

FLOOD RISK ASSESSMENT

**RIXON FARM, ASHTON KEYNES,
WILTSHIRE**

**Report Reference: 2750/FRA
Final: Version F2
September 2020**

Report prepared for:

Dream Home Developments Ltd
1st Floor Offices
Wimberley Park
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GENERAL NOTES

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Site: Rixon Farm, Ashton Keynes
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EXECUTIVE SUMMARY

A Planning Application has been prepared for the development at Rixon Farm, Ashton Keynes, Wiltshire. The Planning Application covers an area of approximately 0.83 hectares. Proposals include the development of domestic properties with associated car parking and gardens.

The Environment Agency's Flood Map for Planning indicates that the site is located within Flood Zone 2, where the probability of fluvial flooding in any one year is between 1 in 100 and 1 in 1,000 (Annual Exceedance Probability, AEP, 1%-0.1%). However, more recent Environment Agency modelling for the site (Thames (MRL to St Johns) 2014) indicates that it lies entirely within Flood Zone 1 (<0.1% AEP).

The principal source of flood risk is the River Thames, 730 m southwest of the site at its closest approach. The risk of flooding to the site from fluvial ('low'), surface water ('negligible'), groundwater ('negligible') and sewage/water mains ('negligible') has been considered.

There will be an overall reduction in run-off volumes between the pre and post-development condition at the site under current climate conditions which offers betterment to the existing site condition in accordance with local policy.

Environment Agency Product 4 modelled flood elevation data indicates the site will remain dry. Finished floor levels for the proposed development would be set at a minimum of 82.90 mAOD, this being 820 mm above the modelled 1 in 100-year flood level plus climate change.

The site would not be flooded during the 1 in 100-year flood event plus climate change, therefore external dry refuge is not required.

As mitigation of the associated residual risk, it is recommended that the site should be registered with the Environment Agency's flood warning service and to make contact with the local flood warden.

In light of the above, the Application Area is considered to satisfy the flood risk requirements of the NPPF and associated technical guidance.

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1 INTRODUCTION

1.1 Background

A Planning Application has been prepared for the proposed development at Rixon Farm, Ashton Keynes, Wiltshire. The Application Area is located within Flood Zone 2 on the Environment Agency's Flood Map for Planning and extends to approximately 8,280 m² (approximately 0.83 hectares (ha)). Due to the site's location (within Flood Zone 2) a Flood Risk Assessment (FRA) is needed to accompany the Planning Application.

Hafren Water has been commissioned to undertake this FRA for the proposed development.

1.2 Data sources

The following data sources were used in this assessment:

Dream Home Developments Ltd

- Layout plan for proposed modifications and development
- Topographical survey

Ordnance Survey (OS) (e-map website for digital maps)

- 1:25,000 series mapping, Sheet OL45, The Cotswolds
- 1:50,000 series mapping, Sheet 163, Cheltenham

British Geological Survey (BGS)

- Geological map, 1:50,000 (England & Wales), Sheet 217, Moreton-in-Marsh
- Soils map (UK Soils Observatory website)

Environment Agency (EA)

- Environment Agency (EA) 'Product 4' Data (from 2018)
- Flood risk maps for flooding from rivers and surface water

Wiltshire Council (WC)

- Core Strategy, adopted January 2015

North Wiltshire District Council (Now Wiltshire Council)

- Level 1 Strategic Flood Risk Assessment (SFRA) – October 2007

1.3 National Planning Policy Framework and Planning Practice Guidance

This FRA has been undertaken with due regard to the statutory requirements of the NPPF and with reference to the Planning Practice Guidance (PPG) in relation to development and

flood risk. This ensures that flood risk is taken into account at all stages of the planning process and to avoid inappropriate development in areas potentially at risk of flooding.

PPG classifies the flood risk vulnerability of sites used for residential as 'more vulnerable' development.

1.4 Local policy

Wiltshire Council (WC) is the local Planning Authority and Lead Local Flood Authority (LLFA) for the site. WC's 'Core Strategy' (January 2015) outlines Core Policy 67 – Flood Risk; which states:

"Development proposed in Flood Zones 2 and 3 as identified within the Strategic Flood Risk Assessment will need to refer to the Strategic Housing Land Availability Assessment when providing evidence to the local planning authority in order to apply the sequential test in line with the requirements of national policy and established best practice.

All new development will include measures to reduce the rate of rainwater run-off and improve rainwater infiltration to soil and ground (sustainable urban drainage) unless site or environmental conditions make these measures unsuitable."

North Wiltshire District Council's (now Wiltshire Council) SFRA (October 2007) states at Chapter 10.2 Sustainable Drainage Systems:

"Runoff rates from previously developed developable land should not exceed existing rates of runoff and should seek betterment. In addition, an allowance should be made for climate change;"

The policies outlined above have been reviewed and the FRA has been compiled in accordance with the relevant objectives.

1.5 Regulatory requirement for this assessment

The site is located within the Environment Agency's indicative Flood Zone 2, where land is assessed as having between a 1 in 100 and 1 in 1,000 annual probability of flooding (1% - 0.1% AEP). Due to the site's location (Flood Zone 2) a Flood Risk Assessment (FRA) is required in accordance with the Planning Practice Guidance (PPG) and the Environment Agency's Flood Risk Standing Advice for Local Planning Authorities.

Residential development is classified as 'more vulnerable' development. More vulnerable development is considered to be appropriate within Flood Zones 1 and 2, under the NPPF and PPG.

2 BACKGROUND INFORMATION

2.1 Site and surrounding area

2.1.1 Location, extent and surroundings

The site currently comprises an agricultural building with surrounding concrete yard within Rixon Farm, Ashton Keynes, Wiltshire. It is centred upon National Grid Reference (NGR) SU 0571 9411 (*Drawing 2750/FRA/01*) and lies within the southern extent of the Cotswold Water Park, an area which contains a number of artificial lakes and waterbodies, all formed in areas of former mineral extraction.

The site is approximately 0.83 hectares (ha). Fridays Ham Lane is located to its north and the proposed Rixon Gate holiday home development is located to the south and east. This includes the erection of 25 holiday homes around the periphery of Lake 82 with associated grassland and ecological improvements. The Rixon Farm farmhouse is included as part of the site.

The region in which the site is located is characterised by numerous water-filled restored quarry workings (see Section 2.1.3 below).

2.1.2 Watercourses

The site lies within the catchment of the River Thames, which is located 730 m to the southwest, at its nearest approach. The overall flow direction of the river within the immediate surrounding area is broadly eastwards. Water features are shown on *Drawing 2750/FRA/02*.

Several minor drains and issues are located in the surrounding area to the west and east of the site, as shown on *Drawing 2750/FRA/02*. Run-off from roofs within the site is to ground. However, some run-off from the existing yard area drains to a small ditch (D1) immediately to the south of the site where it either soaks away or eventually enters Lake 82 to the south.

A highways drainage ditch is located along Fridays Ham Lane to the north of the site and is culverted in parts.

2.1.3 Waterbodies

The closest waterbody to the site is Lake 69 which is located approximately 77 m to the northwest, separated from the site by Fridays Ham Lane. Lake 81 is situated east of Lake 69 and Lakes 82 and 83 lie to the south and southwest of the site respectively. Each of these comprise large artificial waterbodies created in former mineral workings.

Most of the lakes in the Cotswold Water Park are connected to some degree to ensure flow is maintained across the area towards the River Thames. Most are also hydraulically connected with groundwater within the unworked sand and gravel deposits. Lake 82 has a standing water level of 80.9 metres Above Ordnance Datum (mAOD) and is connected to Lake 83 via a concrete spillway.

Following gravel extraction within the Cotswold Water Park, significant volumes of flood storage have been created.

2.1.4 Topography

The topography in the vicinity of the site is predominantly low-lying. The Ordnance Survey map (Sheet OL45) indicates ground elevations in the vicinity are in the order of 83 mAOD. The topographical survey identifies elevations on the northern boundary, adjacent to Fridays Ham Road, are 83.45 mAOD at the entrance to the site and remain just over 83.4 mAOD across the site. At the southern boundary of the farmyard to the south, elevations are 83.35 mAOD. In the vicinity of the site ground elevations gently decline southward towards the River Thames.

