


Betts Associates Ltd		Page 1
Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY		
Date 30/10/2014 14:50	Designed by Chris.Pickles	
File	Checked by	
Micro Drainage		Source Control 2014.1

Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
Site Location	GB 343200 388500 SJ 43200 88500
C (1km)	-0.023
D1 (1km)	0.313
D2 (1km)	0.316
D3 (1km)	0.326
E (1km)	0.288
F (1km)	2.491
Areal Reduction Factor	1.00
Area (ha)	5.625
SAAR (mm)	845
CWI	119.521
SPR Host	24.810
URBEXT (1990)	0.4866

Results

Percentage Runoff (%)	40.44
Greenfield Runoff Volume (m³)	1497.658

SURFACE WATER RUN-OFF CALCULATION SHEET

Development Gateacre, Liverpool
Project No. CPL 13

Revision 1.0 Completed by CP
Date 30.10.2014 Checked by RDN



Areas		Catchment Characteristics	
Total Site	8.249 ha	SAAR	845 mm
Development Area (for SW Strategy)*	8.249 ha	SPR	24.8 %
Existing Impermeable	2.624 ha	i ₁	13.8 mm/hr
Existing Impermeable (for SW Strategy)	2.624 ha	i ₃₀	31.8 mm/hr
Existing Pervious	5.625 ha	i ₁₀₀	43 mm/hr
Existing Pervious (for SW Strategy)	5.625 ha	d ₁	12.5 mm
Proposed Impermeable (total)	4.046 ha	d ₁₀₀	64.4 mm
Proposed Impermeable (domestic only)	ha		

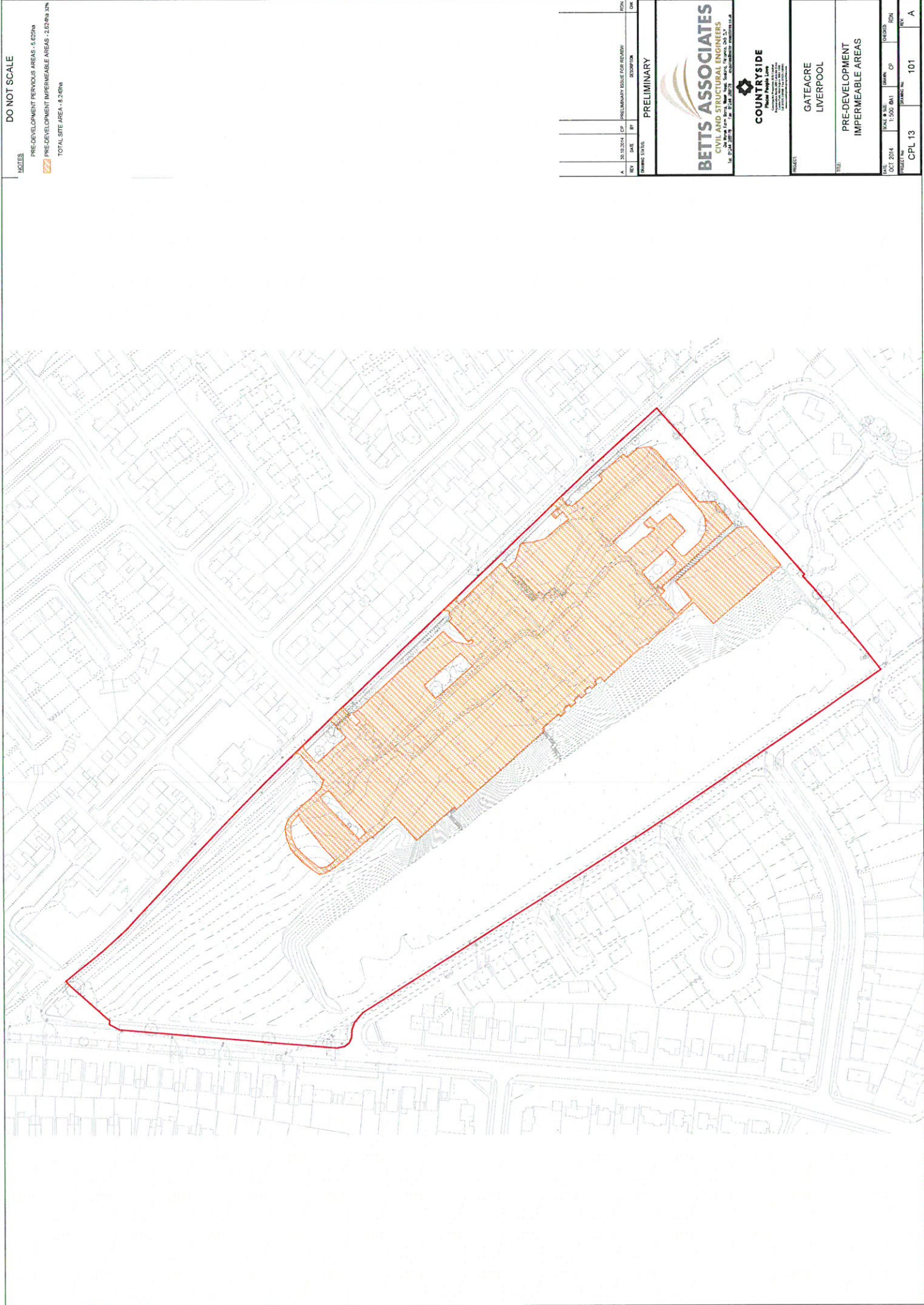
Run-off Rates				Volumes			
<i>Pre-development</i>				<i>Pre-development</i>			
Impermeable	1yr	100.6 l/s		Impermeable	1yr	328.0 cu.m	
	30yr	231.8 l/s			100yr	1689.9 cu.m	
	100yr	313.4 l/s					
	50mm/hr	364.4 l/s		Pervious	1yr	444.7 cu.m	
					100yr	1497.6 cu.m	
Pervious	1yr	25.2 l/s					
	30yr	49.1 l/s		Total	1yr	772.7 cu.m	
	100yr	60.3 l/s			100yr	3187.5 cu.m	
	QBar	29.0 l/s					
Total	1yr	125.8 l/s		<i>Post-development</i>			
	30yr	280.9 l/s		Impermeable (total)	1yr	505.8 cu.m	
	100yr	373.7 l/s			100yr+CC	3387.3 cu.m	
<i>Post-development</i>				Impermeable (domestic only)	1yr	cu.m	
Impermeable (total)	1yr	155.1 l/s			100yr+CC	cu.m	
	30yr	357.4 l/s					
	100yr+CC	628.3 l/s		Reduction (total)	-6%	-199.9 cu.m	
Impermeable (domestic only)	1yr	l/s				cu.m	
	30yr	l/s					
	100yr+CC	l/s					

