



Chipping Lane, Longridge

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**FLOOD RISK ASSESSMENT  
& SUSTAINABLE DRAINAGE ASSESSMENT**

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For

Barratt Homes  
BDW Trading Limited  
Barratt House, Cartwright Way,  
Forest Business Park, Bardon Hill,  
Coalville,  
Leicestershire,  
LE67 1UF



March 2016

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**Chipping Lane, Longridge  
FLOOD RISK ASSESSMENT  
& SUSTAINABLE DRAINAGE ASSESSMENT**

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## EXECUTIVE SUMMARY

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This Flood Risk Assessment (FRA) & Sustainable Drainage Assessment has been prepared for a proposed **residential development** and associated infrastructure located at **Chipping Lane, Longridge**. The site is located within **Flood Zone 1** according to the Environment Agency's (EA's) online flood maps. The National Planning Policy Framework (NPPF) requires a FRA for sites greater than 1 ha. The proposals are 'residential' in nature, classified as 'more vulnerable' in Table 2 within the Technical Guidance to the NPPF. This type of development is appropriate in Flood Zone 1.

This FRA has identified the site to be at **low risk** from all sources of flooding including; fluvial, tidal, pluvial, groundwater, sewer related and flooding from artificial sources. The development is accessible during times of extreme flooding as the site is within Flood Zone 1.

The development proposal was granted outline planning application (N<sup>o</sup> 3/2014/0764) on the 29<sup>th</sup> October 2015. This FRA has built upon the FRA submitted with the application completed by RSK (March 2015, Ref: 880500-R1). The previous FRA proposed that run-off rates will be restricted to QBar. In this report, **QBar** is calculated as **8.3 l/s/ha**. See Appendix C for Hydrological Calculations. Any discrepancy between this QBar and the previous figure is due to refined FEH catchment characteristics being utilised within the ICP SuDS method.

The existing site is classed as greenfield. Surface water runoff from the existing site flows overland in a north-westerly direction before outfalling to a land drainage ditch/ordinary watercourse situated along the northern border. This ditch flows west before outfalling via a 600mm dia pipe to contribute to the Higgin Brook catchment.

The ground investigation report carried out by Soiltechnics (Feb 2016, Ref: STN3505NM-G01) indicates that infiltration is **not viable** at this site.

Surface water will outfall via the existing pathways (i.e. to the on-site ordinary watercourse) at a maximum rate of QBar (l/s). The restriction of runoff rates on increased impermeable areas will create storm water storage volumes. These will be retained on-site for events up to and including the 1 in 100 year event plus an allowance for climate change. Sustainable Drainage Systems (SuDS) could be incorporated into the planning layout which will assist in the reduction of surface water runoff from areas of hardstanding.

The nearest public foul sewers are located within Inglewhite Road to the south-east of the site. The conveyance route of foul flows will be determined during detailed design. A pumped solution will likely be required and early liaisons with UU regarding adoptable pump design are recommended.

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## Specialist Software

-  Flood Estimation Handbook FEH CD-ROM (v.3.0) – Determination of Catchment Descriptors and depths of rainfall.
-  MicroDrainage WinDES (v.14.1) – Calculation of Greenfield run-off rates IH124/ICP-SUDS, Greenfield run-off volumes, rates of rainfall and stormwater storage estimates.

## Abbreviations & Acronyms

AEP	Annual Exceedance Probability	mAOD	Metres Above Ordnance Datum
BGL	Below Ground Level	NGR	National Grid Reference
BGS	British Geological Survey	NPPF	National Planning Policy Framework
CC	Climate Change	NSRI	National Soil Resources Institute
EA	Environment Agency	OS	Ordnance Survey
FEH	Flood Estimation Handbook	PFRA	Preliminary Flood Risk Assessment
FRA	Flood Risk Assessment	PPS	Planning Policy Statement
FZ	Flood Zone	QSE	Quick Storage Estimate
Ha	Hectare	QBAR	Mean Annual Flood
IDB	Internal Drainage Board	SFRA	Strategic Flood Risk Assessment
LLFA	Lead Local Flood Authority	SuDS	Sustainable Drainage Systems
LPA	Local Planning Authority	UU	United Utilities

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## **1.0 INTRODUCTION**

- 1.1.1 The impact of flooding on the natural and built environment are material planning considerations. The NPPF sets out the Government's objectives for the planning system, how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change. Government policy with respect to development in flood risk areas is contained within the NPPF and the supporting Technical Guidance.
- 1.1.2 The NPPF requires a FRA for sites greater than 1 ha. The proposals are 'residential' in nature, classified as 'more vulnerable' in Table 2 within the Technical Guidance to the NPPF. This type of development is appropriate in Flood Zone 1.
- 1.1.3 The development proposal was granted outline planning application (N<sup>o</sup> 3/2014/0764) on the 29<sup>th</sup> October 2015. This FRA has built upon the FRA submitted with the application completed by RSK (March 2015, Ref: 880500-R1).
- 1.1.4 The NPPF advises that the LPA should consult with the EA for advice on flood issues at a strategic level and in relation to planning applications.