2.1.5 Ground conditions

The bedrock geology beneath the site comprises the Oxford Clay Formation. This is a vertically extensive mudstone with occasional silt horizons.

The superficial geology comprises the Quaternary Northmoor Sand and Gravel Member (River Terrace deposits) consisting of sand and gravel. Large tracts of the sand and gravel have been worked commercially, including the footprint of the waterbodies to the north and south of the Application Area. Some Alluvium deposits of clay, silt, sand and gravel may also be present further to the south, associated with the River Thames.

3 APPROACH TO THE FLOOD RISK ASSESSMENT

3.1 'Flood risk'

Using a mixture of quantitative and qualitative methods, the FRA considers the likelihood of flooding, the associated hazards and the vulnerability of the flood receptor. These factors are combined to produce the single measure, 'flood risk'.

3.2 Climate change

Within the UK, projections of future climate change indicate that there will be more frequent, short duration, high intensity rainfall events and periods of long duration rainfall. The National Planning Policy Framework (NPPF) recommends that the effects of climate change are incorporated into Flood Risk Assessments. Recommended precautionary sensitivity ranges for peak rainfall intensities, and peak river flows for the catchment, are outlined in the Environment Agency document, 'Adapting to climate change: Advice for flood and coastal erosion risk management – authorities (April 2016)', with values summarised in *Table 2750/FRA/T1*, below.

2750/FRA/T1: Recommended increases in parameters due to climate change			
Peak rainfall intensity - applies across all of England	Years		
	'2020s' (2015 to 2039)	'2050s' (2040 to 2069)	'2080s' (2070 to 2115)
Upper estimate	+10%	+20%	+40%
Central estimate	+5%	+10%	+20%

A conservative sensitivity range for peak rainfall intensities of 20% for climate change has been used to calculate run-off rates and volumes for the site. NPPF and EA guidance on climate change states it is pertinent to assess both the central and upper end allowances for peak rainfall intensity. This allows consideration and understanding of the range of impacts that may occur, therefore allowances for 40% climate change have also been considered in our assessment (see *Appendix 2750/FRA/A1*).

3.3 Flood receptors

3.3.1 Receptors internal to the site

The proposed residential development on the site has a flood vulnerability classification of 'more vulnerable', as defined in the Planning Practice Guidance.

3.3.2 Receptors external to the site

The closest residential property to the site is located along the northern side of Fridays Ham Lane approximately 75 m northeast of the site. Approximately 340 m to the west is the residential area of Ashton Keynes.

Residential properties form the 'more vulnerable' receptors within the locality of the site. This level of vulnerability increases the potential severity of the consequences of flooding for these receptors. The overall degree of flood risk may thus be higher for such receptors for a given severity of flood event.

Other receptors outside the site comprising roads, fishing lakes, public footpaths and agricultural fields are classed as water compatible or 'less vulnerable'.

3.4 Design events and flooding pathways

As required by the National Planning Practice Guidance, the return period to be considered for fluvial and rainfall events is 100 years and the effects of climate change will be factored in as described in Section 3.2 of this report. This design event will be referred to as the climate-changed, 1% AEP event where 'AEP' means 'Annual Exceedance Probability'.

This FRA considers the following sources of flooding:

- Fluvial flow
- Surface water run-off
- Groundwater
- Sewer and/or water mains leakage

Pathways for flooding may involve two or more such components in sequence, such that the type of flow at the source is not the same as that delivering flooding to the receptor.

Within this FRA, flood risk to both internal and external receptors is assessed with reference to interactions between the development site and the flood sources itemised above. For internal, but not external, receptors this furnishes information on the degree of flood hazard and hence the degree of flood risk. In the case of external receptors, flood hazard and hence flood risk during the design events is not evaluated. Instead the potential for the development to qualitatively increase or decrease flood risk at external receptors is assessed so that targeted measures to ensure a qualitative reduction can subsequently be taken, if necessary.

4 PROPOSED DEVELOPMENT

Full details of the proposals are included elsewhere in the Planning Application, however a summary is provided below as it forms the basis of the Flood Risk Assessment. The existing site (including topographic elevations) is shown in *Appendix 2750/FRA/A3* and the proposed layout is shown in *Appendix 2750/FRA/A4*.

The application is for a residential development with associated access road, parking and gardens as described in the Planning Application.

Roof areas will reduce slightly from 1,286 m² to 1,160 m².

Landscaping to create gardens south, east and west of this will result in the reduction of hardstanding within the proposed development from approximately 1,486 m² to 258 m².

In addition, the loose chippings driveway will be replaced by a semi permeable shingle driveway with a slightly smaller area of 1,340 m² as opposed to the previous 1,530 m². A small area at the entrance to the driveway (22 m²) will be tarmac.

The site will be accessed off Fridays Ham Lane as currently.

Surface water run-off from building roofs, surfaced roads and paths will discharge to the existing ditch in the south of the site. Discharge from the site will be maintained below the current rate, hence offering a betterment.

5 FLOOD RISK TO THE PROPOSED DEVELOPMENT

5.1 Fluvial flooding

5.1.1 Historical flooding

Historical Environment Agency records show that the majority of the site and surrounding areas were flooded in March 1947.

5.1.2 North Wiltshire District Council's Strategic Flood Risk Assessment (SFRA)

According to North Wiltshire District Council's (now Wiltshire Council) SFRA from October 2007, the site is located within the 1 in 1,000-year (Flood Zone 2) flood extent. However, it should be noted that the SFRA is based on previous modelling data (from 2007) and is subject to several assumptions, in particular not taking into account the increase in flood storage from gravel extraction in the area.

5.1.3 Modelled flood events

The Environment Agency's Flood Map for Planning indicates the site lies within Flood Zone 2 (*Drawing 2750/FRA/03*).

However, the modelled floodplain flood levels from the Environment Agency's 'Product 4' (*Appendix 2750/FRA/A2*) is based on more recent hydraulic modelling (Thames (MRL to St Johns, 2014) and LiDAR data, and therefore provides a more accurate representation of flood conditions at the site. The modelled floodplain flood levels from the Environment Agency's Product 4 indicate the site and surrounding land lies within Flood Zone 1 (<0.1% AEP).

The Environment Agency Product 4 provides flood levels for a modelled scenario during the 1% AEP flood event plus 20% climate change. The closest model node is 'Flood Point 1' centred on the northeastern extent of Lake 82, immediately south of the site. Under the Environment Agency's 'Thames Area Climate Change Allowance' guidance (dated January 2017), an allowance can be added to the 1% AEP flood peak elevation to account for updates to the representation of potential climate change impacts in the Thames area.

For 'more vulnerable' developments within Flood Zone 2 the guidance suggests a central allowance for climate change of +500 mm and higher central allowance of +700 mm. Therefore, the 1% AEP event (81.58 mAOD) plus climate change (500 mm for the 'central' allowance) flood level is 82.08 mAOD.

The LiDAR-based flooding pattern suggests that flood waters would remain within the curtilage of the various nearby lakes and that the entire site would remain unaffected. This is confirmed by the topographic survey of the site, which indicates the minimum ground elevation, in the southwestern corner of the site, as 83.02 mAOD.

The Environment Agency has confirmed that the modelled flood elevations remain static for modelled Flood Points 1 and 2 as the lakes are groundwater-fed and are themselves connected via the sand and gravel deposits. Significant 'buffering' of flood waters is therefore available.

Fluvial flood risk to the development from the design event is considered to be 'low'. Mitigation measures are proposed in Section 7.

5.2 Groundwater flooding

Historic incidents of groundwater flooding have not been reported at the site and groundwater flooding has not been identified as a significant mechanism of flooding in the area, according to the SFRA.

Therefore it is considered that the risk of flooding to the site from groundwater is 'very low'.

5.3 Flooding from sewers

Historic incidents of sewer flooding have not been reported at the site according to the SFRA. Thames Water Utilities sewer records do not show any foul sewers or surface water sewers within the vicinity of the site.

Therefore it is considered that the risk of flooding to the site from sewers is 'very low'.

5.4 Flooding from surface water run-off

The Environment Agency's 'Risk of Flooding from Surface Water' map indicates small areas of 'low' risk (<1%) to the south and west of the proposed development (*Drawing 2750/FRA/04*).

