Central Lancashire Level 1 Strategic Flood Risk Assessment

Preston City Council

South Ribble Borough Council

Chorley Borough Council

Final Report

February 2021

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Revision history

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Contract

This report describes work commissioned by Johndaniel Jaques, on behalf of Central Lancashire Local Plan Team, by a contract dated 19 February 2019. Central Lancashire Authority's representative for the contract was Johndaniel Jaques. Hannah Bishop and Mike Williamson of JBA Consulting carried out this work.

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Purpose

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

Acknowledgements

JBA would like to thank representatives of Chorley Borough Council, South Ribble Borough Council, Preston City Council, Lancashire County Council, the Environment Agency, and United Utilities for their time and commitment to providing data to inform this assessment.

Carbon footprint

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Executive summary

This Level 1 Strategic Flood Risk Assessment (SFRA) is an update to the 2007 Level 1 SFRA using all up-to-date flood risk information together with the most current flood risk and planning policy available from the National Planning Policy Framework[1] (NPPF) (2019) and Flood Risk and Coastal Change Planning Practice Guidance[2] (FRCC-PPG).

The Level 1 SFRA is focused on collecting readily available flood risk information from a number of key stakeholders, the aim being to help identify the number and spatial distribution of flood risk sources present throughout the Central Lancashire Authorities' (CLA) authority areas of Chorley, South Ribble and Preston to inform the application of the Sequential Test.

The CLA require this Level 1 SFRA to initiate the sequential risk-based approach to the allocation of land for development and to identify whether application of the Exception Test is likely to be necessary. This will help to inform and provide the evidence base for the Central Lancashire Authorities' (CLA) Local Plan.

The three LPAs provided their latest potential development sites data and information. An assessment of flood risk to all assessed sites is provided to assist the CLT in its decision-making process for sites to take forward as part of the Local Plan.

A number of the CLA's potential development sites are shown to be at varying risk from fluvial, tidal, surface water and residual risk. Development consideration assessments for all potential development sites are summarised through a number of strategic recommendations within this report and the Development Sites Assessment spreadsheet in Appendix C. The strategic recommendations broadly entail the following:

- Strategic Recommendation A – consider withdrawal based on significant level of fluvial/tidal or surface water flood risk (if development cannot be directed away from areas at risk);
- Strategic Recommendation B – Exception Test required, if site passes the Sequential Test;
- Strategic Recommendation C – consider detailed site layout and design around the identified flood risk if site passes the Sequential Test i.e. redrawing of development boundaries to remove risk or incorporation of risk through appropriate mitigation techniques;
- Strategic Recommendation D – site-specific FRA required as a minimum; and
- Strategic Recommendation E – subject to consultation with the LPA and LLFA, the site could be allocated or permitted for development on flood risk grounds due to little perceived risk.

Local Plan sites

A total of 878 sites were screened against the latest available flood risk information. The majority of the sites were proposed for residential use at 734 with other proposed uses: 42 employment, 73 mixed use and 29 other use. The sites with proposed use stated as other were considered as more vulnerable to provide a worse-case scenario for recommendation.

Following the flood risk screening, 71 sites are recommended as being potentially unsuitable for development, 14 of which is due to their location within the functional floodplain, and 50 due to significant surface water flood risk.

1 https://www.gov.uk/government/publications/national-planning-policy-framework--2
2 http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

There are 26 sites to which Strategic Recommendation B applies of which all are considered more vulnerable as 23 are residential, 2 mixed use and 1 other. Overall, there are 101 sites to which Strategic Recommendation C applies. Of these sites, 42 have over 97% within Flood Zone 1, meaning surface water is the main source of risk requiring mitigation at these sites. For these sites, the developer should carefully consider site layout and design with a view to removing the development site footprint from the flood zone that is obstructing development i.e. the high and medium risk surface water flood zones. If this is not possible then the alternative would be to investigate the incorporation of temporary on-site storage of water during a rainfall event into the site design through appropriate Sustainable Drainage Systems (SuDS), following detailed ground investigation.

Strategic Recommendation D applies to 579 sites with 557 of these sites being wholly within Flood Zone 1. Strategic Recommendation E applies to 101 sites.

See Appendix C for a full breakdown of the risk to each site and Appendix E which discusses the identified risks.

SFRA Recommendations

The main planning and flood risk policy recommendations to come out of this SFRA are outlined briefly below and are based on the fundamentals of the National Planning Policy Framework and the Flood Risk and Coastal Change Planning Practice Guidance. Section 8.2 of this report provides further detail.

SFRA recommendation:

- No development within the functional floodplain, unless development is water compatible;
- Surface water flood risk should be considered with equal importance as fluvial and tidal risk;
- The sequential approach must be followed in terms of site allocation and site layout;
- Ensure site-specific Flood Risk Assessments are carried out to a suitable standard in accordance with national guidance as a minimum, where required, with full consultation required with the LPAs, LLFA, the EA, and United Utilities (UU);
- Ensure a Sustainable Drainage Strategy is provided for developments in which consideration is given to appropriate SuDS components, the design, adoption and lifetime maintenance of the SuDS at the earliest outset of development discussions, with full consideration required with the LPAs, LLFA, the EA, and UU;
- SuDS (which may incorporate Natural Flood Management techniques) must be considered, where appropriate, for mitigation;
- Phasing of development must be carried out to avoid possible cumulative impacts, and consideration given to the on-site management of water during each of development phase; and
- Planning permission for at risk sites can only be granted by the LPA following a site-specific FRA and suitable Sustainable Drainage Strategy, with full consultation required with the LPAs, LLFA, the EA, and UU.

Included within this Level 1 SFRA, along with this main report, are:

- Flood risk policy and planning framework – Appendix A;
- Detailed interactive GeoPDF maps showing all available flood risk information together with the potential development sites - Appendix B;
- Development Site Assessment spreadsheet detailing the risk to each site with recommendations on development - Appendix C; and
- A note on the delineation of the functional floodplain following discussion and agreement between the Council and the EA - Appendix D.
- Section explaining the strategic recommendations of the proposed sites – Appendix E;
- Figures showing the proposed sites with their strategic recommendation – Appendix F; and
- A User Guide for the SFRA – Appendix G.

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Abbreviations

AAP	Area Action Plans
ABD	Areas Benefitting from Defences
ACDP	Area with Critical Drainage Problems
AEP	Annual Exceedance Probability
AONB	Area of Outstanding Natural Beauty
BGS	British Geological Society
CaBA	Catchment Based Approach
CBC	Chorley Borough Council
CC	Climate change
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plan
CLA	Central Lancashire Authorities
CLLP	Central Lancashire Local Plan
CLT	Central Lancashire Team
DCLG	Department for Communities and Local Government
DPD	Development Plan Documents
DTM	Digital Terrain Model
EA	Environment Agency
FAA	Flood Alert Area
FAS	Flood Alleviation Scheme
FCDPAG	Flood and Coastal Defence Project Appraisal Guidance
FCERM	Flood and Coastal Erosion Risk Management Network
FCRMS	Flood and Coastal Risk Management Strategy
FDGiA	Flood Defence Grant in Aid
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
FRMS	Flood Risk Management Strategy
FRR	Flood Risk Regulations
FSA	Flood Storage Area
FWA	Flood Warning Area
FWMA	Flood and Water Management Act
GI	Green Infrastructure
GIS	Geographical Information Systems
HFM	Historic Flood Map
IDB	Internal Drainage Board
LA	Local Authority
LASOO	Local Authority SuDS Officer Organisation
LCC	Lancashire County Council
LDF	Local Development Framework
LEC	Lancaster Environment Centre

LES	Local Economic Strategy
LFRMS	Local Flood Risk Management Strategy
LIS	Lancashire Integrated Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Lancashire Resilience Forum
MHCLG	Ministry of Housing, Communities and Local Government
NFM	Natural Flood Management
NGO	Non-Governmental Organisation
NPPF	National Planning Policy Framework
NPPG	Planning Practice Guidance
PCC	Preston City Council
PCPA	Planning and Compulsory Purchase Act
PFRA	Preliminary Flood Risk Assessment
RBD	River Basin District
RBMP	River Basin Management Plan
RCFMP	Ribble Catchment Flood Management Plan
RFO	Recorded Flood Outlines
RFM	Reservoir Flood Map
RFCC	Regional Flood and Coastal Committee
RoFSW	Risk of Flooding from Surface Water map
RMA	Risk Management Authority
RoFRS	Risk of Flooding from Rivers and the Sea Map
RSPB	Royal Society for the Protection of Birds
SA	Sustainability Appraisal
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SHLAA	Strategic Housing Land Availability Assessment
SoP	Standard of Protection
SPD	Supplementary Planning Documents
SRBC	South Ribble Borough Council
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
UKCIP02	UK Climate Projections 2002
UKCP09	UK Climate Projections 2009
UKCP18	UK Climate Projections 2018
UU	United Utilities
WCS	Water Cycle Study
WFD	Water Framework Directive
WwNP	Working with Natural Processes

1 Introduction

1.1 Commission

The Central Team for the Central Lancashire Authorities (CLA) commissioned JBA Consulting in February 2019 for the undertaking of a Level 1 Strategic Flood Risk Assessment (SFRA) to update the existing Level 1 SFRA carried out in 2007. Chorley Council (CC), South Ribble Borough Council (SRBC) and Preston City Council (PCC), collectively form the group of Central Lancashire Authorities. The CLT requires this updated Level 1 SFRA to initiate the sequential risk-based approach to the allocation of land for development and to identify whether application of the Exception Test is likely to be necessary using the most up-to-date information and guidance. This will provide the evidence to support strategic flood risk policies and site allocations for the Central Lancashire Local Plan (CLLP).

CLA is a combination of the three local planning authorities (LPA) with Lancashire County Council (LCC) acting as the Lead Local Flood Authority (LLFA).

1.2 Strategic Flood Risk Assessment

All local planning authorities should produce a Level 1 SFRA. A Level 2 SFRA may also be required depending on whether the Local Authority has plans for development in flood risk areas, identified in the Level 1 SFRA. The Environment Agency's (EA) SFRA guidance for local planning authorities[3] (updated September 2020, at the time of writing) states:

"Your SFRA will help your planning authority make decisions about:

- your local plan or spatial development strategy
- individual planning applications
- how to adapt to climate change
- future flood management
- emergency planning (the resources needed to make development safe)

You also need it to help you:

- *carry out the sequential test for the local plan or spatial development strategy, and individual planning applications*
- *do the exception test, when you're proposing to allocate land for development in flood risk areas*
- *establish if a development can be made safe without increasing flood risk elsewhere*
- *decide when a flood risk assessment will be needed for individual planning applications*
- *identify if proposed development is in functional floodplain*
- *do the sustainability appraisal of the local plan or spatial development strategy."*

1.3 Central Lancashire Level 1 SFRA

This SFRA has been carried out in accordance with Government's latest development planning guidance including the revised National Planning Policy Framework (NPPF) (2019) and flood risk and planning policy guidance, the Flood Risk and Coastal Change

[3] https://www.gov.uk/guidance/local-planning-authorities-strategic-flood-risk-assessment#level-2-strategic-flood-risk-assessment

Planning Practice Guidance (FRCC-PPG) (last updated March 2014, at the time of writing). The latest guidance is available online via:

http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change

An updated version of the NPPF was published on 19 June 2019 and sets out Government's planning policies for England and how these are expected to be applied. This revised Framework replaces the previous NPPF published in March 2012 and is available via:

https://www.gov.uk/government/publications/national-planning-policy-framework--2

This SFRA assesses the spatial distribution of flood risk across the local authority area and provides the discussion and guidance required to put this information into practice when taking account of flood risk in development plans and the level of detail required to carry out site specific Flood Risk Assessments (FRAs).

This SFRA makes use of the most up-to-date flood risk datasets, at the time of submission, to assess the extent of risk, at a strategic level, to potential development sites identified by each individual Council. The SFRA appendices contain interactive GeoPDF maps (Appendix B) showing the potential development sites overlaid with the latest, readily available, gathered flood risk information along with a Development Site Assessment spreadsheet (Appendix C) indicating the level of flood risk to each site following a strategic assessment of risk. Each potential site is assigned a strategic recommendation, discussed in Appendix E. This information will allow the LPAs to identify the strategic development options that may be applicable to each site and to inform on the application of the Sequential Test.

1.4 Aims and objectives

The aims and objectives of this Level 1 SFRA, in line with the NPPF (2019), FRCC-PPG (2014), EA SFRA guidance (2020) and more specifically indicated in CLA's brief, are to:

- Determine the variations in risk from all sources of flooding across Central Lancashire including:
  - Fluvial and tidal from main rivers, ordinary watercourses, estuaries and coastlines (Flood Map for planning and functional floodplain),
  - Surface water (pluvial and sewer),
  - Groundwater,
  - Residual risk from reservoirs and canals,
- Determine the extent of the functional floodplain (Flood Zone 3b);
- Determine the risks to and from surrounding areas in the same flood catchment i.e. Ribble catchment which extends much further upstream north and east through the Ribble Valley District to its source in Craven District;
- Form part of the Local Plan evidence base to inform the Sustainability Appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies, including policies for flood risk management to ensure that flood risk is not increased;
- Apply the Sequential Test and, where necessary, the Exception Test when determining land use allocations;
- Identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from sources other than river flooding;
- Determine the acceptability of flood risk in relation to emergency planning capability, in particular safe access and egress from new developments;

- Consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and storage of floodwater through appropriate SuDS.
- Assess all sources of flood risk across the authority area, entailing: Main Rivers, ordinary watercourses, fluvial / tidal flood zones, surface water flood maps, groundwater flood map, historic flooding, flood risk management infrastructure, as well as potential allocation sites in the future;
- Assess the implications of climate change at potential sites, using the EA's February 2016 allowances where available;
- Assess flood risk management measures, including location, standard of protection afforded and the coverage of flood warning systems. Including an assessment of the potential for Working with Natural Processes, Blue-Green Infrastructure or open space that could be used for flood storage and other multi-functional benefits e.g. biodiversity;
- Review locations where additional development may significantly increase flood risk elsewhere (cumulative impacts) and where development pressures may require the Exception Test to be applied (i.e. where a Level 2 assessment is needed);
- Recommend possible flood mitigation solutions that may be integrated into site design (by the developer) to minimise risk to property and life (in accordance with the NPPF Exception Test) where flood risk has been identified as a potential constraint to future development;
- Inform on site-specific development viability, based on current and future levels of flood risk;
- Ensure the Council meets the requirements of the NPPF (2019) and the FRCC-PPG (2014);
- Provide a reference and policy document to advise and inform the general public and private and commercial developers of their obligations under the latest planning guidance; and
- Enable the SFRA to be used as a tool to inform the Development Management process about the potential risk of flooding associated with future planning applications and the basis for requiring site-specific FRAs where necessary.

1.5 Consultation

The EA's 2020 SFRA guidance recommends consultation with the following parties, external to the CLA:

- the EA
- the LLFA
- emergency planners
- emergency services
- water and sewerage companies
- reservoir owners or undertakers, if relevant
- internal drainage boards, if relevant
- highways authorities
- district councils
- regional flood and coastal committees

1.6 SFRA future proofing

This SFRA has been developed using the most up-to-date data and information available at the time of submission. The SFRA has been future proofed as far as possible though the reader should always confirm with the source organisation (Central Lancashire Authorities (CLA)) that the latest information is being used when decisions concerning development and flood risk are being considered. The FRCC-PPG, alongside the NPPF (2019), is referred to throughout this SFRA, being the current primary development and flood risk guidance information available at the time of the finalisation of this SFRA.

The EA's 2020 SFRA guidance states a review of a SFRA should be carried out when there are changes to:

- the predicted impacts of climate change on flood risk
- detailed flood modelling - such as from the EA or LLFA
- the local plan, spatial development strategy or relevant local development documents
- local flood management schemes
- flood risk management plans
- shoreline management plans
- local flood risk management strategies
- national planning policy or guidance

The SFRA should also be reviewed after a significant flood event.

Where possible, the SFRA should be kept as a 'live' entity and continually updated when new information becomes available. The EA's 2020 SFRA guidance requests for reports and maps to be published online and easily updateable, when required.

This SFRA uses the EA's Flood Map for Planning version issued in February 2020 to assess fluvial and tidal risk to potential development sites. The Flood Map for Planning is updated at quarterly intervals by the EA, as and when new modelling data becomes available. The reader should therefore refer to the online version of the Flood Map for Planning to check whether the flood zones may have been updated since February 2020, via the following link:

https://flood-map-for-planning.service.gov.uk/

To assess surface water risk to potential sites, this SFRA uses the EA's Risk of Flooding from Surface Water (RoFSW) dataset, last updated March 2020. This dataset is updated periodically when applicable local surface water modelling is carried out. The reader should therefore refer to the online version of the RoFSW map to check whether the surface water flood outlines have been updated, via the following link:

https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

2 Study area

The Central Lancashire Authorities (CLA) are located in north-west England and are made up of three councils (Preston, South Ribble and Chorley). Preston is the largest urban centre in Lancashire and the biggest of the local authority areas with around 140,000 residents, Chorley and South Ribble have around 110,000 each[4].

The CLA covers an area of approximately 458 km^2. The authorities of Preston City Council (~142 km^2) and South Ribble Borough Council (~113 km^2) are both densely populated with the number of people per km^2 equalling more than twice the England and Wales average. Chorley Council covers ~203 km^2 and the number of people per km^2 is similar to the North West average. Although there are areas of dense population, the Central Lancashire administrative area is predominantly rural, with a few major urban centres, namely, the city of Preston, and the towns of Chorley, Leyland and Bamber Bridge.

Lancashire rivers drain westwards from the Pennines into the Irish Sea. The Main Rivers located in the study area include the Ribble, Douglas, Lostock and Yarrow. The Main Rivers within the study area are shown in Figure 2-1, Figure 2-2 and Figure 2-3.

The tidal extents of the Ribble and Douglas catchments are within the study area and all watercourses within these catchments in the western part of the study area are tidally influenced. The normal tidal limits are on the outskirts of Preston and at Rufford for the River Ribble and River Douglas respectively. Approximately 7% of the study area is at risk of tidal flooding and the majority of this area is rural. However, some urban areas are at risk, in particular parts of Preston, Walton-le-Dale and Penwortham.