## **2.0 EXISTING SITE LOCATION**

### **2.1 Location**

- 2.1.1 The site is located on land off Chipping Lane, Longridge, PR3 2NA. The OS NGR is 360073E, 437980N.
- 2.1.2 The site is surrounded by greenfield land to the north, east and west and by residential areas to the south. Chipping Lane forms the western site boundary.

### **2.2 Existing and Historical Land Use**

- 2.2.1 The site is currently classed as greenfield. No other land uses have been identified as part of this report.

### **2.3 Topography**

- 2.3.1 The site slopes in a north-westerly direction with levels ranging from around 121m AOD near the eastern border to 102m AOD in the north-west.

### 3.0 DEVELOPMENT PROPOSALS

#### 3.1 Nature of the development




3.1.1 The nature of the development is residential and comprises of residential units associated infrastructure. A copy of the development layout for Phase I is included in Appendix A.

### 4.0 SOURCES OF FLOOD RISK

#### 4.1 Fluvial Flood Risk

4.1.1 The flood risk of the site has been assessed using EA online Flood Maps.



-  Flood Zone 1 – Low Risk (<0.1%)
-  Flood Zone 2 – Medium Risk (1% – 0.1% fluvial, 0.5% – 0.1% tidal)
-  Flood Zone 3 – High Risk (>1% fluvial, >0.5% tidal)

**Figure 1:** EA Flood Map for Planning (Rivers and Sea).

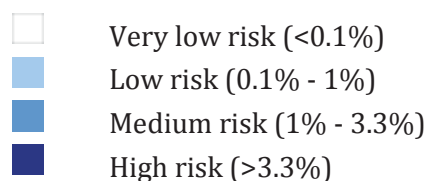
4.1.2 Figure 1 shows that the site is within Flood Zone 1, which would indicate a **low risk** from fluvial flooding.

#### 4.2 Tidal Flooding

4.2.1 As there is no coastline or tidal river near to the site, tidal flood risk is deemed **low**.

### 4.3 Pluvial Flood Risk

- 4.3.1 Pluvial (surface water) flooding occurs when rainwater is unable to drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.
- 4.3.2 Pluvial flood risk as indicated by the EA map (Figure 2) shows that the site is predominantly at **very low** to **low** risk.






**Figure 2:** The EA's Indicative Surface Water Flood Risk Map.

- 4.3.3 There are some areas of low to medium risk that appear to follow the direction of overland flow. There is a singular area of medium to high risk located centrally to the site that is indicative of a topographic low point.
- 4.3.4 The development proposals, although increasing the impermeable area of the site, will provide a betterment on the pre-existing scenario in that any exceedance flows for storm events up to and including the 100 year event plus 30% climate change, will be attenuated on-site prior to a restricted outfall.
- 4.3.5 Finished floor levels will be raised at least 150mm above the external levels and external areas of hardstanding will comply with building regulations and divert water away from the proposed dwellings. This will further mitigate pluvial flood risk.
- 4.3.6 Therefore the pluvial flood risk to the development is overall considered to be **low**.

## 4.4 Sewer Related Flood Risk

- 4.4.1 Rainwater is sometimes drained into combined sewers. Foul water flooding can occur in areas prone to overland flow when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away. It can also occur when the sewer becomes blocked or is of inadequate capacity, this could lead to there being a high risk of internal property flooding with contaminated water.
- 4.4.2 United Utilities records indicate that there is a 375mm diameter surface water pipe from the eastern site boundary which cuts through the site before outfalling to Higgin Brook near the centre of the site. A 3m easement will apply from this SWS in accordance with UU guidelines.
- 4.4.3 New sewers will be designed and constructed in accordance with Sewers for Adoption and put up for adoption by United Utilities as part of the detailed design (stc).
- 4.4.4 Flood Risk from sewer related sources is considered to be **low**. See Appendix B for UU sewer records.

## 4.5 Groundwater Flood Risk

- 4.5.1 In general terms groundwater flooding can occur from three main sources: - raised water tables, seepage and percolation and groundwater recovery or rebound.
-  If groundwater levels are naturally close to the surface then this can present a flood risk during times of intense rainfall.
  -  Seepage and percolation occur where embankments above ground level hold water. In these cases water travels through the embankment material and emerges on the opposite side of the embankment.
  -  Groundwater recovery/rebound occurs where the water table has been artificially depressed by abstraction. When the abstraction stops the water table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level.
- 4.5.2 The online BGS maps show that the underlying geology consists of the Bowland Shale Formation, whilst the Soilscales online Map indicates that the soil has impeded drainage. The presence of surface water flood lines in the direction of overland flow in Figure 2 is also indicative of the presence of poorly permeable underlying clay soils.
- 4.5.3 Groundwater flood risk is therefore considered to be **'low'**, this will be further mitigated by the increase in Finished Floor Levels by at least 150mm above existing external levels.

## 4.6 Artificial Sources of Flood Risk

4.6.1 The site is partially at risk of flooding from the 'Dilworth Upper' reservoir, yet the risk designation is yet 'to be determined' according to the EA online maps and information. Reservoir flooding is extremely rare, therefore the flood risk from artificial sources is deemed **low**.

## 4.7 Flood Risk Mitigation Measures & Residual Risks

4.7.1 Finished Floor Levels will be a minimum of 150mm above the external levels (following any re-grade). External levels within proximity will fall away from proposed dwellings in accordance with building regulations.

