Derbyshire County Council & Derby City Council

Strategic Flood Risk Assessment (SFRA) Level 1

For Minerals and Waste Local Development Framework

August 2012

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Revision Schedule

Minerals and Waste Strategic Flood Risk Assessment Level 1

August 2012

Rev No	Date	Details	Prepared by	Reviewed By	Approved By
00	13/12/2011	Draft Report	James Biddlestone - Project Engineer Derbyshire County Council	Steve Mead - Principal Engineer Technical Policies Derbyshire County Council	
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01	29/03/2012	Revised Draft Report	James Biddlestone - Project Engineer Derbyshire County Council	David Slinger Environment Team Leader Derby City Council	
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03	01/08/2012	Revised Draft Report Version 3	James Biddlestone - Project Engineer Derbyshire County Council	David Slinger Environment Team Leader Derby City Council	

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Executive Summary

The aim of the Derby and Derbyshire Minerals and Waste Strategic Flood Risk Assessment (SFRA) is to assess and map the different levels and types of flood risk within the study area.

The ability to demonstrate sustainability is a primary government objective for development in Great Britain. Of particular importance is sustainable development within flood affected areas. The purpose of the SFRA is to inform planning decision making and consider the nature and scale of flood risk. Careful consideration must be given to the measures that can be put in place to minimise the risk to property and life posed by flooding. These should address the flood risk throughout the lifetime of proposed development.

A key aim of a Level 1 SFRA is to guide development to the appropriate Flood Zone using the Sequential Test. This document will provide information required to apply the Sequential Test for identification of land suitable for development and provide information to assess flood risk for minerals and waste development proposal sites, thereby setting out the requirements for site specific Flood Risk Assessments (FRAs). The Sequential Test refers to the application of the sequential approach by Minerals and Waste Planning Authorities which requires planning authorities to seek to allocate sites for future development in Local Plans within areas of lowest flood risk in the first instance. Development should be steered towards Flood Zone 1 where possible, and then sequentially to Flood Zones 2 and 3 if appropriate.

Central Government planning guidance encourages development to be allocated in Local Plans into areas which avoid risk to people and property. These allocations will be generally based on the risk of flooding as set out in this SFRA and supplemented with the Derby City and Derbyshire District and Borough SFRAs. Using the Sequential Test development will be steered towards areas at lowest risk of flooding. Individual planning applications should be supported by site FRAs which take into account the relevant SFRA.

The SFRA is a strategic document that provides an overview of flood risk throughout the County and City. More detail is provided in the local SFRAs produced by the Districts and the forthcoming Derby City Council SFRA. A site based Flood Risk Assessment (FRA) must be carried out for all proposed developments and submitted as part of the planning application.

Glossary of Terms and Abbreviations

Term	Definition
AStSWF	Areas Susceptible to Surface Water Flooding
AStGWF	Areas Susceptible to Ground Water Flooding
CIRIA	Construction Industry Research and Information Association
Confirm	Derbyshire's Asset Management System
CLG	Communities and Local Government
DCC	Derbyshire County Council
DEFRA	Department For Environment, Food And Rural Affairs
DG5	Water Authority Record of Flooding Resulting From Sewer Inundation
EA	Environment Agency
EU	European Union
FRM	Flood Risk Management
Flood Event	Flood event comprising many individual flood incidents, ie heavy rain
Flood Incident	A single incident of flooding, ie road closed due to flooding
FMfSW	Flood Maps for Surface Water
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act 2010
GHG	Greenhouse Gases
GIS	Geographical Information System
INSPIRE	EU Spatial Data Infrastructure Directive for GIS Data Management
Km Grid Square	OS National Grid mapping overlay of 1km x 1km squares
LCLIP	Local Climate Impacts Profile
LDF	Local Development Framework
LDD's	Local Development Documents
LIDAR	3D Topographic models of the landform generated by aerial survey
LLFA	Lead Local Flood Authority
LRF	Local Resilience Forum
MasterMap	OS mapping including intelligent information relating to map features
MapInfo	Derbyshire's Preferred Geographical Information System Mapping Software
MDD	Minerals Development Document
MWDF	Derby and Derbyshire Minerals and Waste Development Framework
MWPA	Minerals and Waste Planning Authority
NI 188	National Indicator 188: Planning To Adapt To Climate Change
NPPF	National Planning Policy Framework
NSWG	National SuDS Working Group
Ofwat	The Water Services Regulation Authority
OS	Ordnance Survey
PCPA	Planning and Compulsory Purchase Act 2004
PFRA	Preliminary Flood Risk Assessment
PPS10	Planning Policy Statement 10: Planning for Sustainable Waste Management
PPS25	Planning Policy Statement 25: Development and Flood Risk Practice Guide
RBD	River Basin District
RBMPs	River Basin Management Plans
RBPG	River Basin Planning Guidance

RFDC	Regional Flood Defence Committee
RMA	Risk Management Authority
RSS	Regional Spatial Strategy
SA	Sustainability Appraisal
SAB	SuDs Approving Body
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SuDs	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
UKCIP	UK Climate Change Impacts Programme
UKCP09	UK Climate Projections 2009
WAG	Welsh Assembly Group
WDD	Waste Development Document
WFD	Water Framework Directive
WRAP	Winter Rain Acceptance Potential

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1 Introduction

The Derby and Derbyshire Minerals and Waste Local Plans were adopted in April 2000 and March 2005 respectively. Under the Planning and Compulsory Purchase Act 2004 (PCPA) these will be replaced by the Minerals Development Document (MDD) and Waste Development Document (WDD) which when adopted will form part of the Derby and Derbyshire Minerals and Waste Development Framework (MWDF). The MDD and WDD are known as Local Development Documents (LDDs) and these will form part of a portfolio of documents which comprises the MWDF.

The PCPA requires LDDs to undergo a Sustainability Appraisal (SA) which assists the Minerals and Waste Planning Authorities (MWPA) in ensuring its policies fulfil the principles of sustainability. Strategic Flood Risk Assessments (SFRAs) are one of the documents to be used as the evidence base for planning decisions. They are also an integral part of the SA process and should be utilised in the production or review of LDDs.

This Level 1 Minerals and Waste SFRA has been prepared in accordance with the guidance contained in the National Planning Policy Framework (NPPF), its supporting Technical Guidance and the retained PPS25: Development and Flood Risk Practice Guide..

The aim of this study is to assess and map at a strategic level the different levels and types of flood risk within Derbyshire (including Derby). Not covered by this SFRA is that part of North Derbyshire covered by the Peak District National Park. This information will be used in the strategic minerals and waste land use planning process.

1.1 Flood Risk Terminology

The NPPF and the PPS25 Practice Guide uses the Flood Zones to differentiate between low probability (Flood Zone 1) and high probability (Flood Zone 3) areas. Flood Zone 3 is further divided into high probability (Flood Zones 3a) and Functional Floodplain (Flood Zone 3b). Functional Floodplain is land where water has to flow or be stored during an event with a return period of less than 1 in 20 years or as agreed with the LPA and the Environment Agency. Areas that would normally flood in a 1 in 20 year event but do not due to the presence of solid buildings or infrastructure would not normally be classified as Functional Floodplain.

The NPPF states that a sequential approach to the allocation of land and the development of sites should be adopted. Development in higher risk areas should only occur if there are no suitable areas within low risk zones. Development in higher risk areas should take into account the type, layout and projected lifetime of development.

1.2 Mineral Extraction and Waste Management in Derbyshire

Derbyshire is one of the richest counties in terms of its range and variety of mineral resources, which include limestone, sandstone, sand and gravel, coal and vein minerals. The county has for many years been one of the country's largest mineral producers. Limestone workings are

mainly concentrated in the Carboniferous Limestone around Buxton and Wirksworth with other sites in the Permian Limestone in the north east of the county. Sand and gravel deposits are mainly concentrated in the major river valleys of the Trent, Lower Derwent and Lower Dove Valleys to the south of Derby. Derbyshire's deep mined coal industry has undergone a radical contraction in recent years, with the county's long history of large scale coal production ending in 1993. The opencast coal industry continues to a small extent in the exposed coalfield in the east of the county.

For minerals, there is a careful balance to be struck so that Derbyshire makes an appropriate contribution to society's demand for minerals, whilst protecting and minimising the impacts of mineral extraction on people, local communities and the environment.

The situation for waste is different. Whilst there is a need to minimise the production of waste, there is also a need to develop facilities which manage waste in locations close to its source, in ways that care for the environment. The key challenge in the coming years will be to find sites to accommodate these facilities.

1.3 Aims and Objectives

The aim of the Derby and Derbyshire Minerals and Waste SFRA is to assess and map the different levels and types of flood risk within the study area to be used in the strategic minerals and waste land use planning process. The aim of the SFRA will be met through the following objectives:

To provide an assessment of the impact of all potential sources of flooding in accordance with the NPPF and the retained PPS25 Practice Guide using available information, including an assessment of any future impacts associated with climate change;

Enable planning policies to be identified to minimise and manage local flooding issues; Provide information required to apply the Sequential Test for identification of land suitable for development in line with the principles of the NPPF and the retained PPS25 Practice Guide;

To provide baseline data to inform the Sustainability Appraisal (SA) of the Development Plan Documents (DPDs) with regard to catchment-wide flooding issues which affect the study area;

To provide sufficient information to allow the Councils to assess flood risk for minerals and waste development proposal sites, thereby setting out the requirements for site specific Flood Risk Assessments (FRAs) and sites where they may be necessary;

Ensure consistency with the Preliminary Flood Risk Assessment for Derbyshire which covers the three river catchment areas in Derbyshire comprising: Derbyshire Derwent; Dove; Lower Trent and Erewash.

1.4 SFRA Structure and Methodology

The PPS25 Practice Guide (2009) recommends that SFRAs are completed in two consecutive stages. The two stages are:

Level 1 SFRA – Study Area, Flood Source and Data Review to enable application of the Sequential Test by the LPA;

Level 2 SFRA – Increases the scope of the SFRA to include development site assessments for Exception Testing.

Level 1 SFRA

The Level 1 SFRA will enable Derbyshire County Council and Derby City Council to apply the Sequential Test to potential mineral and waste sites to inform the scope of the Sustainability Appraisal (SA).
The purpose of the Level 1 SFRA is to collate and review available information on flood risk in the Study Area. The Level 1 SFRA should be used by the LPA, together with other evidence and the draft SA, to undertake the Sequential Test. This will assist in identifying where sites can be located in Flood Zone 1 or where they may require further investigation through a Level 2 SFRA.

Level 2 SFRA

A Level 2 SFRAs purpose is to facilitate the application of the Exception Test where required by providing more detailed flood risk information e.g. flood hazard, velocity and depth of flood waters. Development can then be steered towards the lowest risk within a particular Flood Zone.

The Sequential and Exception Tests are discussed in more detail in Sections 6 and 7.

2. Policy Framework

2.1 Introduction

This chapter on planning policy summarises European, National, Regional and Local policy and guidance relevant to planning for flood risk in Derbyshire.

2.2 European Policy

Water Framework Directive (December 2000)

The Water Framework Directive (WFD) is a substantial piece of European Commission legislation and the largest directive related to water to date. The Directive came into force on 22 December 2000, and establishes a new integrated approach to the protection, improvement and sustainable use of Europe's rivers, lakes, estuaries, coastal waters and groundwater. The Directive requires that all member states manage their inland and coastal water bodies so that a 'good status' is achieved by 2015. This aims to provide substantial long term benefits for sustainable management of water. The EA is responsible for implementing the WFD in England and Wales.

The Directive introduces two key changes to the way the water environment must be managed across the European Community:

Environmental and Ecological Objectives and River Basin Management Plans (RBMPs).

The WFD provides for Protected Areas and Priority Substances to safeguard uses of the water environment from the effects of pollution and dangerous chemicals. Important ecological goals are also set out to protect, enhance and restore aquatic ecosystems.

RBMPs are the key mechanism to ensure that the integrated management of rivers, canals, lakes, reservoirs and groundwater is successful and sustainable. RBMPs aim to provide a framework in which costs and benefits can be properly taken into account when setting environmental and water management objectives.

Each RBMP must apply to a 'River Basin District' (RBD) (a geographical area which is defined based on hydrology – see Annex 1, DEFRA and WAG River Basin Planning Guidance (RBPG), August 2006). The main RBD that is relevant to Derbyshire is the River Humber river basin district (Derbyshire's rivers discharge into the North Sea via the River Humber).

The aforementioned DEFRA and WAG guidance states that a RBMP should be a strategic plan that gives all stakeholders within a RBD some confidence about future water management in their District. It should also set the policy framework within which future regulatory decisions affecting the water environment will be made.

The river basin planning process involves setting environmental objectives for all groundwater and surface water within the RBD and designing steps and timetables to meet these objectives.
Although RBMPs specifically address sustainable water management issues, the WFD also requires that other environmental considerations and socio-economic issues are taken into account. This ensures that the policy priorities between different stakeholders are balanced to ensure that sustainable development within RBDs is achieved.

European Union (EU) Floods Directive 2007/60/EC (November 2007)

The EU Flood Directive 2007/60/EC (November 2007) was proposed by the European Commission in January 2006. Its aim is to reduce and manage the risks that floods pose to human health, cultural heritage, the environment and economic activity. The Directive required Member States to first prepare a Preliminary Flood Risk Assessment (PFRA) by 2011 to identify the river basins and associated coastal areas at risk of flooding.

2.3 National Policy

PPS10 Planning for Sustainable Waste Management (CLG, March 2011)

Planning Policy Statement 10 (PPS10) sets out the government's policy to be taken into account by waste planning authorities in respect of the sustainable management of waste.

Annex E, Part A, of this guidance outlines the considerations required to adequately protect water resources. This guidance will be subsumed within the revised National Waste Management Plan for England which will be published for consultation sometime in 2012.

PPS25 Development and Flood Risk Practice Guide (CLG, December 2009)

Whilst PPS25 has been formally revoked in Annex 3 of the NPPF, the PPS25 Practice Guide remains extant.

MPS1 Planning and Minerals Practice Guide (CLG, November 2006)

Whilst MPS1 has been formally revoked in Annex 3 of the NPPF, the MPS1 Practice Guide remains extant.

The National Planning Policy Framework (CLG, March 2012)

The National Planning Policy Framework and its supporting Technical Guidance to the National Planning Policy Framework replaced most of the PPSs and PPGs including PPS25 Development and Flood Risk in March 2012. The NPPF retains the PPS practice guide companion documents which Central Government considered were necessary and helpful. The retention of this guidance is an interim measure pending a wider review of guidance to support planning policy.

With respect to flood risk the NPPF seeks to steer development away from areas of highest risk. The flood zones are the beginning of this sequential approach. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. The NPPF seeks that Local Plans should be supported by SFRAs and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies.

SFRAs provide the basis for applying the Sequential Test. Where there is a need to apply the Exception Test, as set out in the NPPF and the PPS25 Practice Guide, the scope of a SFRA will be widened. The overall aim of guidance set out in the NPPF is to steer development to Flood Zone 1.

When preparing local plans, the NPPF seeks that local planning authorities should set out environmental criteria against which minerals and waste planning applications will be assessed so as to ensure that permitted operations do not have unacceptable adverse impacts on the environment including from increased flood risk and impacts on the flow and quantity of surface and groundwater and migration of contamination from the site.

Flood and Water Management Act 2010

The Flood and Water Management Act 2010 brought in new responsibilities for local authorities. The Act defines the role of Lead Local Flood Authority (LLFA), which includes County Councils and Unitary Authorities. The LLFA is encouraged in the Act to bring together

relevant bodies and stakeholders to effectively manage local flood risk. These Flood Risk Management Authorities include County, City and District Councils, Internal Drainage Boards, highways authorities, water companies and the EA.

The new responsibilities that the Act assigns to LLFAs include:

- **Investigating flood events** – LLFAs have a duty to investigate and record details of significant flood events within their area. DCC has been recording reported flooding events for some years, however the information has been somewhat limited in detail. This recording is being improved to comply with the Inspire Regulations 2009. The Inspire Regulations are a European Spatial Data Infrastructure Directive for GIS Data Management.
- **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 of ownership and condition. DCC has been building such a register for some time; however the work will be on-going as our understanding of the flood risk is increased. The information is currently contained on a set of GIS shape files.
- **Sustainable Urban Drainage System (SuDS) Approving Body** – LLFAs have been designated as (SuDS) Approving Bodies (SABs) for new developments and drainage systems and will be responsible for approving, adopting and maintaining new systems. DCC has been promoting the use of SuDS for some time and has adopted some SuDS features within public open space for multi-ownership systems. Schedule 3 of the act has yet to be enabled.
- **Local Strategy for Flood Risk Management** – LLFAs are required to develop, maintain, apply and monitor a local strategy for flood risk management in their areas.
- **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, 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 risk management.

The Flood Risk Regulations (2009)

The Flood Risk Regulations (2009) transpose the EU Floods Directive into British Law. One of the main impacts on LAs in the UK is that they were required to complete PFRAs by 22 December 2011. Where the LLFA identifies a relevant flood risk, there is a requirement to prepare flood hazard and flood risk maps for these areas for publication by the EA before 22 December 2013. A flood risk management plan must also be prepared for publication by the EA by 22 December 2015.

Future Water – The Governments Water Strategy for England (DEFRA, February 2008)

This document provides the Governments long term vision and the framework for water management in England.

Flood risk management and policy should aim to improve public understanding and perception of the causes and consequences of all sources of flooding in order to assist the management of flood risk. The Strategy aims for more adaptable surface water drainage systems to reduce the risk of flooding, improve water quality, and decrease burdens on sewerage infrastructure. Risk management and policy in respect of river and coastal flooding should take account of environmental and social benefits alongside the protection of economic assets. An understanding of future risks of river and coastal flooding should be embedded into the spatial planning system.

Making Space for Water (DEFRA, March 2005)

In 2004 the Government's Making Space for Water strategy set out a new national direction for flood risk management planning in England. The report recognised the need for a coordinated approach between the various responsible bodies, including flood defence operating authorities, sewerage undertakers and highways authorities.

2.4 Regional Planning Policy

The Regional Spatial Strategy for the East Midlands is set out in the East Midlands Regional Plan which was adopted in March 2009.

The Localism Act confirms the previously announced abolition of regional strategies. The effect of this will be to remove this tier of the development plan for the purpose of decision making on minerals and waste developments.

Revocation of the strategies has not yet occurred as strategic environmental assessments (SEAs) were required on the impact of the proposed revocations. The SEA consultation period is now over. The Department of Communities and Local Government (CLG) have not yet fixed dates for the revocations and it is not known if they will be revoked together or individually.

Until they are abolished the RSS's continue to have development plan status. The current requirement for Plans to be in general conformity with RSS's is also still in effect but will cease when the RSS's go. When the RSS is revoked the evidence base and studies which supported it may still be relevant to decision making.

2.5 Local Policy

Derby and Derbyshire Minerals Local Plan (DCC, April 2000)

This was adopted in April 2000 and updated in November 2002 when the authorities formally adopted an alteration to most of its policies. Several policies have been 'saved' (except MP8, 9, 14, 20, 26, 30 and 31) as part of the development plan until they are replaced by new mineral development plan documents.

Supplementary Planning Guidance on the After-Use of Sand and Gravel Sites (Derby City Council and Derbyshire County Council, December 2010)

This carries significant weight in supplementing the saved policies of the adopted Minerals Local Plan.

Derby and Derbyshire Waste Local Plan (DCC, March 2005)

This was adopted in March 2005 and contains a Waste Planning Strategy which guides its objective-led approach. All but one (Policy W1a) of its policies are 'saved' and continue to provide an appropriate strategic and general policy framework for waste development proposals.

Derby and Derbyshire Minerals and Waste Development Framework – The MWDF will form the structure for future minerals extraction and waste management for the next 20 years. This will comprise a range of documents that contain policies setting out overall requirements for minerals and new waste management facilities. These policies will form the main guidance for determining all minerals and waste planning applications received by DCC.

The main purpose of LDDs is to make informed decisions on identifying where minerals and waste sites should be located in Derbyshire.

Minerals and Waste Development Framework

Current progress on document preparation is summarised below:

Derbyshire County Council and Derby City Council are working together to prepare a portfolio of development plan documents (referred to here as Mineral and Waste Plans) that deal with spatial planning for the production and movement of minerals and the management of waste for the administrative areas of both Councils, excluding the Peak District National Park. These would replace the existing minerals and waste joint local plans.

The Minerals Plan will set out the strategy to manage the availability, extraction and movement of minerals so they are available at the right time to supply the construction and other industries over the period 2030, whilst seeking to protect the interests of local communities and the wider environment.

The Waste Plan will set out the detailed planning strategy for the delivery of a network of waste management facilities for all types of waste in suitable locations across the Plan area. The Plan will deal with all waste streams including commercial and industrial, construction and demolition, agricultural, hazardous and municipal waste.

The two key documents of the Minerals and Waste Development Framework are the Local Plans. A separate Local Plan is being prepared for each. The Councils are currently concentrating on progressing both Core Strategies which will guide minerals and waste development in the Plan area until 2030.

Derby City Council – Policy Statement on Flood Defence & Land Drainage

This document states that Derby City Council will work in partnership with the Environment Agency to reduce flooding through the Planning process and through encouragement of Sustainable Urban Drainage Systems in order to return water to the ground thereby contributing to available ground water and reducing the possible effects of shrinkage of plastic soils.
Derby City Council will also work with its neighbouring Authorities to secure a sensible long term policy approach with regard to flood mitigation.

(Derby City) Local Plan Review Jan 2006 (GD3) Flood Protection

This document states:

Except where satisfactory compensatory measures are provided to offset any potential adverse effects of development on the water environment and associated lands, planning permission will not be granted for development which;

a) Lies within undefended areas at risk of flooding
b) Would create or exacerbate flooding elsewhere
c) Results in the loss of natural floodplain
d) Would impede access to a watercourse for maintenance or flood defence purposes.
e) Does not provide for the adequate management of surface run off using Sustainable Drainage principles, unless it can be demonstrated that their use is inappropriate.

The Council will only permit development within the floodplain, as indicated in the Local Plan Proposals map, if (in the case of sites on or adjacent to Main River) it would not increase the risk of flooding to the adjacent area (GD3 3.6):

by reducing the capacity of any floodplain;

by increasing flows within that floodplain;

through the increased discharge of surface water above undeveloped flows the proposed area would not be at risk itself;

adequate provision for upkeep and maintenance is provided alongside the river or if (in the case of sites on or adjacent to an Ordinary Watercourse) (GD3 3.5) it considers the SUDS options first and demonstrates that this option is neither viable nor suitable;

surface Water is disposed of into the watercourse without increasing the undeveloped contribution;

proposed discharges meet the full requirements of the Environment Agency.

A full flood risk assessment will be required if in the opinion of the Land Drainage & Flood Defence Team representative for the Local Authority it is considered that there may be an increased risk of flooding as a result of the development or the development itself may be at risk of flooding. Wherever development is permitted the Local Planning Authority may impose conditions or seek agreements to ensure that compensatory measures are provided to alleviate flood risk both on and off site. The effectiveness of a floodplain should not be impaired by development, its existing occupiers put at risk, or additional discharge from the development exceeds the capacity of the watercourse or floodplain downstream.

Where a development proposal is allowed the agreed compensatory element shall be included as part of the Planning application. (GD3).

No development shall be considered until the authority is satisfied that the above criteria have been met and any existing development, whether vulnerable or not, remains unaffected by any new development proposals.

It is important that any development proposals include an element that will demonstrate that these will both enhance and if possible improve the environment of the specific area proposed for development and that of the surrounding area."

This is the adopted Derby City Council policy with regard to its approach to the maintenance and management of land drainage infrastructure.

3. Data Collection and Review

3.1 Overview

The objective of this SFRA (Level 1) is to collect and review all readily available information which relates to flooding in the study area of Derbyshire County and Derby City.

Flooding can arise/be caused/originate from numerous mechanisms/sources such as:

- **Fluvial Flooding** – Related to the flooding of Rivers and Streams.
- **Surface Water Flooding** – Occurs where high rainfall events exceed the drainage capacity in an area.
- **Groundwater Flooding** – Occurs as a result of water rising up from the underlying rocks or from water flowing from abnormal springs.
- **Sewers/Drainage Infrastructure** – Caused by the capacity of designed infrastructure being exceeded.
- **Artificial Flooding** – Flooding from Canals, Ponds and Reservoirs.
- **Structures** –Culverts and other/below ground structures which when obstructed become a mechanism of flooding.

Table 1 shows the publication history for all district wide SFRA's in Derbyshire.

SFRA publication history	Publication Date
Amber Valley Borough	June 2009
Bolsover District Council	March 2009
Chesterfield Borough Council	March 2009
Derbyshire Dales District Council	September 2008
Erewash Borough Council	July 2008
High Peak Borough Council	September 2008
North East Derbyshire District Council	March 2009
South Derbyshire District Council	November 2008

Table 1 – District/Borough publication history for SFRA Level 1

Note: Derby City Council have prepared a Draft SFRA for the Derby City area, however, this has not yet been published.

Once data has been collated and reviewed, an assessment can be undertaken to ascertain whether gaps within the data exist, if so these areas may require additional assessment to support the need to progress to a Level 2 SFRA.

3.1.1 Data Collection

Information gathered during the production of both Derbyshire County Councils and Derby City's PFRA's (Preliminary Flood Risk Assessment's) is currently available within the Authorities.

The information captured comprises data provided by District Councils, Town/Parish Councils, Environment Agency, Highways Agency, Yorkshire Water, Severn Trent Water, Emergency Services as well as various County and City Council Departments. All of which are subject to constant update and addition.

The information has been reviewed, assessed for its significance, quality and allocated a confidence level.

3.2 Environment Agency

Derbyshire and Derby is located within the Environments Agency Midlands Region and is administered by the Eastern and Central Area Offices. Derbyshire is split by three catchment areas the Don, Trent and the Upper Mersey. Each catchment has its own Catchment Flood Management Plan (CFMP). CFMPs were produced by the EA to help Authorities to understand the scale and extent of flooding now and in the future and to set policies for managing flood risk within the catchment. The CFMP's are used to inform planning and decision making by key stakeholders such as:

The Environment Agency
Regional Planning Bodies
Internal Drainage Boards, Water and Utility Companies.
Transportation Planners

Land Owners
The Public and Businesses

3.2.1 Environment Agency Flood Zone Maps

The Environment Agency has produced a national dataset of Fluvial Flood Maps. The Flood Maps show the areas across England and Wales that could possibly be affected by flooding from rivers or the sea. The associated flood zones are produced within the maps excluding the presence of existing flood defences, as defences can be overtopped if an event occurs which surpasses the design threshold for the defence. The flood maps do not show/consider the effects that climate change may have upon future flooding, nor do they it show where flooding from other sources such as groundwater or surface water runoff from rainfall may or may not occur. Watercourses with catchments of smaller than three square kilometres will have no floodzone mapping attributed to them and is therefore another limitation to the data set.

One key limitation when reviewing the flood maps is that they are not to be used to provide details of individual properties.

The Flood Maps have been developed by using detailed information from hydraulic models, where possible, and from the Environments Agency's National Generalised Model.

