



**FLOOD RISK ASSESSMENT
SuDS STRATEGY AND
DRAINAGE STRATEGY**

FOR

RESIDENTIAL DEVELOPMENT

AT

WENSLEY ROAD

READING

Client

Reading Borough Council
Civic Offices
Bridge St
Reading
RG1 2LU

Drainage Engineer

WFBA
The Old Hayloft
Pucknall Farm
Dores Lane
Romsey
Hampshire, SO51 0QJ

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Prepared by	E McDade	E McDade			
Checked by	R Lowe	R Lowe			

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1.0 Introduction

1.1 Brief

- 1.1.1 WFBA have been instructed by Reading Borough Council to undertake a Flood Risk Assessment (FRA) for a proposed housing development on Wensley Road, Reading.
- 1.1.2 The site is a residential area, containing a mixture of properties: high rise flats, terrace and semi detached houses along with communal parking and gardens.
- 1.1.3 This FRA outlines the flood risk and drainage issues in relation to the redevelopment proposals.
- 1.1.4 The purpose of this report is to demonstrate how the proposed development complies with planning policy on flood risk (National Planning Policy Framework, and the supporting Planning Practice Guidance) and drainage.
- 1.1.5 The structure of this report is summarised as follows:
 - Section 2: Describes the existing conditions with respect to flooding and drainage;
 - Section 3: Provides commentary on how flood risk from a range of potential sources may or may not constrain development proposals;
 - Section 4: Describes how surface water from the development area can be drainage in a sustainable manner, without increasing the risk of flooding elsewhere;
 - Section 5: Presents a summary of the report and identifies the main conclusions that can be drawn.

2.0 Site Description and Proposed Development

2.1 Site Location

- 2.1.1 The proposed development is located in Reading, Berkshire, as shown in figure 1. The boundary of the site encloses approximately 2.29Ha that is broadly rectangular in shape in shape. The site is approximately centred on OS grid reference SU701720.



Figure 1. Site Location

- 2.1.2 The site is located approximately 1.88 km South West of the centre of Reading, Berkshire. It is surround by residential dwellings all round. Water Meadows are situated behind the dwellings to the south and a trainline to the West.
- 2.1.3 The site currently comprises of a mixture of residential dwellings. High rise flats with communal parkings and gardens to the centre of the site, with terrace and semi detached properties surrounding this all round.

2.2 Site Topography

- 2.2.1 The topography of the site can affect the movement of water through soil. This is as a result of gravity, which along with site gradients and permeability, directly influences water movement. It is a major factor in determining how much water enters the soil, how much water is stored in the soil and how water moves through the soil.

- 2.2.2 The site generally falls from 49.00m in the north, to 44.00m in the south. The majority of the site slopes from north to south. A copy of the topographical survey is included within **Appendix A**.

2.3 Site Hydrology

- 2.3.1 The Environment Agency maps show the site to be within entirely within Flood Zone 1.
- Flood Zone 1 means the risk of flooding from river and sea sources is less than 1 in 1000. There are also areas of Flood Zone 2 & 3 on the site.
 - Flood Zone 2 signifies the land has between a 1 in 100 and 1 in 1000 annual probability of river flooding or land having between a 1 in 200 and 1 in 1000 annual probability of sea flooding.
 - Flood Zone 3 signifies the land having a 1 in 100 or greater annual probability of river flooding; or land having a 1 in 200 or greater annual probability of sea flooding.
- 2.3.2 A copy of the flood map from the Environment Agency is included within **Appendix B**.
- 2.3.3 The nearest EA Main River is the Holy Brook which is less than 110m to the south of the site at its closest point.

2.4 Site Hydrogeology

- 2.4.1 The bed rock consists of Lambeth Group-Clay, Silt and Sand. Bedrock formed approximately 48 to 59 million years ago in the Palaeogene Period. Local environment previously dominated by swamps, estuaries and deltas.

2.5 Proposed Development

- 2.5.1 44 dwelling units of houses and apartments with affordable homes along with associated access roads, open spaces and required infrastructure. A copy of the architects layout is included within **Appendix C**.

3.0 Flood Risk Assessment

3.1 National Planning Policy Framework

- 3.1.1 The National Planning Policy Framework set out the Government's planning policies for England and how these are expected to be applied.
- 3.1.2 Flooding is addressed in Section 10 'Meeting the Challenge of Climate Change, Flooding and Coastal Change' of the NPPF. Footnote 20 to the NPPF states:

'A site specific Flood Risk Assessment (FRA) is required for proposals of 1 hectare or greater in Flood Zone 1; and all proposals for new development in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the EA); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding'. Table 3 of the 'Flood Risk and Coastal Change' section of the Planning Practice Guidance states that all uses of land are appropriate in Flood Zone 1, as below:

Table 3: Flood risk vulnerability and flood zone 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	✗	✗	✗

Key: ✓ Development is appropriate.
✗ Development should not be permitted.

Notes to table 3:

This table does not show:

- the application of the Sequential Test which guides development to Flood Zone 1 first, then Zone 2, and then Zone 3;
- flood risk assessment requirements; or
- the policy aims for each flood zone.

3.2 Non-statutory Technical Standards for Sustainable Drainage Design

- 3.2.1 On 23rd March 2015 the Planning Policy Guidance (PPG) was updated to include non-statutory technical standards for sustainable drainage. These standards set the framework to work towards in the design of sustainable drainage systems and include topics such as peak flow control, volume control and maintenance.
- 3.2.2 The update also provided guidance on the circumstances for when SuDS will be appropriate.

3.3 Local Planning Policy

- 3.3.1 On 6th April 2015 DEFRA updated the guidance for Local Authorities in relation to water drainage management. The aim of the new guidance is to ensure that for developments or more; or equivalent non-residential or mixed development sustainable drainage systems are put in place to ensure the effective management of surface water, unless demonstrated to be inappropriate.
- 3.3.2 The site is within the area included in the latest revision of the Reading Borough Council Strategic Flood Risk Assessment (SFRA) which was published in June 2017.

3.4 Sources of Flooding

- 3.4.1 All of developable area of the site is located within Environment Agency Flood Zone 1, at little to no risk of flooding, and current policy is to locate all development in this zone. Therefore, domestic development here would be in full compliance with Government and EA planning policy on flooding.
- 3.4.2 There are a wide range of potential flooding mechanisms which can cause flooding. Each potential source of flooding is discussed individually below:

3.5 Tidal Flooding

- 3.5.1 Tidal flooding occurs through inundation from the sea or estuarine waters. Wensley Road lies approximately 75km inland from the nearest coastal area. The site therefore is not considered to be at risk of tidal flooding.

3.6 Fluvial Flooding

- 3.6.1 Fluvial flooding occurs through the inundation from rivers and watercourses. The Environment Agency Flood Zone Maps (see **Appendix B**) shows that the developable area of the site is located within Flood Zone 1 and is regarded as having less than a 1 in 1000 annual probability of fluvial flooding.

- 3.6.2 All types of flooding are acceptable in Flood Zone 1. The proposed development is approximately 110m from flood zones 2 and 3, therefore fluvial flooding is not considered a risk.
- 3.6.3 RBC SFRA shows records of historic fluvial near to the site in: June 1971, August 1977 and January 2003.

3.7 Surface Water Flooding

- 3.7.1 This form of flooding can occur during high intensity rainfall events as sheet runoff from fields or large hard paved areas.
- 3.7.2 EA surface water flooding map shows the proposed site is generally at very low risk of surface water flooding. There is however some areas around the existing garages to the west and surrounding roads that are rated at medium and high risk of surface water flooding.

