

The Rookery, Didsbury

Flood Risk Assessment

March 2014



DOCUMENT VERIFICATION RECORD

**CLIENT:**

Taylor Pickles Homes

SCHEME:

Flood Risk Assessment for a development at The Rookery, Palatine Road, Didsbury, Manchester, M20 2WG.

INSTRUCTION:

The instruction to carry out this Flood Risk Assessment was received from Mark Pickles of Taylor Pickles Homes.

ISSUE HISTORY:

Issue / Revision	Issue Date	Comment
Original	03/03/2014	First issue
2 nd Issue	17/03/2014	Revised report

DOCUMENT REVIEW & APPROVAL

Prepared by Dafydd Loyd

Reviewed by Aled Williams BSc (Hons)

Approved by Dr. Deepak B. Kharat BE MTech PhD MCIWEM CWEM CSc

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Supporting Documents:

National Planning Policy Framework (March 2012)

Manchester City, Salford City and Trafford Councils Strategic Flood Risk Assessment (March 2010)

Manchester City Council Preliminary Flood Risk Assessment (May 2011)

Abbreviations

AEP *Annual Exceedance Probability*

CCA *Climate Change Allowance*

EA *Environment Agency*

m AOD *metres Above Ordnance Datum*

NPPF *National Planning Policy Framework*

PFRA *Preliminary Flood Risk Assessment*

SFRA *Strategic Flood Risk Assessment*

1 Development Description and Vulnerability Classification

- 1.1 This Flood Risk Assessment (FRA) has been prepared to provide information on flood risk for a proposed residential development at The Rookery, Palatine Road, Didsbury, Manchester, M20 2WG (grid reference 383711E, 391182N). A location plan and an aerial image are included in Appendix A.
- 1.2 The site covers an area of 0.2ha (2000m²) and is bordered by a housing estate and Berkeley Court (retirement/sheltered housing) to the north, Palatine Road to the east, and a wooded area to the south and west. The existing site consists of an impervious driveway, a garage and the garden area of 196 Palatine Road.
- 1.3 The proposed development is for the erection of four detached dwellings with associated garages and permeable access road. Access to the site is provided from Palatine Road. Site levels vary from a high of 33.7m AOD in the north to 29.45m AOD in the south. A proposed development plan and a topographical survey are included in Appendix B.

2 Scope of Site Specific Flood Risk Assessment

- 2.1 The potential sources of flooding considered in the following sections are: Fluvial - from rivers and streams; Tidal; Pluvial – from rainfall on the surface; Rising Groundwater; Overwhelmed Sewers and Drainage Systems; Reservoirs, Canals, Lakes and Artificial sources.
- 2.2 A Homecheck Flood Report (Appendix D) has been obtained to inform the assessment. Research for historical flooding has also been undertaken and the Manchester City, Salford City and Trafford Councils SFRA (March 2010) and the Manchester City Council PFRA (May 2011) have been reviewed for site specific information.
- 2.3 The effects of climate change are taken into account, in accordance with sections 11-15 of the NPPF Technical Guidance document.

3 Fluvial Risk - from rivers and streams

- 3.1 The site is located within the River Mersey catchment. The Mersey is located approximately 240m west of the site and flows north in this location. The Fielden Park Brook is located approximately 230m south of the site and flows west in this location to its confluence with the Mersey. There are no other watercourses in the area.
- 3.2 Fluvial flooding could occur if the River Mersey or Fielden Park Brook overtopped their banks during extreme rainfall events due to lack of channel capacity.
- 3.3 The area benefits from flood defences in the form of raised earth embankments along the Mersey. The defences offer a 1 in 100 year standard of protection. The area also benefits from a designated flood storage area in Withington Golf Course, located approximately 225m south of the site.
- 3.4 A review of the Manchester City, Salford City and Trafford Councils SFRA and the Manchester City Council PFRA found no records of any past fluvial flooding at the site.

EA Estimated Water Levels

- 3.5 Estimated water levels for the River Mersey and Fielden Park Brook have been obtained from the EA on 03/02/2014 and are included in Appendix C. The results are taken from the EA Upper Mersey 2012 study. A summary of the estimated water levels for the node points closest to the site is provided in Table 1 and Table 2:

Table 1 – River Mersey Estimated Water Levels

Node	Grid Ref	Modelled Water Levels (m AOD)			
		Undefended		Defended	
		1% AEP	1% AEP + CCA	1% AEP	1% AEP + CCA
ea013_Model_MERS03_00005	E383433 N391174	27.92	28.41	28.69	28.91

Table 2 – Fielden Park Brook Estimated Water Levels

Node	Grid Ref	Modelled Water Levels (m AOD)			
		Undefended		Defended	
		1% AEP	1% AEP + CCA	1% AEP	1% AEP + CCA
ea013_Model_FIEL01_00006	E383584 N390879	29.87	30.22	29.77	30.15
ea013_Model_FIEL01_00004	E383723 N390915	29.87	30.21	29.77	30.15

River Mersey

- 3.6 The Topographical Survey included in Appendix B shows that the site levels vary from 29.45m AOD in the south to 33.7m AOD in the north. By comparing the estimated defended and undefended water levels in the Mersey to the site levels it can be seen that no flooding would affect the site during the 1% Annual Exceedance Probability (AEP) and 1% AEP + Climate Change Allowance (CCA). Palatine Road is also shown to be flood free during all modelled events.

Fielden Park Brook

- 3.7 Water levels in Fielden Park Brook are influenced by downstream water levels in the Mersey. Flooding to the site is predicted during a combined flood event of the Mersey and Fielden Park Brook.
- 3.8 By comparing the estimated water levels of the Fielden Park Brook to site levels it can be seen that approximately 25% of the site is at risk during the 1% AEP + CCA event. Table 3 overleaf provides an estimate of the maximum flood depths at each proposed dwelling (see Appendix B for plot locations). The maximum estimated water levels for the defended and undefended events (i.e. the undefended 1% AEP and 1% AEP + CCA) have been compared to average ground levels at each plot and the sites access (Palatine Road) to provide a worst case scenario for each event.

Table 3 – Estimated Flood Depths for Proposed Dwellings & Access

Plot No.	Average Ground Level (m AOD)	Maximum Flood Depth (mm)	
		1% AEP	1% AEP + CCA
Palatine Road	29.51	360	700
1	29.90	-	310
2	30.50	-	-
3	31.25	-	-
4	33.75	-	-

3.9 Table 3 shows that the site access from Palatine Road is at risk during both modelled flood events with a maximum flood depth of 360mm during the 1% AEP event and 700mm during the 1% AEP + CCA event. Plot 1 is shown at risk during the 1% AEP + CCA. Plots 2, 3 and 4 are situated on higher ground and are not shown to be at risk during any of the modelled flood events.

3.10 It can be concluded that only plot 1 is at risk during the 1% AEP + CCA event.

4 Tidal Risk

4.1 The site is located approximately 53km from the coastline and is situated at a minimum of 29.45m above sea level. Therefore there is no risk from tidal sources.

5 Pluvial Risk – From Rainfall on the Surface

5.1 Pluvial flooding is defined as local flooding in areas not normally associated with natural or manmade watercourses that results from rainfall generated overland flow, before it enters any watercourse or sewer. It is usually associated with high intensity rainfall events, but can also occur with lower intensity rainfall or melting snow, where the ground is saturated, frozen or developed resulting in overland flow and ponding in depressions in the topography. Pluvial flooding is unpredictable, to the extent that localised heavy rainfall can occur anywhere without any warning. However, flow paths and depths can be determined by consideration of contours and relative levels.

-
- 5.2 The Homecheck Flood Report (Appendix D) shows that the site is not at risk of pluvial flooding during all events up to and including the 1% AEP + CCA event.
- 5.3 The SFRA contains no records of pluvial flooding at or near to the site. The SFRA 'Susceptibility to Surface Water Flooding – Current Scenario' map (Appendix E) shows that the site is not susceptible to surface water flooding. Any potential surface water flooding arising on Palatine Road would be contained within the highway and directed south-west, away from the site, following the local topography. Furthermore site levels are above road levels and therefore any potential pluvial flooding on Palatine Road would not reach the site.
- 5.4 It can therefore be concluded that the risk of pluvial flooding is low.

6 Risk of Rising Groundwater

- 6.1 Groundwater flooding occurs when water levels underneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.
- 6.2 The Homecheck Report gives details of BGS groundwater flooding data and indicates that the susceptibility of the site to groundwater flooding, based on the underlying geological conditions is very low.
- 6.3 The SFRA states that there are no known reports of groundwater flooding in the areas of Manchester, Trafford and Salford authorities. The SFRA 'Groundwater Flooding' map (Appendix E) shows that the site is not within an area considered to be at risk of groundwater flooding.
- 6.4 It can therefore be concluded that the risk of groundwater flooding is low.

7 Sewer Flooding

- 7.1 Flooding from sewers can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged or is of inadequate capacity. This is mostly applicable to combined and surface water sewers.
- 7.2 During extreme rainfall events sewer systems (surface water and combined) can become surcharged very quickly. Local blockages and sewer collapses can create localised flood events during short duration high intensity storms.
- 7.3 The SFRA states that sewer flooding affected parts of Didsbury in 1965. This was the result of a burst sewer and flooded properties in Didsbury and Northenden. The SFRA does not contain any other records of past sewer flooding at or near to the site. There are no records to suggest that any past sewer flooding incidents have affected the site. It is considered that any potential sewer flooding arising on Palatine Road would be contained within the highway and directed south-west, away from the site, following the local topography. Furthermore site levels are above road levels and therefore any potential sewer flooding would not reach the site.
- 7.4 It can be concluded that the risk of sewer flooding is low.

8 Risks from Reservoirs, Canals, Lakes and Artificial Sources

- 8.1 The site is not shown to be at risk of flooding from reservoirs on the EA Flooding from Reservoirs Flood Map included in Appendix C. There are no canals within the immediate vicinity of the site. Therefore the probability of flooding from artificial sources can be considered to be low.

9 Summary of Site Specific Flood Risk Assessment

- 9.1 From the preceding sections it can be concluded that fluvial flooding from a combined flood event of the Mersey and the Fielden Park Brook is the main source of flood risk to the site.

10 Surface Water Management

- 10.1 The existing site currently comprises a garage and an impermeable driveway covering a combined area of 560m².
- 10.2 The proposed development will slightly decrease the impermeable area of the site to 535m². The proposed development will incorporate permeable paving for all hard surfaced areas.
- 10.3 The pre- and post-development surface water runoff rates and volumes have been estimated using a spreadsheet calculation in accordance with current best practice (see Appendix F). A summary of the runoff rates and volumes is provided in Tables 4 and 5 below. The additional surface water runoff resulting from a 30% increase for climate change has been taken into account in the calculations.

Table 4 – Pre- and post-development runoff rates

Peak Flow (l/s)	1 yr	30 yr	100 yr
Pre-development Peak Flow (l/s)	4.30	10.56	13.28
Post-development Peak Flow (l/s)	5.41	13.27	16.69
Increase (l/s)	1.11	2.71	3.41

Table 5 – Pre- and post-development runoff volumes

Volume (m ³)	100 yr
Pre-development	58.05
Post-development	74.53
Increase	16.48

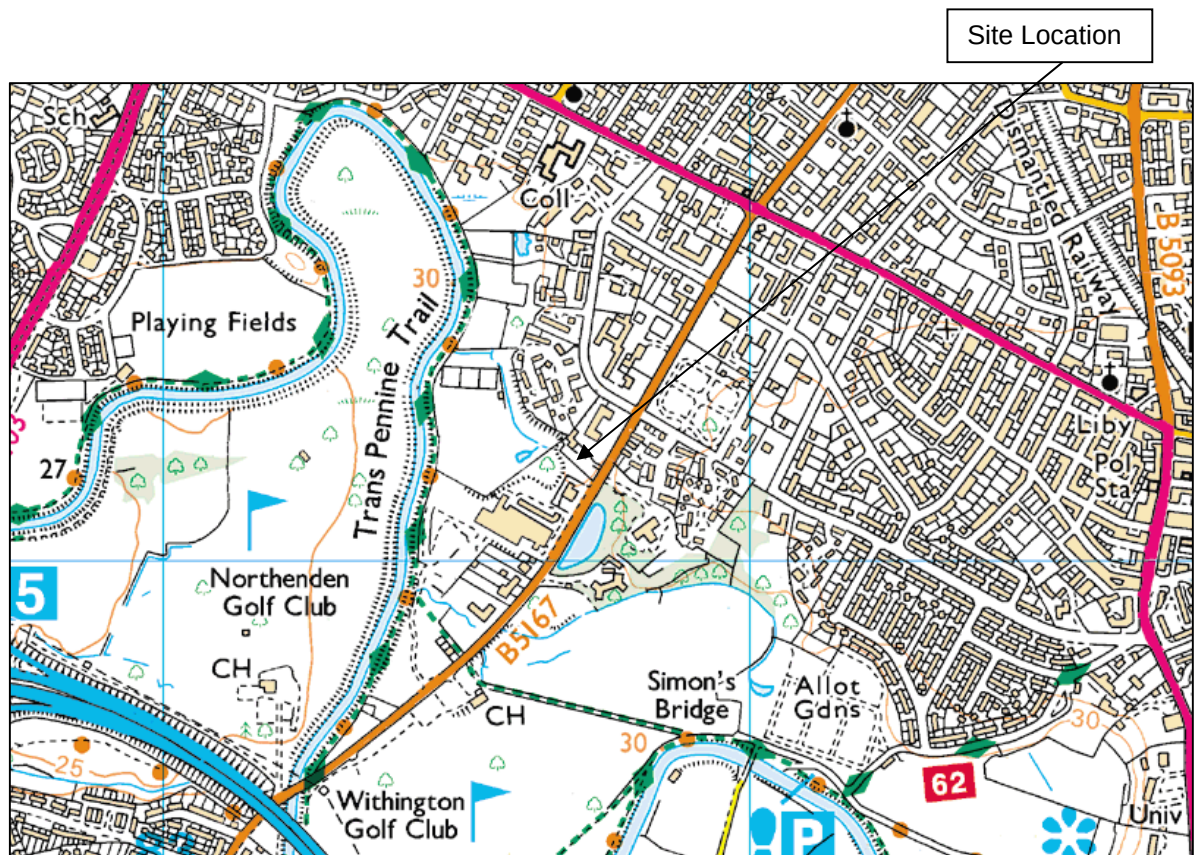
- 10.4 Tables 4 and 5 show that the surface water runoff rates and volumes marginally increase due to the 30% addition for climate change. In order to ensure this increase will not have an impact elsewhere, the runoff should be dealt with by using appropriate sustainable drainage techniques.

- 10.5 It is proposed to discharge surface water via soakaways and permeable paving. This will ensure the proposed development will not increase runoff rates and volumes and will therefore not have an impact elsewhere.
- 10.6 The soakaways should be designed in accordance with the BRE 365 specification.