Consideration must be given as to the limitations of this data set, as the Flood Maps do not provide information such as:

- Velocity of water/debris
- Hazard Mapping
- Flood Depths
- Direction and volume of flow

Derbyshire County Council and Derby City has licensed access to the following Environment Agency mapping data:

- Flood zone 3 - Land assessed, ignoring the presence of flood defences, as having a 1% or greater annual probability of fluvial flooding or a 0.5% or greater annual probability of tidal flooding.

- Flood zone 2 - Land assessed, ignoring the presence of flood defences, as having between 1% and 0.1% annual probabilities of fluvial flooding or between a 0.5% and 0.1% annual probabilities of tidal flooding in any year.

- Flood defences - The Flood Map displays the location of linear raised flood defences such as embankments and walls.

- Flood Storage Areas - Flood storage areas, land designated and operated to store flood water.

The Environment Agency's understanding of floodplains is constantly being improved as better information becomes available, e.g. changes in hydrological river response, observations following flood events and improved modelling techniques.

As more appropriate information is received, validated and accepted it is included in quarterly updates to the published Flood Maps. Flood defences not yet shown are added gradually through these quarterly updates. It is important to refer to these updated Flood Maps in association with this Level 1 SFRA.

3.2.2 Environment Agency Flood Maps for Surface Water

The Environment Agency has produced a national assessment of surface water flood risk in the form of two national mapping datasets.

The first generation of national mapping; "Areas Susceptible to Surface Water Flooding" (AStSWF), is based on a rainfall event with a 1 in 200 chance of occurring.

In the past year, the national methodology has been updated to produce a second generation of national mapping, "Flood Map for Surface Water" (FMfSW). This later mapping is based on modelling where surface water is likely to accumulate and uses a LIDAR 3D model of the County's topography to determine low lying areas. To provide a more realistic approach the modelling exercise also considered all parts of the built environment to have an elevation above surrounding ground level thereby generating a number of water flow paths likely to occur within urban areas as a result of an intense rainfall event. The result of the modelling exercise is a comprehensive map depicting a series of polygons that either represent where water will stand in low lying areas or where it will flow across the surface.

The Flood Map for Surface Water is based on two rainfall events of 1 in 30 and 1 in 200 annual chance and provides for two flood depth bandings; greater than 100mm and greater than 300mm.

The Environment Agency's surface water flood maps give an indication of the broad areas likely to be at risk of surface water flooding. However, the Environment Agency surface water flood maps are not suitable for identifying whether an individual property will flood. This is because the modelling only gives an indication of broad areas at risk, and because they do not hold information on floor levels, construction characteristics or designs of properties. The maps may assist in identifying where properties are in areas at risk of flooding for locations where surface water flooding is strongly influenced by topography.

3.2.3 Maps of Areas Susceptible to Groundwater Flooding

The Areas Susceptible to Groundwater Flooding is a strategic scale map showing groundwater flood areas in a 1 kilometre square grid. It identifies at a broad scale areas susceptible to flooding from groundwater on the basis of geological and hydrogeological conditions. It does not show the likelihood of groundwater flooding occurring and therefore is a hazard not risk-based dataset. It does not take account of areas where groundwater is likely to pond or flow, but simply considers where groundwater might emerge.

Hazard is represented by one of four area categories showing the proportion of each 1 km square that is susceptible to groundwater flood emergence:

< 25%;
>=25% <50%
>=50% <75%
>=75%

Absence of a value means that no risk is anticipated to be present. In common with the majority of datasets showing areas which may experience groundwater emergence, this dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

This data set should not be used as the sole evidence for any specific flood risk management, land use planning or other decision at any scale.

3.2.4 Hydraulic Modelling

Derbyshire County Council currently has no hydraulic modelling information to substantiate projections of possible future flooding. Information of this nature may be available at a more local level such as District/Borough Council through the planning/regeneration departments.

Derby City in conjunction with the Environment Agency has commissioned a number of detailed flooding investigations over the years within the City. These studies generally incorporate the development of a detailed hydraulic model, providing a more robust understanding of the localised fluvial flooding regime in line with Section 105 (2) of the Water Resources Act. This knowledge has been developed through hydraulic reports and studies undertaken over a large number of years.

The City has information relating to the following:-

- River Derwent at Derby – Final Modelling Report.
- Asset report for defences.
- Report on condition of defences for Pride Park.
- STW sewer plans.
- OS Tablet maps for Derby.
- LIDAR Information.
- Modelling information for small watercourses.
- Soils information for Derby.

Like all data sets they are subject to revision and limitations in terms of accuracy and appropriate use.

Further to the release of the second generation Flood Maps for Surface Water, Derbyshire County Council, Derby City and the Environment Agency have commissioned a revised model to be produced. The proposal is to re-map the risk of surface water flooding in Derbyshire at a

finer resolution to that originally used in the second generation Flood Maps for Surface Water. The outputs will enable a more detailed understanding of areas at possible future risk of surface water flooding, particularly at Town/ Parish Level. By having more narrowly defined flow paths properties will be more accurately represented than in the national maps. Derbyshire County Council hopes to use the information to better inform Derbyshire's Local Flood Risk Strategy and Parish PFRA's (the local equivalent of Surface Water Management Plans SWMP's).

3.3 Historic Flooding

Derbyshire and Derby City hold data relating to historic flood events caused by a wide variety of mechanism/sources over a considerable time span.

3.4 Flood Defences

The Environment Agency has a GIS layer of the National Flood and Coastal Defence Database (NFCDD). The NFCDD contains details of structures and flood defences which provide some of the following attribute fields:-

- the location, composition and condition of fluvial defences and watercourse referenced to identified risk areas.
- the types of asset (i.e. property, infrastructure, environmental) at risk within identified risk areas and including those protected by fluvial, tidal and coastal defences.
- the extent of floods related to different flooding scenarios (e.g. different return periods and different types of flood event such as overtopping or embankment failure).

The NFCDD is a good starting point for trying to assess what structures are deemed as significant flood defences. However quality of data still remains a concern as in some cases not all of the attribute fields listed above are populated. This information is sufficient for the Level 1 SFRA but if a Level 2 SFRA was undertaken then more detailed accurate information would be required. The information within this dataset is classed as formal flood defences.

Informal Flood Defences are features such as road networks and railway embankments or any other linear feature which acts as a flood defence. These features could divert flood water elsewhere or even create a barrier and act as an area of attenuation/storage.

A limited number of properties situated immediately adjacent to watercourses within Derby City are reliant to some degree upon the presence of localised raised defences and/or constructed barriers to protect against river flooding. The future sustainability of the area is reliant upon the long term structural and operational integrity of these defences.

It is important to reiterate that the risk of flooding can never be fully addressed. There will always be a residual risk of flooding, due to more extreme events, climate change, and/or a structural failure of the constructed flood defence system. It is extremely important that both

Derbyshire County Council, Derby City and developers ensure that the level and integrity of defence provided within developing areas can be assured for the lifetime of the development.

An assessment of all informal defences should be included within all FRA's that are produced as part of a new development proposal.

3.5 Derbyshire County Councils (Summary of Data Capture)

Data detailing past flooding incidents has been captured and continues to be captured from the following sources and is summarised in the table at the end of this section.

- DCC Highway District Managers – records of flooding events which have had a detrimental affect on the Highway Infrastructure, includes some land drainage issues where surface water run off flows onto the adopted highway.

- DCC Emergency Planning Team – records of flood events which have been reported directly to the Emergency Planning Team.

- Elected Members and Town/Parish Councils – all County Elected Members and Parish/Town Councils have been provided with maps of their electoral ward / town / parish seeking the following information;

    - Road Name / Location
    - Source of flooding
    - Type of Properties affected / areas affected by flooding
    - Frequency of Flooding

The consulted parties were encouraged to draw / annotate the maps making reference to individual flooding events. The response has been extremely rewarding providing a better understanding of historic flooding within the county.

- CONFIRM Reports – CONFIRM is the software used by DCC's Environmental Services 'back office' systems. It is used to log calls from members of the public and inspector reports using sub categories; Collapsed drain, Drain/gully blocked, Flooding and Ponding/Surface Water. Reports date back to 2000.

- District/Borough Officers – Strategic Flood Risk Assessment Stage 1 data and Land Drainage information.

- Emergency Services – Historic information from the Emergency Services had predominately been provided within the District / Borough Strategic Flood Risk Assessments.

- Highways Agency – A1+ (HA's current contractor) provided flood event reports for the Highway Agency's Infrastructure within Derbyshire.

- Water Authorities – Severn Trent Water, Yorkshire Water and the Council have begun the first steps of data sharing, signing a 'Data Sharing Protocol'. Discussions with United Utilities are continuing.

- Derbyshire's LSP Local Climate Impacts Profile (LCLIP) – Derbyshire County Council took part in the first regional LCLIP in 2008. The regional LCLIP was developed to better understand the vulnerability of services to severe weather events on the understanding that the frequency of severe weather events is likely to increase in the future. The LCLIP findings were used to look at the effects flooding and snow melt had on the county between January 2000 and June 2008.

The methodology was based upon standards developed by UKCIP and made reference to;

- Local media sourced for articles about severe weather events between January 2000 and June 2008.

- Weather events were correlated with local authority records to establish the impact of each event on service provision

- Derbyshire Local Resilience Forum (LRF) – Flood risk assessments prepared for the Civil Contingencies Act 2004.

- Newspaper articles and reports – In addition to the information contained within the LCLIP a separate media search was undertaken for flooding events within the County. This search did not have any date restrictions.

Data sets were collated and reviewed to identify not just the individual incidents of flooding but also to identify details of major past flood events and associated consequences.

Source of Data	Dates of data	Depths of flooding	Property Affected	Areas Affected	Risk Rating for event	Frequency/dates of event	Data Confidence
District/ Borough	SFRA 2009	Yes in parts	Yes	Yes	No	Yes in parts	High in parts
DCC Emergency Planning	2000 - 11	No	Yes	Yes	No	Yes in parts	Medium
Elected Members	2011	Yes in parts	Yes	Yes	No	Yes in parts	Medium
Parish Councils	2011	Yes in parts	Yes	Yes	No	Yes in parts	High in parts
CONFIRM	2000 - 11	No	Yes	Yes	No	Yes	Medium
Emergency Services	SFRA 2009	No	No	No	No	No	Low
Highway Agency	2011	No	No	Yes	No	Yes	Low
LCLIP	2008 - 09	No	Yes	Yes	No	No	Low
News reports	2000 - 11	No	Yes	Yes	No	Yes	Low
DCC District Managers	2010	Yes	No	Yes	No	Yes	High

Table 2: Source information gathered by Derbyshire County Council

All data relevant to flood risk is now stored on dedicated network workspaces and drives within the corporate IT systems and is only accessible to approved officers. Information is held in a number of data formats including;

Software / Format	Application
Microsoft Word	Documents
Microsoft Excel	Spreadsheet analysis Data input to GIS GIS data analysis and reporting
Adobe PDF	Drawing representing GIS mapping.
CONFIRM	Associated Highways Assets are managed by CONFIRM Assets.
MapInfo Professional	Mapping analysis SQL data queries Spatial data queries Comparison with other mapped data sets, e.g. Highways assets, critical services

Table 3: Software/Format data held by Derbyshire County Council

3.5.1 Derby City Councils (Summary of Data Capture)

Data	Source of information (or Supplied by)
Plan showing all rivers, watercourses within or adjacent to the city	Derby City Council Land drainage
Details of each brook course – section by section – start/end/open or culverted/condition Markeaton Bramble Littleover Hell Cuttle Thulston Cotton Lees Chaddesden Boosemoor Dam	Derby City Council Land drainage
Summary of channel long section and cross section data	Derby City Council with EA input for Derwent & Markeaton/ Mackworth and others
Flooding Records & maps – all minor incidents – tabulate on a spreadsheet including a location reference (GR). Reference on plans (Arcview or Acad)	Derby City Council, STW, EA & incident files for each watercourse
Summary results of all gauging stations in brook courses – only one station I think at St Mary's bridge on the R.Derwent	Derby City Council
Flooding warning schemes – what do we have in the city	Derby City Council data

Table 4: Source information gathered by Derby City Council

Data	Who from
Arcview GIS plans showing all the brook courses and levels associated with land in the floodplain. Need to check the format that the planners will use.	Derby City Council
Availability of LIDAR data – reference on a plan	Derby City Council – own records
OS level data from development plans and private sector schemes.	Derby City Council data – planning drawings
Any other levels information – highways design team – footway schemes – reference on a plan showing the highway scheme reference as a source of further detail if/as required.	Derby City Council

Table 5: Survey and plan data used by Derby City Council

Data	Who from
City of Derby Local Plan Review	Derby City Council planners
Major (and other significant) developments with planning permission within the catchments and proposed developments.	Derby City Council planners (and district council areas within the catchment areas)
Areas zoned for development	Derby City Council planners (local plan) – also district council plans

Table 6: Land use information used by Derby City Council

3.6 Topography

The County of Derbyshire sits about as far from the coast as a County can in the UK but its wide variety of topography, varying from the southern end of the Pennines with steep fast watersheds and large catchments to the flatter land of the south, provides a challenge to Flood Risk Management.

The three principal rivers in Derbyshire are the Derwent, Trent and the Dove and form part of the River Humber river basin district and eventually discharge into the North Sea via the River Humber. In the North West of the County the Etherow and Goyt discharge into the Irish Sea via the River Mersey. The largest tributaries are rivers Wye, Amber and Erewash. There are three catchment areas in Derbyshire; Derbyshire Derwent; Dove; Lower Trent and Erewash.

The County of Derbyshire includes eight District/Borough Authorities:-

- Amber Valley Borough Council
- Bolsover District Council
- Chesterfield Borough Council
- Derbyshire Dales District
- Erewash Borough Council
- High Peak Borough Council
- North East District Council
- South Derbyshire District Council

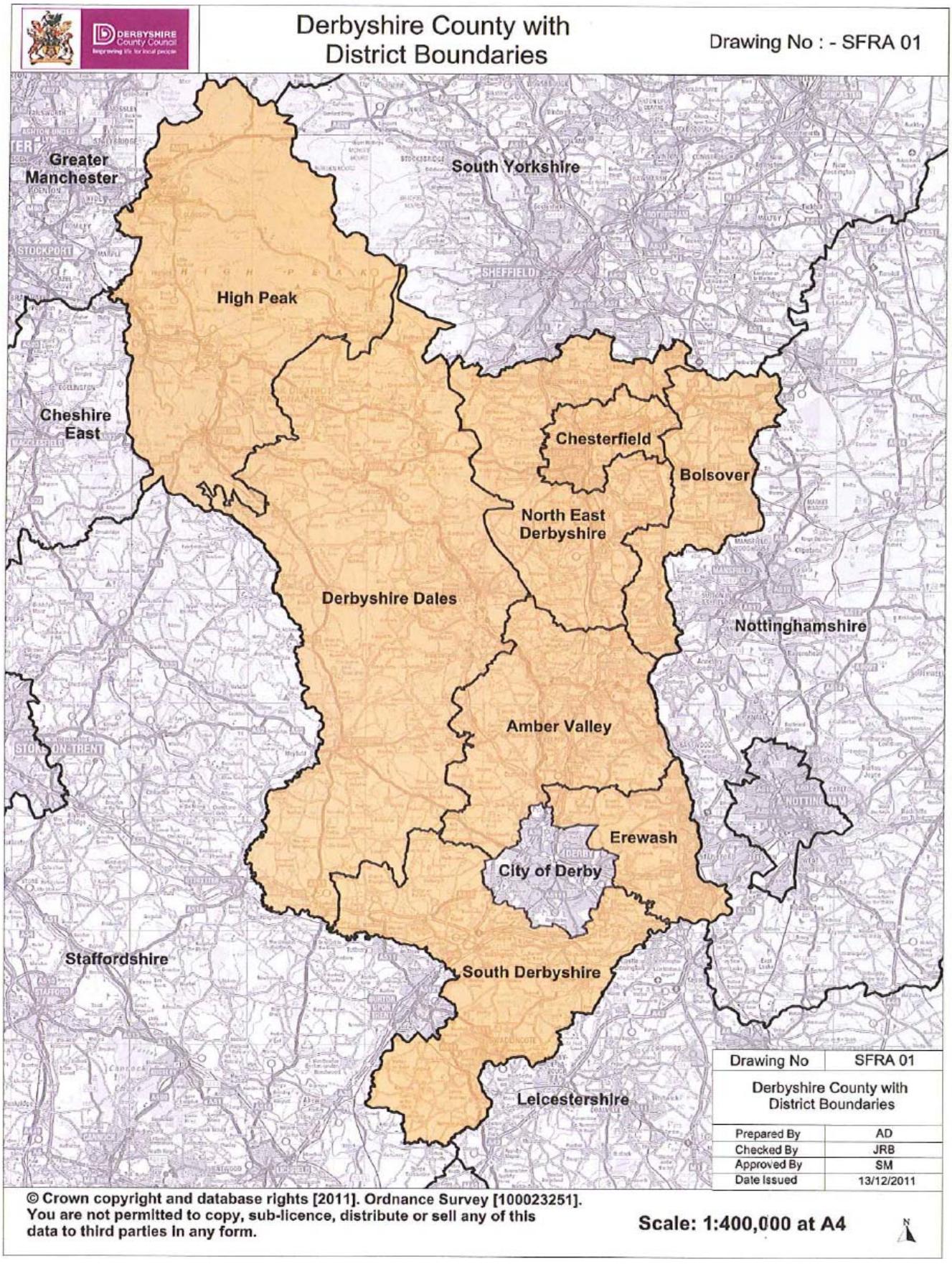
Derby City Council is a unitary authority.

Please refer to “Drawing No SFRA 01” on page 32 which shows the County of Derbyshire and the District/Borough Boundaries. Also refer to “Drawing No SFRA 02” on page 33 which shows the topography of Derbyshire.

The city of Derby covers an area of some 30 square miles and has a population of approximately 244,000. It is situated on the banks of the River Derwent just to the north of its confluence with the River Trent, the influence of this union dominates the topography of the city.

The River Derwent enters the city from the north in a steep sided relatively narrow valley, with the high ground of Darley Abbey and Allestree on the west bank and Chaddesden on the east bank. As it progresses through Derby city centre, the River Derwent veers to the east and the valley broadens as it approaches its confluence with the River Trent. To the south of the city, the land is generally flat with much marshy land lining the banks of the River Trent and the adjacent Trent and Mersey Canal. The wards of Alvaston, Boulton and Sinfin are particularly notable for this land feature and are known to have high groundwater levels throughout.

Figure 1: City extents and ward boundaries


Derbyshire County with District Boundaries
Drawing No : - SFRA 01
Greater Manchester
South Yorkshire
High Peak
Cheshire East
Chesterfield
Bolsover
North East Derbyshire
Derbyshire Dales
Nottinghamshire
Amber Valley
Erewash
City of Derby
Staffordshire
South Derbyshire
Leicestershire
Drawing No SFRA 01
Derbyshire County with District Boundaries
Prepared By AD
Checked By JRB
Approved By SM
Date Issued 13/12/2011
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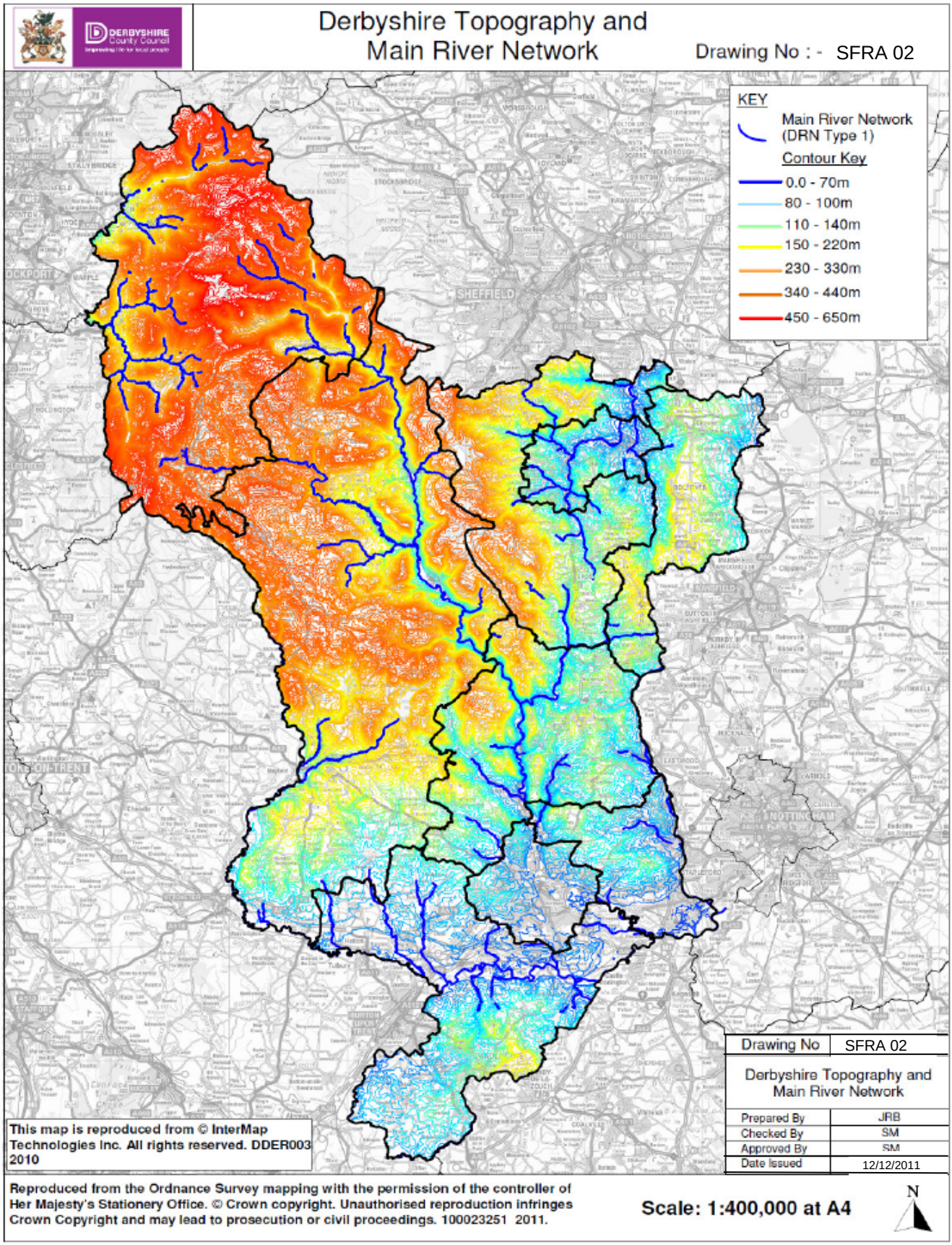
Scale: 1:400,000 at A4


Derbyshire Topography and Main River Network
Drawing No : - SFRA 02
KEY
Main River Network (DRN Type 1)
Contour Key
0.0 - 70m
80 - 100m
110 - 140m
150 - 220m
230 - 330m
340 - 440m
450 - 650m
SHEFFIELD
NOTTINGHAM
Drawing No SFRA 02
Derbyshire Topography and Main River Network
Prepared By JRB
Checked By SM
Approved By SM
Date Issued 12/12/2011
This map is reproduced from © InterMap Technologies Inc. All rights reserved. DDER003 2010
Reproduced from the Ordnance Survey mapping with the permission of the controller of Her Majesty's Stationery Office. © Crown copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. 100023251 2011.
Scale: 1:400,000 at A4
N

3.7 Availability and Limitations

The availability and limitations of information has varied across the County and City. Some information is anecdotal, being generated by word of mouth between numerous individuals. Other information falls short of all the desired attributes, i.e. road name and location were provided but no other information. A number of GIS layers were provided with point features on a mapping layer; however the points did not contain any information to support the flood incident.

As a result of the variance in data it has been difficult to ascertain what is affected and the severity and frequency of flooding events. However now that a data set has been provided further discussions/ investigation can be pursued with relevant parties to better support the reported flood incidents.

When supporting evidence has been provided such as engineering reports, photographs and paper based maps they are attached to the specific flood incident within the GIS systems and can be viewed alongside the flood information.

4 Flood Risk in Derby and Derbyshire

4.1 Overview

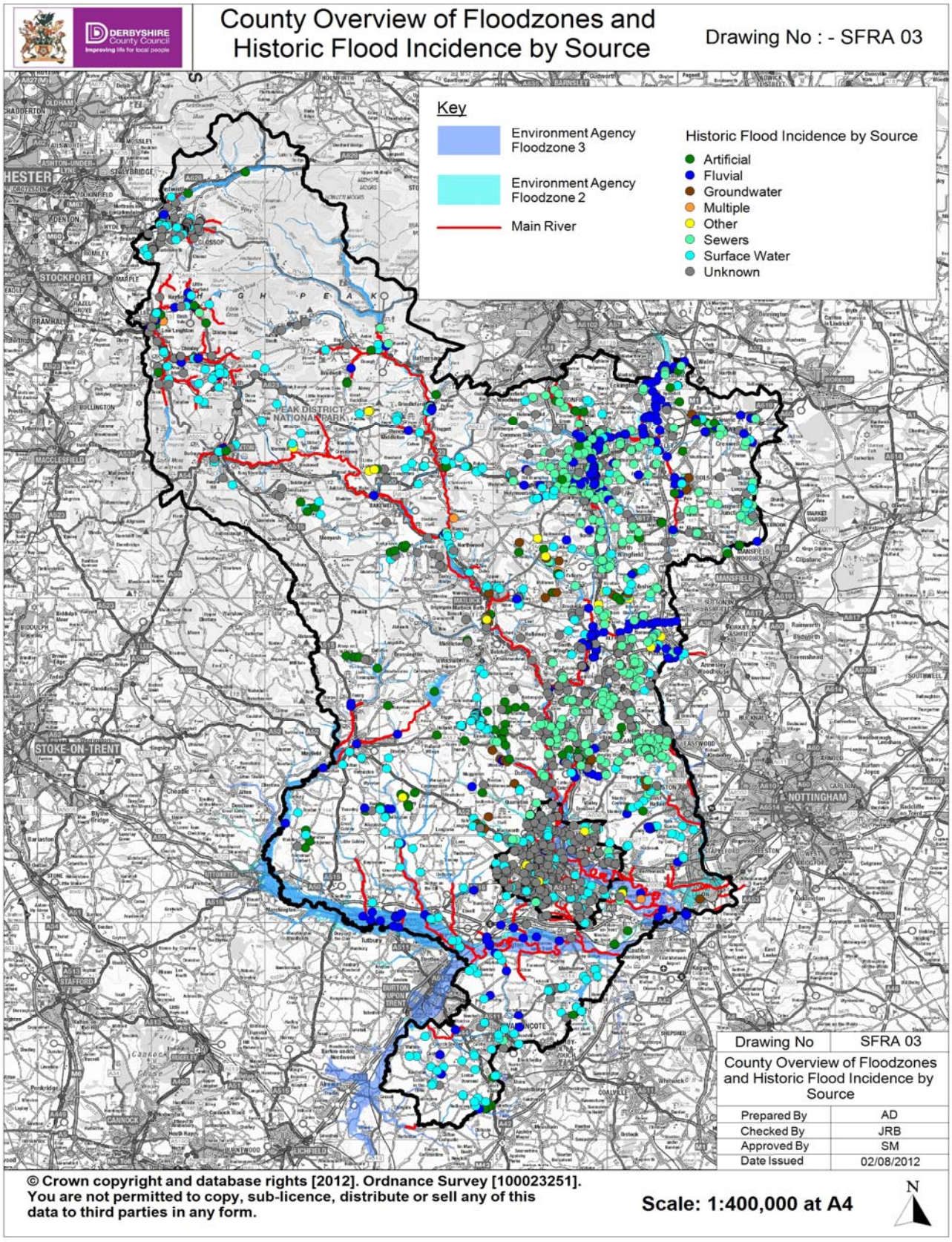
The Derbyshire region covers a geographically large and diverse area which contains sizeable rivers and, numerous smaller watercourses.