3.8 Sewer Flooding

- 3.8.1 Reading Borough Council SFRA provides data on historic sewer flooding incidences by postcode, based on information from Thames Water Sewer Incident Report Form data. Map F9 in Appendix C of the RBC SFRA shows this. This stated that there were between 51-100 recorded flood incidents from February 2016 to June 17 for the postcode area RG1 6 which Wensley Road is located in.

3.9 Groundwater Flooding

- 3.9.1 Groundwater flooding can occur when the water table rises and emerges above the ground level.
- 3.9.2 There are no useful borehole records on the British Geological Society records regarding groundwater levels.
- 3.9.3 Bore hole records round the site indicates made ground, consisting of plastic, glass and pieces of metal upto 0.6m. From 0.6m ashes, bottles and wood. At 2.7m loose and wet grey clay.
- 3.9.4 Map F3 in Appendix C of RBC SFRA shows evidence of groundwater flooding near to the site. Flood events south of the site behind properties and to the east both in 2011. There was also infomated collated in 2016 by RBC highways east of the site.
- 3.9.5 When taking into consideration the geological make up of the site and the surrounding area, the site is not considered to be at risk from Groundwater flooding.

- 3.9.6 Maps from the Reading Borough Council Strategic Flood Risk Assessment are included with **Appendix B**.

3.10 Flood Risk from other Sources

- 3.10.1 On rare occasions a development may be subject to flood risk from upstream features such as reservoirs, where there is a theoretical risk of failure.
At this development, there are no records of flooding from other sources.

4.0 Drainage Strategy for Surface Water

4.1 Policy

- 4.1.1 As the development is wholly contained within Flood Zone 1, the key objective is to ensure that the development does not increase the potential flooding elsewhere, and if the opportunity arises, to reduce the potential for flooding off site. This objective can be achieved by designing a drainage strategy for the development which will set the strict framework which the detailed designers of the drainage will ultimately have to work within.
- 4.1.2 A further objective is to ensure that the risk of overland flows (surface water flooding) is managed so that there is an acceptable level of protection to both new and existing developments downstream of the site.
- 4.1.3 The surface water drainage strategy will be delivered in accordance with prevailing local and national planning policy. Currently, the most significant factors influencing the design of the drainage strategy are the Flood and Water Management Act 2010, RBC SFRA, the National Planning Policy Framework (NPPF) and relevant chapters of the Planning Practice Guidance (PPG). This drainage strategy sets the guidelines for future detailed design, but more importantly, it demonstrates that a sustainable drainage solution is deliverable at the site, complying with all relevant planning and legislative criteria. The most important function of this drainage strategy is to demonstrate that the development will not increase flood risk elsewhere.
- 4.1.4 The method of discharge of surface water is critical to ensuring that flood risk will not be increased elsewhere. Planning Practice Guidance and Building Regulations dictate the hierarchy for discharge options. In order of preference these are:
- To the ground (infiltration);
 - To a surface water body;
 - To a surface water sewer, highway drain or another drainage system;
 - To a combined sewer.
- 4.1.5 There is no ground investigation data currently available to denote infiltration rate to ascertain the sites suitability to use soakaways as the primary source of drainage. The HR Wallingford website www.uksuds.com places the site within an area that has a Standard Percentage Runoff (SPR) of 0.3. This would suggest soakaways are not suitable as a stand alone solution.
- 4.1.6 The next viable solution to consider is discharge to a watercourse.

- 4.1.7 The existing site is a mixture of open space and existing residential development and as such there is an existing drainage system within the proposed development area. The new surface water system will connect into this network to discharge its surface water. This surface water network discharges into the Holy Brook which runs near the southern boundary of the site.

4.2 Greenfield Runoff and Volume

- 4.2.1 As runoff from the site is discharged into the surface water network, it is essential to avoid increasing flood risk downstream. As this site contains a mixture of existing and proposed impermeable areas, the proposed drainage scheme will reduce existing flows using a combined brownfield and greenfield runoff rate. The greenfield areas will be limited to Q_{BAR} which has been calculated as 3.27l/s. The brownfield areas will be limited to a 40% reduction of the 1 in 1 year 60 minute storm for the areas. This equates to 6.83l/s. This runoff rate will be used by all storms up to and including 1 in 100 year plus 40% climate change. This provides betterments in all storm events, in addition to mitigating the risk of flooding downstream of the site.
- 4.2.2 The outfall rate is yet to be agreed with Reading Borough Council. An outfall rate of 10.1/s has been proposed. A copy of the calculations used to calculate this figure can be found in **Appendix D**.

4.3 Attenuation

- 4.3.1 The attenuation structure type is yet to be decided. An open attenuation pond/basin will provide the cheapest form of attenuation but will also take up the most room within a constrained development space. Closed attenuation such as cellular storage crates or oversized pipes could be located underneath roads and parking areas and allow more of the site to be developed.
- 4.3.2 Modelling shows an attenuation volume of up to 359m³ would be required. This structure would store all water runoff from storms up to and including the 1 in 100 year plus 40% climate change storms. A copy of the illustrative drainage strategy is included within **Appendix E**.

4.4 Outfall

- 4.4.1 The outfall for the site will be the surface water sewer that is located within Wensley Road. This sewer ultimately discharges into Holy Brook located to the south of the site.

4.5 Future Responsibility and Maintenance

- 4.5.1 There are a number of options for the adoption and maintenance of the drainage network. The ownership and maintenance responsibilities will be decided at a later date. Options could include keeping ownership private and maintained by a maintenance company or offering the network for adoption to Thames Water.
- 4.5.2 In this instance it is understood the roads will be offered for adoption to Reading Borough Council and so the permeable paving would be offered to Reading Borough Council for their continued maintenance.

4.6 Foul Water

- 4.6.1 The foul water from the site will discharge into the existing foul water network maintained by Thames Water. The site will utilise a new connection into the network.

5.0 Sustainable Drainage

5.1 SuDS Introduction

- 5.1.1 Sustainable Drainage (SuDS) as described in the SuDS manual are drainage systems designed to maximise the opportunities and benefits we can secure from surface water management. They can provide benefits in 4 main areas, Water Quantity, Water Quality, Amenity, and Biodiversity.
- 5.1.2 SuDS should be chosen to reflect the environment that surrounds them. Not all SuDS are compatible in all locations and care should be taken to ensure that when used they enhance as many of the 4 main areas as possible.
- 5.1.3 In order to comply with the national guidelines and local policies set by Reading Borough Council, an assessment of the possible use of Sustainable Drainage techniques within the proposed surface water drainage design is required.