Quick storage Estimate				Imp. Area (ha)	Max. Discharge (l/s)	Rainfall	CC
		low	high				
Return Period	1yr	37	193	4.046	255.1	FEH	0
Return Period	30yr	485	804	4.046	255.1	FEH	0
Return Period	100yr+CC	1230	1766	4.046	255.1	FEH	30%
Return Period	1yr	26	188	4.046	255.1	FSR	0
Return Period	30yr	377	713	4.046	255.1	FSR	0
Return Period	100yr+CC	880	1513	4.046	255.1	FSR	30%

* Development Area (for SW strategy) is reduced as infiltration is being applied as a partial solution

APPENDIX J: IMPERMEABLE AREAS PLANS

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DO NOT SCALE

NOTES

PRE-DEVELOPMENT PERVIOUS AREAS - 1.625ha

PRE-DEVELOPMENT IMPERMEABLE AREAS - 2.02ha (2N)

TOTAL SITE AREA - 8.20ha

REV	DATE	BY	DESCRIPTION	FOR REVIEW	FOR
A	20.10.2014	CP	PRELIMINARY ISSUE FOR REVIEW	OK	OK
DRAWING STATUS					
PRELIMINARY					
BETTS ASSOCIATES CIVIL AND STRUCTURAL ENGINEERS 2nd Floor, 100, North Street, Ipswich, Suffolk, IP1 1BT Tel: 01473 207777 Fax: 01473 207778 Email: info@betts.co.uk					
COUNTRYSIDE ARCHITECTS 100, North Street, Ipswich, Suffolk, IP1 1BT Tel: 01473 207777 Fax: 01473 207778 Email: info@betts.co.uk					
PROJECT					
GATEACRE LIVERPOOL					
SITE					
PRE-DEVELOPMENT IMPERMEABLE AREAS					
DATE	SCALE & SIZE	DRAWN	CP	CHECKED	FOR
OCT 2014	1:500 (A1)	OK	OK	OK	OK
PROJECT No	DRAWING No	101	101	101	A
CPL 13					



DO NOT SCALE

NOTES

TOTAL SITE AREA - 8.2489a
POST-DEVELOPMENT IMPERMEABLE AREAS -
ROADS - 1.4789a
DENSE - 0.7294a
ROADS - 1.4789a
TOTAL IMPERMEABLE AREAS - 4.0469a 49%

REV	DATE	BY	DESCRIPTION	NOTED
A	10/13/2014	CP	PRELIMINARY ISSUE FOR REVIEW	CHK

PRELIMINARY

BETTS ASSOCIATES
CENTRAL ENGINEERS
300 Main Street, New York, NY 10014
Tel: 212-279-2875 Fax: 212-279-2875

COUNTRYSIDE
1000 West 10th Street, Suite 100
Arlington, VA 22204
Tel: 703-261-1000 Fax: 703-261-1001