The site and surrounding topography is generally low-lying without significant gradients. Waterbodies are located to the south and north of the site and various drainage ditches are in the vicinity. It is therefore considered that the risk of surface water flooding to the site is 'very low'.

6 FLOOD RISK POSED BY THE DEVELOPMENT

6.1 Fluvial flooding (floodwater displacement)

The modelled flood levels from the Environment Agency's Product 4 ('Thames (MRL to St Johns) 2014' model data in *Appendix 2750/FRA/A2*) indicate the site and surrounding land lies within Flood Zone 1 (<0.1% AEP).

Therefore, the proposed development will not displace flood waters unless an event with a return period in excess of 1 in 1,000-years were to occur.

Fluvial flood risk from the development is considered to be 'low'.

6.2 Surface water flooding - changes in run-off

The proposed development will cause some changes to run-off characteristics of the site due to the proposed changes in ground cover (Section 4). The change to the run-off derived from the site is calculated below. The results of the calculations are provided in *Appendix 2750/FRA/A1* and are summarised below in *Table 2750/FRA/T2*.

6.2.1 Existing brownfield run-off rates

The peak run-off rate from the existing site has been estimated using the Rational method, as given below, for the 1 in 100-year rainfall event for a storm duration of 6 hours.

$$Q_p = 2.78 CiA$$

Where: C = run-off co-efficient (dimensionless)
i = rainfall intensity (mm/hr)
A = catchment area (ha)

The run-off co-efficient, C, varies for different surfaces. The values of C used for this assessment are consistent with the 'Wallingford Procedure for design and analysis of urban storm drainage' (HR Wallingford, 1981) with a value of 0.95 for roofing, grassed area (C = 0.4), track (C = 0.7), and 0.8 for concrete hard surfacing.

The rainfall intensities were obtained from the Flood Estimation Handbook (FEH) Web Service (<https://fehweb.ceh.ac.uk/>).

6.2.2 Post-development run-off rates

The Rational method has also been used to calculate the post-development run-off. C values and areas have been changed to represent the reduced roof area (C = 0.95), grassed garden area (C = 0.4), semi-permeable granular paths and parking areas (C = 0.7),

and hard impermeable surfaces ($C = 0.8$). In addition 20% (and 40%) has been added to peak rainfall to account for climate change, assuming a development lifetime of 75 to 100 years.

2750/FRA/T2: Run-off rate calculations			
Phase of development	Return period (yrs)	Run-off rate* (l/s)	Run-off volume* (m ³)
Pre-development (existing brownfield)	1 in 100	16.2*	349*
Post-development	1 in 100	14.2*	307*
	1 in 100 +20%CC	17.1*	368*
	1 in 100 +40%CC	19.9*	430*
CC = climate change * for storm duration of 6 hours			

As summarised in the table above, run-off from the site would reduce by 42 m³ post-development for the 1 in 100-year storm event without climate change allowance. This offers a betterment to the existing conditions. However, with an allowance of 20% for climate change the attenuation volume increases by 19 m³ and by 81 m³ for 40% climate change.

6.2.3 Flood risk

The overall topography of the site will not be altered as a result of the development. Surface water run-off from roof and parking areas will be collected and discharged to the existing ditch to the south of the site. In order to prevent external impact it will be necessary to demonstrate that discharge from the proposed drainage features will offer a betterment from the existing brownfield run-off rates. The brownfield run-off rates have been calculated above together with run-off rates for the proposed development. These indicate that an overall reduction in run-off will result from the proposed re-development of the site although the effects of climate change will potentially increase future run-off.

There is currently an overall 'very low' risk of surface water flooding across the site and this is not expected to change as a result of the development. It is considered, therefore, that with appropriately sized attenuation storage (Section 7.3) that the development will not increase risk of flooding to the surrounding area and will, in fact, offer betterment to existing conditions.

6.3 Interaction with other hydrological components

The degree of flood risk associated with the site's hydrological interaction with groundwater and sewer/water mains in the surrounding area is unlikely to be significant. Therefore further mitigation measures are not considered necessary.

7 MITIGATION MEASURES

7.1 Finished floor levels

Environment Agency Product 4 modelled flood elevation data indicates the site will remain dry. Finished floor levels for the proposed development would be set at a minimum of 82.90 mAOD, this being 820 mm above the modelled 1 in 100-year flood level plus climate change.

7.2 Access, egress and dry refuge

The modelled extents for the 1% AEP event plus climate change (*Appendix 2750/FRA/A2*) coupled with the topographic information indicate that the proposed development would remain completely dry, therefore external dry refuge is not required.

7.3 Surface water run-off attenuation – external receptors

Run-off calculations have been completed for the 1 in 100-year event plus climate change (20%), for a peak storm duration of 6 hours.

The pre-development (existing) run-off volume has been subtracted from the post-development volumes in order to calculate the attenuation storage required on-site. In order to provide a betterment for brownfield sites, the pre-development run-off volume (349 m³) will be reduced by 30% (104.7 m³). Hence, the total post-development attenuation storage required is $104.7 + 19.0 = 123.7 \text{ m}^3$.

In the pre-development (existing) scenario, run-off discharges to the south of the site into the existing drain. However, post-development all run-off will be directed into the proposed SuDS system, reducing the risk of flooding to external receptors and offering betterment to the existing situation.

A below ground geo-cellular attenuation tank (or similar) will provide below ground storage for 123.7 m³. The attenuation tank will discharge directly into the ditch south of the site, with discharge limited to a rate of 2.0 l/s/ha, which is 1.66 l/s.

7.4 Environment Agency flood warning service

The site is located within the EA Flood Alert Area for 'River Thames from Ewen down to and including Cricklade' (EA Ref 061WAF23EwnCrkld), and the EA Flood Warning Area for 'River Thames from Somerford Keynes to Cricklade' (EA Ref 061FWF23SKCrkld).

The Environment Agency flood warning service issues warnings by phone, e-mail or text message. Registration can be completed on the EA website or by contacting the EA Floodline on 0345 988 1188. The site should be registered with the EA flood warning service in order to allow preparatory action to be taken and reduce residual flood risk.

8 SUMMARY AND CONCLUSIONS

A Planning Application has been prepared for the re-development of an agricultural building and surrounding yard at Rixon Farm farmhouse at Ashton Keynes, Wiltshire. The site is approximately 0.83 ha. The proposals include the re-development of an existing agricultural building to provide residential properties with associated gardens and car parking.

The Environment Agency's Flood Map for Planning indicates the site is located within Flood Zone 2, where land is assessed as having between a 1 in 100 and 1 in 1,000 annual probability of flooding (1% - 0.1% AEP). However, more recent Environment Agency modelling (Thames (MRL to St Johns) 2014) indicates that the site lies within Flood Zone 1 (<0.1% AEP).

The principal source of flood risk is the River Thames, which is located 730 m southwest of the site at its closest approach. The risk of flooding to the site from fluvial ('low'), surface water ('very low'), groundwater ('very low') and sewage/water mains ('very low') has been considered.