5.2 SuDS Options

- 5.2.1 There are currently no infiltration results available for the application site. Due to the ground make up and it is assumed infiltration will not be a suitable method of surface water disposal.
- 5.2.2 Where it is possible, it is proposed to incorporate a fully compliant SuDS strategy where economically viable and reasonable in relation to the discharge of surface water drainage from the proposed development.
- 5.2.3 This section will seek to identify some of the SuDS systems and techniques which are to be considered and reviewed as part of the proposed detailed surfacewater drainage design and subsequent planning application for the development site.
- 5.2.4 The accepted SuDS management train consists of three elements:
 - Source Control – Features that capture surface water as close to where it lands such as water butts, green roofs, permeable pavements.
 - Site Control – Features that collect surface water from an area such as a small housing development or commercial development such as swales, ponds and wetlands.
 - Regional Control – Features that take water from large areas such as basins, ponds and wetlands.
- 5.2.5 To select the best method on a site by site basis, a review should be undertaken to see how each could be incorporated into the surface water drainage design. A review for this site has been undertaken below in **Table 5.2.5** for Source Control and **Table 5.2.6** for Site Control methods:

Type of SuDS	Description	Applicability to the Site
Water Butts	Small storage tanks on each housing plot	This application may be appropriate to the site
Green Roofs	Water collected from roofs and reused	This application may be appropriate to the site
Filter Drains	Linear drains or trenches filled with granular material that allow infiltration to the surrounding ground	Unlikely to be appropriate due to the lack of potential infiltration
Permeable Pavement	Surface that allow surface water inflow to underlying surfaces	This application may be appropriate to the site
Swales	Vegetated channels to convey, store and treat runoff	This application may be appropriate to the site pending incorporation into the landscape design
Shallow Basin/Pond	Shallow areas of open space that temporarily hold water and collect silt	This application may be appropriate to the site pending incorporation into the landscape design

Table 5.2.5 Source Control Measures

Type of SuDS	Description	Applicability to the Site
Swales	Vegetated channels to convey, store and treat runoff	This application may be appropriate to the site pending incorporation into the landscape design
Infiltration Devices	Generally granular trenches or soakaways that store water and allow infiltration into the ground	Unlikely to be appropriate due to the lack of potential infiltration
Shallow Basin/Pond	Shallow areas of open space that temporarily hold water and collect silt	This application may be appropriate to the site pending incorporation into the landscape design

Table 5.2.6 Site Control Measures

5.2.6 Due to the size of the site, regional methods have not been considered.

5.2.7 It is proposed to use tanked permeable paving for this site. The roads will be constructed using a permeable surface course with the attenuation storage being provided within the construction materials of the road. The road construction will be wrapped in an impermeable membrane which will hold

the water in the system similar to a tank. This approach will allow for open spaces to be maximised with amenity spaces and used at all times of year.

- 5.2.8 The drainage system will use a restricted outfall at the discharge location. This restricted outfall will allow the permeable pavement to store the water in times of rainfall above a 1 in 1 year storm.
- 5.2.9 The permeable paving will provide water cleansing at the source. This is done by using the filtration layer within the permeable to catch hydrocarbons, heavy metals and suspended solids to prevent them from ending up in the local watercourses. This is discussed more in section 5.3.

5.3 Water Quality

- 5.3.1 Land use is the primary influencing factor in the quality of urban surface water runoff and is used to assess the pollution hazard posed by the development. In accordance with CIRIA SuDS Manual (C753), it is proposed that the Simple Index Approach is used to assess pollution risk based upon land use:

TABLE 26.1 Approaches to water quality risk management			
Design method	Hazard characterisation	Risk reduction	
		For surface water	For groundwater
Simple index approach	Simple pollution hazard indices based on land use (eg Table 26.2 or equivalent)	Simple SuDS hazard mitigation indices (eg Table 26.3 or equivalent)	Simple SuDS hazard mitigation indices (eg Table 26.4 or equivalent)

- 5.3.2 CIRIA C753 assigns the site as having a Very Low/Low risk of pollution due to the residential nature of the development. This risk is from Suspended Solids, Metals and Hydrocarbons. Pollution mitigation methods will be implemented accordingly. To deliver adequate treatment, the selected SuDS components will have a total pollution index that equals or exceeds the total pollution hazard index (by contaminant type).
- 5.3.3 The surface water produced by the site will pass through a two stage treatment train to ensure it is clean when it discharges from the site.

Area	Total Indices	Mitigation Measures	Mitigation Indices	Acceptable?
Residential roofs	0.45	Permeable Paving	2.0	Yes
Individual property driveways and low traffic roads	1.3	Permeable Paving	2.0	Yes

Table 5.3.3 Pollution and Mitigation Indices

- 5.3.4 As can be seen in **Table 5.3.3** the proposed SuDS component mitigation indices exceed those produced.

6.0 Summary and Conclusions

- 6.1.1 WFBA have been commissioned by Reading Borough Council to produce a Flood Risk Assessment (FRA), SuDS Strategy and Drainage Strategy for a new residential scheme at Wensley Road, Reading.
- 6.1.2 The site is located approximately 1.88 km South West of the centre of Reading, Berkshire. It is surrounded by residential dwellings all round. Water Meadows are situated behind the dwellings to the south and a trainline to the West.
- 6.1.3 The developable area is located within Flood Zone 1, and this FRA proves the site will not increase risk of flooding elsewhere.
- 6.1.4 The surface water strategy proposes to use permeable pavements as the attenuation structure. Attenuated surface water will be discharged at a combination of greenfield and a reduction of brownfield rate. The proposed rate is 10.1l/s.
- 6.1.5 The outfall rate will be restricted to this rate for all storm events up to and including a 1 in 100 year storm event + 40% climate change allowance.
- 6.1.6 Separate foul and surface water networks will be utilised by this development.
- 6.1.7 The development proposals are duly presented in terms of flood risk and in line with the guidance set out in the TGNPPF and the requirements of the Environment Agency and Lead Local Flood Authority.

Appendix A

Topographical Survey

TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

AH	Arch Head Height	FH	Fire Hydrant	RSJ	Roller Steel Joist
AR	Assumed Route	FBD	Floor Board Direction	SI	Sign Post
AV	As Valve	FN	Fire Hydrant	SP	Arch Spring Post Height
BB	Bellish Beacon	FL	Floor Level	SV	Stop Valve
BH	Bore Hole	FP	Flag Pole	SW	Surface Water
BL	Bed Level	FW	Foul Water	SY	Stay
BO	Bolted	GS	Gully Grate	Tac	Tackle Paving
B/P	Brace Post	GV	Gas Valve	TC	Telecom Cover
BS	Bus Stop	HH	Head Height	TH	Thresh Level
BU	Bath	IC	Inspection Cover	THL	Threshold Level
BW	Barbed Wire Fence	IL	Invert Level	TL	Traffic Light
EX	Box (Utilities)	IR	Iron Railings	ToW	Top of Wall
C/B	Close Board Fence	KD	Kerf Outlet	TP	Telegraph Pole
CH	Cill Height	LP	Lamp Post	TV	Cable TV Cover
CL	Cover Level	MH	Manhole	UB	Universal Beam
CL	Chain Link Fence	MP	Marker Post	UC	Unknown Cover
CL-lev	Ceiling Level	NB	Name Board	UK	Unknown Tree
Col	Column	OHL	Overhead Line (approx)	USB	Under Side Beam
CP	Chestnut Paving Fence	Pan	Panel Fence	UTL	Unable To Lift
CR	Cable Rise	PB	Post Box	VP	Vent Pipe
DC	Drainage Channel	PM	Parking Meter	WB	Waste Bin
DH	Door Head Height	PO	Post	WH	Weep Hole
DP	Down Pipe	PR	Post & Rail Fence	WL	Water Level
DR	Drain	PW	Post & Wire Fence	WM	Water Meter
EL	Eaves Level	PWall	Partition Wall	WO	Wash Out
EP	Electric Pole	RE	Rodding Eye	WC	Floor to Ceiling Height
ER	Earth Road	RL	Ridge Level	W/C	Floor to False Ceiling Ht
ET	EP-Transformer	RP	Reflector Post	W	Water
FB	Flower Bed	RS	Road Sign	W	Water
FBD	Floor Board Direction	RSD	Roller Shutter Door	W	Water
				W	Water

DRAWING NOTE

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including: sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

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Do not scale from this drawing.

The coordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using Smartnet, then orientated to grid north with a scale factor of 1.000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies any coordinated data used in conjunction with this survey must be derived directly from this control data.