PROJECT	GATEACRE LIVERPOOL
DATE	10/13/2014
SCALE	1:500
BY	CP
CHK	REN

PROJECT NO.	CPL 13
DATE	10/13/2014
SCALE	1:500
BY	CP
CHK	REN


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APPENDIX K: STORMWATER STORAGE ESTIMATES



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STORMWATER STORAGE ESTIMATES


FEH


 Variables Results Design Overview 2D Overview 3D Vt	Variables			
	FEH Rainfall		Cv (Summer)	0.750
	Return Period (years) 1		Cv (Winter)	0.840
	Site Location		Impemeable Area (ha)	4.046
	GB 343200 388500 SJ 43200 88501		Maximum Allowable Discharge (l/s)	255.1
	C (1km) -0.023	D3 (1km) 0.326	Infiltration Coefficient (m/hr)	0.00000
	D1 (1km) 0.313	E (1km) 0.288	Safety Factor	2.0
	D2 (1km) 0.316	F (1km) 2.491	Climate Change (%)	0

 Variables Results Design Overview 2D Overview 3D Vt	Results	
	Global Variables require approximate storage of between 37 m³ and 193 m³.	
	These values are estimates only and should not be used for design purposes.	

 Variables Results Design Overview 2D Overview 3D Vt	Variables			
	FEH Rainfall		Cv (Summer)	0.750
	Return Period (years) 30		Cv (Winter)	0.840
	Site Location		Impermeable Area (ha)	4.046
	GB 343200 388500 SJ 43200 88501 ...		Maximum Allowable Discharge (l/s)	255.1
	C (1km) -0.023	D3 (1km) 0.326		
	D1 (1km) 0.313	E (1km) 0.288	Infiltration Coefficient (m/hr)	0.00000
	D2 (1km) 0.316	F (1km) 2.491	Safety Factor	2.0
			Climate Change (%)	0
				

 Variables Results Design Overview 2D Overview 3D Vt	Results	
	<p>Global Variables require approximate storage of between 485 m³ and 804 m³.</p> <p>These values are estimates only and should not be used for design purposes.</p>	



 Variables Results Design Overview 2D Overview 3D Vt	Variables			
	FEH Rainfall		Cv (Summer)	0.750
	Return Period (years) 100		Cv (Winter)	0.840
	Site Location		Impervious Area (ha)	4.046
	GB 343200 388500 SJ 43200 88501 ...		Maximum Allowable Discharge (l/s)	255.1
	C (1km) -0.023	D3 (1km) 0.326	Infiltration Coefficient (m/hr)	0.00000
	D1 (1km) 0.313	E (1km) 0.288	Safety Factor	2.0
	D2 (1km) 0.316	F (1km) 2.491	Climate Change (%)	30


 Variables Results Design Overview 2D Overview 3D Vt	Results	
	<p>Global Variables require approximate storage of between 1230 m³ and 1766 m³.</p> <p>These values are estimates only and should not be used for design purposes.</p>	


FSR

Micro Drainage		Variables			
<div>Variables</div> <div>Results</div> <div>Design</div> <div>Overview 2D</div> <div>Overview 3D</div> <div>Vt</div>	FSR Rainfall		Cv (Summer)	0.750	
	Return Period (years)	1	Cv (Winter)	0.840	
	Region	England and Wales	Impervious Area (ha)	4.046	
	Map	M5-60 (mm)	19.000	Maximum Allowable Discharge (l/s)	255.1
		Ratio R	0.400	Infiltration Coefficient (m/hr)	0.00000
			Safety Factor	2.0	
			Climate Change (%)	0	

Micro Drainage		Results
<div>Variables</div> <div>Results</div> <div>Design</div> <div>Overview 2D</div> <div>Overview 3D</div> <div>Vt</div>	<p>Global Variables require approximate storage of between 26 m³ and 188 m³.</p> <p>These values are estimates only and should not be used for design purposes.</p>	

 Variables Results Design Overview 2D Overview 3D Vt	Variables		
	FSR Rainfall ▼		Cv (Summer) 0.750
	Return Period (years) 30		Cv (Winter) 0.840
			Impemeable Area (ha) 4.046
	Region England and Wales ▼	Maximum Allowable Discharge 255.1 (l/s)	
	Map	M5-60 (mm) 19,000	
		Ratio R 0.400	
		Infiltration Coefficient (m/hr) 0.00000	
		Safety Factor 2.0	
		Climate Change (%) 0	

 Variables Results Design Overview 2D Overview 3D Vt	Results	
	<p>Global Variables require approximate storage of between 377 m³ and 713 m³.</p> <p>These values are estimates only and should not be used for design purposes.</p>	



Variables

Results

Design

Overview 2D

Overview 3D

Vt

Variables

FSR Rainfall

Return Period (years)

Region

Map

M5-60 (mm)

Ratio R

Cv (Summer)

Cv (Winter)

Impermeable Area (ha)

Maximum Allowable Discharge (l/s)

Infiltration Coefficient (m/hr)

Safety Factor

Climate Change (%)

0.750

0.840


4.046

255.1

0.00000

2.0

30



Variables

Results

Design

Overview 2D

Overview 3D

Vt

Results

Global Variables require approximate storage of between 880 m³ and 1513 m³.

