Liverpool City Council
Preliminary Flood Risk Assessment Report

June 2011

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Executive Summary

The Flood Risk Regulations (FRR) 2009 and the Flood and Water Management Act (FWMA) 2010 place significant new duties on Liverpool City Council in identifying and managing flood risk. The FRRs require Lead Local Flood Authorities (LLFA) to produce Flood Risk Management Plans by 2015 and Defra have produced a four year programme that LLFAs must comply with to meet these objectives. The first element of this programme is the production of a Preliminary Flood Risk Assessment (PFRA) submission, which comprises this document, supporting spreadsheets and GIS layer. The key milestones identified in the four year programme are:

- Preliminary Flood Risk Assessment – by 22 June 2011
- Identify Flood Risk Areas – by 22 June 2011
- Prepare Flood Hazard Maps for Flood Risk Area – by 22 June 2013
- Prepare Flood Risk Management Plans for Flood Risk Area – by 22 June 2015

The scope of the PFRA is inclusive of flooding from surface water, ordinary watercourses, groundwater, and canals. The methodology for producing the PFRA has been based on Environment Agency's PFRA Final Guidance document and Defra's guidance on selecting and reviewing Flood Risk Areas.

The Environment Agency has used a national methodology for identifying indicative Flood Risk Areas, to be reviewed and either confirmed or amended by LLFAs. The fourth largest of the ten indicative Flood Risk Areas is an area covering most of Liverpool and large parts of Sefton and Knowsley. An amended Flood Risk Area which includes Liverpool and Sefton only is shown in this report. Knowsley has been detached from the Flood Risk Area and a separate PFRA is being submitted by them. Annex spreadsheets which include the amended Flood Risk Area for Liverpool and Sefton are included with this submission, however this report concerns flood risk for Liverpool only and a separate PFRA report is to be submitted for Sefton.

To gain an understanding of flood risk in Liverpool, historic flooding records from a number of sources have been reviewed for the PFRA, including LCC, United Utilities and British Waterways data. The citywide rainfall event in July 2010 which flooded 257 properties as well three known flooding locations, Crawford Close, Churchdown Road and Leyfield Road are considered to have had significant harmful consequences and are hence detailed in the Annex 1 spreadsheet. The July 2010 flooding also caused significant delays and disruption to the highway network. The heavy rainfall event came as a timely reminder of the risk of flooding within the City and reinforced the findings of the work already undertaken in identifying and understanding flood risk.

Future flood mapping produced by the Environment Agency has been used to determine future floods with potential significant harmful consequences. Areas Susceptible to Surface Water Flooding (AStSWF) mapping developed by the Environment Agency has determined that 20,100 properties in Liverpool are at risk in areas with intermediate susceptibility from a rainfall event with a 1 in 200 annual chance of occurring. The amended Flood Risk Area for Liverpool and Sefton includes 22,200 residential properties at risk, which equates to 52,000 people.

As a Lead Local Flood Authority (LLFA) LCC has a duty under the FWMA to develop, maintain, apply and monitor a local strategy for flood risk management. The work undertaken during the development of the PFRA will support these objectives and inform future strategies on managing flood risk.

1 Introduction

1.1 Scope of the report

As a unitary authority, Liverpool City Council (LCC) is designated as a Lead Local Flood Authority (LLFA). The Preliminary Flood Risk Assessment (PFRA) process is being undertaken in response to the requirement of the Flood Risk Regulations (2009).

This PFRA report assesses significant local flood risk across Liverpool City Council administrative area. The scope is inclusive of flooding from surface water, ordinary watercourses, groundwater, and canals. Flooding from the sea is not considered in the PFRA. Flooding solely from main rivers is not considered, however where this links to surface water or ordinary watercourse flooding it is included.

1.2 Aims and objectives

The aim of the PFRA is to provide an assessment of local flood risk across the study area, including past floods and potential consequences of future floods. The following is a list of objectives for Liverpool's PFRA:

- To support local flood risk management strategy
- To identify Flood Risk Areas
- To collate information on past floods and potential future flood risk
- To determine significant local flood risk
- To provide a reference point for local flood risk management and inform strategies
- To establish partnership arrangements in assessment of flood risk

1.3 Study area

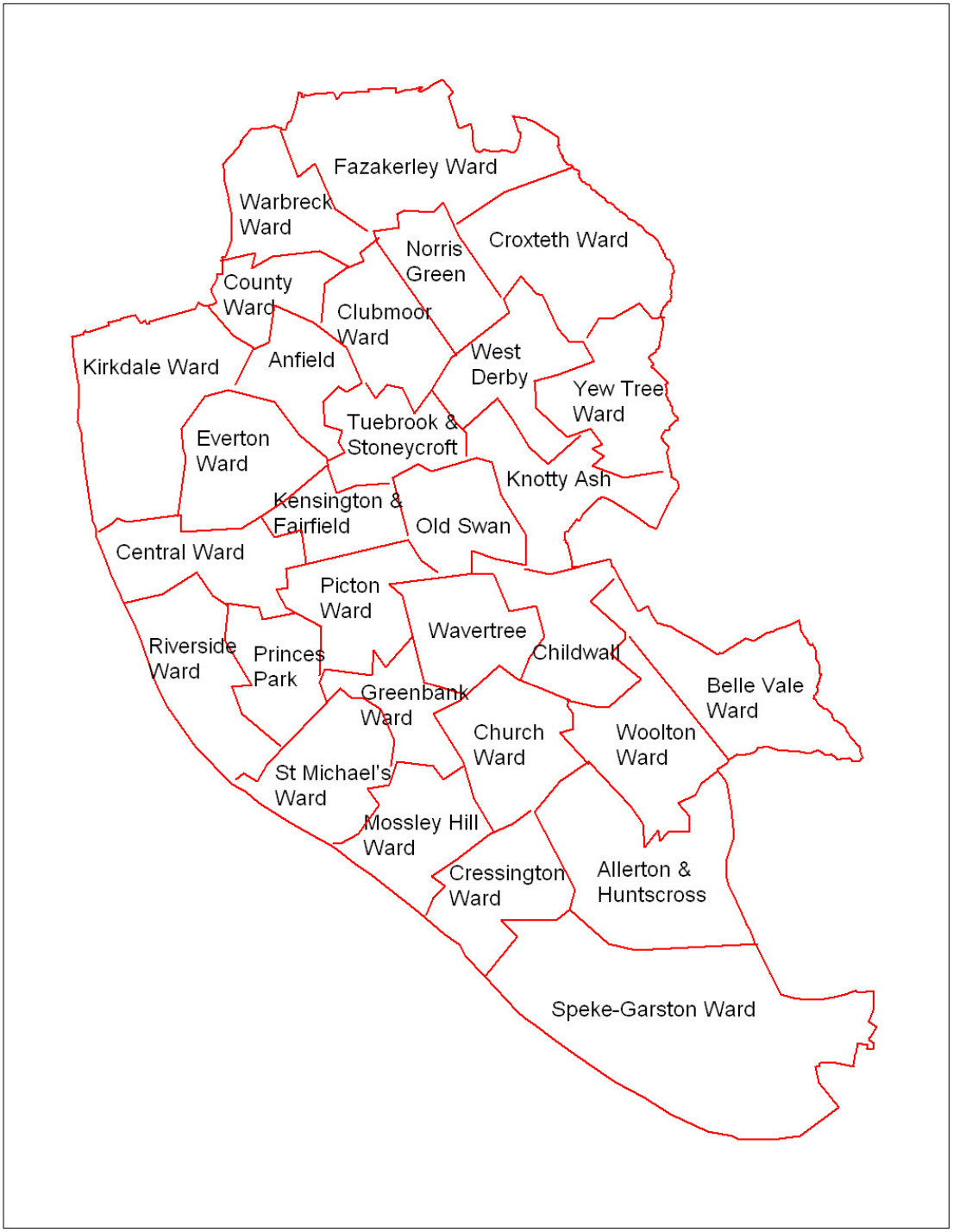
This report considers significant flood risk within the Liverpool City Council boundary. There are cross boundary flooding issues with neighbouring LLFA Sefton Borough Council. Flood risk mapping and PFRA spreadsheets have been undertaken jointly across Liverpool City Council and Sefton Borough Council.

Liverpool is a predominantly urban area of approximately 114km^2 with a population of 443,300 (ONS 2009 Mid Year Estimate). In addition to the boundary with Sefton, Liverpool borders Knowsley Metropolitan Borough Council to the east and shares a short boundary to the south with Halton Borough Council. The city is bordered to the west by the river Mersey.

Prior to any development Liverpool was drained by a network of open channels, brooks and rivers. These discharged into the River Alt to the North and East, and the River Mersey to the South and West. As Liverpool developed the surface water system grew around the existing open channel network and the resultant drainage system comprised a series of small sub-catchments linked by ditches and watercourses. Today Liverpool is a predominantly urban area and as the open fields were developed, the more minor channels were either culverted, laid with land drains and backfilled, or simply filled in.

