FRA for land at Benthams Way

2015s3315 - FINAL Report

October 2015

Sefton Council
Magdalen House
30 Trinity Road
Bootle
Merseyside
L20 3NJ

JBA Project Manager

Howard Keeble
JBA Consulting
Bank Quay House
Sankey Street
Warrington
WA1 1NN

Revision History

Revision Ref / Date Issued	Amendments	Issued to
DRAFT Report / 22 October 2015		**Andrea O'Connor**
FINAL Report / 28 October 2015	Following client review	**Andrea O'Connor**

Contract

This report describes work commissioned by Stuart Bate, on behalf of Sefton Council, by a letter dated 21 September 2015. Sefton Council's representative for the contract was Andrea O'Connor. Ed Blackburn and Howard Keeble of JBA Consulting carried out this work.

Prepared by ..... Edward Blackburn BSc
Senior Analyst

Reviewed by ..... Howard Keeble MPhil BEng BSc CertBusStud CEng CEnv CSci MICE MCIWEM C.WEM
Principal Engineer

Purpose

This document has been prepared as a Final Report for Sefton Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Sefton Council.

Copyright

Carbon Footprint

A printed copy of the main text in this document will result in a carbon footprint of 107g if 100% post-consumer recycled paper is used and 136g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

Contents

List of Figures

List of Tables

Abbreviations

AEP	Annual Exceedance Probability
ARFQ	Advanced Request for Quotation
AStGWF	Areas Susceptible to Ground Water Flooding
AStSWF	Areas Susceptible to Surface Water Flooding
CDA	Critical Drainage Area
EA	Environment Agency
FEH	Flood Estimation Handbook
FFL	Finished Floor Level
FRA	Flood Risk Assessment
IH	Institute of Hydrology
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
uFMfSW	updated Flood Map for Surface Water
UU	United Utilities

Definitions

Flood Zones

The following table is a reproduction of Table 1 of the Planning Practice Guidance[1]. These refer to the probability of river and sea flooding (disregarding sea defences) as shown on the EA Flood Map for Planning (Rivers and Sea).

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

[1] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-1-flood-zones/

1 Introduction

1.1 Overview

This report has been prepared in response to task (i) of Sefton Council's Advanced Request for Quotation (ARFQ) (Contract Number 9ZQD-D30FN5) which requires the following:

- Undertake a Site Flood Risk Assessment (FRA) for land adjacent to Dobbies Garden Centre, Benthams Way, Southport, which is a proposed housing allocation in the draft Local Plan.

The proposed allocation site for approximately 215 dwellings covers an area of approximately 8.7 ha and is located entirely within Flood Zone 1. The site is at risk from surface water flooding and is crossed by three Ordinary Watercourses which join Fine Jane's Brook to the south of Benthams Way. Available surface water mapping indicates that up to 51% of the site area should not be developed due to the risk of surface water flooding at this location.

The proposed development is considered appropriate in this flood zone in accordance with National Planning Policy Framework (NPPF). However, NPPF further states that any proposals of 1 ha or greater in Flood Zone 1 require a site specific FRA to assess surface water issues.

1.2 Information provided

The following information, from Sefton Council's Strategic Flood Risk Assessment (SFRA) and Surface Water Management Plan (SWMP), has been provided:

- EA Flood Zone Mapping
- EA Modelled Flood Levels
- Areas Susceptible to Ground Water Flooding
- Areas Susceptible to Surface Water Flooding
- updated Flood Map for Surface Water
- LiDAR
- SWMP Surface Water Flood Mapping

1.3 Scope of FRA

The assessment of flood risk is based on flood and hazard mapping products provided by Sefton Council and includes consideration of safe access and egress in times of flood. Owing to tight timescales for this study, direct consultation with the Environment Agency (EA) and United Utilities (UU) has not been possible.

In accordance with the ARFQ this FRA determines what proportion of the site should remain undeveloped due to flood risk issues.

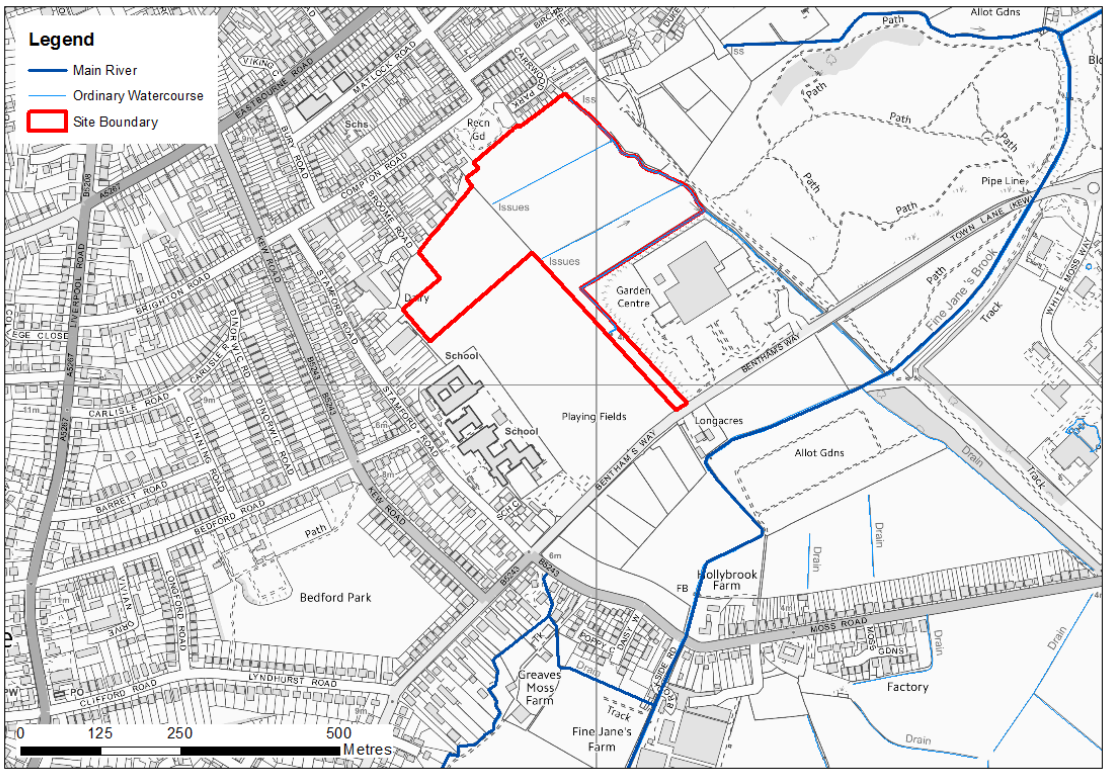
It should be noted that no site investigation or contaminated land results are available at this initial stage. This assessment has therefore been prepared in order to quantify likely attenuation volumes required onsite to ensure that development of the proposed housing allocation site does not increase flood risk elsewhere. It should also be noted that this assessment does not include consideration of contamination issues, detailed ecological issues, detailed drainage or the design of Sustainable Drainage Systems (SuDS), although these and wider issues would need to be considered at the planning application stage.