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

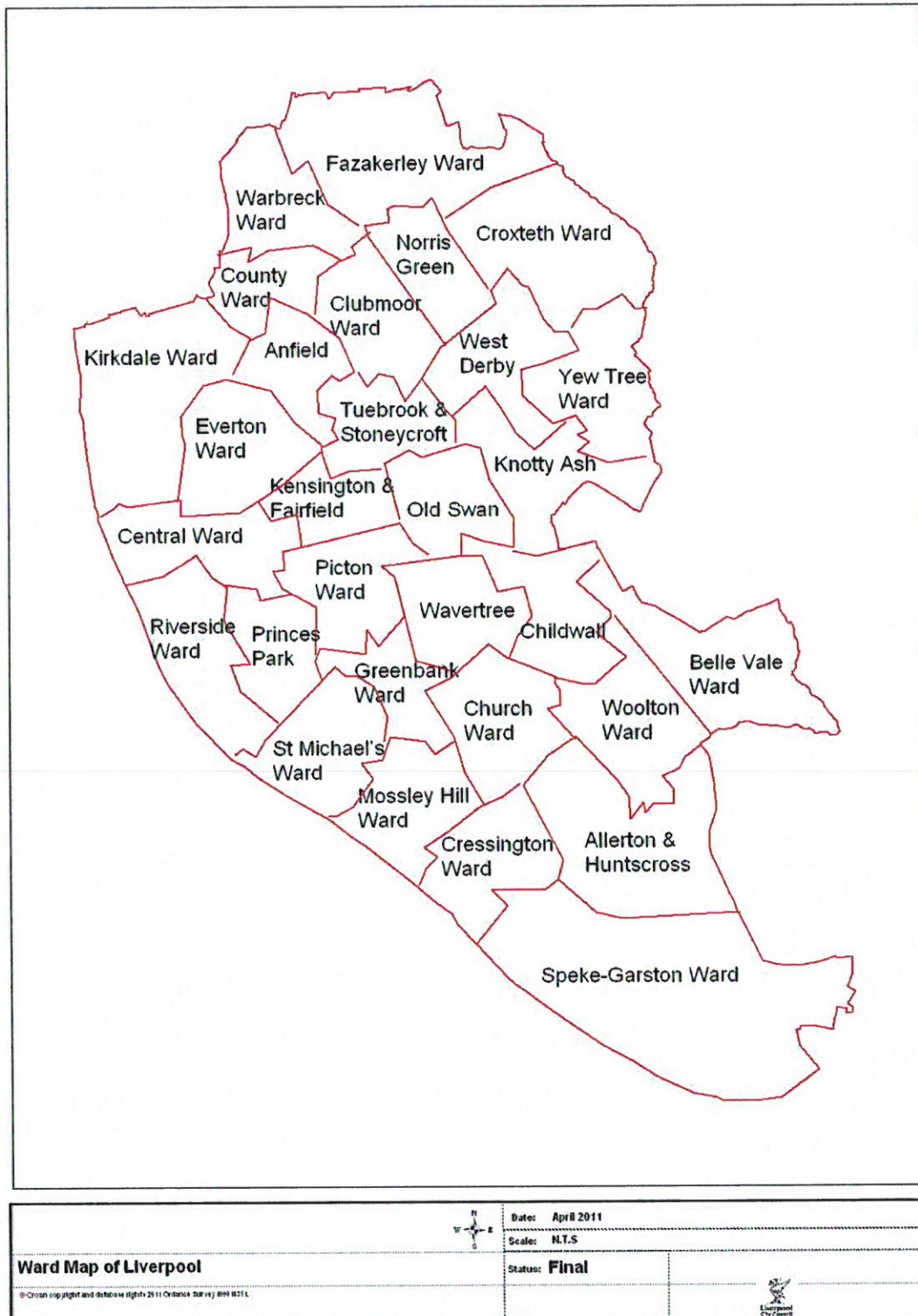
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APPENDIX L: PFRA/SFRA INFORMATION

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This has all led to a reduction in the efficiency of the original land drainage system. Ultimately all surface water drains via the ditches, watercourses and public sewers to the rivers Alt and Mersey.