It is important to reiterate that this SFRA is reviewing the potential constraints posed by flood risk upon the establishment and/or expansion of minerals extraction sites and waste management facilities within the County. A number of flooding related considerations arise in this context, including the potential of flooding to the site itself (resulting in possible contamination to waterways and/or costly disruption to operations), and the potential risk that the proposed works may pose to surrounding property. This should be borne in mind when reviewing the risk of flooding within Derby and Derbyshire as outlined in the following sections.

In the following sections there are descriptions of the various sources of flooding which Derbyshire County Council and Derby City have faced in the past. To best illustrate the supporting evidence for each of the different sources please refer to the drawings listed at the end of each section. Using the maps should provide a strategic overview of the areas within Derbyshire which have, or could in the future, be affected by flooding from a variety of sources.

4.2 Historic Flooding

Information collected for the purposes of understanding Past Flood Risk can be displayed in map form to illustrate knowledge of where flooding has occurred in the past but limitations in the data used constrain identification of the consequences. Please refer to “Drawing No SFRA 03” Historic Flood Events within Derbyshire on the following page.


County Overview of Floodzones and Historic Flood Incidence by Source
Drawing No : - SFRA 03
Key
Environment Agency Floodzone 3
Environment Agency Floodzone 2
Main River
Historic Flood Incidence by Source
Artificial
Fluvial
Groundwater
Multiple
Other
Sewers
Surface Water
Unknown
PEAK DISTRICT NATIONAL PARK
STOKE-ON-TRENT
NOTTINGHAM
Drawing No SFRA 03
County Overview of Floodzones and Historic Flood Incidence by Source
Prepared By AD
Checked By JRB
Approved By SM
Date Issued 02/08/2012
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Scale: 1:400,000 at A4
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4.3 Fluvial Flooding

Floods can occur in rivers, when flow exceeds the capacity of the river channel, particularly at bends or meanders. Floods often cause damage to homes and businesses if they are located in natural flood plains of rivers.

The largest concentrations of fluvial flood risk normally arise in the flatter low lying areas with the County.

The precise extents of fluvial flooding within County and City is not known in all locations, and reliance has been placed (through necessity) upon the current Environment Agency flood zone maps. Whilst somewhat coarse, the flood zone maps do provide a reasonable indication of likely flood risk areas, triggering a more detailed assessment should future development be under consideration.

It is essential to recognise that flood risk within the County is not limited solely to flooding of main rivers. There is always a risk to properties as a result of groundwater flooding, exacerbated by high river levels.

Please refer to “Drawing No SFRA 03” Flood Zones 3 and 2 in Derbyshire on page 35.

4.4 Sewer Flooding

Derbyshire County consists of three Water Authorities; Severn Trent Water, Yorkshire Water and United Utilities. Derby City consists of only Severn Trent Water. South Staffordshire Water do not have any sewerage network within Derbyshire but does have clean water supplies.

Each Water Authority maintains a register of historical sewer flooding events, (DG5 Register). Within their respective areas they are responsible for public drain sewer systems within Derbyshire, typically Surface Water Drains, Combined Sewer and Foul Water Sewers.

If sewers are unable to accommodate intense rainfall, the result will often be flooding via the inspection covers and road gullies. This type of flooding tends to coincide with summer convectional storms e.g. thunderstorms and is generally localised and of a short duration and usually remain within highway boundaries. Areas at risk from this type of event are often at the base or lower parts of a hill where the gradient of the sewer eases. Properties that have a ground floor level lower than the level of the adjacent road may be at risk from this type of event.

An added complication in Derby is the widespread network of combined sewers where the rainwater and foul sewage share the same pipe. These were built many years ago prior to requirements to provide separate foul and surface water systems. There are numerous overflows from this type of sewer within the City to divert the excess flows into either an adjacent watercourse or into a newer surface water sewer that may be nearby.

Unfortunately Derbyshire County Council has not yet been able to obtain a complete record of DG5 information from the listed Water Authorities, and thus is unable to assess the number of

properties at risk of sewer flooding. When information becomes available an issue still remains in terms of the usefulness of the DG5 data. As due to the Data Protection Act 1998, the Water Authorities are unable to provide a specific detailed location of an historic flood event, and data is released to a four-digit postcode level.

Some information relating to Sewer flooding has been captured by the District/Borough Authorities when producing their SFRA Level 1.

4.5 Surface Water

Surface Water Flooding is caused where the volume of water falling or flowing is unable to percolate into the ground and overwhelms existing drainage systems. This type of flooding is usually short lived and associated with heavy downpours of rain, thunder storms etc. It is extremely difficult to predict precisely where surface water flooding will happen as it is dependent on ground levels, rainfall, and the local drainage network. Overland flow paths are an essential consideration and need to be taken into account in spatial planning.

Historically the split in responsibilities between local authorities and water companies has meant that there has not been a common approach to the management of drainage systems in urban areas. This has been addressed in the Flood & Water Management Act (2010) which has given Lead Local Flood Authorities responsibility for the management of local flood risk, which includes surface water runoff, groundwater and flooding from ordinary watercourses (smaller rivers and streams).

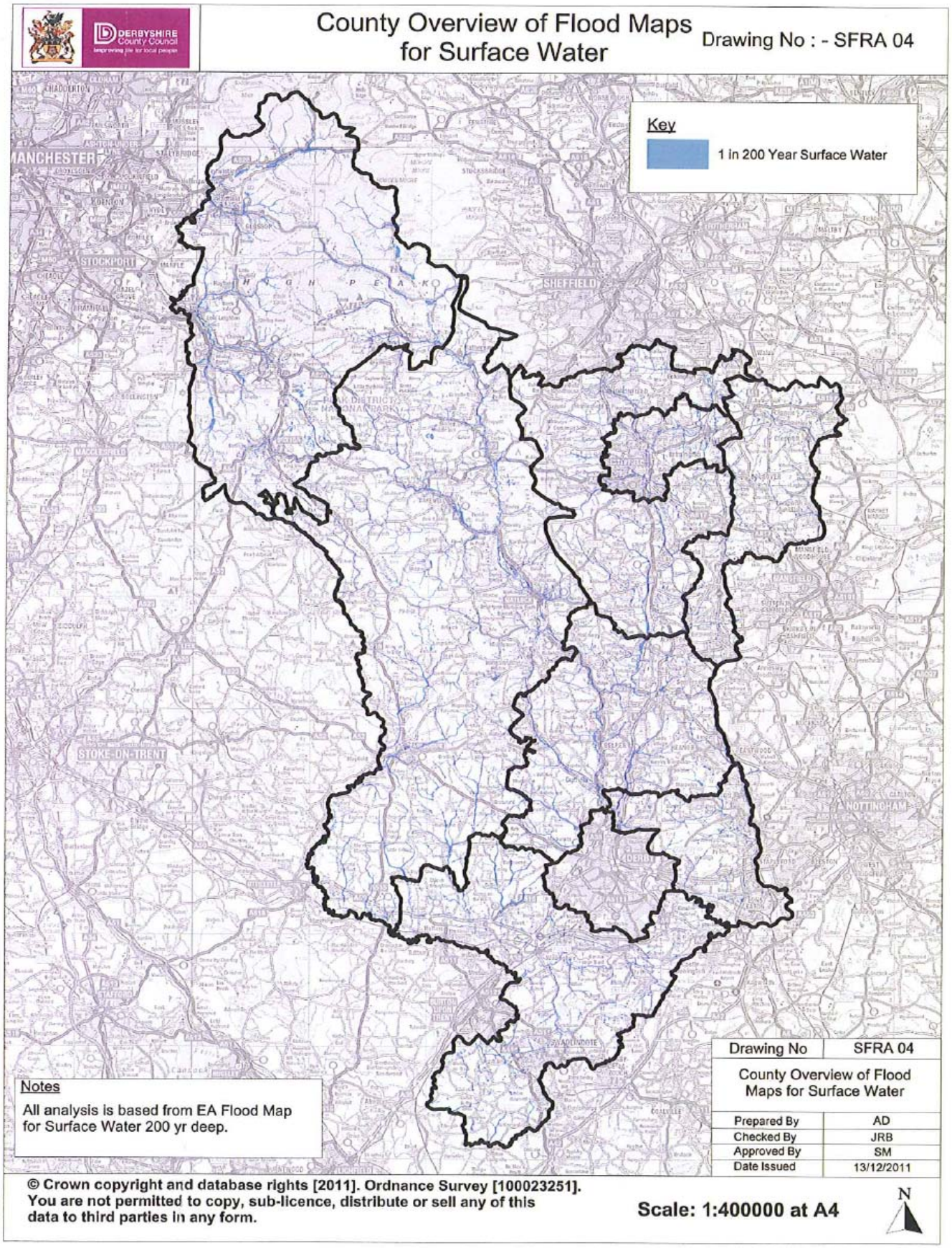
Under the Flood Risk Regulations (2009) Lead Local Flood Authorities are also responsible for assessing, mapping and planning for local flood risk. Water companies and Lead Local Flood Authorities will need to work in partnership with LLFA's to manage surface water flooding.

Highway drainage systems are designed to deal with certain frequencies of storm and rainfall intensity and drain the public highway of excess water. Flooding can be caused by the sheer volume of water or may be caused by a blockage or maintenance problem with the system.

It is difficult to pinpoint problem areas other than through assessment of historically recorded incidents.

Please refer back to Drawing No SFRA 03 County Overview of Flood Zones and Historic Flood Events on page 36, which shows recorded Surface Water related flood events.

Note: Surface Water Flood mapping data should only be used where there are no fluvial flood maps for the site in question.


County Overview of Flood Maps for Surface Water
Drawing No : - SFRA 04
Key
1 in 200 Year Surface Water
MANCHESTER
STOCKPORT
SHEFFIELD
STOKE-ON-TRENT
NOTTINGHAM
Notes
All analysis is based from EA Flood Map for Surface Water 200 yr deep.
Drawing No SFRA 04
County Overview of Flood Maps for Surface Water
Prepared By AD
Checked By JRB
Approved By SM
Date Issued 13/12/2011
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Scale: 1:400000 at A4
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4.6 Groundwater

Groundwater flooding occurs when water levels in the ground rise above surface levels and is most likely to occur in areas underlain by permeable rocks, or aquifers. These can be extensive regional aquifers, such as chalk or sandstone, or may be more local sand or river gravels in valley bottoms underlain by less permeable rocks.

Groundwater generally flows to the surface naturally and discharge often occurs at springs and seeps, leading to oases or wetlands. Groundwater is also often withdrawn for agricultural, municipal and industrial use by constructing and operating extraction wells.

Water pollution of groundwater, from pollutants released to the ground can create a contaminant within the aquifer. Movement of water and dispersion within the aquifer spreads the pollutant over a wider area, which can then intersect with groundwater wells or discharge/resurge into surface water such as seeps and springs, making the water supplies unsafe for humans and wildlife. The interaction of groundwater contamination with surface waters is analysed by use of hydrology transport models.

Detailed assessment needs to be undertaken within the FRA to ascertain the development possible interaction with the Groundwater aquifer.

Within Derbyshire there is an historic network of soughs, underground channels for draining water out of a mine. The term sough is closely associated with the lead mining areas of Derbyshire.

Early Derbyshire lead mines were fairly shallow, since methods to remove water were inefficient and miners had to stop when they reached the water table. The digging of soughs was found to be an effective way of lowering the water table and allowing mines to be worked deeper. There are risks of groundwater flooding caused by rebound/ recharge of groundwater following the cessation of mine water pumping.

Please refer to Drawing No SFRA 05 Areas Susceptible to Groundwater Flooding in Derbyshire on page 41.

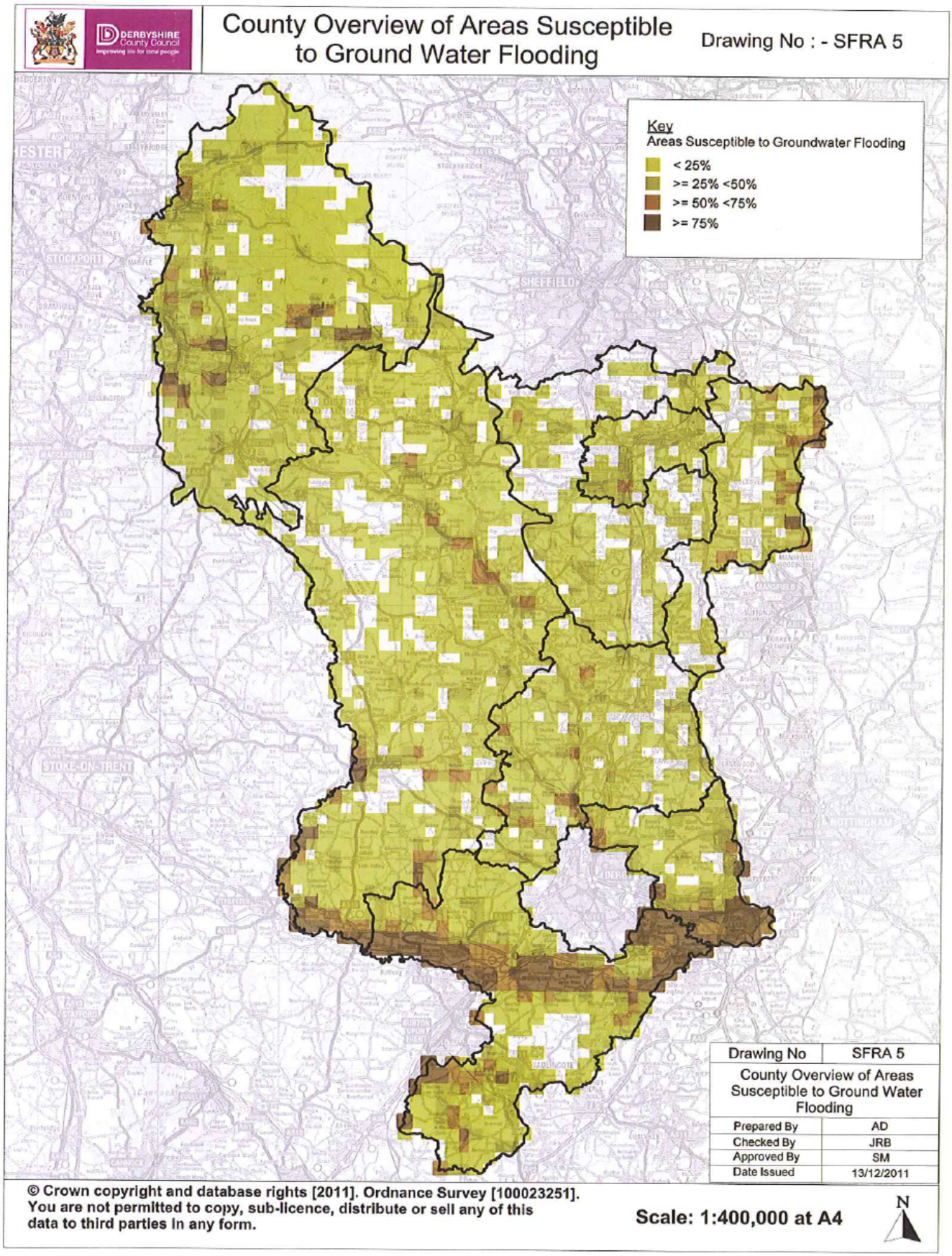
4.7 Artificial Flooding

Artificial Flooding can originate from Canals, Ponds and Reservoirs where the water is retained, in some cases above ground level.

Any such Artificial source which falls within 1km radius of the development site should be assessed from the perspective of residual risk of the water body over topping or the failure of a structure i.e. retaining wall. Assessment should also include calculations to show the potential flow paths for flood water that would occur if such a failure happened. On completion of the above required assessments a decision can be formulated as to whether it is considered an actual or residual flood risk.

The Environment Agency holds Reservoir Flooding data which can be viewed on the EA website. Please see link:

http://www.environment-agency.gov.uk/homeandleisure/floods/124783.aspx


County Overview of Areas Susceptible to Ground Water Flooding
Drawing No : - SFRA 5
Key
Areas Susceptible to Groundwater Flooding
< 25%
>= 25% <50%
>= 50% <75%
>= 75%
Drawing No
SFRA 5
County Overview of Areas Susceptible to Ground Water Flooding
Prepared By
AD
Checked By
JRB
Approved By
SM
Date Issued
13/12/2011
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Scale: 1:400,000 at A4
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4.8 Climate Change

The impacts of climate change on future flood risk are not fully understood. United Kingdom Climate Projections 2009 (UKCP09) information has been used in this SFRA to provide an insight into the possible impacts of climate change on future flood risk within Derby and Derbyshire.

There is scientific evidence that global climate change is happening now and cannot be ignored. Over the past century around the UK sea levels have risen and more winter rain falls in intense wet spells. Seasonal rainfall is highly variable and seems to have decreased in summer and increased in winter. 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 and past GHG emissions suggest 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. There is enough confidence in large scale climate models to require a plan for change and whilst there is more uncertainty at a local level, model results can help in planning to adapt. e.g. rain storms may become more intense, but there is no certainty 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) and it is plausible that the amount of rain in extreme storms could increase locally by 40%.

The climate change projections provided by UKCP09 currently reflect the best scientific understanding of how the climate system operates and might change in the future.

Using UKCP09 – 2011, climate projections were obtained for the year 2020. The climate projections used were based on a 50% probability and medium emissions scenario in the East Midlands region. Therefore for a 50% probability at a given location, it should be interpreted that there is a 50% likelihood that the climate variable will be equal to or less than the predicted climate variable value.

By 2020, for the East Midlands region and for a medium emissions scenario, the following rainfall statistics are estimated.

- Mean winter precipitation is estimated to increase by up to 5%.
- Mean summer precipitation is estimated to decrease by up to 8%.
- Precipitation on the wettest day in winter is estimated to increase by up to 10%.
- Precipitation on the wettest day in summer is estimated to increase by up to 10%.

The consequences being an increase in surface water flooding due to increased levels of precipitation. During the winter months flooding may increase as a result of higher rainfall. During the summer months with estimated increased temperatures there is a possibility of increased convective rain storms with high intensity rainfall events.

Climate changes can affect local flood risk in several ways as impacts will depend on local conditions and vulnerability. Wetter winters and more rain falling in wet spells may increase river flooding with more intense rainfall causing 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 there is a need to be prepared for the unexpected. In adapting to change there is a requirement to plan ahead and understand current and future vulnerability to flooding, to develop plans for increased resilience and build capacity to adapt to achieve long-term, sustainable benefits.

Local information will be invaluable in understanding climate impacts in detail, including effects from other factors, such as land use. Sustainable development and sustainable drainage (SuDs) will help in adapting to climate change and managing the risk of damaging floods in future.

4.9 Flood Risks to Mineral Extraction Sites

Minerals can only be worked where they naturally occur. This has implications when carrying out the Sequential Test in accordance with the NPPF as reasonable alternatives are not always available. This is especially the case with sand and gravel deposits which are usually within main river floodplains.

Mineral extraction in the floodplain may reduce the level of flood risk by providing additional storage capacity during its operation phase for flood waters. Alternatively, stockpiles and ancillary buildings could reduce the storage capacity of the floodplain. In addition, stockpiles and ancillary buildings could alter the natural flow of flood water increasing flood risk to surrounding land.

There are numerous factors to consider in relation to flood risk posed to a mineral extraction site, such as:

- Ecology
- Water Table
- Geology
- Climate Change
- Hydrology
- Method of material extraction/open/closed
- Topography
- Site layout/restrictions
- Dewatering
- Fluvial System
- Weather Systems
- Water Supply

The vast majority of mining extraction sites requires some form of dewatering system to keep operations active. During the operational life period of the site the dewatering activities have an impact on groundwater levels as they are kept at a low level. However upon closure of the site

the underlying water level returns back to its original level. With this in mind consideration must be given to any local development near to the extraction site as original groundwater assessments may not have considered the impact post closure of the site.

A large majority of sites which are used for sand and gravel extraction are classed as “Water Compatible”. However if they are located in flood sensitive areas a development phase plan should be used in order to minimise the flood impacts.

In terms of the design and management of extraction sites there are numerous aspects to consider, here are a few for example:

- Storage bund assessments
- Hydraulic models
- Runoff calculations
- Hydrological Impact Assessments
- Flow Levels pre and post construction
- Production of FRA
- Ecological Issues
- Water Resources
- Regulatory Constraints
- Discussion with appropriate bodies i.e. EA, Natural England and Wildlife Trusts.

Development should be directed to flood zone 1 (low probability) wherever possible, and then sequentially to flood zones 2 (medium probability) and 3 (high probability), and to the areas of least flood risk within zones 2 and 3. The most vulnerable uses should be directed towards the lowest risk areas.

Site uses are classified at different levels of vulnerability. Specific waste-related uses are classified as follows:

- Highly vulnerable: installations requiring a hazardous substances consent
- More vulnerable: landfill and hazardous waste management
- Less vulnerable: waste treatment (except above), minerals working and processing
- Water compatible: sand and gravel extraction.

The NPPF confirms that a risk-based sequential test should be applied at all stages of planning.

More detailed assessment and the production of a FRA and sequential test evidence needs to be undertaken in parallel with the development of the planning submission and licensing/permitting process. This shall also include the possible effects to the surrounding area after the site closure.

4.9.1 Flood Risks to Waste Disposal Sites

The NPPF Technical Guidance (table 2) classifies landfill sites and facilities dealing with the treatment of hazardous waste as 'More Vulnerable' developments, and as such is restricted to Flood Zones 1, 2 (prior to the application of the Sequential Test).

Installations requiring hazardous substances consent are classified as 'Highly Vulnerable' and are restricted to Flood Zones 1 and 2 (prior to the application of the Sequential Test). All other sites are classified as 'Less Vulnerable' (excluding hazardous waste) and are appropriate in Flood Zones 1, 2 and 3a.

The relationship between groundwater and potential contamination needs to be investigated prior to approval of any landfill.

5 Emergency Planning and Flood Risk

5.1 Overview

Derbyshire Emergency Planning Division ensures that the County Council complies with the statutory duties of the Civil Contingencies Act 2004. This requires Contingency Plans to be prepared which reflect the County's Risk Profile. Flooding, including fluvial, surface water and rapid response catchment (flash flooding) are risk assessed to better understand both the likelihood and impacts on health, the economy, the environment and social impacts such as loss of key services and infrastructure. Many parts of the County are considered to be Very High or High Risk.

Other aspects of "Flood Risk" that the Division addresses are inundation from certain reservoirs, categorised by DEFRA as High Priority for emergency planning purposes. Also, under the Major Accident Off-site Emergency Plan (Management of Waste from Extractive Industries) Regulations 2009, the Division will have responsibility for producing emergency plans for sites where accidental loss of containment from "slurry lagoons" could occur. One such extraction site has been identified in Derbyshire. All work carried out by the Emergency Planning Division is overseen by the Local Resilience Forum.

5.2 Flood Evacuation Plans

The Emergency Planning Division takes responsibility for producing Derbyshire's Multi-Agency Flood Contingency Plan. This identifies all the areas that are susceptible to flooding from a range of sources, predominantly our main rivers. Each district/borough has a detailed Annex to enable a planned and co-ordinated response to be deployed where flooding is affecting a community. The Plan identifies properties with vulnerable occupants such as schools, hospitals and residential homes. When evacuation of property is required, then a Plan to deliver "Humanitarian Assistance" through temporary accommodation is implemented.

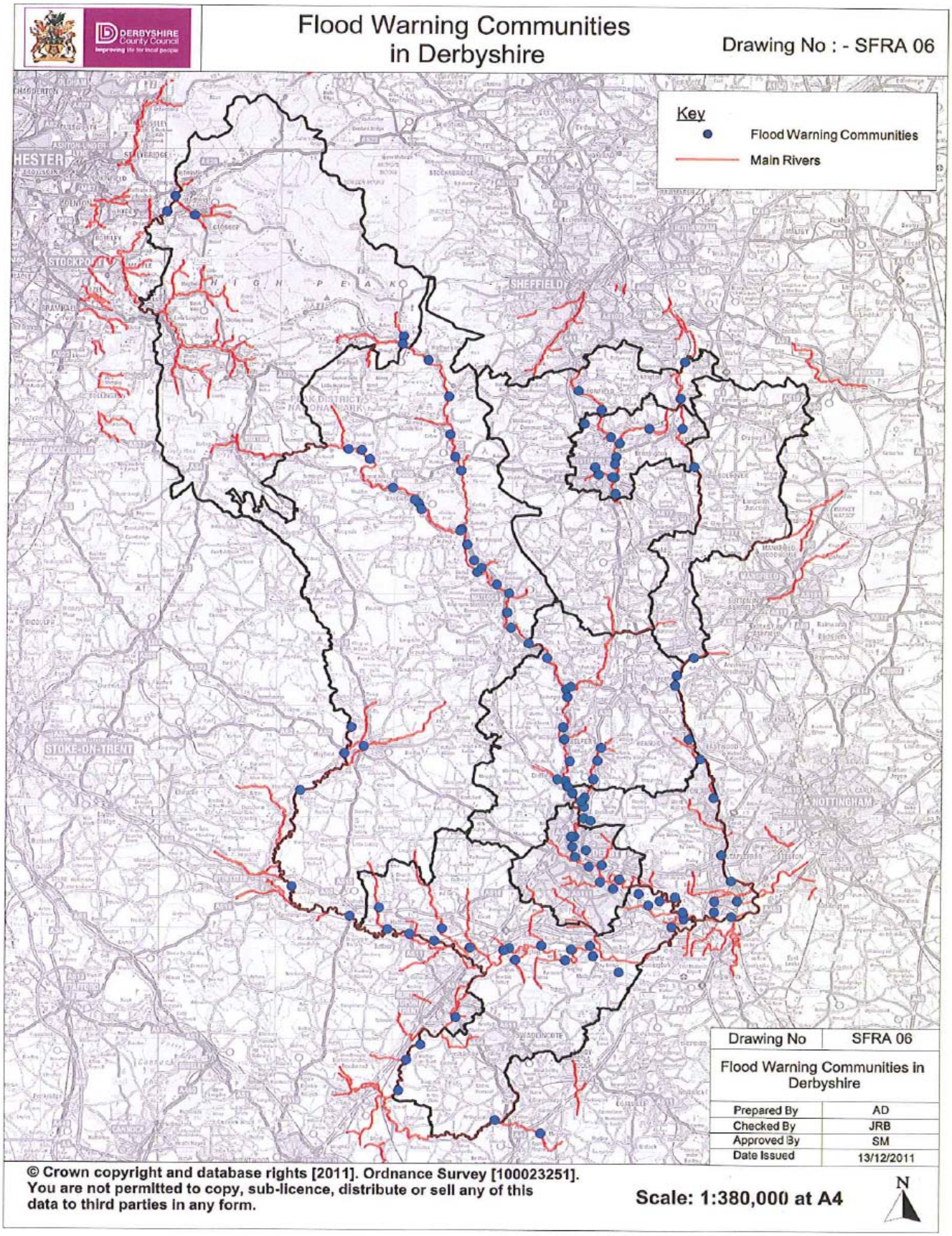
5.3 Flood Warning Systems

The principal means by which Flood Warnings are delivered to the public, businesses and response agencies is the **Floodline Warnings Direct** service operated by the Environment Agency. A series of river level gauges coupled with information from the Met Office enables a Warning to be delivered to recipients in community focussed "Flood Warning Areas". There are three levels of warning:

- Flood Alert - Flooding is possible, be prepared
- Flood Warning - Flooding is expected, immediate action is required
- Severe Flood Warning - Severe flooding, danger to life

The County Council's Emergency Planning Division will provide additional information and advice when appropriate under its "Warning and Informing" duty (Civil Contingencies Act 2004) and the implementation of the LRF's Warning and Informing Plan. The Derbyshire Prepared website - www.derbyshireprepared.org.uk - is one medium that will be used.