2 Development description and location

The proposed housing allocation is for approximately 215 dwellings on land adjacent to Dobbies Garden Centre on Benthams Way, Southport (Figure 2-1). Interrogation of OS mapping indicates that the allocation site covers an area of approximately 8.7 ha of Greenfield land. The site is bounded by housing to the north and northwest, playing fields and Christ the King Catholic High School to the southwest, Dobbies Garden Centre to the southeast and open ground to the northeast. Access is likely to be from Benthams Way via the narrow strip of land adjacent to Dobbies Garden Centre.

Three Ordinary Watercourses cross the main part of the allocation site in a north easterly direction and form a tributary of Fine Jane's Brook along the eastern boundary of Dobbies Garden Centre before joining the Main River to the south of Benthams Way.

Figure 2-1 Site location



The site visit of 30 September 2015 identified that the Ordinary Watercourse running along the eastern boundary of Dobbies Garden Centre is poorly maintained (Figures 2-2 and 2-3 below).

Figure 2-2 Ordinary Watercourse looking downstream

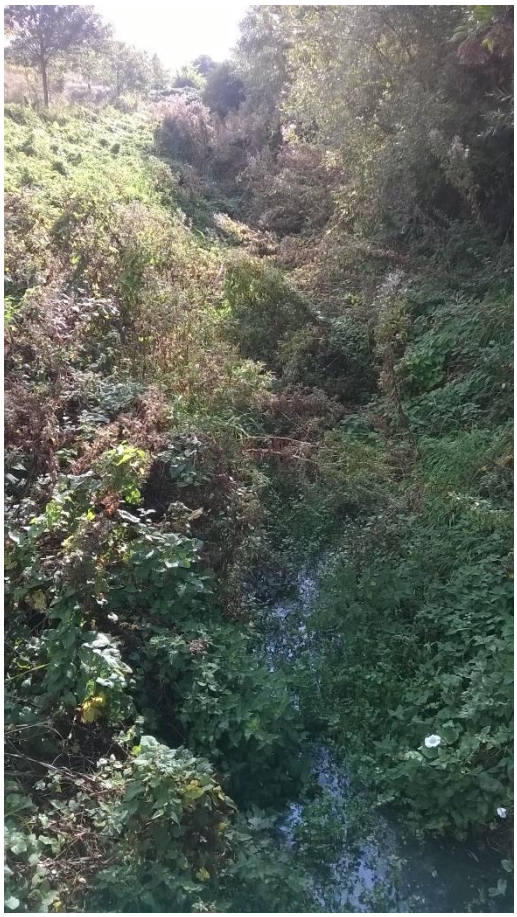


Figure 2-3 Ordinary Watercourse looking upstream

Photographs taken on site visit of 30 September 2015

There are no layout plans for the proposed housing development, however the proposed allocation is for approximately 215 dwellings. As no development plans are available at this stage it is assumed that development of the site for housing will result in the introduction of impermeable areas covering 60% of the developable area. The area available for development is dependent on flood risk issues and is discussed in subsequent sections of this report.

In accordance with NPPF Planning Practice Guidance (PPG) Table 2[2], the flood risk vulnerability classification for this development is 'More Vulnerable'.