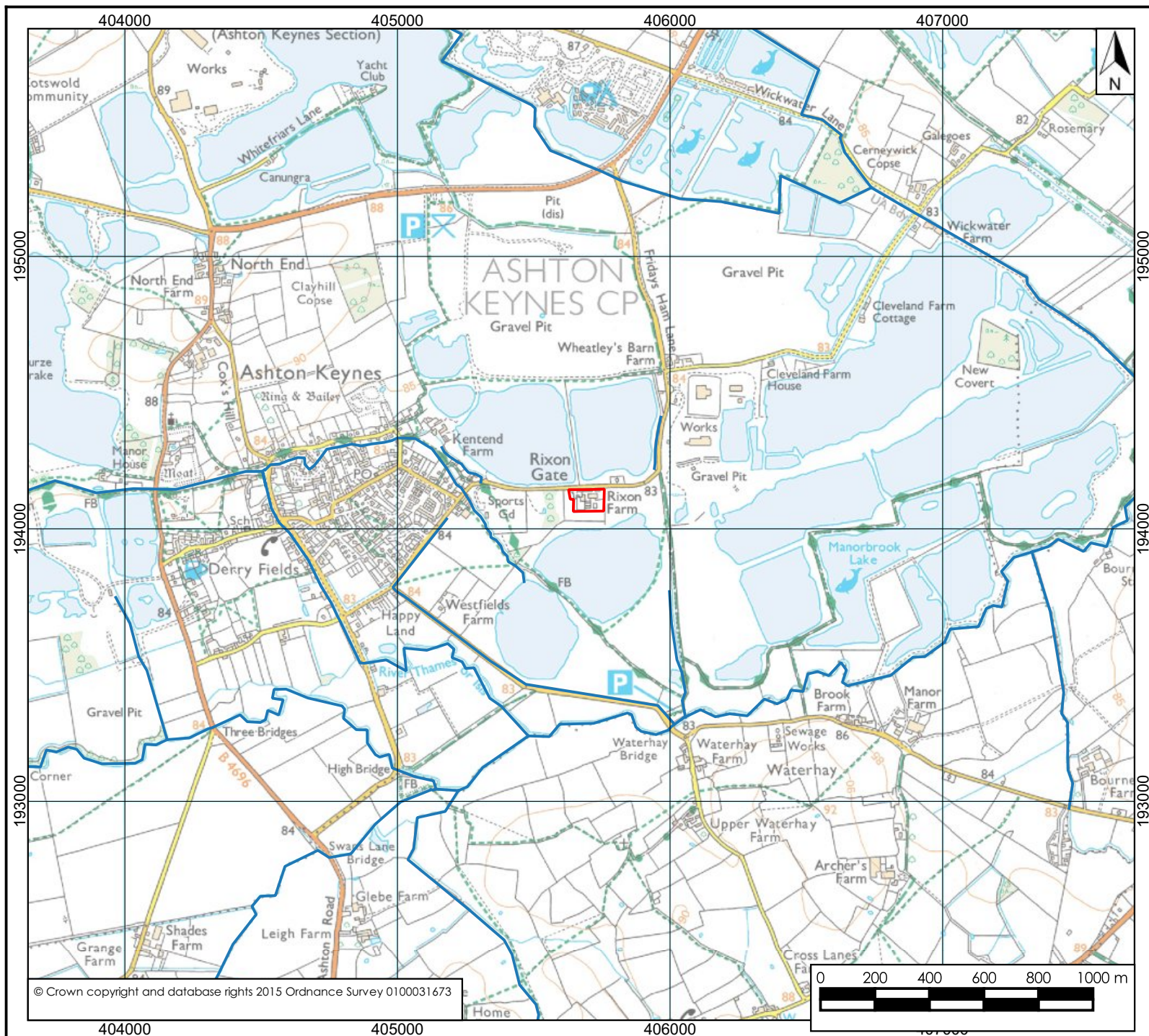
The proposed development will reduce flood risk to external receptors by reducing areas of roofs and hardstanding, increasing permeable areas through the provision of gardens and provision of permeable paving for parking areas and paths. This results in a surface water run-off reduction which offers a betterment to the existing conditions.

Finished floor levels on-site will be set at 82.90 mAOD, which is a minimum of 820 mm above the 1 in 100-year plus climate change elevation.

As mitigation of any residual risk, it is recommended that the site should be registered with the Environment Agency's flood warning service and to make contact with the local flood warden.

In light of the above, the site is considered to satisfy the flood risk requirements of the NPPF and associated technical guidance. It also complies with WC's Core Strategy Policy 67 – Flood Risk whereby development should include measures to reduce the rate of rainwater run-off. It also complies with the Council's SFRA recommendation that run-off rates from previously developed land should not exceed existing rates of run-off and should seek betterment.

DRAWINGS



Legend
 Application Area

Scale corrected at A4

Client	Dream Home Developments Wimberley Park Knapp Lane STROUD GL5 2TH		
Title	Site Location		
Project	Rixon Farm FRA		
Drawing	2214/FRA/01	Version	1
Date	Sep 2020	Scale	1:

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Legend

- Application Area
- Waterbody
- Watercourse

Scale correct at A4

Client Dream Home Developments
Wimberley Park
Knapp Lane
STROUD
GL5 2TH

Title Water Features

Project Rixon Farm FRA

Drawing 2214/FRA/02 Version 1

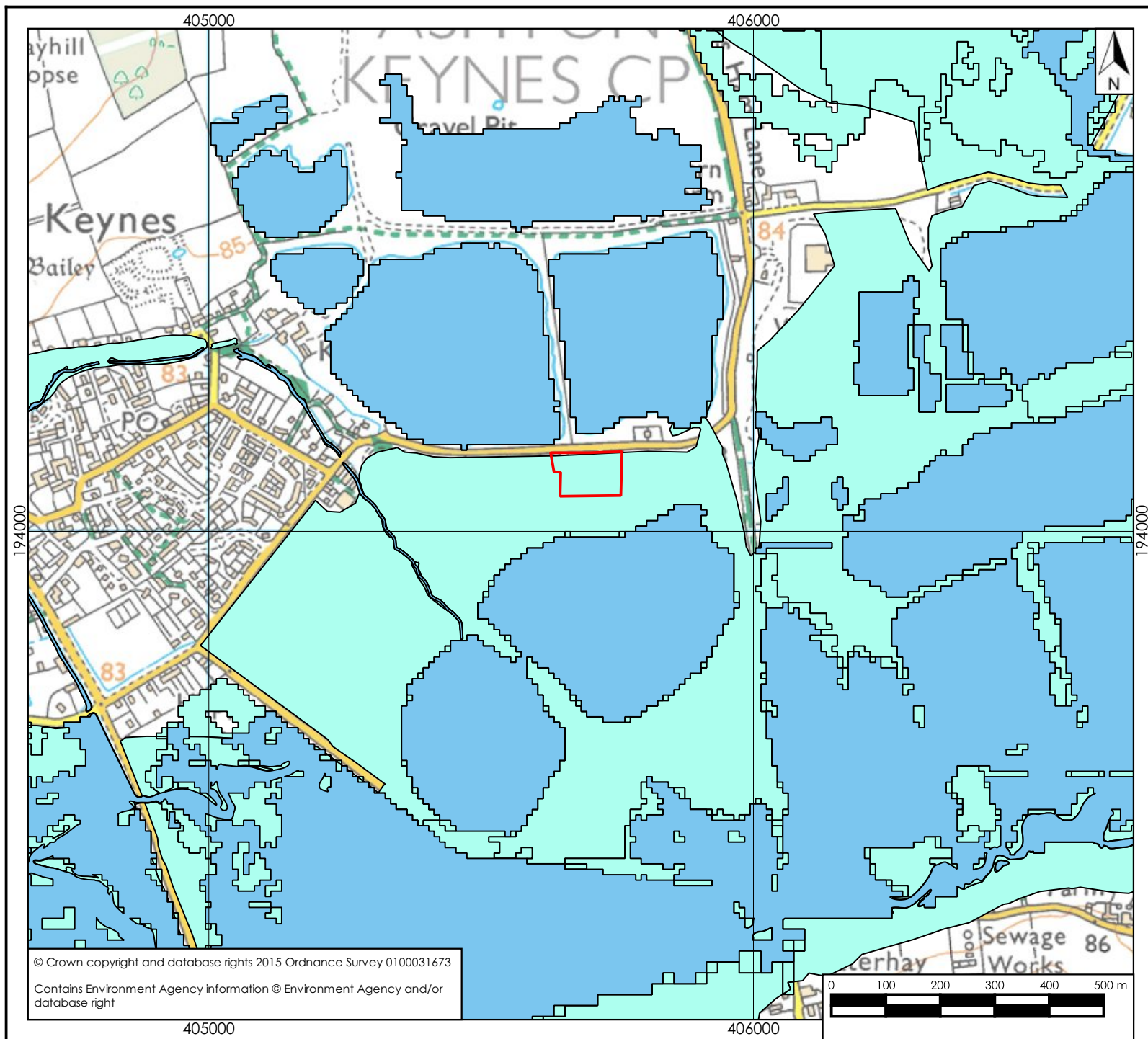
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Legend

Application Area

Flood Zones

Flood Zone 1

Flood Zone 2

Flood Zone 3

Scale correct at A4

Client Dream Home Developments
Wimberley Park
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Title EA Flood Map for Planning