Please refer to Drawing No SFRA 06 Flood Warning Communities in Derbyshire on the following page.


Flood Warning Communities in Derbyshire
Drawing No : - SFRA 06
Key
Flood Warning Communities
Main Rivers
HESTER
STOCKPORT
SHEFFIELD
STOKE-ON-TRENT
NOTTINGHAM
Drawing No
SFRA 06
Flood Warning Communities in Derbyshire
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6 The Sequential Test

Flood Risk

This section describes the guidance notes within the NPPF and its supporting Technical Guidance. The methodology of the 'sequential test' is described along with explanatory notes regarding the flood zones and also the differing vulnerability classifications for various types of development.

Zone 1 - low probability

Definition
This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Appropriate uses
All uses of land are appropriate in this zone.

Flood risk assessment requirements
For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or other local considerations require particular attention.

Policy aims
In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.

Figure 2: Flood Zones (reproduced from table 1 of the Technical Guidance to the National Planning Policy Framework)

Zone 2 - medium probability

Definition
This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Appropriate uses
Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are *only* appropriate in this zone if the Exception Test is passed.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a Flood risk assessment.

Policy aims
In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques.

Figure 2: Contd.

Zone 3a high probability

Definition
This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Appropriate uses
The water-compatible and less vulnerable uses of land (**listed in table 2 of the NPPF Technical Guidance, table 8 of this SFRA**) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone.

The more vulnerable uses and essential infrastructure uses should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a Flood risk assessment.

Policy aims
In this zone, developers and local authorities should seek opportunities to:

i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
ii. relocate existing development to land in zones with a lower probability of flooding; and
iii. create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Figure 2: Contd.

Zone 3b the functional floodplain

Definition
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. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses
Only the water-compatible uses and the essential infrastructure listed in **table 2 of the NPPF Technical Guidance (table 8 of this SFRA)** that has to be there should be permitted in this zone. It should be designed and constructed to:
– remain operational and safe for users in times of flood;
– result in no net loss of floodplain storage;
– not impede water flows; and
– not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a flood risk assessment.
Policy aims
In this zone, developers and local authorities should seek opportunities to:
i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques;

Figure 2: Contd.

6.1 The Sequential Approach

The Sequential Test refers to the application of the sequential approach by MWPAs and seeks to ensure that the most vulnerable development is located in an area at lowest risk of flooding. This is a simple decision making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk.

All development should be steered towards Flood Zone 1 where possible, and then sequentially to Flood Zones 2 and 3 if appropriate. Additionally, within each Flood Zone development should be directed to areas of least flood risk.

The NPPF Technical Guidance acknowledges that some areas will be at risk of flooding from flood sources other than fluvial or tidal systems. All sources of flooding must be considered when looking to locate new development. Other sources of flooding that require consideration when situating new development allocations include:

Flooding from Rainfall – Surface Water;
Flooding from Rising Groundwater;
Flooding from Sewers and Drains; and,
Flooding from Reservoirs, Canals and Lakes and Other Artificial Sources.

To assist MWPAs in their strategic land use planning, SFRAs should provide sufficient information to enable them to apply a sequential approach to the allocation of sites for waste management and where possible mineral extraction and processing.

The application of the sequential approach aims to manage the risk of flooding by avoidance. This will prevent the promotion of sites that are inappropriate on flood risk grounds. The application of the Exception Test through a Level 2 SFRA will ensure that new developments in flood risk areas will only occur where flood risk is clearly outweighed by other sustainability drivers.

The MWPA must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone information from the MWDF Level 1 SFRA and applied the Sequential Test in the site allocation process.

MWPAs are required to identify minerals and waste sites to meet their targets and ensure 15 years of delivery post adoption. Where this cannot be achieved broad areas for future use should be indicated.

Any proposed development on a windfall site will require a Sequential Test at the planning application stage, given that the site is not an allocation in the development plan that has been sequentially tested.

The spatial strategy for minerals development is primarily driven by geology as minerals can only be worked where they occur. This has implications for the Sequential Test as suitable alternative sites may not always be available

Where sand and gravel workings are located within the floodplain, ancillary buildings and infrastructure should be located in areas of least flood risk. This reduces the risk of being adversely affected by flooding or increasing flooding elsewhere.

The Level 1 SFRA mapping provides the tools for the MWPAs to undertake the Sequential Test.

Flood Risk Vulnerability	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1 (Lowest Risk)	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test Required	✓	✓
Zone 3a	Exception Test Required	✓	×	Exception Test Required	✓
Zone 3b (Highest Risk)	Exception Test Required	✓	×	×	×

Key

- ✓ Development is appropriate
- × Development should not be permitted

Table 7: Flood Risk Vulnerability and Flood Zone 'Compatibility' (adapted from the Technical Guidance to the National Planning Policy Framework, Table 3)

Development Type	Vulnerability Classification	Acceptable Flood Zone
Installations Requiring Hazardous Substances Consent	Highly Vulnerable	Flood Zone 1 (Exception Test required for Flood Zone 2)
Landfill and Sites Used for Waste Management Facilities for Hazardous Waste	More Vulnerable	Flood Zone 1 and 2 (Exception Test required for Zone 3a)
Sewage Treatment Works	Less Vulnerable	Flood Zone 1, 2 and 3a
Waste Treatment (except landfill and hazardous waste facilities)	Less Vulnerable	Flood Zone 1, 2 and 3a
Minerals Working and Processing (excluding sand and gravel working)	Less Vulnerable	Flood Zone 1, 2 and 3a
Sand and Gravel Working	Water Compatible	Flood Zone 1, 2, 3a and 3b

Table 8: Flood Risk Vulnerability Classification (adapted from the Technical Guidance to the NPPF, Table 2)

7 The Exception Test

7.1 The Exception Approach

The Exception Test process is detailed in the Technical Guidance to the NPPF and should only be applied following application of the Sequential Test. There are two stringent conditions, both of which must be fulfilled before the Exception Test can be passed. These conditions are as follows:

a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and

b) A site specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

The Exception Test is only required (in terms of minerals and waste development) where landfill sites or sites used for waste management facilities for hazardous waste (more vulnerable development) are proposed in Flood Zone 3a (refer back to Table 7 above).

Application of the Sequential Test should ensure that more vulnerable types of development, such as landfill sites (in reference to Table 2 of the NPPF Technical Guidance), are not

allocated to areas at high risk of flooding. There may be other reasons for a development type which is not entirely compatible with the level of flood risk at a particular site to be considered. In these circumstances it will be necessary for the MWPA to demonstrate that the site qualifies for development by passing all elements of the Exception Test.

It may be necessary to apply the Exception Test where the Sequential Test alone cannot deliver acceptable sites, and where some continuing development is necessary for wider sustainable development reasons. It is important to take into account the need to avoid social or economic blight and the need for essential civil infrastructure to remain operational during floods.

Where use of the Exception Test is required, decision-makers should apply it at the earliest stage possible in planning to all the MWDF potential allocations for development and all planning applications other than for minor development. Further data collection and analysis may be required through a Level 2 SFRA to assist in the Exception Test. Where a Level 2 SFRA has not been completed, a site specific Flood Risk Assessment (FRA) will be required in support of the Exception Test.

A Level 2 SFRA will assess the nature of the flooding in more detail to include hazard and depth mapping including the presence of flood defence measures. The difference between a Level 2 SFRA and a site specific FRA is the scale of the study.

8 Sustainable Management of Flood Risk

8.1 Overview

The ability to demonstrate sustainability is a primary government objective for development in Great Britain. Of particular importance is sustainable development within flood affected areas. The purpose of the SFRA is to inform planning decision making and consider the nature and scale of flood risk. Careful consideration must be given to the measures that can be put in place to minimise the risk to property and life posed by flooding. These should address the flood risk throughout the lifetime of proposed development.

The SFRA is a strategic document that provides an overview of flood risk throughout the County and City. More detail is provided in the local SFRAs produced by the Districts and the forthcoming Derby City Council SFRA. A site based Flood Risk Assessment (FRA) must be carried out for all proposed developments and submitted as part of the planning application.

8.2 Responsibility for Flood Risk Management

There is no statutory requirement for central or local government to protect land and property against flooding, although the government does recognise the importance of safeguarding the wider community.

There is no single body responsible for managing flood risk in the UK.

The Department for Environment Flood and Rural Affairs (Defra) and the Welsh Assembly Government determine policy and are responsible the management of flood risk at a government level.

Implementation of the policy, delivery and operational activities are mainly shared between the Environment Agency (EA), local authorities and Internal Drainage Boards (IDBs).

An overview of key responsibilities with regard to the management of flood risk is:

Environment Agency

The Environment Agency has the role of implementing government policy on flood risk, and has a strategic overview of coastal erosion and flooding from all sources.

The EA has responsibilities for flood defences and powers and duties relating to the drainage, maintenance and operations of the main rivers. Its overall aim is to reduce the risk of flooding from main rivers and the sea. The EA has a duty to produce flood risk maps and issue flood warnings with regard to Main River.

The EA develops a number of management plans to understand the threat of flooding, and plan for the sustainable management of those risks over the long-term.

It is also a statutory consultee to the development planning process.

Local Authorities (Lead Local Flood Authority)

Local authorities have a lead role and responsibility for local flood risk management – surface water, groundwater and ordinary water courses.

They have the powers to maintain and improve ordinary watercourses and flood defences, and along with partner organisations to encourage and influence the adoption of 'sustainable drainage systems' (SUDS).

Sewerage Undertakers (Water Authorities)

Sewerage undertakers are responsible for maintaining the public sewage systems, including sewers carrying surface water away from impermeable surfaces.

In flood conditions, the sewer systems can often become overloaded with a mixture of floodwater and sewage leading to overflow and flooding. Sewerage undertakers are responsible for the removal of surface water from impermeable surfaces through the sewer system.

To prevent further flooding, water and sewer companies have a responsibility to:

- prevent overloading sewer systems
- maintain and repair pipes to prevent further flooding.

Where there is frequent and severe sewer flooding, sewerage undertakers are required to address this through their capital investment plans which are regulated by the Water Services Regulation Authority (Ofwat).

Water UK represents all UK water and wastewater service suppliers at national and European level. It provides a framework for the water industry to engage with government, regulators, stakeholder organisations and the public.

Local Authorities (District/Borough)

Local authorities have certain permissive powers to undertake flood defence works and powers of enforcement under the Land Drainage Act 1991, Flood and Water Management Act 2010 Section 14A and Public Health Act on watercourses which have not been designated as Main Rivers and which are not within Internal Drainage Board areas.(i.e. ordinary watercourses)

The local planning authority will prepare development plans and determine planning applications in line with planning policy. They can consider the refusal of planning permission if a development increases the risk of flooding. Local authorities also coordinate local resilience and emergency planning in their area, including response to and recovery from major flood emergencies.

Highway Authorities

The local highway authority has responsibility for effectual drainage of roads on the local road network, in so far as ensuring that drains, including gullies, which are their responsibility to maintain.

The Highways Agency

The Highways Agency is responsible for managing road drainage from the trunk road network in England, including the slip roads to and from trunk roads.

Emergency Services and Multi-Agency Emergency Planning

The Civil Contingencies Act 2004 and associated Regulations sets out an emergency preparedness framework, including planning for and response to emergencies. Local Resilience Forums, which include representatives from the Emergency Services, Local Authorities and the Environment Agency, should ensure that risks from flooding are fully considered, including the resilience of emergency infrastructure that will have to operate during floods. Emergency Services should be consulted during the preparation of LDD's and the consideration of planning applications where emergency evacuation requirements are an issue.

Internal Drainage Boards

Where present, Internal Drainage Boards (IDBs) are responsible for maintenance, improvement and operation of drainage systems and regulation of watercourses apart from main rivers. Their main role is to manage the level of watercourses. There are no Internal Drainage Boards within Derbyshire.

8.3 Planning and Development

Many settled areas of the UK are subject to periodic flooding given their historical location along river corridors. The solution is a planning led approach where development is steered away from areas susceptible to flooding where possible. The NPPF advocates a sequential approach that will guide the planning decision making process. This requires planning authorities to seek to allocate sites for future development within areas of lowest flood risk in the first instance. Only if it can be demonstrated that there are no suitable sites within these areas should alternative sites be considered.

The level of detail in the FRA must be proportionate to the risk of flooding to the proposed development i.e. where the flood risk is negligible (Zone 1 Low Probability), there is little benefit to be gained in assessing the potential risk to life/ operations as a result of flooding. In this type of scenario, emphasis should be placed on ensuring that surface water runoff does not exacerbate flooding lower down the catchment.

8.4 Overview of Flood Risk at MWDF Sites

At this time no Minerals or Waste sites have been identified. This Level 1 SFRA is a strategic document. Some FRAs have been produced for mineral and waste sites in Derbyshire, however, DCC would require new site specific FRAs to be undertaken per proposed development site.

8.5 SuDS – Sustainable Drainage Systems

Introduction

The principal of Sustainable Drainage Systems (SuDS) is to replicate natural discharge systems using cost effective solutions with low environmental impact. To drain away surface water run-off through collection, storage, and cleaning before allowing it to be released slowly back into the environment, such as into water courses.

The main aim of SuDS solutions should be that of a system that is easy to manage, requiring little or no energy input, resilient to use, environmentally efficient and friendly as well as aesthetically attractive.

A common misconception of SuDS systems is that they reduce flooding on the development site. In fact the SuDS system is designed to reduce the impact that the surface water drainage system of one site has on other sites. The SuDS system aims to minimise or eliminate discharges from the site, and unlike traditional urban stormwater drainage systems, SuDS can also help to protect and enhance ground water quality.

With the introduction of the Flood and Water Management Act 2010. Schedule 3 there is now a greater influence supporting the implementation of SuDS.

8.6 Current Application of SuDs techniques within Derby and Derbyshire

Derbyshire County Council actively supports and promotes the use of sustainable drainage techniques. Through liaison with our eight District/Borough Planning Authorities we try and encourage early dialogue with developers in terms of drainage design.

The County Council sees the use of SuDS for a development site should aim to improve the management of water by reducing peak flows to watercourses or sewers and therefore hopefully helping to reduce the risk of flooding downstream within the catchment.

Implementation of a SuDS system would hopefully deliver an improvement in the water quality, with the use of source control through the system, pollutants will be diluted. SuDS encourage replicating natural drainage patterns which by doing so should replenish groundwater base flows.

Derby City Council aims to minimise the flows into the sewers and watercourses within the City to reduce or control the risk of flooding as far as possible. In this regard the application of management techniques to reduce the discharge of surface water from development sites to ‘greenfield’ rates is vital to achieve the policy objective of reducing flood risk. In essence the SUDs approach is to try to mimic the pre-development behaviour of the site, limiting the discharge of surface water and enabling the infiltration of water into the ground.

The ground conditions in the undeveloped parts of Derby are typically organic soils with a clay subsoil overlying gravely clays trending to weathered mudstones at depth. Overall, the ground conditions do not appear at first sight to be suitable for infiltration however a consideration of the behaviour of the natural environment demonstrates that the rainwater is attenuated within the soil matrix and then may infiltrate into the weathered mudstones albeit at a slow rate. Typically, much of the City has soils with a ‘winter rain acceptance potential’ (WRAP) class of 4. This essentially means that Greenfield run-off rates are quite high as the soils are easily saturated and once in this state, the ground behaves as if it is impermeable.

In parts of the City near to the main watercourses, the ground conditions comprise sands and gravels as river terrace deposits and also areas of silt and clay. The former ground conditions should be suitable for infiltration methods although an appreciation of the ground water level is required when assessing the suitability of a particular design. Areas of silts and clays would typically pose difficulties for infiltration methods however they may still be applicable with increased storage.

The following destinations must be considered for surface runoff in order of preference:

1. Discharge into the ground
2. Discharge to a surface water body
3. Discharge to a surface water sewer

4. Discharge to a combined sewer

Discharge into the Ground

Surface runoff must be discharged to the ground except where one or more of the following criteria can be demonstrated:

a) The rate of surface runoff is greater than the rate at which water can infiltrate into the ground. In this case as much of the water as reasonably practicable must be discharged by infiltration; or
b) There is an unacceptable risk of ground instability or subsidence; or
c) There is an unacceptable risk of pollution from mobilising existing contaminants on the site; or
d) Infiltration is not compliant with the water quality requirements or
e) There is an unacceptable risk of groundwater flooding or
f) The infiltration system would create a high risk of groundwater leakage into the combined sewer.
g) The use of local water recycling initiatives including rainwater harvesting for re-use in toilets or garden watering can reduce the volume of runoff that needs to infiltrated into the ground.

Discharge to a Surface Water Body

Surface runoff not discharged into the ground must be discharged to a surface water body except where it can be demonstrated that:

a) It is not reasonably practicable to convey the runoff to a surface water body; or
The following destinations must be considered for surface runoff in order of preference:
b) Pumping of the surface runoff, either on site or further downstream, would be required and there is a reasonably practicable alternative; or
c) Discharge would result in an unacceptable risk of flooding from the surface water body.

Discharge to a Surface Water Sewer or Local Highway Drain

Surface runoff that cannot be discharged into the ground or to a surface water body must be discharged to a surface water sewer or local highway drain, except where it can be demonstrated that it is not reasonably practicable to do so.

Discharge to a Combined Sewer

Surface runoff that cannot be discharged into the ground, a surface water body or a surface water sewer or local highway drain must be discharged to a public combined sewer system. Surface runoff must not be discharged to a separate foul sewer.

The following situations may preclude the use of infiltration methods:

a) Where ground conditions are essentially impermeable leading to excessive or impractical storage requirements;
b) High groundwater levels, proximity of other structures and foundations renders the use of infiltration systems difficult;
c) Where contamination within the ground may be mobilised and spread by the direct infiltration of water into the ground.

Derby City Council has produced a SuDs guidance document which is available for use by developers.

There are various ways that Sustainable Urban Drainage could be incorporated into a development and the most commonly used SuDS components are described below in Table 9.

SuDS Component	Description
Filter Strips	The main aim of filter strips are to remove sediment with the use of grass strips, they can be small such as between one and two metres wide.
Pervious Pavements	Such as roads and parking areas where water is able to drain through the surface. There are various surface types including block paving, gravel and porous asphalts.
Infiltration	Includes soakaways, trenches and basins. They are sub-surface devices to promote natural infiltration of surface water into the ground.
Swales	Are shallow grass channels designed to slow and capture runoff by spreading it horizontally across the landscape along a contour line, facilitating runoff infiltration into the soil. Water is then transported in a controlled manner to another SuDS component or to a stream or river downstream.
Trench Troughs	Open landscaped channels which can be vegetated, over filter medium and under drained. Normally used to convey, attenuate and improve water quality.
Basins	Ponds and wetland areas that can be used to store surface water runoff.
Canal and Rills	These are open surface water channels that have hard constructed edges.
Bio-retention	Engineered filters that also use plants/vegetation to remove and treat runoff. Used more so for treatment as opposed to storage.
Filter Drains	Linear drains consisting of trenches filled with a permeable material, often with a perforate pipe at the base of the trench to aid drainage.
Green Roofs	The roof of a building that is partially or completely covered with vegetation or another growing medium. They are designed to intercept and retain precipitation, reduce the volume of runoff and attenuate peak flow.

Modular Systems	Modular plastic systems that can be used to create below ground infiltration or storage.
Detention Basin	Shallow vegetated depressions to control the amount and rate of runoff and some water quality improvement.
Rainwater Harvesting	System to collect water from impermeable surfaces for use in non-potable water situations.

Table 9: SuDS components and their description.

For guidance on SuDS, the following documents and websites are recommended as a good starting point:-

- CIRIA C521/2 Sustainable urban drainage systems, design manual – superseded http://www.ciria.org.uk/suds/design_guidance.htm .
- CIRIA (WaND) (C690) Guidance on water cycle management for new developments http://www.ciria.org.uk/suds/design_guidance.htm .
- CIRIA C687 Planning for SuDS – making it happen http://www.ciria.org.uk/suds/ciria_publications.htm
- CIRIA C680 Structural designs of modular geocelluar drainage tanks http://www.ciria.org.uk/suds/ciria_publications.htm
- CIRIA C644 Building Greener http://www.ciria.org.uk/suds/ciria_publications.htm
- CIRIA C697 The SuDS Manual http://www.ciria.org.uk/suds/ciria_publications.htm
- CIRIA C698 Site handbook for the construction of SuDS http://www.ciria.org.uk/suds/ciria_publications.htm
- CIRIA C635 Designing for exceedance in urban drainage : Good practice http://www.ciria.org.uk/suds/ciria_publications.htm
- Harvesting rainwater for domestic uses. Information guide http://environment-agency.gov.uk
- Derby City Council: Sustainable Urban Drainage (SUD) Design guidance for Derby.

8.7 Maintenance and Adoption of SuDS

When planning SuDS schemes, it is important for developers to give detailed consideration to the future maintenance requirements for a SuDS system to ensure that the system continues to function throughout its life cycle. Systems which are not appropriately maintained can lead to increased flood risk.

At the conception of the development consideration must be given to the future ownership and management of all elements of the SuDS system, as the maintenance responsibility must be given to durable and accountable bodies which have the resources to meet the long term needs of the system.

Ensuring developers make a full contribution to the costs of both building and maintaining such systems is vital to their long term effectiveness. The costs of maintaining SuDS devices will be dependent on the types of system used and this should be considered by the developer at an early stage.

The majority of SuDS are at the surface elements and they are best incorporated into local landscape maintenance regimes where possible. An advantage of this is that the site managers and landscape contractors will have a good knowledge of the site through regular maintenance operations such as grass cutting and litter removal. This should also ensure regular monitoring and a quick response to any maintenance needs.

The National SuDS Working Group (NSWG) has developed an Interim Code of Practice for SuDS (NSWG, 2004) which provides a set of planning model agreements for use between those public organisations with statutory or regulatory responsibilities relating to SuDS. The model agreements are based on current legislation and the current planning system. This code of practice is complemented by CIRIA publication C625 Model agreements for SuDS.

9 Conclusions and Recommendations

The risk of flooding within Derby and Derbyshire arises from a number of sources, including fluvial, surface water and groundwater flooding.

Each of the major fluvial systems poses a potential risk of flooding to homes and businesses within Derby and Derbyshire.

A risk of surface water flooding also exists, a result of the topography and impermeable geology (clays). A risk of groundwater flooding is also associated with the permeable geology (chalks).

The NPPF advocates that development should be allocated in Local Plans into areas which avoid risk to people and property, where possible and manage it elsewhere. In these allocations they should apply the sequential approach to seek to steer development to areas at the lowest risk of flooding,

These allocations will be generally based on the risk of flooding as set out in this SFRA as supplemented by the District and Borough SFRAs. In addition, individual planning applications should be supported by site risk flood assessments, as appropriate, taking into account the relevant SFRAs.