2.1 Flood History

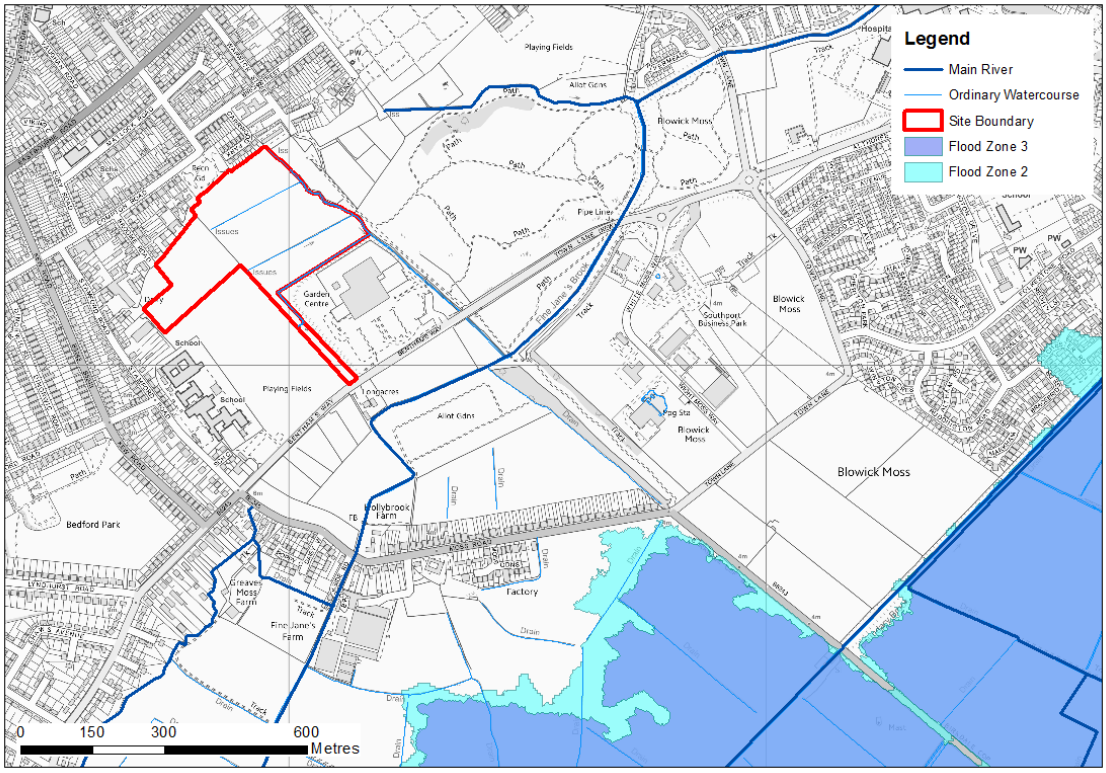
The Sefton Strategic Flood Risk Assessment (SFRA) does not have any details of flood history at the allocation site. The allocation site is not covered by the EA Historic Flood Map.

[2] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-2-flood-risk-vulnerability-classification/

3 Fluvial Flood Risk

The proposed allocation site is within EA Flood Zone 1 (Figure 3-1 below). The site is therefore assessed as having less than 1 in 1,000 annual probability of river flooding (<0.1% Annual Exceedance Probability (AEP)).

Figure 3-1 EA Fluvial Flood Mapping



As identified in Section 2, the flood risk vulnerability classification for this development is 'More Vulnerable'. NPPF guidance (Table 3[3]) states that 'More Vulnerable' development, and therefore the proposed housing allocation at Benthams Way, is appropriate in Flood Zone 1.

The nearest Main River to the housing allocation site is Fine Jane's Brook which runs in a north easterly direction to the south of the site. The Main River is approximately 90 m distant from the development boundary at the closest point at Longacres. Flood Mapping indicates that the proposed allocation site is not at risk of fluvial flooding from Fine Jane's Brook. This reach of Main River is provided with defences in the form of maintained channels with a 1 in 50 year (2% AEP) design standard of protection.

The ARFQ for this study requires that the proportion of the site that should remain undeveloped due to flood risk issues is to be identified. There are no Main River fluvial flood risk issues that would require any area of the site to remain undeveloped. However, parts of the site may need to remain undeveloped due to surface water flood risk issues (see Section 4 below).

Three Ordinary Watercourses cross the main part of the allocation site and form a tributary of Fine Jane's Brook to the east of Dobbies Garden Centre before joining the Main River to the south of Benthams Way. Although EA fluvial flood modelling does not include the Ordinary Watercourses, surface water mapping indicates that flooding of the site is likely. It is possible that the Ordinary Watercourses flowing across the allocation site could contribute to flooding in this area.

[3] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-3-flood-risk-vulnerability-and-flood-zone-compatibility/

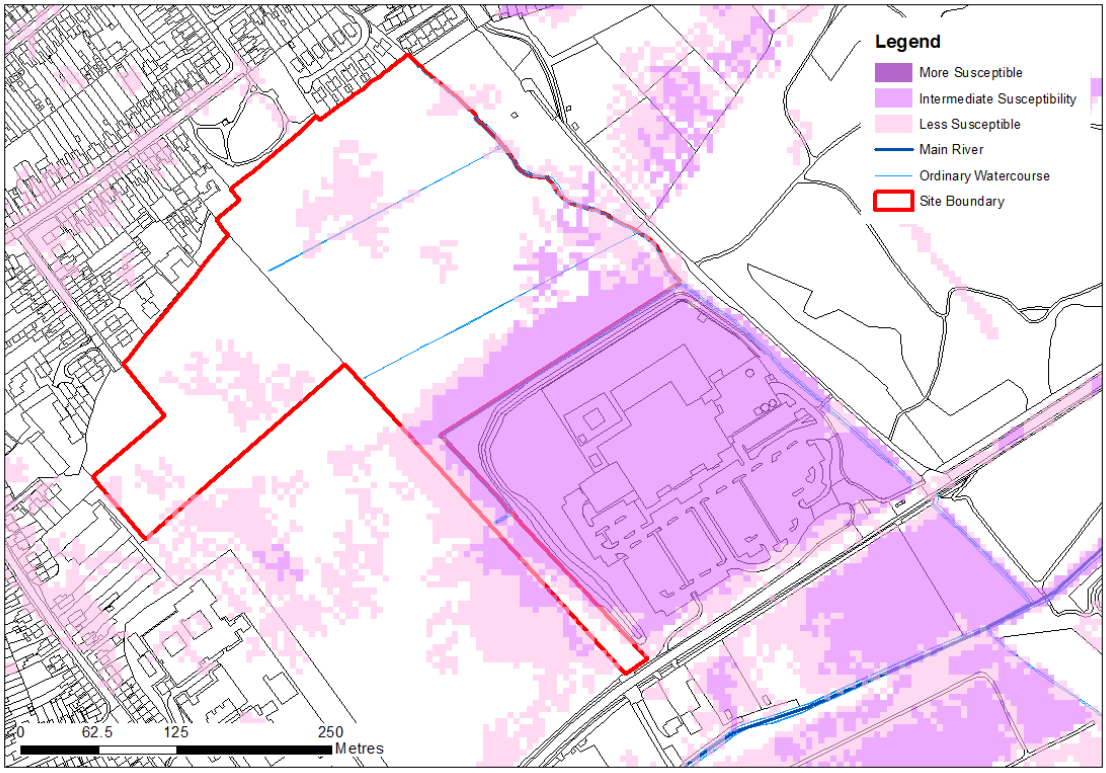
The allocation site is not covered by the EA Historic Flood Map and is not within a designated EA Flood Warning Area (FWA).

