depths (d)	Pasture/Arable	Woodland	Urban
0 to 0.25 m	0	0	0
0.25 to 0.75 m	0	0.5	1
d>0.75 m and/or v>2	0.5	1	1

The way that Flood Hazard Rating and thresholds have been presented in Table 13.1 in FD2320/TR2 compared to Figure 3.2 of FD2321/TR1

A concern was raised in the FD2320 consultation workshops and by the FD2320 Project Board during discussions on FD2321, that the methodology was complex and the results presented in the Figure 3.2 of FD2321 were not reflecting the potential risk to people (as this table was of hazard rating for different depths and velocity without debris). There was a need for further work to include debris, area vulnerability and people vulnerability aspects. They requested a simpler single table to represent the risk to people.

For example Figure 3.2 of FD2321 did not reflect the fact that there is a risk from drowning even at low depths and velocities. In reality FD2321/TR1 recognises this but only in the subsequent “people vulnerability” calculation (risk to children, old, sick and disable). For still water up to 1.25m depth, the Figure 3.2 of FD2321/TR1 assumes that there is low hazard, if there are no debris or vulnerable group. However to avoid further calculation, but include the vulnerability aspect the Table 13.1 of FD2320 for still water with the depths between 0.25–1.25m were reclassified as “danger to some”, which was felt to be more appropriate for development planning and control, where users may make use of flood hazard without completing the more complex full calculations including people and area vulnerability.

Similarly Figure 3.2 of FD2321/TR1 shows that at the depth of 0.25m, if there is no debris then up to the flow velocity of 2.0 m/sec there would be low hazard. However FD2321/TR1 suggests the usage of an appropriate debris factor dependent on depth, velocity and the dominant land use. To make the process simpler (whatever the land use), FD2320/TR2 includes a default debris factor. In the Table 13.1 of FD2320/TR2 a debris factor of 0.5 has been applied for depths less than and equal to 0.25m and a debris factor of 1.0 has been used for depths greater than 0.25m. Therefore, in the Table 13.1 of FD2320/TR2 at the depth of 0.25m, up to the flow velocity of 0.30 m/sec is treated as low hazard.

Table 3.2 of FD2321/TR1 (Table 2 of this note) provides thresholds for classifying the hazard to people. In the FD2321/TR1 report the threshold between “danger for most” and “danger for all” is 2.5 and it was used as an initial indication of Risk to People (further calculation is recommended using the formulas). However as there is no further analysis in FD2320 but the Project Board decided that the threshold between “danger for most” and “danger for all” should be more precautionary and a Flood Hazard Rating of 2.0 is selected as a key threshold. i.e. In FD2321 the threshold for “danger for all” is 2.5 and it lowered to 2.0 in FD2320. Therefore, the Flood Hazard Rating between 2.0 to 2.5 in FD2320 is not classified as it is in FD2321.

Table 2: Hazard to People (Source Table 3.2 in FD2321/TR1)

Thresholds for Flood Hazard Rating $H = d \times (v + 0.5) + DF$		Degree of Flood Hazard	Description
FD2321	FD2320		
<0.75	<0.75	Low	Caution - "Flood zone with shallow flowing water or deep standing water"
0.75 - 1.25	0.75 - 1.25	Moderate	Dangerous for some (i.e. children) - "Danger: Flood zone with deep or fast flowing water"
1.25 - 2.5	1.25 - 2.0	Significant	Dangerous for most people - "Danger: flood zone with deep fast flowing water"
>2.5	>2.0	Extreme	Dangerous for all - "Extreme danger: flood zone with deep fast flowing water"

The final difference between Table 13.1 in FD2320/TR2 and Figure 3.2 of FD2321/TR1 is the use of smaller increments of depth, so that lower depths are presented more fully in FD2320/TR2. This was felt to be more helpful for identifying what might be judged as acceptable depending on site specific circumstances.

Conclusions

Table 13.1 of FD2320 and Figure 3.2 of FD2321 look very similar but there are significant differences (see Table 3 of this paper). Either Table/Figure can be used as the basis for assessing the risks to people associated with different flood depths velocities and debris factors.