10 References

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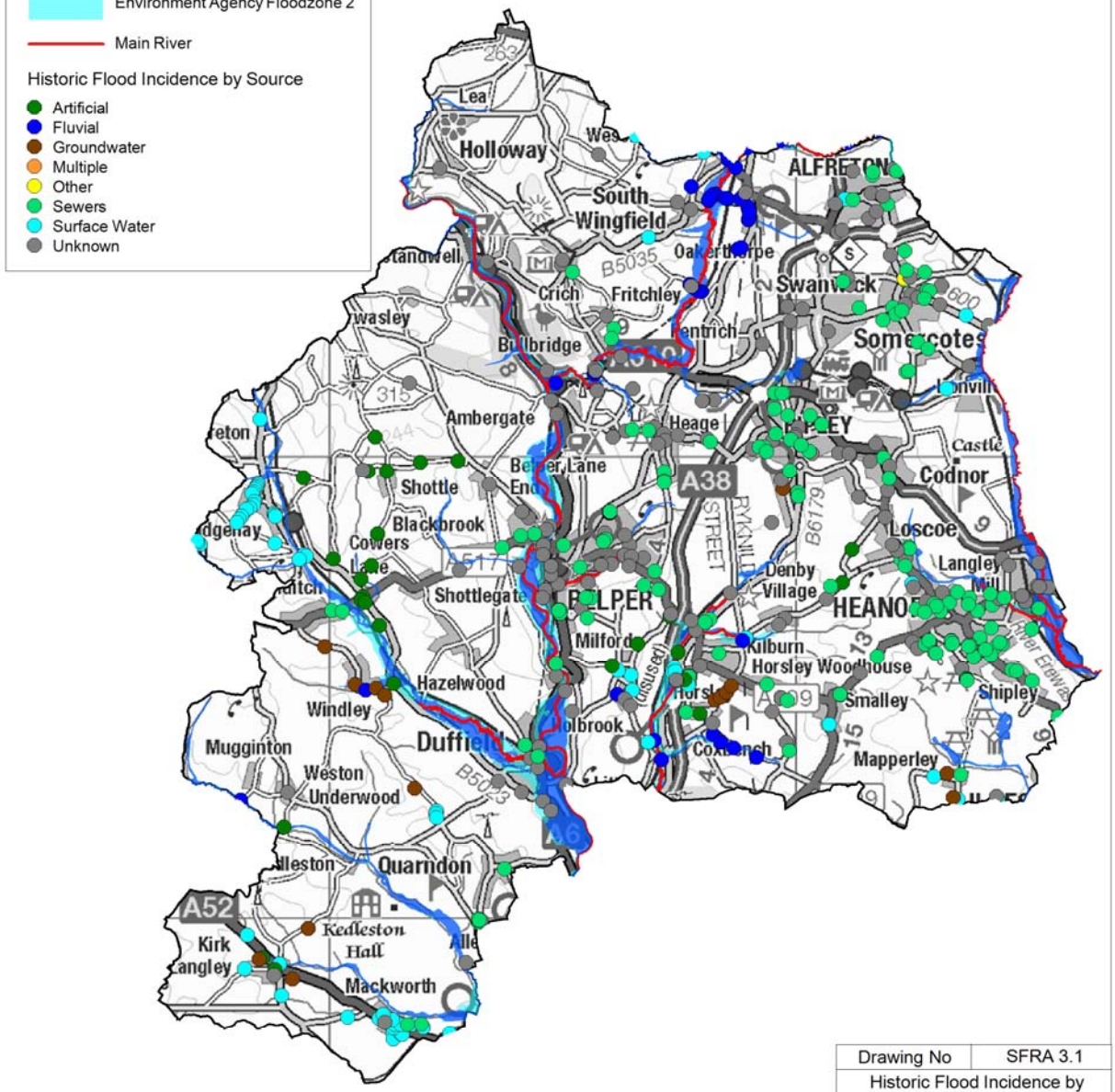
The National Archives. HM Government (2010)
The Flood and Water Management Act
Available from
http://www.legislation.gov.uk/ukpga/2010/29/contents

11 Annex Contents

ANNEX 1:
Amber Valley Borough Council

Historic Flood Incidence by Source and Floodzones in Amber Valley Borough

Drawing No : - SFRA 3.1



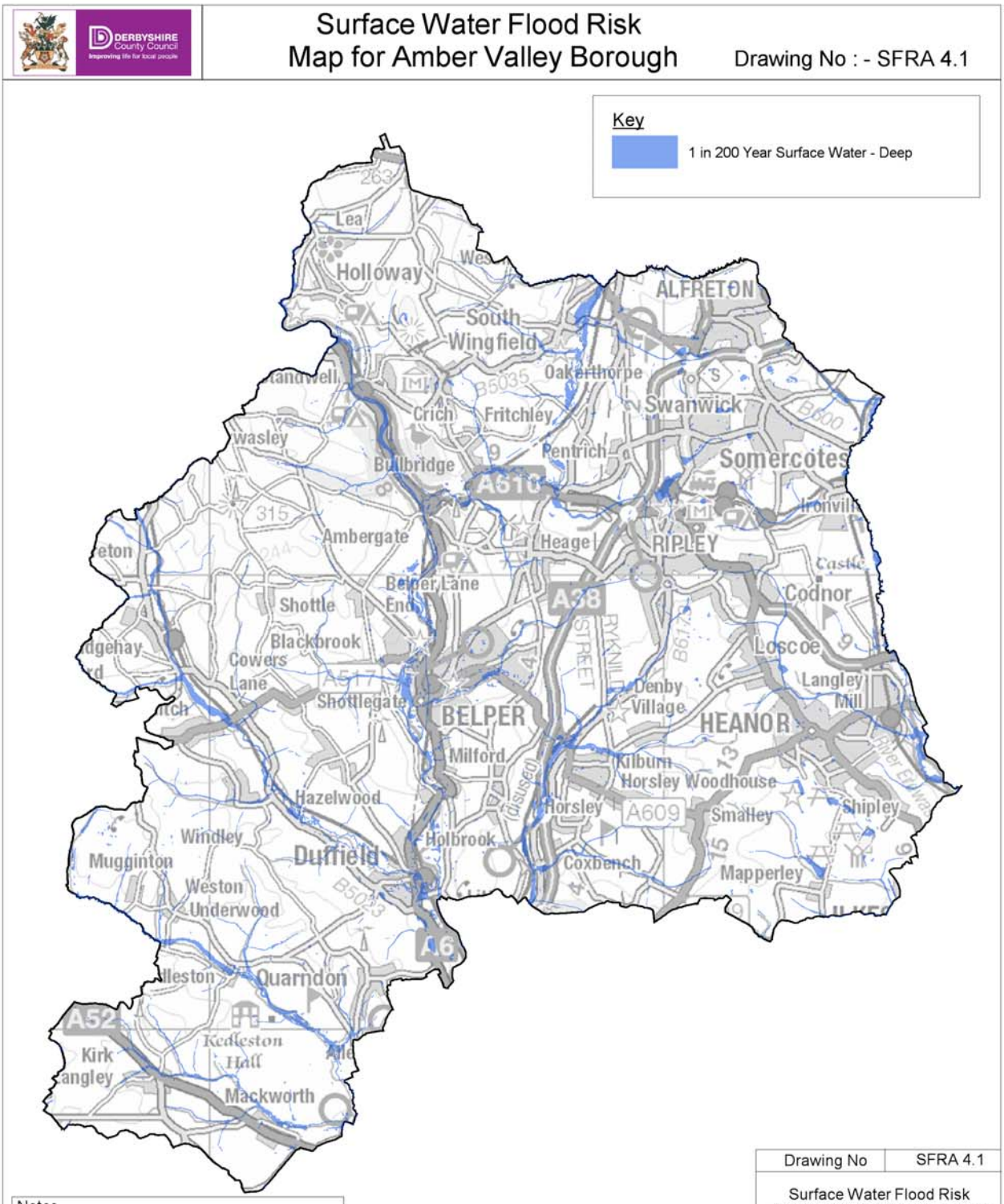
Drawing No	SFRA 3.1
Historic Flood Incidence by Source and Floodzones in Amber Valley Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	01/08/2012

Scale: 1:100000 at A4

N

Surface Water Flood Risk Map for Amber Valley Borough

Drawing No : - SFRA 4.1



Drawing No	SFRA 4.1
Surface Water Flood Risk Map for Amber Valley Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Notes

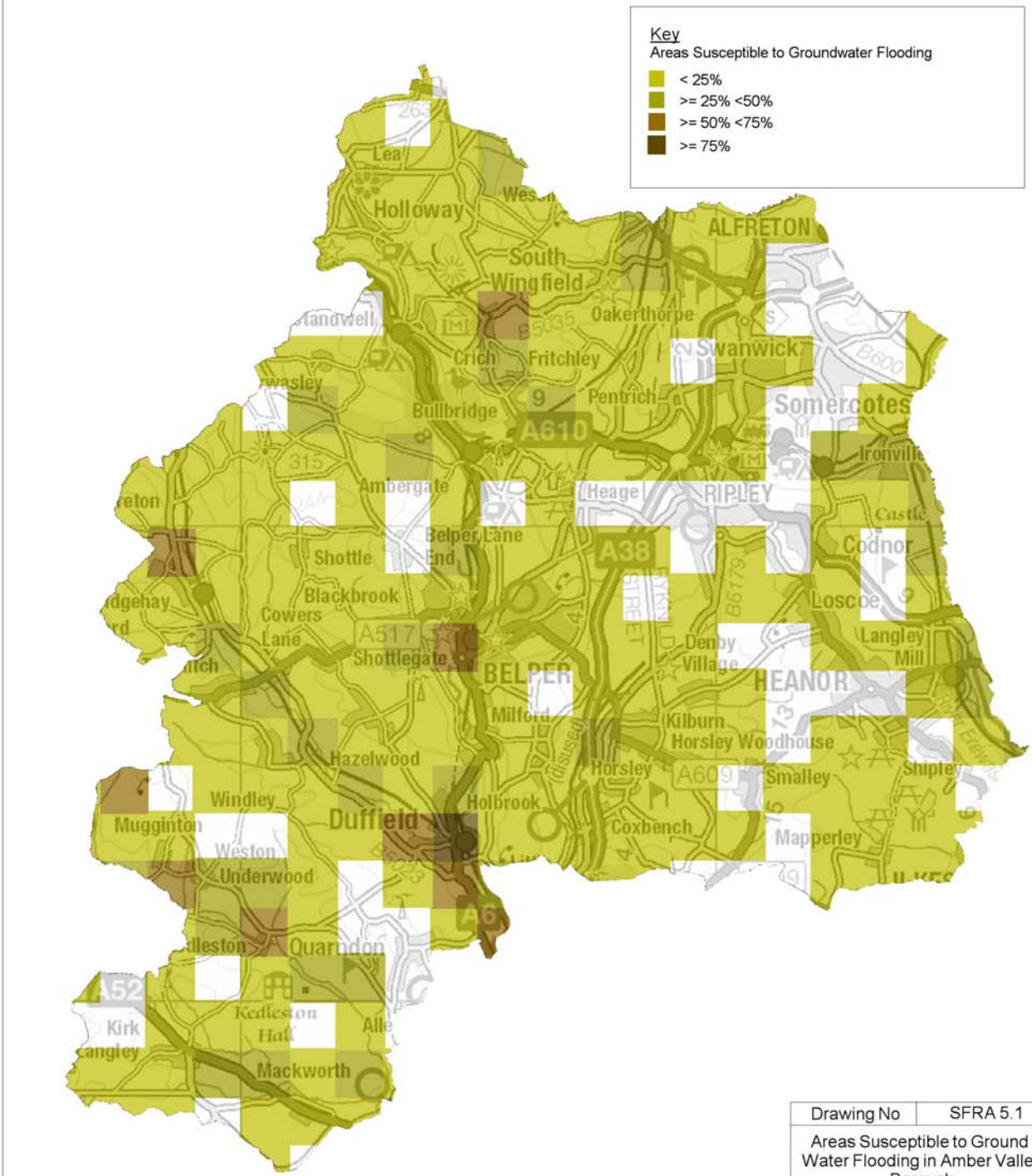
All analysis is based from EA Flood Map for Surface Water 200 yr deep.

Scale: 1:100000 at A4

N

Areas Susceptible to Ground Water Flooding in Amber Valley Borough

Drawing No : - SFRA 5.1



Drawing No	SFRA 5.1
Areas Susceptible to Ground Water Flooding in Amber Valley Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Scale: 1:100000 at A4

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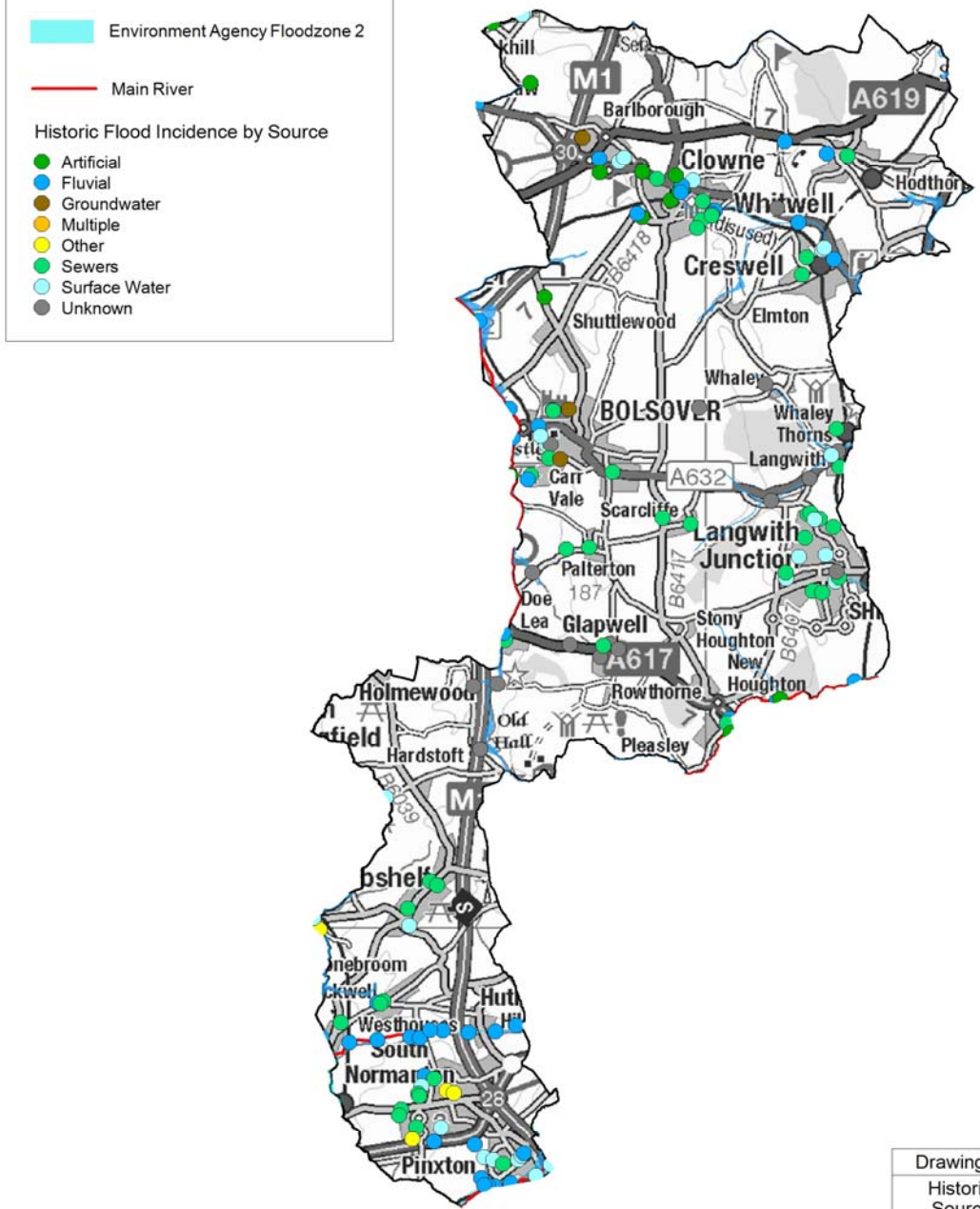
ANNEX 2:
Bolsover District Council

Historic Flood Incidence by Source and Floodzones in Bolsover District

Drawing No : - SFRA 3.2



Drawing No	SFRA 3.2
Historic Flood Incidence by Source and Floodzones in Bolsover District	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	02/08/2012

Scale: 1:100000 at A4

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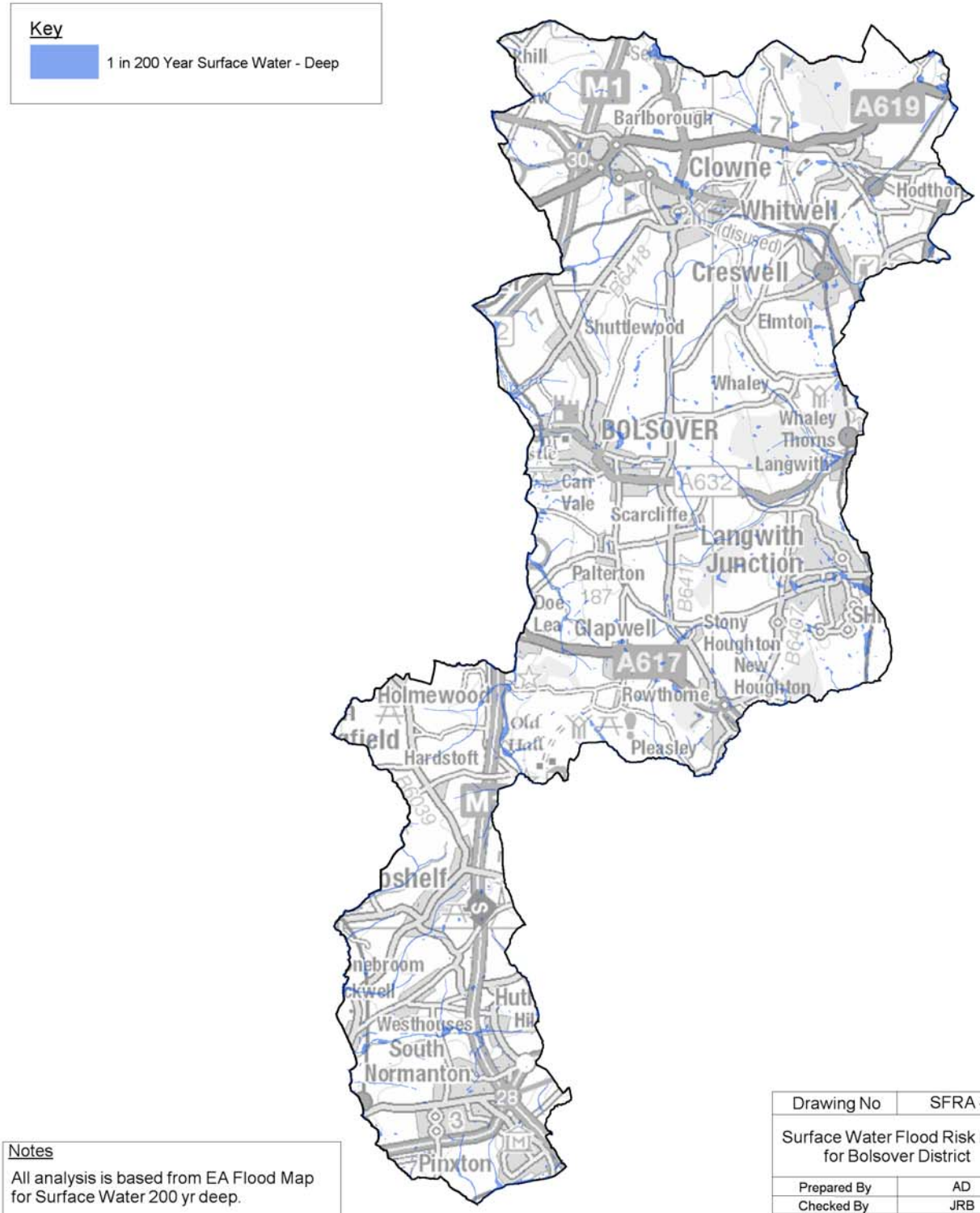
Surface Water Flood Risk Map for Bolsover District

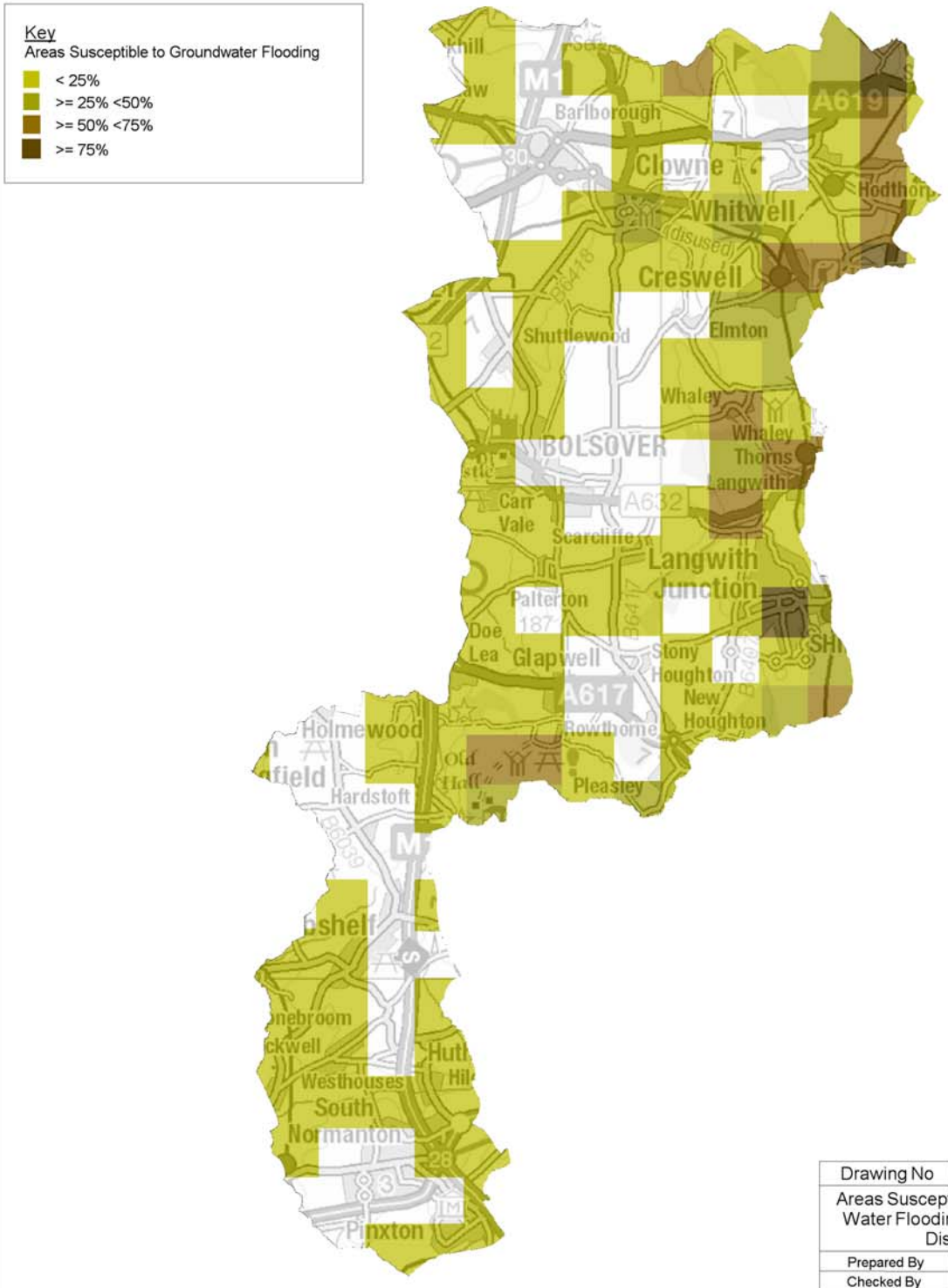
Drawing No : - SFRA 4.2



Scale: 1:100000 at A4

Areas Susceptible to Ground Water Flooding in Bolsover District

Drawing No : - SFRA 5.2



Drawing No	SFRA 5.2
Areas Susceptible to Ground Water Flooding in Bolsover District	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Scale: 1:100000 at A4

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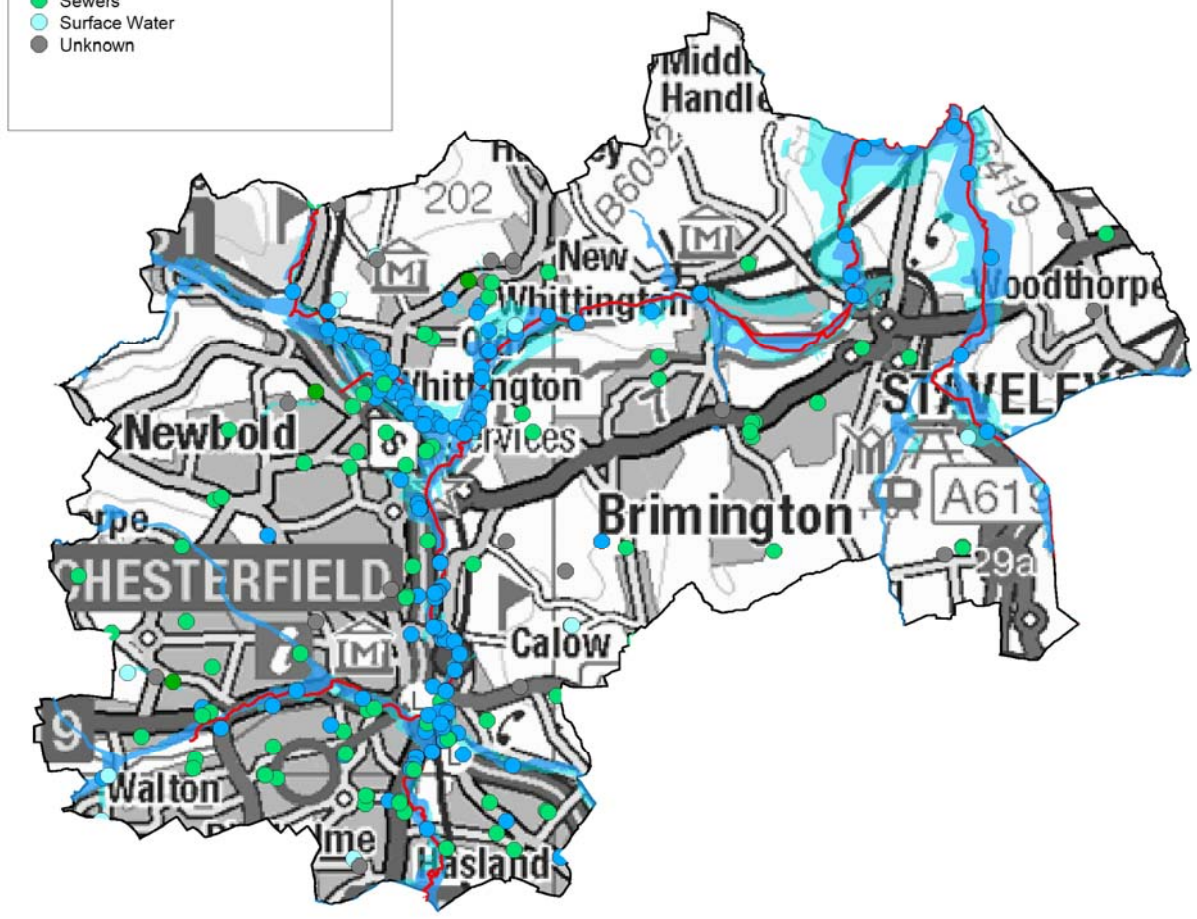
ANNEX 3:
Chesterfield Borough Council

Historic Flood Incidence by Source and Floodzones in Chesterfield Borough

Drawing No : - SFRA 3.3



Drawing No	SFRA 3.3
Historic Flood Incidence by Source and Floodzones in Chesterfield Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	02/08/2012

Scale: 1:75000 at A4

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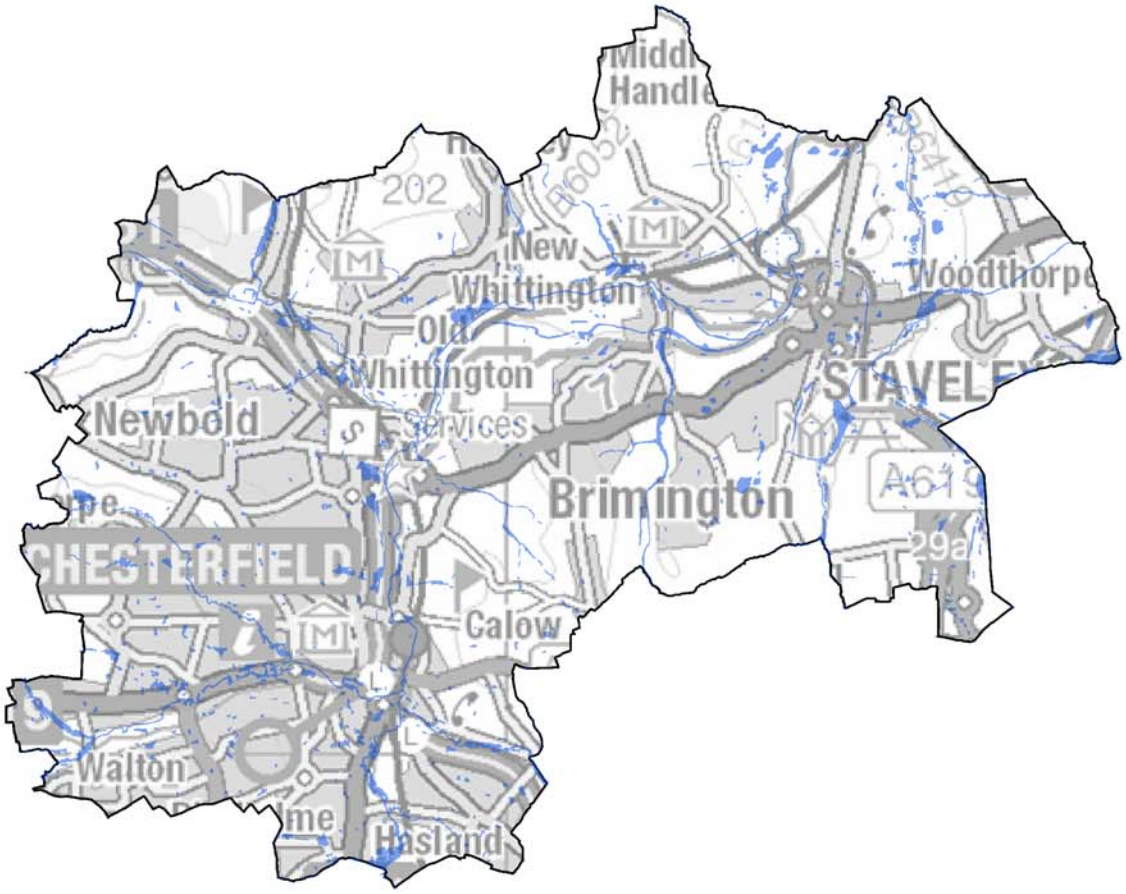
Surface Water Flood Risk Map for Chesterfield Borough

Drawing No : - SFRA 4.3

Key

1 in 200 Year Surface Water - Deep



Notes

All analysis is based from EA Flood Map for Surface Water 200 yr deep.