Project Rixon Farm FRA

Drawing 2214/FRA/03 Version 1

Date Sep 2020 Scale 1:10000

hafrenwater 
environmental water management

Barkers Chambers • Barker Street • Shrewsbury •
Shropshire • SY1 1SB
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APPENDIX 2750/FRA/A1

Run-off calculations

Required Storage Retention Volume - 1-in-100-year 6hr storm

	Soft Landscaping	Roofs	Hardstanding	Track
Runoff Coefficient	0.4	0.95	0.8	0.7
Area Ha	0.3978	0.129	0.149	0.153

Climate change (% rainfall increase)	0	%
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The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78 C i A$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

IH124 Estimate of QBAR Greenfield Discharge	0.0	l/s
--	-----	-----

Groundwater Inflow Rate (-ve for Outflow)	0.0	l/s
--	-----	-----

	Rainfall *2	Rainfall intensity	Accretion Rate from Roofing *3	Accretion Rate from Hardstanding *3	Accretion Rate from Soft Landscaping *3	Accretion Rate from Track *3	Discharge Rate to Watercourse *3	Net Accretion Rate in Storage	Net Accretion Volume in Storage
Duration	100 year event								
hours	mm	mm/hr	l/s	l/s	l/s	l/s	l/s	l/s	m ³
0.25	30.5	122.0	41.4	40.3	54.0	36.3	0	172.0	155
0.5	36.4	72.8	24.7	24.1	32.2	21.7	0	102.7	185
1	43.5	43.5	14.8	14.4	19.2	12.9	0	61.3	221
2	51.9	25.9	8.8	8.6	11.5	7.7	0	36.6	263
4	62.0	15.5	5.3	5.1	6.9	4.6	0	21.8	315
6	68.7	11.5	3.9	3.8	5.1	3.4	0	16.2	349
8	74.0	9.2	3.1	3.1	4.1	2.8	0	13.0	375
12	82.0	6.8	2.3	2.3	3.0	2.0	0	9.6	416
16	86.0	5.4	1.8	1.8	2.4	1.6	0	7.6	437
20	89.2	4.5	1.5	1.5	2.0	1.3	0	6.3	453
24	91.9	3.8	1.3	1.3	1.7	1.1	0	5.4	467
28	94.2	3.4	1.1	1.1	1.5	1.0	0	4.7	478
32	96.3	3.0	1.0	1.0	1.3	0.9	0	4.2	489
36	98.2	2.7	0.9	0.9	1.2	0.8	0	3.8	498
40	99.9	2.5	0.8	0.8	1.1	0.7	0	3.5	507
44	101.5	2.3	0.8	0.8	1.0	0.7	0	3.3	515
48	102.9	2.1	0.7	0.7	0.9	0.6	0	3.0	522

		Barkers Chambers Barker Street Shrewsbury, Shropshire SY1 1SB UK Tel: 01743 355770 www.hafrenwater.com	Client:
Title:	Runoff rates and retention volumes for existing site		
Project:	Rixon Farm		
Calc Sheet:	A1.1		Date: Sep-20

Required Storage Retention Volume - 1-in-100-year 6hr storm

	Soft Landscaping	Roofs	Hardstanding	Shingle driveway
Runoff Coefficient	0.4	0.95	0.8	0.7
Area Ha	0.55	0.116	0.028	0.134

Climate change (% rainfall increase)	0	%
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The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78 C i A$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

IH124 Estimate of QBAR Greenfield Discharge	0.0	l/s
---	-----	-----

Groundwater Inflow Rate (-ve for Outflow)	0.0	l/s
---	-----	-----

	Rainfall *2	Rainfall intensity	Accretion Rate from Roofing *3	Accretion Rate from Hardstanding *3	Accretion Rate from Soft Landscaping *3	Accretion Rate from Shingle Driveway *3	Discharge Rate to Watercourse *3	Net Accretion Rate in Storage	Net Accretion Volume in Storage
Duration	100 year event								
hours	mm	mm/hr	l/s	l/s	l/s	l/s	l/s	l/s	m ³
0.25	30.5	122.0	37.4	7.6	74.6	31.8	0	151.4	136
0.5	36.4	72.8	22.3	4.5	44.5	19.0	0	90.4	163
1	43.5	43.5	13.3	2.7	26.6	11.3	0	53.9	194
2	51.9	25.9	7.9	1.6	15.9	6.8	0	32.2	232
4	62.0	15.5	4.7	1.0	9.5	4.0	0	19.2	277
6	68.7	11.5	3.5	0.7	7.0	3.0	0	14.2	307
8	74.0	9.2	2.8	0.6	5.7	2.4	0	11.5	330
12	82.0	6.8	2.1	0.4	4.2	1.8	0	8.5	367
16	86.0	5.4	1.6	0.3	3.3	1.4	0	6.7	384
20	89.2	4.5	1.4	0.3	2.7	1.2	0	5.5	398
24	91.9	3.8	1.2	0.2	2.3	1.0	0	4.8	411
28	94.2	3.4	1.0	0.2	2.1	0.9	0	4.2	421
32	96.3	3.0	0.9	0.2	1.8	0.8	0	3.7	430
36	98.2	2.7	0.8	0.2	1.7	0.7	0	3.4	439
40	99.9	2.5	0.8	0.2	1.5	0.7	0	3.1	446
44	101.5	2.3	0.7	0.1	1.4	0.6	0	2.9	453
48	102.9	2.1	0.7	0.1	1.3	0.6	0	2.7	460

 Barkers Chambers Barker Street Shrewsbury, Shropshire SY1 1SB UK Tel: 01743 355770 www.hafrenwater.com		Client:
Title:	Runoff rates and retention volumes for developed site	
Project:	Rixon Farm	
Calc Sheet:	A1.2	Date: Sep-20

Required Storage Retention Volume - 1-in-100-year 6hr storm

	Soft Landscaping	Roofs	Hardstanding	Shingle driveway
Runoff Coefficient	0.4	0.95	0.8	0.7
Area Ha	0.55	0.116	0.028	0.134

Climate change (% rainfall increase)	20	%
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The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78 C i A$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

IH124 Estimate of QBAR Greenfield Discharge	0.0	l/s
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Groundwater Inflow Rate (-ve for Outflow)	0.0	l/s
---	-----	-----

	Rainfall *2	Rainfall intensity	Accretion Rate from Roofing *3	Accretion Rate from Hardstanding *3	Accretion Rate from Soft Landscaping *3	Accretion Rate from Shingle Driveway *3	Discharge Rate to Watercourse *3	Net Accretion Rate in Storage	Net Accretion Volume in Storage
Duration	100 year event								
hours	mm	mm/hr	l/s	l/s	l/s	l/s	l/s	l/s	m ³
0.25	30.5	122.0	44.9	9.1	89.5	38.2	0	181.7	164
0.5	36.4	72.8	26.8	5.4	53.4	22.8	0	108.4	195
1	43.5	43.5	16.0	3.2	31.9	13.6	0	64.7	233
2	51.9	25.9	9.5	1.9	19.0	8.1	0	38.6	278
4	62.0	15.5	5.7	1.2	11.4	4.8	0	23.1	332
6	68.7	11.5	4.2	0.9	8.4	3.6	0	17.1	368
8	74.0	9.2	3.4	0.7	6.8	2.9	0	13.8	397
12	82.0	6.8	2.5	0.5	5.0	2.1	0	10.2	440
16	86.0	5.4	2.0	0.4	3.9	1.7	0	8.0	461
20	89.2	4.5	1.6	0.3	3.3	1.4	0	6.6	478
24	91.9	3.8	1.4	0.3	2.8	1.2	0	5.7	493
28	94.2	3.4	1.2	0.3	2.5	1.1	0	5.0	505
32	96.3	3.0	1.1	0.2	2.2	0.9	0	4.5	516
36	98.2	2.7	1.0	0.2	2.0	0.9	0	4.1	526
40	99.9	2.5	0.9	0.2	1.8	0.8	0	3.7	536
44	101.5	2.3	0.8	0.2	1.7	0.7	0	3.4	544
48	102.9	2.1	0.8	0.2	1.6	0.7	0	3.2	552

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Title:	Runoff rates and retention volumes for developed site		
Project:	Rixon Farm		
Calc Sheet:	A1.2	Date:	Sep-20