The geology of the study area is varied. Triassic mudstones and the Permian and Triassic sandstones make up the western part of the study area. The sandstones are classified as major aquifers and are highly permeable. The mudstones are less permeable and result in medium to rapid runoff. Namurian Millstone Grit underlies the south west of the study area. The Millstone Grit series is largely impermeable, resulting in rapid runoff in response to rainfall. The Carboniferous Limestone in the northeast of the study area is classified as minor aquifers of low vulnerability and is moderately permeable.

[4] https://www.lancashire.gov.uk/lancashire-insight/area-profiles/local-authority-profiles/

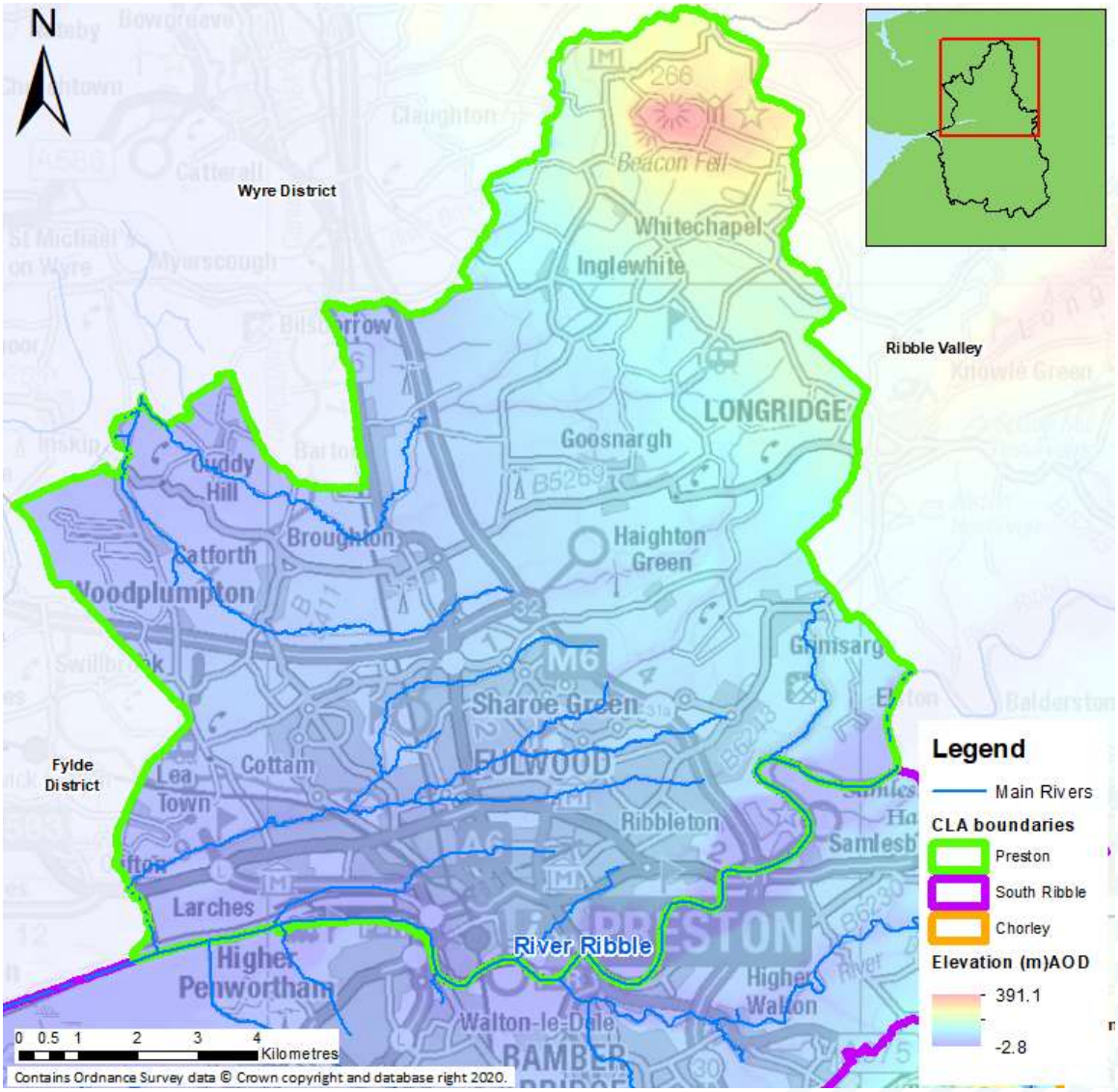

Figure 2-1: Study area of Preston City Council area

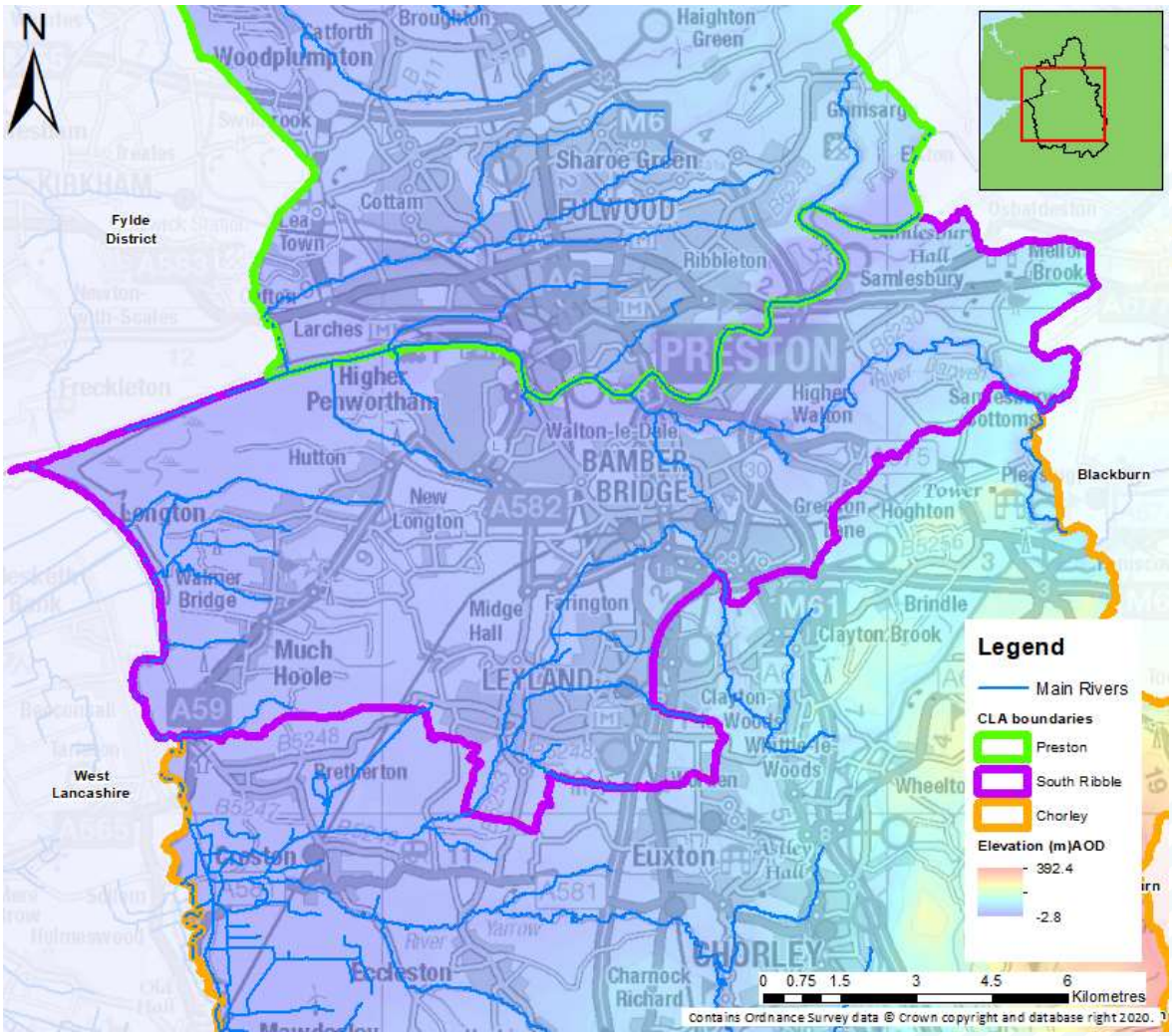

Figure 2-2: Study area of South Ribble Borough Council area

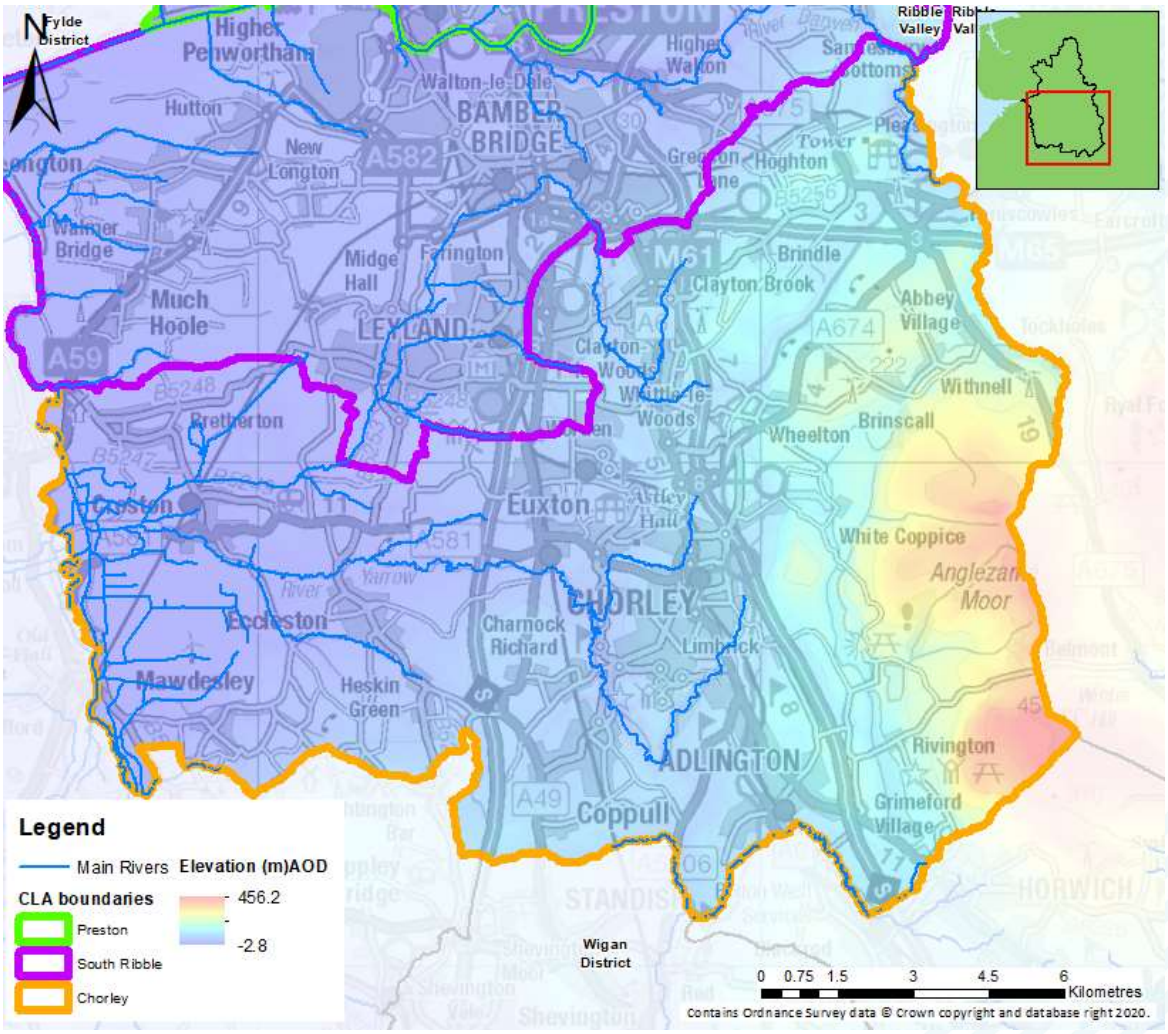

Figure 2-3: Study area for Chorley Borough Council area

2.1 Main rivers

Main rivers are usually larger rivers and streams. The EA has permissive powers to carry out maintenance, improvement or construction work on main rivers to manage flood risk. The EA also regulate works next to Main River watercourses through the Environmental Permitting Regulations 2016. The range of activities subject to regulation are listed at:

https://www.gov.uk/guidance/flood-risk-activities-environmental-permits#check-if-the-activity-is-on-a-main-river

While the EA has permissive powers to undertake works, the maintenance of Main Rivers is primarily the responsibility of riparian owners. The CLA area contains the Main Rivers of the Ribble, Douglas, Yarrow, and Lostock.

2.1.1 River Ribble

The River Ribble rises in the Pennines in the Yorkshire Dales at the confluence of Gayle Beck and Cam Beck. It is the only river rising in Yorkshire which flows westward. It flows through Settle, Clitheroe, Ribchester and Preston, before discharging into the Irish Sea; a length of 75 miles (121 km). It is one of the longest rivers in the North West, draining a catchment of 2,128 km^2. Its 10-mile (16 km) wide estuary forms part of the Ribble and Alt Estuaries Special Protection Area for wildlife.

2.1.2 River Douglas

The River Douglas is a tributary of the River Ribble and has itself two tributaries, the River Tawd (not applicable to the CLA) and River Yarrow. The Douglas rises on Rivington Moor, before travelling 23 miles to meet the Ribble near Hesketh Bank. The river flows through Lancashire and Greater Manchester. The Douglas rises at relatively low altitude, draining extensive areas of flat land where intensive agriculture and horticulture dominate before flowing into the Ribble Estuary.

2.1.3 River Yarrow

The River Yarrow is a tributary of the River Douglas. The river originates from the West Pennine Moors where it then feeds the Yarrow Reservoir, which in turn feeds the Anglezarke and Upper and Lower Rivington Reservoirs. The river then flows until it passes underneath the Leeds and Liverpool Canal, joining Black Brook at Yarrow Bridge before passing through Eccleston and Croston, where it feeds the River Douglas at Sollom. The entire course of the River Yarrow falls within Chorley district and its villages.

2.1.4 River Lostock

The source of the Lostock is at the confluence of Slack Brook and Whave's Brook at the entrance to Miller Wood near Withnell Fold. The Lostock continues along the Leeds and Liverpool Canal to Lower Copthurst, where it turns westwards, watering Whittle-le-Woods before turning north by Clayton-le-Woods. The river continues bypassing the towns of Farington and Leyland before moving west towards Croston and joining the River Yarrow.

2.1.5 Other Main Rivers

There are many other tributaries of the Rivers Ribble, Douglas, Yarrow and Lostock that are also designated as Main River watercourses by the EA.

2.2 Ordinary watercourses

Ordinary watercourses are any watercourse that is not designated as a Main River. These watercourses can vary in size considerably and can include rivers, streams and all ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 2014) and passages, through which water flows.

Ordinary watercourses come under control of the LLFA, which has permissive powers to carryout works, should this be deemed necessary, and have regulatory control over certain development activities within the watercourse channel. However, the responsibility for the maintenance of Ordinary Watercourses lies with the riparian owner.

3 Understanding flood risk

3.1 Sources of flooding

Flooding is a natural process and can happen at any time in a wide variety of locations, as discussed below. It constitutes a temporary covering of land not normally covered by water and presents a risk when human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding can occur from many different and combined sources and in many different ways. Major sources of flooding (also see Figure 3-1) include:

- **Fluvial** (main rivers and ordinary watercourses) – inundation of floodplains from rivers and watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- **Tidal** – sea; estuary; overtopping of defences; breaching of defences; other flows (e.g. fluvial surface water) that could pond due to tide locking; wave action.
- **Surface water** – surface water flooding covers two main sources including direct run-off from adjacent land (pluvial) and surcharging of piped drainage systems (public sewers, highways drains, etc.)
- **Groundwater** – water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- **Infrastructure failure** – reservoirs; canals; industrial processes; burst water mains; blocked sewers or failed pumping stations.

Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth and duration of flooding can vary greatly. With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging.

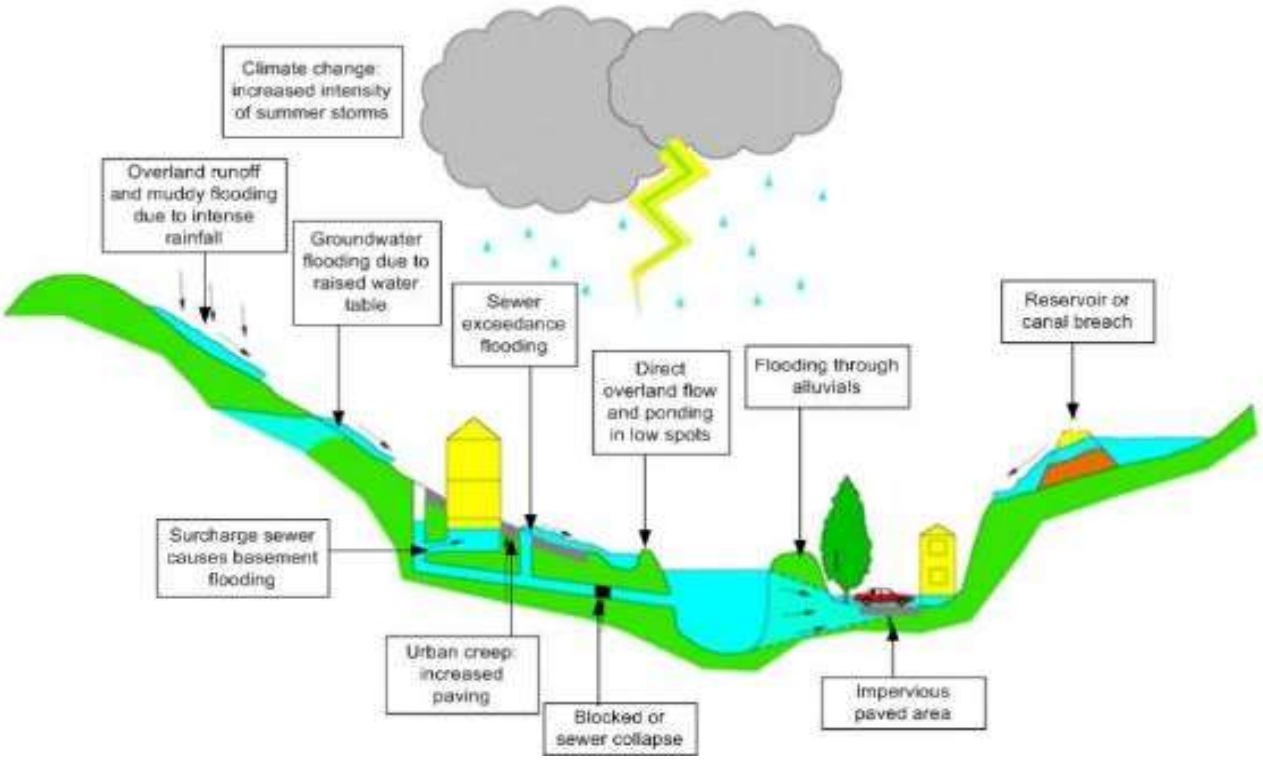

Figure 3-1: Flooding from all sources

3.2 Likelihood and consequence

Flood risk is a combination of the likelihood of flooding and the potential consequences arising. It is assessed using the source – pathway – receptor model as shown in Figure 3-2 below. This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. However, it should be remembered that flooding could occur from many different sources and pathways, and not simply those shown in the illustration below.