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



Date: April 2011
Scale: N.T.S
Ward Map of Liverpool
Status: Final

2 Lead Local Flood Authority Responsibilities

2.1 Coordination of Flood Risk Management

The Flood and Water Management Act (FWMA) 2010 brought the recommendations of the 2007 Pitt Report into legislation, giving Local Authorities a co-ordinating role for flood risk management. As a LLFA, Liverpool City Council is now responsible for coordinating flood risk management across Liverpool. The Flood Risk Regulations (2009) impose the duty to complete this Preliminary Flood Risk Assessment.

A Steering Group comprised of senior LCC officers has been established to oversee the delivery of new Flood Risk Management duties. This group is taking a strategic lead and consists of representatives from Planning and Development Control; Transportation; Public Protection, Parks and Green Spaces, and Asset Management and Estates. A programme of work is underway to deliver a flood risk management strategy for Liverpool.

A Scrutiny Committee and process has been established within the existing Select Committee structure of LCC to scrutinise flood response and planning arrangements and will also provide a platform to engage local flood risk management authorities and residents affected by flooding. The existing Environment and Climate Change Select Committee will take the lead role on flood risk management in 2011/12 and provide periodic updates to the Overview and Scrutiny Committee.

All relevant teams within LCC have been made aware of the new legislation and new LLFA responsibilities and are developing suitable working practices, procedures and protocols. In response to new duties and legislation around flood responsibilities Liverpool City Council has taken the opportunity of current restructure plans to align the existing Climate Change Team and Emergency Planning Team into a future Environment and Emergency Resilience Team. This will enable closer working between the two current teams, the sharing of expertise, co-ordination of resources and allow greater flexibility and capacity to respond to future flood risk and climate change impacts.

2.2 Partnerships

A key part of the LLFA co-ordinating role involves forming partnerships with flood risk management agencies. Partnership groups at operational and strategic levels are being established with representation from LCC, EA and UU. The operational group is for representatives to investigate and manage individual locations. The strategic group is to consider the way forward for flood risk strategy in Liverpool. The remits of these groups will become better defined as the new duties become fully understood and additional sections of the FWMA become enacted.

There are a number of stakeholders that have an interest in flood risk management in Liverpool. These are listed below:

- Liverpool City Council- Lead Local Flood Authority

- Local Ward Members
- Liverpool Enterprise Ltd (LCC venture partner)
- 2020 Liverpool Ltd (LCC venture partner)
- Glendale Liverpool Ltd (LCC venture partner)
- Environment Agency
- United Utilities
- British Waterways
- Neighbouring LLFAs- Knowsley, Sefton and Halton
- City of Liverpool residents
- Merseyside Fire and Rescue Service
- Merseytravel
- Network Rail
- Merseyside Police Service

2.3 Communication with partners

Cross boundary issues have been discussed with Knowsley and Sefton to gain an understanding of how one LLFA area may affect another. These discussions will continue to ensure risk is reduced through good communication and management.

The PFRA mapping and spreadsheet annexes have been undertaken jointly with Sefton and the amended Flood Risk Area covers areas of both authorities. Liverpool also has a boundary with Knowsley Metropolitan Borough Council, along which several flooding instances have occurred. Merseyside authorities meet regularly to discuss drainage issues, and an ad hoc meeting was held for the purpose of discussing cross boundary issues during the PFRA development process.

2.4 Public engagement

It is recognised that members of the public can contribute valuable information to flood risk management. Public engagement can afford significant benefits to local flood risk management including building trust, gaining access to additional local knowledge and increasing public involvement in options and decisions proposed in future flood risk management plans. Such engagement is undertaken in known flooding locations in Liverpool, for example public meetings to discuss flood risk management proposals. Elected members and Neighbourhood Services play an important part in engaging with residents on flood risk management. The Climate Change Team and Emergency Planning Unit have delivered community resilience workshops to elected members, Neighbourhood Services colleagues, Registered Social Landlords and community and voluntary organisations to share predicted climate change impacts and outline the role of community resilience. It is anticipated that this work can be progressed by working with a group at risk of flooding to further develop a community resilience plan. Property Level Grant funding has been approved by the Environment Agency to provide residents with flood protection to properties. Of the £2m national grant scheme Liverpool's projects will receive £204,000 and benefit 57 at risk properties.

The *Lets Get Ready Liverpool* booklet promotes and raises awareness about community resilience responses to events such as severe weather and flooding. A separate booklet entitled *Building Business Resilience* focuses on the risks to business

and commerce. These booklets have been promoted via the LCC web site, through a series of presentations, via a range of media and through multi-agency training, workshops and exercises. Further programmed activity includes the roll out of training to new partners, identification of vulnerable resident information, and promoting key resources such as food banks or emergency community shelters and accommodation.

2.5 Further responsibilities

The Flood Risk Regulations contain a number of key actions as outlined below:

- Preliminary Flood Risk Assessment – by 22 June 2011
- Identify Flood Risk Areas – by 22 June 2011
- Prepare Flood Hazard Maps for Flood Risk Area – by 22 June 2013
- Prepare Flood Risk Management Plans for Flood Risk Area – by 22 June 2015

In addition to taking the overarching role for flood risk management, there are a number of other key responsibilities that are a requirement of the Flood & Water Management Act.

Further responsibilities of the Flood & Water Management Act are:

Investigating flood incidents – LLFAs have a duty to investigate and record details of significant flood events within their area. This duty includes identifying which authorities have flood risk management functions and what they have done or intend to do with respect to the incident, notifying risk management authorities where necessary and publishing the results of any investigations carried out.

Asset Register – LLFAs have a duty to maintain a register of structures or features which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.

SuDS Approving Body – LLFAs are designated the SuDS Approving Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new sustainable drainage systems (SuDS) within their area.

Local Strategy for Flood Risk Management – LLFAs are required to develop, maintain, apply and monitor a local strategy for flood risk management. The local strategy will build upon information such as national risk assessments and will use consistent risk based approaches across different local authority area and catchments.

Works powers – LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local flood risk management strategy for the area.

Designation powers – LLFAs, as well as district councils and the EA have powers to designate structures and features that affect flooding or coastal erosion in order to safeguard assets that are relied upon for flood or coastal erosion risk management.

Cooperate and Share Information – An authority must cooperate with other authorities in exercising Flood and Coastal Erosion Risk Management (FCERM) and this includes sharing data.

Sustainable Development – LLFA must aim to contribute towards sustainable development whilst exercising FCERM.

Establish a Scrutiny Committee for Flooding – power to allow LLFA to allow scrutiny committee when exercising FCERM.

3 Methodology and Data Review

3.1 Data sources

The PFRA preparation is to be based on readily available or derivable data. Information gathered from a number of sources has been used in the preparation of the PFRA. The datasets obtained and utilised are listed below in Table 3.1.1.

Table 3.1.1 Data sources

	Dataset	**Description**
Liverpool City Council	Historic flooding records	Records of flooding incidents held by LCC including dates and incident details.
	Land Drainage Investigations-Open Watercourse Survey Report 2008/09	Surveys of open sections of ordinary watercourses.
	Land Drainage Investigations-Manhole Survey Reports 2009/10	Manhole surveys of culverted ordinary watercourses –inventory and condition
	Land Drainage Investigations-Traverse Survey Reports 2009/10 and 2010/11	Traverse surveys of culverted ordinary watercourses determining inventory and condition information.
	Surface Water Management Plan (SWMP)	SWMP currently under development. Initial modelling outputs available and have been considered when compiling this report. Risk from ordinary watercourses available.
	Strategic Flood Risk Assessment (SFRA)	Document produced in 2007 by LCC Planning to inform planning process.
	Anecdotal past flooding information	Local knowledge of flooding from LCC officers and stakeholders and partner organisations
	Water Cycle Study (WCS) scoping study	Scoping report for Liverpool and Wirral Growth Point currently in preparation.
	Core Strategy	LCC Planning document for future growth.
	Media search	Collated media reports of widespread flooding event in July 2010.
Environment Agency	Areas Susceptible to Surface Water Flooding (AStSWF)	First generation future flood mapping -three susceptibility bandings (less, intermediate, more) for a rainfall event with a 1 in 200 chance of occurring.
	Flood Map for Surface Water (FMfSW)	Second generation future flood mapping - two depth bandings (greater than 0.1m and greater than 0.3m) for two flood events (1 in 30 annual probability and 1 in 200 annual probability).
	Areas Susceptible to Groundwater Flooding	Future flood mapping for groundwater.
	Flood Map (Rivers and Sea)	Future flood mapping for rivers and sea where the catchment is greater than 3km^2.