The proposed housing allocation is for approximately 215 dwellings. It is assumed that development of the site for housing will result in the introduction of impermeable areas covering 60% of the developable area.

4 Surface Water Flood Risk

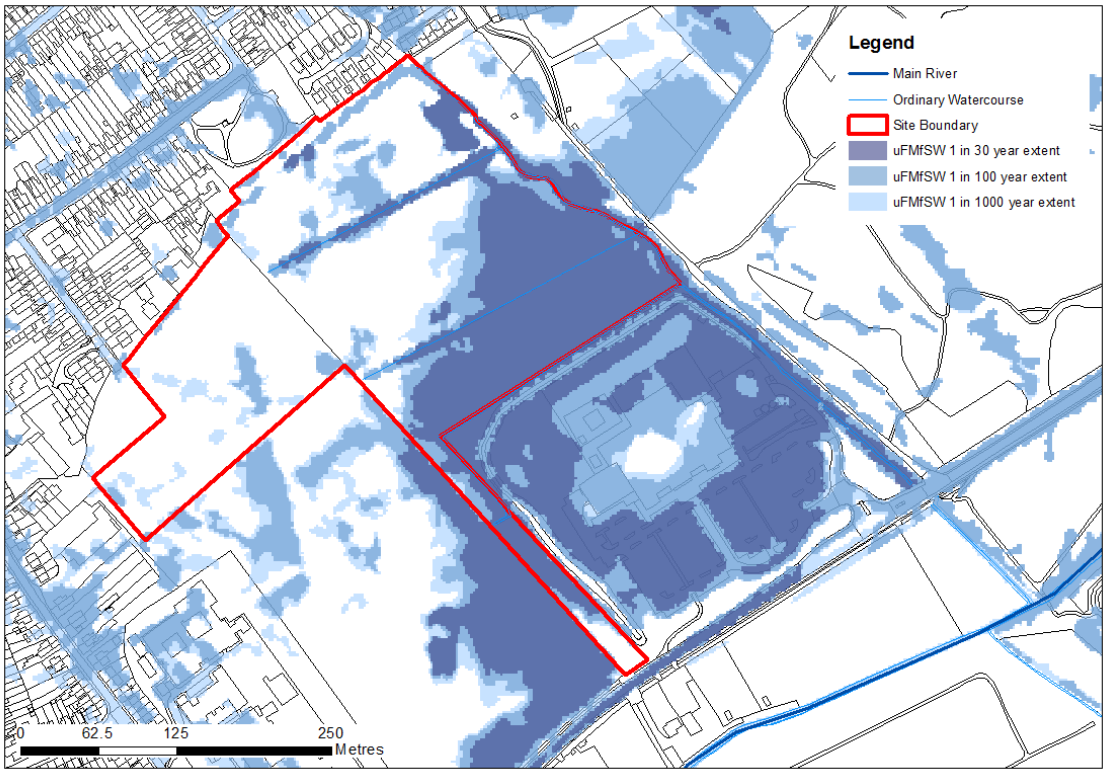
Areas Susceptible to Surface Water Flooding (AStSWF) mapping indicates that parts of the housing allocation site, particularly along the boundary with Dobbies Garden Centre and including the likely access route from Benthams Way, are classified as having Intermediate (or Medium) Susceptibility to flooding from a 1 in 200 year (0.5% AEP) storm event (Figure 4-1 below). Flood depths are estimated to be in the range 0.3 m to 1.0 m deep in these areas.

Figure 4-1 Areas Susceptible to Surface Water Flooding



The updated Flood Map for Surface Water (uFMfSW) also indicates that significant areas of the housing allocation site, again along the boundary with Dobbies Garden Centre and the likely access route, could be at risk of flooding from surface water in a 1 in 30 year (3.33 % AEP) event (Figure 4-2 below). It should be noted that no uFMfSW flood depth data has been provided at this stage.