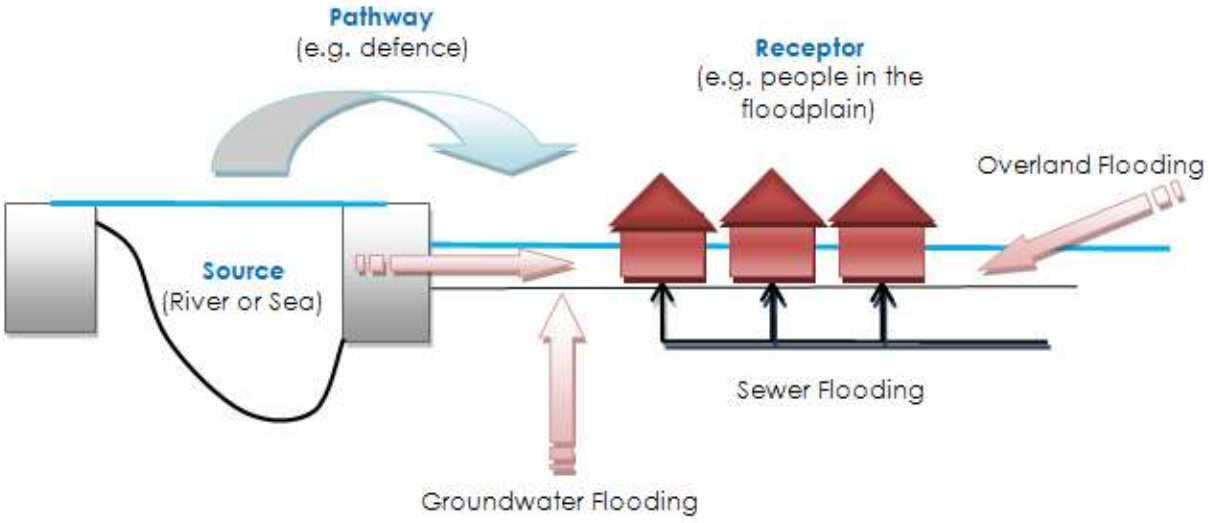

Figure 3-2: Source-Pathway-Receptor model

The principal sources are rainfall or higher than normal sea levels, the most common pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets and the receptors can include people, their property and the environment. All three elements must be present for flood risk to arise. Mitigation measures have little or no effect on sources of flooding, but they can block or impede pathways or remove receptors.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk in order to apply this guidance in a consistent manner.

3.2.1 Likelihood

Likelihood of flooding is expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1 in 100 AEP (Annual Exceedance Probability) events indicates the flood level that is expected to be reached on average once in a hundred years, i.e. it has a 1 in 100 AEP event of occurring in any one year, not that it will occur once every one hundred years.

Table 3-1 provides an example of the flood probabilities used to describe the fluvial and tidal flood zones as defined in the FRCC-PPG and as used by the EA in their Flood Map for Planning (Rivers and Sea).

Note that the flood zones shown on the Flood Map for Planning do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. The Flood Map for Planning can be accessed via:

https://flood-map-for-planning.service.gov.uk/

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	**This zone comprises land where water has to flow or be stored in times of flood.** Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone3a on the Flood Map)

Table 3-1: NPPF flood zones[5]

[5] Table 1: Flood Zones, Paragraph 065 of the Flood Risk and Coastal Change Planning Practice Guidance

3.2.2 Consequence

The consequences of flooding include fatalities, property damage, disruption to lives and businesses, with severe implications for people (e.g. financial loss, emotional distress, health problems). Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc.). Flood risk is then expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

3.3 Risk

Flood risk is not static; it cannot be described simply as a fixed water level that will occur if a river overtops its banks or from a high spring tide that coincides with a storm surge. It is therefore important to consider the continuum of risk carefully. Risk varies depending on the severity of the event, the source of the water, the pathways of flooding (such as the condition of flood defences) and the vulnerability of receptors as mentioned above.

3.3.1 Actual risk

This is the risk 'as is' taking into account any flood defences that are in place for extreme flood events (typically these provide a minimum Standard of Protection (SoP)). Hence, if a settlement lies behind a fluvial or tidal flood defence that provides a 1 in 100-year SoP then the actual risk of flooding from the river in a 1 in 100-year event is generally low. However, the residual risk may be high in that the impact of flood defence failure would likely have a major impact.

Actual risk describes the primary, or prime, risk from a known and understood source managed to a known SoP. However, it is important to recognise that risk comes from many different sources and that the SoP provided will vary within a river catchment. Hence, the actual risk of flooding from the river may be low to a settlement behind the defence but moderate from surface water, which may pond behind the defence in low spots and is unable to discharge into the river during high water levels.

3.3.2 Residual risk

Defended areas, located behind EA, CLA and privately owned flood defences, remain at residual risk as there is a risk of overtopping or defence breach during significant flood events. Whilst the potential risk of failure may be reduced, consideration of inundation and the impact on development needs to be considered.

Paragraph 041 of the FRCC-PPG defines residual risk as:

"…those remaining after applying the sequential approach to the location of development and taking mitigating actions. Examples of residual flood risk include:

- *The failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, overtopping of an upstream storage area, or failure of a pumped drainage system;*
- *failure of a reservoir, or;*
- *a severe flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot cope with.*

Areas behind flood defences are at particular risk from rapid onset of fast-flowing and deep-water flooding, with little or no warning if defences are overtopped or breached."

Even when flood defences are in place, there is always a likelihood that these could be overtopped in an extreme event or that they could fail or breach. Where there is a

consequence to that occurrence, this risk is known as residual risk. Defence failure can lead to rapid inundation of fast flowing and deep floodwaters, with significant consequences to people, property and the local environment behind the defence. Whilst the actual risk of flooding to a settlement that lies behind a flood defence that provides a 1 in 100-year SoP may be low, there will always be a residual risk from flooding if these defences overtopped or failed that must be taken into account. Because of this, it is never appropriate to use the term "flood free".

Developers must be able to demonstrate that development will be safe for the lifespan of the development. To that end, Paragraph 042 of the FRCC-PPG states:

"Where residual risk is relatively uniform, such as within a large area protected by embanked flood defences, the Strategic Flood Risk Assessment should indicate the nature and severity of the risk remaining, and provide guidance for residual risk issues to be covered in site-specific flood risk assessments. Where necessary, local planning authorities should use information on identified residual risk to state in Local Plan policies their preferred mitigation strategy in relation to urban form, risk management and where flood mitigation measures are likely to have wider sustainable design implications".

Table 5-5 (Section 5.7.1) lists the main EA defences in the CLA area and Table 5-6 lists the Areas Benefitting from Defences (ABD). The EA defences and ABD dataset are also shown on the SFRA maps in Appendix B. ABDs indicate the areas that are protected by an EA flood defence that provides a Standard of Protection against a 1% AEP fluvial or 0.5% AEP tidal event.

Where development in flood risk areas is necessary, it must be designed to be safe up to a 1% fluvial or 0.5% tidal plus climate change event and take account of any residual flood risk.

Detailed mitigation must be agreed through site-specific FRAs or through Level 2 SFRAs where it would be necessary to demonstrate site allocations would be safe for their lifetime.

Chapter 6 discusses various mitigation measures that may be appropriate depending on the site-specific circumstances.

4 The planning framework and flood risk policy

4.1 Introduction

The main purpose of this section of the SFRA is to provide an overview of the key planning and flood risk policy documents that have shaped the current planning framework. This section also provides an overview and context of the LLFA's and LPA's responsibilities and duties in respect to managing local flood risk including but not exclusive to the delivery of the requirements of the Flood Risk Regulations (FRR) 2009 and the Flood and Water Management Act (FWMA) 2010.

Figure 4-1 illustrates the links between legislation, national policy, statutory documents and assessment of flood risk. The figure shows that whilst the key pieces of legislation and policy are separate, they are closely related, and their implementation should aim to provide a comprehensive and planned approach to asset record keeping and improving flood risk management within communities.

It is intended that the non-statutory Surface Water Management Plans (SWMPs) and SFRAs can provide much of the base data required to support the delivery of the LLFA's statutory flood risk management tasks as well supporting local authorities in developing capacity, effective working arrangements and informing Local Flood Risk Management Strategies (LFRMS) and Local Plans, which in turn help deliver flood risk management infrastructure and sustainable new development at a local level. This SFRA should be used to support the CLA's emerging Local Plan and to help inform planning decisions.

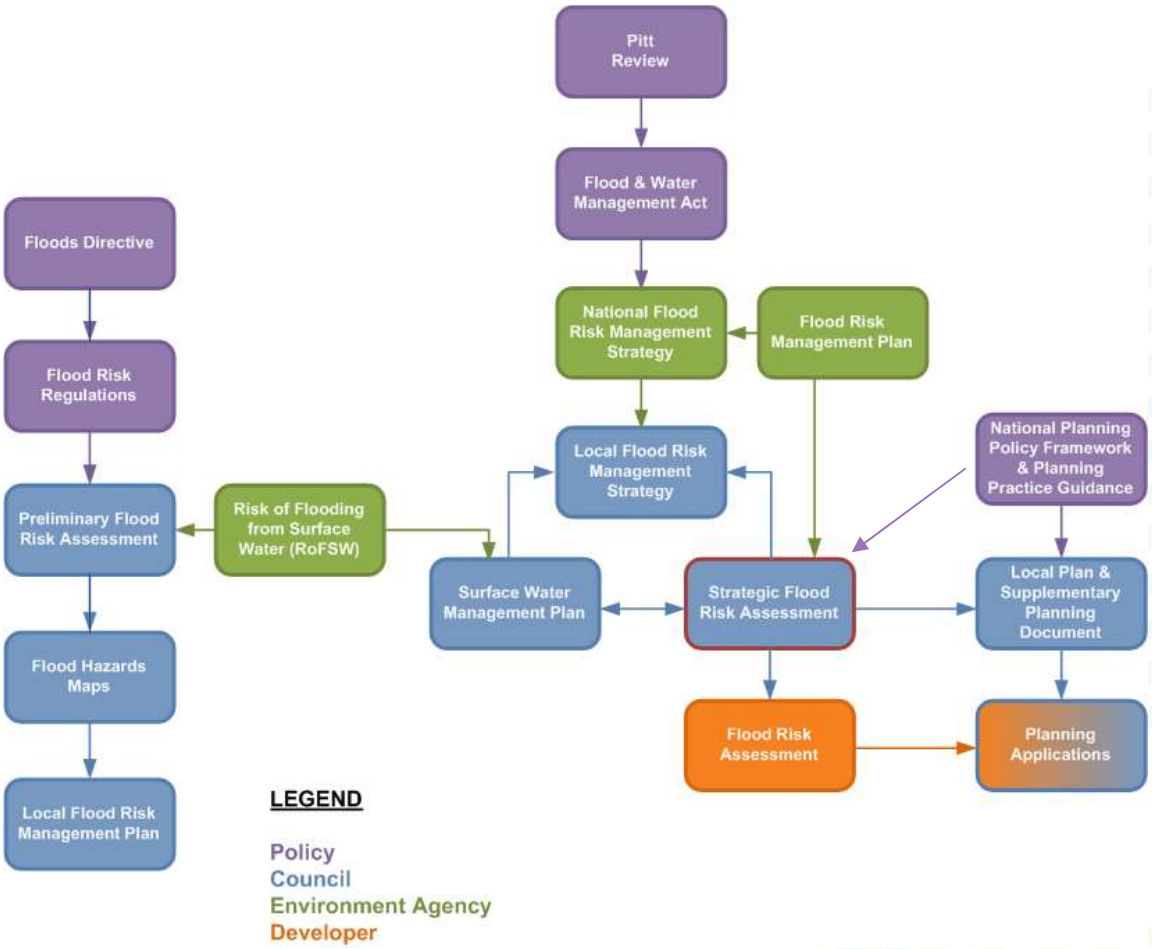

Figure 4-1: Key documents and strategic planning links with flood risk

4.2 Central Lancashire Local Plan[6]

The three local authorities (Preston City Council, South Ribble Borough Council, and Chorley Borough Council) collaborated between 2008 and 2012 to produce the Local Development Framework whilst a Core Strategy team was based at LCC. In July 2012, the three councils adopted a Core Strategy which is the key document in the statutory development area, which sets out the strategic planning policies for Central Lancashire and is supported by the individual local plans, which were each produced in 2015.

The Central Lancashire Core Strategy sets out the long-term spatial vision for Central Lancashire to the year 2026 and the overall strategy for delivering that vision. It identifies the overall need for different types of development including housing, employment, leisure and retail, as well as the need to protect the environment, create and enhance open spaces, and secure investment. The plan informs the scale and scope of future community spaces, commercial sites and infrastructure across the region.

The Chorley Local Plan, adopted in 2015, identifies the scale of development in each settlement and allocates sites to meet the development needs of Chorley up to the period 2026 in order to achieve the vision for growth as outlined in the Core Strategy.

The South Ribble Local Plan (2012-2026), adopted in 2015, forms part of the statutory Development Plan for South Ribble; it identifies and allocates land required over a 15 year period in order to achieve the vision for growth as outlined in the Central Lancashire Core Strategy.

The Preston Local Plan, adopted in 2015, is a Development Plan Document produced under the Planning and Compulsory Purchase Act 2004 and forms part of the statutory Development Plan for Preston. The Preston City Centre Plan is an Area Action Plan (AAP) that sits alongside the Preston Local Plan and was adopted in 2016.

Now, a review of the Core Strategy and individual local plans is being undertaken with a view to delivering a single Central Lancashire Local Plan (CLLP), to include shared strategic policy objectives, more detailed non-strategic policies and site allocations.

The remaining flood risk policy information relating to the CLA is located in Appendix A.

[6] https://centrallocalplan.lancashire.gov.uk/about/

5 Flood risk across Central Lancashire

According to the LFRMS (2013), Lancashire, as a region, is divided in two by the M6 motorway, with the steeper upland catchments in the east, where flooding can occur rapidly and be more localised, and flatter lowland catchments in the west. In the areas to the west, the risk of flooding is predominantly linked to the capacity of the drainage networks, including piped networks in urban areas and open drainage ditches in both urban and rural areas. The areas to the east, flooding from local sources is predominantly as a result of intense rainfall events that cause surface water runoff and flooding from watercourses.

Across the authority areas of Chorley, Preston and South Ribble as a whole, fluvial flood risk could be considered in general to be low to medium, although a number of locations have historically flooded from both fluvial and surface water sources. There is little history of groundwater flooding in the Central Lancashire area, although permeable superficial deposits overlying major aquifers indicates a potential risk. Similarly, there are a number of canals, reservoirs and other artificial waterbodies in the area which pose a potential residual flood risk.

5.1 Flood risk datasets

This section of the SFRA provides a strategic overview of flood risk from all sources within Central Lancashire. The information contained is the best available at the time of publication and is intended to provide each LPA with an overview of risk. Table 5-1 provides a summary of the key datasets used in this SFRA according to the source of flooding.

Flood Source	Datasets / Studies
Fluvial / Tidal	EA Flood Map for Planning (Rivers and Sea) (February 2020 version)
	EA Risk of Flooding from Rivers and Sea map
	Modelled Flood Outlines (MFO) from latest available EA Flood Risk Mapping Studies
	EA Historic Flood Map (HFM) (February 2020)
	EA Recorded Flood Outlines (RFO) (February 2020)
	EA Areas Benefitting from Flood Defences (ABD) (February 2020)
	EA Flood Warning Areas (FWA) (February 2020)
Pluvial (surface water runoff)	EA Risk of Flooding from Surface Water (RoFSW)
	Preliminary Flood Risk Assessment 2011 and update 2017
Sewer	UU Historical Flood Incident Data
Groundwater	JBA 5m Resolution Groundwater Flood Map
Reservoir	EA Reservoir Flood Maps (available online)
All sources	North West Flood Risk Management Plan 2015 to 2021
	North West River Basin Management Plan (June 2018)
	Douglas Catchment Flood Management Plan (2009)
	Ribble Catchment Flood Management Plan (2009)
	Lancashire & Blackpool Local Flood Risk Management Strategy (2013)
	LCC Historic Flood Records
	CLA Level 1 Strategic Flood Risk Assessment 2007

Flood Source	Datasets / Studies
Flood risk management infrastructure	EA Spatial Flood Defence data (February 2020)
	LLFA FRM asset register

Table 5-1: Flood source and key datasets

5.2 Fluvial and tidal flooding

Fluvial flooding is associated with the exceedance of channel capacity during higher flows or as a result of blockage. The process of flooding from watercourses depends on a number of characteristics associated with the catchment including geographical location and variation in rainfall; steepness of the channel and surrounding floodplain; and infiltration and rate of runoff associated with urban and rural catchments.

Tidal flooding is caused by storm surge and wave action in times of high astronomical tides.

The SFRA Maps in Appendix A present the EA's Flood Map for Planning which shows the fluvial and tidal coverage of flood zones 2 and 3 across the Central Lancashire area.

5.2.1 EA Flood Map for Planning (Rivers and Sea)

The EA's Flood Map for Planning is the main dataset used by planners for predicting the location and extent of fluvial and tidal flooding. This is supported by the CFMPs and FRMPs along with a number of detailed hydraulic river modelling reports which provide further detail on flooding mechanisms.