Drawing No	SFRA 4.3
Surface Water Flood Risk Map for Chesterfield Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Scale: 1:75000 at A4

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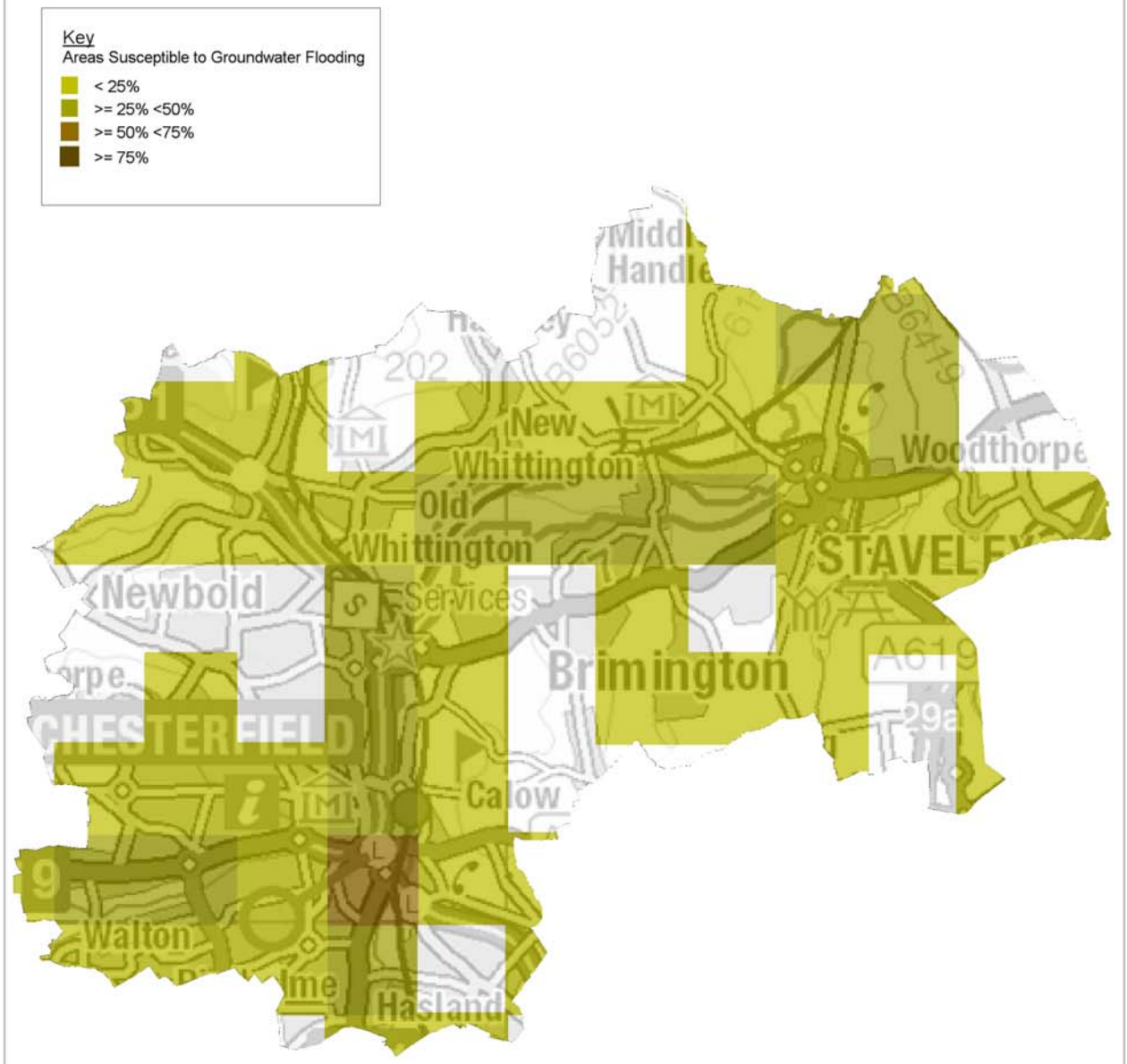
Areas Susceptible to Ground Water Flooding - Chesterfield Borough

Drawing No : - SFRA 5.3



Drawing No	SFRA 5.3
Areas Susceptible to Ground Water Flooding - Chesterfield Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Scale: 1:75000 at A4

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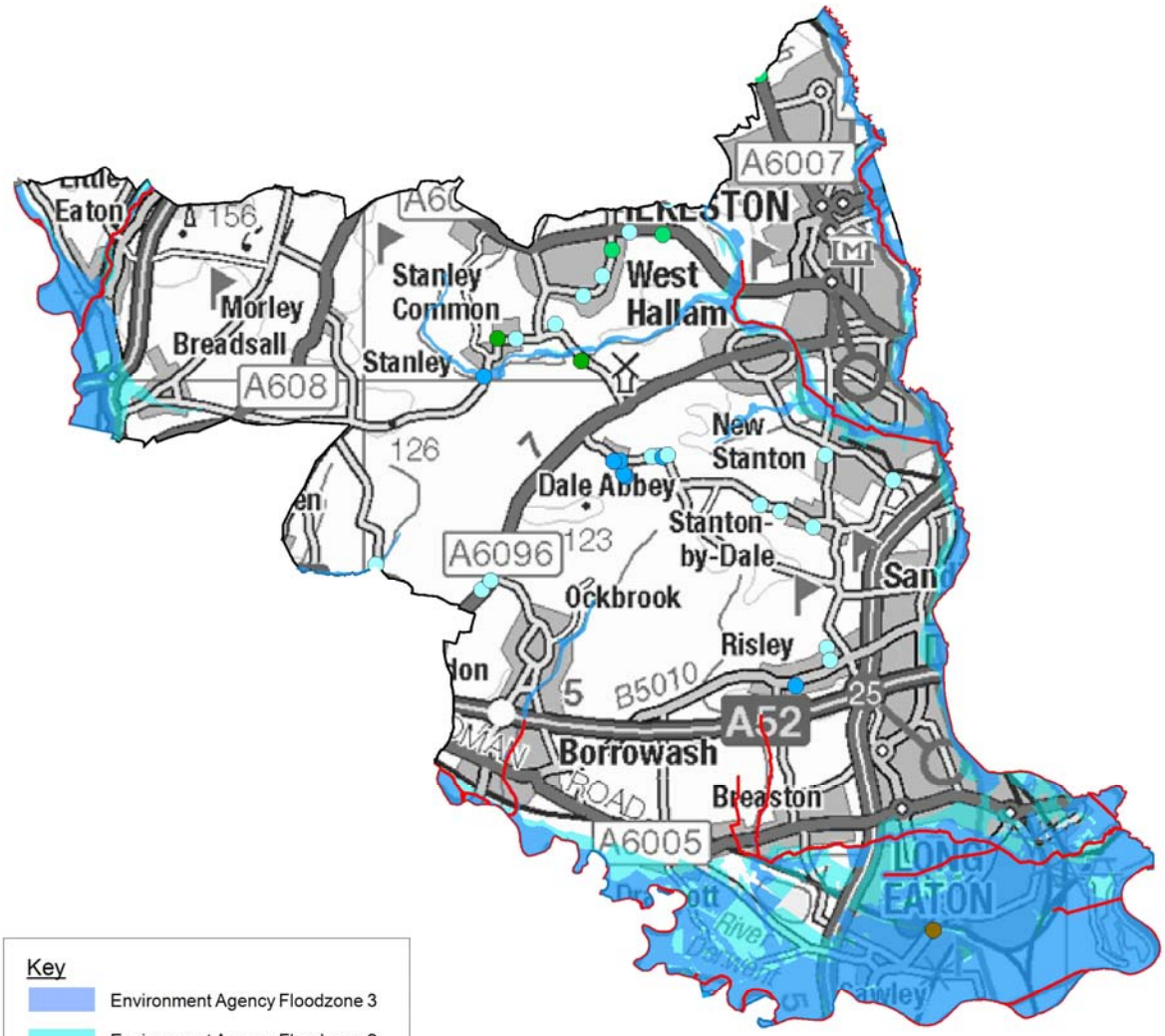
ANNEX 4:
Erewash Borough Council

Historic Flood Incidence by Source and Floodzones in Erewash Borough

Drawing No : - SFRA 3.4



Key

- Environment Agency Floodzone 3
- Environment Agency Floodzone 2
- Main River

Historic Flood Incidence by Source

- Artificial
- Fluvial
- Groundwater
- Multiple
- Other
- Sewers
- Surface Water
- Unknown

Drawing No	SFRA 3.4
Historic Flood Incidence by Source and Floodzones in Erewash Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	02/08/2012

Scale: 1:75000 at A4

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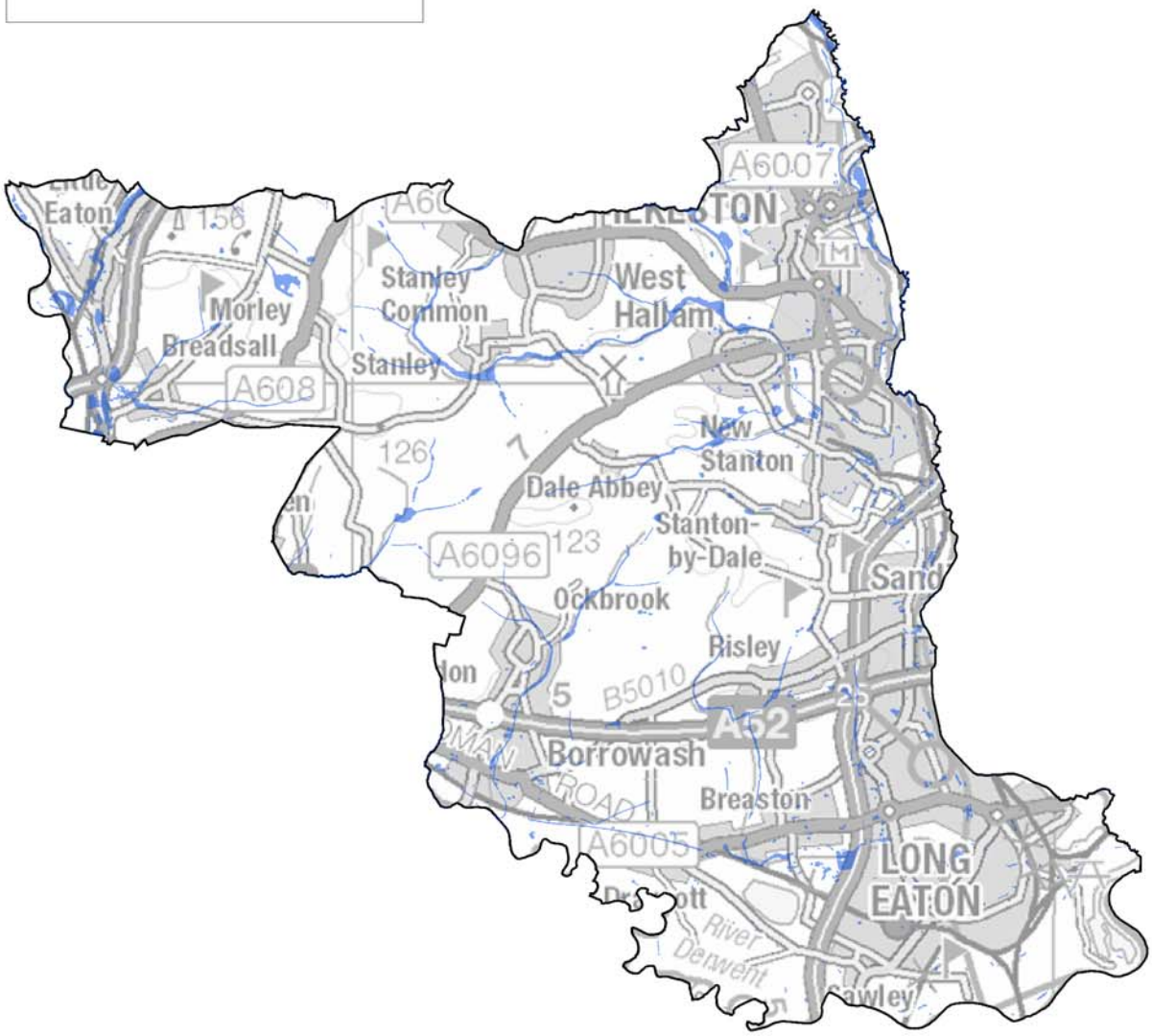
DERBYSHIRE County Council
Improving life for local people

Surface Water Flood Risk Map for Erewash Borough

Drawing No : - SFRA 4.4

Key

1 in 200 Year Surface Water - Deep



Notes

All analysis is based from EA Flood Map for Surface Water 200 yr deep.

Drawing No	SFRA 4.4
Surface water Flood Risk Map for Erewash Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Scale: 1:75000 at A4

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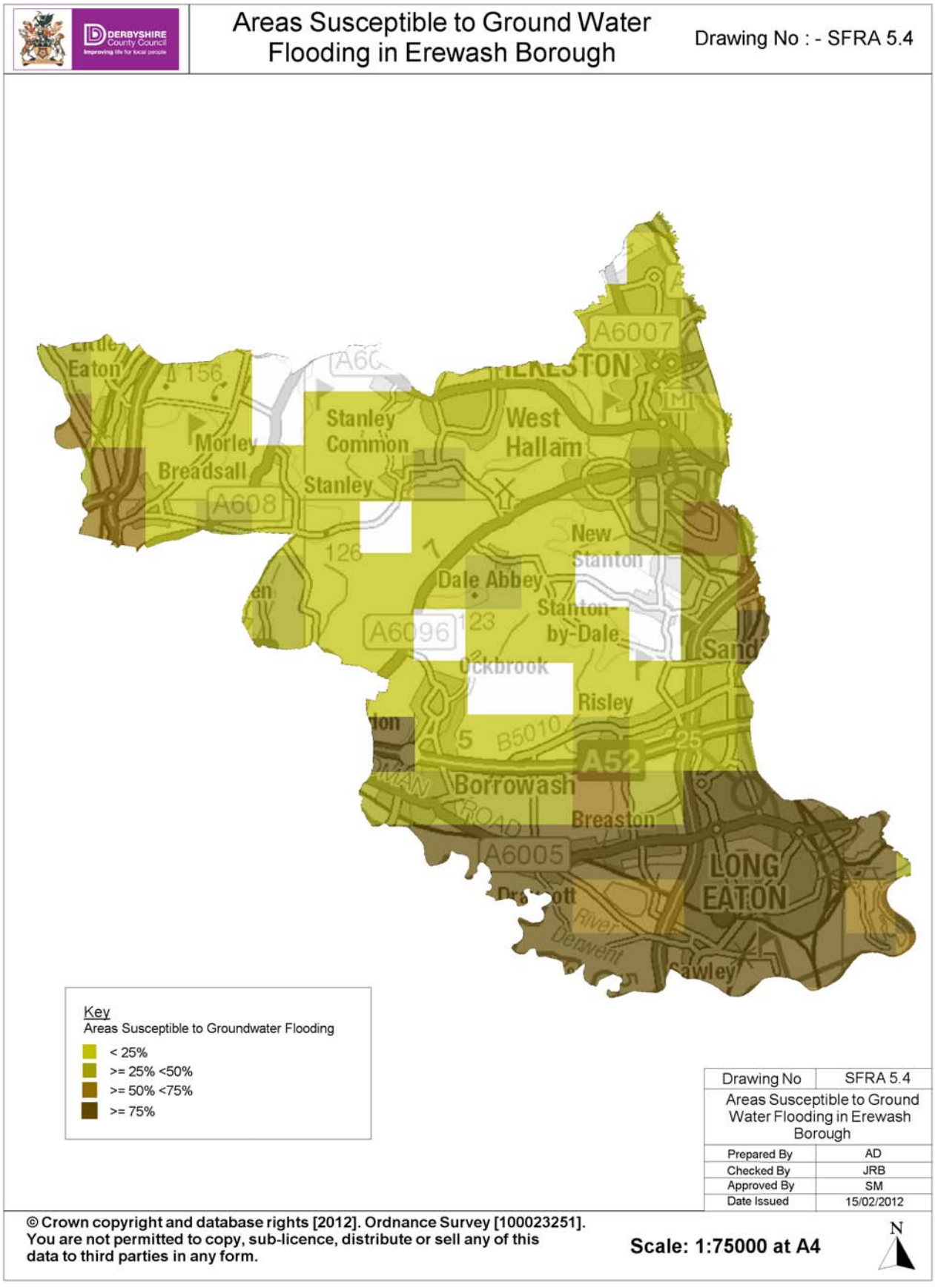
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Morley
Breadsall
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A608
New Stanton
Dale Abbey
Stanton-by-Dale
A6096
Ockbrook
Risley
B5010
A52
Borrowash
Breaston
A6005
LONG EATON
River Derwent
Key
Areas Susceptible to Groundwater Flooding
< 25%
>= 25% <50%
>= 50% <75%
>= 75%
Drawing No SFRA 5.4
Areas Susceptible to Ground Water Flooding in Erewash Borough
Prepared By AD
Checked By JRB
Approved By SM
Date Issued 15/02/2012
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Scale: 1:75000 at A4
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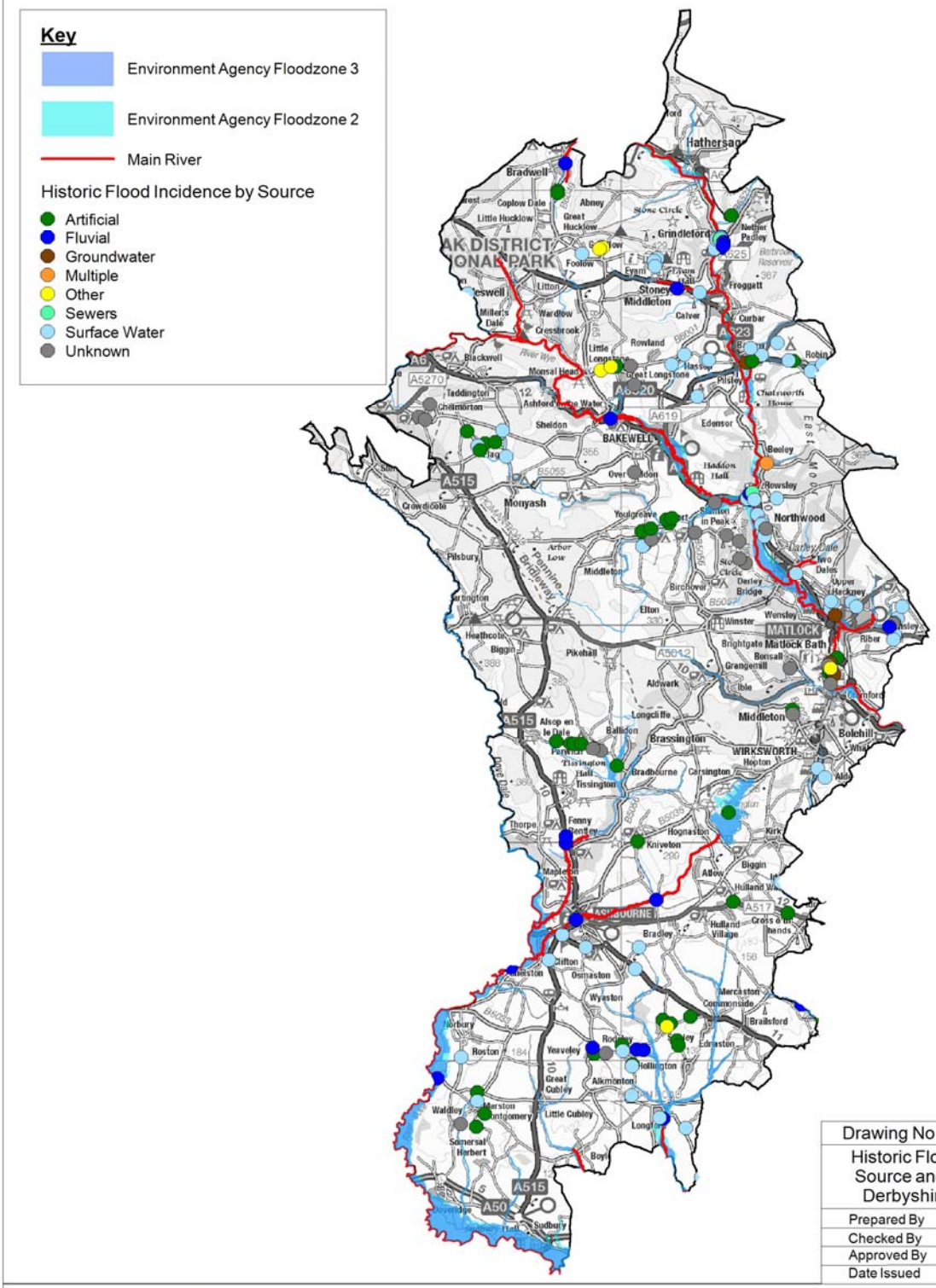
ANNEX 5:
Derbyshire Dales District Council

Historic Flood Incidence by Source and Floodzones in Derbyshire Dales District

Drawing No : - SFRA 3.5



Scale: 1:170000 at A4

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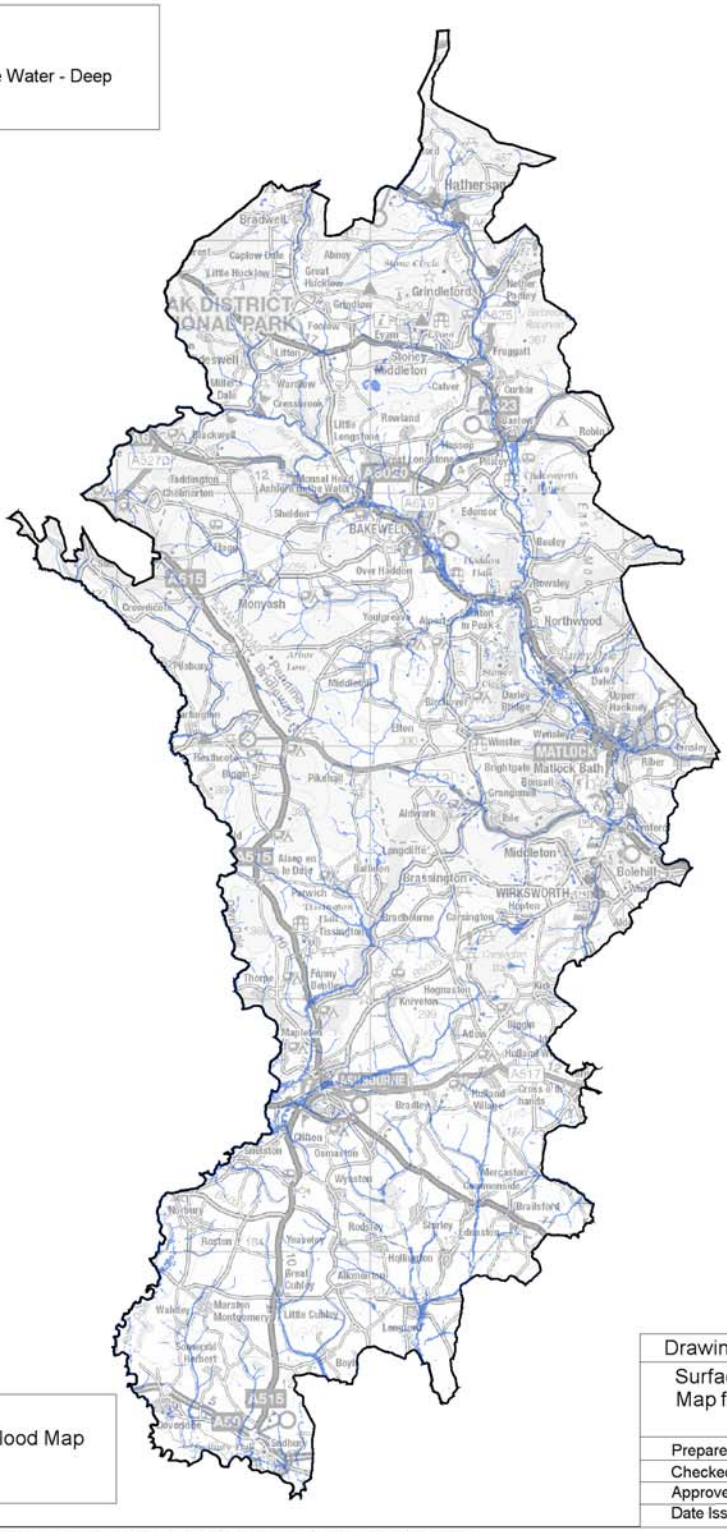
DERBYSHIRE County Council
Improving life for local people

Surface Water Flood Risk Map for Derbyshire Dales District

Drawing No : - SFRA 4.5

Key

1 in 200 year Surface Water - Deep



Notes

All analysis is based from EA Flood Map for Surface Water 200 yr deep.