Figure 4-2 Updated Flood Map for Surface Water



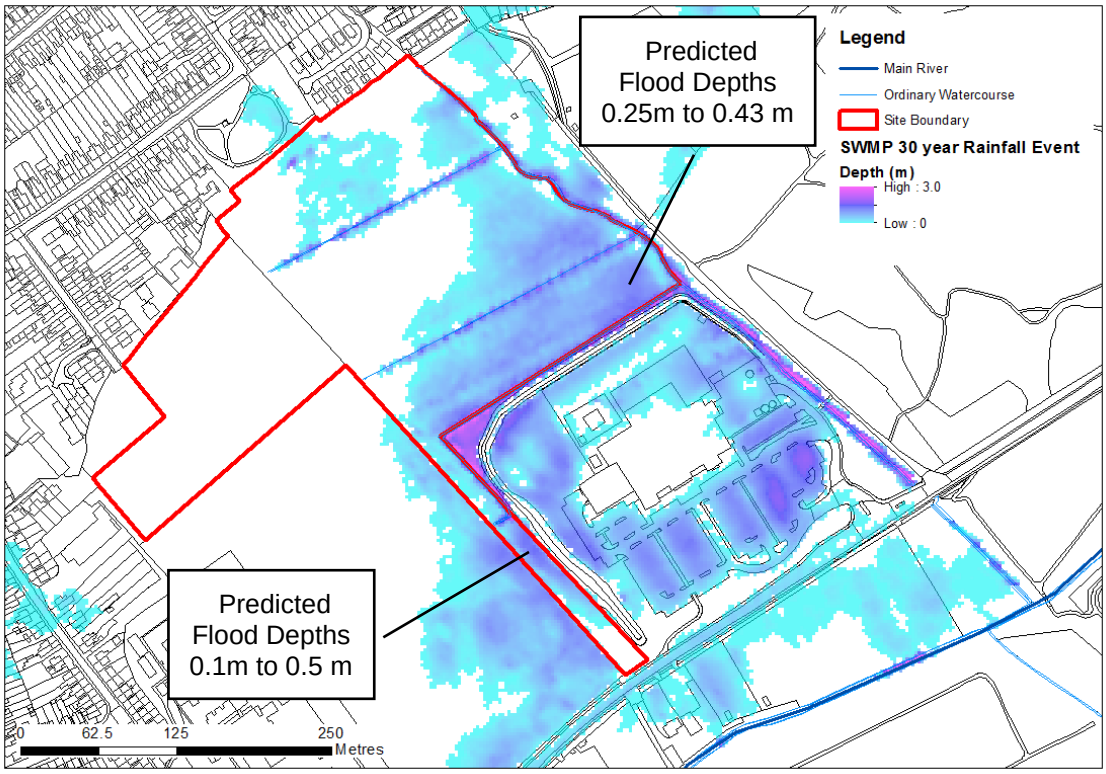
Based on uFMfSW flood mapping, approximately 51% of the site area (equivalent to 4.4 ha) is at risk of surface water flooding and this will limit the area of the site available for development. The total area at risk of surface water flooding is broken down as follows:

Table 4-1 Site area at risk of surface water flooding

Storm event	Site area	
	ha	%
1 in 30 year (3.33% AEP)	2.7	31.3
1 in 100 year (1% AEP)	1.1	12.4
1 in 1000 year (0.1% AEP)	0.6	7.1

SWMP mapping for the 1 in 30 year (3.33 % AEP) storm event indicates a similar flood extent to that given by the uFMfSW for the same design event (Figure 4-3 below). Flood depths towards the boundary with Dobbies Garden Centre between the two southern most watercourses are predicted to be approximately 0.25 m to 0.43 m. Predicted flood depths along the access route from Benthams Way are in the range 0.1 m to 0.5 m.

Figure 4-3 SWMP 30 year rainfall event



The ARFQ for this study requires that the proportion of the site that should remain undeveloped due to flood risk issues is to be identified. Available surface water mapping indicates that up to 51% of the site area is at significant risk of surface water flooding at this location.

It is noted that the allocation site is within a Critical Drainage Area (CDA) as designated in the Sefton SWMP and SFRA (rather than by the Environment Agency in terms of footnote 20 to para 103 of the National Planning Policy Framework). It is therefore recommended that the developer consults Sefton Council and United Utilities early to identify their requirements for management of surface water runoff from this site.

5 Other Sources of Flood Risk

5.1 Tidal

Tidal flood risk mapping from the SFRA indicates that the allocation site is not at risk of tidal flooding.

5.2 Groundwater

Areas Susceptible to Ground Water Flooding (AStGWF) mapping indicates that the allocation site is located within an area considered to be susceptible to groundwater emergence. The relevant 1 km grid square covering the site suggests that greater than 75% of the grid square area could be susceptible to groundwater emergence from superficial deposits. It should be noted that the AStGWF dataset does not take account of the chance of flooding from groundwater rebound.

5.3 Reservoir

Reservoir inundation mapping from the SFRA indicates that the allocation site is not at risk from uncontrolled releases from reservoirs.

5.4 Canal

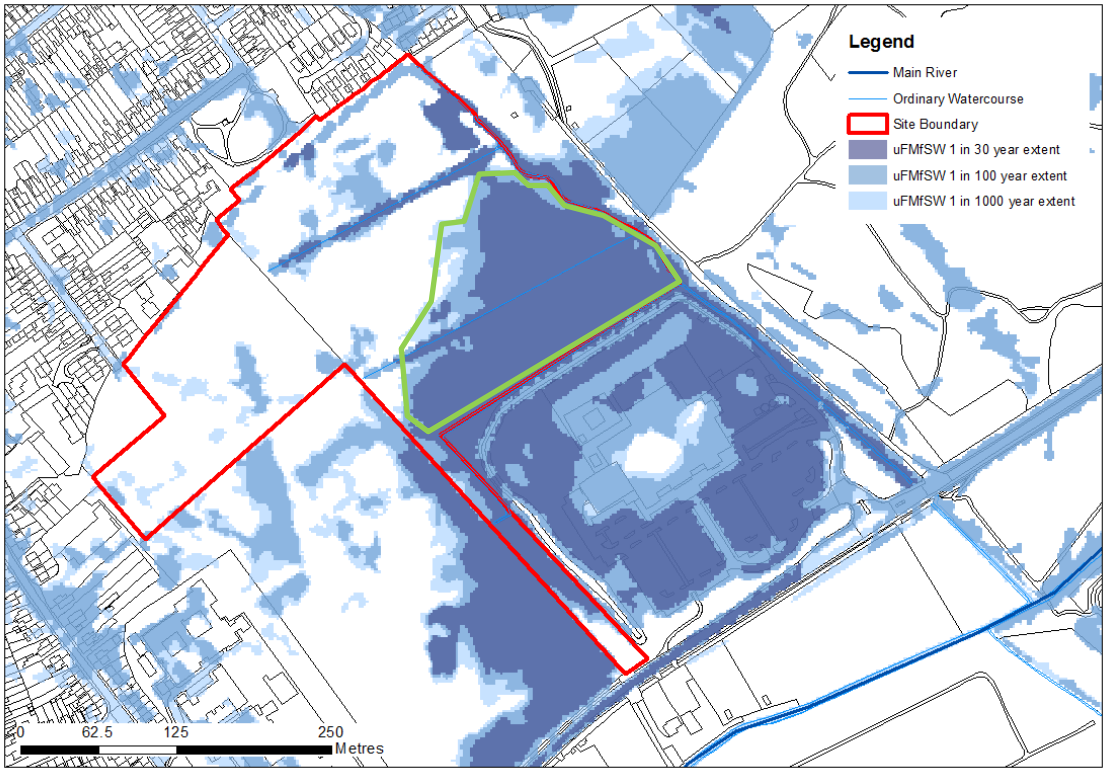
Canal risk mapping from the SFRA indicates that the allocation site is not at risk of flooding from canals.