The Flood Map for Planning provides flood extents for the 1 in 100 AEP (1%) fluvial event and 1 in 200 AEP (0.5%) tidal event (Flood Zone 3) and the 1 in 1000 AEP (0.1%) fluvial and tidal flood events (Flood Zone 2). Flood zones were originally prepared by the EA using a methodology based on the national digital terrain model (NextMap), derived river flows from the Flood Estimation Handbook (FEH) and two-dimensional flood routing. Since their initial release, the EA has regularly updated its flood zones with detailed hydraulic model outputs as part of their national flood risk mapping programme.

The Flood Map for Planning is precautionary in that it does not take account of flood defence infrastructure (which can be breached, overtopped or may not be in existence for the lifetime of the development) and, therefore, represents a worst-case scenario of flooding. The flood zones do not consider sources of flooding other than fluvial and tidal and do not take account of climate change. As directed by the FRCC-PPG, this SFRA subdivides Flood Zone 3 into Flood Zone 3a and Flood Zone 3b (functional floodplain – see Section 5.2.2).

The EA also provides a 'Risk of Flooding from Rivers and Sea Map'. This map shows the EA's assessment of the likelihood of flooding from rivers and the sea, at any location, and is based on the presence and effect of all flood defences, predicted flood levels and ground levels. This dataset is not used in the assessment of flood risk for planning applications but is a useful source of information to show the presence and effects of flood risk management infrastructure. This dataset is further discussed in Section 5.2.3.

This SFRA uses the Flood Map for Planning issued in February 2020 to assess fluvial and tidal risk to assessed sites, as per the NPPF and the accompanying FRCC-PPG. The Flood Map for Planning is updated at quarterly intervals by the EA, as and when new modelling data becomes available. The reader should therefore refer to the online version of the Flood Map for Planning to check whether the flood zones may have been updated since February 2020:

https://flood-map-for-planning.service.gov.uk/

5.2.2 Functional floodplain (Flood zone 3b)

The functional floodplain forms a very important planning tool in making space for floodwaters when flooding occurs. Development should be directed away from these areas.

Table 1, Paragraph 065 of the FRCC-PPG defines Flood Zone 3b as:

"…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."

Paragraph 015 of the FRCC-PPG explains that:

"…the identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point to help identify the functional floodplain.

The area identified as functional floodplain should take into account the presence and effect of all flood risk management infrastructure including defences. Areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, will not normally be identified as functional floodplain. If an area is intended to flood, e.g. an upstream flood storage area designed to protect communities further downstream, then this should be safeguarded from development and identified as functional floodplain, even though it might not flood very often."

The EA's most up-to-date Historic Flood Map (HFM), Areas Benefitting from Defences (ABD), Recorded Flood Outlines (RFO) and Flood Storage Areas (FSA) datasets were assessed with regards to using them to update the functional floodplain where appropriate.

Additionally, the available modelled flood outlines used to create the functional floodplain were:

- 2006 – Ribble Tribs (Longton Brook, Mill Brook and RN);
- 2008 – Hall Pool, Higher Walton (River Darwen), and Horwich;
- 2009 – River Yarrow;
- 2010 – River Ribble;
- 2011 – Bannister Brook, Black Brook, Chorley, and Savick Brook;
- 2014 – River Wyre and Tribs;
- 2015 – Wymott Brook, Blashaw Brook, Wade Brook, and BRIS;
- 2017 – Croston, Hennel Brook, and River Lostock;
- Unknown date – Buckow Brook.

The functional floodplain outline was assessed and agreed upon by the CLA, the LLFA and the EA, based on their in-depth local knowledge. The methodology note for the delineation of the functional floodplain is located in Appendix D.

5.2.3 EA Risk of Flooding from Rivers and the Sea map

This Risk of Flooding from Rivers and Sea map (RoFRS) shows the likelihood of flooding from rivers and the sea based on the presence and effect of all flood defences, predicted flood levels and ground levels and is shown on the Appendix A maps. The RoFRS map splits the likelihood of flooding into four risk categories:

- High – greater than or equal to 1 in 30 AEP event (3.3%) chance in any given year
- Medium – less than 1 in 30 AEP event (3.3%) but greater than or equal to 1 in 100 AEP event (1%) chance in any given year
- Low – less than 1 in 100 AEP event (1%) but greater than or equal to 1 in 1000 AEP flood event (0.1%) chance in any given year
- Very Low – less than 1000 AEP event (0.1%) chance in any given year

The RoFRS map is included on the SFRA maps to act as a supplementary piece of information to assist the LPA in the decision-making process for site allocation.

This dataset is not suitable for use with any planning application nor should it be used for the sequential testing of site allocations. The EA's Flood Map for Planning should be used for all planning purposes, as per the FRCC-PPG.

5.3 Surface water flooding

Surface water flood risk is afforded equal standing in importance and consideration as fluvial and tidal flood risk, given the increase in rainfall intensities due to climate change and the increase in impermeable surfacing due to development.

Surface water flooding, in the context of this SFRA, includes:

- **Surface water runoff (also known as pluvial flooding); and**
- **Sewer flooding**

There are certain locations, generally within urban areas, where the probability and consequence of pluvial and sewer flooding are more prominent due to the complex hydraulic interactions that exist in the urban environment. Urban watercourse connectivity, increased impermeable surfacing, sewer capacity, and the location and condition of highway gullies all have a major role to play in surface water flood risk.

Paragraph 013 of the FRCC-PPG states that SFRAs should address surface water flooding issues by identifying areas of surface water flooding and areas where there may be drainage issues that can cause surface water flooding. The EA's Risk of Flooding from Surface Water (RoFSW) map along with information within the LFRMS (see Section A.6.4 of Appendix A) should assist with this and various mitigative measures, i.e. SuDS, should be identified. Section 0 provides guidance on mitigation options and SuDS for developers.

It should be acknowledged that once an area is flooded during a large rainfall event, it is often difficult to identify the route, cause and ultimately the source of flooding without undertaking further site-specific and detailed investigations.

In the 2017 PFRA the number of properties susceptible to surface water flooding in South Ribble are 1,647 and 10,219 in Preston[7].

5.3.1 Pluvial flooding

Pluvial flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours. In these instances, the volume of water falling on permeable land can exceed infiltration rates in a short amount of time, resulting in the flow of water over land. Within urban areas, this intensity can be too great for the urban drainage network resulting in excess water flowing along roads, through properties and ponding in natural depressions. Areas at risk of pluvial flooding can, therefore, lie outside of the fluvial and tidal flood zones.

[7] https://webarchive.nationalarchives.gov.uk/20140328094439/http://www.environment-agency.gov.uk/research/planning/135532.aspx#10

Pluvial flooding within urban areas across the country will typically be associated with events greater than the 1 in 30 AEP (3.3%) design standard of new sewer systems. Some older sewer and highway drainage networks will have a lower capacity than what is required to mitigate for the 1 in 30 AEP event. There is also residual risk associated with these networks due to possible network failures, blockages or collapses.

Risk of Flooding from Surface Water dataset

The Risk of Flooding from Surface Water (RoFSW), formally referred to as the updated Flood Map for Surface Water (uFMfSW) is the third-generation national surface water flood map, produced by the EA, aimed at helping to identify areas where localised, flash flooding can cause problems even if the Main Rivers are not overflowing. The RoFSW, used in this SFRA to assess risk from surface water, has proved extremely useful in supplementing the EA Flood Map for Planning by identifying areas in Flood Zone 1, which may have critical drainage problems. However, any sites identified to be at risk from surface water flooding should be assessed in more detail, following this SFRA, as the RoFSW is a national-scale dataset and may therefore over-represent.

The RoFSW includes surface water flood outlines, depths, velocities and hazards for the following events:

- 1 in 30 AEP event (3.3%) – high risk
- 1 in 100 AEP event (1%) – medium risk
- 1 in 1000 AEP event (0.1%) – low risk

The National Modelling and Mapping Method Statement, May 2013 details the methodology applied in producing the map. The RoFSW is displayed on the SFRA maps.

5.3.2 Sewer flooding

Within the North West, the public sewerage network is made up of around 50% of combined systems, which serve residential homes, and businesses, conveying waste and surface water to waste water treatment works. Combined Sewer Overflows, (CSOs) provide relief of the sewer network during times of heavy rainfall and high flows in the network, through an Environment Agency consented discharge to the environment. If areas are not served by a combined sewer system, they are served by separated foul and surface water sewers which also convey the wastewater to wastewater treatment works and the surface water discharges into the local environment.

There are a number of reasons why flooding from a public sewer network can occur:

1. Hydraulic Incapacity
   a. When the flow entering the network exceeds its design capacity.
   b. Surface water outfalls or CSO outfalls can become restricted due to high water levels in the receiving watercourse, resulting in the water not being to discharge
2. Flooding Other Causes
   a. Flooding can also occur through other means such as a result of a blockage within the sewer, which is defined as sewer misuse
   b. Collapse of the sewer or burst of a rising main, and also mechanical or electrical faults with pumping stations.

5.3.3 Areas with Critical Drainage Problems and Critical Drainage Areas

The EA can designate Areas with Critical Drainage Problems (ACDPs). ACDPs may be designated where the EA is aware that development within a certain catchment / drainage area could have detrimental impacts on fluvial flood risk downstream, and / or where the EA has identified existing fluvial flood risk issues that could be exacerbated

by upstream activities. In these instances, the EA would work with the LLFA and LPA to ensure that adequate surface water management measures are incorporated into new development to help mitigate fluvial flood risk.

EA guidance on carrying out Flood Risk Assessments[8] states that a FRA should be carried out for sites in Flood Zone 1 that are…

"…in an area with critical drainage problems as notified by the Environment Agency."

This statement refers to sites within an ACDP, not a CDA. At the time of writing there are no ACDPs or CDAs in the CLA area.

CDAs can be designated by LPAs or LLFAs for their own purposes. The EA do not have to be consulted on sites that are within a CDA if such sites are in Flood Zone 1.

5.3.4 Locally agreed surface water information

EA guidance, from within the Flood and Water Management Act (FWMA) (2010)[9], on using surface water flood risk information recommends that LCC, as a LLFA, should:

"…review, discuss, agree and record, with the Environment Agency, Water Companies, Internal Drainage Boards and other interested parties, what surface water flood data best represents their local conditions. This will then be known as locally agreed surface water information".

Following on from the LLFA consultation on the RoFSW in 2013 before its release, the EA stated that the Flood Map for Surface Water (2010) and the Areas Susceptible to Surface Water Flooding (2008) maps do not meet the requirements of the Flood Risk Regulations and are not compatible with the 2013 RoFSW mapping. Consequently, these datasets cannot be used as 'locally agreed surface water information'.

Locally agreed surface water information either consists of:

- The RoFSW map, or
- Compatible local mapping if it exists i.e. from a SWMP, or
- A combination of both these datasets for defined locations in the LLFA area.

The CLA should consider the RoFSW to be its locally agreed surface water flood information as this is the latest, most robust surface water flood map available for the district, at the time of writing. See Section A.6.4 of Appendix A for more information on Surface Water Management Plans for the Central Lancashire area.

5.4 Groundwater flooding

Groundwater flooding is caused by the emergence of water from beneath the ground, either at point or diffuse locations. The occurrence of groundwater flooding is usually local and unlike flooding from rivers and the sea, does not generally pose a significant risk to life due to the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas, and can pose further risks to the environment and ground stability.

There are several mechanisms that increase the risk of groundwater flooding including prolonged rainfall, high in-bank river levels, artificial structures, groundwater rebound and mine water rebound. Properties with basements or cellars or properties that are located within areas deemed to be susceptible to groundwater flooding are at particular risk. Development within areas that are susceptible to groundwater flooding will generally not be suited to infiltration SuDS components; however, this is dependent on

[8] https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zone-1-and-critical-drainage-areas
[9] https://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf

detailed site investigation and site-specific risk assessment at planning application stage.

This SFRA uses groundwater data in the form of JBA's 5m groundwater map, which provides a general broad-scale assessment of the groundwater flood hazard. The map is categorised by grid code where each code is explained in Table 5-2.

Groundwater head difference (m)*	Grid Code	Class label
0 to 0.025	4	Groundwater levels are either at very near (within 0.025m of) the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	3	Groundwater levels are between 0.025m and 0.5m below the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	2	Groundwater levels are between 0.5m and 5m below the ground surface in the 100-year return period flood event. There is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely.
>5	1	Groundwater levels are at least 5m below the ground surface in the 100-year return period flood event. Flooding from groundwater is not likely.
N/A	0	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
***Difference is defined as ground surface in mAOD (metres above ordnance datum) minus modelled groundwater table in mAOD.**		

Table 5-2: Groundwater flood hazard classification of JBA groundwater map

This dataset shows that the areas with the highest levels of groundwater vulnerability are located mainly within Chorley Borough Council's region with the majority being focused around the east, particularly in Withnell and along the M61 by Lower Copthurst, High Copthurst, Knowley, and Little Knowley. To the south west of the CBC region there is an area of high vulnerability near Mawdesley and Eccleston. There are also areas of high vulnerability along the Preston/South Ribble boundary following the River Ribble, and along the South Ribble/Chorley boundary by Higher Walton, Gregson Lane and Hoghton. There are also varied levels of vulnerability around Preston city centre. Most of the CLA region is classified as having very little or no risk from groundwater.

It is important to ensure that future development is not placed at unnecessary risk therefore groundwater flood risk should be considered on a site by site basis in development planning.

Groundwater flood risk should be considered particularly when determining the suitability of SuDS components as a way of managing surface water flood risk as part of their Sustainable Drainage Strategy. Developers should consult with the relevant LPA, the LLFA and UU at an early stage of the assessment.

The groundwater vulnerability dataset is shown on the SFRA Maps in Appendix B.

5.5 Canal and reservoir flood risk

5.5.1 Canals

Non-natural or artificial sources of flooding can include canals where water is retained above natural ground level. The risk of flooding along a canal is considered to be residual and is dependent on a number of factors. As canals are manmade systems that are heavily controlled, it is unlikely they will respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with residual risks, similar to those associated with river defences, such as overtopping of canal banks, breaching of embanked reaches or asset (gate) failure as highlighted in Table 5-3. Canals can also have a significant interaction with other sources, such as watercourses that feed them and minor watercourses or drains that cross underneath.

Potential Mechanism	Significant Factors
Leakage causing erosion and rupture of canal lining leading to breach	Embankments Sidelong ground Culverts Aqueduct approaches
Collapse of structures carrying the canal above natural ground level	Aqueducts Large diameter culverts Structural deterioration or accidental damage
Overtopping of canal banks	Low freeboard Waste weirs
Blockage or collapse of conduits	Culverts

Table 5-3: Canal flooding

The risks associated with these events are also dependent on their potential failure location with the consequence of flooding higher where floodwater could cause the greatest harm due to the presence of local highways and adjacent property.

The Lancaster Canal runs south into the Preston boundary from Kendal; it was originally isolated from the rest of the national waterway network and was connected via the Ribble Link in 2002. The Ribble Link runs around the outskirts of Preston and flows into the River Ribble; the link connects the Lancaster Canal to the Leeds and Liverpool Canal. The Leeds and Liverpool Canal flows through the whole of Chorley before being connected to the Lancaster Canal via the Preston Link. Figure 5-1 below highlights the canal network passing through the boundary.

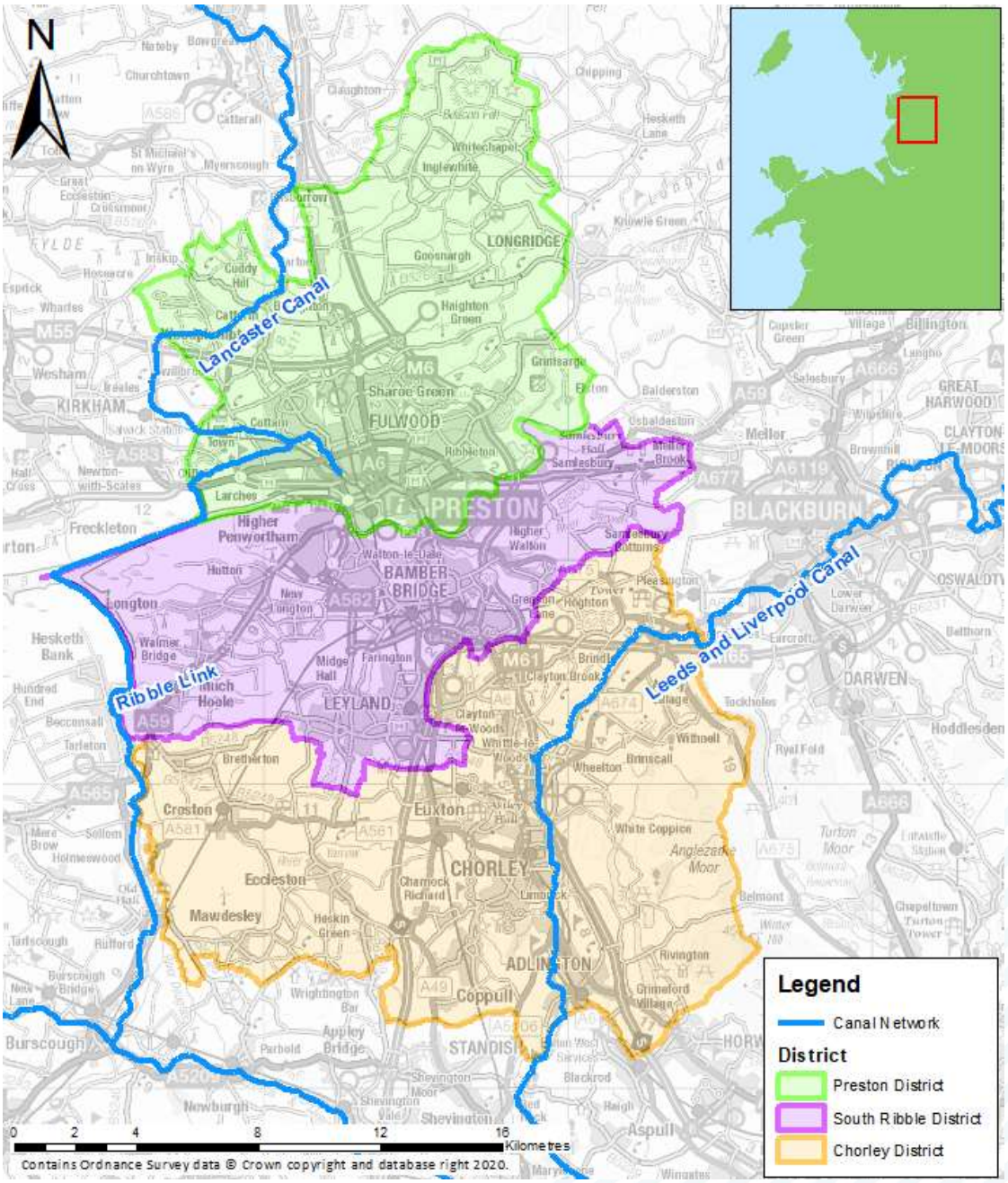

Figure 5-1: Canal network through CLA

5.5.2 Reservoirs

A reservoir can usually be described as an artificial lake where water is stored for use. Some reservoirs supply water for household and industrial use, others serve other purposes, for example, as fishing lakes or leisure facilities. Like canals, the risk of flooding associated with reservoirs is residual and is associated with failure of reservoir outfalls or breaching. This risk is reduced through regular maintenance by the operating authority. Reservoirs in the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

The EA is the enforcement authority for the Reservoirs Act 1975 in England and Wales, with the Flood and Water Management Act (2010) amending this Act. All large reservoirs must be regularly inspected and supervised by reservoir panel engineers.