Drawing No	SFRA 4.5
Surface Water Flood Risk Map for Derbyshire Dales District	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Scale: 1:170000 at A4

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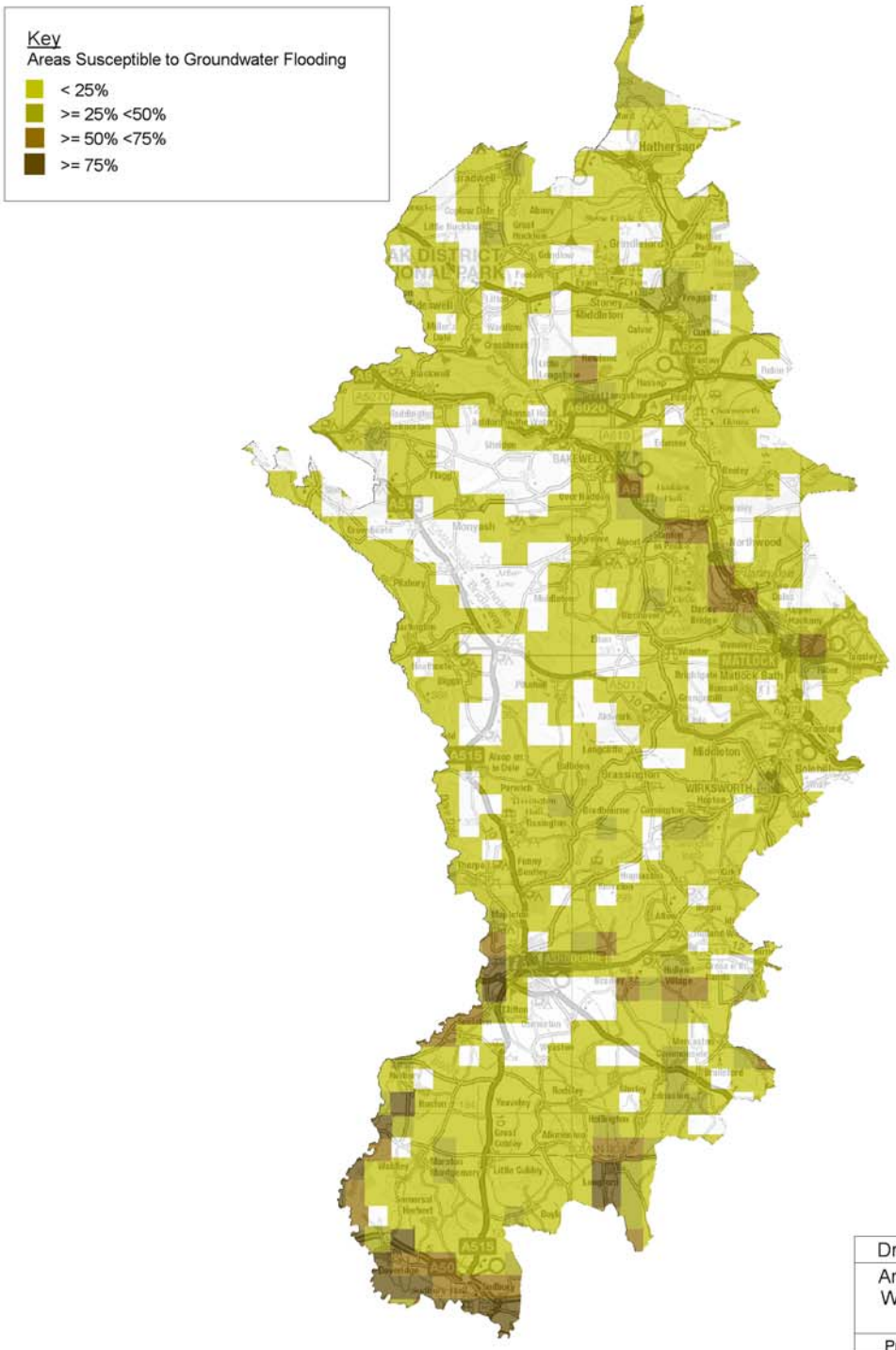
Areas Susceptible to Ground Water Flooding - Derbyshire Dales District

Drawing No : - SFRA 5.5



Drawing No	SFRA 5.5
Areas Susceptible to Ground Water Flooding - Derbyshire Dales District	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Scale: 1:170000 at A4

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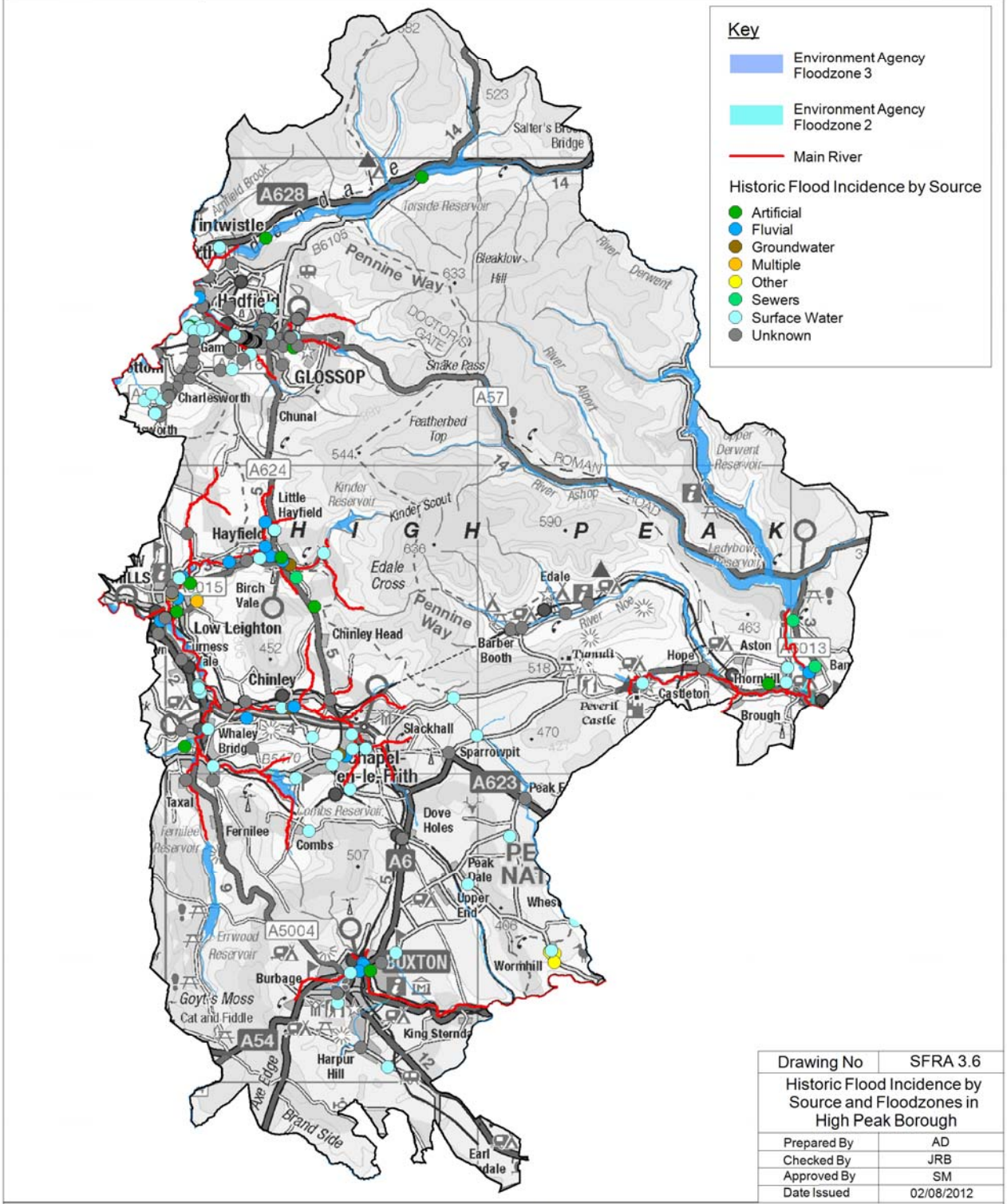
ANNEX 6:
High Peak Borough Council

Historic Flood Incidence by Source and Floodzones in High Peak Borough

Drawing No : - SFRA 3.6



Drawing No	SFRA 3.6
Historic Flood Incidence by Source and Floodzones in High Peak Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	02/08/2012

Scale: 1:160000 at A4

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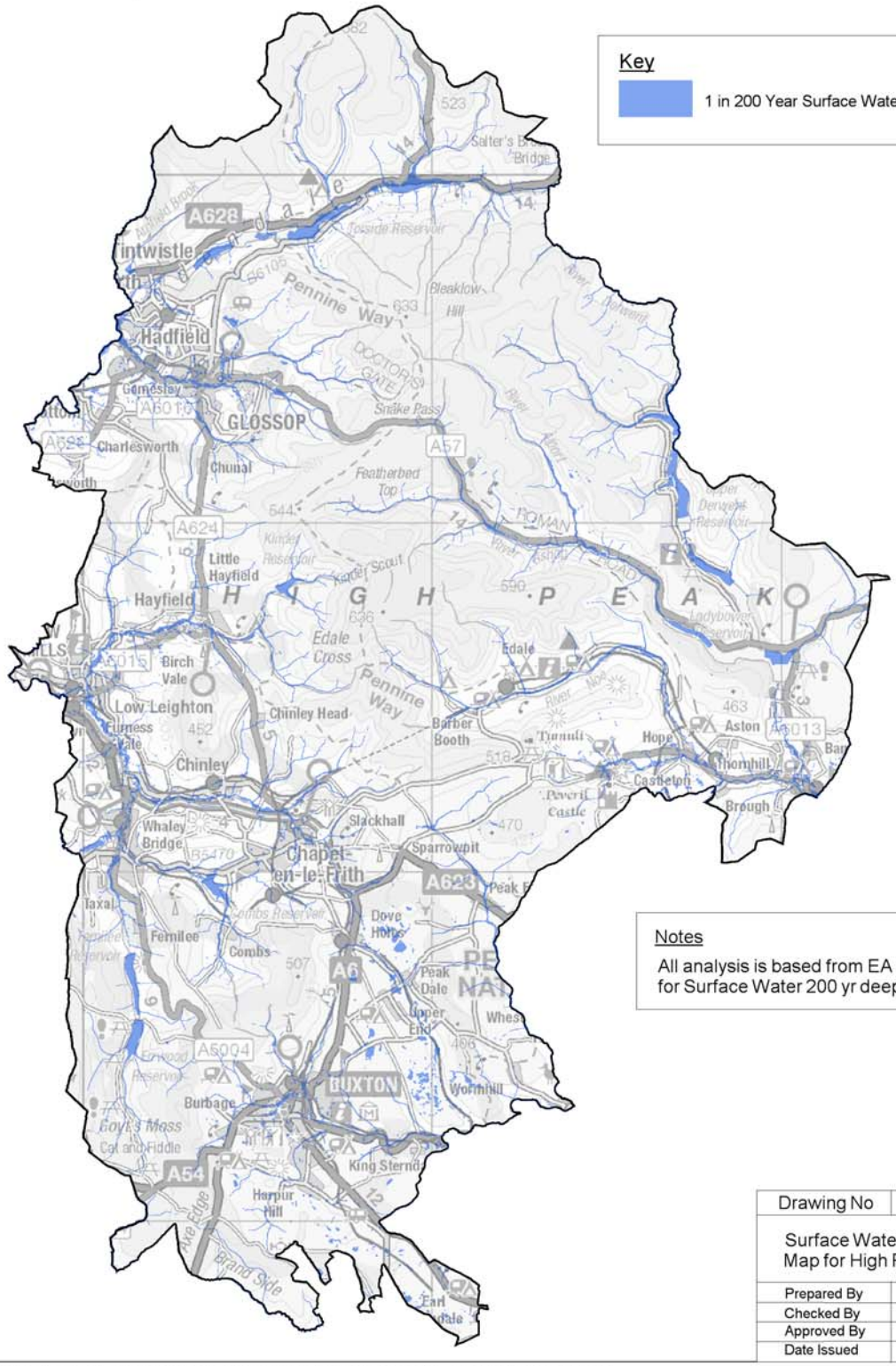
Surface Water Flood Risk Map for High Peak District

Drawing No : - SFRA 4.6



Drawing No	SFRA 4.6
Surface Water Flood Risk Map for High Peak District	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Scale: 1:160000 at A4

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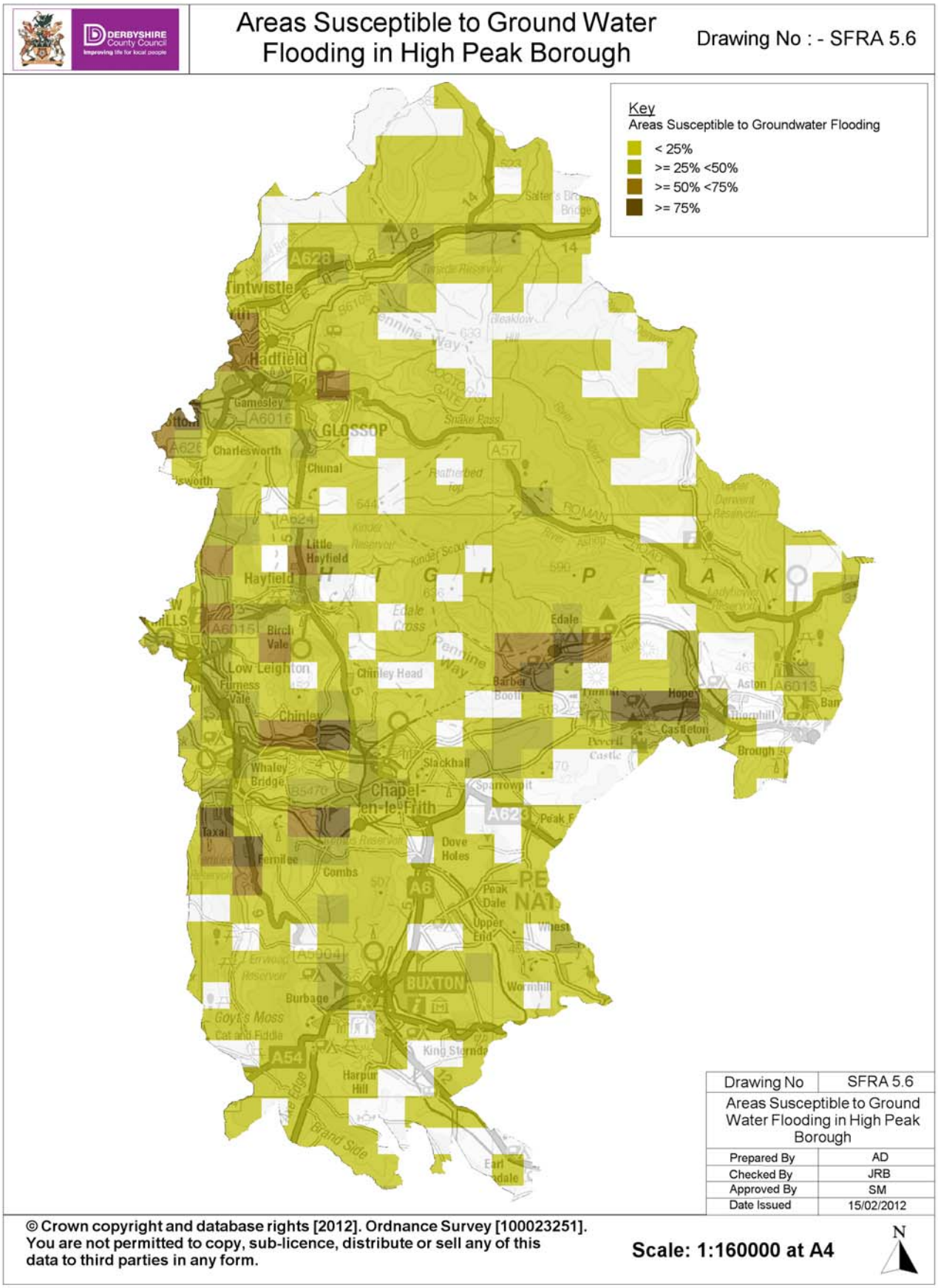
Areas Susceptible to Ground Water Flooding in High Peak Borough
Drawing No : - SFRA 5.6
Key
Areas Susceptible to Groundwater Flooding
< 25%
>= 25% <50%
>= 50% <75%
>= 75%
Hadfield
Tintwistle
Glossop
Charlesworth
Chunal
Little Hayfield
Hayfield
Edale
Birch Vale
Low Leighton
Chinley Head
Chinley
Whaley Bridge
Chapel-en-le-Frith
Dove Holes
Peak Dale
Upper End
Buxton
Burbage
Harpur Hill
Brand Side
Castleton
Hope
Aston
Drawing No | SFRA 5.6
Areas Susceptible to Ground Water Flooding in High Peak Borough
Prepared By | AD
Checked By | JRB
Approved By | SM
Date Issued | 15/02/2012
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Scale: 1:160000 at A4
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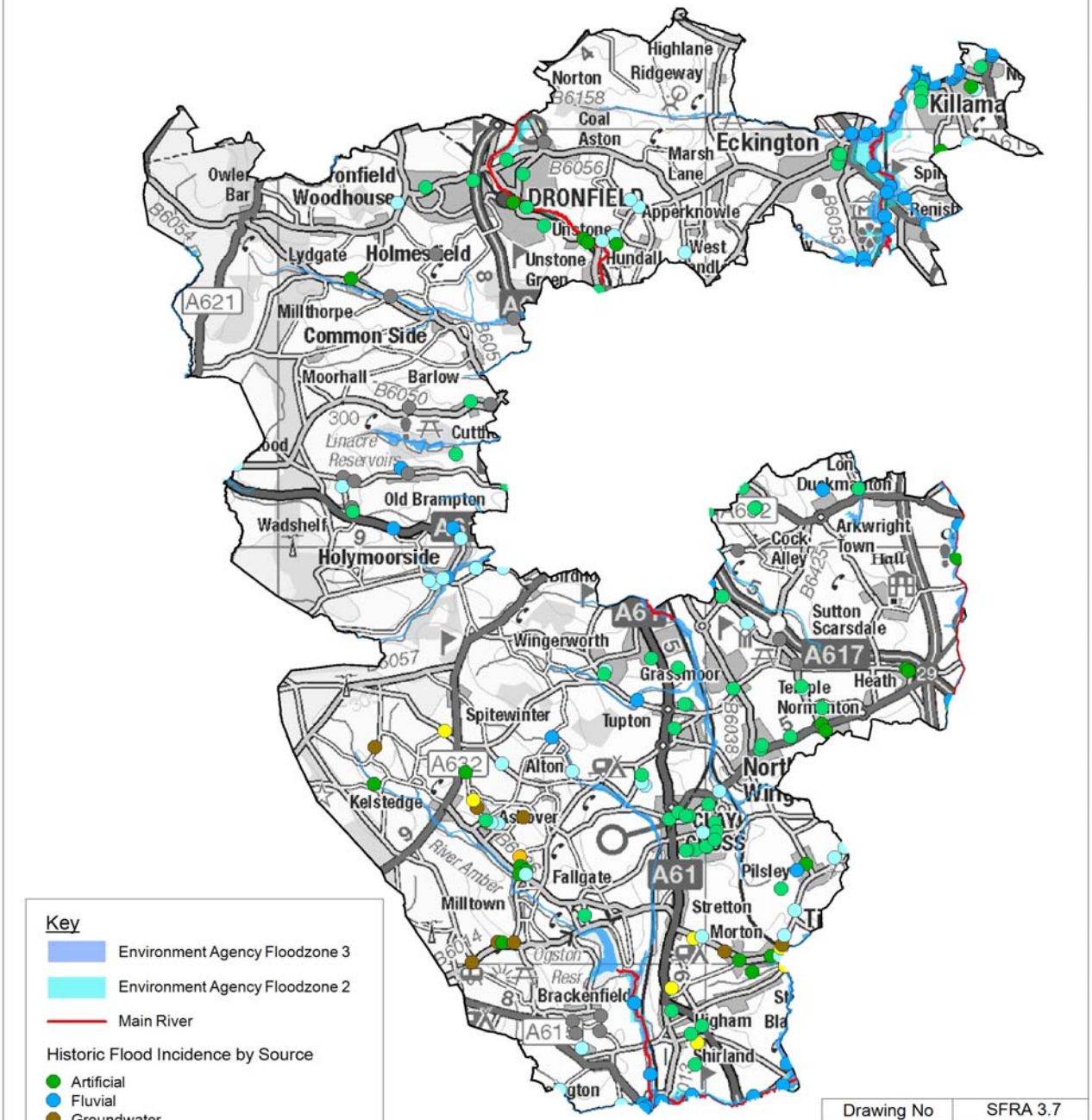
ANNEX 7:
North-East Derbyshire District Council

Historic Flood Incidence by Source and Floodzones in North-East Derbyshire

Drawing No : - SFRA 3.7



Drawing No	SFRA 3.7
Historic Flood Incidence by Source and Floodzones in North-East Derbyshire	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	02/08/2012

Scale: 1:150000 at A4

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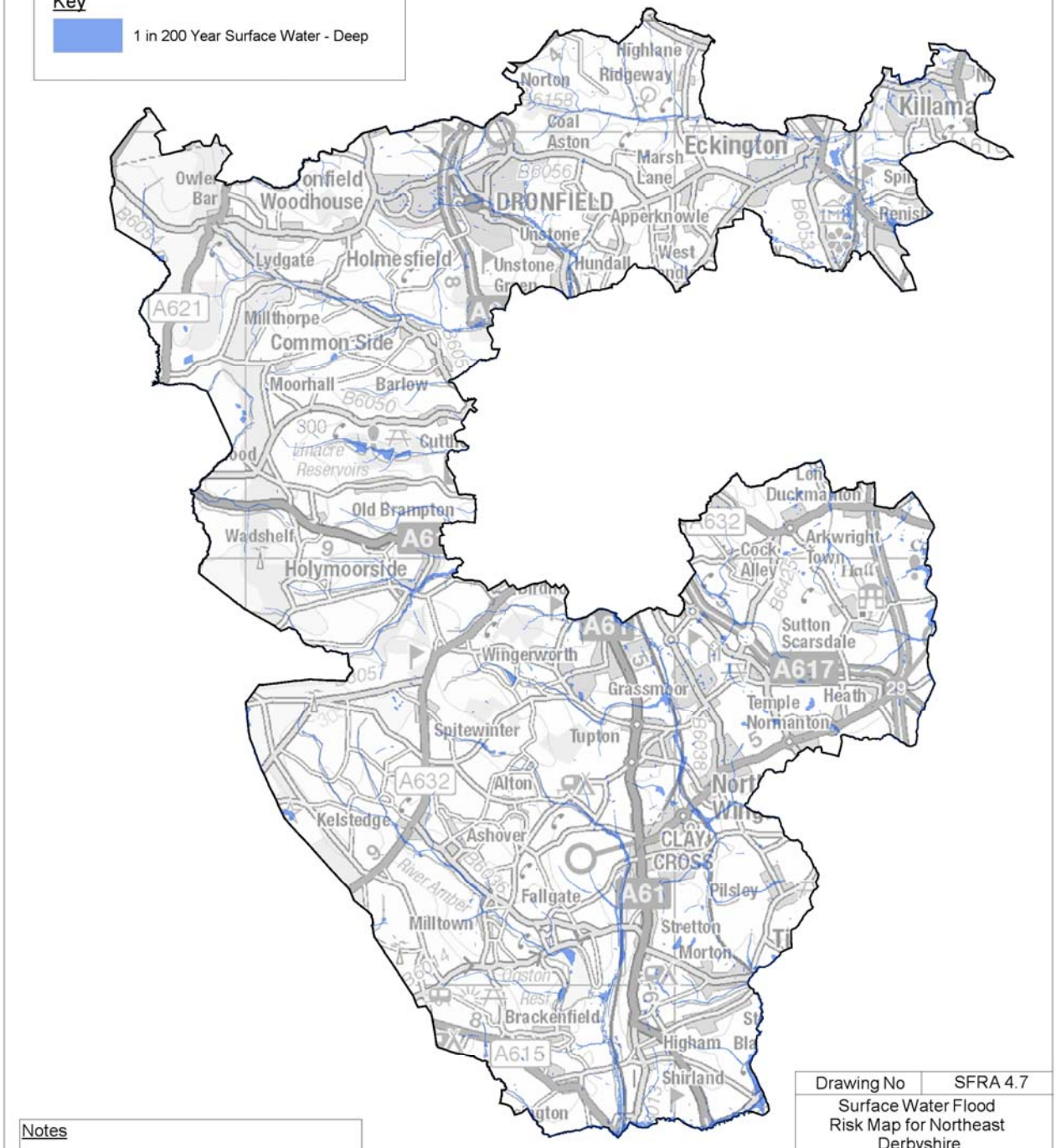
Surface Water Flood Risk Map for North-East Derbyshire

Drawing No : - SFRA 4.7



Scale: 1:160000 at A4

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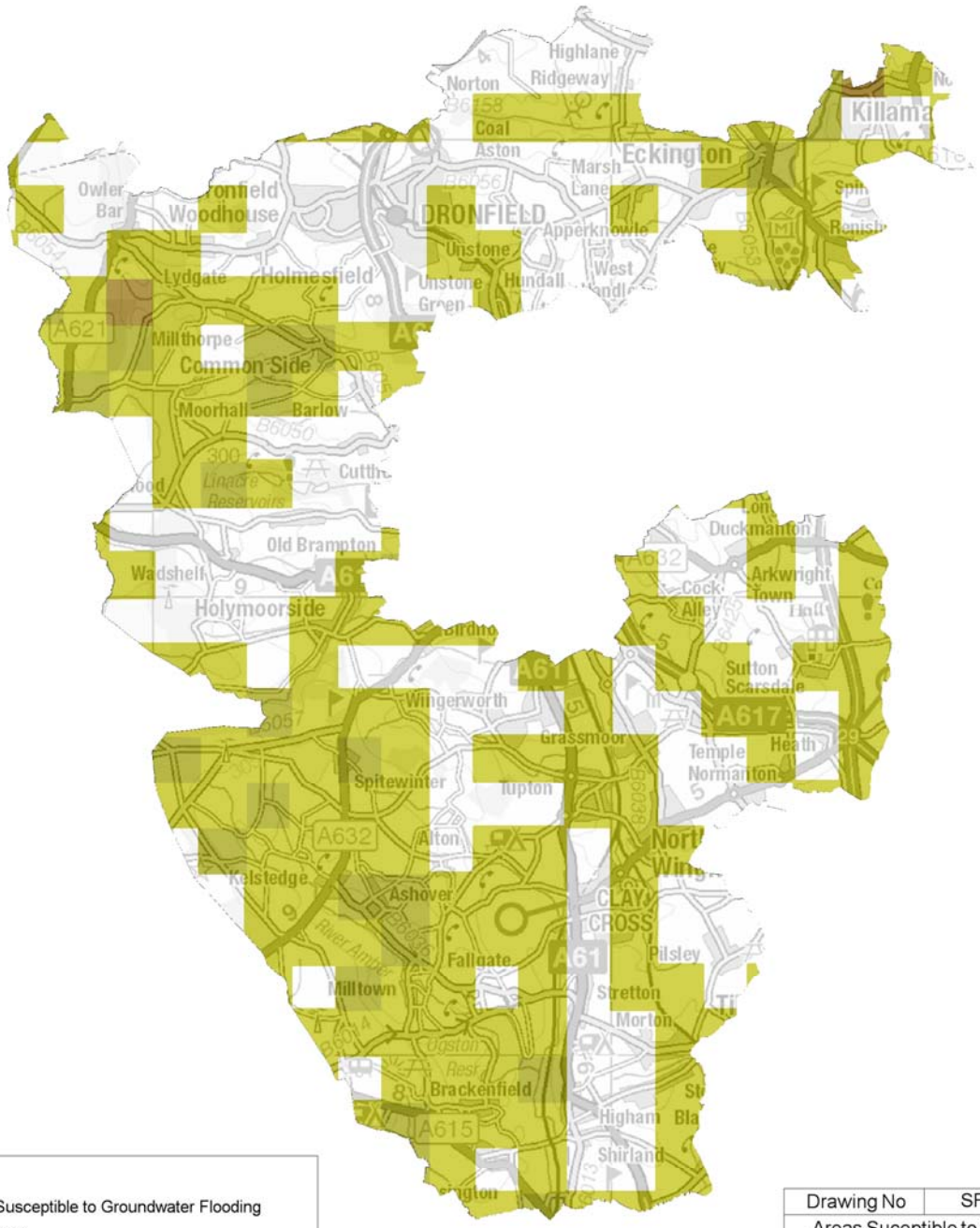
Areas Susceptible to Ground Water Flooding in North-East Derbyshire