6 Flood Risk Management measures

6.1 Area to remain undeveloped

In accordance with the Sefton SFRA, a sequential approach to future site layout planning is required to minimise surface water flood risk to the development identified in Section 4. Available surface water mapping indicates that approximately 30% of the site area, as defined by the green area shown, should not be developed due to the risk of surface water flooding at this location (Figure 6-1). The depth of flooding in this area is unlikely to be manageable so land should be set aside to provide community wide mitigation against surface water flood risk on site and to the neighbouring Dobbies Garden Centre. This area of open space could be used to provide added amenity, attenuation and habitat value. However, it should be noted that non-development of this area, including the susceptibility to surface water flood risk of some other parts of the site and the existence of the three Ordinary Watercourses is likely to reduce the number of dwellings that can be constructed.

Figure 6-1 Approximate area to remain undeveloped



6.2 Maintenance of Ordinary Watercourses

Owing to identified surface water flood risk, notably the area outlined in green in Figure 6-1, and the existence of three Ordinary Watercourses running across the allocation site; watercourses will need to be maintained in order to manage onsite flood risk and to ensure flood risk is not increased elsewhere (particularly to Dobbies Garden Centre). A maintenance plan will therefore need to be agreed between the developer and Sefton Council. The Council has stipulated that flow into ordinary watercourses should not exceed the greenfield runoff rate.

Any ditches crossing the site will either need to be retained or diverted as part of any development proposals. Suitably sized culvert crossings, capable of conveying the 1 in 100 year plus climate change flow should be included for in any future site layout plans where road (or

any) crossing points over the existing Ordinary Watercourses are required. Guidance on design and details can be found in the CIRIA Report C689 Culvert design and operation guide[4].

Environmental considerations associated with the design of any culverts should also be taken into account and is also covered by the EA culvert design and operation guide[5]. The guide states that the following principles should be considered:

- retain a natural bed,
- limit damage to the river-banks,
- limit disturbance to natural flow,
- ensure alignment works with geomorphological processes.

Land Drainage Consent (under Section 23 of the Land Drainage Act, 1991) will be required from Sefton Council for the construction or alteration of any culvert on an Ordinary Watercourse.

6.3 Finished Floor Levels

For all new development, the Sefton SFRA states that it is good practice and it is recommended to have Finished Floor Levels (FFLs) at least 0.3 m above the finished ground level. In addition to this general guidance, developers should review the depth outputs from the SWMP for the 1 in 100 annual probability event, and use this information so that their development proposals specify floor levels that are at least 300mm higher. Future master planning and subsequent detailed design for the proposed housing development should therefore take into account SWMP 1 in 100 year surface water mapping and ensure that FFLs are at least 300 mm above predicted flood depths.

Raised FFLs will also help to mitigate against any potential Groundwater emergence at the allocation site.

6.4 Safe Access and Egress

Available surface water mapping indicates that the likely access route from Benthams Way along the south western boundary of Dobbies Garden Centre is at risk of surface water flooding in a 1 in 30 year (3.33 % AEP) storm event. The access road will, therefore, need to be raised above predicted flood depths to facilitate access. Development proposals will need to include consideration and provision of compensatory storage within the site to offset displacement of surface water along the access route. Further the road will need to be designed with sufficient drainage features to maintain existing flow routes and to prevent increased flooding elsewhere. Connectivity of land either side of the road will need to be considered so that offsite impacts are not increased. It is envisaged that this will take the form of a series of culverts beneath the road surface connecting to swales then the existing Ordinary Watercourses.

[4] CIRIA (Balkham, Fosbeary, Kitchen and Rickard 2010), Culvert design and operation guide (C689).

[5] Environment Agency, http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter8.aspx?pagenum=6

7 Surface Water Management

In accordance with PPG, this report assesses the volumes of surface water runoff likely to be generated by the proposed development. Proposals for surface water management are made to ensure any increased runoff does not cause flood risk elsewhere, in accordance with Sefton SFRA requirements for greenfield sites where development should restrict runoff to existing runoff rates and where possible volumes. Allowances have been made for the impact of climate change on increasing rainfall.

Based on the assumptions outlined in Section 2 the proposed housing development is likely to result in impermeable areas covering 60% of the developable area. As discussed in Section 4, and Section 6, 51% of the site is at risk of surface water flooding. Figure 6-1 shows approximately 30% of the site which should not be developed due to a combination of return period and anticipated depth of surface water flooding. In relation to the other areas at risk of surface water flooding, we are assuming that the developer will be able to provide mitigation to offset surface water flooding.