4.7.2 Surface water run-off rates will be restricted through the use of vortex flow control devices. The increased volume of run-off for storms greater than the 30 year event can be mitigated through the use of SuDS (evapotranspiration/bio-retention/rainwater re-use).

4.7.3 The development is considered accessible during the extreme storm events as the site is within Flood Zone 1.

## 5.0 SURFACE WATER MANAGEMENT

### 5.1 Pre-Development Surface Water Run-off

5.1.1 The previous FRA completed by RSK (March 2015, Ref: 880500-R1) proposed that run-off rates will be restricted to QBar. In this report, QBar is calculated as 8.3 l/s/ha. See Appendix C for Hydrological Calculations. Any discrepancy between this QBar and the previous figure is due to refined FEH catchment characteristics being utilised within the ICP SuDS method.

5.1.2 The pre-development (greenfield) runoff rates are shown in Table 1. The ICP SuDS method was utilised using FEH catchment characteristics.

Storm Event	Greenfield Rate (l/s/ha)
Q1 year	7.2
QBar	8.3
Q30 years	14.0
Q100 years	17.2

Table 1: Greenfield Run-off Rates (ICP SuDS)

### 5.2 Post-Development Surface Water Run-off

5.2.1 The impermeable area will increase as a result of the development and increased run-off rates will be restricted to QBar (l/s/ha) thereby providing **significant betterment** to the downstream catchment for all storm events greater than the average annual event.

- 5.2.2 Rates will be restricted through the use of a vortex flow control device. Increased run-off volumes for storms greater than the 30 year event can be reduced through the use of SuDS (evapotranspiration/bio-retention/rainwater reuse).
- 5.2.3 Storm-water storage volumes will be attenuated on-site prior to outfall. Table 2 indicates the estimated volumes of storm-water storage that will be required if flows are restricted to variable discharge rates.
- 5.2.4 The impermeable area is estimated to be 60% of the total site area. This is a conservative estimation that considers gardens, permeable driveways and landscaped areas.

Storm Event	Storage Estimate (m <sup>3</sup> /ha)
Q1 year	32 - 73
QBar (~ 2.3 years)	45 - 96
Q30 years	141 - 249
Q100 years + cc	327 - 507

**Table 2:** Quick Storage Estimates

- 5.2.5 Hydrological Calculations are included within Appendix C. The above figures are estimates only and will be recalculated during detailed design.

### 5.3 Sustainable Drainage Systems (SuDS)

- 5.3.1 In accordance with the NPPF, SuDS should be used wherever possible to manage surface water and reduce the impact on downstream watercourses and sewers.
- 5.3.2 SuDS have the ability to address four core objectives; water quantity, water quality, amenity and biodiversity. With the appropriate system specified, all four core objectives can be satisfied. Where possible, peak surface water discharge rates to watercourses and sewers should be reduced.
- 5.3.3 Preference should always be given to practical SuDS over conventional pipe systems. Opportunities should be taken to provide soft landscaping on site to minimise surface water run-off, improve bio-diversity and increase visual enhancement.
- 5.3.4 The ground investigation report carried out by Soiltechnics (Feb 2016, Ref: STN3505NM-G01) indicates that infiltration is **not viable** at this site.
- 5.3.5 There is potential to utilise SuDS on this site, with large areas of POS provided within the layout at the lowest points of the site. Due to the level gradient of the site, shallow SuDS would be preferable to systems such as deep ponds or detention basins. Suitable SuDS would include the use of swales and bio-retention areas.

- 5.3.7 It is important that SuDS is seen as a multi-use commodity, and that areas that benefit from SuDS, and the additional environmental and aesthetic enhancement they can bring if designed properly, are open to the public.

## 5.4 Methods of Surface Water Management

- 5.4.1 There are three methods that have been reviewed for the management and discharge of surface water detailed below; these may be applied individually or collectively to form a complete strategy. They should be applied in the order of priority listed below.
- 5.4.2 **Discharge via Infiltration** - The ground investigation report carried out by Soiltechnics (Feb 2016, Ref: STN3505NM-G01) indicates that infiltration is **not viable** at this site.
- 5.4.3 **Discharge to Watercourse** – There are several on-site watercourses which the site currently drains to. These are designated ‘ordinary watercourses’ and ordinary watercourse consent should be applied for with Lancashire County Council prior to any on-site works. As the watercourses are not designated as ‘Main River’, a 3-5m easement is considered appropriate.
- 5.4.4 **Discharge to Public Sewer** – Surface water will not outfall to a public sewer.

## 5.5 Climate Change

- 5.5.1 The UK climate is changing significantly will vary greatly by region with more short duration and high intensity rainfall events as well as more periods of long duration rainfall.
- 5.5.2 The NPPF Technical Guidance states that the recommended national precautionary sensitivity ranges for increase of peak rainfall intensity is 30% until 2115. The impact of climate change means there is likely to be a long term increase in average sea levels.
- 5.5.3 An increase in flood water levels means that flooding events will occur more frequently and have a greater impact. Any increase flood risk to the site from climate change is likely to be related to the increase in rainfall intensity and duration.
- 5.5.4 An additional 30% to accommodate climate change will be incorporated into the design of the stormwater storage attenuation.