	Indicative Flood Risk Areas	Defined areas with risk to over 30,000 people.
	Historic Flood Map	Spatial extent mapping of past flooding recorded by the EA.
	National Receptors Dataset	Collection of risk receptors including buildings (schools, hospitals electricity substations), utilities, environment, heritage and transport.
	Catchment Flood Management Plan	Plan prepared by EA and local authorities to consider priorities for flood risk.
United Utilities	DG5 records	United Utilities records of internal and external hydraulic flooding at property level.
	Comments from model	United Utilities comments made from results of their model.
British Waterways	British Waterways canal network	Canal network
	Locks, sluices and weirs	Locks, sluices and weirs
	Breaches	Point dataset of historic breach events

3.2 Availability and limitations of data

Initial data outputs from the Surface Water Management Plan (SWMP) have been available to support and inform PFRA mapping, however the development of the SWMP is still in progress. Initial model outcomes corroborate the indicative Flood Risk Area. For the next stages of the PFRA process, there will be much greater availability of data from the SWMP. Similarly, the Water Cycle Study scoping study for Liverpool and Wirral is in preparation and will provide useful flood risk information for future PFRA stages of Flood Hazard and Flood Risk maps in 2013 and Flood Risk Management Plans in 2015.

Historic flooding records for LCC are recorded on the Confirm system after being logged through the call centre. The Confirm records are recorded for the LCC services, and hence records focus on flooding to LCC owned highways and parks and gardens. Despite this, notes of residential flooding are usually included, however this has not been the primary purpose of this recording mechanism.

Information is limited by previous proformas used by the call centre and the way data has been recorded. In the past, data that has been captured has not been of the highest quality and this has limited understanding of the causes of flooding. In response to this, a new call centre script and recording process has been developed for flooding. The aim is that call centre staff will be able to ask appropriate questions to gain meaningful information from each call on highway flooding and flooding to properties. It was developed by the Transportation and Emergency Planning teams working in conjunction with the call centre team. The main driver for this is to improve service and for relevant flood risk agencies to be notified, however flood monitoring and investigation should also lead to improved service levels. Future monitoring is planned

and will include taking photographs that will provide an indication of depth and extents of flooding. This will assist with validating model outputs.

Even with the improved recording mechanism, information can only be obtained if a call is actually made. If a known flooding location is attended during or after a period of heavy rainfall, calls may not be made if residents feel the situation is already being dealt with as in the case of emergency services, LCC or UU attendance on site.

3.3 Data systems

MapInfo has been used for the PFRA flood mapping. Information from different agencies has been made available in this format including Environment Agency, United Utilities and British Waterways. The Confirm data management system used by Liverpool City Council is linked to MapInfo. Confirm is an infrastructure asset management system used by LCC to record incidents, assign jobs and monitor progress. It is used to manage corporate plans, meet legislative obligations and maintain standards for corporate governance and community duty-of-care. Confirm data is stored on the LCC Oracle universal data management system.

A shared folder has been set up on the LCC network for information on flood risk management to be stored and shared between all the relevant LCC service areas. Flood risk management information is shared externally in a number of ways including the publication of documents on the LCC website and electronic transfer when data sharing with other flood risk management agencies.

3.4 Data quality assurance, security and data restrictions

Data has been reviewed and assessed before being included for mapping. Knowsley and Sefton data was removed from UU DG5 internal flooding information after being considered for cross boundary flooding issues. Correlation between different datasets, especially UU and LCC data gives confidence in the quality of the data.

A data sharing contract prepared by United Utilities has been signed by LCC for agreed use of their data. This restricts sharing the data and using it for purposes other than those stated in the agreement. Similarly, British Waterways require LCC to keep the information provided by them confidential and not to pass it on to third parties unless required to do so by law. The use of some of the Environment Agency data is restricted for preparation of the PFRA but other EA data is unrestricted.

4 Past Flood Risk

4.1 Past floods

In July 2010 Liverpool experienced a high intensity rainfall event in which a total of 257 properties suffered internal flooding attributed to surface water. This has been assessed to have been a rainfall event with approximate annual probability of 1 in 20 to 50. Flooding was widespread across the city. Internal flooding reports were grouped into cluster areas at Deysbrook area L12, East Prescot Road area L14, Allerton Road area L18, Wavertree L15 and Aigburth L17. However, flooding was not limited to these localities and occurred across the Liverpool City Region. Records of this flooding event comprise the majority of the historic flooding element of the PFRA.

Three known flooding locations (Leyfield Road, Churchdown Road and Crawford Close) have also been included in PFRA mapping and are detailed in the annex 1 spreadsheet. These locations suffer regular flooding and were affected during the July 2010 rainfall event. Data gathered shows many other locations have suffered flooding, however the three locations listed are the only ones that have met the significant harmful consequences criteria for historic flooding on one or more occasion.

Crawford Close is part of the wider Deysbrook area, which has suffered frequent flooding and was affected particularly badly in the July 2010 event. The Deys Brook is designated as a Main River from Alundale Road to its confluence with the river Alt and is an ordinary watercourse upstream of this. Crawford Close is within the main river section of the brook, however flooding in the area has not been attributed solely to the Deys Brook and is thought to be a combination of surface water flooding and fluvial flooding.

Records do not show any instances of groundwater flooding, however due to the nature of the LCC call centre recording mechanism it is unlikely for this to have been diagnosed as the source of flooding. In future, investigations may identify flooding that can be attributed to groundwater. There are no LCC records of canal flooding and British Waterways' records show no breaches within Liverpool since a breach in 1940 caused by WW2 bombing.

Investigations are key to understanding the mechanisms of flooding at any location and identifying where LCC, EA or UU may have responsibilities.

4.2 Significant harmful consequences

Significant harmful consequences have been determined locally as historic flooding that meets one or more of the following criteria:

- Number of residential properties > 8
- Number of critical services > 1
- Number of non-residential properties > 2

Flooding events that have met these limits have been included in the PFRA mapping and the annex 1 spreadsheet, and future flood events that do so will be reported in future PFRA cycles. The criteria have been determined such that major flood events

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.

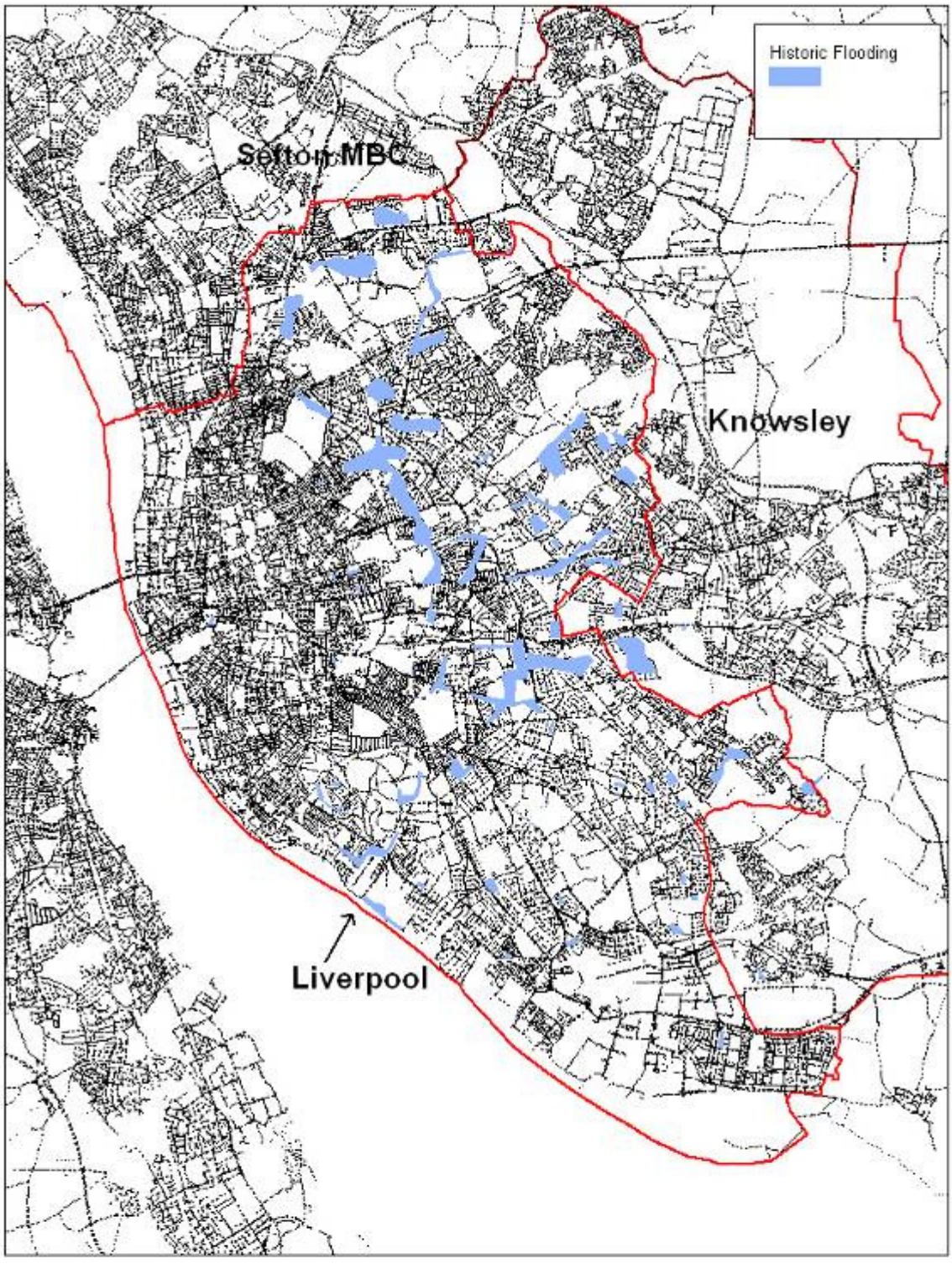
Table 4.2.1 Summary of past flooding with significant harmful consequences