LAs are responsible for coordinating emergency plans for reservoir flooding and ensuring communities are well prepared. The LPAs should work with other members of the Lancashire Resilience Forum to develop these plans. See Section 7.1.1 for more information on the Lancashire Resilience Forum.

Paragraph 014 of the FRCC-PPG states that, in relation to development planning and reservoir dam failure:

"the local planning authority will need to evaluate the potential damage to buildings or loss of life in the event of a dam failure, compared to other risks, when considering development downstream of a reservoir. Local planning authorities will also need to evaluate in Strategic Flood Risk Assessments (and when applying the Sequential Test) how an impounding reservoir will modify existing flood risk in the event of a flood in the catchment it is located within, and/or whether emergency draw-down of the reservoir will add to the extent of flooding."

5.5.3 Reservoir Flood Map (RFM)

The EA has produced Reservoir Flood Maps (RFM) for all large reservoirs that they regulated under the Reservoirs Act 1975 (reservoirs that hold over 25,000 cubic metres of water). The FWMA updated the Reservoirs Act and targeted a reduction in the capacity at which reservoirs should be regulated from 25,000m^3 to 10,000m^3. This reduction is, at the time of writing, yet to be confirmed meaning the requirements of the Reservoirs Act 1975 should still be adhered to.

In September 2016, the EA produced a RFM guide 'Explanatory Note on Reservoir Flood Maps for Local Resilience Forums – Version 5[10]' which provides information on how the maps were produced and what they contain.

The RFM can be viewed nationally at:

https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

The RFM shows that there are 26 reservoirs within the Central Lancashire boundary[11]. The RFM extent shows the worst credible area that is susceptible to dam breach flooding. The map should be used to prioritise areas for evacuation/early warning. It is worth considering that reservoirs within the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

If development is proposed downstream of a reservoir, there will need to be an assessment of whether work is needed to improve the design or maintenance of the reservoir. Together with the reservoir undertakers, the LPA should look to avoid an intensification of development within the risk areas and/or ensure that reservoir undertakers can assess the cost implications of any reservoir safety improvements required due to changes in land use downstream of these assets.

The LPA will need to evaluate:

- The potential damage to buildings or loss of life in the event of dam failure, compared to other risks;
- How an impounding reservoir will modify existing flood risk in the event of a flood in the catchment is located within, and/or whether emergency draw-down of the reservoir will add to the extent of flooding;
- Emergency planning requirements with appropriate officers to ensure safe, sustainable development

[10] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/558441/LIT_6882.pdf
[11] https://www.lancashire.gov.uk/media/321179/Flood-Risk-Asset-Register.pdf

5.6 Historic flooding

As LLFA, LCC is required, under the FWMA, to maintain and update its historic flood incidents database following any flood incidents. The LLFA has a statutory responsibility to investigate and report upon any 'significant' flood events.

5.6.1 Lancashire County Council (LCC) historic flood data

LCC provided records of historic flooding in the Preston, South Ribble and Chorley District boundaries. Due to a lack of georeferenced data i.e. no National Grid References (NGR), several of these records have been unable to be mapped.

Whilst they are not mapped, the data could be used in support of the strategic response to identified sites where lasting or significant issues are picked up in the datasets, and could also be referred to in detailed responses from LCC to planning applications as they come forward.

5.6.2 United Utilities (UU) supplied historic drainage events

UU provided three shapefiles showing historic drainage incidents both internal and external hydraulic incidents, and drainage areas (everything which drains to a specific treatment works is known to be the drainage area). The drainage areas primarily remain in the centre of the CLA area with the internal and external hydraulic incidents being distributed across all three LPA areas. This data could not be mapped within this SFRA due to data protection.

5.6.3 Historic canal overtopping and breaches

According to the Canal and Rivers Trust, there are a few historic events that occurred within the CLA area; 13 overtopping events and 3 breach events. The majority of the overtopping events occurred on the Lancaster Canal with a total of 10 with the other 3 occurring on the Leeds and Liverpool Canal from 2009 to 2017. One breach event occurred on the Lancaster Canal in 1935 and two breach events on the Leeds and Liverpool Canal in 1940 and 1967. These events are shown spatially in Figure 5-2 below.

In Preston, a level 2 SFRA will be required to assess risk of breach of the Lancaster Canal if developments adjacent to the canal are proposed.

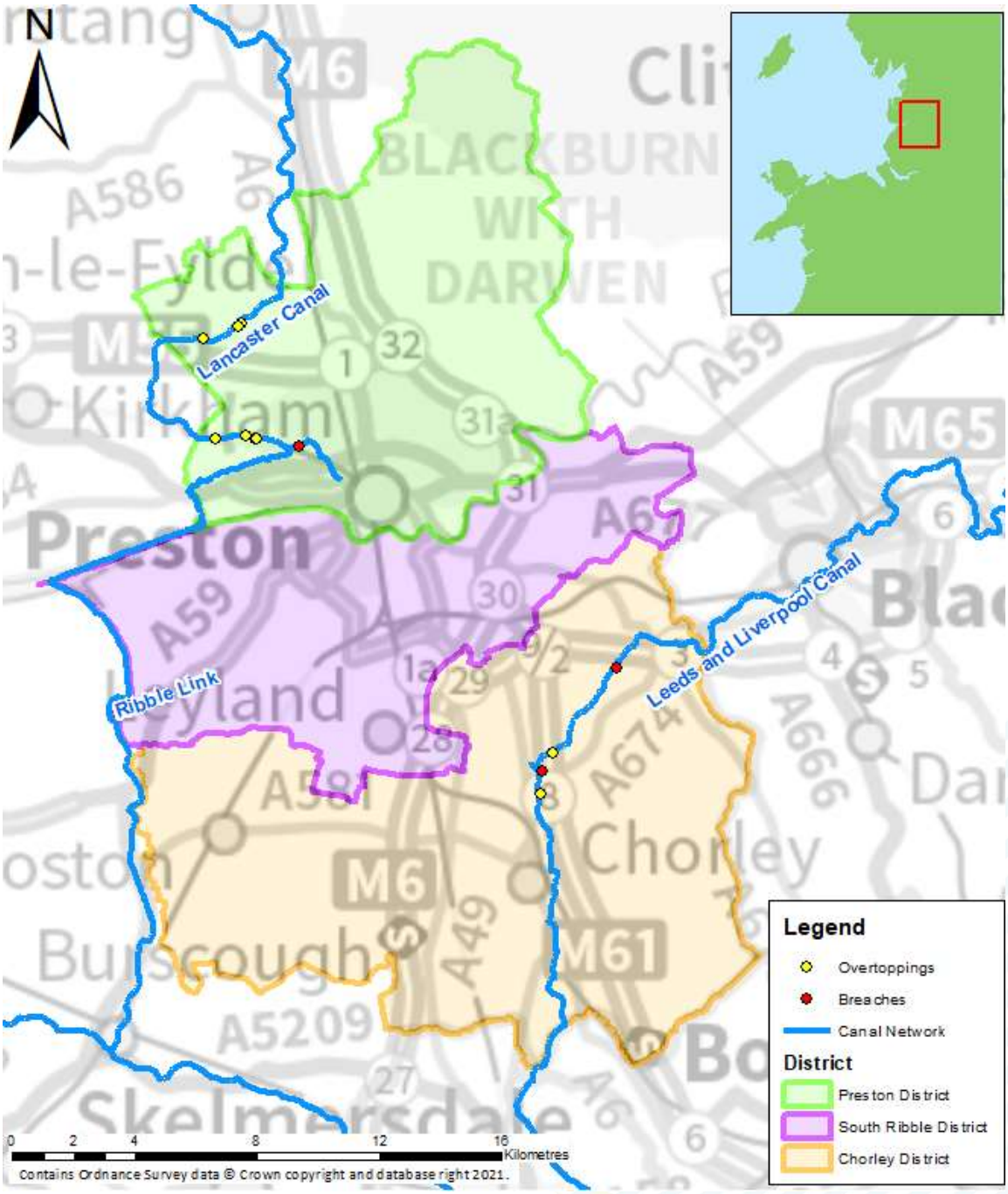

Figure 5-2: Historic canal overtopping and breach events within the CLA

5.6.4 Historic surface water flooding

Summer 2012

Sewer flooding is often caused by excess surface water entering the drainage network. Two flood events occurred in the summer of 2012: one in June (surface water) and one in September (fluvial). In June, rain intensities were recorded at 10-15 mm per hour in several rain gauge regions. 1,676 properties flooded across the North West due to overloaded sewers. 86 customer contacts reported wastewater issues in South Ribble and 58 in Chorley.

5.6.5 Historic pluvial/tidal flooding

September 2012

Parts of the region of Lancashire witnessed monthly average rainfall for September in two days. Severe rain intensities resulted in the River Wyre surcharging. Property flooding occurred during this event in addition to extensive field flooding in Fylde and the Wyre catchment.

November – December 2015 floods

The floods of December 2015, caused by Storm Desmond, inundated over 2,500 homes within 229 communities in Lancashire and turned lives of many hundreds of local people upside down[12]. Due to prolonged periods of heavy rainfall from a succession of Atlantic storms, all large main rivers (Ribble, Wyre, Lune and Douglas) surcharged simultaneously[13]. Flooding occurred from a number of additional sources in combination.

Roads were closed and there was significant damage to properties and infrastructure in a wide number of areas across the CLA. The association of British Insurers estimated that the final costs for homes, businesses and motor vehicles from flood damage, caused by storms Eva, Frank and Desmond in 2015, was £1.3 billion[14]. The personal impact on residents and communities such as; long-term health impacts and disruption is difficult to quantify.

Data on flooded properties from Storm Desmond on the 26th December 2015 have been mapped below, see Figure 5-3 and Figure 5-4.

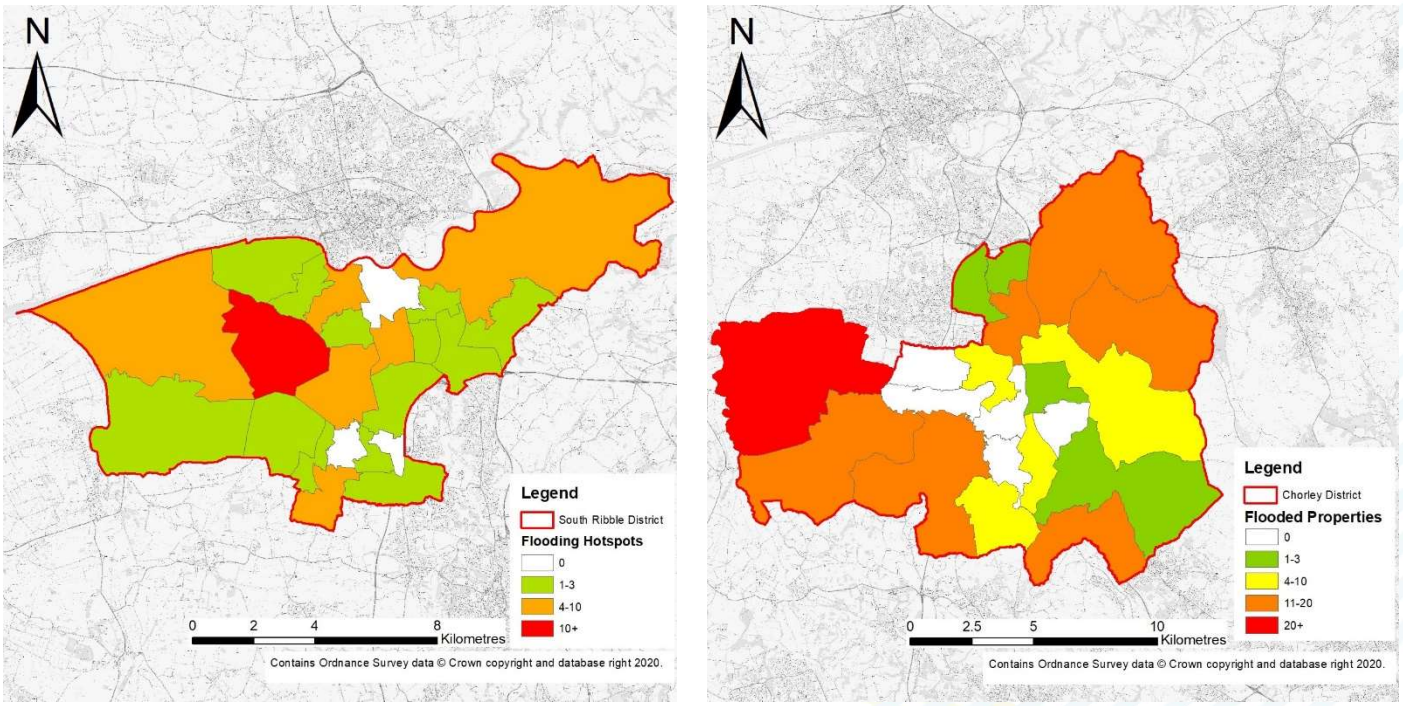

Figure 5-3: Final flooded property data from Storm Desmond for Chorley, South Ribble and Preston District

[12] https://www.lancashire.gov.uk/media/900010/section-19-flood-investigation-report-december-2015-floods.pdf
[13] Central Lancashire Local Flood Risk Management Strategy (LFRMS) (2016)
[14] https://www.lancashire.gov.uk/media/900010/section-19-flood-investigation-report-december-2015-floods.pdf

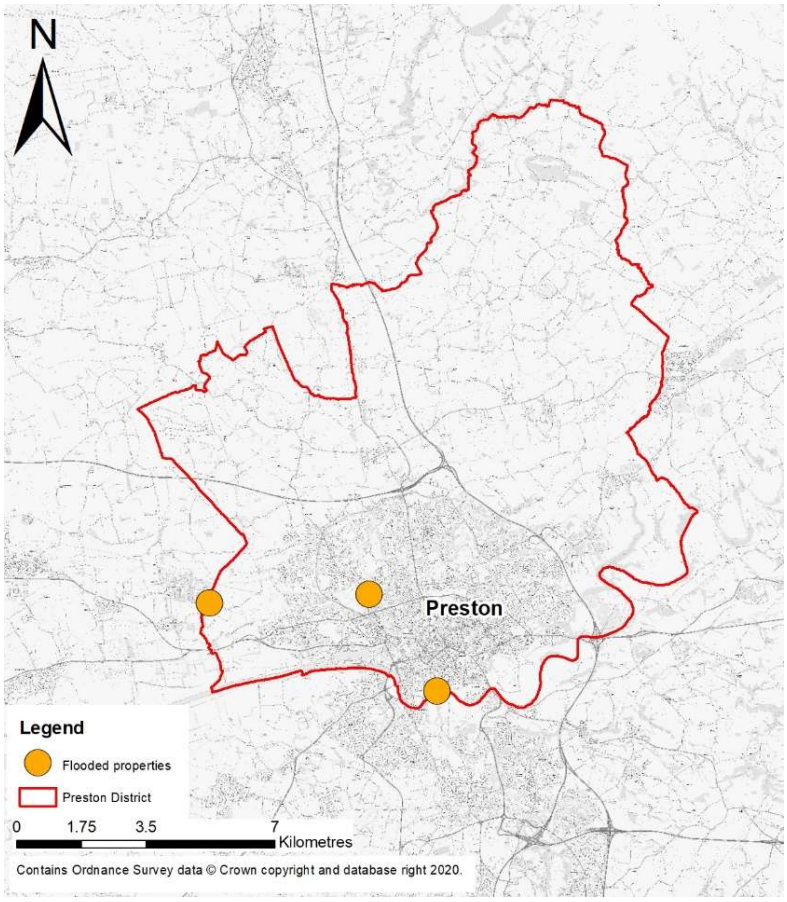

Figure 5-4: Distribution of flood properties from Storm Desmond within Preston District

November 2017 floods

In November 2017, an intense rainstorm travelled over the Irish Sea to the north-easterly extent of the Lancashire District, affecting Blackpool, Lancaster and Preston. Communities lying in the storm's path experienced extreme rainfall at greater intensities than those in the December 2015 floods. Over 900 homes within Lancashire were flooded and 70 homes evacuated overnight[15]. Many major roads that are used for emergency access including the M6 motorway and the A6 were also flooded. Transport was further disrupted due to the flooding of railway lines north of Preston resulting in cancellations.

5.6.6 EA Historic Flood Map (HFM)

The Historic Flood Map (HFM) is a spatial dataset showing the maximum extent of all recorded historic flood outlines from river, sea and groundwater, and shows areas of land that have previously been flooded across England. Records began in 1946 when predecessor bodies to the EA started collecting information about flooding incidents. The HFM accounts for the presence of defences, structures, and other infrastructure where such existed at the time of flooding. It includes flood extents that may have been affected by overtopping, breaches or blockages. It is also possible that historic flood extents may have changed and that some areas would not flood at present i.e. if a flood defence has been built.

[15] https://www.lancashire.gov.uk/media/911617/covering-report-nov-2017-section-19.pdf

The HFM does not contain any information regarding the specific flood source, return period or date of flooding, nor does the absence of the HFM in an area mean that the area has never flooded, only that records of historic flooding do not exist. The Recorded Flood Outlines (RFO) dataset however does include details of flood events. The difference between the two datasets is that the HFM only contains flood outlines that are 'considered and accepted' by the EA following adequate verification using certain criteria. For those areas not within an HFM or RFO outline, this does not mean these areas have never flooded, only that the EA does not have records of flooding in the area.