Drawing No : - SFRA 5.7



Key
Areas Susceptible to Groundwater Flooding

- < 25%
- >= 25% <50%
- >= 50% <75%
- >= 75%

Drawing No	SFRA 5.7
Areas Suceptible to Ground Water Flooding in Northeast Derbyshire	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Scale: 1:160000 at A4

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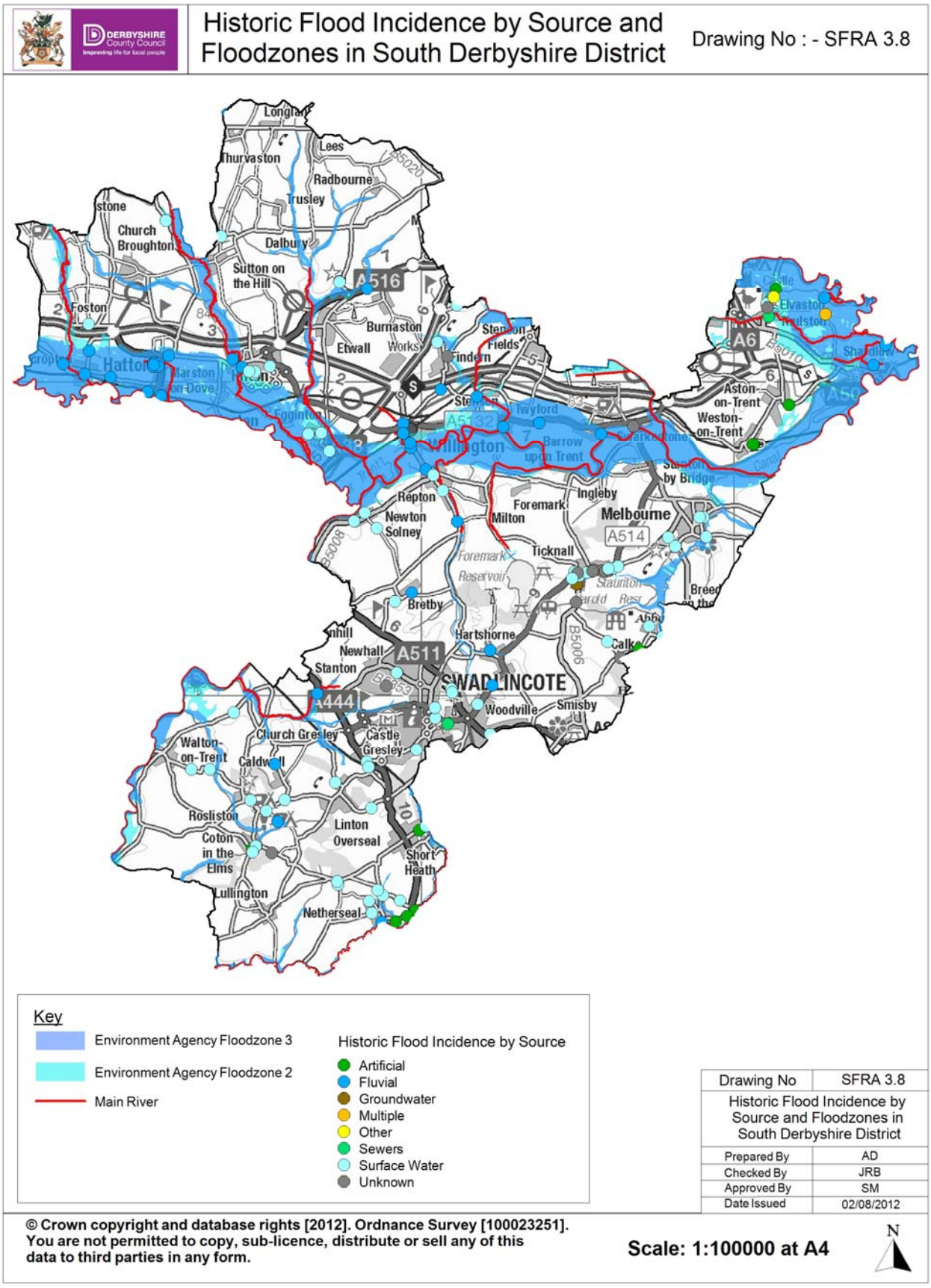
ANNEX 8:
South Derbyshire District Council


Historic Flood Incidence by Source and Floodzones in South Derbyshire District
Drawing No : - SFRA 3.8
Longlan
Thurvaston
Lees
Radbourne
Trusley
Church Broughton
Dalbury
Sutton on the Hill
A516
Foston
Hatton
Burnaston
Etwall
Works
Findern
Stenson Fields
A6
Aston-on-Trent
Weston-on-Trent
Barrow upon Trent
Twyford
Repton
Newton Solney
Foremark
Milton
Ingleby
Melbourne
A514
Ticknall
Foremark Reservoir
Bretby
Hartshorne
Newhall
A511
Stanton
SWADLINCOTE
Woodville
Smisby
Church Gresley
Castle Gresley
Walton-on-Trent
Rosliston
Coton in the Elms
Linton
Overseal
Short Heath
Lullington
Netherseal
B5006
Key
Environment Agency Floodzone 3
Environment Agency Floodzone 2
Main River
Historic Flood Incidence by Source
Artificial
Fluvial
Groundwater
Multiple
Other
Sewers
Surface Water
Unknown
Drawing No SFRA 3.8
Historic Flood Incidence by Source and Floodzones in South Derbyshire District
Prepared By AD
Checked By JRB
Approved By SM
Date Issued 02/08/2012
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Scale: 1:100000 at A4
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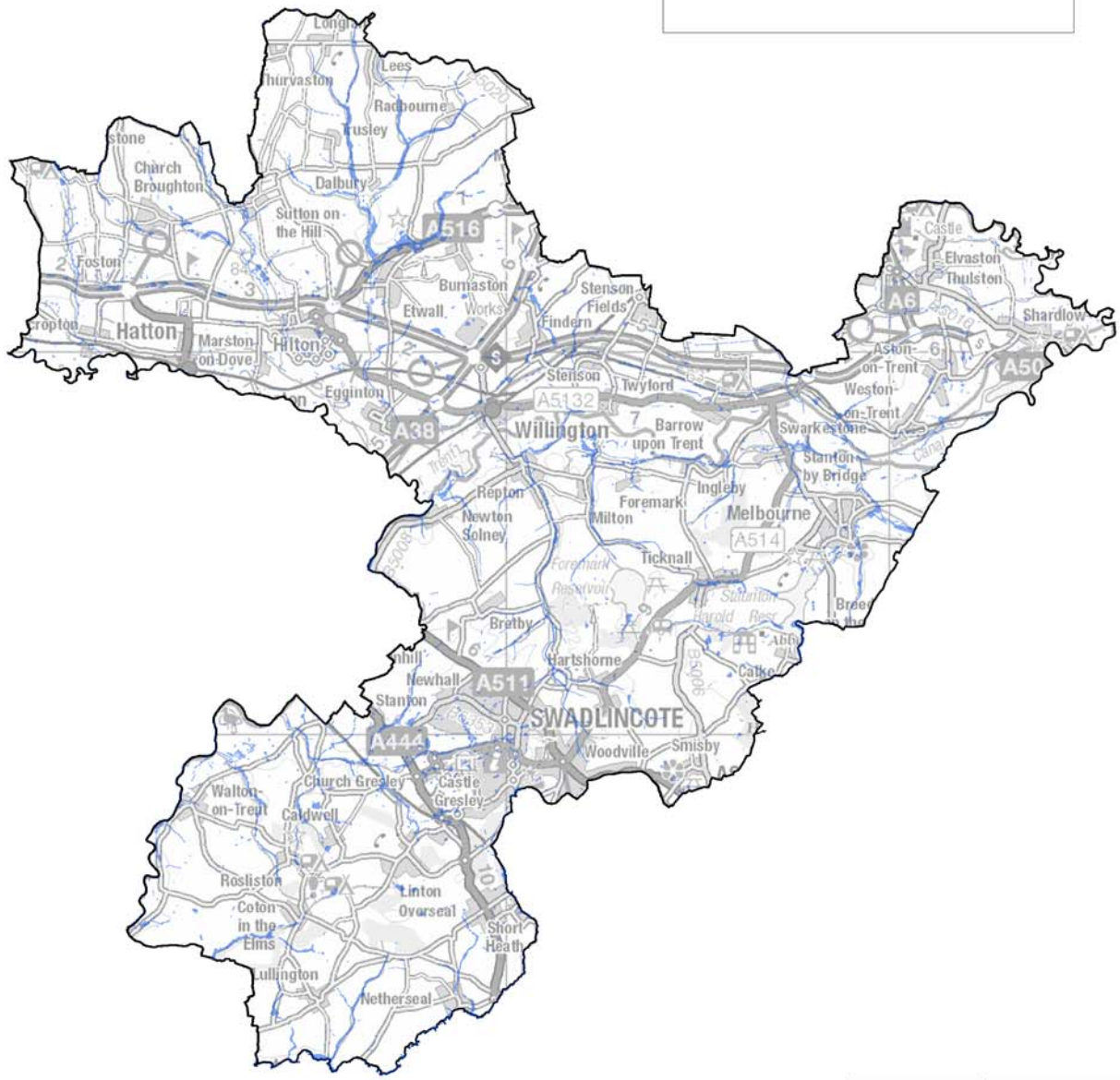
Surface Water Flood Risk Map for South Derbyshire District

Drawing No : - SFRA 4.8



Drawing No	SFRA 4.8
Surface Water Flood Risk Map for South Derbyshire District	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Notes

All analysis is based from EA Flood Map for Surface Water 200 yr deep.

Scale: 1:100000 at A4

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DERBYSHIRE County Council
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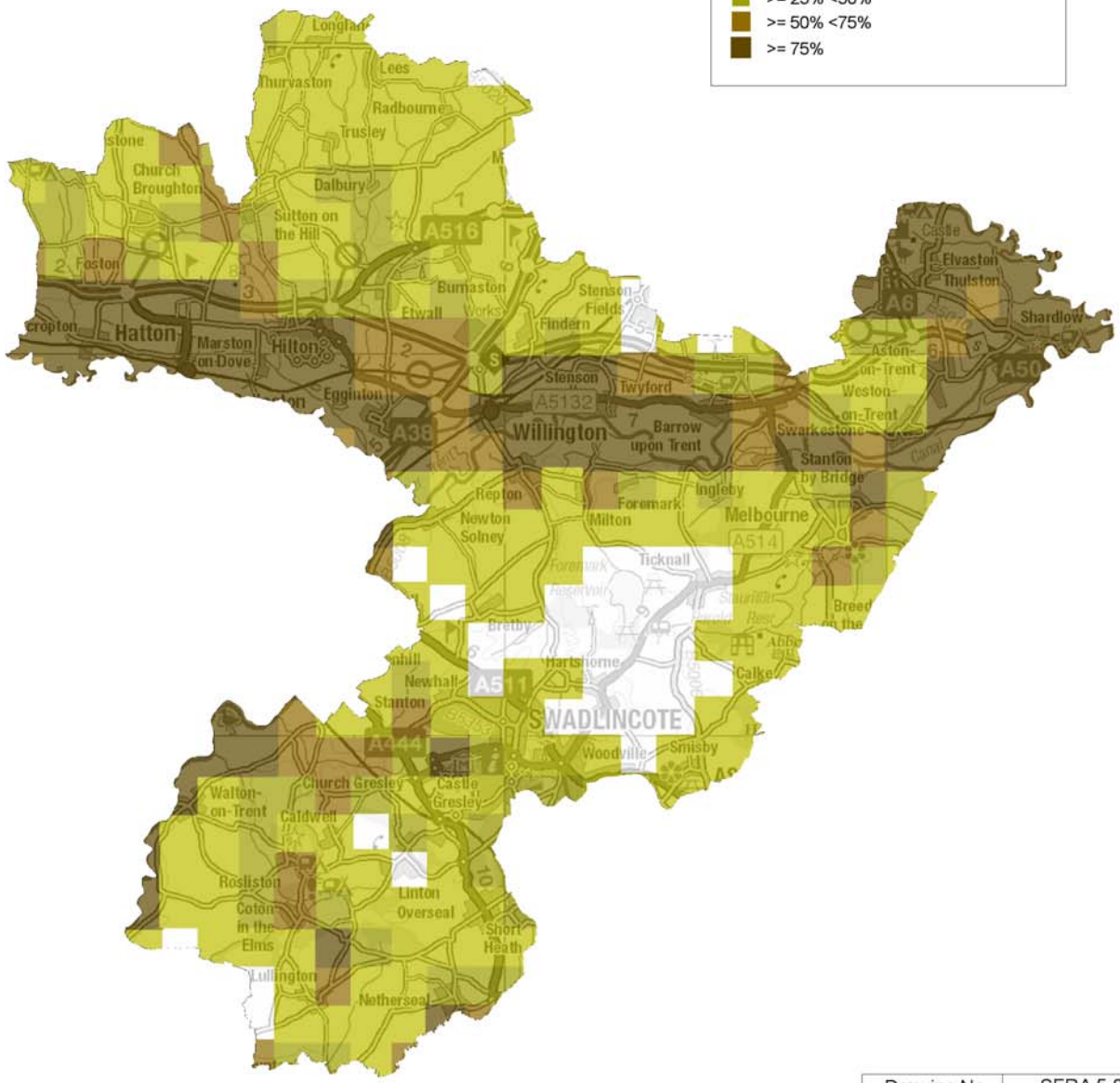
Areas Susceptible to Ground Water Flooding in South Derbyshire District

Drawing No : - SFRA 5.8

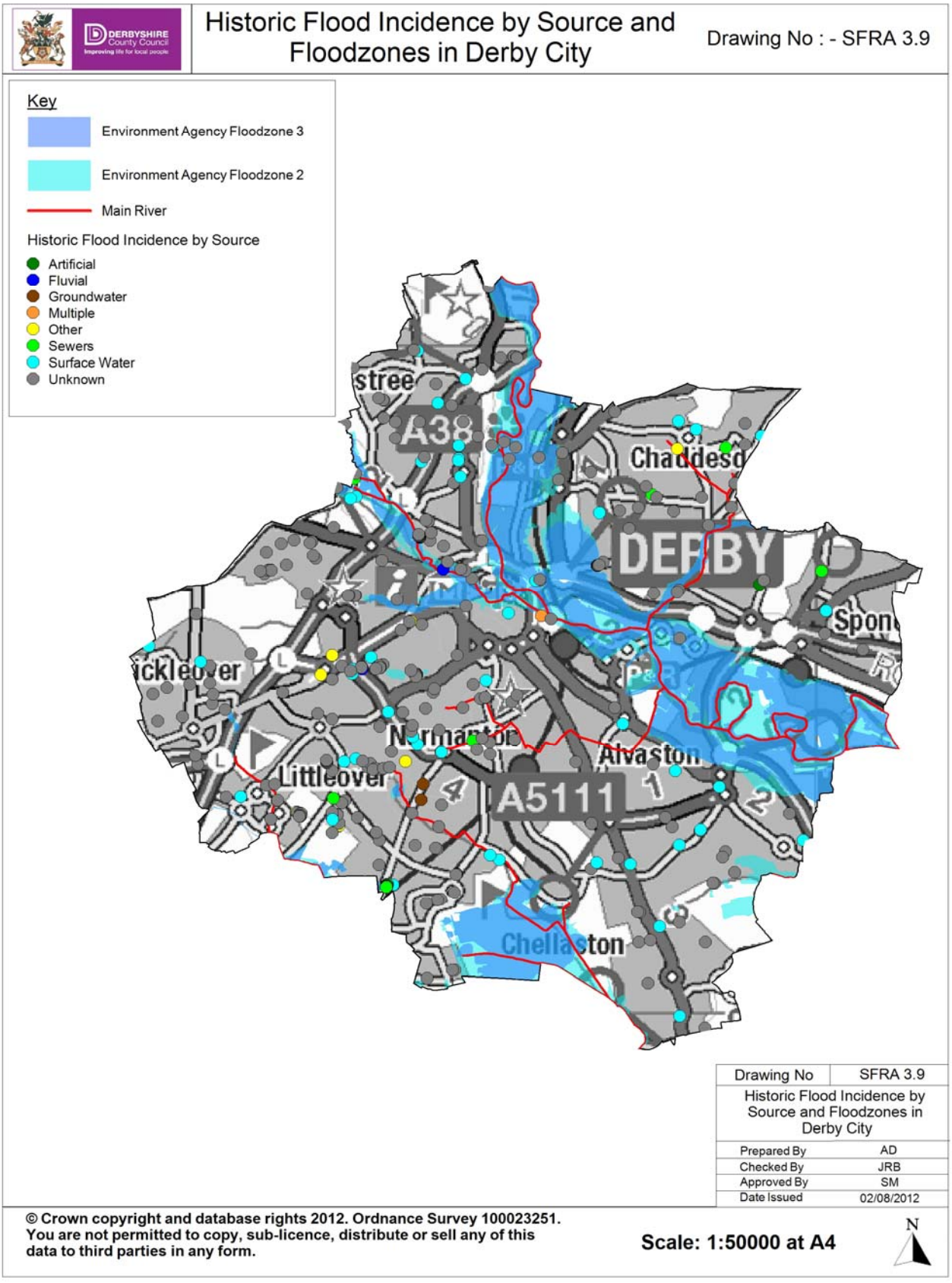


Drawing No	SFRA 5.8
Areas Susceptible to Ground Water Flooding in South Derbyshire District	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Scale: 1:100000 at A4

N

ANNEX 9:
Derby City Council


Historic Flood Incidence by Source and Floodzones in Derby City
Drawing No : - SFRA 3.9
Key
Environment Agency Floodzone 3
Environment Agency Floodzone 2
Main River
Historic Flood Incidence by Source
Artificial
Fluvial
Groundwater
Multiple
Other
Sewers
Surface Water
Unknown
A38
DERBY
A5111
Littleover
Alvaston
Drawing No SFRA 3.9
Historic Flood Incidence by Source and Floodzones in Derby City
Prepared By AD
Checked By JRB
Approved By SM
Date Issued 02/08/2012
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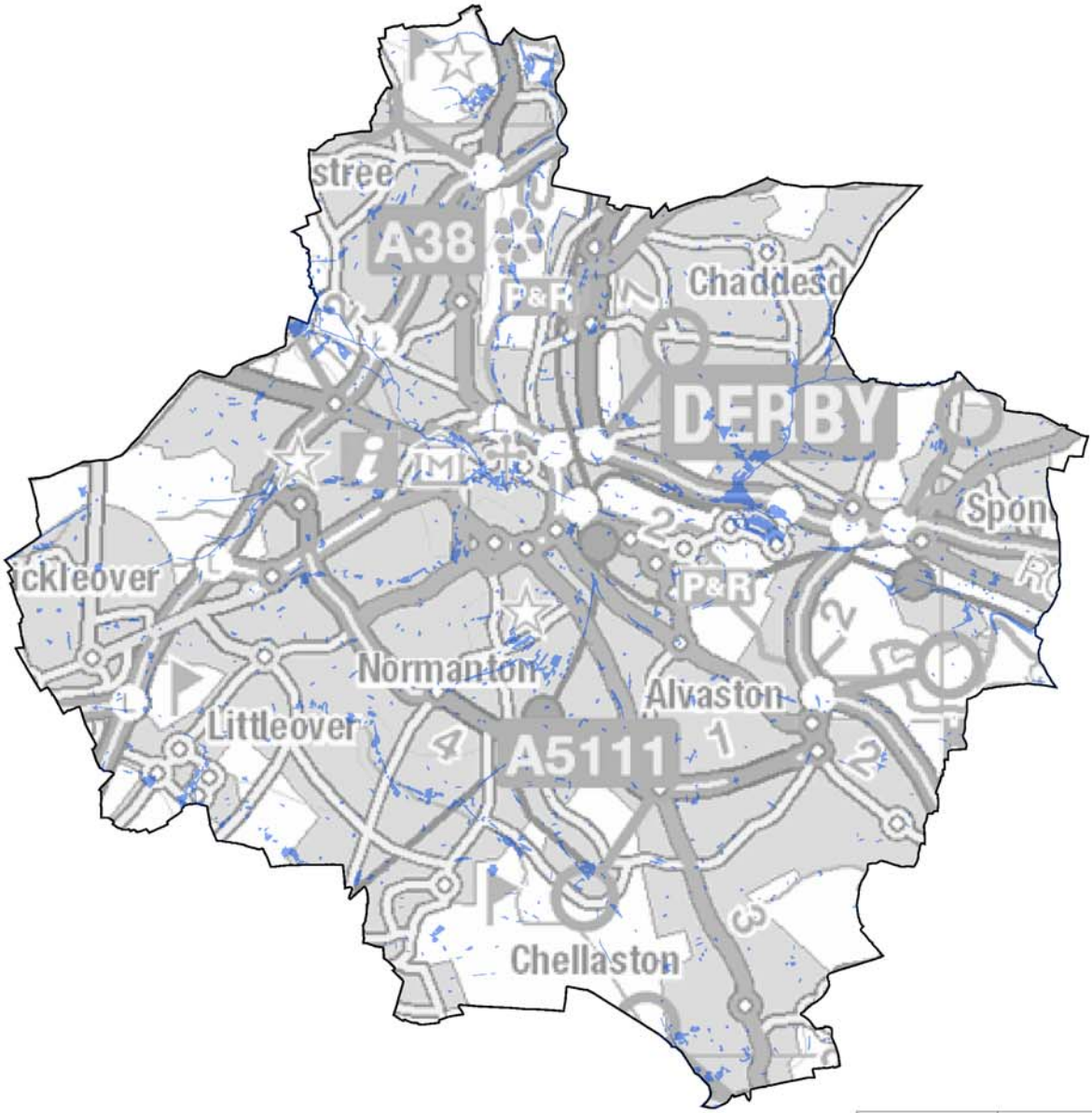
Scale: 1:50000 at A4
N

DERBYSHIRE County Council
Improving life for local people

Surface Water Flood Risk Map for Derby City

Drawing No : - SFRA 4.9



Drawing No	SFRA 4.9
Surface Water Flood Risk Map for Derby City	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	15/02/2012

Notes

All analysis is based from EA Flood Map for Surface Water 200 yr deep.

Scale: 1:60000 at A4

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K
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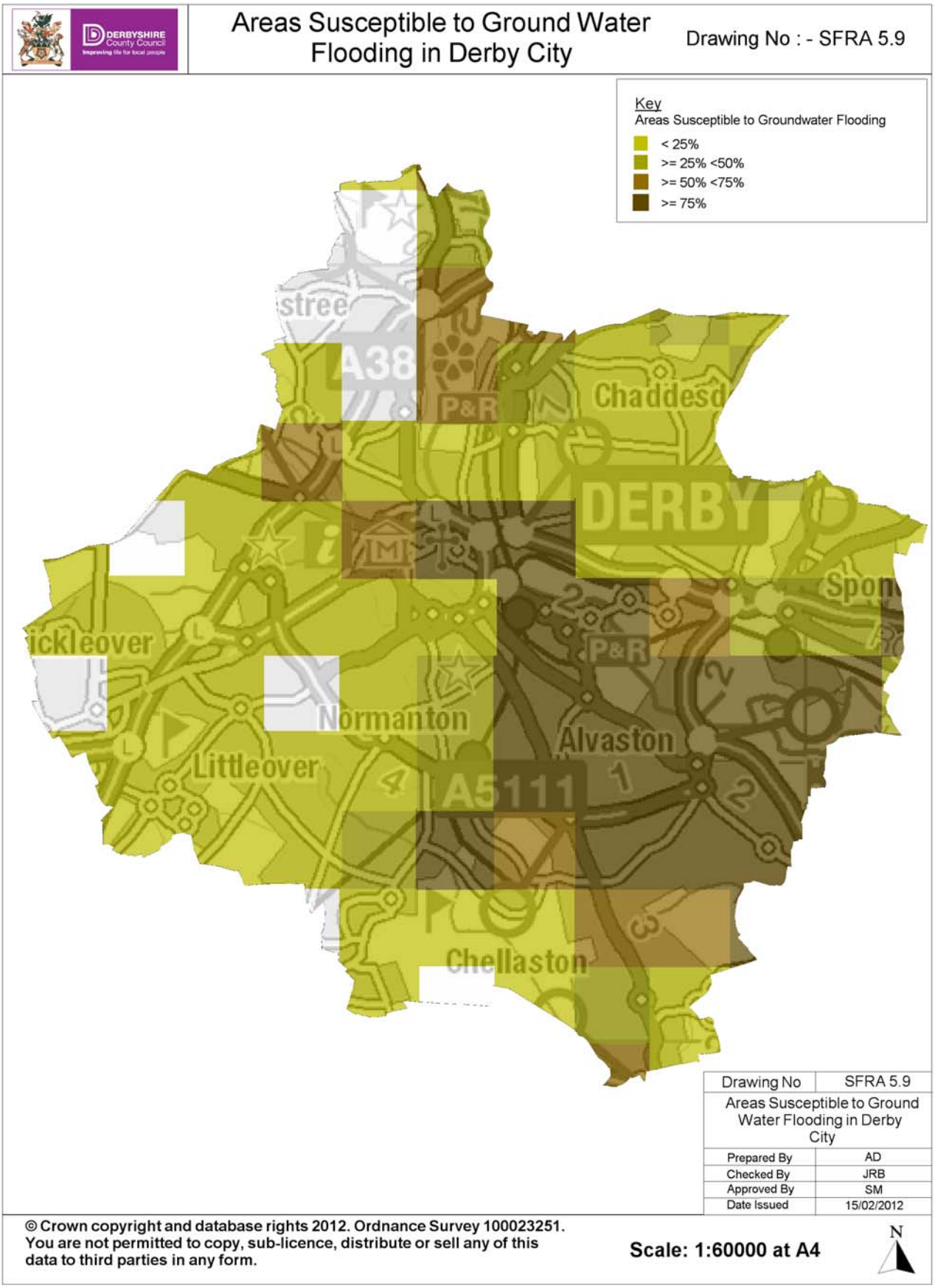
Areas Susceptible to Ground Water Flooding in Derby City
Drawing No : - SFRA 5.9
Key
Areas Susceptible to Groundwater Flooding
< 25%
>= 25% <50%
>= 50% <75%
>= 75%
A38
P&R
DERBY
P&R
Normanton
Alvaston
Littleover
A5111
Chellaston
Drawing No
SFRA 5.9
Areas Susceptible to Ground Water Flooding in Derby City
Prepared By
AD
Checked By
JRB
Approved By
SM
Date Issued
15/02/2012
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Scale: 1:60000 at A4
N