Location	Date	Residential properties flooded	Non-residential properties flooded
Liverpool (city wide)	20th 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) **11May 2008** – internal flooding recorded (resident records) **11 Sept 2008** - road flooded (recorded on *CONFIRM) **23 Nov 2008** - entire road flooded (recoded 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)- **20/21July 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



	Date: April 2011	
	Scale: N.T.S	
Historic Flooding Locations	Status: Final	
This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.		The City of Liverpool

5 Future Flood Risk

5.1 Future flood risk

Details of potential future floods and their consequences obtained from EA mapping are detailed in the Annex 2 spreadsheet. The following future flood mapping provided by the Environment Agency has been utilised for populating the spreadsheet:

- Areas Susceptible to Surface Water Flooding (AStSWF) – three susceptibility bandings (less, intermediate, more) for a rainfall event with a 1 in 200 chance of occurring
- Flood Map for Surface Water (FMfSW) –two depth bandings (greater than 0.1m and greater than 0.3m) for two flood events (1 in 30 annual probability and 1 in 200 annual probability)
- Areas Susceptible to Groundwater Flooding (AStGF)

The indicative Flood Risk Area for Liverpool was determined by the EA from clusters of areas above the flood risk thresholds based on Areas Susceptible to Surface Water Flooding (AStSWF) mapping- intermediate susceptibility banding for a rainfall event with an annual probability of 1 in 200. This was used as an alternative to the Flood Map for Surface Water mapping that was used to determine the majority of Flood Risk Areas across England.

The AStSWF mapping shows a great deal of alignment with the past flooding records. Records from the wide scale flooding in July 2010 mapped alongside the future flood risk mapping show that there is good correlation between the areas deemed as susceptible to surface water flooding and the areas that were affected in reality. This gives confidence in the future flood risk mapping and substantiates its outcomes. Initial outcomes from SWMP modelling also corroborate the areas determined by AStSWF mapping and past flooding records.

The culverted watercourse network is closely aligned to the topography of the area and these lower lying areas tend to be at risk of surface water flooding in addition to the fluvial flood risk from the watercourses. An example of this is the full length of the Upper Tue Brook watercourse running south to north through the city which is highlighted on the Areas Susceptible to Surface Water Flooding plan (Figure 5.2.2).

Table 5.1.1 Summary table for Liverpool Areas Susceptible to Surface Water Flooding

Future flooding prediction	**Estimated number of properties at risk**	**Estimated number of non-residential properties**	**Total estimated properties at risk**
Areas Susceptible to Surface Water Flooding - 1 in 200 annual chance of occurring *(intermediate)*	17,600	2,500	20,100
Areas Susceptible to Surface Water Flooding - 1 in 200 annual chance of occurring (*less)*	49,800	7,300	57,100

Table 5.1.1 above and mapping in Figure 5.2.2 show areas of Liverpool that are susceptible to a rainfall event with annual probability of 1 in 200. Such an event could flood up to 57,100 properties if the more, intermediate and less susceptible areas were all flooded. A rainfall event with a more likely chance of occurring would still flood very large numbers of properties. Modelling to predict consequences of a 1 in 30 annual probability flood is being undertaken for the Surface Water Management Plan (SWMP). The flooding in July 2010 which affected 257 properties was estimated to have had an annual probability of 1 in 20-50.

5.2 Locally agreed surface water information

The AStSWF mapping along with mapped polygons of past flooding has been used to determine 'locally agreed surface water information'. These plans have been shared with United Utilities as the sole water company for Liverpool and with the Environment Agency. The plans have been agreed and constitute 'locally agreed surface water information'. As information is refined in the future, cooperation with UU and EA will be used to refine flood risk plans. The map is shown in Figure 5.2.1 below.

The local drainage capacity is comprised of highway drainage, the UU sewer network and the network of culverted watercourses described in Section 5.4 below.

5.3 Surface water and groundwater future flood risk

A Surface Water Management Plan (SWMP) for Liverpool is under development, which covers the full area within Liverpool City Council boundary. The current phase is scheduled for completion in September 2011, however it should be acknowledged that the SWMP is a living document. Microdrainage Floodflow (2D modelling software) is being used to model surface water flooding for 1 in 30 year and 1 in 200 year events, however it is likely that this range of events will be increased. Floodflow will use a digital terrain model (DTM) prepared from LiDAR, to determine the depth and velocity of surface water over the DTM.

The results from the Floodflow modelling will be verified from Met Office records and data from known historic flooding events. Once verified, Floodflow will then be used to map the flood water depth, and velocity which will then be used within the risk assessment procedure.

Two known flooding locations, Churchdown Road and the Deysbrook area are being modelled initially to verify the approach and support the PFRA. Initial outputs from the model corroborate future flood risk from AStSWF mapping. For the next stages of requirements for the Flood Risk Regulations, outputs from the SWMP will be more developed and will be readily available to support and inform the process.

Groundwater flooding poses a future flood risk to the three Mersey tunnels. The two road tunnels and one rail tunnel are key transport links connecting Liverpool to Wirral. Potential consequences are an economic impact through closures obstructing commuters, commercial traffic and public transport passengers. Emergency services could also be hindered through potential closure of this strategic link, limiting their ability to reach both flooding and other incidents.

Groundwater levels are continuing to rise due to a significant reduction in industrial abstraction with the decline of industry. This causes increasing risk of groundwater flooding. Areas Susceptible to Groundwater flooding mapping has been used to provide information detailed in the future flood risk spreadsheet (Annex 2).

5.4 Ordinary watercourse and canal future flood risk

Liverpool has a substantial network of ordinary watercourses across the city which is comprised of 29.7km of culverted watercourse and 3.6 km of open watercourse sections. Many of the culverted sections are over 150 years old and in poor condition. Potential collapses to these culverts pose a considerable risk of future flooding.

The ordinary watercourse network in Liverpool has been surveyed through the on-going Liverpool Land Drainage Investigations. This includes an open watercourse study in 2008/09, manhole surveys undertaken in 2009/10 and traverse surveys undertaken in 2009/10 and 2010/11. As a result of these surveys two sections of the Upper Tue Brook watercourse that were identified as being in significant danger of collapse have now been replaced. A number of other sections of culvert in poor condition have been identified as posing future flood risk. These locations have been shared with statutory undertakers by the LCC Emergency Planning Team for the purposes of identifying their critical infrastructure, such that risk can be identified and minimised. In the event of a culvert collapse, nearby underground apparatus is in danger, which poses the risk to electricity and clean water supplies to thousands of properties. This is in addition to the risk of flooding.

In 2011/12 a programme of camera surveys is to be undertaken to assess the condition of culvert sections that could not be traversed due to their size or condition. This will be used to assess future flood risk posed by these culverts.

Figure 5.2.1 Map of 'locally agreed surface water information'