The HFM shows areas of flooding being centred along the River Ribble on the border of the Preston and South Ribble boundary recorded with flood source as from main rivers (River Ribble) or drainage, and around the River Yarrow by the town of Croston within Chorley Borough Council's area with flood source stated as main river (River Yarrow).

The HFM and RFO datasets are shown on the SFRA maps in Appendix B.

5.7 Flood risk management

The aim of this section of the SFRA is to identify existing Flood Risk Management (FRM) assets and previous / proposed FRM schemes. The location, condition and design standard of existing assets will have a significant impact on actual flood risk mechanisms. Whilst future schemes in high flood risk areas carry the possibility of reducing the probability of flood events and reducing the overall level of risk. Both existing assets and future schemes will have a further impact on the type, form and location of new development or regeneration.

5.7.1 EA inspected assets (Spatial Flood Defences)

The EA maintain a spatial dataset called the Spatial Flood Defences dataset. This national dataset contains such information as:

- Asset type (flood wall, embankment, high ground, demountable defence);
- Flood source (fluvial, tidal, fluvial and tidal combined)
- Design Standard of Protection (SoP);
- Asset length;
- Asset age;
- Asset location; and
- Asset condition. See Table 5-4 for condition assessment grades using the EA's Condition Assessment Manual[16] (CAM).

The design standard of protection (SoP) for a flood defence is a measure of how much protection a flood defence gives. If the SoP is 100, the defence protects against a flood with the probability of occurring once in 100 years.

[16] Environment Agency. (2012). Visual Inspection Condition Grades. In: EA Condition Assessment Manual. Bristol: Environment Agency. p9.

Grade	Rating	Description
1	Very Good	Cosmetic defects that will have no impact on performance
2	Good	Minor defects that will not reduce the overall performance of the asset
3	Fair	Defects that could reduce the performance of the asset
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation needed.
5	Very Poor	Severe defects resulting in complete performance failure.

Table 5-4: EA flood defence condition assessment grades

Defence Location	Asset Type	Flood Source	Watercourse	Design Standard	Condition
Croston along the River Lostock	7 Embankments	Fluvial/ Tidal	River Lostock	50 (3) 70 (3) 150 (1)	3 (7)
Along the River Ribble between Preston/South Ribble LPA boundaries	5 Flood Walls 22 Embankments	Fluvial/ Tidal	River Ribble	25 (2) 70 (2) 75 (2) 100 (21)	2 (1) 3 (20) 4 (6)
Longton and Walmer Bridge	16 Embankments	Fluvial/ Tidal	River Ribble	25 (2) 100 (14)	3 (16)
River Douglas near Sollom and Croston	15 Embankments	Tidal	River Douglas	25 (1) 100 (14)	3 (14)
Number in brackets = number of assets					

Table 5-5: Major flood defences in Central Lancashire area

The Spatial Flood Defences dataset is show on the SFRA maps in Appendix B. In total, there are 78 flood defence assets within the CLA area, according to the EA's spatial flood defence dataset. Table 5-5 highlights the main locations within the area that have significant FRM assets, the majority of which are located on the Rivers Ribble, Lostock and Douglas, defending the urban areas that are vulnerable to flood risk within Central Lancashire.

Of the 78 constructed fluvial flood defence assets within the CLA area, 5 are floodwalls and 73 are flood embankments. The floodwalls aim to prevent the flooding from the River Ribble for the areas of Broadgate, Walton-le-Dale, and Frenchwood. 4 of the floodwalls have a design standard of 100 and can therefore be described as providing a 1 in 100-year standard of protection, with 1 floodwall having a design standard of 70. 3 floodwalls are in 'Fair' condition according to the EA's Condition Assessment Manual (CAM) (as discussed in Table 5-4) with defences having 'defects that could reduce the performance of the asset' and 2 floodwalls having a 'Poor' condition.

The embankment defences are mainly located along the River Douglas, Lostock and Ribble, and look to be designed to protect properties and agricultural land that could be affected by fluvial / tidal flooding.

In 2017 Conservefor were hired by The River Ribble Trust to improve a section along the River Ribble. This project included re-locating the existing embankment, and re-profiling eroded riverbank. Vegetation was secured in the new embankment for support and wider environmental benefits[17]. 330 yards of embankments on the River Douglas raised the standard of protection of 1 in 20 years and were built to provide protection from flooding to around 610 houses[18].

The most common condition associated with the defences in Central Lancashire is 3, which is considered 'Fair' according to the EA's CAM with defences 'having defects that could reduce the performance of the asset'.

As well as the ownership and maintenance of a network of formal defence structures, the EA carries out a number of other flood risk management activities that help to reduce the probability of flooding, whilst also addressing the consequences of flooding. These include:

- Maintaining and improving the existing flood defences, structures and watercourses.
- Enforcement and maintenance where riparian owners carry out work that may be detrimental to flood risk.
- Identifying and promoting new Flood Risk Management Schemes (FRMS) where appropriate.
- Working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is permitted relative to the scale of flood risk.
- Operation of Floodline Warnings Direct and warning services for areas within designated Flood Warning Areas (FWA) or Flood Alert Areas (FAA). EA FWAs are shown on the SFRA maps in Appendix B.
- Promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and therefore are sufficiently prepared in the event of flooding.
- Promoting resilience and resistance measures for existing properties that are currently at flood risk or may be in the future as a result of climate change.

EA Areas Benefitting from Defences (ABD)

Alongside the Spatial Flood Defences dataset discussed above, the EA also publishes a spatial dataset showing the areas that benefit from major flood defences. ABDs show those areas that would benefit from the presence of defences in a 1% AEP fluvial or 0.5% AEP tidal flood event. The ABDs present within the CLA area are included on the SFRA maps in Appendix B and are also listed in Table 5-6.

The EA only maps defended areas that offer protection against a 1% AEP fluvial or 0.5% AEP tidal event, as required by the NPPF. This does not mean that only these areas are defended, but that other areas where defences may be present will have a lower standard of protection. ABDs do not take account of the effects of climate change and over time, the extent of an ABD will likely change as climate change reduces the standard of protection of existing defences.

[17] https://www.conservefor.co.uk/portfolio-item/1144/
[18] https://www.hydro-int.com/en/case-studies/hydro-brake%c2%ae-flood-protects-over-600-properties-wigan-0

Areas Impacted	District	Unitary Ward	Sites Impacted	Area (ha)	NGR
Along Wolseley Road and Connaught Road	Preston District	City Centre Ward	-	1.52	SD531592 8395
Between Christ the King Catholic School and River Ribble	Preston District	Fishwick & Frenchwood Ward	-	17.35	SD547352 8534
Between A583 and River Ribble, south east of Clifton	Preston District	Lea & Larches Ward	-	76.91	SD472432 9251
Along Savick Brook in Haslam Park	Preston District	Cadley Ward	19P003, 19P009	1.12	SD519173 1197
Along Savick Brook through Cadley	Preston District	Greyfriars Ward	19P006	1.29	SD527633 1525
Open area between River Ribble, Longton and Hutton	South Ribble District	Longton & Hutton West Ward	-	545.87	SD479082 7812
Along Parkgate Drive	South Ribble District	Seven Stars Ward	-	0.09	SD535492 1370
North of Mill Lane, adjacent to Bannister Brook	South Ribble District	Broadfield Ward	-	0.59	SD528662 1923
Land on right bank of meandering River Ribble, west of Much Hoole	South Ribble District	Hoole Ward	-	50.26	SD456392 2242
Land on straight River Ribble, west of Much Hoole	South Ribble District	Hoole Ward	-	29.10	SD459572 3583
Between River Ribble and Darwen at Walton le-Dale	South Ribble District	Samlesbury & Walton Ward	19S070, 19S105	22.20	SD557982 8010
North of Higher Walton Community Centre	South Ribble District	Samlesbury & Walton Ward	19S294, 19S295	3.73	SD577332 7768
Between A6 and River Ribble at Walton le-Dale	South Ribble District	Samlesbury & Walton Ward	19S305	18.26	SD553052 8334
Land between Croston and Mawdesley, west of railway line	Chorley District	Croston, Mawdesley & Euxton South Ward	-	85.68	SD478571 6106
East of River Yarrow confluence near Syd Brook Lane	Chorley District	Eccleston, Heskin & Charnock Richard Ward	19C106	6.73	SD501741 7738
West of River Yarrow confluence near Syd Brook Lane	Chorley District	Croston, Mawdesley & Euxton South Ward	19C035, 19C385, 19C340, 19C341	2.66	SD499831 7689
Along River Yarrow, near confluence at Syd Brook Lane	Chorley District	Croston, Mawdesley & Euxton South Ward	-	3.09	SD498911 7939
South of River Yarrow at Turflands and Moss Lane	Chorley District	Croston, Mawdesley &	-	49.53	SD485411 8163

Areas Impacted	District	Unitary Ward	Sites Impacted	Area (ha)	NGR
		Euxton South Ward			
North of River Yarrow within Croston	Chorley District	Croston, Mawdesley & Euxton South Ward	19C083, 19C260x, 19C259x, 19C089	16.27	SD488611 8537
Land between River Douglas, Yarrow and railway line	Chorley District	Croston, Mawdesley & Euxton South Ward	-	233.42	SD473361 7637
North of River Douglas and Yarrow confluence	Chorley District	Croston, Mawdesley & Euxton South Ward	-	131.26	SD470391 9277
Land between A59 and River Douglas, between Rufford and Sollom	Chorley District	Croston, Mawdesley & Euxton South Ward	-	239.84	SD461501 7868
Right bank of River Douglas near Tarleton	Chorley District	Croston, Mawdesley & Euxton South Ward	-	4.06	SD459342 1128

Table 5-6 ABDs within CLA boundary

5.7.2 LCC assets and future Flood Risk Management schemes

Lancashire County Council, as Highway Authority, own and maintain a number of assets throughout the area which includes culverts, bridge structures, gullies, weirs and trash screens. These assets may lie along watercourses within smaller urban areas where watercourses may have been culverted or diverted, or within rural areas. All these assets can have flood risk management functions as well as an effect on flood risk if they become blocked or fail. In most cases responsibility lies with the riparian owner / landowner.

Lancashire County Council (as the LLFA), under the provisions of the FWMA, has a duty to maintain a register of structures or features that have a significant effect on flood risk, including details of ownership and condition as a minimum. The Asset Register should include those features relevant to flood risk management function including feature type, description of principal materials, location, measurements (height, length, width, diameter) and condition grade.

There are five proposed flood defence schemes for Preston and South Ribble that are in the preferred option stages with defences proposed such as embankments, solid walls, solid walls with glass panels and floodgates. The general timescales aim to see completion of the scheme by Winter 2023 following the approval of detailed scheme in Summer 2021. More information on the schemes can be found https://thefloodhub.co.uk/psr/#section-1

- Phase 1: Broadgate – River Ribble
- Phase 2: Lower Penwortham – River Ribble
- Phase 3: Frenchwood – River Ribble
- Phase 4: Capitol Centre & Walton-le-Dale – River Darwen
- Phase 5: Higher Walton – River Darwen

5.7.3 Water company assets

The majority of sewerage infrastructure within Central Lancashire is likely to be based on Victorian sewers from which there may be a risk of localised flooding associated with the existing drainage capacity and sewer system. United Utilities are responsible for the management of the public sewerage system for their areas. This includes both domestic surface water and foul sewerage.

United Utilities wastewater asset base includes Wastewater Treatment Works, public sewerage network which encompasses domestic foul and surface water sewers, combined sewers, combined sewer overflows (CSOs), pumping stations, detention tanks, and any related infrastructure such as manholes situated on the public sewerage network.

5.7.4 Natural Flood Management / Working with Natural Processes

Natural flood management (NFM) or Working with Natural Processes (WwNP) is a type of flood risk management used to protect, restore and re-naturalise the function of catchments and rivers to reduce flood and coastal erosion risk. NFM is a component of Sustainable Drainage Systems (SuDS). WwNP has the potential to provide environmentally sensitive approaches to minimising flood risk, to reduce flood risk in areas where hard flood defences are not feasible and to increase the lifespan of existing flood defences. NFM and WwNP are used interchangeably in the UK though the term WwNP will be used throughout this report. As part of the evidence base for a site-specific FRA, defining NFM in the SFRA and identifying it as an alternative to hard engineering solutions is important to assist developers undertaking FRAs and identify any appropriate mitigation measures.

A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes in order to store or slow down floodwaters before they can damage flood risk receptors (e.g. people, property, infrastructure, etc.). WwNP involves taking action to manage flood and coastal erosion risk by protecting, restoring and emulating the natural regulating functions of catchments, rivers, floodplains and coasts (not applicable). Applicable NFM techniques in the CLA, particularly in the Wyre catchment were identified in project by the Environment Agency that was funded by DEFRA. Potential NFM options in this catchment included: Riparian zone management, slow and store floodwater, large woody debris and woodland planting. These measures would be applicable due to the fluvial flood risk in this catchment[19].

United Utilities in conjunction with the Rivers Trust, Cooperative Insurance and the Environment Agency have gained interest in understanding the potential for Natural Flood Management in a catchment in Lancashire, to protect communities which are regularly flooded by the catchment that drains water from 5 rivers.

The Environment Agency have also worked on the Ribble Catchment Flood Management Plan (RCFMP), which sets out a sustainable flood risk management plan for the coming 50-100 years[20]. LCC have been involved in this project and have actively engaged with key partners including: Craven District Council, Ribble Valley Borough Council, Pendle Borough Council, Natural England, RSPB and landowners, in the Ribble and Hodder catchments.

Both the European Commission and UK Government are actively encouraging the implementation of WwNP measures within catchments and coastal areas in order to assist in the delivery of the requirements of various EC Directives relating to broader environmental protection and national policies. It is fully expected that the sustained

[19] https://ecosystemsknowledge.net/natcap-project/lancashire-natural-flood-management-modelling-project

[20] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/293727/Ribble_Catchment_Flood_Management_Plan.pdf

interest in WwNP implementation across the UK will continue in the post-Brexit era as a fundamental component of the flood risk management tool kit.

Evidence base for WwNP to reduce flood risk

There has been much research on WwNP, but to date it has never been synthesised into one location. This has meant that it has been hard for flood risk managers to access up-to-date information on WwNP measures and to understand their potential benefits. The EA has now produced the WwNP evidence base which includes three interlinked projects:

- Evidence directory
- Mapping the potential for WwNP
- Research gaps

The evidence base can be accessed via:

https://www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk

The evidence base can be used by those planning projects which include WwNP measures to help understand:

- Their potential FCRM benefits and multiple benefits
- Any gaps in knowledge
- Where it has been done before and any lessons learnt
- Where in a catchment they might not be most effective

The evidence directory presents the evidence base, setting out the scientific evidence underpinning it. Its purpose is to help flood risk management practitioners and other responsible bodies access information which explains what is known and what is not about the effectiveness of the measures from a flood risk perspective. There is also a guidance document which sits alongside the evidence directory and the maps which explains how to use them to help make the case for implementing WwNP when developing business cases.

Mapping the potential for WwNP

JBA Trust has worked with Lancaster Environment Centre (LEC) to produce an interactive catalogue of nature-based flood risk management projects in the UK. This map includes a catalogue of projects where WwNP is being applied on the ground or being considered as an option to reduce flood risk. Additionally, the map includes a set of layers that indicates the potential areas where WwNP would be beneficial based on research by the EA, Defra and NRW. The interactive map is available using this link:

http://wwnp-dev.jbahosting.com/

JBA Consulting has also been working with the EA and LEC to update national maps of Potential for Working with Natural Processes. LEC has developed a new spatial model of slowly permeable soils to identify areas where shrub or tree-planting could increase hydrological losses and slow the flow based on British Geological Survey (BGS) 1:50k maps, who have also agreed to an open government license for the maps. The new national maps for England make use of different mapping datasets and highlight potential areas for tree-planting (for three different types of planting), runoff attenuation storage, gully blocking, and floodplain reconnection. The maps can be used to signpost areas of potential, and do not take into account issues such as land-ownership and drainage infrastructure, but they may well help start the conversation and give indicative estimates of, for example, additional distributed storage in upstream catchments.

These maps are intended to be used alongside the evidence directory to help practitioners think about the types of measure that may work in a catchment and the best places in which to locate them. There are limitations with the maps, however it is a useful tool to help start dialogue with key partners. The maps are provided as spatial data for use in GIS and also interactive GeoPDF format, supported by a user guide and a detailed technical guide.

WWNP Type	Open data licence details
Floodplain reconnection	• Risk of Flooding from Rivers and Seas (April 2017) • Data derived from the Detailed River Network, which is not displayed, rescinding the licence requirements for displaying the dataset (to be superseded by OS Water Network but not available for project in time). • Constraints data
Run-off attenuation features	• Data derived from Risk of Flooding from Surface Water (Depth 1 percent annual chance and Depth 3.3 percent annual chance) (October 2013). The original data is not displayed, due to licensing restrictions.[2] • Constraints data • Gully blocking potential (a subset of run-off attenuation features on steeper ground) • Data derived from OS Terrain 50 (2016) to classify each run-off attenuation feature based on median slope.
Tree planting (3 categories)	• Floodplain: Flood Zone 2 from Flood Map for Planning (April 2016) and new constraints layer • Riparian: 50m buffer OS water features from Section 2.2.3 with constraints layer • Wider catchment woodland: - Based on slowly permeable soils. - BGS Geology 50,000 Superficial and Bedrock layers (both V8, 2017). Used with new science to derive new 100m gridded open data. This new layer can be used to signpost areas of SLOWLY PERMEABLE SOILS and can be checked in more detail on the BGS portal. - To the north of the line of Anglian glaciation, the presence of till-diamicton has been shown to be a strong predictor of slowly permeable soils. - To the south of this line, particular bedrock geologies have shown a similarly strong spatial relationship to the presence of slowly permeable soils.