Ipswich Coventry Yeovil Norwich Perth Nottingham Brentwood

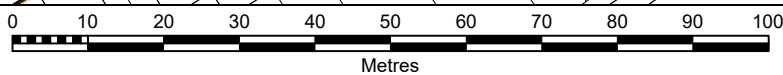
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LAND SURVEYING BUILDING SURVEYING UNDERGROUND SURVEYING

Rev	Date	Drawn	Description
1	18/11/19	RLH	Initial Issue

Notes:
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Site Topographical Survey
drawing title Wensley Road, Reading

Reading Borough Council
Wensley Road

client / project

HTA-A_DR_0004
drawing number

1:1000
Scale @ A3

RBC-WLR
project number

-
revision

PPR
originated by

FOR INFORMATION
status



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Appendix B

EA Flood Maps

Flood map for planning

Your reference
Wensley Road

Location (easting/northing)
470025/171948

Created
19 Dec 2019 10:12

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

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

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

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<https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>



Flood map for planning

Your reference
Wensley Road

Location (easting/northing)
470025/171948

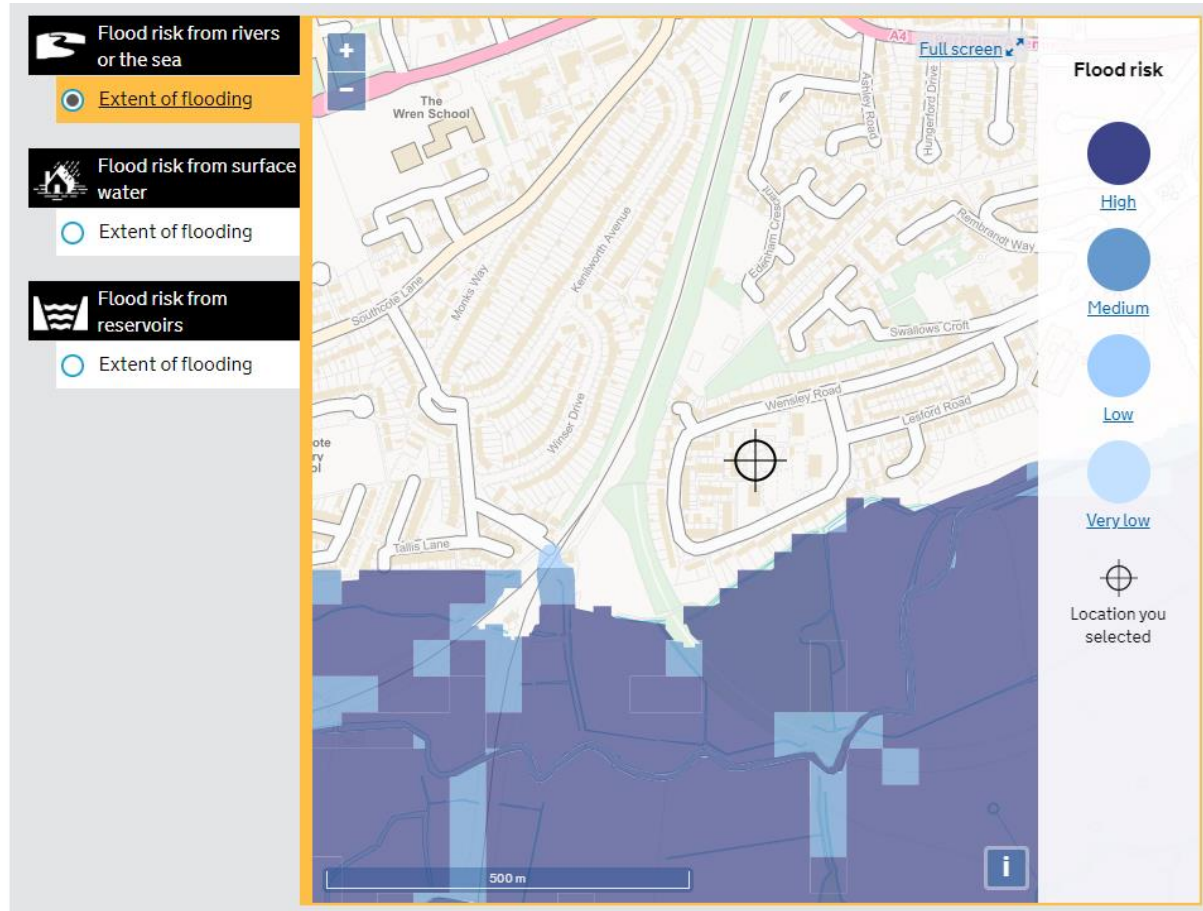
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Created
19 Dec 2019 10:12

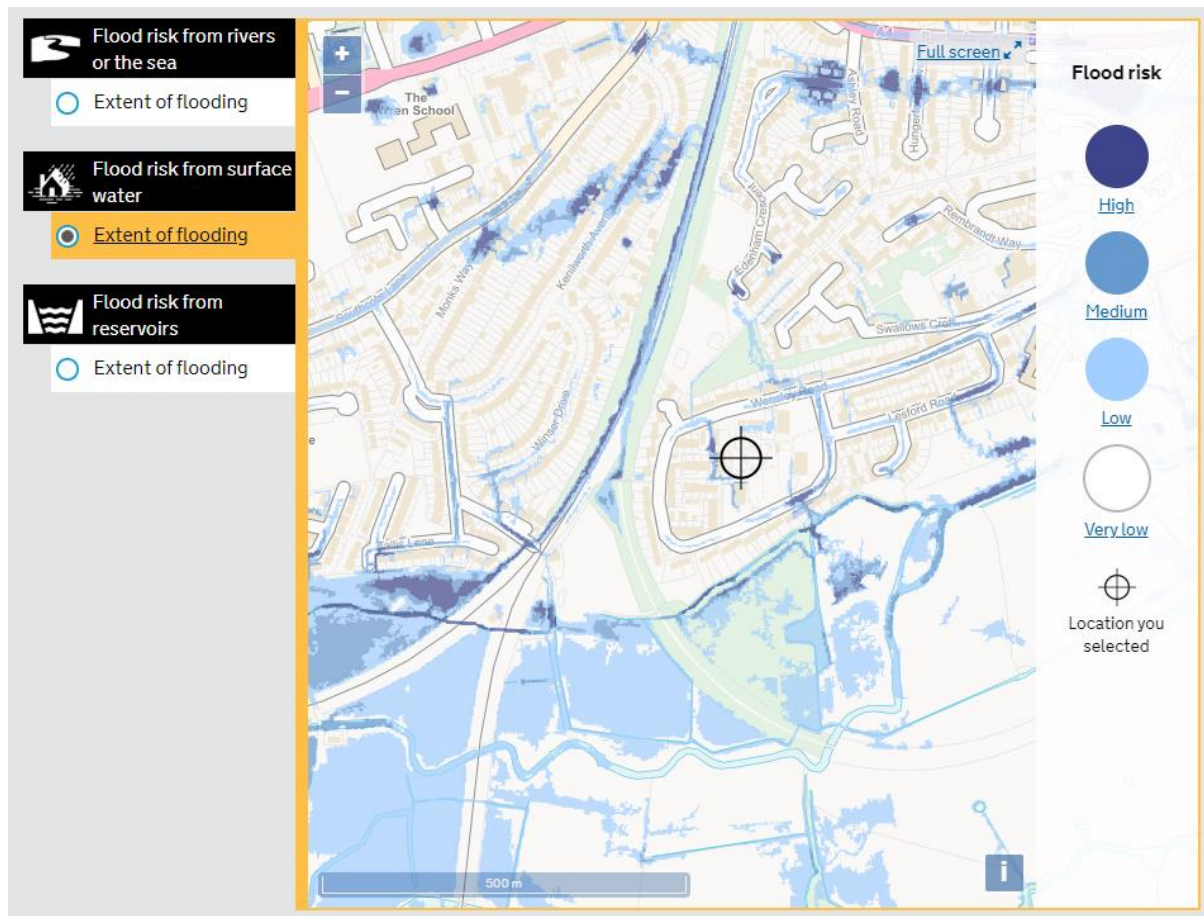
-  Selected point
-  Flood zone 3
-  Flood zone 3: areas benefitting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area