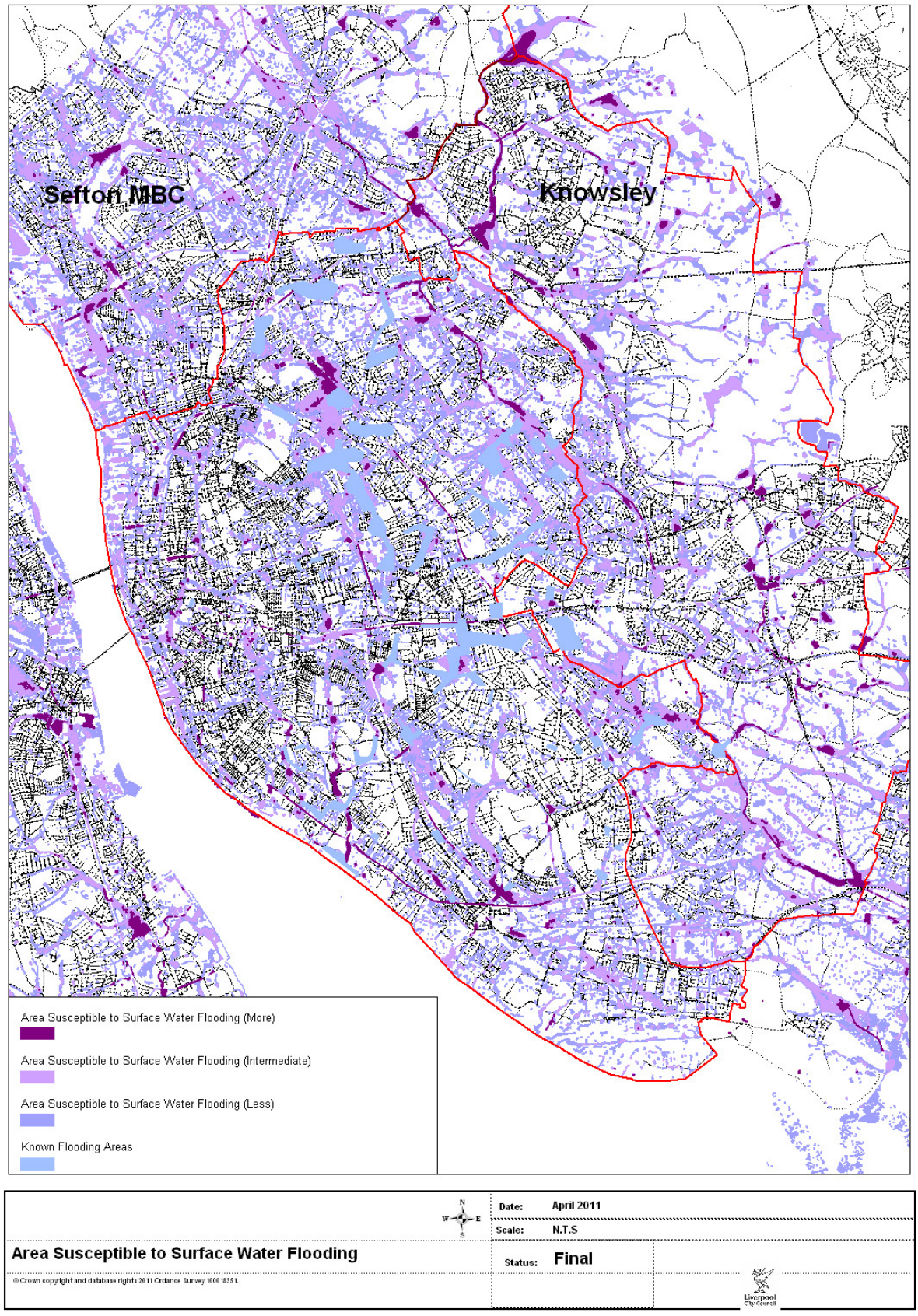


Figure 5.2.2 Areas Susceptible to Surface Water Flooding (AStSWF)

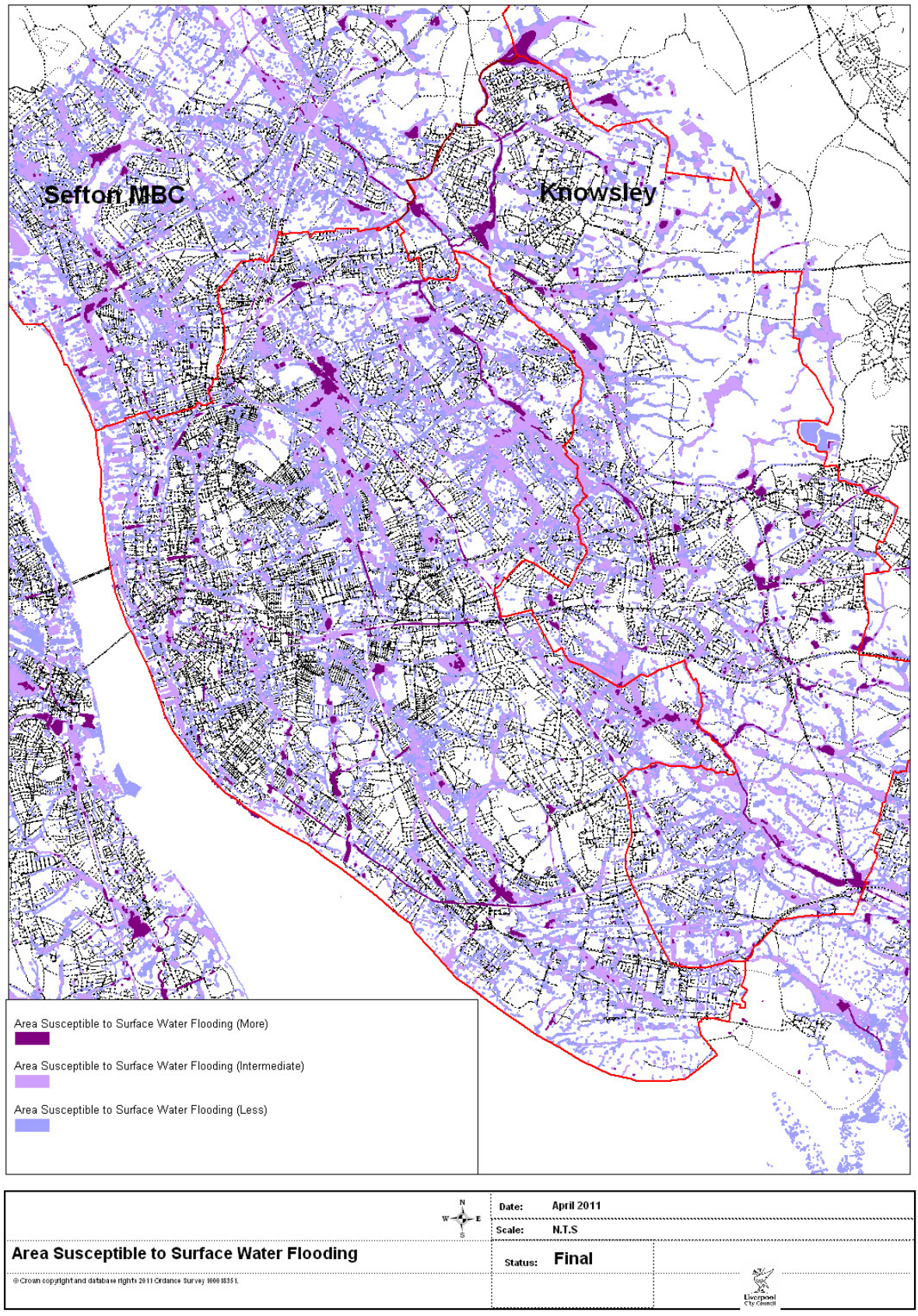
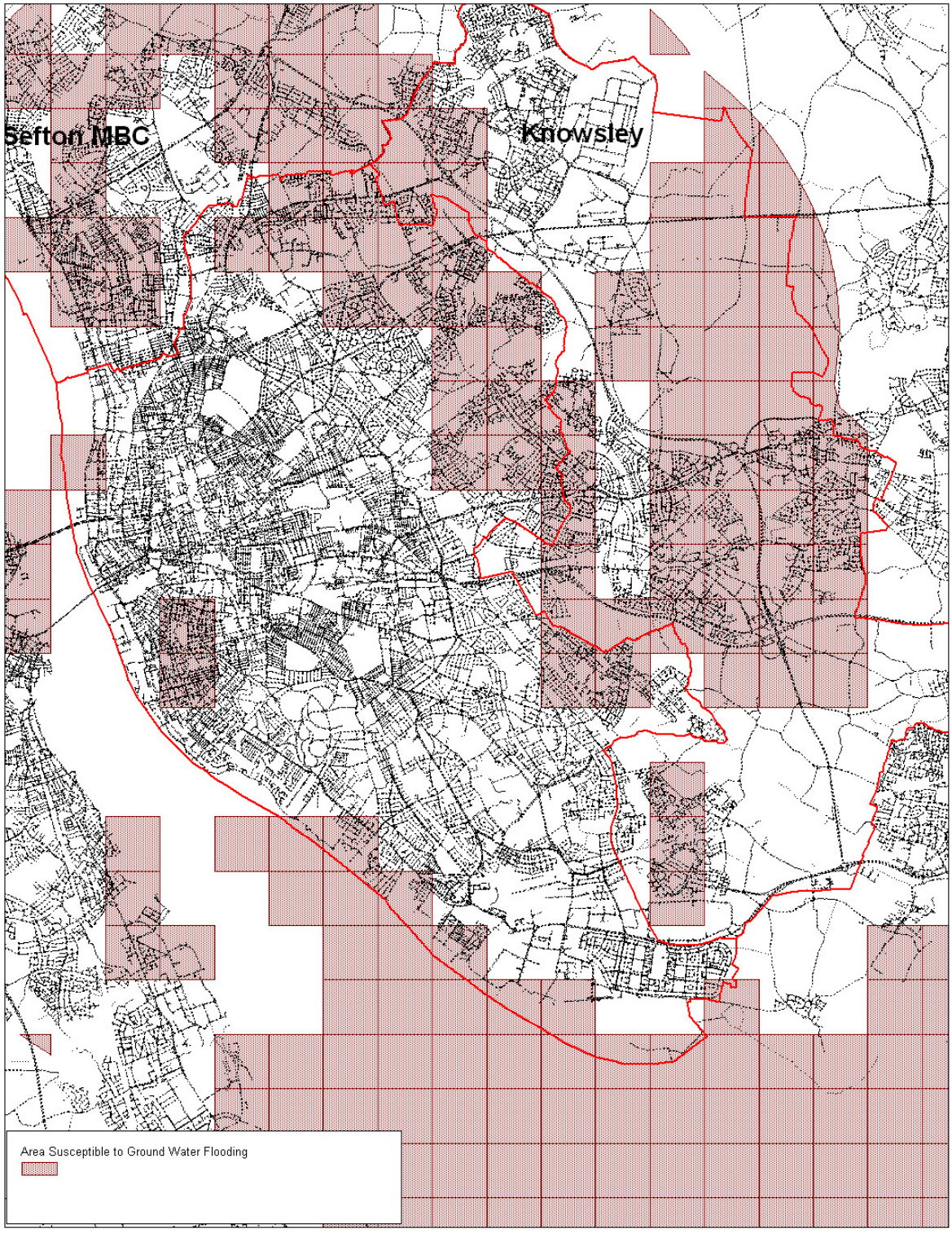