Figure 1.3.1 Liverpool City Council administrative area



and flooding locations are recognised, without an overabundance of records being included. This will enable identification of floods that are significant on a national scale. Areas affected by flooding that are not classified as having significant harmful consequences will still be reviewed as part of the local flood risk strategy in Liverpool.

Table 4.2.1 shows the flooding in July 2010, which is the only flooding event for which detailed records are held, after investigations were undertaken by LCC. A summary map of past flooding is shown in Figure 4.2.2, which is based on LCC and UU DG5 flooding information for July 2010 and LCC historic flooding information from the Confirm database. Table 4.2.2 shows all known past flooding at the three locations that have suffered locally significant historic flooding. Further information for these flooding locations is detailed in the annex 1 spreadsheet.

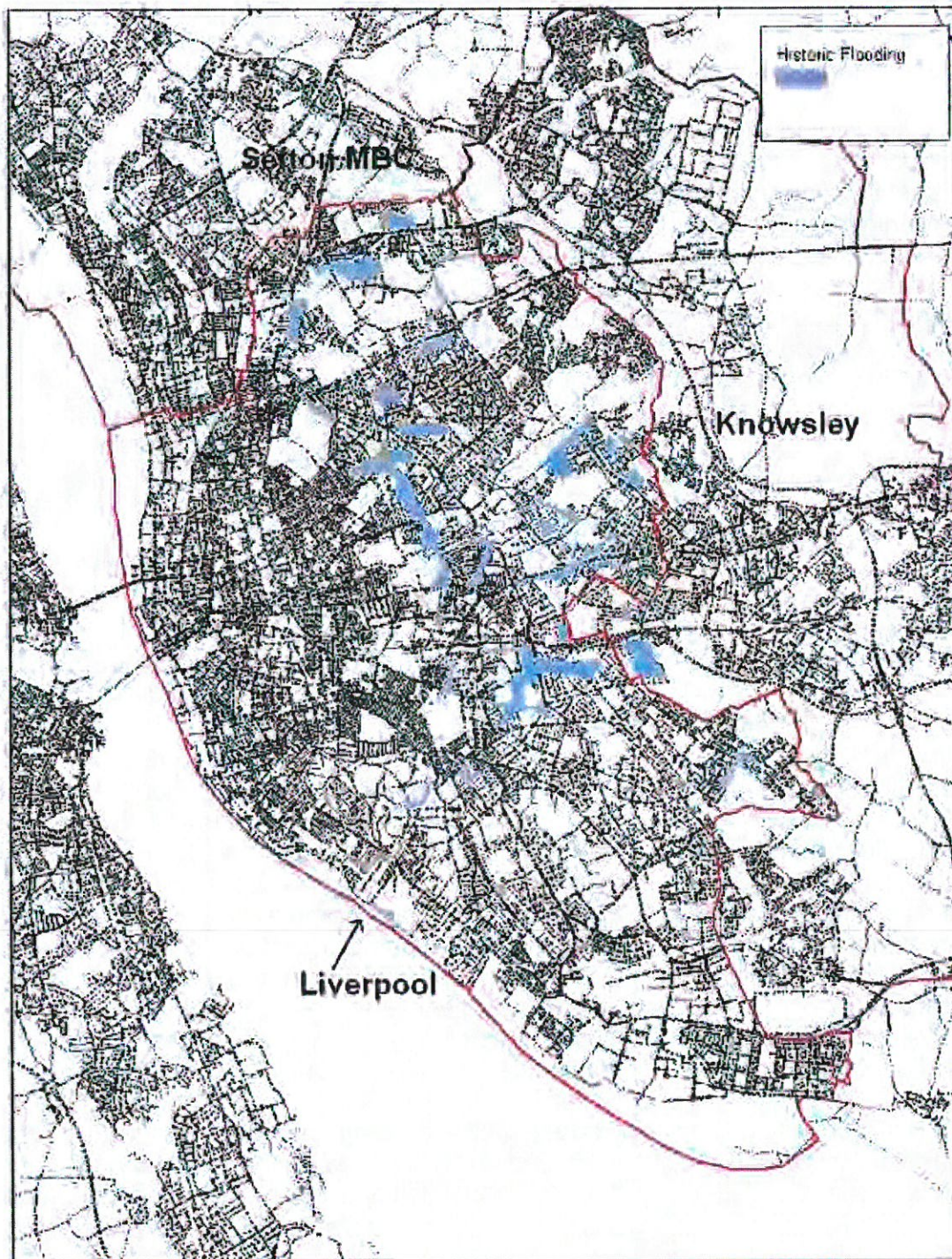
Table 4.2.1 Summary of past flooding with significant harmful consequences

Location	Date	Residential properties flooded	Non-residential properties flooded
Liverpool (city wide)	20 th July 2010	247	10

Table 4.2.2 Summary of all known past flooding at locally significant historic flooding locations