Detailed ground investigation results were not available at the time of writing this FRA. Furthermore, indicative SuDS suitability mapping from the SFRA suggests that the allocation site is likely to have very low potential for SuDS due to the possibility of groundwater emergence at the site. We have therefore based our review on providing a fully compensated surface water management scheme on site to restrict surface water runoff from the development. A conventional piped surface water drainage system including a combination of storage tanks or oversized pipes is envisaged at this stage as a means of regulating surface water discharge to the sewer network.

7.1 Greenfield Runoff Rate

Greenfield runoff rates have been estimated for the allocation site in accordance with EA guidance Rainfall runoff management for developments using the drainage tools provided on the UK SuDS Tools Website6. The EA guidance indicates that two methods of calculating Greenfield runoff peak flow rates can be used, the Institute of Hydrology (IH) Report 124 method, or the Flood Estimation Handbook (FEH) statistical method. Further details of the strengths and weaknesses of these methods are available in the EA guidance. Runoff rates (l/s) for the allocation site estimated using both methods are provided in Table 6-1 below for comparison. A calculation record is provided in Appendix A.

Table 6-1 Estimated Greenfield runoff rates (l/s)

Method	IH124	FEH
QBAR*	5	13
1 in 1 year	5	11
1 in 30 years	9	22
1 in 100 years	10	26

*QBAR - Mean Annual Flood flow rate.

EA Report SC090031[7] regarding flood peak and hydrograph estimation in small catchments recommends that FEH methods should be used provided that the catchment is not highly permeable or heavily urbanised. In this instance, Greenfield runoff rates derived from the FEH method have been used. However, it should be noted that permissible discharge rates for the site will need to be agreed with the relevant authority at detailed design.

[6] http://geoservergisweb2.hrwallingford.co.uk/uksd/

[7] Environment Agency, 2012, Estimating flood peaks and hydrographs for small catchments. Project SC090031.

7.2 Surface Water Risks

Rainfall depths for the 30 year and 100 year rainfall events at the site were abstracted from the FEH CD-ROM. The rainfall depths were increased by an allowance of 30% to account for the effects of climate change (Table 6-2 below).

Table 6-2 Design rainfall depths

Duration (hours)	30-year rainfall (mm)	30-year rainfall plus 30% (mm)	100-year rainfall (mm)	100-year rainfall plus 30% (mm)
0.25	22.38	29.1	32.95	42.8
0.5	26.66	34.7	38.48	50.0
0.75	29.54	38.4	42.13	54.8
1	31.77	41.3	44.93	58.4
1.5	35.2	45.8	49.19	63.9
2	37.85	49.2	52.46	68.2
3	41.94	54.5	57.44	74.7
4	45.1	58.6	61.25	79.6
6	49.97	65.0	67.07	87.2
8	53.74	69.9	71.52	93.0
10	56.86	73.9	75.18	97.7
12	59.54	77.4	78.31	101.8
18	65.83	85.6	85.57	111.2
24	70.7	91.9	91.12	118.5
36	78.17	101.6	99.57	129.4
48	83.94	109.1	106.03	137.8

Likely attenuation volumes for the proposed development are provided in Table 6-3 below. These values are based on limiting discharge to 22 l/s and 26 l/s respectively for the 1 in 30 year climate change and 1 in 100 year climate change events in accordance with the Greenfield runoff rates estimated in Section 6-1.

Table 6-3 Estimated attenuation volumes (m^3)

Design event (including climate change)	Critical storm duration Hours	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hours
1 in 30 year rainfall plus 30%	12	1983	475	1508	38.0
1 in 100 year rainfall plus 30%	12	2508	562	2047 (539 m^3 of exceedance storage)	43.6

The attenuation volumes estimated above assume a gravity outfall to the Ordinary Watercourse draining away from the site. The final point of discharge is to be determined at detailed design.

7.3 Outline Drainage Strategy

As stated above, detailed ground investigation results were not available at the time of writing this FRA. Furthermore, indicative SuDS suitability mapping from the SFRA suggests that the allocation site is likely to have very low potential for SuDS due to the possibility of groundwater emergence at the site. We have therefore based our review on providing a fully compensated surface water management scheme on site to restrict surface water runoff from the development. A conventional piped surface water drainage system including a combination of storage tanks or oversized pipes is envisaged at this stage as a means of regulating surface water discharge to the sewer network.

In accordance with Table 6-3 and in the absence of any infiltration drainage for impermeable areas, the total attenuation required for the proposed development for 1 in 30 year and 1 in 100 year design events including climate change are estimated to be 1500 m^3 and 2000 m^3 respectively.

Although SUDS options have not been investigated as part of this study due to the absence of ground investigations and percolation tests, it is possible that attenuation could be provided in basins developed from the existing Ordinary Watercourses which run across the allocation site. These watercourses would need to be developed for this purpose by creating basins with control structures at points on each watercourse. An offline attenuation pond could be located in the area to remain undeveloped outlined in Figure 6-1 above. These features would also provide significant ecological benefits and added pubic/resident amenity value. However, as groundwater depths could be shallow in this area, fully sealed systems are likely to be required.

Even if attenuation basins could provide sufficient storage for the 1 in 100 year climate change runoff volume, the capacity of the piped drainage system connecting the developed area is likely to be designed to a 1 in 30 year standard. It is therefore recommended that additional storage should be provided within the developed area to accommodate the estimated exceedance volume of 500 m^3 to limit offsite impacts. This could be achieved by landscaping and making best use of available green space to contain exceedance flows in swales. Use of raised kerbs could also provide some storage within internal road areas. Owing to the extent of green areas available in the proposed development, use of swales or existing Ordinary Watercourses may be suitable. These approaches can be used to allow certain areas of the site to flood to shallow depths when the capacity of the onsite drainage network is exceeded. Flood water will then be able to pond before gradually discharging back into the site drainage system.