Figure 5.2.3 Areas Susceptible to Groundwater Flooding (AStGF)



N
W E
S

Date: April 2011
Scale: N.T.S
Status: Final

Area Susceptible to Ground Water Flooding

Liverpool City Council

5.5 Climate change and long term developments

5.5.1 The Evidence

There is clear scientific evidence that global climate change is happening now. It cannot be ignored.

Over the past century around the UK we have seen sea level rise and more of our winter rain falling in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation, however the broad trends are in line with projections from climate models.

Greenhouse gas (GHG) levels in the atmosphere are likely to cause higher winter rainfall in future. Past GHG emissions mean some climate change is inevitable in the next 20-30 years. Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s.

We have enough confidence in large scale climate models to say that we must plan for change. There is more uncertainty at a local scale but model results can still help us plan to adapt. For example we understand rain storms may become more intense, even if we can't be sure about exactly where or when. By the 2080s, the latest UK climate projections (UKCP09) are that there could be around three times as many days in winter with heavy rainfall (defined as more than 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance, or rarer) could increase locally by 40%.

5.5.2 Key Projections for North West River Basin District

If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are

• Winter precipitation increases of around 14% (very likely to be between 4 and 28%)
• Precipitation on the wettest day in winter up by around 11% (very unlikely to be more than 25%)

• Relative sea level at Morecambe very likely to be up between 6 and 36cm from 1990 levels (not including extra potential rises from polar ice sheet loss)

• Peak river flows in a typical catchment likely to increase between 11 and 18%

Increases in rain are projected to be greater near the coast than inland.

5.5.3 Implications for Flood Risk

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.

Wetter winters and more of this rain falling in wet spells may increase river flooding especially in steep, rapidly responding catchments. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase

pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected.

Drainage systems in the district have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.

Where appropriate, we need local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

5.5.4 Adapting to Change

Past emission means some climate change is inevitable. It is essential we respond by planning ahead. We can prepare by understanding our current and future vulnerability to flooding, developing plans for increased resilience and building the capacity to adapt. Regular review and adherence to these plans is key to achieving long-term, sustainable benefits.

Although the broad climate change picture is clear, we have to make local decisions against deeper uncertainty. We will therefore consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that we do not increase our vulnerability to flooding.

5.5.5 Long Term Developments

It is possible that long term developments might affect the occurrence and significance of flooding. However current planning policy aims to prevent new development from increasing flood risk.

In England, Planning Policy Statement 25 (PPS25) on development and flood risk aims to "ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall."

Adherence to Government policy ensures that new development does not increase local flood risk. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels which are "significant" (in terms of the Government's criteria).

5.6 Local information concerning climate change impacts

5.6.1 Development and Strategy

Liverpool City Council has recognised and addressed the local impacts of climate change through a number of published documents which include:

- Climate Impacts and Vulnerabilities Framework for Liverpool City, June 2009 (containing information on UKCIP02 climate scenario data for Liverpool, historical media records of extreme weather impacts, flood risk maps, risk assessment matrices and identification of priority risks for services)

- City of Liverpool Climate Change Strategic Framework: A Prospectus for Action, September 2009 (containing information on carbon emissions nationally, regionally and locally together with priority action planning areas and supporting actions)

- Adapting to Climate Change: Liverpool City Council Adaptation Action Plan, March 2010 (containing adaptation action plans for priority services)

- Developing Liverpool's Resilience to Climate Change, March 2011 (currently in final draft and containing information on adaptation action plans for other business units and the future role of increased local resilience to predicted climate change impacts)

5.6.2 Practical Response

In response to persistent surface water flooding to properties in three areas (Crawford Close, Churchdown Road, Leyfield Road), funding has been awarded for Environment Agency property level grants to install flood resilience measures into the worst affected properties. Liverpool Housing Trust also plans to install flood resilience measures into a number of their priority properties in Crawford Close that have previously flooded on more than one occasion.

5.6.3 Research and Weather

Surface water flooding is recognised as a key climate change risk for Liverpool. LCC has been working with the University of Liverpool to identify the potential flood risks posed by sea level rise and storm surge. Whilst much of the city coastline is considered to be well protected against sea level rise, storm surge is likely to make low lying areas vulnerable to flooding, salt spray and the backing up of freshwater drainage waters, sewers and drains - which could result in localised flooding.

A UK wide report on Coastal Flood Boundary Conditions has recently been produced by the EA which raises some uncertainty about the sea levels predicted at Gladstone Dock and instead utilises data from Hilbre Island which provides a better coastal fit with other available trend data. The EA commissioned work predicting tidal surge and outputs are available for modelled surge heights for a range of wind directions along the River Mersey estuary resulting in a point dataset.

Data on extreme weather events in the past 30 years, from the records of the Meteorological Office relating to the weather stations at Aughton (1979-1996 – now closed) and Crosby (1984 to 2008) show a number of weather trends which are likely to exacerbate flooding in the future. These include:

- high frequency summer rainfall (many of the heavy rainfall events recorded over the period 1979-2009 occurred during the summer months (e.g. 50% of the events where rain exceeded 40mm per day occurred in the months June, July and August)
- high frequency high winds (gusts more than 70 miles per hour have been recorded nearly every year since 1996 at Crosby weather station)
- an increase in winter rainfall of between 10.7% and 20.7% by the end of the century
- an increasing trend in median tides taken from Gladstone Dock

5.7 New and proposed major developments

The scale of development proposed for Liverpool over the next fifteen years is referred to in the Core Strategy, which is under consultation. In particular, the draft refers to the scale of housing growth envisaged amounts to approximately 40,000 (net) additional dwellings between 2008-2026, supporting economic development, and community facilities and infrastructure. It is proposed that development will be accommodated within the built-up area of the city, with a spatial focus on the City Centre and Inner Core areas.

The production of the Core Strategy has been informed, in relation to flood risk, by the Strategic Flood Risk Assessment (January 2008), which classified only 4% of the city as being subject to tidal and fluvial flood risk. More detailed evidence is being gathered to assess flood risk emanating from surface water drainage. The Core Strategy contains a number of sustainable development policies to ensure development adapts to climate change and contains mitigation measures to address flood risk.

Identification of specific sites for proposed development, to be integrated into the city's urban fabric, will be included in the Land Allocations and Development Management Policies Development Plan Document. Major development opportunities / proposals identified in the Core Strategy include:

- City Centre areas i.e. Baltic Triangle, Islington
- North Liverpool, incorporating Liverpool Waters and Growth Point Area
- Knowledge Quarter
- Stonebridge Cross
- Speke / Halewood

Both the major development opportunities and small infill development sites, where the delivery of most of the proposed development is likely to occur, will need to be integrated in the existing infrastructure network. The extent of flood risk is not uniform across the city and the assessment of the degree of flood risk posed by infill development and measure required will vary depending on location, informed by the mapping work undertaken.

6 Review of Indicative Flood Risk Areas

6.1 Indicative Flood Risk Areas

The indicative Flood Risk Areas have been identified nationally through clusters of 1km squares. The 1km squares are above flood risk threshold if they meet any one of the following flood risk criteria:

- Number of people > 200
- Number of critical services > 1
- Number of non-residential properties > 20

Squares meeting the criteria are referred to as 'blue squares'. The number of people is determined using the number of residential properties at risk weighted by a factor of 2.34 people per property. Clusters are created when 5 adjoining squares of the 9 in a 3km x 3km grid are above the threshold criteria and deemed to be blue. The indicative Flood Risk Areas are created through areas of adjoining clusters that have a total of 30,000 people at risk of flooding.