Required Storage Retention Volume - 1-in-100-year 6hr storm

	Soft Landscaping	Roofs	Hardstanding	Shingle driveway
Runoff Coefficient	0.4	0.95	0.8	0.7
Area Ha	0.55	0.116	0.028	0.134

Climate change
(% rainfall increase)

40 %

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78 C i A$$

Where:

C co-efficient of run-off (dimensionless)
i rainfall intensity (mm/hr)
A catchment area (Ha)

IH124 Estimate of QBAR Greenfield Discharge	0.0	l/s
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Groundwater Inflow Rate (-ve for Outflow)	0.0	l/s
---	-----	-----

	Rainfall *2	Rainfall intensity	Accretion Rate from Roofing *3	Accretion Rate from Hardstanding *3	Accretion Rate from Soft Landscaping *3	Accretion Rate from Shingle Driveway *3	Discharge Rate to Watercourse *3	Net Accretion Rate in Storage	Net Accretion Volume in Storage
Duration	100 year event								
hours	mm	mm/hr	l/s	l/s	l/s	l/s	l/s	l/s	m ³
0.25	30.5	122.0	52.3	10.6	104.5	44.5	0	212.0	191
0.5	36.4	72.8	31.2	6.3	62.4	26.6	0	126.5	228
1	43.5	43.5	18.6	3.8	37.2	15.9	0	75.5	272
2	51.9	25.9	11.1	2.3	22.2	9.5	0	45.1	325
4	62.0	15.5	6.6	1.4	13.3	5.7	0	26.9	387
6	68.7	11.5	4.9	1.0	9.8	4.2	0	19.9	430
8	74.0	9.2	4.0	0.8	7.9	3.4	0	16.1	463
12	82.0	6.8	2.9	0.6	5.9	2.5	0	11.9	513
16	86.0	5.4	2.3	0.5	4.6	2.0	0	9.3	538
20	89.2	4.5	1.9	0.4	3.8	1.6	0	7.7	558
24	91.9	3.8	1.6	0.3	3.3	1.4	0	6.7	575
28	94.2	3.4	1.4	0.3	2.9	1.2	0	5.8	589
32	96.3	3.0	1.3	0.3	2.6	1.1	0	5.2	602
36	98.2	2.7	1.2	0.2	2.3	1.0	0	4.7	614
40	99.9	2.5	1.1	0.2	2.1	0.9	0	4.3	625
44	101.5	2.3	1.0	0.2	2.0	0.8	0	4.0	635
48	102.9	2.1	0.9	0.2	1.8	0.8	0	3.7	644

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Title: Runoff rates and retention volumes for developed site			
Project: Rixon Farm			
Calc Sheet: A1.2			Date: Sep-20

APPENDIX 2750/FRA/A2

EA Product 4 data

Product 4 (Detailed Flood Risk) for Site at Rixon Gaet, Ashton Keynes

Our Ref: THM_76390

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 request our guidance which sets out the 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.

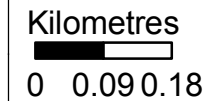
This letter is not a Flood Risk Assessment. The information supplied can be used to form part of your Flood Risk Assessment. Further advice and guidance regarding Flood Risk Assessments can be found on our website at:

<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

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

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Created on 05/03/2018 REF: THM_76390



 Main River
 Flooding from rivers or sea (FZ3)
 Extent of extreme flood (FZ2)

- 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.

Defence information

THM_76390

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.

Model information

THM_76390

Model: Thames (MRL to St Johns) 2014

Description: The information provided is taken from the Thames (MRL to St Johns Lock) Flood Mapping Study completed in January 2014. The study was carried out using 2D modelling software (ISIS-Tuflow).

Model design runs:

1 in 5 / 20% Annual Exceedance Probability (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 plus 20% increase in flows

Mapped Outputs:

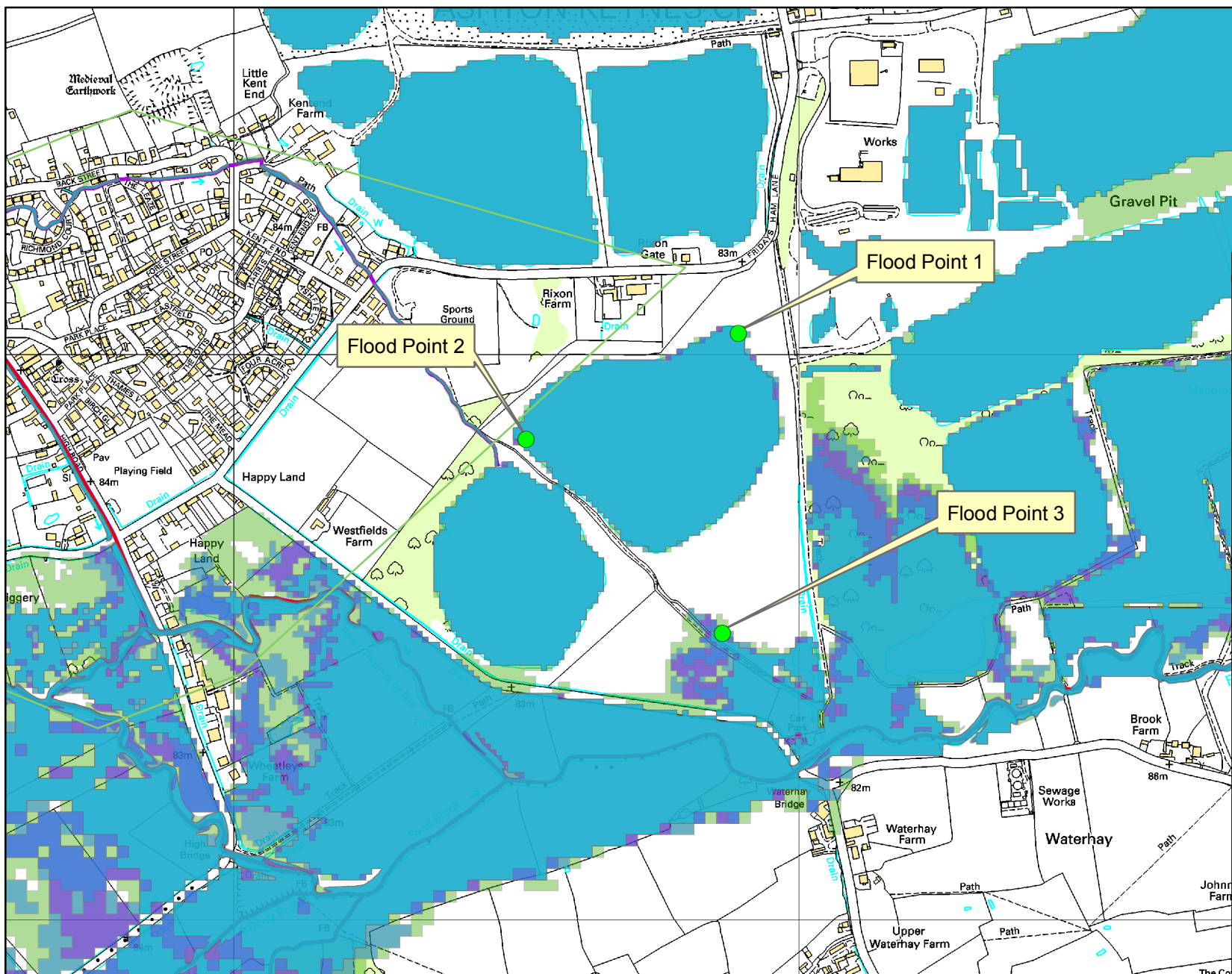
1 in 5 / 20% AEP; 1 in 20 / 5% AEP; 1 in 50 / 2% AEP; 1 in 100 / 1% AEP and 1 in 1000 / 0.1% AEP

Model accuracy:

Levels $\pm$ 250mm

FRA Map centred on: Site at Rixon Gate, Ashton Keynes

Created on 05/03/2018 REF: THM_76390



Kilometres

0 0.09 0.18

Legend

- 20% AEP Flood Outline
- 5% AEP Flood Outline
- 2% AEP Flood Outline
- 1% AEP Flood Outline
- 0.1% AEP Flood Outline
- Main River