0 20 40 60m

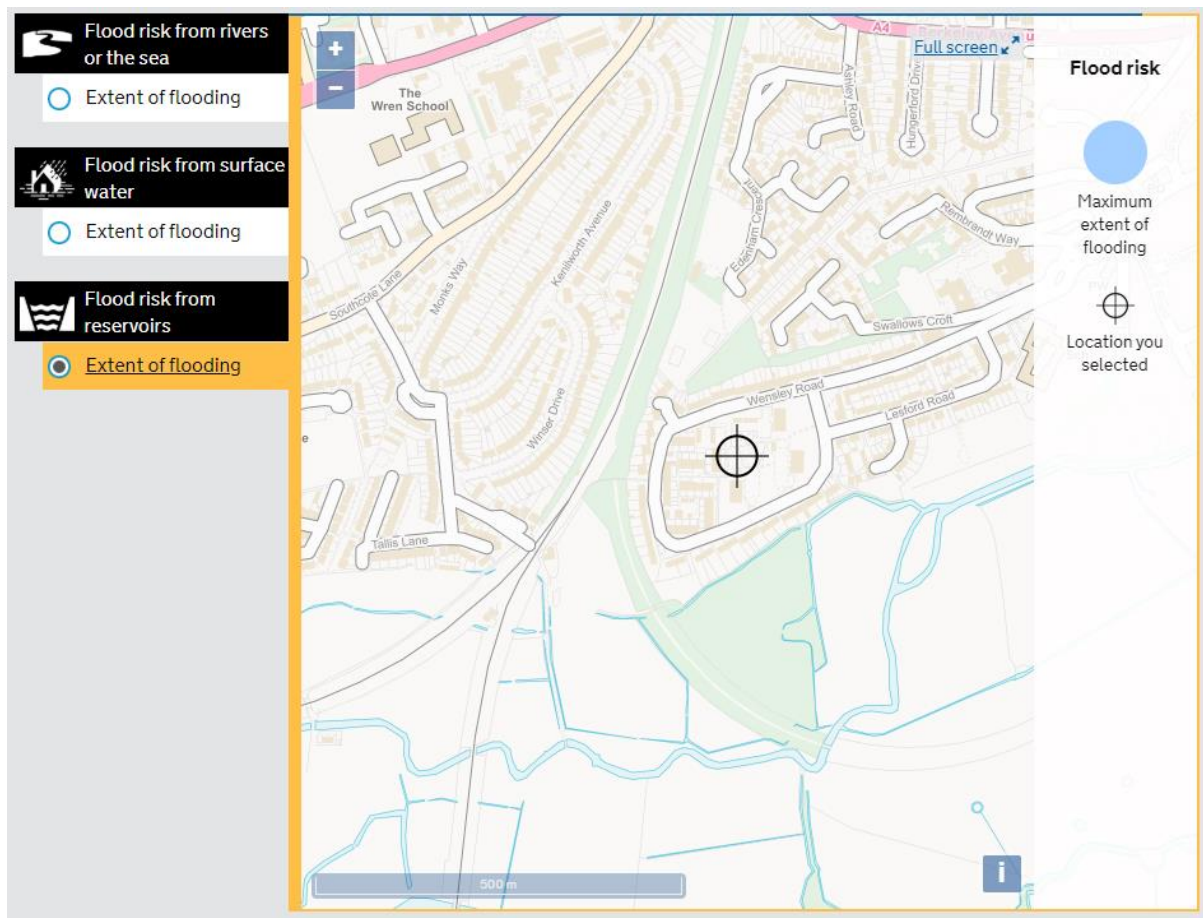
EA Extent of Flood Risk Map

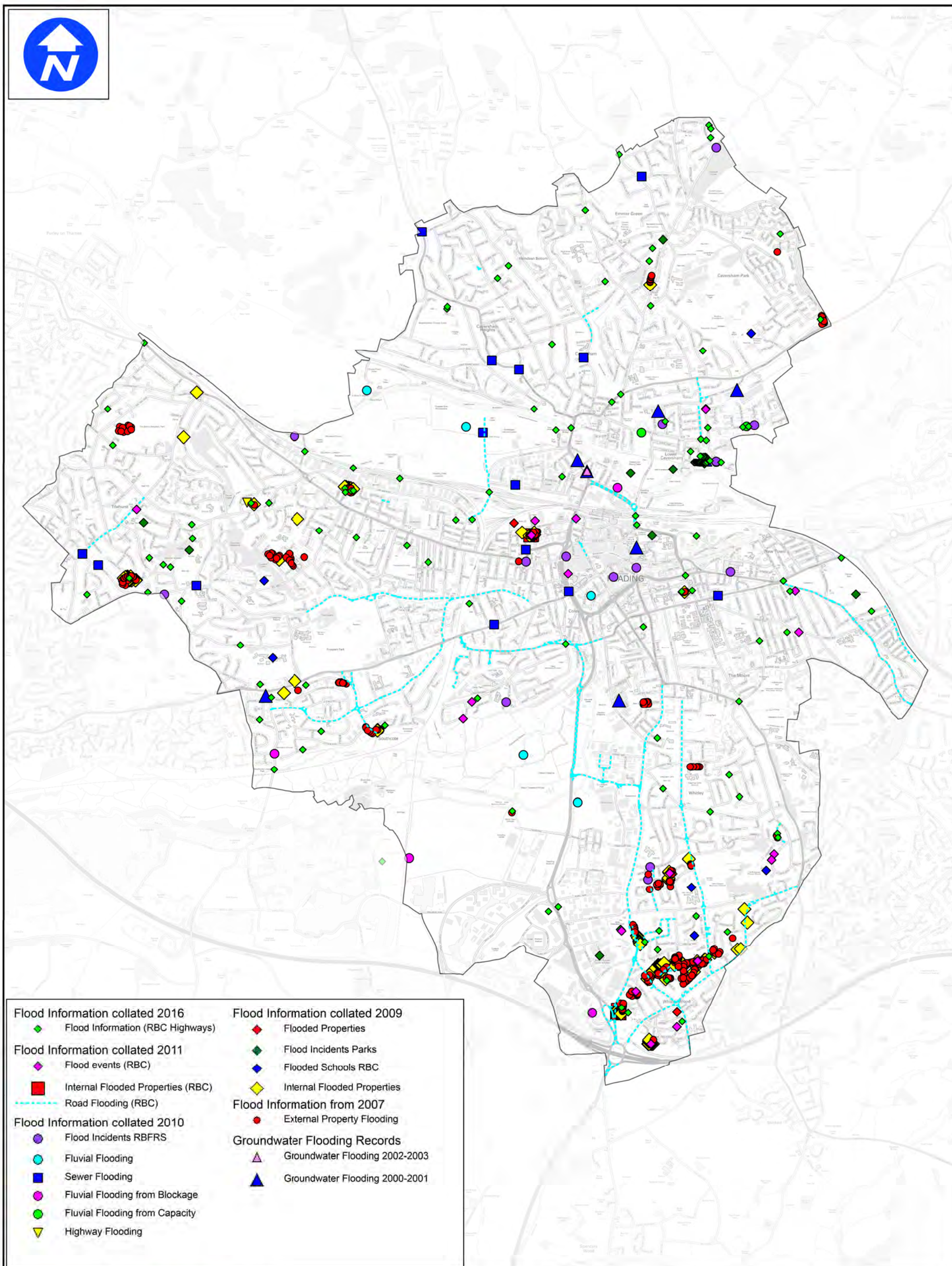


EA Surface Water Flood Risk Map



EA Flooding Risk from Reservoirs





Flood Information collated 2016

- Green diamond: Flood Information (RBC Highways)