The indicative Flood Risk Area for Liverpool, which covers areas of Liverpool, Sefton and Knowsley (see Figure 6.1.1), is based on the Areas Susceptible to Surface Water Flooding (AStSWF) – intermediate susceptibility for a 1 in 200 annual probability event. This was thought to be more appropriate for the area than the Flood Map for Surface Water (FMfSW) that was used to determine most other Flood Risk Areas due to the heavily urbanised nature of the region.

The Liverpool indicative Flood Risk Area includes 24,860 residential properties at risk, which equates to 58,172 people using the 2.34 multiplier. It is the fourth largest of the indicative Flood Risk Areas in England. The indicative area covers large parts of three LLFAs, Liverpool City Council, Sefton Metropolitan Borough Council and Knowsley Metropolitan Borough Council. Liverpool and Sefton have combined to produce joint PFRA spreadsheets and flood risk plans, however Knowsley are preparing an entirely separate PFRA submission. Upon review of flooding Knowsley agreed with EA and UU that FMfSW was more appropriate to their boundary. This subsequently meant they were removed from the indicative Flood Risk Area. An amended Flood Risk Area for Liverpool and Sefton without Knowsley is shown in Chapter 7.

The data listed in Figure 3.1.1 in Chapter 3 has been used to corroborate the squares included in the Flood Risk Area, and check if any further areas should be included based on this additional information. Past flooding has been mapped alongside the AStSWF plans for 'locally agreed surface water information' mapping. The plans show that AStSWF future flood risk areas are well aligned with areas that have suffered flooding in the past. Initial indications are that this is supported by SWMP modelling. No areas have been added or taken from the indicative Flood Risk with the exception of the removal of Knowsley. The indicative Flood Risk Area and 'blue squares' over the flood risk threshold are shown below in Figure 6.1.1.

Figure 6.1.1 Indicative Flood Risk Area for Liverpool

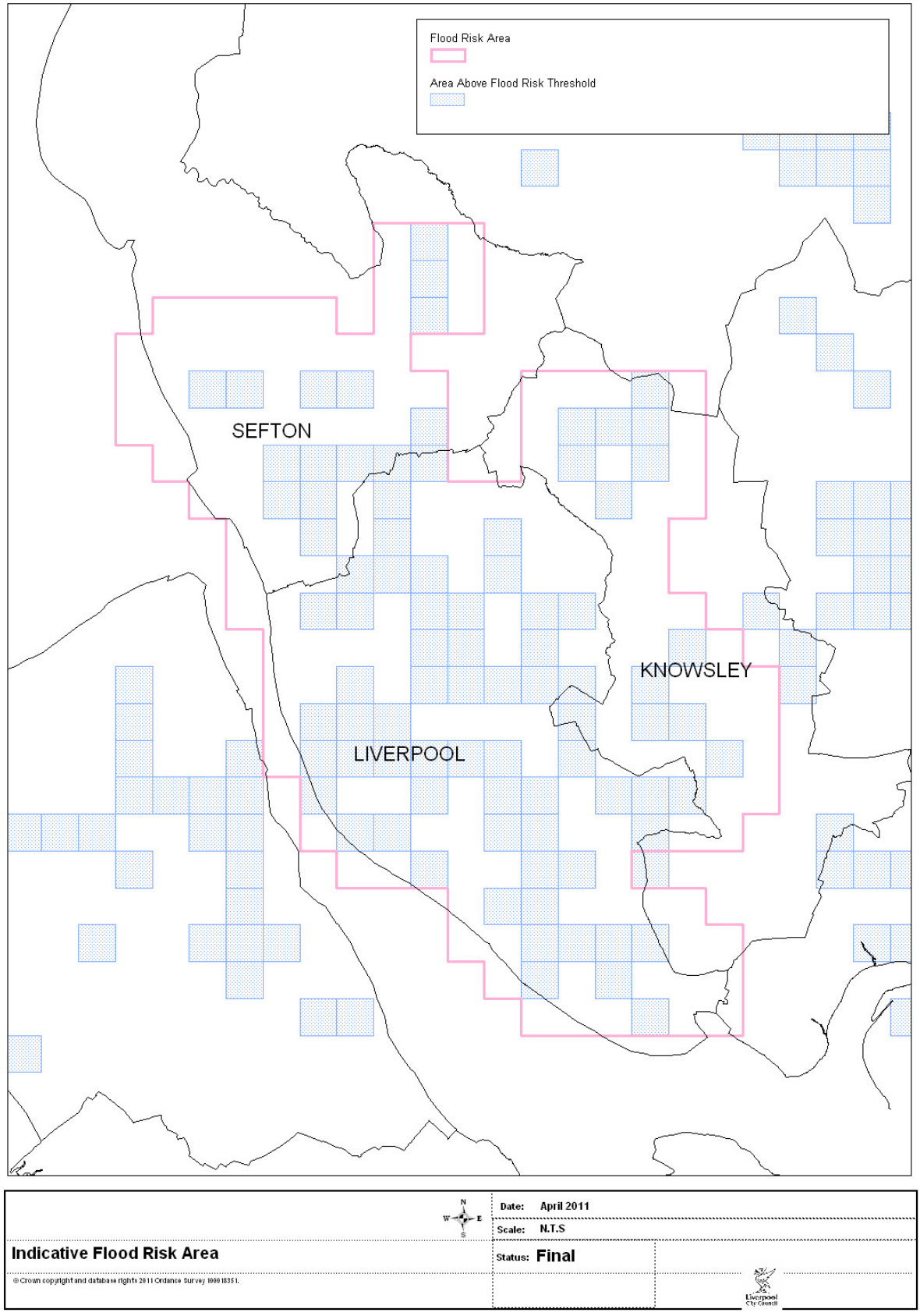
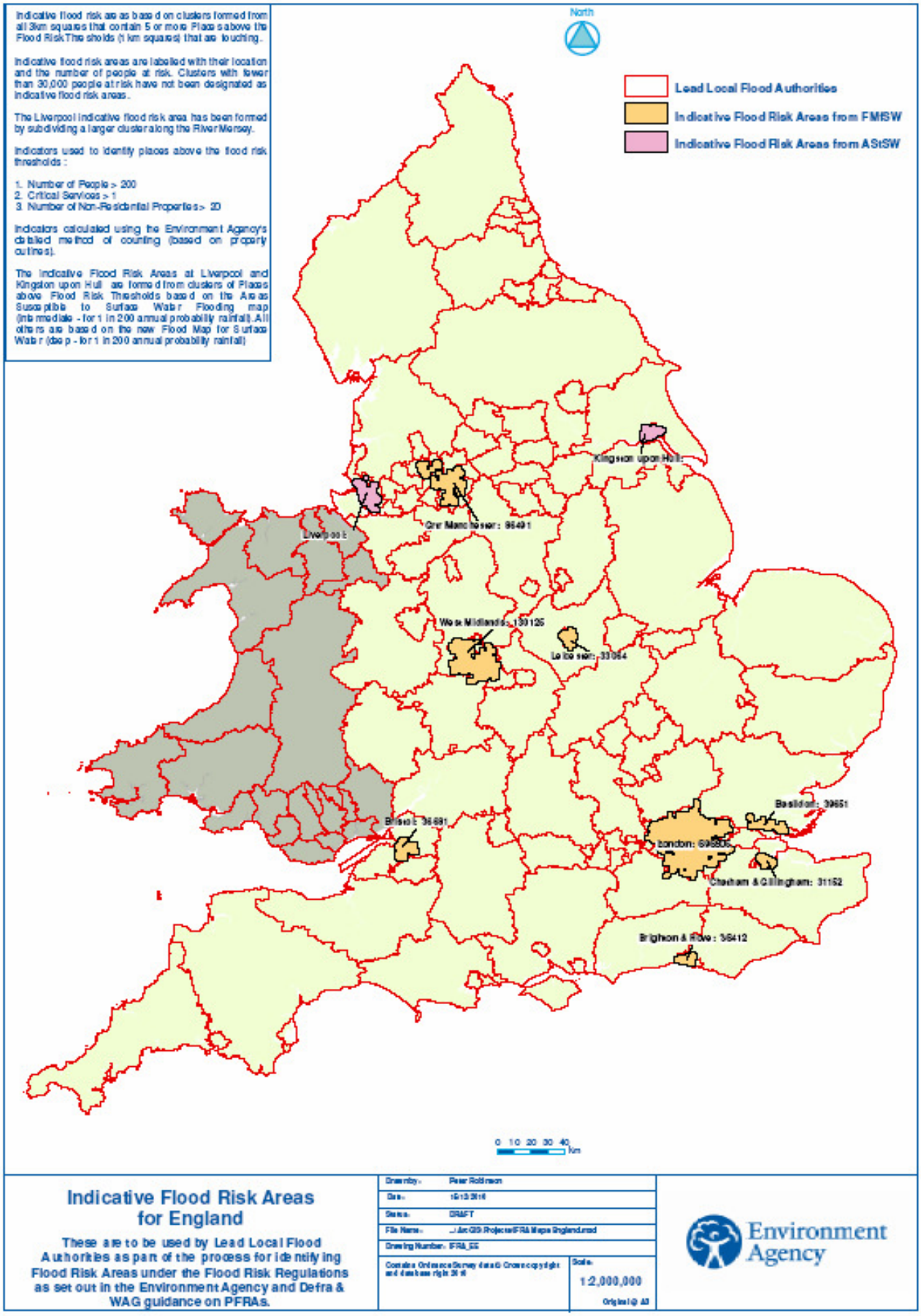


Figure 6.1.2 Indicative Flood Risk Areas for England



7 Identification of Flood Risk Areas

7.1 Amendments to indicative Flood Risk Areas

The indicative Flood Risk Area for Liverpool covers areas of three LLFAs, Liverpool City Council, Sefton Metropolitan Borough Council and Knowsley Metropolitan Borough Council. Areas within Liverpool and Sefton only are included in the amended Flood Risk Area. Flood risk for Knowsley is being considered separately for the PFRA process and they are preparing a separate PFRA submission. To distinguish it from the indicative Flood Risk Area this amended Flood Risk Area has been renamed as 'Liverpool and Sefton'.