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

THM_76390

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% increase in flows)	0.1% AEP
Flood Point 1	Thames (MRL to St Johns) 2014	405,889	194,039	81.34	81.44	81.58	81.63	81.77
Flood Point 2	Thames (MRL to St Johns) 2014	405,517	193,850	81.34	81.44	81.58	81.63	81.77
Flood Point 3	Thames (MRL to St Johns) 2014	405,861	193,506	No Data	82.27	82.32	82.35	82.38

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

Note:

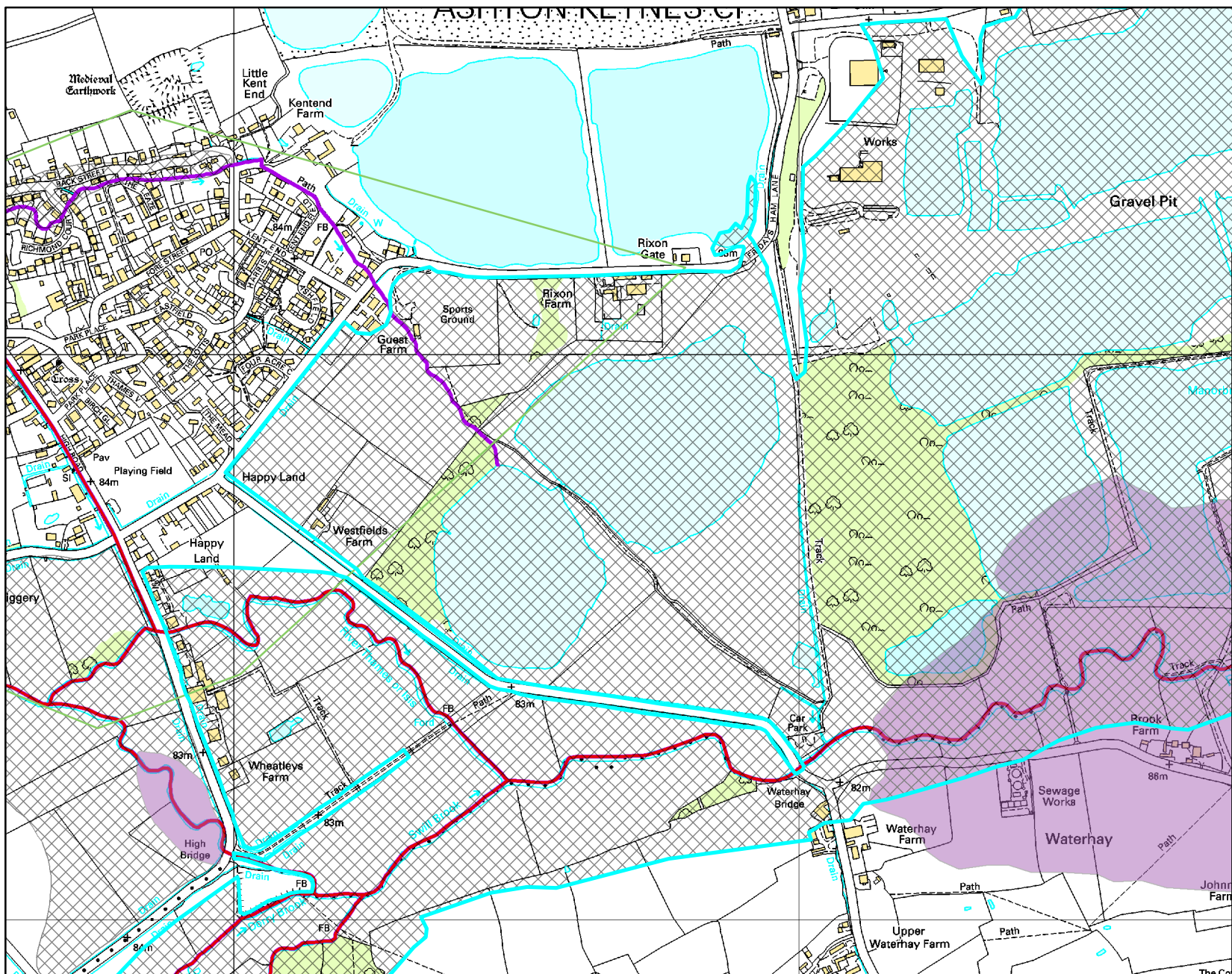
Due to changes in guidance on the allowances for climate change, the 20% increase in river flows should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an intermediate level assessment.

For further advice on the new allowances please visit

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

Historic Flood Map centred on: Site at Rixon Gate, Ashton Keynes

Created on 05/03/2018 REF: THM_76390



Kilometres
0 0.09 0.18

Legend

Flood Event Outlines year

- 1947
- 1992
- Main River

THM 76390

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:

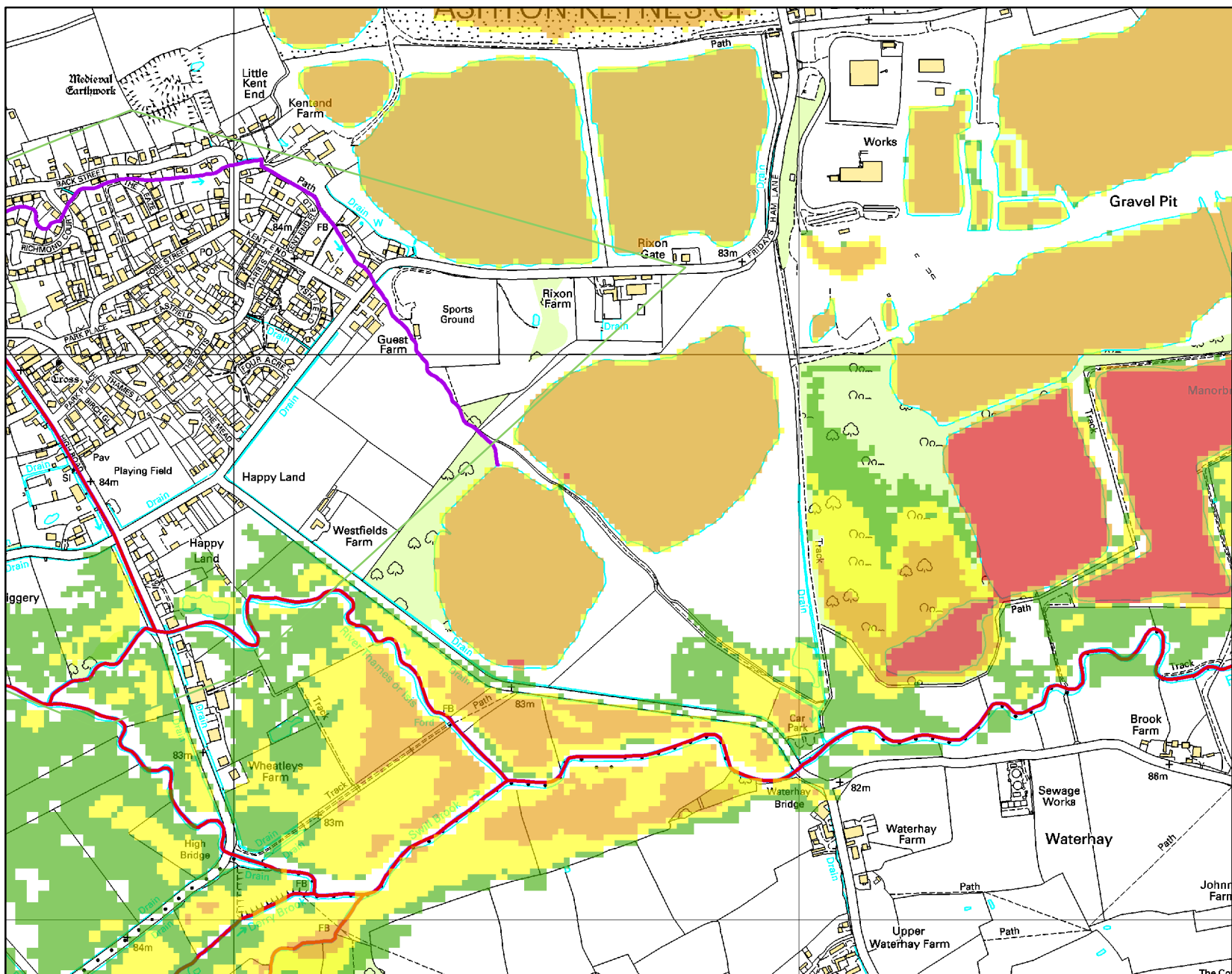
[illegible]

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.