Table 3: comparison of Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1

	In Table 13.1 of FD2320/TR2	In Figure 3.2 of FD2321/TR1
The depths above 0.25m	Danger for some, most or all	For still water, up to 1.25m the hazard is low (In addition to hazard rating further calculation to include vulnerability aspect is recommended)
Debris factor	Debris factor of 0.5 has been applied for depths $\leq 0.25m$ and a debris factor of 1.0 has been used for depths $\geq 0.25m$.	In this case a Debris factor of zero applied (in addition to this further calculation is recommended using debris factor and the formulas)
HR Thresholds for "Dangerous for all" hazard classification	>2.0 (precautionary due to uncertainties and to avoid further calculation as FD2321)	>2.5
Increments of depth	Small increments at lower depths	Every 0.25 m

Table 13.1 of FD2320/TR2 is a simple method applies the precautionary principle and uses suitable assumptions (so that there is no need for further calculations) for application in the development planning and control context (see Table 4 of this paper - an extended version of table 13.1).

This table is recommended for development planning and control use.

Table 4 – Hazard to People Classification using Hazard Rating ($HR = d \times (v + 0.5) + DF$) for (Source Table 13.1 of FD2320/TR2 - Extended version)

HR	Depth of flooding - d (m)												
	DF = 0.5				DF = 1								
Velocity v (m/s)	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.0	0.03+0.5 = 0.53	0.05+0.5 = 0.55	0.10+0.5 = 0.60	0.13+0.5 = 0.63	0.15+1.0 = 1.15	0.20+1.0 = 1.20	0.25+1.0 = 1.25	0.30+1.0 = 1.30	0.40+1.0 = 1.40	0.50+1.0 = 1.50	0.75+1.0 = 1.75	1.00+1.0 = 2.00	1.25+1.0 = 2.25
0.1	0.03+0.5 = 0.53	0.06+0.5 = 0.56	0.12+0.5 = 0.62	0.15+0.5 = 0.65	0.18+1.0 = 1.18	0.24+1.0 = 1.24	0.30+1.0 = 1.30	0.36+1.0 = 1.36	0.48+1.0 = 1.48	0.60+1.0 = 1.60	0.90+1.0 = 1.90	1.20+1.0 = 2.20	1.50+1.0 = 2.50
0.3	0.04+0.5 = 0.54	0.08+0.5 = 0.58	0.15+0.5 = 0.65	0.19+0.5 = 0.69	0.23+1.0 = 1.23	0.30+1.0 = 1.30	0.38+1.0 = 1.38	0.45+1.0 = 1.45	0.60+1.0 = 1.60	0.75+1.0 = 1.75	1.10+1.0 = 2.10	1.40+1.0 = 2.40	1.75+1.0 = 2.75
0.5	0.05+0.5 = 0.55	0.10+0.5 = 0.60	0.20+0.5 = 0.70	0.25+0.5 = 0.75	0.30+1.0 = 1.30	0.40+1.0 = 1.40	0.50+1.0 = 1.50	0.60+1.0 = 1.60	0.80+1.0 = 1.80	1.00+1.0 = 2.00	1.50+1.0 = 2.50	2.00+1.0 = 3.00	2.50+1.0 = 3.50
1.0	0.08+0.5 = 0.58	0.15+0.5 = 0.65	0.30+0.5 = 0.80	0.38+0.5 = 0.88	0.45+1.0 = 1.45	0.60+1.0 = 1.60	0.75+1.0 = 1.75	0.90+1.0 = 1.90	1.20+1.0 = 2.20	1.50+1.0 = 2.50	2.25+1.0 = 3.25	3.00+1.0 = 4.00	3.75+1.0 = 4.75
1.5	0.10+0.5 = 0.60	0.20+0.5 = 0.70	0.40+0.5 = 0.90	0.50+0.5 = 1.00	0.60+1.0 = 1.60	0.80+1.0 = 1.80	1.00+1.0 = 2.00	1.20+1.0 = 2.20	1.60+1.0 = 2.60	2.00+1.0 = 3.00	3.00+1.0 = 4.00	4.00+1.0 = 5.00	5.00+1.0 = 6.00
2.0	0.13+0.5 = 0.63	0.25+0.5 = 0.75	0.50+0.5 = 1.00	0.63+0.5 = 1.13	0.75+1.0 = 1.75	1.00+1.0 = 2.00	1.25+1.0 = 2.25	1.50+1.0 = 2.50	2.00+1.0 = 3.00	3.50	4.75	6.00	7.25
2.5	0.15+0.5 = 0.65	0.30+0.5 = 0.80	0.60+0.5 = 1.10	0.75+0.5 = 1.25	0.90+1.0 = 1.90	1.20+1.0 = 2.20	1.50+1.0 = 2.50	1.80+1.0 = 2.80	3.00	4.00	5.50	7.00	8.50
3.0	0.18+0.5 = 0.68	0.35+0.5 = 0.85	0.70+0.5 = 1.20	0.88+0.5 = 1.38	1.05+1.0 = 2.05	1.40+1.0 = 2.40	1.75+1.0 = 2.75	3.10	3.00	4.50	6.25	8.00	9.75
3.5	0.20+0.5 = 0.70	0.40+0.5 = 0.90	0.80+0.5 = 1.30	1.00+0.5 = 1.50	1.20+1.0 = 2.20	1.60+1.0 = 2.60	3.00	3.40	4.20	5.00	7.00	9.00	11.00
4.0	0.23+0.5 = 0.73	0.45+0.5 = 0.95	0.90+0.5 = 1.40	1.13+0.5 = 1.63	1.35+1.0 = 2.35	1.80+1.0 = 2.80	3.25	3.70	4.60	5.50	7.75	10.00	12.25
4.5	0.25+0.5 = 0.75	0.50+0.5 = 1.00	1.00+0.5 = 1.50	1.25+0.5 = 1.75	1.50+1.0 = 2.50	2.00+1.0 = 3.00	3.50	4.00	5.00	6.00	8.50	11.00	13.50
5.0	0.28+0.5 = 0.78	0.60+0.5 = 1.10	1.10+0.5 = 1.60	1.38+0.5 = 1.88	1.65+1.0 = 2.65	3.20	3.75	4.30	5.40	6.50	9.25	12.00	14.75
Flood Hazard Rating (HR)		Colour Code		Hazard to People Classification									
Less than 0.75				Very low hazard - Caution									
0.75 to 1.25				Danger for some – includes children, the elderly and the infirm									
1.25 to 2.0				Danger for most – includes the general public									
More than 2.0				Danger for all – includes the emergency services									