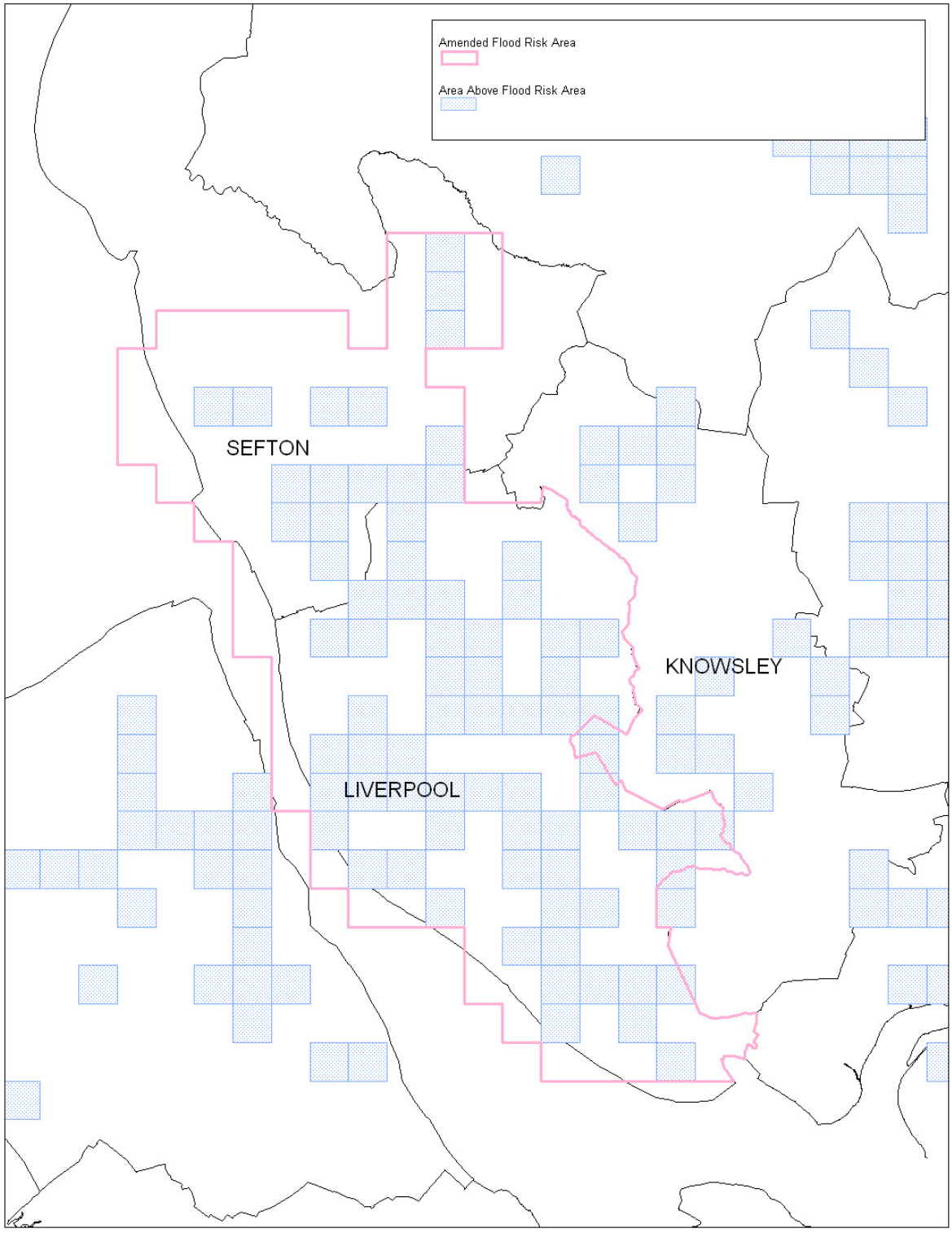
In reviewing the indicative Flood Risk Area, local flood risk information was used to consider whether it should be further amended on the basis of flood risk. Information considered includes historic flood records and future flood risk determined by initial outputs of the Liverpool SWMP.

The amended Liverpool and Sefton Flood Risk Area is shown below in Figure 7.1.2. The 1km squares that form part of the indicative Flood Risk Area that are within the Knowsley boundary have been removed. The east side border of the amended Flood Risk Area now runs along the Liverpool Knowsley boundary. No further alterations have been made since the area is a suitable representation of areas at flood risk. No additional 1km squares were deemed to be above the 'blue square' threshold criteria listed in Chapter 6. No areas have been added or taken from the indicative Flood Risk area with the exception of the detachment of Knowsley.

Table 7.1.1 Amended Flood Risk Area - Liverpool and Sefton

Consequences	Number at risk
Human health consequences: residential properties	22,220
Human health consequences: number of people (2.34 multiplier)	51,995
Economic consequences: number of non-residential properties	3356
Other human health consequences: number of critical services	263

Figure 7.1.2 Amended Flood Risk Area –Liverpool and Sefton



8 Next Steps

8.1 Reviewing PFRA

Scrutiny and review procedures are being followed for the PFRA process. The first stage is an internal LCC review in accordance with appropriate internal review procedures to gain Cabinet approval.

Under the Flood Risk Regulations, the Environment Agency has been given a role of reviewing, collating and publishing all PFRAs. The Environment Agency will undertake a technical review of the PFRA which will focus on instances where Flood Risk Areas have been amended and ensure the format of these areas meets the standard required. Once satisfied, the Environment Agency will recommend submission to the relevant Regional Flood Defence Committee (RFDC) for endorsement. RFDCs will make effective use of their local expertise and ensure consistency at a national scale. Once the RFDC has endorsed the PFRA, the relevant Environment Agency Regional Director will sign it off, before all PFRAs are collated, published and submitted to the European Commission.

8.2 Next stages of the Flood Risk Regulations

The following stages will be undertaken for reporting in 2013 and 2015:

- Prepare Flood Hazard Maps for Flood Risk Area
  Deadline 22 June 2013

- Prepare Flood Risk Management Plans for Flood Risk Area
  Deadline 22 June 2015

The hazard and risk maps will show the likely extent, depth, direction, speed of flow and probability of possible floods and their consequences.

The Flood Risk Regulations require LLFAs to investigate future flood events and ensure continued collection, assessment and storage of flood risk data and information. A central data collection spreadsheet is to be used for recording flood event information and ensuring all PFRA compulsory field information is gathered effectively. Information for PFRA spreadsheet fields that are non-compulsory but useful will also be collected. The PFRA cycle starts again in 2016 and more information is to be mandatory for all floods that occur after 22 Dec 2011.

Abbreviations

AStGF	Areas Susceptible to Groundwater Flooding
AStSWF	Areas Susceptible to Surface Water Flooding
CFMP	Catchment Flood Management Plan
Defra	Department for Environment, Food and Rural Affairs
DG5	Water company register of internal and external flooding –DG standing for Director General
DTM	Digital Terrain Model
EA	Environment Agency
EC	European Commission
FCERM	Flood and Coastal Erosion Risk Management
FMfSW	Flood Map for Surface Water
FRA	Flood Risk Area
FRR	Flood Risk Regulations 2009
FWMA	Flood & Water Management Act 2010
GHG	Greenhouse Gas
GIS	Geographical Information System
LCC	Liverpool City Council
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LRF	Local Resilience Forum
ONS	Office for National Statistics
PFRA	Preliminary Flood Risk Assessment
PPS25	Planning and Policy Statement 25: Development and Flood Risk
RBD	River Basin District
RFDC	Regional Flood Defence Committee
SAB	SuDS Approving Body
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
UKCP09	UK Climate Projections
UU	United Utilities
WCS	Water Cycle Study

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