Hazard Map centred on: Site at Rixon Gate, Ashton Keynes

Created on 05/03/2018 REF: THM_76390



Kilometres

0 0.09 0.18

Legend

- 0.5 - 0.75
- 0.75 - 1.25
- 1.250000001 - 2
- 2.000000001 - 8.580580767
- Main River

For hazard and debris factor we used HR Wallingford and Environment Agency (May 2008) supplementary note on flood hazard ratings and thresholds for development planning and control purpose. The following calculation is used:
 $HR = d \times (v + 0.5) + DF$
HR = flood hazard rating
d = depth of flooding (m)
v = velocity of floodwaters (m/sec)
DF = debris factor calculated (0, 0.5, 1 depending on probability that debris will lead to a hazard)

Hazard Mapping

Hazard Mapping methodology:

To calculate flood hazard with the debris factor we have used the supplementary note to Flood Risk to People Methodology (see below).

The following calculation is used:

$$HR = d \times (v+0.5) + DF$$

Where HR = flood hazard rating

d = depth of flooding (m)

v = velocity of floodwaters (m/sec)

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

The resultant hazard rating is then classified according to:

Flood Hazard	Colour	Hazard to People Classification
Less than 0.75	Green	Very low hazard - Caution
0.75 to 1.25	Yellow	Danger for some - includes children, the elderly and the infirm
1.25 to 2.0	Orange	Danger for most - includes the general public
More than 2.0	Red	Danger for all - includes the emergency services

REF: HR Wallingford and Environment Agency (May 2008) Supplementary note of flood hazard ratings and thresholds for development planning and control purpose – Clarification of the Table 113.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1

Thames Area Climate Change Allowances

Guidance for their use in flood risk assessments

Jan 2017

We recently updated our national guidance on climate change allowances for Flood Risk Assessments. The following information provides additional local guidance which applies to developments within our Thames area boundary.

Climate change allowances - overview

The National Planning Practice Guidance refers planners, developers and advisors to the Environment Agency to our guidance on considering climate change in Flood Risk Assessments. We updated this guidance in February 2016 and it should be read in conjunction with this document to inform planning applications, local plans, neighbourhood plans and other projects. It provides:

- Climate change allowances for peak river flow, peak rainfall, sea level rise, wind speed and wave height
- A range of allowances to assess fluvial flooding, rather than a single national allowance
- Advice on which allowances to use for assessments based on vulnerability classification, flood zone and development lifetime

Updated climate change allowances guidance:

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

National Planning Practice Guidance:

<http://planningguidance.communities.gov.uk/>

Assessing climate change impacts on fluvial flooding

Table A below indicates the level of technical assessment of climate change impacts on fluvial flooding appropriate for new developments depending on their scale and location (flood zone). Please note that this should be used as a guide only. Ultimately, the agreed approach should be based on expert local knowledge of flood risk conditions, local sensitivities and other influences.

Applicants and consultants may contact the Environment Agency at the pre-planning application stage to confirm the assessment approach on a case-by-case basis. We provide standard guidance free of charge or bespoke advice for a fee for developments for which we are a statutory consultee. If your development is instead covered by Flood Risk Standing Advice, we recommend you contact the relevant Local Planning Authority for their guidance and confirmation of the assessment approach. Flood Risk Standing Advice can be found here:

<https://www.gov.uk/flood-risk-assessment-local-planning-authorities>

Table A defines three possible approaches to account for flood risk impacts due to climate change in new development proposals:

1. **Basic** - Developer can add an allowance to the 'design flood' (i.e. 1% annual probability) peak levels to account for potential climate change impacts. The allowance should be derived and agreed locally by Environment Agency teams.
2. **Intermediate** - Developer can use existing modelled flood and flow data to construct a stage-discharge rating curve, which can be used to interpolate a flood level based on the required peak flow allowance to apply to the 'design flood' flow.
3. **Detailed** - Perform detailed hydraulic modelling, through either re-running Environment Agency hydraulic models (if available) or construction of a new model by the developer.

Table A – Indicative guide to assessment approach

Vulnerability classification	Flood zone	Assessment by development type		
		Minor	Small-Major	Large-Major
Essential infrastructure	Zone 2	Detailed		
	Zone 3a	Detailed		
	Zone 3b	Detailed		
Highly vulnerable	Zone 2	Intermediate/Basic	Intermediate/Basic	Detailed
	Zone 3a	Not appropriate development		
	Zone 3b	Not appropriate development		
More vulnerable	Zone 2	Basic	Basic	Intermediate/Basic
	Zone 3a	Basic	Detailed	Detailed
	Zone 3b	Not appropriate development		
Less vulnerable	Zone 2	Basic	Basic	Intermediate/Basic
	Zone 3a	Basic	Basic	Detailed
	Zone 3b	Not appropriate development		
Water compatible	Zone 2	None		
	Zone 3a	Intermediate/Basic		
	Zone 3b	Detailed		

Definitions of terms in Table A

Minor

1-9 dwellings/less than 0.5 ha; office/light industrial under 1ha; general industrial under 1 ha; retail under 1 ha; travelling community site between 0 and 9 pitches.

Small-Major

10 to 30 dwellings; office/light industrial 1ha to 5ha; general industrial 1ha to 5ha; retail over 1ha to 5ha; travelling community site over 10 to 30 pitches.

Large-Major

30+ dwellings; office; light industrial 5ha+; general industrial 5ha+; retail 5ha+; gypsy/traveller site over 30+ pitches; any other development that creates a non-residential building or development over 1000 sqm.

Further info on vulnerability classifications:

<http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-2-flood-risk-vulnerability-classification/>

Further info on flood zones:

<http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-2-flood-risk-vulnerability-classification/>

Specific local considerations

Where the Environment Agency and the applicant or their consultant has agreed that a basic level of assessment is appropriate, the figures in Table B below can be used as an allowance for potential climate change impacts on peak design (i.e. 1% annual probability) fluvial flood level rather than undertaking detailed modelling.

Table B – Local allowances for potential climate change impacts

Watercourse	Central	Higher central	Upper
Thames	500mm	700mm	1000mm

Use of these allowances will only be accepted after discussion with the Environment Agency.

Fluvial food risk mitigation

Please use the [national guidance](#) to find out which allowances to use to assess the impact of climate change on flood risk.

For planning consultations where we are a statutory consultee and our [Flood Risk Standing Advice](#) does not apply, we use the following benchmarks to inform flood risk mitigation for different vulnerability classifications.

These benchmarks are a guide only. We strongly recommend you contact us at the pre-planning application stage to confirm this on a case-by-case basis. Please note you may be charged for pre-planning advice.

For planning consultations where we are not a statutory consultee or where our Flood Risk Standing Advice does apply, we recommend local planning authorities and developers use these benchmarks but we do not expect to be consulted.

Essential Infrastructure

For these developments, our benchmark for flood risk mitigation is for it to be designed to the **upper end** climate change allowance for the epoch that most closely represents the lifetime of the development, including decommissioning.

Highly Vulnerable

For these developments in flood zone 2, the **higher central** climate change allowance is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **upper end** allowance.

More Vulnerable

For these developments in flood zone 2, the **central** climate change allowance is our minimum benchmark for flood risk mitigation. In flood zone 3 the **higher central** climate change allowance is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **higher central** (in flood zone 2) and the **upper end** allowance (in flood zone 3).

Water Compatible or Less Vulnerable

For these developments, the **central** climate change allowance for the epoch that most closely represents the lifetime of the development is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **higher central** to inform built in resilience, particularly in flood zone 3.

Further info on our Flood Risk Standing Advice:

<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

There may be circumstances where local evidence supports the use of other data or allowances. Where you think this is the case we may want to check this data and how you propose to use it.

For more information

Please contact our Thames area Customers and Engagement team:

Enquiries_THM@environment-agency.gov.uk

APPENDIX 2750/FRA/A3

Topographic survey

APPENDIX 2750/FRA/A4

Proposed development