11 Summary and Conclusions

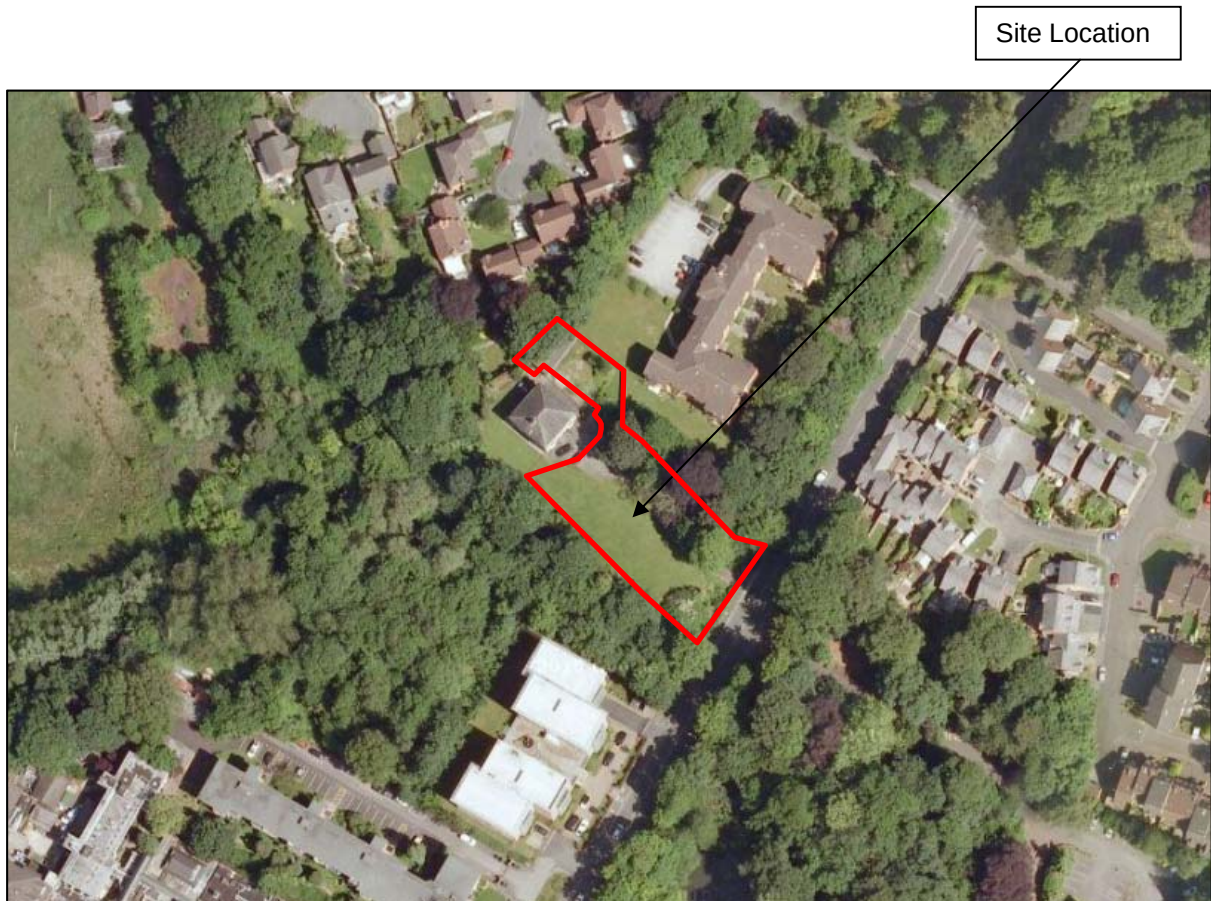
- 11.1 The proposed residential development at The Rookery, Didsbury is located in Flood Zones 1 and 2, as identified on the Environment Agency Flood map.
- 11.2 The proposed development is for 4no. detached dwellings with associated garages and permeable access road.
- 11.3 The principal source of flooding at this site is from a combined flood event of the Mersey and Fielden Park Brook. There are no records of flooding at the site. Estimated water levels have been obtained from the Environment Agency for the Mersey and Fielden Park Brook and compared to site levels. Approximately 25% of the site is at risk of flooding during the 1% AEP + CCA event.
- 11.4 Plots 2, 3 and 4 are shown to be flood free during the 1% AEP + CCA event. Plot 1 is shown at risk during this event with the estimated maximum flood depths of up to 310mm.
- 11.5 It is proposed to discharge surface water via soakaways and permeable paving. This will ensure the proposed development will not increase runoff rates and volumes, and will therefore not have an impact elsewhere.

Appendix A – Location Plan and Aerial Image



Site Location Plan

(Source: Streetmap)



Aerial Photograph
(Source: Google Maps)

Appendix B – Proposed Development Plan and Topographical Survey



DRAFT

PAGE 1 OF 1
The Rookery
CLIENT
Taylor Pickles
DRAWING TITLE
Proposed Site Plan
DATE
20/09/13
SCALE
1:250 @ A1
DRAWING NUMBER
7010.001
REVISION NO.

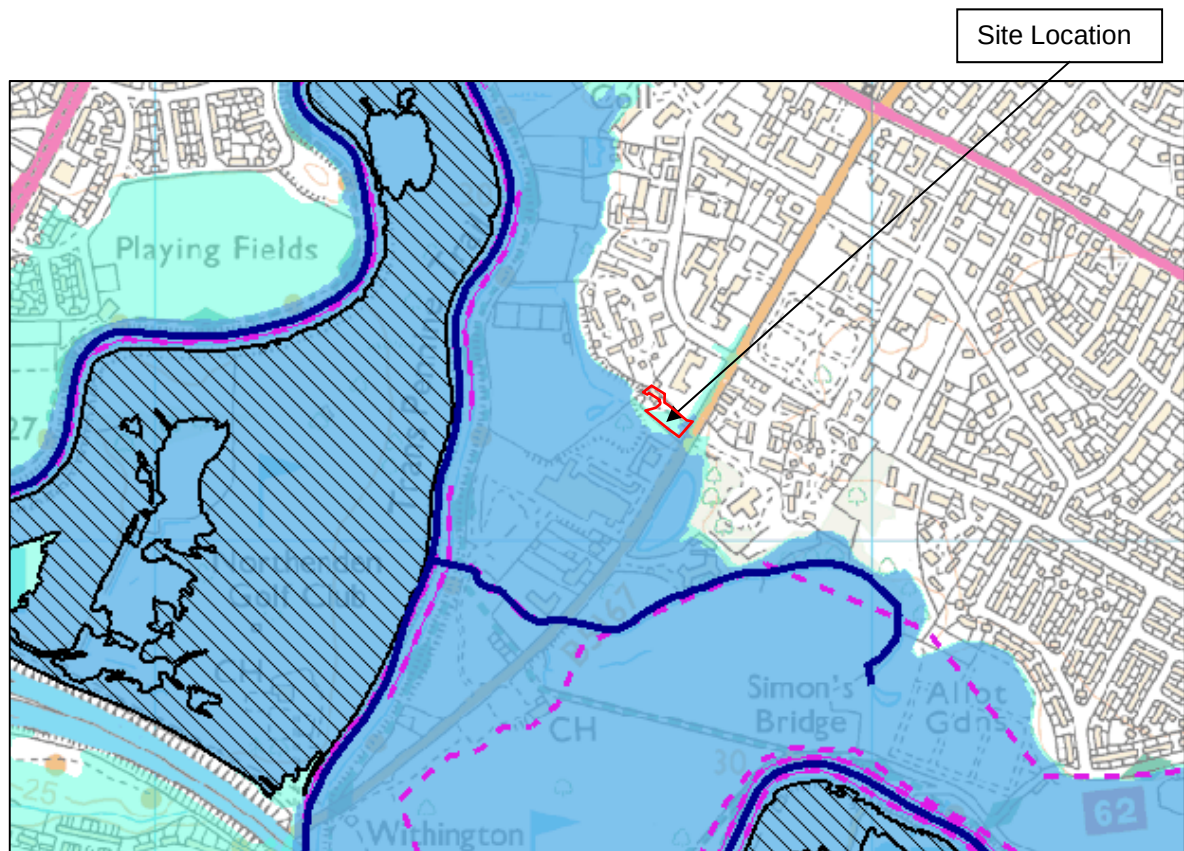
SHEPHERDMYERS

Architectural Design Consultants
Chartered Building Surveyors
www.shepherdmyers.co.uk
info@shepherdmyers.co.uk

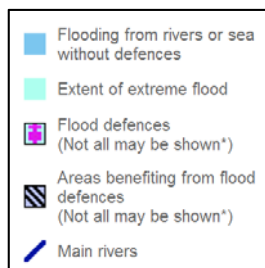
Cumbria Office
Unwin & Coles
25 New Market Street
Unwin
Cumbria
LA1 1TL
T: 01229 588 951

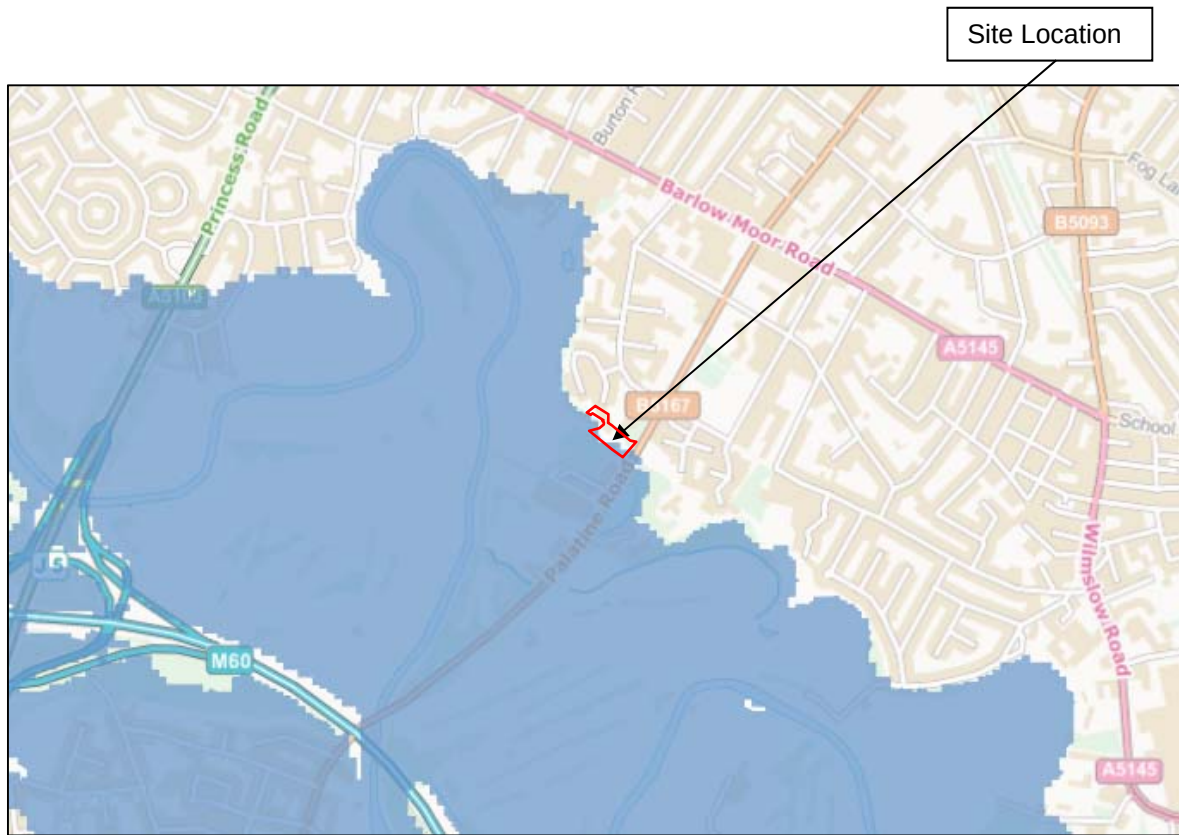
Chester Office
25 Grosvenor
Warrington
Cheshire
WA1 3JG
T: 0151 680 1999

Appendix C – EA Flood Maps and Data



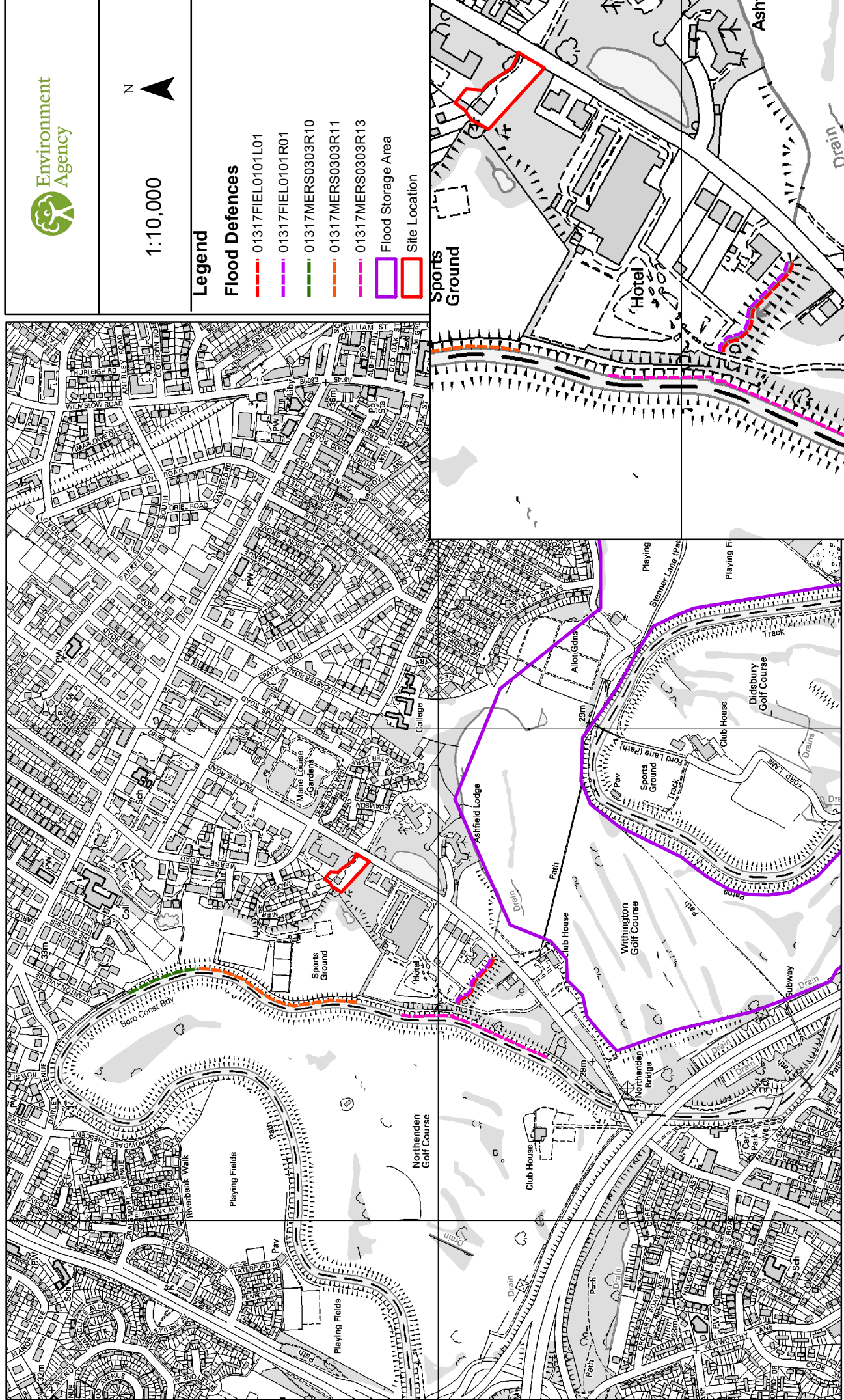
Environment Agency Flood Map
(March 2014)