## 5.6 Foul Water Management

- 5.6.1 The nearest public foul sewers are located within Inglewhite Road to the south-east of the site. The conveyance route of foul flows will be determined during detailed design. A pumped solution will likely be required and early liaisons with UU regarding adoptable pump design are recommended. Sewers will be designed and constructed in accordance with Sewers for Adoption.

## 6.0 SUMMARY

### 6.1 Conclusion and Recommendations

- 6.1.1 This report has been prepared for a development proposal of residential dwellings and associated infrastructure. The site lies within Flood Zone 1. The residential proposals are classified as 'more vulnerable'. This type of development is considered to be appropriate in accordance with the NPPF.
- 6.1.2 The report has indicated that the site is at **low** risk of flooding from fluvial, tidal, sewer related and artificial sources. There is some medium indicative risk of pluvial flooding which will be reduced and mitigated by the implementation of the development proposal. Flood risk to the surrounding area as a result of the development will be significantly reduced due to the restriction of proposed run-off rates to mimic the existing rate for the average annual event (QBar).
- 6.1.3 Attenuation will be provided on-site for storm events up to and including the 1 in 100 year event + 30% climate change.
- 6.1.4 Any residual or unforeseen flood risk to the proposed development will be further mitigated by raising finished floor levels to at least 150mm above external levels. External levels will fall away from dwellings in accordance with Building Regulations.
- 6.1.5 Applications for sewer adoption will be discussed and submitted during detailed design.



## **BIBLIOGRAPHY & REFERENCES**

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- CIRIA 522: Sustainable urban drainage systems – design manual for England and Wales (2000).  
CIRIA 523: Sustainable urban drainage systems – best practice manual (2001).  
CIRIA 609: Sustainable drainage systems. Hydraulic, structural and water quality advice (2004).  
CIRIA 624: Development and flood risk – guidance for the construction industry (2004).  
CIRIA 635: Designing for Exceedance in urban drainage: Good practice (2006).  
CIRIA 644: Building Greener (2007).  
CIRIA 753: The SUDS manual (2015).  
Flood Risk to People – Phase 2 (FD2321/TR2), DEFRA and the Environment Agency (2006).  
Flood estimation for small catchments: Institute of Hydrology Report No.124, NERC (1994).  
Flood Estimation Handbook, Centre for Ecology and Hydrology (1999).  
Planning Policy Statement 25: Development and Flood Risk (2006).  
Sewers for Adoption 7th Edition, WRc (2012).  
Technical Guidance to the National Planning Policy Framework, CLG (2012).

### **Web-based References**

- Bingmaps – [www.bing.com/Maps](http://www.bing.com/Maps)  
British Geological Survey – [www.bgs.ac.uk/opengeoscience/home.html](http://www.bgs.ac.uk/opengeoscience/home.html)  
CIRIA – [www.ciria.org](http://www.ciria.org)  
Cranfield University – [www.landis.org.uk/soilscapes](http://www.landis.org.uk/soilscapes)  
Environment Agency – [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)  
Flood Forum – [www.floodforum.org.uk](http://www.floodforum.org.uk)  
Google Maps – [www.maps.google.co.uk](http://www.maps.google.co.uk)  
Streetmap – [www.streetmap.co.uk](http://www.streetmap.co.uk)

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## Appendix A: Site Plans

Identifier	Descriptor
Betts Associates Ltd	Location Plan
Barratt Homes	Proposed Planning Layout (Phase I)
Betts Associates Ltd	Indicative Drainage Strategy