Leyfield Road/ Leyfield Close L12	Crawford Close L12	Churchdown Road L14
1989 – 10 high risk properties affected and 20 at lower risk 1998 – flooding recorded (resident records) 6 Nov 2001 – flooding recorded (resident records) 19 May 2004 – flooding recorded (resident records) 16 Nov 2005 – flooding recorded (resident records) 2 July 2007 - internal flooding and entire road flooded (recorded on *CONFIRM) 11 May 2008 – internal flooding recorded (resident records) 11 Sept 2008 - road flooded (recorded on *CONFIRM) 23 Nov 2008 - entire road flooded (recorded on *CONFIRM) 5 November 2009 – highway flooded (recorded on *CONFIRM) 15 July 2010 –flooding recorded (resident records) 20 July 2010 – Internal flooding and highway flooded (recorded on *CONFIRM)	2000 – LHT experienced flooding within the close 2002 – 5 or 6 properties recorded on United Utilities DG5 register as having been flooded greater than 1 in 10 years due to hydraulic inadequacy (removed on completion of pumping station in 2008 but have flooded since due to exceptional storm event) 10 August 2004 – 8 properties flooded (recorded on *CONFIRM system) 13 July 2007 – flooding reported (recorded on *CONFIRM system) 11 May 2008 – flooding reported 3 inches from houses (recorded on *CONFIRM system) 9 July 2010 – whole road flooded (recorded on *CONFIRM system)- 20/21 July 2010 – 9 LHT houses affected to depths of 0.5m – 1.0m deep, plus approx 7 owner occupier properties (recorded on *CONFIRM system)	11 May 2008 surface water flooding occurred and 25 properties were flooded – up to 3ft depth (recorded on *CONFIRM). 9 July 2008 – roads and carriageways were flooded (recorded on *CONFIRM). 20 July 2010 – roads were flooded, water over kerb, water into gardens and up to front doors (recorded on *CONFIRM).

Figure 4.2.2 Summary of past flooding



<p>Historic Flooding Locations</p> <p>This map is reproduced from Ordnance Survey, written with the permission of Ordnance Survey. It is not to be used for any other purpose without the written permission of Ordnance Survey. It is not to be used for any other purpose without the written permission of Ordnance Survey.</p>	<p>Date: April 2011</p>
	<p>Scale: N.T.S.</p>
	<p>Status: Final</p>
	<p>The City of Liverpool</p>

Figure 5.2.1 Map of 'locally agreed surface water information'