Next, the document addresses the issue of data security. It states that all data must be stored securely and that access to the data should be restricted to authorized personnel only. The document also discusses the importance of regular backups and the need to have a disaster recovery plan in place.

The third part of the document focuses on the importance of communication. It states that all staff members should be kept informed of any changes or updates to the system. The document also discusses the importance of providing training and support to staff members who are new to the system.

Finally, the document concludes by stating that the goal of the system is to improve the efficiency and effectiveness of the organization's operations. It encourages staff members to provide feedback and suggestions for improvement.

Appendix D Other Information

- Thames Water Sewer Flooding History Enquiry 14th October 2016
- Reading Borough Council e-mails 7th December 2016

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Sewer Flooding

History Enquiry



Peter Brett Associates LLP

Search address supplied 2-4
Church Street
Reading, Caversham
RG4 8AT

Your reference 39232/4001

Our reference SFH/SFH Standard/2016_3431923

Received date 14 October 2016

Search date 14 October 2016

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Cleanwater Court, Vastern Road
Reading RG1 8DB

Sewer Flooding

History Enquiry



Search address supplied: 2-4, Church Street, Reading, Caversham, RG4 8AT

This search is recommended to check for any sewer flooding in a specific address or area

TWUL, trading as Property Searches, are responsible in respect of the following:-

- (i) any negligent or incorrect entry in the records searched;
- (ii) any negligent or incorrect interpretation of the records searched;
- (iii) and any negligent or incorrect recording of that interpretation in the search report
- (iv) compensation payments

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Registered in England and Wales
No. 2356661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Sewer Flooding

History Enquiry



History of Sewer Flooding

Is the requested address or area at risk of flooding due to overloaded public sewers?

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

For your guidance:

- A sewer is "overloaded" when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- "Internal flooding" from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- "At Risk" properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company's reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0800 316 9800 or website www.thameswater.co.uk

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