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## LOCATION PLAN



OS X (Easting) 360073

OS Y (Northing) 437980

Nearest Post Code PR3 2NA

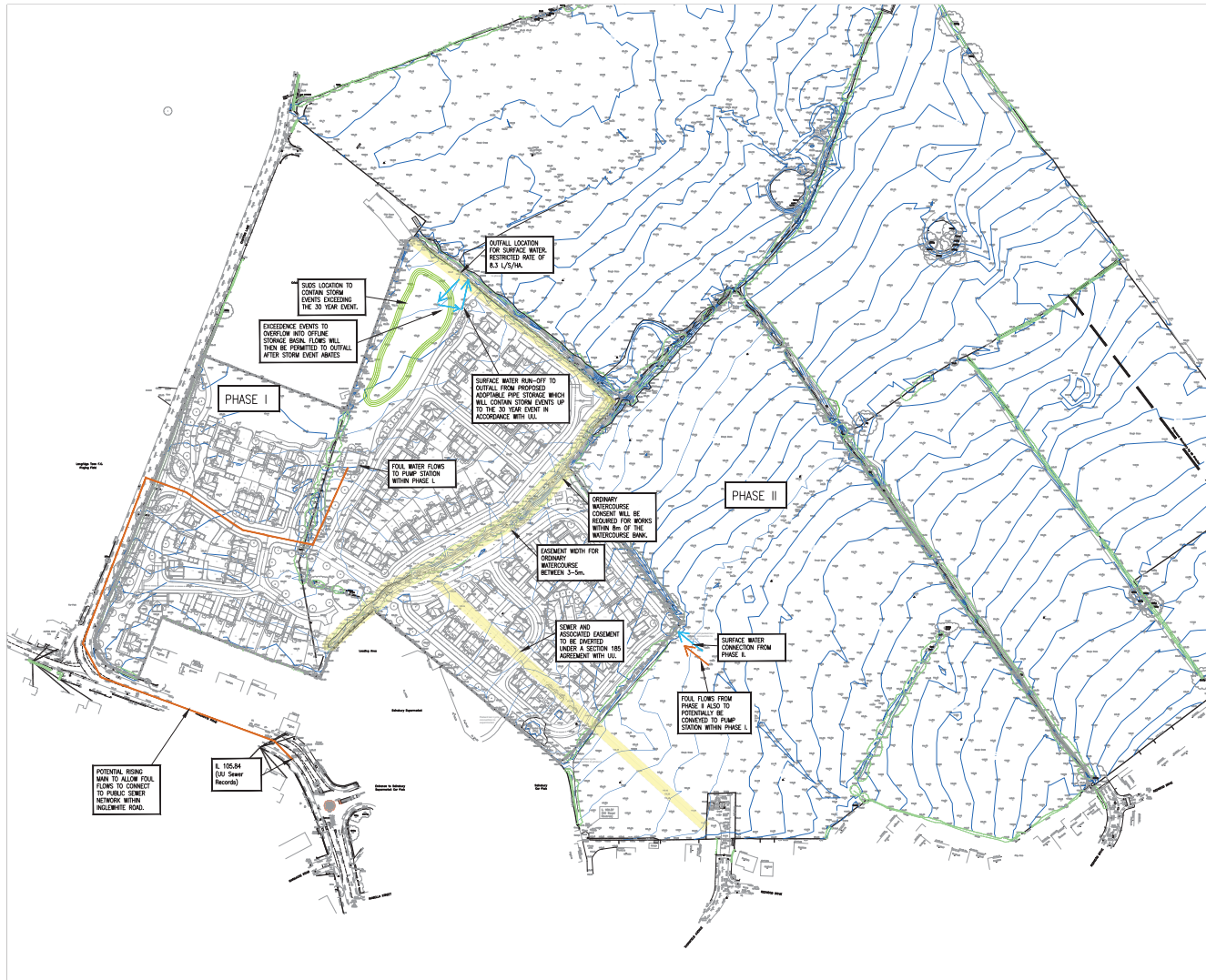
Lat (WGS84) N53:50:12 (53.836529)

Long (WGS84) W2:36:30 (-2.608205)

Lat,Long 53.836529,-2.608205

Nat Grid SD600379 / SD6007337980

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**DO NOT SCALE**

**KEY**

- INDICATIVE SURFACE WATER CONVEYANCE ROUTE
- INDICATIVE FOUL WATER CONVEYANCE ROUTE
- INDICATIVE SLUDGE POTENTIAL
- WATERCOURSE/SEWER EASEMENT

REV	DATE	BY	DESCRIPTION	CHK
A	03.03.16	HPJ	PRELIMINARY ISSUE FOR REVIEW	RCH
<b>INDICATIVE</b>				
 <small>Dr. Hugh Tomlinson, Water &amp; Soil, Ipswich, Suffolk, UK        Tel: 01473 251515        www.bettshydric.co.uk</small>				
<b>CHIPPING LANE LONGRIDGE</b>				
<b>INDICATIVE DRAINAGE STRATEGY</b>				
DATE	DRAWN BY	CHECKED BY	SCALE	PROJECT
MARCH 16	HPJ	HPJ	1:1000 @ A1	HYD068
REV	DATE	BY	DESCRIPTION	CHK

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**WARNING TO HOUSE PURCHASERS**  
 The information contained in this document is for general information only and does not constitute an offer of any financial product. It is intended to provide a general overview of the proposed development and is not intended to be relied upon as a basis for investment decisions. The information is subject to change without notice and is not intended to be a contract. For more information, please contact your solicitor or the developer.

**GENERAL INFORMATION**

Item	Value
Plot Area	10,000 sqm
Plot Depth	100m
Plot Width	100m
Plot Length	100m
Plot Area	10,000 sqm
Plot Depth	100m
Plot Width	100m
Plot Length	100m

**GENERAL INFORMATION**

Item	Value
Plot Area	10,000 sqm
Plot Depth	100m
Plot Width	100m
Plot Length	100m
Plot Area	10,000 sqm
Plot Depth	100m
Plot Width	100m
Plot Length	100m

**BARRATT HOMES MANCHESTER**  
 14 AVONDALE ROAD, MANCHESTER, M13 9PL  
 TEL: 0161 872 1818  
 FAX: 0161 872 1819

**COMPASS**  
 THE PHASE PLANNING LAYOUT



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## Appendix B: Sewer Records

Identifier	Descriptor
United Utilities	Sewer Records

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Printed By: Property Searches