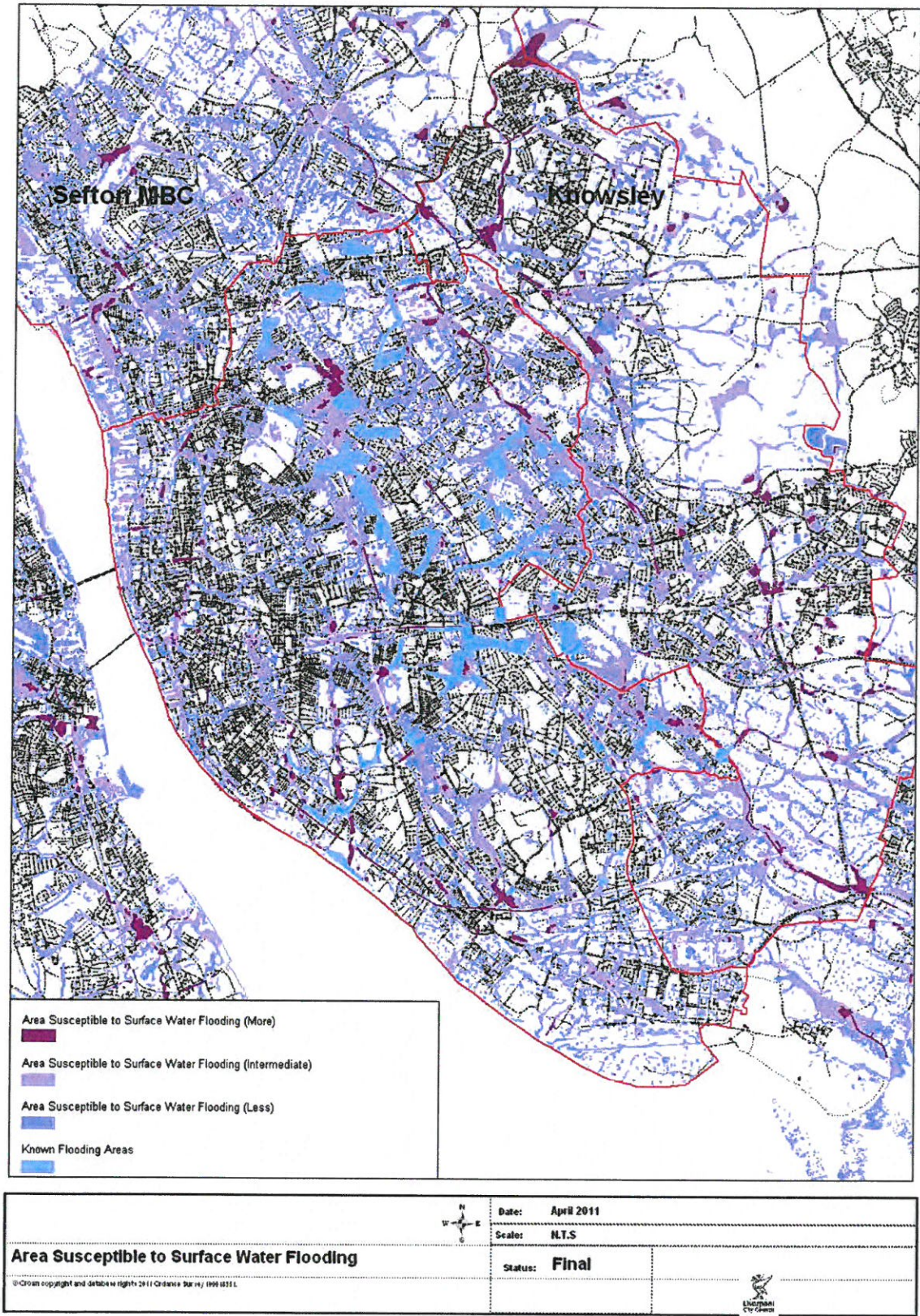


Figure 5.2.2 Areas Susceptible to Surface Water Flooding (AStSWF)