Table 5-7: WwNP measures and data[21]

[21] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/677592/Working_with_natural_processes_mapping_technical_report.pdf

The WwNP datasets are included on the SFRA Maps in Appendix B and should be used to highlight any sites or areas where the potential for WwNP should be investigated further as a means of flood mitigation:

- Floodplain Reconnection:
  - Floodplain Reconnection Potential – areas of low or very low probability based on the Risk of Flooding from Rivers and Sea dataset (see Section 5.2.3), which are in close proximity to a watercourse and that do not contain properties, are possible locations for floodplain reconnection. It may be that higher risk areas can be merged, depending on the local circumstances.
- Runoff Attenuation Features (Run-off attenuation features are based on the premise that areas of high flow accumulation in the RoFSW) maps are areas where the runoff hydrograph may be influenced by temporary storage if designed correctly):
  - Runoff Attenuation Features 1% AEP
  - Runoff Attenuation Features 3.3% AEP
- Tree Planting:
  - Floodplain Woodland Potential and Riparian Woodland Potential – woodland provides enhanced floodplain roughness that can dissipate the energy and momentum of a flood wave if planted to obstruct significant flow pathways. Riparian and floodplain tree planting are likely to be most effective if close to the watercourse in the floodplain, which is taken to be the 0.1% AEP flood extent (Flood Zone 2), and within a buffer of 50 metres of smaller watercourses where there is no flood mapping available. There is a constraints dataset that includes existing woodland.
  - Wider Catchment Woodland Potential – slowly permeable soils have a higher probability of generating 'infiltration-excess overland flow' and 'saturation overland flow'. These are best characterised by gleyed soils, so tree planting can open up the soil and lead to higher infiltration and reduction of overland flow production.

Limitations

The effectiveness of WwNP measures is site-specific and depends on many factors, including the location and scale at which they are used. It may not always be possible to guarantee that these measures alone will deliver a specified standard of defence. Consequently, flood risk management measures should be chosen from a number of options ranging from traditional forms of engineering through to more natural systems. The research gaps that need to be addressed to move WwNP into the mainstream are identified in the evidence directory.

WwNP in CLA

There are two NFM Masterplans in place for Chorley: Yarrow Meadow and Astley Park Reed Bed.

As part of the 10-year vision for the River Yarrow, the Yarrow Meadows site was identified by partners as being available to deliver multiple benefits to the river and community. Yarrow Meadow is approximately 20 ha in size, owned and managed by Chorley Council, it is in the river valley which runs the length of Yarrow Valley Way near Gillibrand. The delivery of the masterplan will incorporate a number of mitigation measures outlined in order to begin a change in classifications of WFD. This will include floodplain connectivity, bank rehabilitation, preservation or restoration of habitats, removal or softening of hard banks, inclusion of woody debris, non-native species eradication, woodland creation and woodland management.

As part of the Douglas Catchment Partnership Action Plan (April 2016), the Friends of Astley Park worked in partnership with Chorley Council, the EA, Highways England, Groundwork and Lancashire Wildlife Trust to create a new river channel at the Park Road end of the park which diverts the existing river through a quarter hectare of wet reed bed planted with Typha augistfolia and phragmites australis which remove pollutants from the water. The project was to improve biodiversity of the whole area through native woodland, wetland and meadow wildflower planting, tree planting and the installation of rock ramps which help to oxygenate water whilst still enabling fish to pass through the scheme. This project was completed in summer 2016.

5.7.5 EA flood risk management activities and Flood and Coastal Erosion Risk Management research and development

The FCERM Research and Development programme is run by the EA and Defra and aims to serve the needs of all flood and coastal operating authorities in England. The programme provides the key evidence, information, tools and techniques to:

- Inform the development of FCERM policy and strategy.
- Understand and assess coastal and flood risk and the processes by which these risks arise.
- Manage flood and coastal erosion assets in a sustainable way.
- Prepare for and manage flood events effectively.

Based on information publicly available from the EA, there are a number of completed, ongoing and proposed flood risk management work programmes applicable to Central Lancashire. Follow the link below for the latest news:

https://www.gov.uk/government/publications/programme-of-flood-and-coastal-erosion-risk-management-schemes

The only potential works in the area, at the time of writing, associated with the FCERM Development Programme includes:

- Croston Village FAS, opened in July 2017

6 Development and flood risk

6.1 Introduction

This section of the SFRA provides a strategic assessment of the suitability, relative to flood risk, of the assessed SHLAA sites to be considered through the Local Plan.

The information and guidance provided in this chapter (also supported by the SFRA Maps in Appendix B and the Development Site Assessment spreadsheet in Appendix C) can be used by the CLA to inform its Local Plan and provide the basis from which to apply the Sequential Approach in the development allocation and development management process.

There are several consequential development considerations which could come out of the site assessment sequential testing process. The CLA should refer to Appendix E and Appendix C, for details on the site assessments carried out for this SFRA.

The LPAs must use Appendix C to record their decisions on how to take each site forward or whether to remove a site from allocation, based on the evidence and strategic recommendations provided in this Level 1 SFRA. Recording their decisions in the Sites Assessment Spreadsheet demonstrates that a sequential, sustainable approach to development and flood risk has been adopted.

6.2 The Sequential Approach

The FRCC-PPG provides the basis for the Sequential Approach. It is this approach, integrated into all stages of the development planning process, which provides the opportunities to reduce flood risk to people, property, infrastructure and the environment to acceptable levels.

The approach is based around the FRM hierarchy, in which actions to avoid, substitute, control and mitigate flood risk is central. For example, it is important to assess the level of risk to an appropriate scale during the decision-making process, (starting with this Level 1 SFRA). Once this evidence has been provided, positive planning decisions can be made and effective FRM opportunities identified.

Figure 6-1 illustrates the FRM hierarchy with an example of how these may translate into each authorities' management decisions and actions.

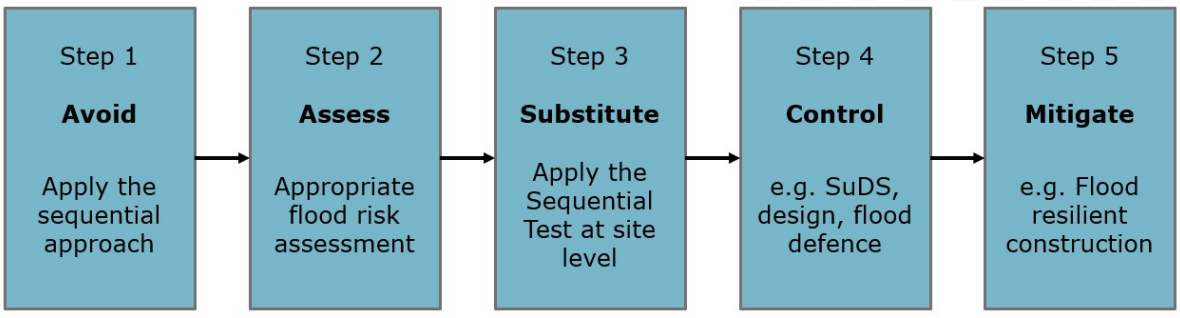

Figure 6-1: Flood risk management hierarchy

Using the EA's Flood Map for Planning, the overall aim of the Sequential Approach should be to steer new development to low risk Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, the flood risk vulnerability of land uses and reasonably available sites in Flood Zone 2 should be considered, applying the Exception Test if required.

Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in higher risk Flood Zone 3, be considered. This should take into

account the flood risk vulnerability of land uses and the likelihood of meeting the requirements of the Exception Test if required.

There are two different aims in carrying out the Sequential Approach depending on what stage of the planning system is being carried out i.e. LPAs allocating land in Local Plans or determining planning applications for development. This SFRA does not remove the need for a site-specific Flood Risk Assessment at a development management stage.

The following sections provide a guided discussion on why and how the Sequential Approach should be applied, including the specific requirements for undertaking Sequential and Exception Testing.

6.3 Local Plan Sequential & Exception Tests

The FRCC-PPG, para 019, states the aim of the Sequential Test is:

"…to steer new development to areas with the lowest probability of flooding. The flood zones as refined in the SFRA for the area provide the basis for applying the Test. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required."

The NPPF, paras 160-161, sets out the Exception Test as below:

"The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Both elements of the exception test should be satisfied for development to be allocated or permitted."

The LPA should seek to avoid inappropriate development in areas at risk of flooding by directing development away from areas at highest risk and ensuring that all development does not increase risk and where possible can help reduce risk from flooding to existing communities and development.

At a strategic level, this should be carried out as part of the LPA's Local Plan. This should be done broadly by:

1. Applying the Sequential Test and if the Sequential Test is passed, applying and passing the Exception Test, if required;
2. Safeguarding land from development that is required for current and future flood management (i.e. using potential for WwNP data);
3. Using opportunities offered by new development to reduce the causes and impacts of flooding;
4. Identifying where flood risk is expected to increase with climate change so that existing development may not be sustainable in the long term; and
5. Seeking opportunities to facilitate the relocation of development including housing to more sustainable locations.

Figure 6-2 illustrates the Sequential and Exception Tests as a process flow diagram using the information contained in this SFRA to assess sites put forward in the Local Plan against the EA's Flood Map for Planning flood zones and development vulnerability compatibilities.

This is a stepwise process, but a challenging one, as a number of the criteria used are qualitative and based on experienced judgement. The process must be documented and evidence used to support decisions recorded.

This can be done using the development site assessment spreadsheets in Appendix C. This spreadsheet will help show that the LPA, through the SFRA, has applied the Sequential Test for sites at fluvial / tidal risk and also considered surface water flood risk in equal standing and thus considered development consideration options for each assessed SHLAA site.

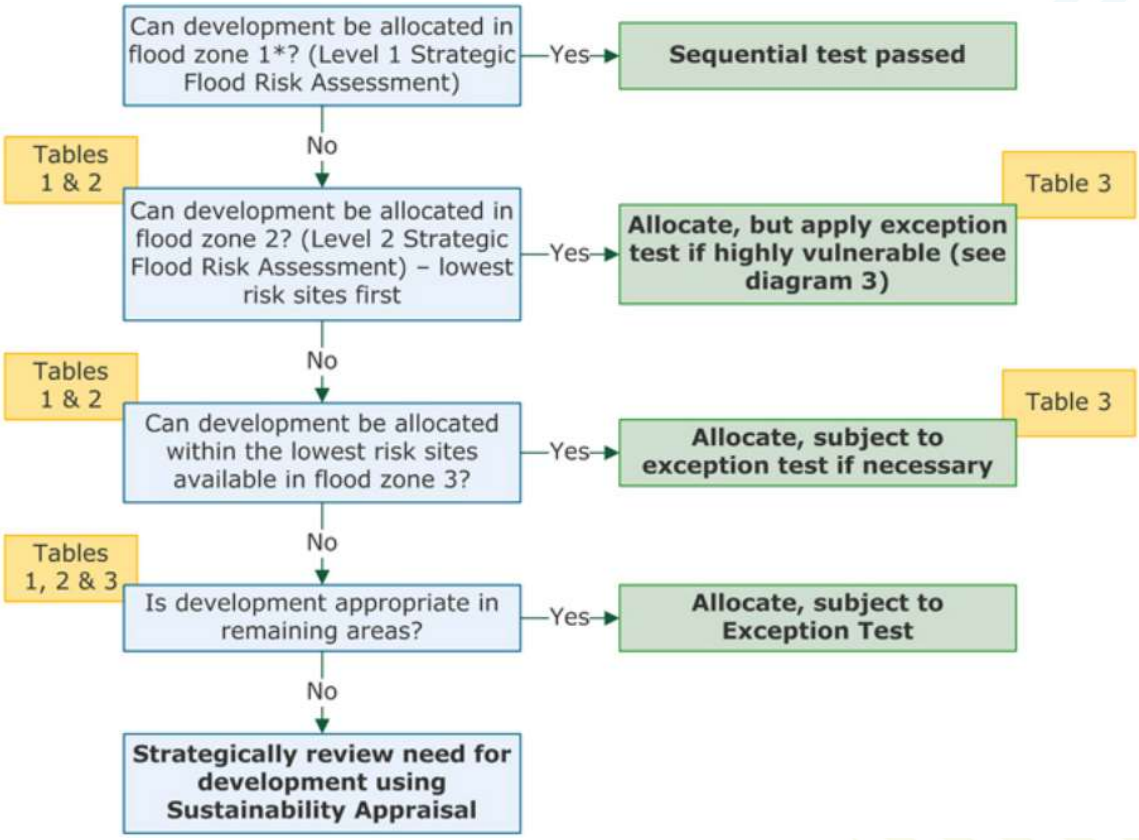

Figure 6-2: Local Plan sequential approach to site allocation[22]

**Other sources of flooding also need to be considered. For example, if the site is solely within FZ1 but is at risk from other sources and / or climate change impacts, the Sequential Test has not been satisfied.*

(Tables 1, 2, 3 refer to the Flood Zone and flood risk tables of the FRCC-PPG Paragraphs 065-067).

The approach shown in Figure 6-2 provides an open demonstration of the Sequential Test being applied in line with the NPPF and the FRCC-PPG. The EA works with local authorities to agree locally specific approaches to the application of the Sequential Test and any local information or consultations with the LLFA should be taken into account.

This SFRA provides the main evidence required to carry out this process. The process also enables those sites that have passed the Sequential Test, and may require the Exception Test, to be identified. Following application of the Sequential Test the LPA and developers should refer to 'Table 3: Flood risk vulnerability and flood zone 'compatibility'' of the FRCC-PPG (Paragraph 067) when deciding whether a development may be suitable or not.

Although passing the Exception Test will require the completion of a site-specific FRA, the LPAs should be able to assess the **likelihood** of passing the test at the Local Plan level by using the information contained in this SFRA to answer the following questions:

a. Can development within higher risk areas be avoided or substituted?
b. Is flood risk associated with possible development sites considered too high; and will this mean that the criteria for Exception Testing are unachievable?
c. Can risk be sustainably managed through appropriate development techniques (resilience and resistance) and incorporate Sustainable Drainage Systems without compromising the viability of the development?
d. Can the site, and any residual risks to the site, be safely managed to ensure that its occupiers remain safe during times of flood if developed?

Where it is found to be unlikely that the Exception Test can be passed due to few wider sustainability benefits, the risk of flooding being too great, or the viability of the site being compromised by the level of flood risk management work required, then the LPA should consider avoiding the site altogether.

Once this process has been completed, the LPA should then be able to allocate appropriate development sites through its Local Plan as well as prepare flood risk policy including the requirement to prepare site-specific FRAs for all allocated sites that remain at risk of flooding or that are greater than one hectare in area.

6.4 Sustainability Appraisal and flood risk

The Sustainability Appraisal (Section A.5.4 of Appendix A) of the Local Plan should help to ensure that flood risk is taken into account at all stages of the planning process with a view to directing development away from areas at flood risk, now and in the future, by following the sequential approach to site allocation, as shown in Figure 6-2. The SA should be informed by this SFRA so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies, including policies for flood risk management to ensure that flood risk is not increased (para 010 FRCC-PPG).

[22] https://www.gov.uk/guidance/flood-risk-and-coastal-change#Sequential-Test-to-Local-Plan

By avoiding sites identified in this SFRA as being at significant risk, such as those listed in Section E.1.1 of Appendix E or by considering how changes in site layout can avoid those parts of a site at flood risk, such as any site included within Recommendation C (Section E.1.3 of Appendix E), the Council would be demonstrating a sustainable approach to development.

In terms of surface water, the same approach should be followed whereby those sites at highest risk should be avoided or site layout should be tailored to ensure sustainable development. This should involve investigation into appropriate Sustainable Drainage Systems techniques (see Section 6.7).

Surface water flood risk is considered with the same importance as fluvial and tidal flood risk.

Once the Local Planning Authority has decided on a final list of sites following application of the Sequential Test and, where required, the Exception Test following a Level 2 SFRA, a phased approach to development should be carried out to avoid any cumulative impacts that multiple developments may have on flood risk. For example, for any site where it is required, following the Sequential Test, to develop in Flood Zone 3, detailed modelling would be required to ascertain where displaced water, due to development, may flow and to calculate subsequent increases in downstream flood volumes. The modelling should investigate scenarios based on compensatory storage techniques to ensure that downstream or nearby sites are not adversely affected by development on other sites.

6.4.1 Cumulative impacts

The NPPF (2019) states that strategic policies…

"…should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards". (para 156)

Previous policies have relied on the assumption that if each individual development does not increase the risk of flooding, the cumulative impact will also be minimal. However, if there is a lot of development occurring within one catchment, particularly where there is flood risk to existing properties or where there are few opportunities for mitigation or proposed developments of less than 10 dwellings that are not referred to the LLFA for consultation under the DMPO 2015, the cumulative impact may be to change the flood response of the catchment.

Consideration should be given to the following:

- The importance of phasing development, as discussed in Section 6.4.4;
- Cross boundary impacts i.e. there should be dialogue between the CLA and neighbouring authorities upstream and downstream of the Council areas, particularly those also located within LCC's authority area. Decisions on flood risk management practices and development in these authorities should involve discussion with the CLA, given the possible downstream impacts of development on flood risk (see Section 6.4.2);
- Leaving space for floodwater, utilising greenspace for flood storage and slowing the flow (see Sections 6.4.3 and 5.7.4), with its potential links to biodiversity net gain and enhancing the natural environment for biodiversity; and
- SuDS and containment of surface water on-site as opposed to directing elsewhere (see Section 6.7).

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume, as well as the impact of increased flows on flood risk downstream. Whilst the loss of storage for individual

developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing all new development complies with the latest guidance and legislation relating to flood risk and sustainable drainage, in theory there should not be any increase in flood risk downstream.

Strategic solutions may include upstream flood storage, integrated major infrastructure/ Flood Risk Management schemes, new defences, and watercourse improvements as part of regeneration and enhancing green infrastructure, with opportunities for Working with Natural Processes and retrofitting of SuDS to existing development.

Through the Local Plan, the CLA should consider the following strategic solutions:

- Use of sustainable flood storage and mitigation schemes to store water and manage surface water runoff in locations that provide overall flood risk reduction as well as environmental benefits,
- In areas where flood risk is being managed effectively, there will be a need in the future to keep pace with increasing flood risk as a result of climate change,
- Assessment of long-term opportunities to move development away from the floodplain and to create blue/green river corridors with potential links to biodiversity net gain and enhancing the natural environment for biodiversity throughout the CLA area,
- Identification of opportunities to use areas of floodplain to store water during high flows, to reduce long-term dependence on engineered flood defences located both within and outside the CLA area,
- Safeguarding the natural floodplain from inappropriate development,
- Where possible, changes in land management should look to reduce runoff rates from development whilst maintaining or enhancing the capacity of the natural floodplain to retain water. Land management and uses that reduce runoff rates in upland areas should be supported,
- Development should maintain conveyance of watercourses through hamlets and villages to help reduce the impact of more frequent flood events and to improve the natural environment and WFD targets,
- Use of this SFRA to inform future development and minimise flood risk from all sources,
- Implementation of upstream catchment management i.e. slow the flow and flood storage schemes could be implemented in upper catchments to reduce risk downstream and across neighbouring authority boundaries, and
- Promotion and consideration of SuDS at the earliest stage of development planning.