Sheet No: SD6037NE

Scale: 1:1250 Date: 10/11/2015

Station	Depth	Flow	Notes
1+00	0.05	1.0	
1+25	0.10	2.0	
1+50	0.15	3.0	
1+75	0.20	4.0	
2+00	0.25	5.0	
2+25	0.30	6.0	
2+50	0.35	7.0	
2+75	0.40	8.0	
3+00	0.45	9.0	
3+25	0.50	10.0	
3+50	0.55	11.0	
3+75	0.60	12.0	
4+00	0.65	13.0	
4+25	0.70	14.0	
4+50	0.75	15.0	
4+75	0.80	16.0	
5+00	0.85	17.0	
5+25	0.90	18.0	
5+50	0.95	19.0	
5+75	1.00	20.0	
6+00	1.05	21.0	
6+25	1.10	22.0	
6+50	1.15	23.0	
6+75	1.20	24.0	
7+00	1.25	25.0	
7+25	1.30	26.0	
7+50	1.35	27.0	
7+75	1.40	28.0	
8+00	1.45	29.0	
8+25	1.50	30.0	
8+50	1.55	31.0	
8+75	1.60	32.0	
9+00	1.65	33.0	
9+25	1.70	34.0	
9+50	1.75	35.0	
9+75	1.80	36.0	
10+00	1.85	37.0	
10+25	1.90	38.0	
10+50	1.95	39.0	
10+75	2.00	40.0	

**MANHOLE SYMBOLS**

Symbol	Material	Notes
[Symbol]	Cast Iron	
[Symbol]	Concrete	
[Symbol]	Steel	
[Symbol]	Aluminum	
[Symbol]	Other	

**SEWER LINE SYMBOLS**

Symbol	Material	Notes
[Symbol]	Cast Iron	
[Symbol]	Concrete	
[Symbol]	Steel	
[Symbol]	Aluminum	
[Symbol]	Other	

**LEGEND**

Symbol	Description
[Symbol]	Manhole
[Symbol]	Sewer Line
[Symbol]	Storm Line
[Symbol]	Water Line
[Symbol]	Gas Line
[Symbol]	Electric Line
[Symbol]	Other Utility

OS Sheet No: SD6037NE  
 Scale: 1:1250 Date: 10/11/2015  
 108 Notes  
 Sheet 1 of 1

**United Utilities**  
 Sewer Records



OS Sheet No: SD6037NW

Printed By: Property Searches

Scale: 1:1250 Date: 10/11/2015

Stationing	Description	Notes
1+00.00	Start of Sewer Line	
1+05.00	Manhole 1	
1+10.00	Manhole 2	
1+15.00	Manhole 3	
1+20.00	Manhole 4	
1+25.00	Manhole 5	
1+30.00	Manhole 6	
1+35.00	Manhole 7	
1+40.00	Manhole 8	
1+45.00	Manhole 9	
1+50.00	Manhole 10	
1+55.00	Manhole 11	
1+60.00	Manhole 12	
1+65.00	Manhole 13	
1+70.00	Manhole 14	
1+75.00	Manhole 15	
1+80.00	Manhole 16	
1+85.00	Manhole 17	
1+90.00	Manhole 18	
1+95.00	Manhole 19	
2+00.00	End of Sewer Line	

**NOTES WITH SYMBOLS**

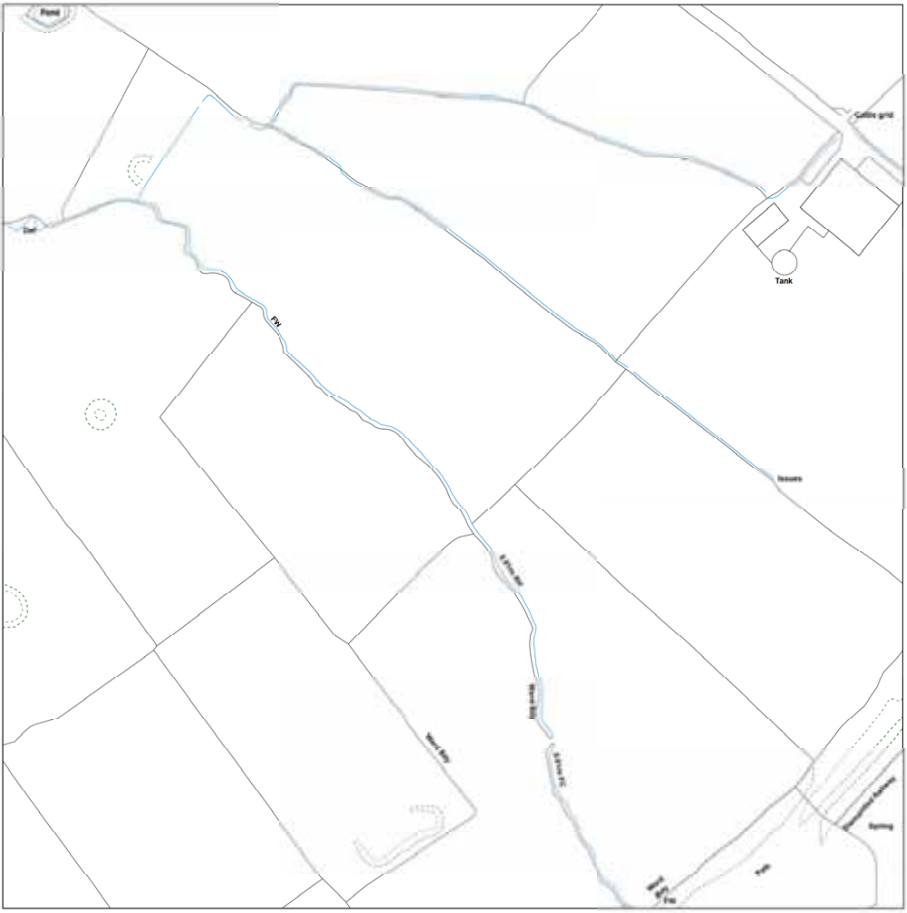
Symbol	Color	Description
[Red Line]	Red	Proposed Sewer Line
[Blue Line]	Blue	Existing Sewer Line
[Green Line]	Green	Proposed Stormwater Line
[Yellow Line]	Yellow	Proposed Gas Line
[Black Line]	Black	Proposed Water Line
[Grey Line]	Grey	Proposed Electric Line
[Red Circle]	Red	Proposed Manhole
[Blue Circle]	Blue	Existing Manhole
[Green Circle]	Green	Proposed Stormwater Manhole
[Yellow Circle]	Yellow	Proposed Gas Manhole
[Black Circle]	Black	Proposed Water Manhole
[Grey Circle]	Grey	Proposed Electric Manhole