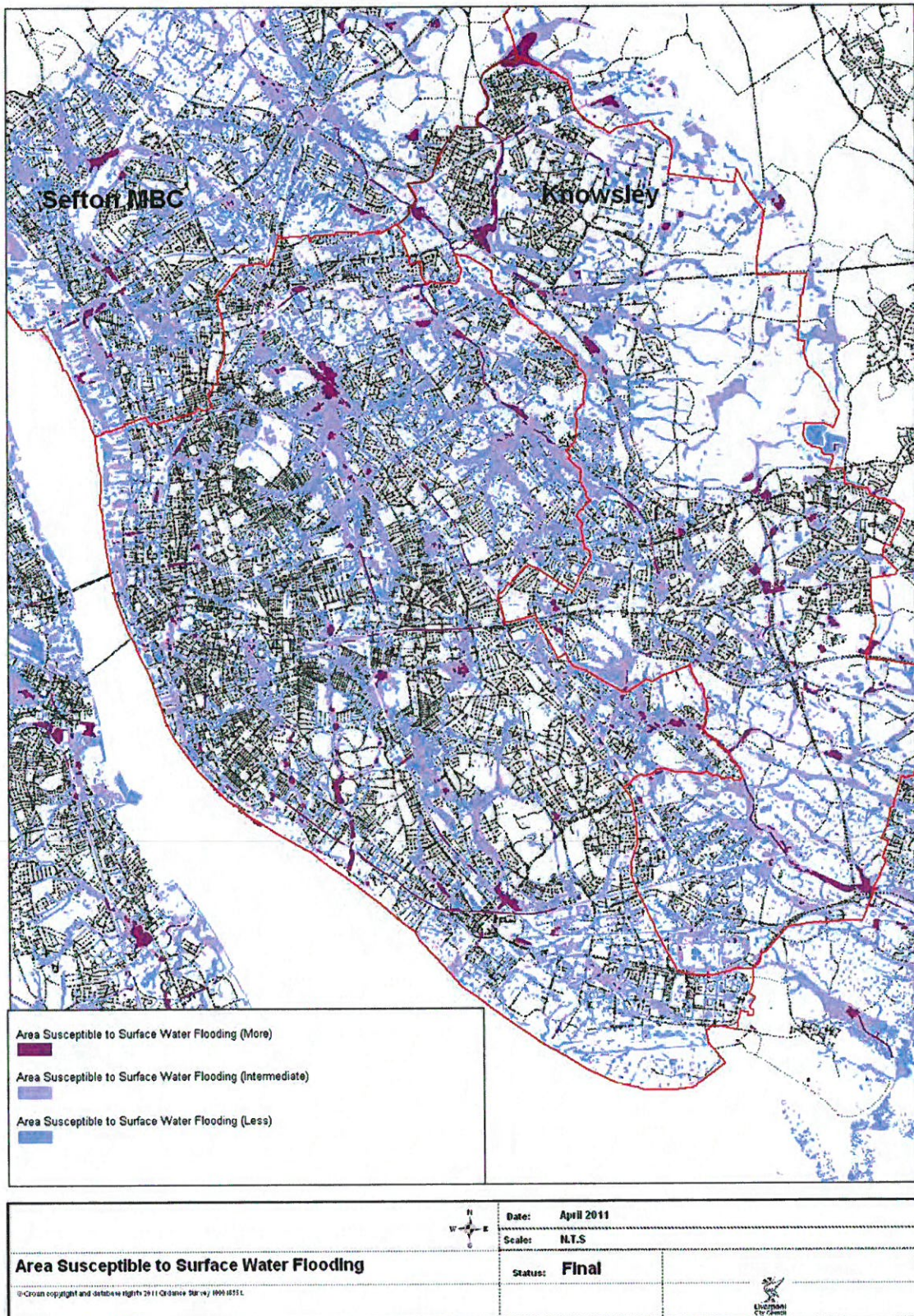


Figure 5.2.3 Areas Susceptible to Groundwater Flooding (AStGF)

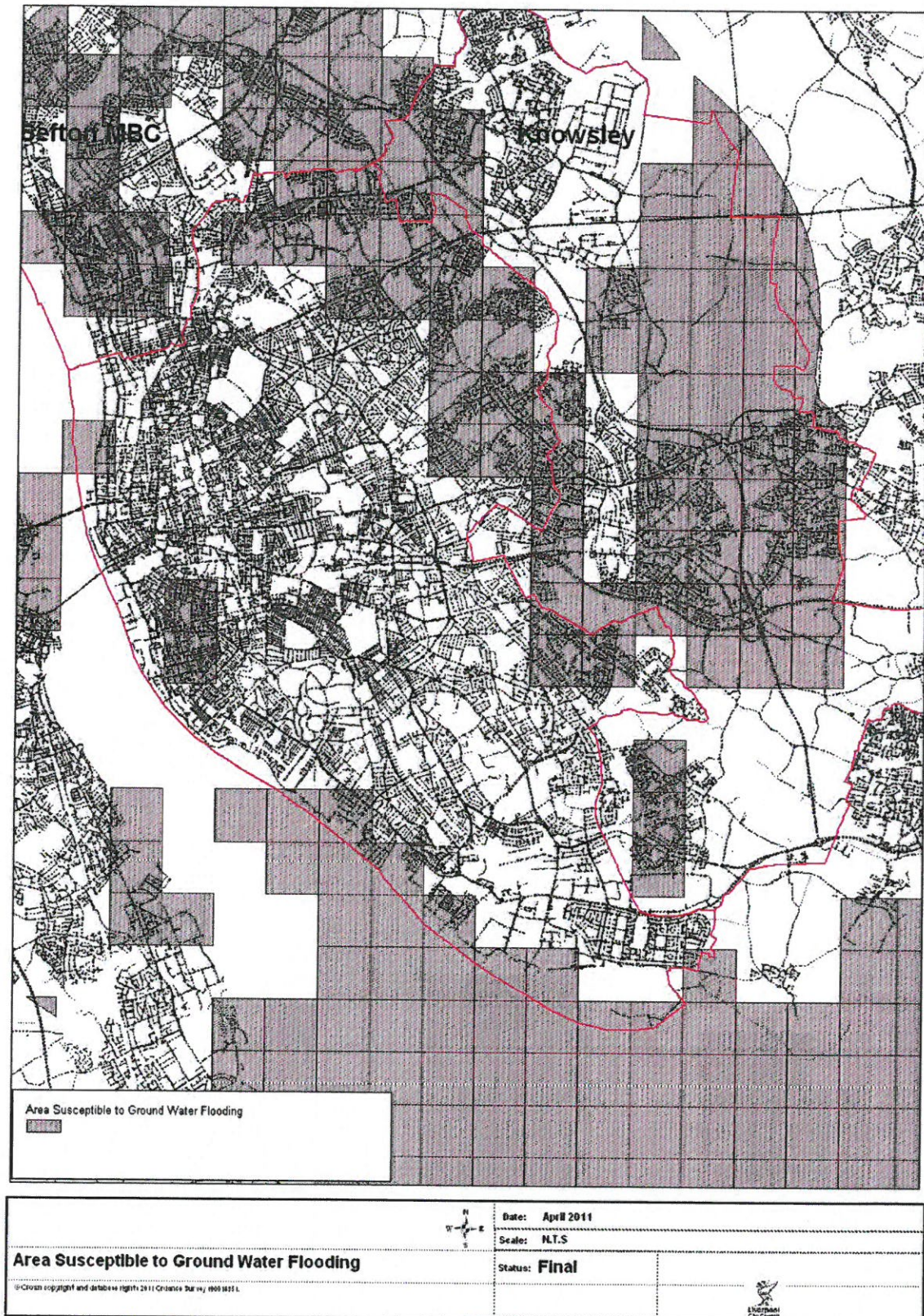


Figure 6.1.1 Indicative Flood Risk Area for Liverpool