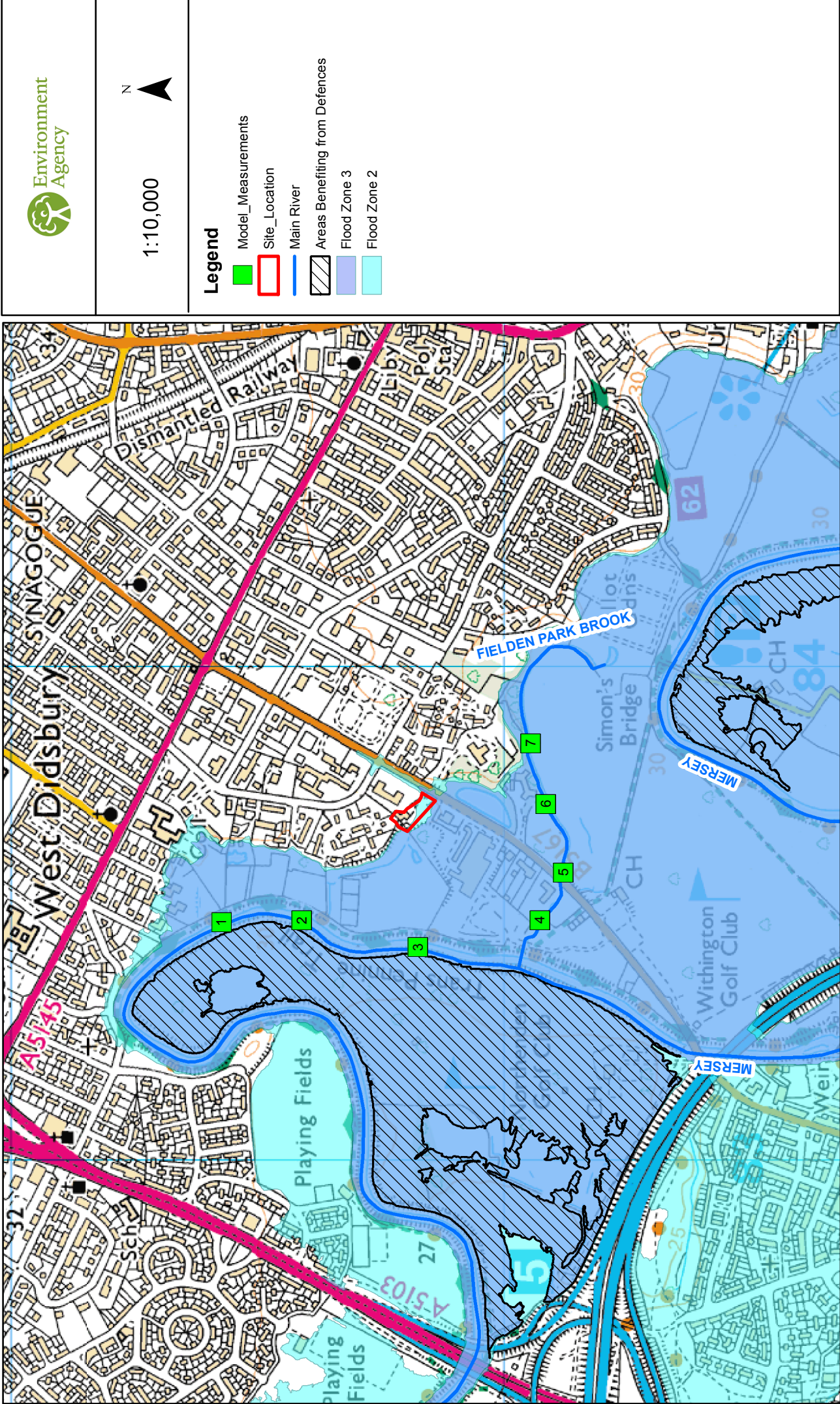




Environment Agency Flooding from Reservoirs Map
(March 2014)

Defences Map centred on Palatine Road, Didsbury. Created 31st January 2014 [PROTECT-STH1426]





Map Reference	Model Node Reference	Easting	Northing	Data	ea013_0162 (Un defended)				ea013_0162_D (Defended)			
					1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + Climate Change*	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + Climate Change*	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)
1	ea013_Model_MERS03_00007	383483	391573	Modelled Water Level (m aod) Modelled Flow (cumecs)	27.95 138.16	28.43 165.85	28.22 151.35	29.10 256.36	28.45 317.61	28.70 354.82	28.64 343.77	29.46 485.86
2	ea013_Model_MERS03_00006	383487	391410	Modelled Water Level (m aod) Modelled Flow (cumecs)	27.95 163.9	28.43 189.58	28.22 176.5	29.09 264.58	28.56 318.12	28.76 365.79	28.72 350.12	29.41 508.96
3	ea013_Model_MERS03_00005	383433	391174	Modelled Water Level (m aod) Modelled Flow (cumecs)	27.92 211.98	28.41 234.08	28.20 222.9	29.08 310.17	28.69 318.17	28.91 367.13	28.86 350.79	29.43 551.05
4	ea013_Model_FIEL01_00008	383488	390927	Modelled Water Level (m aod) Modelled Flow (cumecs)	29.87 26.71	30.22 27.08	30.05 26.95	30.97 27.78	29.77 17.63	30.15 18.83	30.05 18.57	31.34 22.19
5	ea013_Model_FIEL01_00006	383584	390879	Modelled Water Level (m aod) Modelled Flow (cumecs)	29.87 34.06	30.22 34.99	30.05 34.57	30.97 37.53	29.77 17.29	30.15 18.46	30.05 18.21	31.34 22.32
6	ea013_Model_FIEL01_00004	383723	390915	Modelled Water Level (m aod) Modelled Flow (cumecs)	29.87 70.43	30.21 99.08	30.05 78.44	30.96 127.78	29.77 14.2	30.15 33.62	30.05 25.72	31.34 129.6
7	ea013_Model_FIEL01_00003	383846	390946	Modelled Water Level (m aod) Modelled Flow (cumecs)	29.87 92.17	30.21 131.77	30.05 102.66	30.96 169.67	29.77 22.45	30.15 39.74	30.05 29.78	31.34 165.73

Model data taken from Upper Mersey 2012 study

Notes:

AEP - Annual Exceedence Probability

m aod - metres above ordnance datum

cumecs - cubic metres per second

*Climate Change Scenario - 20% increase in flow

Flood Defence

ID	Standard of Protection	Upstream Crest Level (m aod)	Downstream Crest Level (m aod)	Overall Condition Grade
01317MERS0303R10	1 in 100 year	28.52	29.09	3
01317MERS0303R11	1 in 100 year	28.96	28.6	3
01317MERS0303R13	1 in 100 year	29.06	29.49	2
01317FIEL0101L01	1 in 75 year	23.33	29	3
01317FIEL0101R01	1 in 75 year	28.45	29.22	3

The Environment Agency maintains these flood defences.

Appendix D – Homecheck Flood Report

Homecheck Professional®

Flood Report



Flood Risk Assessment PASSED

Professional Opinion

The overall flood risk rating for the property is assessed to be 'Negligible'. No further action is considered necessary however a prudent purchaser may wish to consider the measures outlined on page 2.

This report is issued for the property described as:

**Site at 383710,
391180**

Requested By:

Mr D Lloyd, Waterco Ltd, Eden Court, Lon Parcwr, Industria, Ruthin, Clwyd, LL15 1NJ

Report Reference:

53283208_1

National Grid Reference:

383711E, 391184N

Client Reference:

w1527-140213_HCF

Report Date:

13 February 2014



Overall Flood Risk: NEGLIGIBLE RISK IDENTIFIED

	River	Coastal	Ground Water	Surface Pluvial	Other
High					
Moderate					
Low					
Negligible					



Insurability:

Is the property likely to be insurable at standard terms?

YES

Contact Details

If you require any assistance please contact our customer services team on **0844 844 9966**

or email helpdesk@landmark.co.uk

Flood Risk Assessment

Professional Opinion



Passed

The property is considered to be at a negligible risk of flooding following an assessment of all the data contained in this report. No further assessment or investigation should be necessary however we would draw your attention to the prudent measures suggested below.

RECOMMENDATIONS

1. It would be prudent to ask the vendor to confirm whether or not they are aware of any previous flooding at the property. In addition, we would draw your attention to the additional advice on page 4.
2. You may wish to obtain insurance terms prior to exchange of contracts and completion of this transaction.

Approved by



Christopher S. Taylor BSc (Hons), MSc, AIEMA
Chartered Water and Environmental Manager
Technical Director, Argyll Environmental Ltd



Summary of Findings

A '-' indicates no data found. Only those factors with a 'Yes' will offer further explanation in Sections A-D.

Section A.1 – River, Coastal and Surface Water Flood Risk: 1 in 75 Year – From JBA

	0-25m	26-250m	Section
River	-	YES	A.1.1
Coastal	-	-	A.1.2
Surface Water	-	YES	A.1.3

Section A.2 – River, Coastal and Surface Water Flood Risk: 1 in 200 Year – From JBA

	0-25m	26-250m	Section
River	-	YES	A.2.1
Coastal	-	-	A.2.2
Surface Water	-	YES	A.2.3

Section A.3 – River, Coastal and Surface Water Flood Risk: 1 in 1000 Year – From JBA

	0-25m	26-250m	Section
River	YES	YES	A.3.1
Coastal	-	-	A.3.2
Surface Water	YES	YES	A.3.3

Section B – River, Coastal Risk and Flood Defences – From EA

	0-25m	26-250m	Section
Rivers and Coastal (Zone 2)	YES	YES	B.1.1
Rivers and Coastal (Zone 3)	YES	YES	B.1.1
Flood Defended Area	-	-	B.1.2
Flood Defences	-	YES	B.1.3
NAFRA	YES	YES	B.1.4

Section C – Groundwater – From BGS

	0-25m	26-250m	Section
Susceptible to groundwater flooding	YES	YES	C.1.1

Section D – Historical Flood Extents and Insurability Rating

	0-25m	26-250m	Section
EA Historical Flood Extents	-	-	D.1.1
Flood Insurance Claim Rating	YES	YES	D.1.2

Flood Resistance and Resilience Measures

Flooding can usually be managed by the installation of flood protection measures either on or within the building(s) or across the property. Flood protection measures can be divided into two categories; flood resistance and flood resilience.

Flood resistance measures aim to prevent flood water from entering a property (i.e. barriers and baffles) while flood resilience measures aim to reduce the impact of flood water once it enters a property. Both flood resistance and flood resilience solutions can be integrated into design proposals for new developments or be retro-fitted to existing properties. A total solution may often include both resistance and resilience measures and will depend on a number of factors including flood source, likely flood depths, property design and age.

Most properties can be protected against shallow flash flooding from between £2,000 and £6,000, although significantly more may be required for high risk properties. Details of providers are available from the Flood Protection Association (contact details can be found at the end of this report). For further information about flood resistance measures or to be put in touch with one of our partners in this field please contact customers services on 0844 844 9966 or email helpdesk@landmark.co.uk

Guideline costs for Resistance Measures

Building Feature	Cost Estimate including Installation (excluding VAT)
Standard single door	£500-£995
Standard garage door	£700-£1,500
Standard window	£350-£600
Single air brick	£40-£100
Patio doors	£500-£1,500
Simple non-return valve	£20-£50
Large non-return valve	£300-£800
Tanking (of basement, walls or floors)	£25.00 per metre ²

Additional Advice

In purchasing a Homecheck Professional® report you have taken the first step in understanding the risk of flooding at your property. In addition to the installation of flood protection measures, such as those outlined above, there are a number of further practical steps you may wish to consider in order to ensure you are fully prepared in the event of a flood:

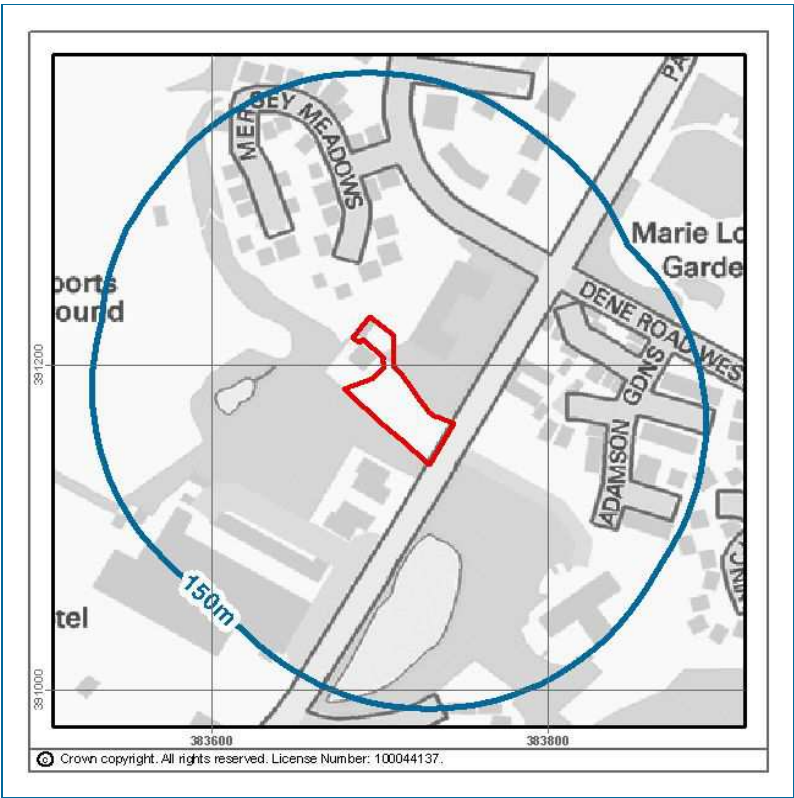
- **Understand Your Flood Risk:** Take time to understand the sources of flooding affecting your property. Additional information on flooding in your area may be available from the Local Authority if they have completed a Strategic Flood Risk Assessment examining flood risk in the wider area. Alternatively, you may wish to consider a further strategic appraisal of flooding at your property to more closely examine available data and provide a more accurate estimate of anticipated flood depths. Further assessment can be undertaken starting from £500 plus VAT please contact customers services on 0844 844 9966 or email helpdesk@landmark.co.uk for more details.
- **Sign Up to Flood Warnings:** The Environment Agency operate a free flood warning service providing alerts by phone, text or email when flooding is anticipated providing an opportunity for home owners to take necessary precautions.
- **Make a Flood Plan:** Prepare a flood plan outlining the precautions and actions you should take when a flood event is anticipated to help reduce the impact and damage flooding may cause. Sensible precautions would include raising electrical items, irreplaceable items and sentimental items off the ground or where possible moving them to a higher floor, rolling up carpets and rugs and turning off utilities. In addition, consider what actions you would take should the property need to be evacuated including access and egress routes and preparing a flood kit in advance containing warm clothing, medication, a torch, food and wellingtons.