Owing to the absence of ground investigations and percolation tests to date, a fully attenuated surface water system has been appraised at this outline planning stage. However, opportunities for SuDS should be fully investigated at detailed design stage.

Sewer maps have not been obtained at this stage. However, the nearest public sewers are likely to serve housing to the north and northwest of the site off Compton Road, and/or Dobbies Garden Centre to the south east. It is assumed that site surface water will discharge to the existing Ordinary Watercourses that cross the site. Consent to discharge will need to be obtained from the relevant authority at detailed design.

8 Conclusion and Discussion

This report has been prepared in response to task (i) of Sefton Council's Advanced Request for Quotation (ARFQ) (Contract Number 9ZQD-D30FN5) which requires a site FRA for a proposed housing allocation on land adjacent to Dobbies Garden Centre, Benthams Way, Southport.

The proposed allocation site for approximately 215 dwellings covers an area of approximately 8.7 ha and is located entirely within Flood Zone 1. The site is at risk from surface water flooding and is crossed by three Ordinary Watercourses which join Fine Jane's Brook to the south of Benthams Way.

There are no layout plans for the proposed housing development, however the proposed allocation is for approximately 215 dwellings. As no development plans are available at this stage it is assumed that development of the site for housing will result in the introduction of impermeable areas covering 60% of the developable area.

The proposed allocation site is within EA Flood Zone 1 and is therefore assessed as having less than 1 in 1,000 annual probability of river flooding from Fine Jane's Brook. Three Ordinary Watercourses cross the main part of the allocation site and form a tributary of Fine Jane's Brook. Although EA fluvial flood modelling does not include the Ordinary Watercourses, surface water mapping indicates that flooding of the site is likely.

AStSWF mapping indicates that parts of the housing allocation site, particularly along the boundary with Dobbies Garden Centre and including the likely access route from Benthams Way, are classified as having Intermediate (or Medium) Susceptibility to flooding from a 1 in 200 year (0.5% AEP) storm event. Flood depths are estimated to be in the range 0.3 m to 1.0 m deep in these areas.

The uFMfSW also indicates that significant areas of the housing allocation site, again along the boundary with Dobbies Garden Centre and the likely access route, could be at risk of flooding from surface water in a 1 in 30 year (3.33 % AEP) event.

SWMP mapping for the 1 in 30 year (3.33 % AEP) storm event indicates a similar flood extent to that given by the uFMfSW for the same design event. Flood depths towards the boundary with Dobbies Garden Centre between the two southern most watercourses are predicted to be approximately 0.25 m to 0.43 m. Predicted flood depths along the access route from Benthams Way are in the range 0.1 m to 0.5 m.

The ARFQ for this study requires that the proportion of the site that should remain undeveloped due to flood risk issues is to be identified. Based on available uFMfSW flood mapping, up to 51% of the site is at risk of surface water flooding. Figure 6-1 shows approximately 30% of the site which should not be developed due to a combination of return period and anticipated depth of surface water flooding. In relation to the other areas at risk of surface water flooding, we are assuming that the developer will be able to provide mitigation to offset surface water flooding.

AStGWF mapping indicates that the allocation site is located within an area considered to be susceptible to groundwater emergence. The site is not assessed to be at risk of flooding from other sources including tidal, reservoirs and canals.

Attenuation requirements for the 1 in 30 year and 1 in 100 year design events including climate change are estimated to be 1500 m^3 and 2000 m^3 respectively.

Although SUDS options have not been investigated as part of this study, it is possible that attenuation could be provided in basins developed from the existing Ordinary Watercourses or in an offline attenuation pond located in the area to remain undeveloped. These features would also provide significant ecological benefits and added pubic/resident amenity value. However, as groundwater depths could be shallow in this area, fully sealed systems are likely to be required.

Even if attenuation basins could provide sufficient storage for the 1 in 100 year climate change runoff volume, the capacity of the piped drainage system connecting the developed area is likely to be designed to a 1 in 30 year standard. It is therefore recommended that additional storage should be provided within the developed area to accommodate the estimated exceedance volume of 500 m^3 to limit offsite impacts. This could be achieved by landscaping and making best use of available green space to contain exceedance flows in swales. Use of raised kerbs could also provide some storage within internal road areas. These approaches can be used to

allow certain areas of the site to flood to shallow depths when the capacity of the onsite drainage network is exceeded.

Owing to the absence of ground investigations and percolation tests to date, a fully attenuated surface water system has been appraised at this outline planning stage. However, opportunities for SuDS should be fully investigated at detailed design stage.

Mitigation measures including an allowance for undeveloped areas of open space, Ordinary Watercourse maintenance and suitably sized culverts/bridges, appropriate FFLs and provision for safe access and egress should ensure that the proposed housing allocation at Benthams Way, Southport will be safe for the lifetime of the development. However, it should be noted that the reduction in the developable area of the site area due to surface water flood risk issues is likely to reduce the number of dwellings that can be constructed.

Master planning and subsequent detailed design for the proposed housing development should take into account SWMP 1 in 100 year surface water mapping to ensure that FFLs are at least 300 mm above predicted flood depths. In addition to the surface water management measures provided in the Outline Drainage Strategy, this should ensure that flood risk is not increased elsewhere following development of the site.

Appendices

A Greenfield runoff estimation record

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Haywards Heath
Limerick
Newcastle upon Tyne
Newport
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
South Barn
Broughton Hall
SKIPTON
North Yorkshire
BD23 3AE

t:+44(0)1756 799919
e:info@jbaconsulting.com

Jeremy Benn Associates Ltd
Registered in England
3246693

Visit our website
www.jbaconsulting.com