Flood Information collated 2011

- Purple diamond: Flood events (RBC)
- Red square: Internal Flooded Properties (RBC)
- Red circle: Road Flooding (RBC)

Flood Information collated 2010

- Purple circle: Flood Incidents RBFRS
- Cyan circle: Fluvial Flooding
- Blue square: Sewer Flooding
- Pink circle: Fluvial Flooding from Blockage
- Green circle: Fluvial Flooding from Capacity
- Yellow triangle: Highway Flooding

Flood Information collated 2009

- Red diamond: Flooded Properties
- Green diamond: Flood Incidents Parks
- Blue diamond: Flooded Schools RBC
- Yellow diamond: Internal Flooded Properties

Flood Information from 2007

- Red circle: External Property Flooding

Groundwater Flooding Records

- Purple triangle: Groundwater Flooding 2002-2003
- Blue triangle: Groundwater Flooding 2000-2001



www.peterbrett.com

Peter Brett Associates LLP
READING
Tel: 0118 950 0761 Fax: 0118 959 7498

Client



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RBC SFRA

RBC Historic Flood Records

Date: 06/12/2016

Scale: NTS

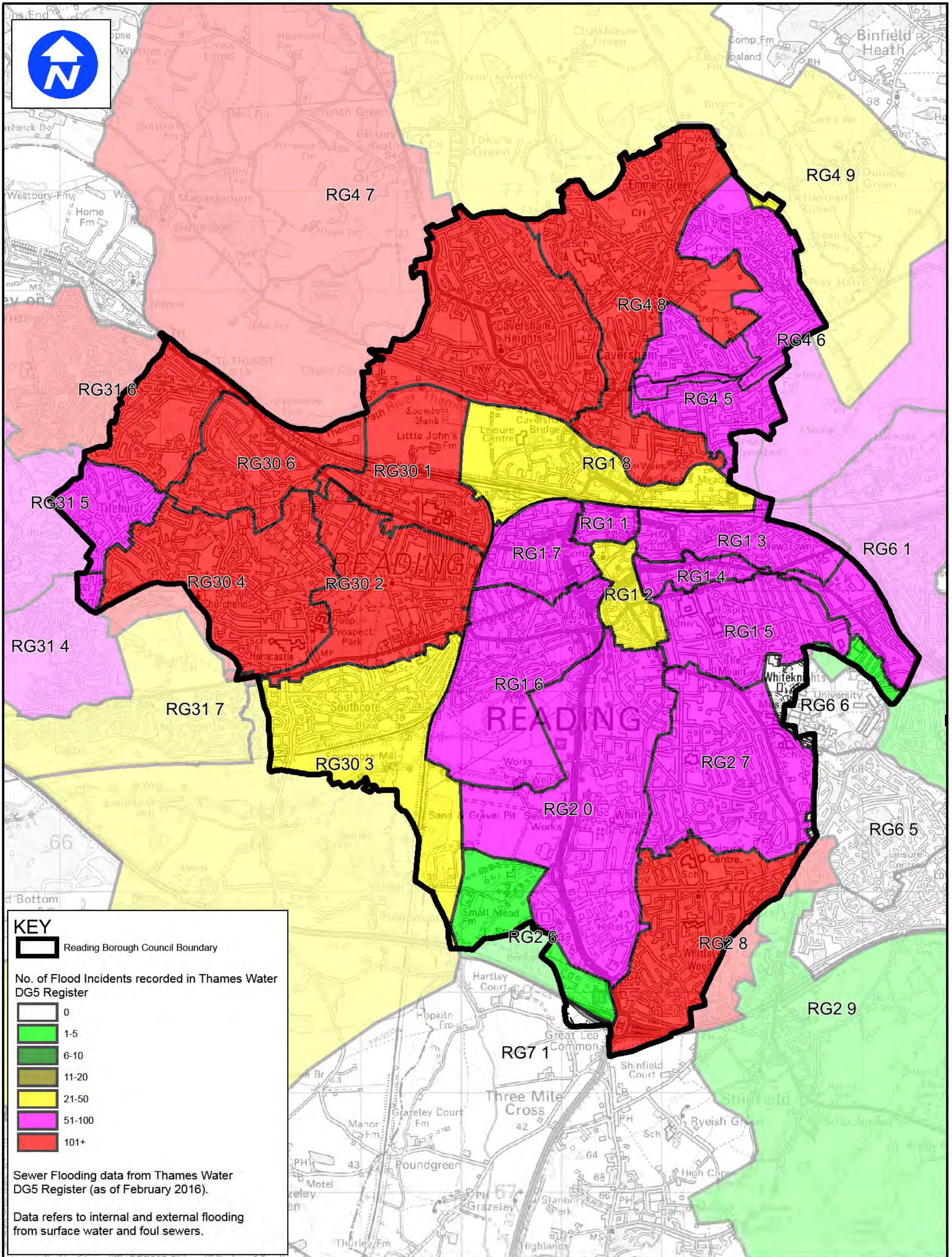
Drawn By: SB Checked By: RF

Rev: -

Figure Number

Figure F3

J:\27560 RBC LLFA support\4002 - Reading SFRA\MapInfo\MapInfo



KEY

Reading Borough Council Boundary

No. of Flood Incidents recorded in Thames Water DG5 Register

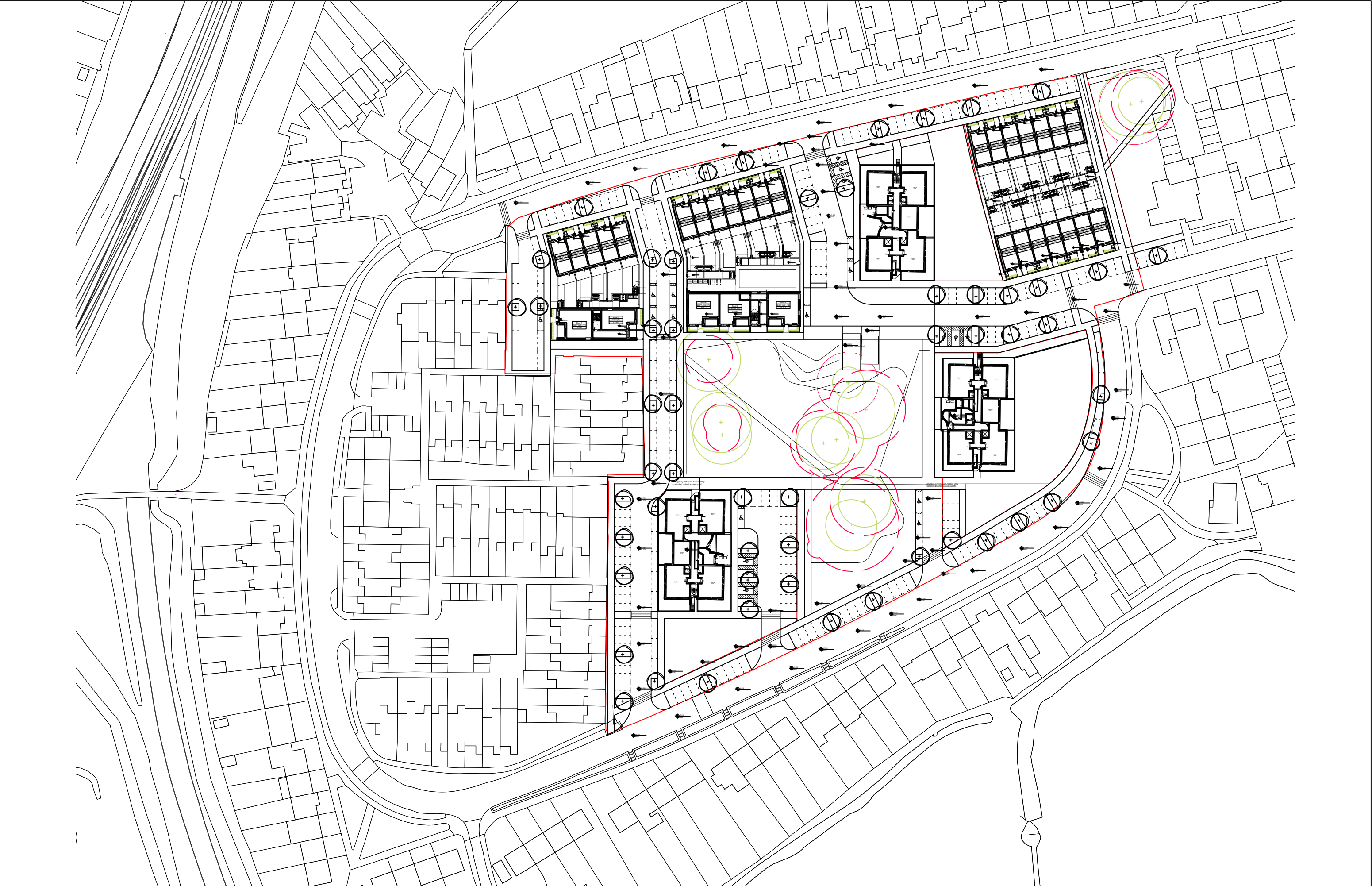
	0
	1-5
	6-10
	11-20
	21-50
	51-100
	101+

Sewer Flooding data from Thames Water DG5 Register (as of February 2016).

Data refers to internal and external flooding from surface water and foul sewers.

Appendix C

Architects Layout



Appendix D

Calculations

Modified Rational Method for Calculating Rate of Run-Off

01:01	hrs	Area (ha)	% Impermeable	Z1	M5-X (mm)	Z2	MW-X (mm)	I (mm/hr)	Q (l/s)
5min	0.08	0.233	1.00	0.36	7.20	0.62	4.46	53.57	45.11
10min	0.17	0.233	1.00	0.51	10.20	0.61	6.22	37.33	31.44
15min	0.25	0.233	1.00	0.62	12.40	0.62	7.69	30.75	25.90
30min	0.50	0.233	1.00	0.79	15.80	0.64	10.11	20.22	17.03
1h	1.00	0.233	1.00	1.00	20.00	0.66	13.20	13.20	11.12
2h	2.00	0.233	1.00	1.22	24.40	0.68	16.59	8.30	6.99
4h	4.00	0.233	1.00	1.48	29.60	0.70	20.72	5.18	4.36
6h	6.00	0.233	1.00	1.67	33.40	0.72	24.05	4.01	3.37

01:30	hrs	Area (ha)	% Impermeable	Z1	M5-X (mm)	Z2	MW-X (mm)	I (mm/hr)	Q (l/s)