Further information is available from the Environment Agency on how to prepare and what to do in the event of a flood at their website www.environment-agency.gov.uk or by calling their Floodline on 0845 988 1188.

Property Location



Aerial Photograph
250m Search Band
Image Resolution 25cm



Location Plan
Site at 383710, 391180
Grid Reference 383711 391184

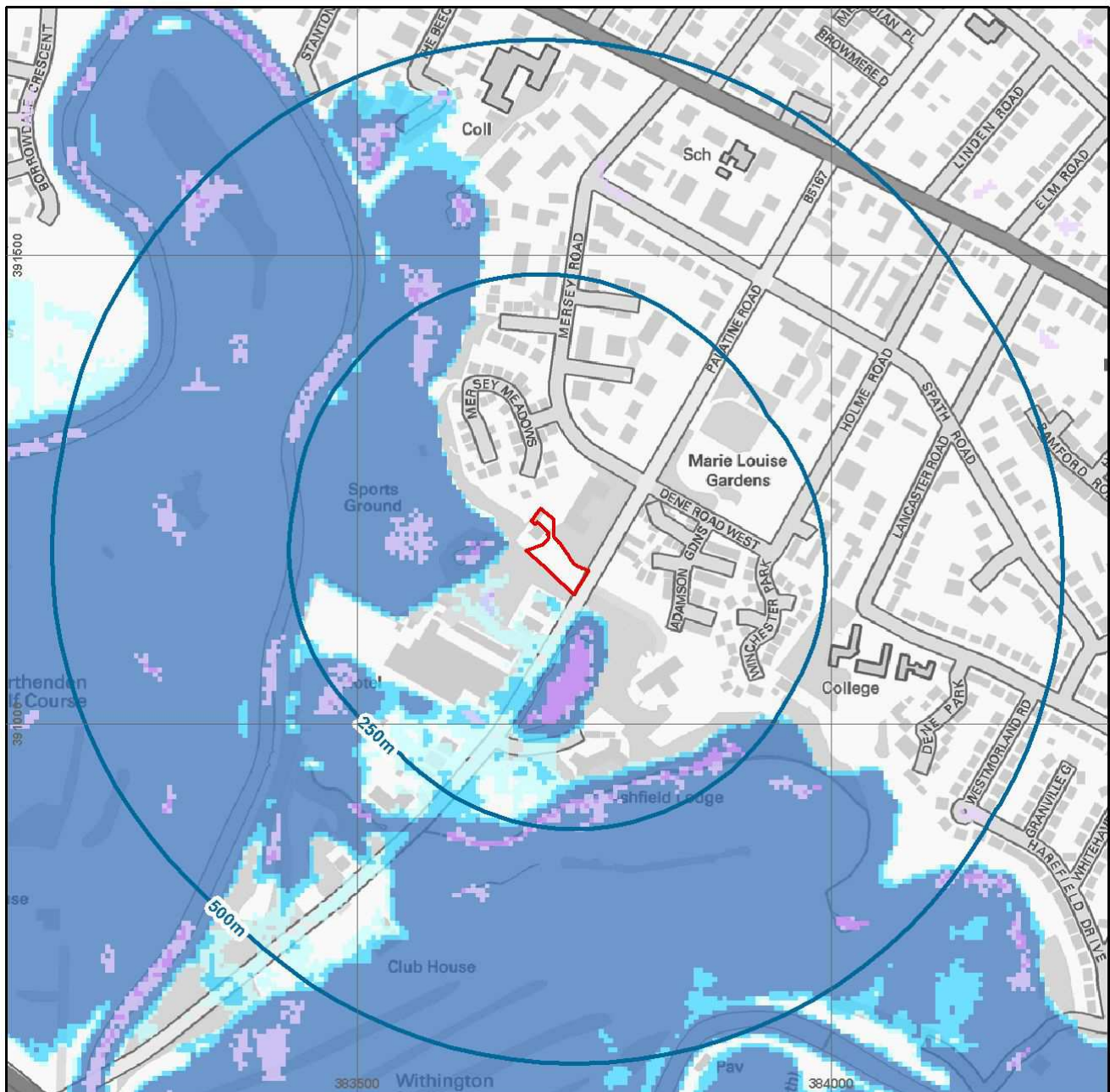
Section A.1 – River, Coastal and Surface Water Flood Risk: 1 in 75 Year – From JBA

Enquiry	Distance	Result	Note
A.1.1 River What is the risk of river water flooding following a 1 in 75 year event?	0-25m 26-250m	Negligible High	Information regarding the risk of river (fluvial) flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 75 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
A.1.2 Coastal What is the risk of coastal flooding following a 1 in 75 year event?	0-25m 26-250m	Negligible Negligible	Information regarding the risk of coastal (tidal) flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 75 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
A.1.3 Surface Water What is the risk of surface water flooding following a 1 in 75 year event?	0-25m 26-250m	Negligible Medium	Information regarding the risk of natural surface water or pluvial flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 75 return period. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of potential surface water flooding.

Comment

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Section A.1 – River, Coastal and Surface Water Flood Risk: 1 in 75 Year – From JBA



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75yr Flood Risk

Client Site	Surface Water Depth	River Depth	Coastal Depth
	10cm - 30cm	10cm - 30cm	10cm - 30cm
	30cm - 1m	30cm - 1m	30cm - 1m
	> 1m	> 1m	> 1m

metres
0 50 100 200

* - Not all features in legend may be present in above map

Nominal scale at A4 paper size - 1:6,750

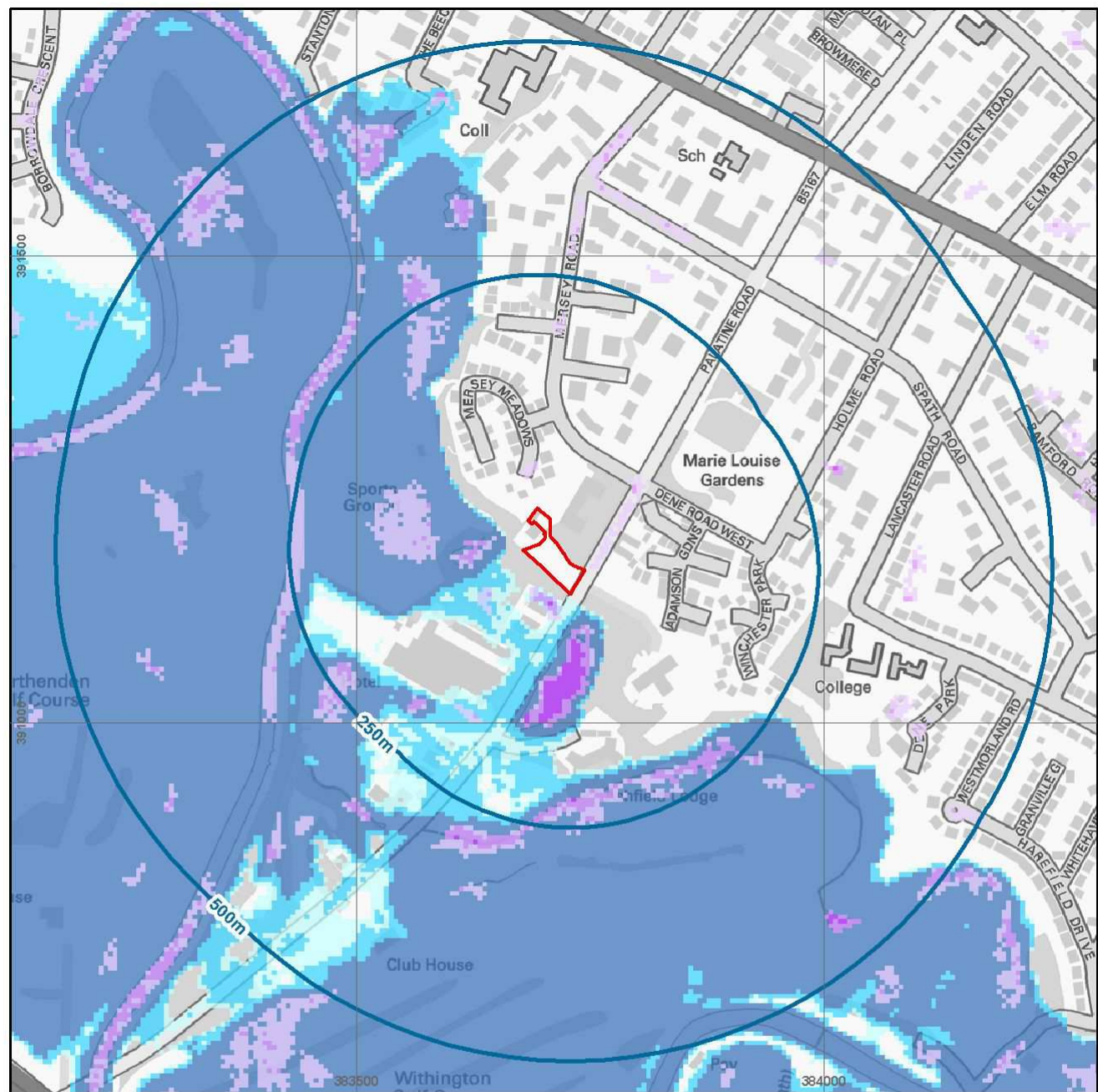
Section A.2 – River, Coastal and Surface Water Flood Risk: 1 in 200 Year – From JBA

Enquiry	Distance	Result	Note
A.2.1 River What is the risk of river water flooding following a 1 in 200 year event?	0-25m 26-250m	Negligible High	Information regarding the risk of river (fluvial) flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 200 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
A.2.2 Coastal What is the risk of coastal flooding following a 1 in 200 year event?	0-25m 26-250m	Negligible Negligible	Information regarding the risk of coastal (tidal) flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 200 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
A.2.3 Surface Water What is the risk of surface water flooding following a 1 in 200 year event?	0-25m 26-250m	Negligible High	Information regarding the risk of natural surface water or pluvial flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 200 return period. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of potential surface water flooding.

Comment

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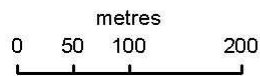
Section A.2 – River, Coastal and Surface Water Flood Risk: 1 in 200 Year – From JBA



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200yr Flood Risk

 Client Site	Surface Water Depth	River Depth	Coastal Depth
	 10cm - 30cm	 10cm - 30cm	 10cm - 30cm
	 30cm - 1m	 30cm - 1m	 30cm - 1m
	 > 1m	 > 1m	 > 1m



* - Not all features in legend may be present in above map

Nominal scale at A4 paper size - 1:6,750

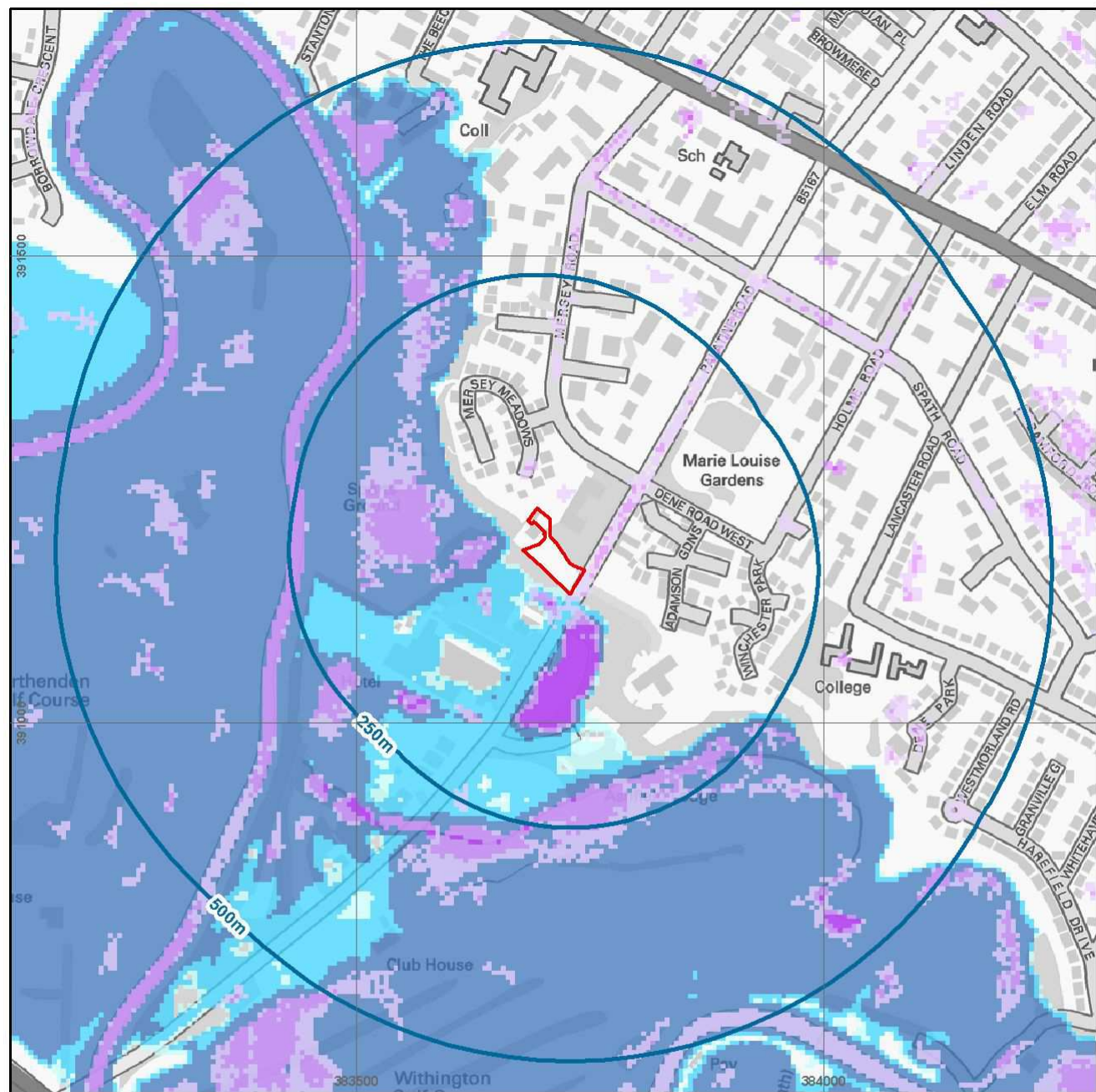
Section A.3 – River, Coastal and Surface Water Flood Risk: 1 in 1000 Year – From JBA

Enquiry	Distance	Result	Note
A.3.1 River What is the risk of river water flooding following a 1 in 1000 year event?	0-25m 26-250m	Medium High	Information regarding the risk of river (fluvial) flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 1000 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
A.3.2 Coastal What is the risk of coastal flooding following a 1 in 1000 year event?	0-25m 26-250m	Negligible Negligible	Information regarding the risk of coastal (tidal) flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 1000 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
A.3.3 Surface Water What is the risk of surface water flooding following a 1 in 1000 year event?	0-25m 26-250m	Low High	Information regarding the risk of natural surface water or pluvial flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 1000 return period. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of potential surface water flooding.