**LEGEND**

Symbol	Description
[Red Line]	Proposed Sewer Line
[Blue Line]	Existing Sewer Line
[Green Line]	Proposed Stormwater Line
[Yellow Line]	Proposed Gas Line
[Black Line]	Proposed Water Line
[Grey Line]	Proposed Electric Line
[Red Circle]	Proposed Manhole
[Blue Circle]	Existing Manhole
[Green Circle]	Proposed Stormwater Manhole
[Yellow Circle]	Proposed Gas Manhole
[Black Circle]	Proposed Water Manhole
[Grey Circle]	Proposed Electric Manhole

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 Scale: 1:1250 Date: 10/11/2015  
 Sheet 1 of 1

**United Utilities**  
 Sewer Records



**MADE WITH PROLOG**

Code	Symbol	Description	Symbol	Description
100	[Symbol]	Manhole	100	Manhole
101	[Symbol]	Manhole	101	Manhole
102	[Symbol]	Manhole	102	Manhole
103	[Symbol]	Manhole	103	Manhole
104	[Symbol]	Manhole	104	Manhole
105	[Symbol]	Manhole	105	Manhole
106	[Symbol]	Manhole	106	Manhole
107	[Symbol]	Manhole	107	Manhole
108	[Symbol]	Manhole	108	Manhole
109	[Symbol]	Manhole	109	Manhole
110	[Symbol]	Manhole	110	Manhole
111	[Symbol]	Manhole	111	Manhole
112	[Symbol]	Manhole	112	Manhole
113	[Symbol]	Manhole	113	Manhole
114	[Symbol]	Manhole	114	Manhole
115	[Symbol]	Manhole	115	Manhole
116	[Symbol]	Manhole	116	Manhole
117	[Symbol]	Manhole	117	Manhole
118	[Symbol]	Manhole	118	Manhole
119	[Symbol]	Manhole	119	Manhole
120	[Symbol]	Manhole	120	Manhole
121	[Symbol]	Manhole	121	Manhole
122	[Symbol]	Manhole	122	Manhole
123	[Symbol]	Manhole	123	Manhole
124	[Symbol]	Manhole	124	Manhole
125	[Symbol]	Manhole	125	Manhole
126	[Symbol]	Manhole	126	Manhole
127	[Symbol]	Manhole	127	Manhole
128	[Symbol]	Manhole	128	Manhole
129	[Symbol]	Manhole	129	Manhole
130	[Symbol]	Manhole	130	Manhole
131	[Symbol]	Manhole	131	Manhole
132	[Symbol]	Manhole	132	Manhole
133	[Symbol]	Manhole	133	Manhole
134	[Symbol]	Manhole	134	Manhole
135	[Symbol]	Manhole	135	Manhole
136	[Symbol]	Manhole	136	Manhole
137	[Symbol]	Manhole	137	Manhole
138	[Symbol]	Manhole	138	Manhole
139	[Symbol]	Manhole	139	Manhole
140	[Symbol]	Manhole	140	Manhole
141	[Symbol]	Manhole	141	Manhole
142	[Symbol]	Manhole	142	Manhole
143	[Symbol]	Manhole	143	Manhole
144	[Symbol]	Manhole	144	Manhole
145	[Symbol]	Manhole	145	Manhole
146	[Symbol]	Manhole	146	Manhole
147	[Symbol]	Manhole	147	Manhole
148	[Symbol]	Manhole	148	Manhole
149	[Symbol]	Manhole	149	Manhole
150	[Symbol]	Manhole	150	Manhole
151	[Symbol]	Manhole	151	Manhole
152	[Symbol]	Manhole	152	Manhole
153	[Symbol]	Manhole	153	Manhole
154	[Symbol]	Manhole	154	Manhole
155	[Symbol]	Manhole	155	Manhole
156	[Symbol]	Manhole	156	Manhole
157	[Symbol]	Manhole	157	Manhole
158	[Symbol]	Manhole	158	Manhole
159	[Symbol]	Manhole	159	Manhole
160	[Symbol]	Manhole	160	Manhole
161	[Symbol]	Manhole	161	Manhole
162	[Symbol]	Manhole	162	Manhole
163	[Symbol]	Manhole	163	Manhole
164	[Symbol]	Manhole	164	Manhole
165	[Symbol]	Manhole	165	Manhole
166	[Symbol]	Manhole	166	Manhole
167	[Symbol]	Manhole	167	Manhole
168	[Symbol]	Manhole	168	Manhole
169	[Symbol]	Manhole	169	Manhole
170	[Symbol]	Manhole	170	Manhole
171	[Symbol]	Manhole	171	Manhole
172	[Symbol]	Manhole	172	Manhole
173	[Symbol]	Manhole	173	Manhole
174	[Symbol]	Manhole	174	Manhole
175	[Symbol]	Manhole	175	Manhole
176	[Symbol]	Manhole	176	Manhole
177	[Symbol]	Manhole	177	Manhole
178	[Symbol]	Manhole	178	Manhole
179	[Symbol]	Manhole	179	Manhole
180	[Symbol]	Manhole	180	Manhole
181	[Symbol]	Manhole	181	Manhole
182	[Symbol]	Manhole	182	Manhole
183	[Symbol]	Manhole	183	Manhole
184	[Symbol]	Manhole	184	Manhole
185	[Symbol]	Manhole	185	Manhole
186	[Symbol]	Manhole	186	Manhole
187	[Symbol]	Manhole	187	Manhole
188	[Symbol]	Manhole	188	Manhole
189	[Symbol]	Manhole	189	Manhole
190	[Symbol]	Manhole	190	Manhole
191	[Symbol]	Manhole	191	Manhole
192	[Symbol]	Manhole	192	Manhole
193	[Symbol]	Manhole	193	Manhole
194	[Symbol]	Manhole	194	Manhole
195	[Symbol]	Manhole	195	Manhole
196	[Symbol]	Manhole	196	Manhole
197	[Symbol]	Manhole	197	Manhole
198	[Symbol]	Manhole	198	Manhole
199	[Symbol]	Manhole	199	Manhole
200	[Symbol]	Manhole	200	Manhole