5min	0.08	0.233	1.00	0.36	7.20	1.43	10.30	123.55	104.04
10min	0.17	0.233	1.00	0.51	10.20	1.49	15.20	91.19	76.79
15min	0.25	0.233	1.00	0.62	12.40	1.53	18.97	75.89	63.90
30min	0.50	0.233	1.00	0.79	15.80	1.54	24.33	48.66	40.98
1h	1.00	0.233	1.00	1.00	20.00	1.53	30.60	30.60	25.77
2h	2.00	0.233	1.00	1.22	24.40	1.51	36.84	18.42	15.51
4h	4.00	0.233	1.00	1.48	29.60	1.47	43.51	10.88	9.16
6h	6.00	0.233	1.00	1.67	33.40	1.42	47.43	7.90	6.66

100.00	hrs	Area (ha)	% Impermeable	Z1	M5-X (mm)	Z2	MW-X (mm)	I (mm/hr)	Q (l/s)
5min	0.08	0.233	1.00	0.36	7.20	1.79	12.89	154.66	130.23
10min	0.17	0.233	1.00	0.51	10.20	1.91	19.48	116.89	98.43
15min	0.25	0.233	1.00	0.62	12.40	1.99	24.68	98.70	83.11
30min	0.50	0.233	1.00	0.79	15.80	2.03	32.07	64.15	54.02
1h	1.00	0.233	1.00	1.00	20.00	2.01	40.20	40.20	33.85
2h	2.00	0.233	1.00	1.22	24.40	1.97	48.07	24.03	20.24
4h	4.00	0.233	1.00	1.48	29.60	1.89	55.94	13.99	11.78
6h	6.00	0.233	1.00	1.67	33.40	1.81	60.45	10.08	8.48

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

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

Site Details

Latitude:

Longitude:

Reference:

Date:

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics

SOIL type:

Default	Edited
2	2
N/A	N/A
0.3	0.3

HOST class:

SPR/SPRHOST:

Hydrological characteristics

SAAR (mm):

Default	Edited
638	638
6	6
0.85	0.85
2.3	2.3
3.19	3.19
3.74	3.74

Hydrological region:

Growth curve factor 1 year:

Growth curve factor 30 years:

Growth curve factor 100 years:

Growth curve factor 200 years:

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	3.27	3.27
1 in 1 year (l/s):	2.78	2.78
1 in 30 years (l/s):	7.52	7.52
1 in 100 year (l/s):	10.43	10.43
1 in 200 years (l/s):	12.23	12.23

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Quick Storage Estimate

Micro Drainage

Variables

FSR Rainfall Cv (Summer)
 Return Period (years) Cv (Winter)
 Region Impervious Area (ha)
 Map M5-60 (mm) Maximum Allowable Discharge (l/s)
 Ratio R Infiltration Coefficient (m/hr)
 Safety Factor
 Climate Change (%)

Analyse OK Cancel Help

Enter Climate Change between -100 and 600

Quick Storage Estimate

Micro Drainage

Results

Global Variables require approximate storage of between 254 m³ and 359 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