Comment

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Section A.3 – River, Coastal and Surface Water Flood Risk: 1 in 1000 Year – From JBA



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1000yr Flood Risk



Client Site

Surface Water Depth

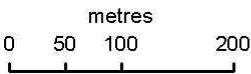
River Depth

Coastal Depth

- 10cm - 30cm
- 30cm - 1m
- > 1m

- 10cm - 30cm
- 30cm - 1m
- > 1m

- 10cm - 30cm
- 30cm - 1m
- > 1m



* - Not all features in legend may be present in above map

Nominal scale at A4 paper size - 1:6,750

Section B – River, Coastal Risk and Flood Defences – From EA

Enquiry	Distance	Result	Note
B.1.1 Rivers and coastal Is the property situated inside an area affected by flooding (Flood Zone 3) or extreme flooding (Flood Zone 2)?	0-25m 26-250m	YES YES	The property has been identified as being on or within 25m of Flood zone 3 according to the Environment Agency's Flood Map and is at a high risk of river or coastal flooding. The annual probability of flooding is either greater than 1% from rivers or greater than 0.5% from the sea. Properties within Flood Zone 3 may have difficulty obtaining flood insurance. In addition, all proposed developments would need to be accompanied by a full Flood Risk Assessment, in accordance with the National Planning Policy Framework. It is recommended further assessment is undertaken to further quantify the flood risk and suggest appropriate flood protection measures.
B.1.2 Flood defended area Is the property situated in an Area Benefiting from Flood Defences ?	0-25m	NO	The property is not situated within 250m of an area benefiting from flood defences according to the Environment Agency's Flood Map. The Environment Agency define areas benefiting from flood defences which should be afforded protection by existing flood defences during flood events with an annual probability of 1% from rivers and 0.5% from the sea. However, not all areas have been mapped and the property may still benefit from some flood defences.
B.1.3 Flood defences Are there any flood defences within 250m of the property?	0-25m 26-250m	NO YES	Flood defences were identified within 250m of the property which should afford the property some level of flood protection. However, there may be a residual risk of flooding should the protection standard of those defences be exceeded (and the defences over-topped) or should the defences fail. Environment Agency data regarding the presence and location of flood defences in England and Wales includes linear flood defences (such as walls and embankments). Not all flood defences may yet be registered and as a result not all flood defences may be shown.
B.1.4 NaFRA What is the flood likelihood category for the property?	0-25m	No Result	There is no known risk at the property according to the Environment Agency's National Flood Risk Assessment. Some areas may be classified as having no result when there is no output data from the analysis used to produce NaFRA, but the area falls within the extreme flood outline. However, where a further risk does exist this should be identified by one of the other datasets contained within this report. The data in the NaFRA Property Flood Likelihood Database is sourced from the Environment Agency's National Property Dataset (NPD2). The information provided includes the flood likelihood category low, moderate, or significant according to the NaFRA flood risk analysis. Some areas may be classified as having no result. This occurs where there is no output data from the analysis used to produce NaFRA, but the area falls within the extreme flood outline (with a 0.1% or 1 in 1000 chance of flooding in any year).

Comment

Information regarding flood zones and flood defences is currently unavailable from the Scottish Environment Protection Agency and Local Lead Flood Authorities in Scotland. As a result replies in Scotland may not identify areas at risk of flooding or existing flood defences when the property may in fact be at risk or in proximity to flood defences. However, this information has been considered in conjunction with all of the other data available in this report and the risk to properties in Scotland will be reflected in our overall risk assessment.

Please note that for an area in Newport in South Wales the Environment Agency has some information missing from their maps. They have issued the following warning:

Environment Agency Flood Map – Information Warnings: Newport, South Wales

We are aware of problems with the flood map for the Newport area. Please contact your local Natural Resources Wales office for accurate information. We are currently working to correct this information.

Environment Agency, 8th August 2013

Section B – River, Coastal Risk and Flood Defences – From EA



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Flood Zones, Defended Areas and Flood Defences



* - Not all features in legend may be present in above map

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Section C – Groundwater – From BGS

Enquiry	Result	Note
C.1.1 Flood Risk What is the BGS defined susceptibility to groundwater flooding in the search area based on the underlying geological conditions?	Very Low	Information from the British Geological Survey (BGS) indicates that the locality has no susceptibility to groundwater flooding. No further action is required. The BGS Susceptibility to Groundwater flooding hazard dataset identifies areas where geological conditions could enable groundwater to come close to the surface and cause groundwater flooding. The susceptibility data is suitable for use for regional or national planning purposes where the groundwater flooding information can be assessed along with a range of other relevant information. A high susceptibility does not necessarily mean that the property is at high risk of groundwater flooding. Argyll consultants have therefore analysed this data based on their professional experience in order to provide an overall groundwater flooding risk rating.

Section D – Historical Flood Extents and Insurability Rating

Enquiry	Result	Note
D.1.1 Historical Flood Extents Have any historical flood events occurred at the property or within 250m?	NO	The Environment Agency's records have no indication of past flooding within 250m of the property. As these records are not comprehensive, it may still be prudent to ask the property owner whether they are aware of any previous flooding at the property or in the surrounding area. The EA has collated extensive records (including outlines) of flooding from rivers, the sea or groundwater which have occurred in England and Wales since c. 1950 in order to map the outlines of recorded historical flood events. This information comes from various sources including maps, aerial photographs and private records. It is not necessarily comprehensive.
D.1.2 Flood Insurance Claim Rating How do Crawfords rate the area for insurance claims?	Low	Less than 2 claims Per 1000 households Crawford & Company is the world's largest independent provider of claims management solutions to the risk management and insurance industries. Crawford have compiled information in over 9,000 postcode sectors regarding the number of insurance claims made as a result of flooding. The risk has been classified by Crawford into five categories, too few, very low (no claims), low (less than 2 claims per 1000 households), moderate (between 2 and 5 claims per 1000 households) and high (more than 5 claims per 1000 households). This information is not necessarily comprehensive and excludes flood claims arising as a result of burst pipes and domestic appliances.

Flood Risk Screening Methodology

The Homecheck Professional® report is a desktop flood risk screening report, designed to enable home buyers and property professionals to assess the risk of flooding at residential sites. It examines two key areas; the overall risk of flooding at a site taking into account any flood defences present (where these are identified) and how flood risk affects the availability of insurance for a site. The report considers current Government guidance including the National Planning Policy Framework (NPPF) and the current agreement between insurance companies and central Government. The report has been designed and produced by qualified flood risk specialists using the data available in this report.

Flood Risk Rating

An overall flood risk rating is provided based on an assessment of the data provided within this report. The overall risk rating in the report takes into account the effect of flood defences, where these are identified, based on the presence of flood defences registered by the Environment Agency within the vicinity of the property. It should be noted that a residual risk of flooding may remain if such defences were to fail owing to extreme weather conditions, over-topping or poor maintenance. In addition, it should be noted that flood defences do not generally offer protection against groundwater or surface water flooding.

Where no flood defences are present in the vicinity of the property the overall risk rating provides a worst case scenario which may be alleviated by smaller scale local flood defences or recently constructed flood defences not currently registered by the Environment Agency. Replies in Scotland will always present the worst case scenario where there are no flood defences in the area benefiting the site or assuming any flood defences will fail or be over-topped. This is because data regarding flood defences in Scotland is currently unavailable from the Scottish Environmental Protection Agency and Local Lead Flood Authorities.

The overall risk of flooding will be answered by one of four standard responses:

Response	Meaning
Negligible	The overall flood risk rating for the property is assessed to be 'Negligible'. Existing datasets do not indicate any risk at the property itself, or any feature within the locality of the property, which would be expected to pose a threat of flooding. It is not considered that any further investigations are necessary in regard to flood risk.
Low	The overall flood risk rating for the property is assessed to be 'Low'. Although large sites (over 1 ha) would require a Flood Risk Assessment examining the impact the development would have on local drainage to accompany any planning application, it is not considered necessary to undertake any other further investigations into the flood risk at the property.
Moderate	The overall flood risk rating for the property is assessed to be 'Moderate'. Information from existing datasets suggests that there are certain features which may present a risk to the property and its occupants. Further assessment would normally be suggested as a prudent measure to clarify the risk of flooding at the property.
High	The overall flood risk rating for property is assessed to be 'High', with a consequent risk to life and property. This means that existing datasets reveal significant flood risk issues which need to be addressed. Further assessment is usually recommended in order to clarify the risk of flooding at the property.

Flood Risk Gauges

The flood risk gauges provide a more detailed analysis of the risk from each of the four main types of flooding – river, coastal, groundwater and surface water. In addition, a fifth gauge provides an analysis of other factors (i.e. historic flood events) that may affect the overall flood risk. For undefended fluvial and tidal flood risk and surface water flood risk data provided by JBA, only the risk rating generated during the modelled the 1:200 year return event is considered in the overall risk assessment. The data on 1:75 year and 1:1000 year return events are provided for information only. For further information on each of these types of flooding, please refer to the Homecheck Professional® User Guide.

This analysis takes into account any existing flood defences, where these are identified, that are intended to protect the property and assumes that these work as designed. The analysis also takes into account the other information contained in those data sections of the report which are relevant to that particular type of flooding. The assessment of the risk as shown in the flood gauges should therefore take priority over the information in the individual data sections of the report.

Insurance Availability

An indication of whether the property is likely to be insurable for flood risk at standard terms is provided by this report. Replies in England and Wales are based on consideration of the National Flood Risk Assessment (NaFRA) data set supplied by the Environment Agency and surface water flooding data supplied by JBA Consulting. Replies in Scotland are based on the consideration of the river flood (undefended fluvial) data and surface water flooding data supplied by JBA Consulting. This data is commonly used by insurance companies to determine the suitability of a property for insurance, although they may access additional information which could affect their assessment.

Under the Association of British Insurers' Revised Statement of Principles on the Provision of Flooding Insurance (July 2008), the general policy of member companies is that flood insurance for domestic properties and small businesses should continue to be available for as many customers as possible until 1 July 2013, by which time a longer term solution should be implemented. The premiums charged and other terms will reflect the risk of flooding but insurance will be available:

- 1) for properties where the flood risk is not significant (generally defined as no worse than 1.33% or 1-in-75 years annual probability of flooding); and
- 2) to existing domestic property and small business customers at significant risk, providing the Environment Agency has announced plans to reduce that risk within five years, such as improving flood defences. (The commitment to offer cover will extend to the new owner of any applicable property subject to satisfactory information about the new owner).

However, for significant risk areas where no improvements in flood defences are planned, and in all cases other than domestic properties and small businesses, insurers cannot guarantee to provide cover, but will examine the risks on a case-by-case basis. The implementation of the revised Statement of Principles depends on action from the Government and is continually reviewed by insurers. In addition, the revised Statement of Principles does not apply to properties built after 1st January 2009. Different guidance applies to these (see Climate Change – Guidance on Insurance Issues for New Developments from www.abi.org.uk).

The responses to the question 'Is the property likely to be insurable at standard terms?' assumes the property is an existing domestic property or small business and makes no allowance for previous claims arising from any type of flooding, nor for non-flood related risks such as subsidence.

Response	Meaning
Yes	The property is likely to be considered acceptable by insurance companies at standard terms and flood insurance should not be difficult to obtain. No further action required.
No	The property may not be considered acceptable by insurance companies at standard terms, on the basis of current information. Further work may be required in order to obtain acceptable insurance terms for the flood risk. This could include a more detailed risk assessment or the use of accredited products, flood resilient materials and temporary defences to defend the property.

Limitations of the Report

The Homecheck Professional® report has been designed to satisfy basic flood-related environmental due-diligence enquiries for residential properties. It is a desktop review of information provided by the client and from selected private and public databases. It does not include a site investigation, nor are specific information requests made of the regulatory authorities for any relevant information. Therefore, Landmark cannot guarantee that all issues of concern will be identified by this report, or that the data and information supplied to it by third parties is accurate and complete. The assessment within the report has been undertaken on a point location provided by the client and a 25m buffer placed around that point in order to assess the most likely areas associated with the property of interest. Landmark cannot be responsible for incidents where the 25m buffer does not encompass the entirety of the property demise.

This report includes an assessment of surface water flooding which examines the risk of the general drainage network overflowing during periods of extreme rainfall. This report does not make a detailed site-specific assessment of the suitability of the existing drainage on the property. If this is required, then a site survey should be considered. The assessment of pluvial flooding does not take into account particular local or temporary factors that may cause surface water flooding such as the blockage or failure of structures on or within watercourses, drains, foul sewers, water mains, canals and other water infrastructure; and any history of drains flooding at the property or in the locality. Surface water flooding can occur before surface water reaches the general drainage network, for example on hills and inclines.

Environment Agency and JBA fluvial and coastal flood data does not include flood risk from very small catchments as models of such small scale catchments are not considered to be reliable for UK-wide flood risk assessments. The potential impact of climate change on flood risk to the property would require further study.

Replies in Scotland are based on the best available data in that locality. The overall risk assessment and insurability assessment will still provide a response based on the best available information within this report. Where information is unavailable or has not been provided for a region the relevant data section will report No Data.

When answering any questions within this report, current applicable legislation is taken into account.

The data used in this report may have inherent limitations and qualifications. Further details are set out in the Homecheck Professional ® User Guide which is available by calling one of our customer services team on 0844 844 9966 or emailing helpdesk@landmark.co.uk.

Homecheck Professional® is provided by Sitescope Limited, part of Landmark Information Group. Sitescope is a leading UK provider of spatially-enabled property and environmental risk information to lawyers, banks, insurance companies, home inspectors and other property professionals.

Sitescope Conveyancing Terms & Conditions

Full Terms and Conditions can be found on the following link: <http://www.landmarkinfo.co.uk/Terms/Show/515>

If you experience difficulties accessing our Terms & Conditions, if you copy and paste the link directly into your browser, you will be able to access our Terms & Conditions from there.

Should you still experience difficulties, then please telephone our Customer Service Team on 0844 844 9966

Useful Contacts

British Geological Survey Enquiry Service

British Geological Survey	Telephone 0115 936 3143
Kingsley Dunham Centre	Fax 0115 936 3276
Keyworth	
Nottingham	Email enquiries@bgs.ac.uk
NG12 5GG	Website www.bgs.ac.uk

Landmark Information Group Limited

Imperium	Telephone 0844 844 9966
Imperial Way	Fax 0844 844 9980
Reading	
RG2 0TD	Email info@landmark.co.uk
	Website www.landmark.co.uk

Argyll Environmental Limited

Lees House	Telephone 0845 458 5250
21-33 Dyke Road	Fax 0845 458 5260
Brighton	
BN1 3FE	Email info@argyllenviro.com

Environment Agency National Customer Contact Centre (NCCC)

PO Box 544	General enquiries 08708 506 506
Templeborough	Floodline 0845 988 1188
Rotherham	
S60 1BY	Email enquiries@environment-agency.gov.uk

Flood Protection Association

10 Cavalry Ride	Telephone 01603 633 440	For advice on Flood Protection Measures
Norwich	Fax 01603 763256	
NR3 1U		
	Website www.floodprotectionassoc.co.uk	

British Insurance Brokers' Association

8th Floor	Telephone 0870 950 1790	For advice on Flood Insurance
John Stow House		
8 Bevis Marks		
London		
EC3A 7JB		

Important Consumer Protection Information

This search has been produced by Landmark Information Group Ltd, Imperium, Imperial Way, Reading, RG2 0TD. Telephone 0844 844 9966, Fax No. 0844 844 9980 email helpdesk@landmark.co.uk which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practice and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details:

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk.