**LEGEND**

**MANHOLE TYPES**

100 Manhole  
101 Manhole  
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**OTHER SYMBOLS**

101 Manhole  
102 Manhole  
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**SEWER RECORDS**



**MADE WITH SYMBOLS**

Symbol	Color	Material	Symbol	Material
[Symbol]	[Color]	Asphalt	[Symbol]	Concrete
[Symbol]	[Color]	Concrete	[Symbol]	Gravel
[Symbol]	[Color]	Gravel	[Symbol]	Soil
[Symbol]	[Color]	Soil	[Symbol]	Water
[Symbol]	[Color]	Water	[Symbol]	Waste
[Symbol]	[Color]	Waste	[Symbol]	Other

**SYMBOLS**

Symbol	Description
[Symbol]	Manhole
[Symbol]	Structure
[Symbol]	Boundary
[Symbol]	Other

**LEGEND**

Symbol	Description
[Symbol]	Manhole
[Symbol]	Structure
[Symbol]	Boundary
[Symbol]	Other

Printed By: Property Searches  
 Scale: 1:1250 Date: 10/11/2015

OS Sheet No: SD60385W  
 Scale: 1:1250 Date: 10/11/2015  
 Notes: Sheet 1 of 1


**SEWER RECORDS**



## Appendix C: Hydrological Calculations

Identifier	Descriptor
Betts Associates Ltd	ICP SuDS Greenfield Runoff Rates
Betts Associates Ltd	FEH Catchment Characteristics

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Betts Associates Ltd		Page 1
Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY		
Date 03/03/2016 10:24 File	Designed by heatherjones Checked by	
Micro Drainage	Source Control 2014.1.1	

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	1.000	Urban	0.000
SAAR (mm)	1200	Region Number	Region 10

**Results    l/s**

QBAR Rural	8.3
QBAR Urban	8.3

Q1 year    7.2

Q1 year	7.2
Q30 years	14.0
Q100 years	17.2

VERSION	FEH CD-RO Version	3 exported a	16:20:35 GMT	Mon	08-Feb-16
CATCHMEN GB	360150	438450	SD 60150	38450	
AREA	0.52				
ALTBAR	115				
ASPBAR	325				
ASPVAR	0.65				
BFIHOST	0.417				
DPLBAR	0.77				
DPSBAR	22.3				
FARL	1				
LDP	1.58				
PROPWET	0.51				
RMED-1H	10.5				
RMED-1D	39.7				
RMED-2D	51.6				
SAAR	1200				
SAAR4170	1137				
SPRHOST	35.03				
URBCONC1	0.964				
URBEXT19C	0.1643				
URBLOC19A	1.515				
C	-0.025				
D1	0.40671				
D2	0.33211				
D3	0.41529				
E	0.29629				
F	2.45864				
C(1 km)	-0.025				
D1(1 km)	0.404				
D2(1 km)	0.33				
D3(1 km)	0.417				
E(1 km)	0.296				
F(1 km)	2.453				

## Appendix D: Notes of Limitations

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

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