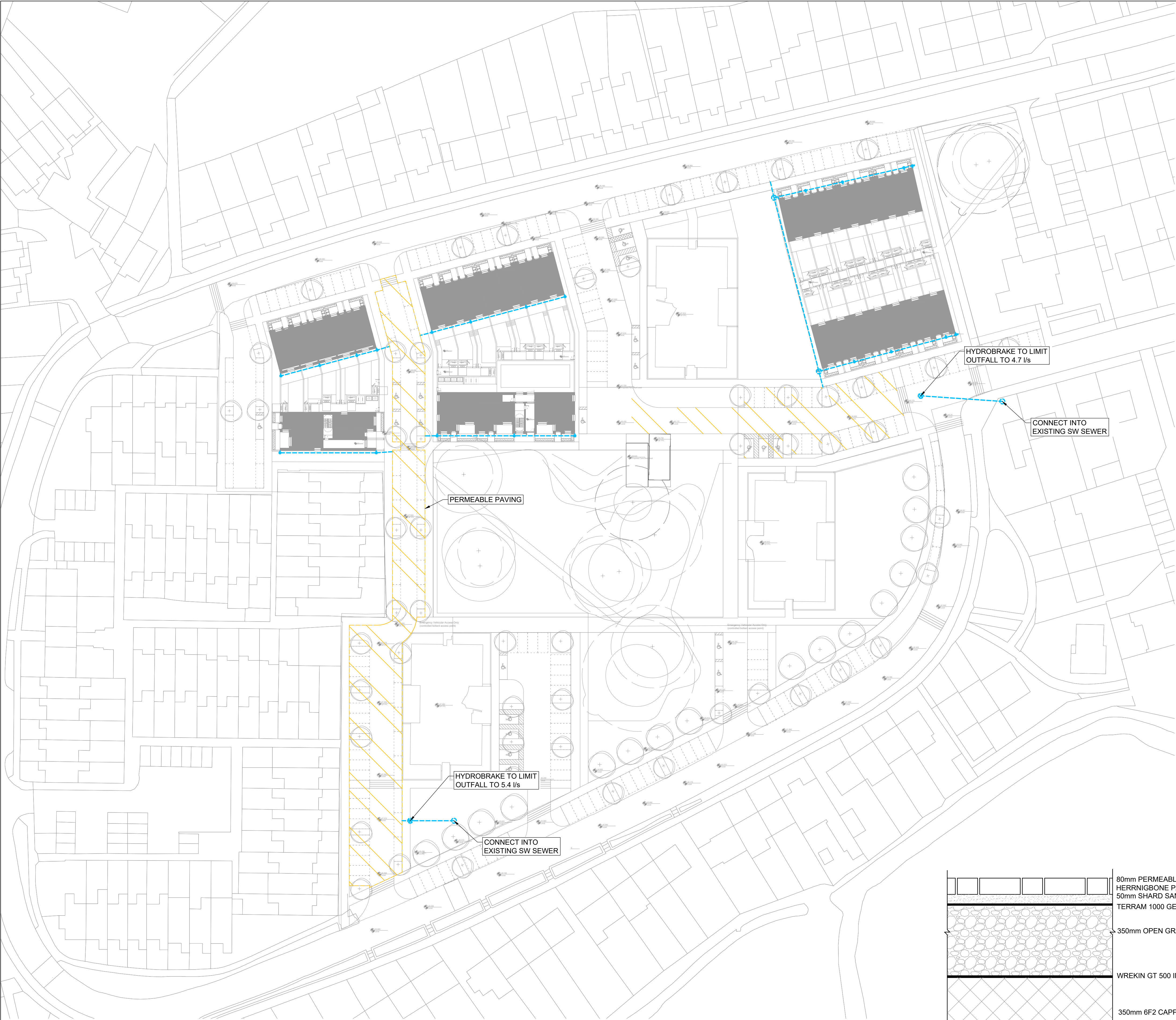
Enter Climate Change between -100 and 600

Appendix E

Drawings

19195-WFB-ZZ-XX-DR-C-0500 Illustrative Drainage Strategy

19195-WFB-ZZ-XX-DR-C-0501 Existing and Proposed
Impermeable Areas



WFBA LEGEND

PERMEABLE PAVING

STORM WATER - PRIVATE DRAIN



- NOTES
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4. THE LEVEL OF THE EXISTING FOUL AND STORM SEWERS ON SITE HAS BEEN EXTRAPOLATED FROM LEVELS OF ADJACENT MANHOLES THE EXACT LEVEL AT POINT OF CONNECTION SHALL BE CHECKED PRIOR TO THE COMMENCEMENT OF THE WORKS AND ANY VARIANCE REPORT TO THE ENGINEER IMMEDIATELY.

5. ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH BUILDING REGULATIONS.

6. ALL ADOPTABLE DRAINAGE TO BE IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION, TOGETHER WITH ANY REQUIREMENTS FROM THE LOCAL DRAINAGE AUTHORITY.

7. UNLESS NOTED OTHERWISE ALL DRAINAGE PIPES TO BE 100mmØ. ALL GULLY LEADS TO BE 150mmØ.

8. UNLESS NOTED OTHERWISE ALL MANHOLE COVERS TO BE DUCTILE IRON.

9. ALL EXTERNAL RWPS TO HAVE RODDING ACCESS.

10. ALL HIGHWAY WORKS TO BE IN ACCORDANCE WITH THE DTP SPECIFICATION FOR HIGHWAYS WORKS, TOGETHER WITH PARTICULAR REQUIREMENTS OF THE LOCAL HIGHWAYS AUTHORITY.

11. THE LOCATION OF KNOWN EXISTING PUBLIC UTILITY SERVICES IS AS PROVIDED BY THE STATUTORY UNDERTAKERS. NO GUARANTEE CAN BE GIVEN AS TO THE ACCURACY OF THIS INFORMATION. THE CONTRACTOR IS TO ASCERTAIN THE EXACT LOCATION PRIOR TO THE COMMENCEMENT OF WORKS.

12. ALL DUCTS TO BE LAID AT DEPTHS TO SUIT THE RELEVANT STATUTORY UNDERTAKER.

13. SERVICE ENTRY POINTS ON BUILDINGS ARE TO BE CHECKED AGAINST ARCHITECTS LAYOUTS PRIOR TO DUCT LAYING AND ANY DISCREPANCIES REPORTED WFBA IMMEDIATELY.

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Architect

HTA

Client

READING BOROUGH COUNCIL

WFBA

Consulting Civil & Structural Engineers

THE OLD HAYLOFT, PUCKNALL FARM
DORES LANE, BRAISHFIELD, ROMSEY,
HAMPSHIRE, SO51 0JQ.
TEL: 01794 368241
EMAIL: CONTACT@WFBA.CO.UK WWW.WFBA.CO.UK

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ILLUSTRATIVE DRAINAGE STRATEGY

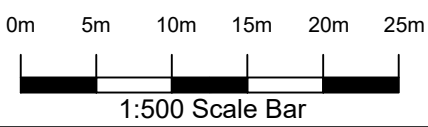
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WFBA Project Reference: 19195	Scale: 1:500 @ A1	DATE DECEMBER 2019

PROJECT - ORIGINATOR - VOLUME - LEVEL - TYPE - ROLE - NUMBER	REVISION
19195-WFB-ZZ-XX-DR-C-0500	P01

LOCATION PLAN

SCALE 1:500

S106 AGREEMENT REQUIRED WITH THAMES
WATER TO CONNECT TO SEWER



80mm PERMEABLE CONCRETE BLOCK PAVIOURS TO BS EN 1338 LAID IN HERRNIGBONE PATTERN
50mm SHARD SAND TO BS EN 12620
TERRAM 1000 GEOTEXTILE

350mm OPEN GRADED CRUSHED ROCK TO BS EN 12620.

WREKIN GT 500 IMPERMEABLE MEMBRANE

350mm 6F2 CAPPING LAYER (SITE WON)

NOTE: ALL SOFT SPOTS ENCOUNTERED ARE TO BE REMOVED AND FILLED IN COMPACTED LAYERS WITH SUBGRADE MATERIAL.

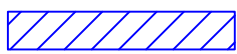
TYPICAL 'PERMEABLE' MODULAR PAVING CONSTRUCTION

(Based on a CBR of <2% on a clay soil)

NOT TO SCALE



WFBA LEGEND

-  EXISTING IMPERMEABLE AREAS
-  PROPOSED IMPERMEABLE AREAS

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DORES LANE, BRAISHFIELD, ROMSEY,
HAMPSHIRE, SO51 0JQ.
TEL: 01794 368241
EMAIL: CONTACT@WFBA.CO.UK WWW.WFBA.CO.UK

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IMPERMEABLE AREAS

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LOCATION PLAN
SCALE 1:500