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

Complaints procedure

If you want to make a complaint, we will:

- Acknowledge it within 5 working days of receipt.
- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
- Keep you informed by letter, telephone or e-mail, as you prefer, if we need more time.
- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

Complaints should be sent to:

Head of Customer Relations
Landmark Information Group Ltd
Landmark UK Property
Imperium
Imperial Way
Reading
RG2 0TD

Telephone: 0844 844 9966

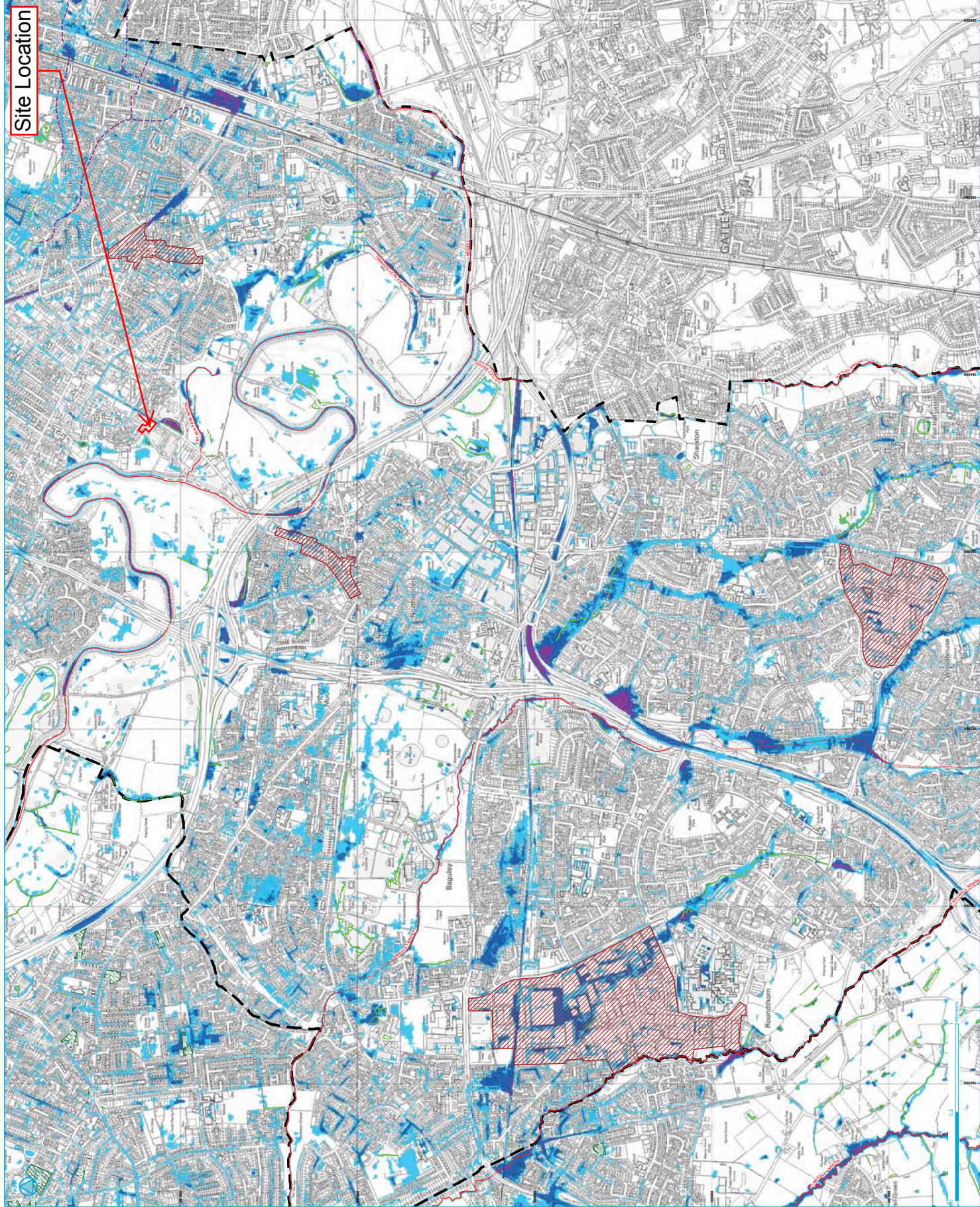
Email: helpdesk@landmark.co.uk

Fax: 0844 844 9980

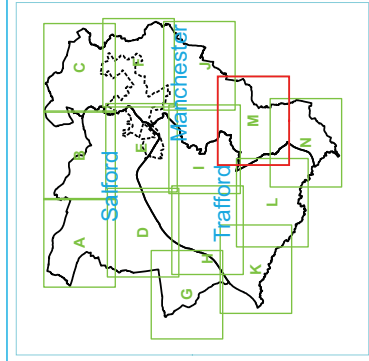
If you are not satisfied with our final response, or if we exceed the response timescales, you may refer the complaint to The Property Ombudsman scheme (TPOs): Tel: 01722 333306, E-mail: admin@tpos.co.uk.

We will co-operate fully with the Ombudsman during an investigation and comply with his final decision.

Appendix E – SFRA Maps



Site Location



- Council Boundary
 - Ashton, Redwater and Rochdale Canals
 - Manchester Ship Canal / Grey Inlet
 - Other Waterbodies
 - Main Rivers (V8.0)
 - Culverted
 - Open
 - Digitised River Lines
 - Culverted
 - Open
- Susceptibility to Surface Water Flooding**
- High Susceptibility
 - Intermediate Susceptibility
 - Low Susceptibility
- Potential Development Sites / Locations**
- Employment
 - Housing
 - Mixed Use
 - Other
 - Regional Centre Boundary

This map has been produced in accordance with IP6235: Development and Flood Risk.

The map reflects the Environment Agency's map of 'Areas at Risk of Surface Water Flooding' based on more detailed modelling outputs produced for this SFRA.

The Main River information shown in the SFRA is provided by the Environment Agency; the centrelines data may deviate from that shown on base-mapping due to inherent differences in data sources. The map is not intended to be used for navigation or to determine precise boundaries. The mapping of culverted sections of watercourse is a strategic screening only and does not represent a detailed assessment of flood risk. The map should be used in conjunction with other data sources to provide a more detailed assessment of flood risk. The map is not intended to be used for navigation or to determine precise boundaries. The mapping of culverted sections of watercourse is a strategic screening only and does not represent a detailed assessment of flood risk. The map should be used in conjunction with other data sources to provide a more detailed assessment of flood risk.

This map should be used to apply the Exception Test and to scope what the Flood Risk Assessment should consider in its placement of surface development and the management of land.

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for		Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA	
Susceptibility to Surface Water Flooding - Current Scenario		Scenario	
Drawn by: J. Crofton	Date: 28/01/2011	Scale: 1:10,000	Sheet: 1 of 1
Checked by: J. Crofton	Date: 01/02/2011	FINAL	
Approved by: J. Crofton	Date: 01/02/2011		
File Name: ActiveWaterLevel2Hybrid_SFRA_Level2_V1.mxd			
Event Number: SS_4.1 M			

Appendix F – Surface Water Runoff Calculations

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref w1527									
Client :	Taylor Pickles Homes			no of pages attached: 1 of 14									
Scheme :	The Rookery, Palatine Road												
Section :	Surface Water Run-off			<table border="1"> <tr> <td>prefix SWR</td> <td>revision A</td> </tr> </table>	prefix SWR	revision A							
prefix SWR	revision A												
<table> <tr> <td>prepared by: Dafydd Lloyd</td> <td>date:</td> <td>17/03/2014</td> </tr> <tr> <td>checked by: Aled Williams</td> <td>date:</td> <td>17/03/2014</td> </tr> <tr> <td>approved by: Dr. Deepak Kharat</td> <td>date:</td> <td>17/03/2014</td> </tr> </table>					prepared by: Dafydd Lloyd	date:	17/03/2014	checked by: Aled Williams	date:	17/03/2014	approved by: Dr. Deepak Kharat	date:	17/03/2014
prepared by: Dafydd Lloyd	date:	17/03/2014											
checked by: Aled Williams	date:	17/03/2014											
approved by: Dr. Deepak Kharat	date:	17/03/2014											
<u>Comparison of pre-development and post-development run-off rates and volumes for greenfield or brownfield sites up to 200 Ha</u> <u>Site description</u> Proposed development of land at The Rookery, Palatine road, Didsbury, M20 2WG. Development includes the erection of 4 semi-detached dwellings see page SWR14. National Grid Reference (centre of site) approx. 383711E 391182N <u>Design Brief</u> To calculate both pre and post development rainfall run-off in accordance with the requirements of the Interim Code of Practice for Sustainable Drainage Systems. The peak run-off rates are to be estimated for return periods of up to 100 years and the run-off volumes are also to be calculated for a 1 in 100 year event of 6 hour duration. An allowance for climate change should be included only in the case of the post-development run-off calculation (as specified in CSH 2010).^[1] <u>Documents Referenced</u> 1. Interim Code of Practice for Sustainable Drainage Systems (ICP-SUDS)(July 2004) 2. I o H Report 124 - Flood Estimation for Small Catchments (Marshall & Bayliss, 1994) 3. FSSR 16 runoff model - Fixed Percentage Runoff Method 4. Wallingford Procedure 1981 5. CIRIA C697 - The SUDS Manual (Feb 2007) <u>Basis of estimates</u> The Interim Code of Practice for Sustainable Drainage Systems (July 2004)^[1] recommends the use of I o H 124^[2] for calculating peak greenfield run-off rates for sites up to 200 Ha. For site less than 50 Ha, the run-off should be calculated for 50 Ha and adjusted in proportion for the actual area. For sites greater than 200 Ha, the FEH run-off model should be used. CIRIA C697^[5] recommends the use of the FSSR 16^[3] run-off method for calculating the run-off volume for greenfield sites. For brownfield sites with a recognised drainage system, the Rational Method^[4] has been used to calculate the run-off for the impermeable portions of the catchment (pre- & post development). For sites without a proper drainage system, the pre-development run-off is calculated as for a greenfield site, assuming soil type 5, regardless of type indicated on mapping. In accordance with National Planning Policy Framework (NPPF) and assuming a 100yr projection, a 30% on peak rainfall intensity increase in rainfall / run-off has been included to allow for the climate change anticipated in the years 2085 - 2115. Rainfall data is taken from maps in Defra / EA Tech Report W5-074/A Rev D (see page SWR10 & 11). Standard Average Annual Rainfall and Soil classification from maps in FSR Report (see page SWR8 & 9). N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.													

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1527
				prefix - page no. SWR2
Scheme :	The Rookery, Palatine Road			dated :
Section :	Surface Water Run-off			17/03/2014

Basis of calculations

Peak run-off rate based on combination of IOH 124 method & Rational method

Run-off volume based on combination of FSSR 16 method & Rational method

N.B. Rational method used for impervious portion of total area for both pre and post development, allowing for pre-development of site where appropriate.

Catchment Details - input data

Proportions of soil type (from maps)

Prop S1	(fraction)		(x 0.15)
Prop S2	(fraction)	1.000	(x 0.30)
Prop S3	(fraction)		(x 0.40)
Prop S4	(fraction)		(x 0.45)
Prop S5	(fraction)		(x 0.50)
Total fraction		1.000	OK - total = 1
Calculated value of SOIL		0.300	
Calculated value of SPR		30.000	

$$SOIL = (0.15S1 + 0.3S2 + 0.4S3 + 0.45S4 + 0.5S5) / (S1 + S2 + S3 + S4 + S5)$$

$$SPR = 10S1 + 30S2 + 37S3 + 47S4 + 53S5$$

Region number		10	Select from list
AREA	(Ha)	0.2000	(1Ha = 0.01Km ²)
SOIL	(fraction)	0.300	Calculated above
SAAR	(mm)	900	From FSR maps
CWI		122.5	From FSR graph

M5-60 rainfall (mm)		17.00	From Defra / EA maps
Ratio M5-60/M5-2d		0.40	From Defra / EA maps
M100-6hr rainfall (mm)		55.00	From Defra / EA maps

Storm duration (min)		15	(To give peak run-off-15 min for small site)
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PIMP Pre-develop (%)		28.00	Provided by client
PIMP Post-develop (%)		27.00	Provided by client

Pre-dev drain system?		Yes	If "No", whole site assumed pervious - Soil type 5 & pre-dev PIMP taken as zero in following calcs
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Climate change

Rainfall increase (%)		30	Based on NPPF (for years 2085 - 2115) Applied to post development case only
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N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220		Calculations		ref : w1527	
						prefix - page no. SWR3	
Scheme :		The Rookery, Palatine Road				dated :	
Section :		Surface Water Run-off				17/03/2014	

Pre- & Post-development peak run-off - Rational Method
(for impervious portions of catchment only)

Input data from sheet 2

Total area (Ha)	0.2000	from sht 2	
Pre dev PIMP (%)	28.00	from sht 2	Or zero if no pre-development drainage
Post dev PIMP (%)	27.00	from sht 2	
Pre-dev Imp area (Ha)	0.0560	calculated	
Post-dev Imp area (Ha)	0.0540	calculated	

M5-60min rain (mm)	17.00	from sht 2
Ratio "r"	0.40	from sht 2
Climate change (%)	30	from sht 2
Storm duration (min)	15.00	from sht 2

Rational Method

Peak run-off $Q_i = 2.78 C_v C_r i A$

Z1 Factor from table	0.633	pro-rata
Volume coeff C_v	0.75	(Typical 0.75)
Routing coeff C_r	1.30	(Standard value 1.3)

Calculation

M5-Dmin rain (mm)	10.761	M5-60min * Z1 factor
Climate change factor	1.30	Applied to post-development run-off only

Return period	1 yr	30 yr	100 yr
Z2 factor from table	0.612	1.525	1.922
Rainfall (mm)	6.59	16.41	20.68
Rainfall intensity (mm/hr)	26.4	65.6	82.7
Rainfall + CC (mm)	8.57	21.33	26.88
R. Intensity + CC (mm/hr)	34.3	85.3	107.5

Peak run-off rate

Pre-development Q_i (l/s)	4.01	9.96	12.55
Post-development Q_i (l/s)	5.02	12.49	15.73

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220		Calculations		ref : w1527	
						prefix - page no. SWR4	
Scheme :		The Rookery, Palatine Road				dated : 17/03/2014	
Section :		Surface Water Run-off					

Pre & Post development peak run-off
IOH124 method for pervious areas - Rational method for impervious areas

Input data from sheet 2

Total Area (Ha)	0.2000	from sht 2	
Pre-dev PIMP (%)	28.00	from sht 2	Or zero if no pre-development drainage
Post-dev PIMP (%)	27.00	from sht 3	
Pre-dev Perv area (Ha)	0.1440	Calculated	< 50 Ha or 0.5 Km2
Post-dev Perv area (Ha)	0.1460	Calculated	< 50 Ha or 0.5 Km2

Region number	10	from sht 2	
SOIL (fraction)	0.300	from sht 2	Pre-dev SOIL 0.300 from sht 2 or fixed 0.5 if no drainage system
SAAR (mm)	900	from sht 2	

Regional growth factors

Multiplier for 1/1 yrs	0.83	FSSR 14 table 1 (lookup table)
Multiplier for 1/30 yrs	1.69	FSSR 14 table 1
Multiplier for 1/100 yrs	2.08	FSSR 14 table 1

Climate change factor

1.3	Applied to post-development run-off only
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Mean annual flood

$Qbar = 0.00108 * (AREA/100)^{0.89} * SAAR^{1.17} * SOIL^{2.17}$

	Pre-development		Post development	
Qbar' (for 50 Ha) (m3/s)	0.12227	basis of pro-rata	0.12227	basis of pro-rata
Qbar (actual area) (m3/s)	0.00035	pro-rata (A/50)*Qbar'	0.00036	pro-rata (A/50)*Qbar'

Peak flows (IoH 124)

Return period	1 yr	30 yr	100 yr	1 yr	30 yr	100 yr
Multiplier	0.830	1.690	2.080	0.830	1.690	2.080
Peak run-off (m³/s)	0.00029	0.00060	0.00073	0.00030	0.00060	0.00074
Peak + CC Qp (m³/s)	n/a	n/a	n/a	0.00039	0.00078	0.00096

Total peak flows (l/s)

Perv area flow-Qp (l/s)	0.29	0.60	0.73	0.39	0.78	0.96
Imp area flow -Qi (l/s)	4.01	9.96	12.55	5.02	12.49	15.73
Total peak flow Q (l/s)	4.30	10.56	13.28	5.41	13.27	16.69

Peak flow increase (l/s)	1.11	2.71	3.41
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N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1527 prefix - page no. SWR5 dated : 17/03/2014
Scheme :	The Rookery, Palatine Road			
Section :	Surface Water Run-off			

Pre & Post development run-off volume - FSSR 16
Applied to pervious and impervious areas
For 1 in 100yr 6hr storm

Input data from sheet 2

Total area (Ha)	0.2000	from sht 2	
Pre-dev PIMP (%)	28.00	from sht 2	Or zero if no pre-development drainage
Post-dev PIMP (%)	27.00	from sht 2	
Pre-dev Perv Area (Ha)	0.1440	calculated	
Pre-dev Imp Area (Ha)	0.0560	calculated	
Post-dev Perv Area (Ha)	0.1460	calculated	
Post-dev Imp Area (Ha)	0.0540	calculated	
SAAR (mm)	900.0	from sht 2	
CWI	122.5	from sht 2	
SPR (%)	30.00	from sht 2	

DPR _{CWI} (%)	-0.625	calc	0.25*(CWI-125)
DPR _{RAIN} (%)	5.035	calc	0.45*(P-40)^0.7 for P>40mm
PR _p (%) (perv area)	34.410	calc	SPR + DPR _{CWI} + DPR _{RAIN}
PR _i (%) (imp area)	100.000	defined	100% of impervious area

Rainfall data
(M100-360 min)

Rainfall P (mm)	55.00	from sht 2	
CC factor	1.30	from sht 2	
Rainfall Pcc (mm)	71.50	calculated	

Storm duration (mins) 360 defined

Run-off volume $V = PR/100 * A * 100000 * P/1000 = PR * A * P / 10$ (m3)

where PR = Percentage run-off PR_p or PR_i (%)
 A = Catchment area A_p or A_i (Ha)
 P = Rainfall depth (M100-360) P or Pcc (mm)
 (including climate change for post development only)

	Pre-dev	Post dev
	-	incl CC
Run-off volume- Pervious area (m3)	27.25	35.92
Run-off volume- Impervious area (m3)	30.80	38.61
Total run-off volume (m3)	58.05	74.53
Volume increase (m3)	16.48	

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1527
Scheme :		The Rookery, Palatine Road		prefix - page no. SWR6
Section :		Surface Water Run-off		dated : 17/03/2014

Z1 Factor for England & Wales (Values from BRE 365 - Table 1)

Ratio	Rainfall Duration (mins)					
r	15	30	60	120	240	360
0.12	0.450	0.670	1.000	1.480	2.170	2.750
0.15	0.480	0.690	1.000	1.420	2.020	2.460
0.18	0.510	0.710	1.000	1.360	1.860	2.250
0.20	0.530	0.723	1.000	1.340	1.800	2.163
0.21	0.540	0.730	1.000	1.330	1.770	2.120
0.24	0.560	0.750	1.000	1.300	1.710	2.000
0.25	0.567	0.753	1.000	1.290	1.687	1.960
0.27	0.580	0.760	1.000	1.270	1.640	1.880
0.30	0.590	0.770	1.000	1.250	1.570	1.780
0.33	0.610	0.780	1.000	1.230	1.530	1.730
0.35	0.617	0.787	1.000	1.223	1.497	1.690
0.36	0.620	0.790	1.000	1.220	1.480	1.670
0.39	0.630	0.800	1.000	1.210	1.460	1.620
0.40	0.633	0.803	1.000	1.207	1.447	1.603
0.42	0.640	0.810	1.000	1.200	1.420	1.570
0.45	0.650	0.820	1.000	1.190	1.380	1.510

Z2 Factors for England & Wales from table 6.2 - Wallingford Procedure

M5 Rain	Diff	M1	M30	M100
(mm)	(mm)			
		1	30	100
5.00	5	0.62	1.45	1.79
10.00	5	0.61	1.52	1.91
15.00	5	0.62	1.55	1.99
20.00	5	0.64	1.58	2.03
25.00	5	0.66	1.57	2.01
30.00	10	0.68	1.55	1.97
40.00	10	0.70	1.50	1.89
50.00	25	0.72	1.45	1.84
75.00	25	0.76	1.36	1.64
100.00	50	0.78	1.32	1.54
150.00	50	0.78	1.26	1.45
200.00		0.78	1.24	1.40
N.B. M30 Factors interpolated graphically				

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1527
Scheme :		The Rookery, Palatine Road		prefix - page no. SWR7
Section :		Surface Water Run-off		dated : 17/03/2014

Hydrological Regions (From Defra / EA R&D Tech Report W5-074/A Rev D)

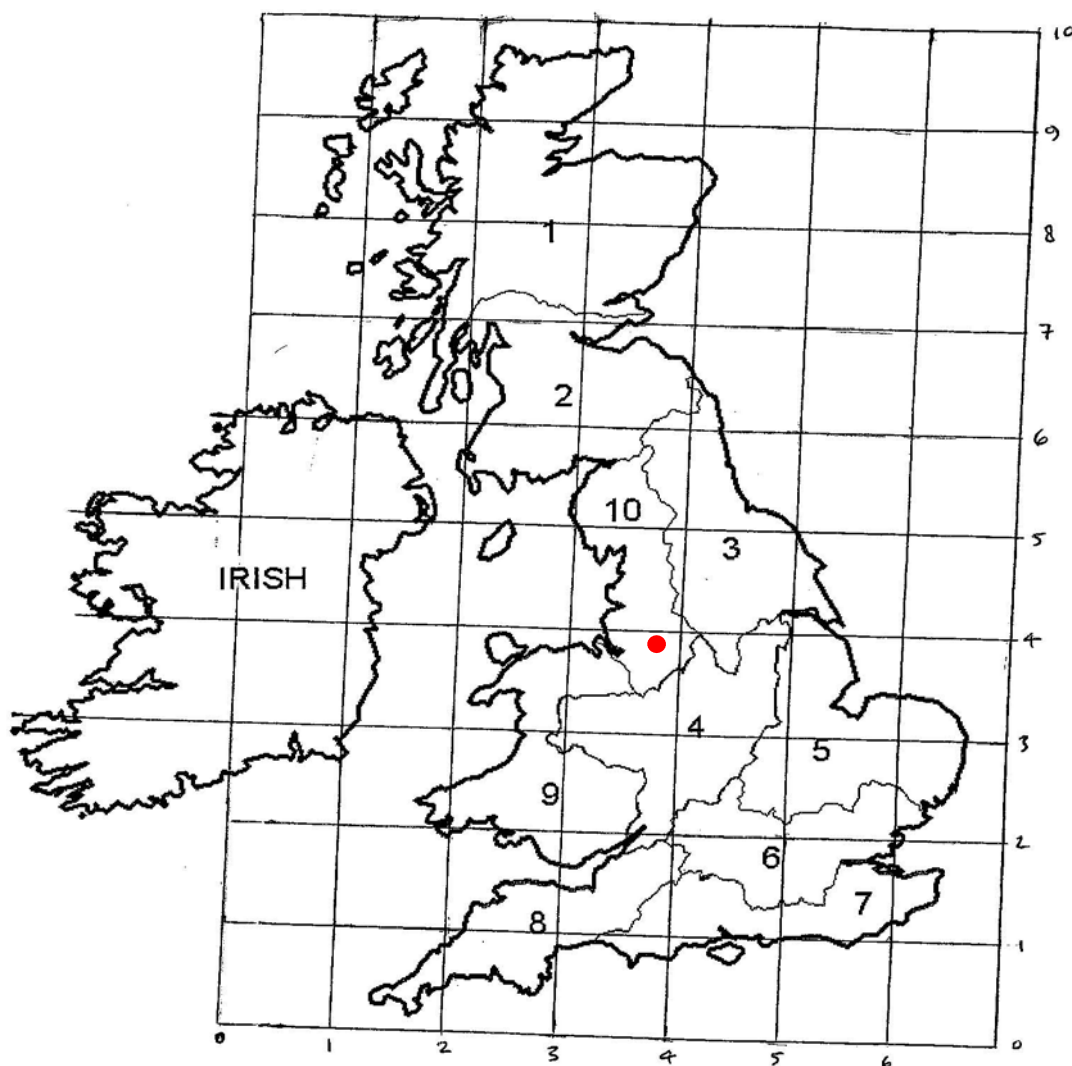


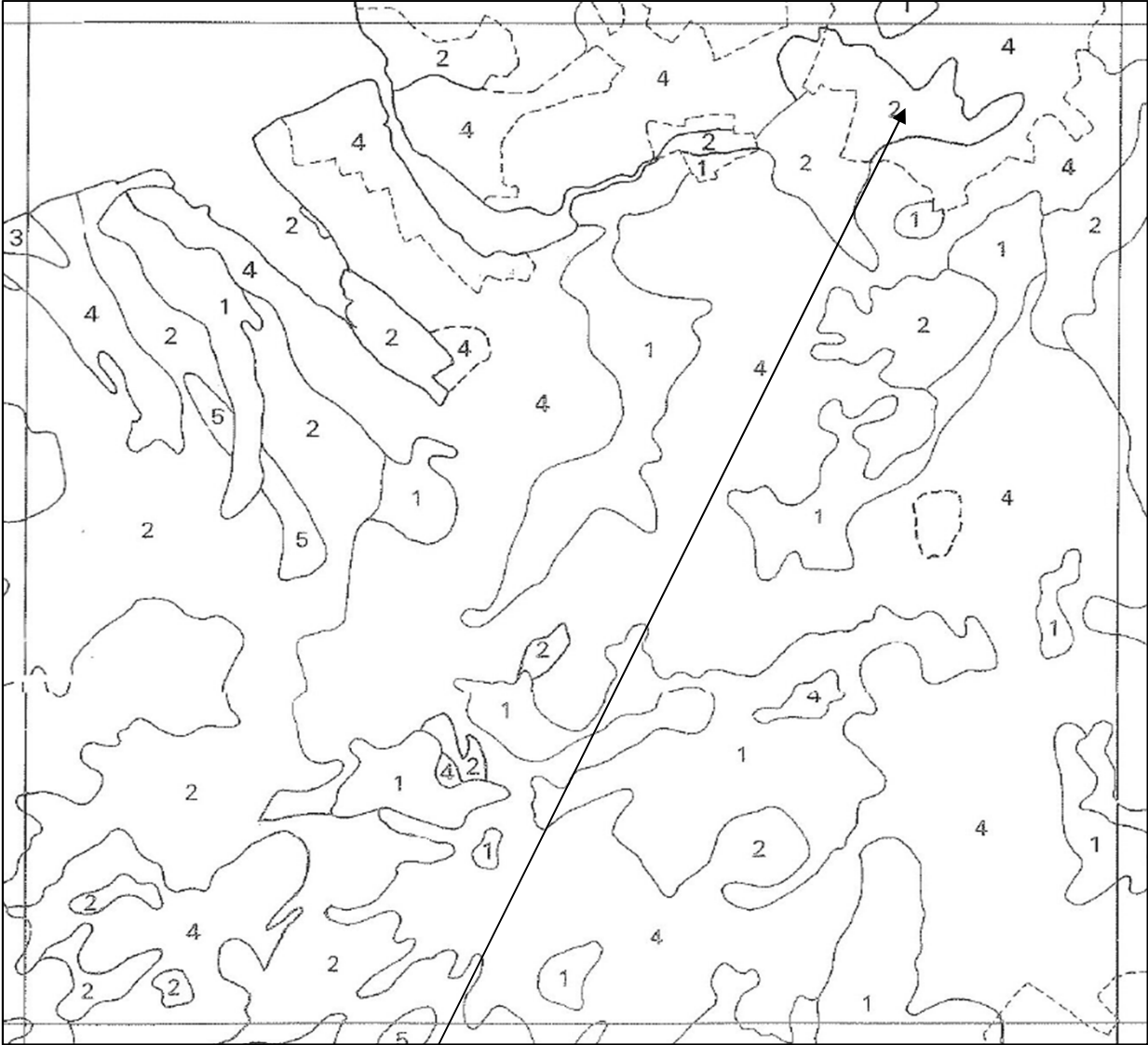
Figure 1.1 Hydrological regions of UK

Grid Ref: - 383711E 391182N - Hydrological region 10

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1527
				prefix - page no. SWR8
Scheme :	The Rookery, Palatine Road			dated :
Section :	Surface Water Run-off			17/03/2014

Soil Classification Chart

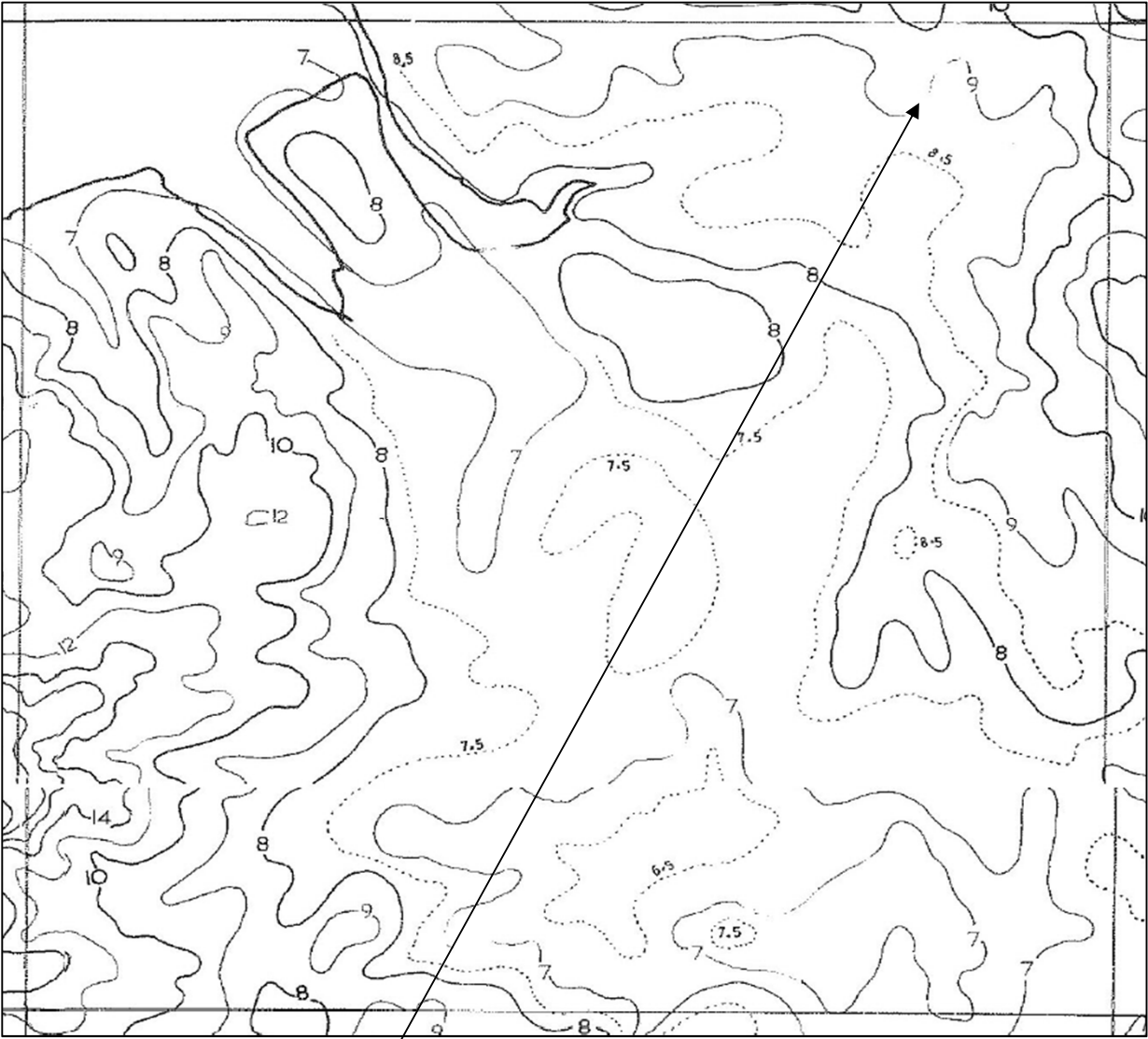


Grid Ref: - 383711E 391182N - Soil Classification = 2

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1527
				prefix - page no. SWR9
Scheme :	The Rookery, Palatine Road			dated :
Section :	Surface Water Run-off			17/03/2014

Standard Annual Average Rainfall (SAAR) Chart



Grid Ref: - 383711E 391182N - SAAR = 900mm

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1527
Scheme :		The Rookery, Palatine Road		prefix - page no. SWR10
Section :		Surface Water Run-off		dated : 17/03/2014

M5-60min Rainfall + r (From Defra / EA R&D Tech Report W5-074/A Rev D)

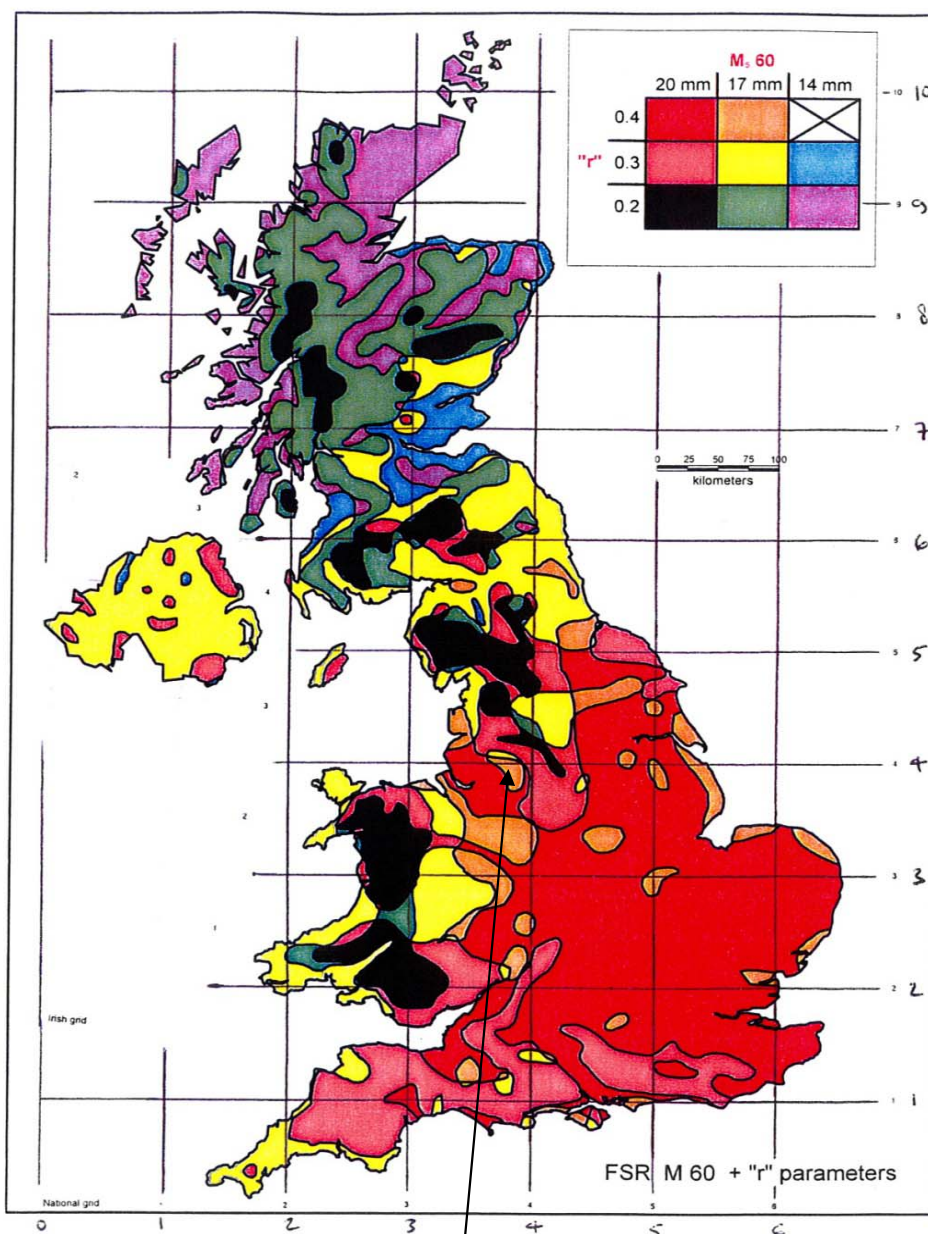


Figure 2 Hydrological rainfall zones of UK

Grid Ref: - 383711E 391182N - M5-60 = 17mm, 'r' = 0.4

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

Scheme :

The Rookery, Palatine Road

Section :

Surface Water Run-off

M100 6hr Rainfall (From Defra / EA R&D Tech Report W5-074/A Rev D)

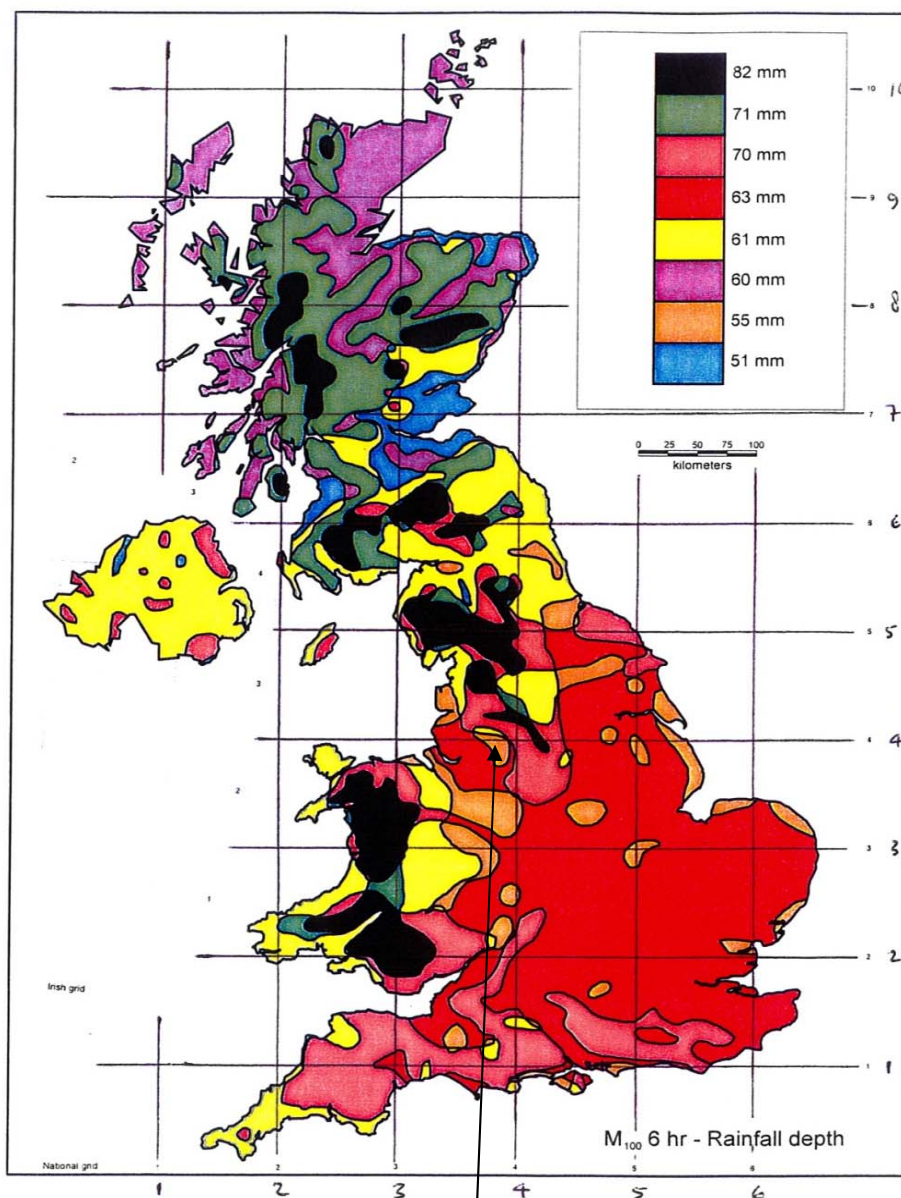


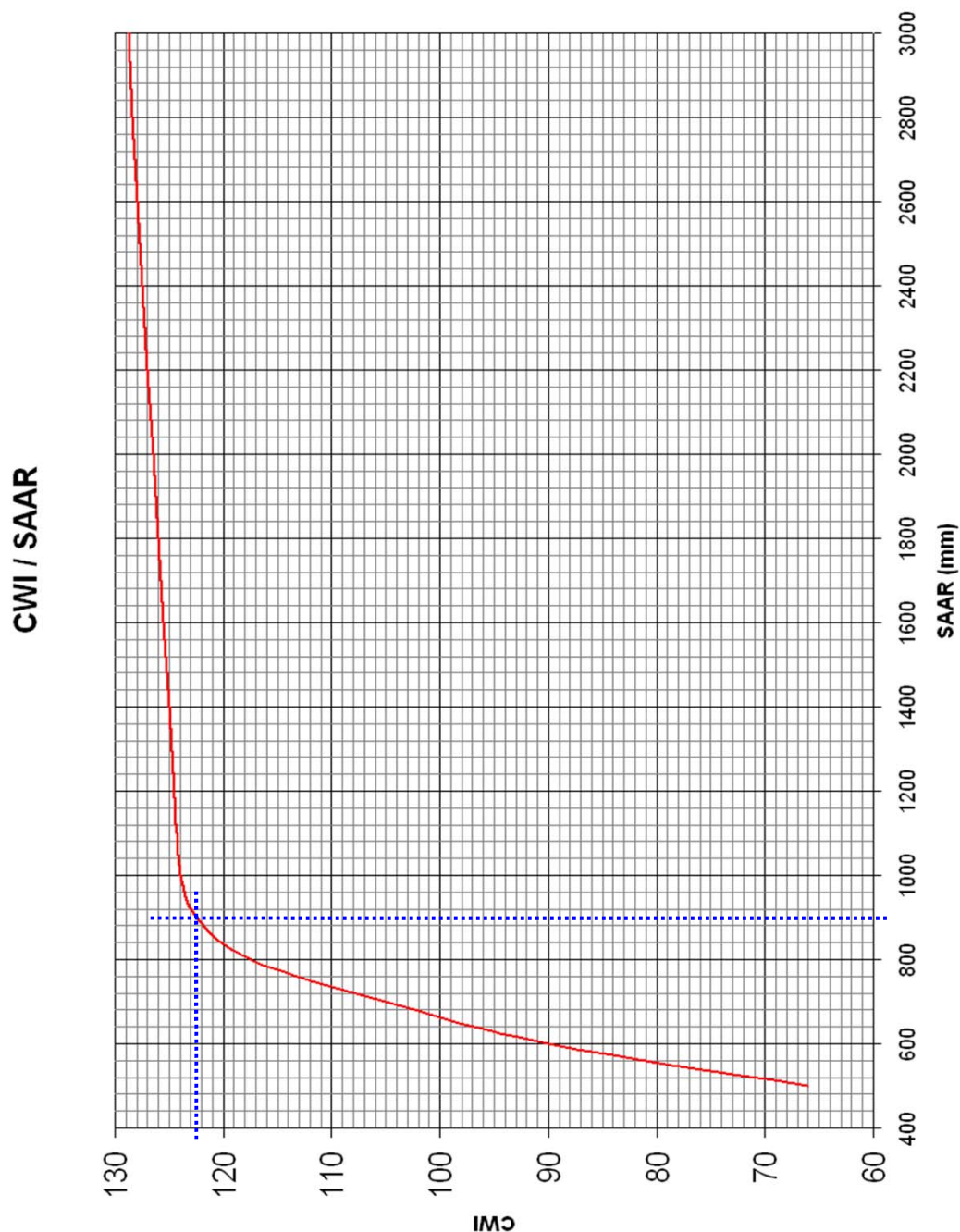
Figure 3.1 100 year 6 hour rainfall depths of UK

Grid Ref: - 383711E 391182N - M100-6hr Rainfall = 55

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1527
Scheme : The Rookery, Palatine Road				prefix - page no. SWR12
Section : Surface Water Run-off				dated : 17/03/2014

Catchment Wetness Index (CWI) vs Standard Annual Average Rainfall (SAAR)



N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1527
Scheme :		The Rookery, Palatine Road		prefix - page no. SWR14
Section :		Surface Water Run-off		dated : 17/03/2014

Post-development Area



Total Area = 2000m²

Permeable Area = 73% = 1443m²

Impermeable Area = 27% = 535m²

- = Site Boundary
- = Impermeable Area

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.