According to the NPPF, the LPAs should work with neighbouring authorities to consider strategic cross boundary issues and infrastructure requirements. Local authorities also have a duty to cooperate whereby councils work together on strategic matters and produce effective and deliverable policies on strategic cross boundary matters.

The Flood and Water Management Act 2010 requires all risk management authorities (RMAs) to cooperate with relevant authorities regarding exercising flood and coastal risk management. Lancashire, Blackburn-with-Darwen and Blackpool are represented on the North West Regional Flood and Coastal Committee where cross-boundary resources, projects and data are shared with Merseyside, Cheshire, Cumbria and Greater Manchester.

6.4.2 Hydrological linkages and cross boundary issues

A number of watercourses within Central Lancashire originate outside the CLA's administrative boundary. Although it is likely that small land use changes within Central Lancashire will only have localised impact on river flows; major land use changes in the upstream catchments of the River Ribble, River Douglas, River Lostock and River Yarrow, could have a significant impact on their flow regimes and, therefore, flood risk. Development control and land management in the upper Ribble catchment is crucial.

Figure 6-3 illustrates fluvial hydraulic linkages for the catchments in and around Central Lancashire. The CLA receives the River Ribble from the Ribble Valley district and Preston also receives from the River Wyre from the Wyre district; upstream land use changes in the Ribble Valley and Wyre authority area could have an effect on fluvial flood risk along these watercourses. The River Douglas originates in the West Lancashire authority area enters Chorley before heading into South Ribble and into the Ribble Estuary; close partnership between the CLA and West Lancashire will need to be maintained.

Were these strategic solutions not considered in upstream development planning, the following issues may occur:

- Reduction in upstream floodplain storage capacity; and
- Increase in impermeable areas leading to a reduction in rainfall infiltration and subsequent increased runoff.

These issues highlight the importance of the Lancashire LRF and the need to work together on flood risk management, particularly where actions could exacerbate flooding in downstream communities. The need for consistent regional development policies controlling runoff or development in floodplains within contributing districts is therefore crucial as this would have wider benefits for local authorities as a whole as well as Central Lancashire. This should be carried out by the successful implementation of the Sequential Test. Appropriate flood risk management policies will also be required in the Local Plans.

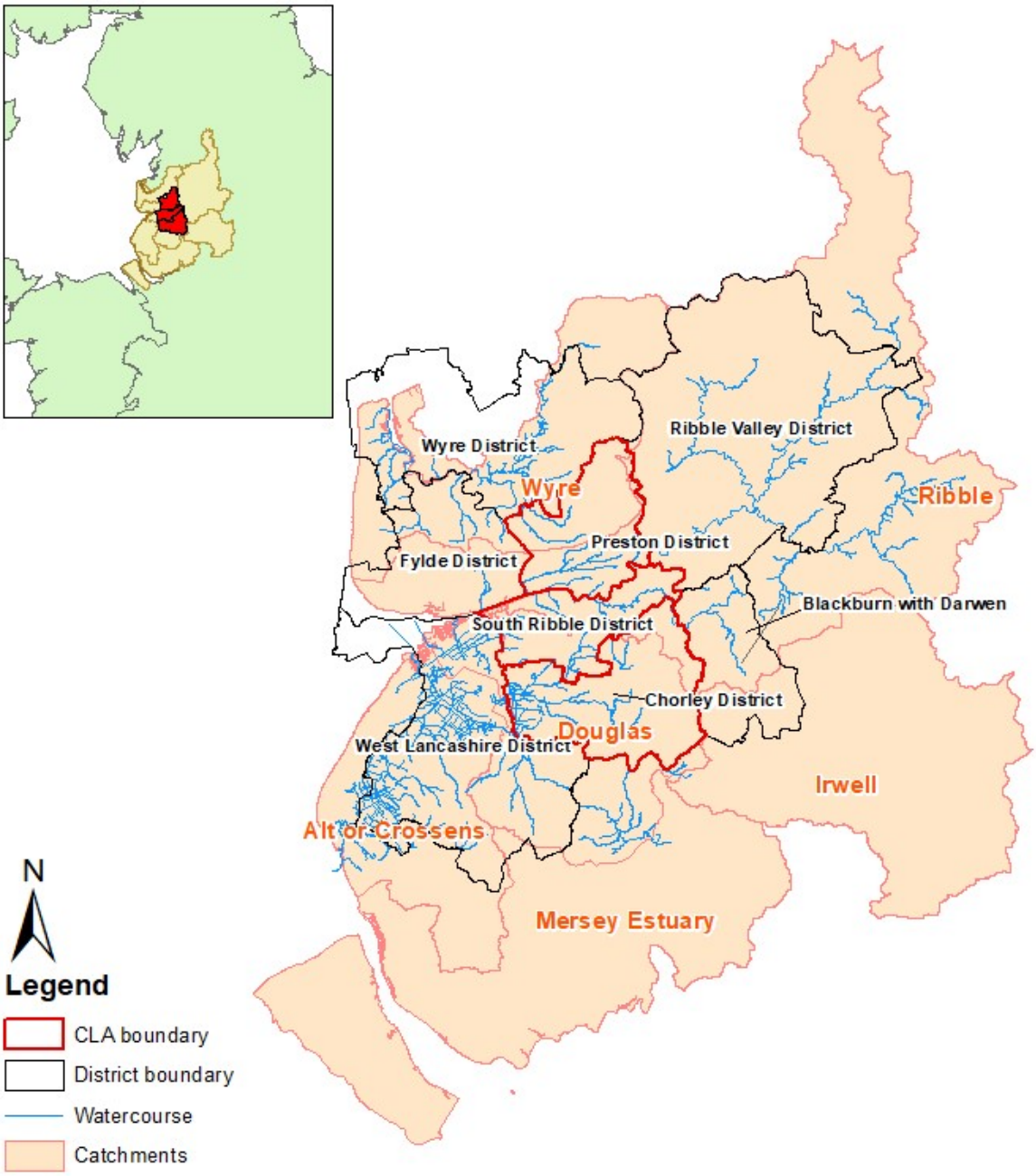

Figure 6-3: Fluvial hydraulic linkages for catchments in and around Central Lancashire

6.4.3 Safeguarded land for flood storage

Where possible, the CLA may look to allocate land designed for flood storage functions. Such land can be explored through the site allocation process whereby an assessment is made, using this SFRA, of the flood risk at assessed sites and what benefit could be gained by leaving the site undeveloped. In some instances, the storage of floodwater can help to alleviate flooding elsewhere, such as downstream developments. Where there is a large area of a site at risk that is considered large enough to hinder development, it may be appropriate to safeguard this land for the storage of floodwater.

Section 14 Paragraph 157 of the revised NPPF states that, to avoid where possible, flood risk to people and property they should manage any residual risk by,

'safeguarding land from development that is required, or likely to be required, for current or future flood management'.

Applicable sites assessed through this SFRA may include any current greenfield sites:

- That are considered to be large enough (>1 hectare) to store floodwater to achieve effective mitigation i.e. through infiltration SuDS,
- With large areas of their footprint at high or medium surface water flood risk (based on the RoFSW),
- That are within the functional floodplain (Flood Zone 3b),
- With large areas of their footprint at risk from Flood Zone 3a, and
- That are large enough and within a suitable distance to receive floodwater from a nearby development site using appropriate SuDS components and techniques which may involve pumping, piping or swales / drains. Note: pumping is considered a last resort due to ongoing maintenance needs.

Brownfield sites could also be considered though this would entail site clearance of any existing buildings, conversion to greenspace and contaminated land assessments.

By using the sequential approach to site layout, the LPA and developers should be able to avoid the areas at risk and leave clear for potential flood storage. See the SFRA Maps in Appendix B to spatially assess the areas of the sites at risk.

6.4.4 Phasing of development

Flood risks should be taken into account at all stages of the planning process with a view to directing development away from areas at flood risk, now and in the future, by following the sequential approach to site allocation, as shown in Figure 6-2.

Using a phased approach to development, based on modelling results of floodwater storage options, should ensure that any sites at risk of causing flooding to other sites are developed first in order to ensure flood storage measures are in place before other sites are developed, thus ensuring a sustainable approach to site development. Also, it may be possible that flood mitigation measures put in place at sites upstream could alleviate flooding at downstream or nearby sites. Large strategic multiple development sites should also carry out development phasing within the overall site boundary so as to avoid cumulative impacts within the site, as well as off the site (see Section 5.7.4 for information on Working with Natural Processes). They will also need to consider how surface water will be managed on-site during each construction phase to ensure flooding doesn't occur to adjacent land during construction.

The EA states that the optimum approach would be to have all development sites that make up a large strategic site to have all developers sign up to a Flood Risk and Drainage Masterplan from the very start of the planning stage. It is often the case that outline planning permission is given for larger strategic sites with individual developers then submitting further separate site-specific FRAs that are not joined up with the rest of the overall site. These individual FRAs can then often be devoid of all the green SuDS infrastructure touted within the Outline FRA.

6.5 Guidance for developers

This SFRA provides the evidence base for developers to assess flood risk at a strategic level and to determine the requirements of an appropriate site-specific Flood Risk Assessment. Before carrying out a Flood Risk Assessment, developers should check with the Local Planning Authority whether the Sequential Test has been carried out. If not, the developer must apply the Sequential Test as part of their Flood Risk

Assessment by comparing their indicative development site with other available sites to ascertain which site has the lowest flood risk. The EA provides advice on this via:

https://www.gov.uk/guidance/flood-risk-assessment-the-sequential-test-for-applicants

Table 6-1 identifies, for developers, when the Sequential and Exception Tests are required for certain types of development and who is responsible for providing the evidence and those who should apply the tests if required.

Development	Sequential Test Required?	Who Applies the Sequential Test?	Exception Test Required?	Who Applies the Exception Test?
Allocated Sites	No (assuming the development type is the same as that submitted via the allocations process)	LPA should have already carried out the test during the allocation of development sites	Dependent on land use vulnerability	LPA to advise on the likelihood of test being passed. The developer must also provide evidence that the test can be passed by providing planning justification and producing a detailed FRA.
Windfall Sites	Yes	Developer provides evidence, to the LPA that the test can be passed. An area of search will be defined by local circumstances relating to the catchment and for the type of development being proposed	Dependent on land use vulnerability	Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Regeneration Sites Identified Within Local Plan	No	-	Dependent on land use vulnerability	LPA to advise on the likelihood of test being passed. The developer must also provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Redevelopment of Existing Single Properties	No if redevelopment remains within existing development footprint and	-	Dependent on land use vulnerability	Developer must provide evidence that the test can be passed by providing planning

Development	Sequential Test Required?	Who Applies the Sequential Test?	Exception Test Required?	Who Applies the Exception Test?
	curtilage. Yes if redevelopment involves demolition and rebuild			justification and producing a detailed FRA
Changes of Use	No (except for any proposal involving changes of use to land involving a caravan, camping or chalet site)	Developer provides evidence to the LPA that the test can be passed	Dependent on land use vulnerability	Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Householder developments	No			
Minor non-residential extensions (less than 250 m^2)	No			

Table 6-1: Development types and application of Sequential and Exception Tests for developers

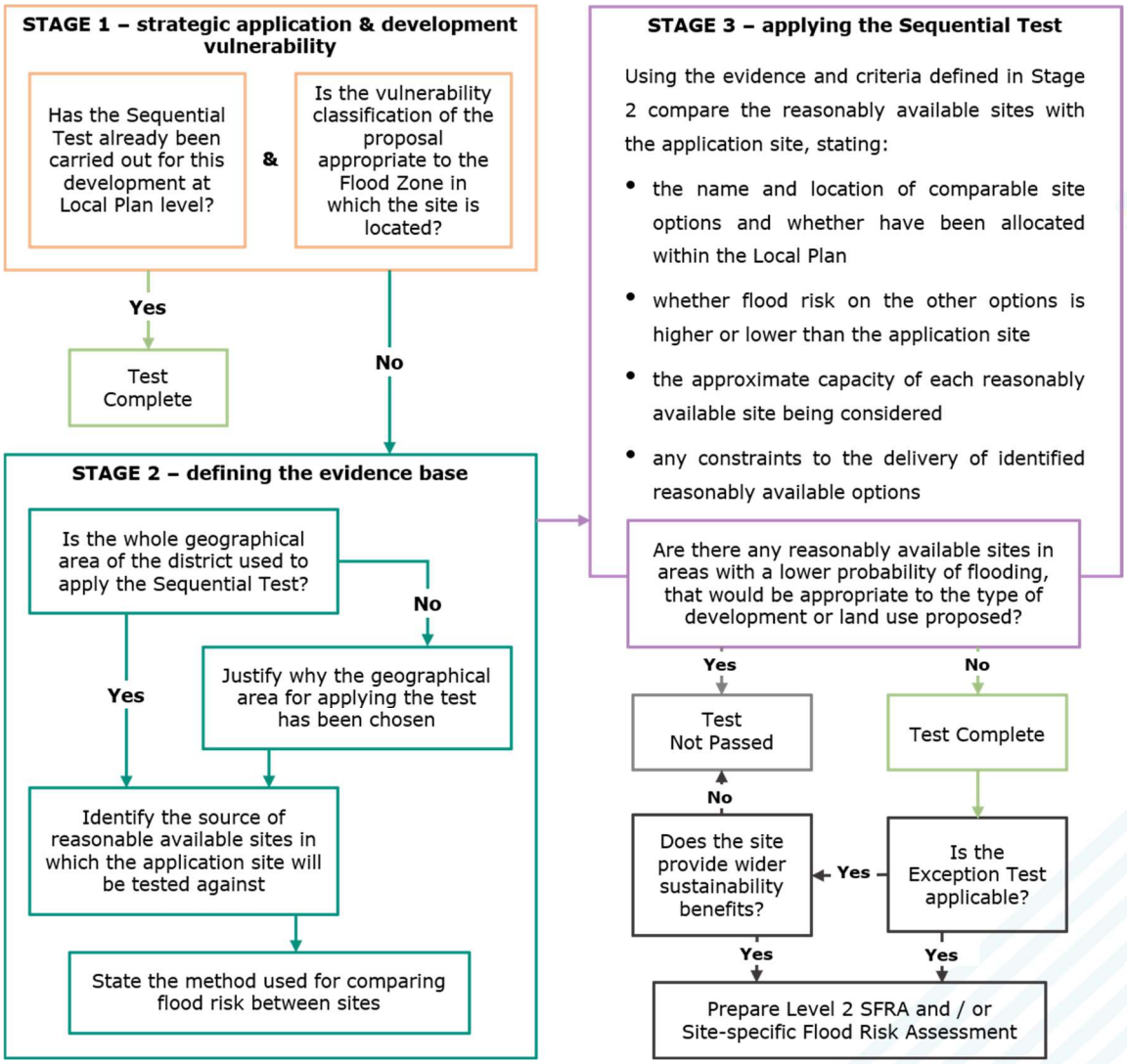

Figure 6-4: Development management Sequential Test process

Figure 6- shows what developers should do with regards to applying the Sequential Test if the Local Planning Authority has not already done so.

The Sequential Test does not apply to change of use applications unless it is for change of land use to a caravan, camping or chalet site, or to a mobile home site or park home site. The Sequential Test can also be considered adequately demonstrated if both of the following criteria are met:

- The Sequential Test has already been carried out for the site (for the same development type) at the strategic level (Local Plan); and
- The development vulnerability is appropriate to the Flood Zone (see Table 3 of the FRCC-PPG).

If both these criteria are met, reference should be provided for the site allocation of the Local Plan document and the vulnerability of the development should be clearly stated.

When applying the Sequential Test, the following should also be considered:

- **The geographic area in which the Test is to be applied;**
- **The source of reasonable available sites in which the application site will be tested against; and**

- **The evidence and method used to compare flood risk between sites.**

Sites should be compared in relation to flood risk; Local Plan status; capacity; and constraints to delivery including availability, policy restrictions, physical problems or limitations, potential impacts of the development on the local area, and future environmental conditions that would be experienced by the inhabitants of the development.

The test should conclude if there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use that has been put forward in the Local Plan.

The LPA should now have sufficient information to be able to assess whether or not the indicative site has passed the Sequential Test. If the Test has been passed, then the developer should apply the Exception Test in the circumstances set out by tables 1 and 3 of the FRCC-PPG.

In all circumstances, where the site is within areas at risk of flooding and where a site-specific FRA has not already been carried out, a site-specific FRA should be completed in line with the NPPF and the FRCC-PPG.

In addition to the formal Sequential Test, the NPPF sets out the requirement for developers to apply the sequential approach to locating development within the site. As part of their application and master planning discussions with applicants, Local Planning Authorities should seek whether or not:

- Flood risk can be avoided by substituting less vulnerable uses or by amending the site layout;
- Less vulnerable uses for the site have been considered; or
- Density can be varied to reduce the number, or the vulnerability of units located in higher risk parts of the site.

When initially considering the development options for a site, developers should use this SFRA, the NPPF and the FRCC-PPG to:

- ***Identify whether the site is***
    - *A windfall development, allocated development, within a regeneration area, single property or subject to a change of use to identify if the Sequential and Exception Tests are required.*
- ***Check whether the Sequential Test and / or the Exception Test have already been applied***
    - *Request information from the LPA on whether the Sequential Test, or the likelihood of the site passing the Exception Test, have been assessed;*
    - *If not, provide evidence to the LPA that the site passes the Sequential Test and will pass the Exception Test.*
- ***Consult with the LPA, the LLFA and the EA and the wider group of flood risk consultees, where appropriate, to scope an appropriate FRA if required***
    - *Guidance on FRAs is provided in Appendix E.3.4 of this SFRA;*
    - *Also, refer to the EA Standing Advice, the NPPF and the FRCC-PPG;*
    - *Consult the LLFA.*
- ***Submit FRA to the LPA and the EA for approval, where necessary***

6.6 Planning for climate change (NPPF, 2019)

In relation to flood risk and climate change in the planning system, the revised NPPF states:

"All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property." (para 157).

Local plans should do this by safeguarding land from development that is required, or likely to be required, for current or future flood management; and to seek opportunities for the relocation of development, including housing, to more sustainable locations from areas where climate change is expected to increase flood risk.

6.6.1 EA climate change allowances

The EA revised the climate change allowances in 2016, for use in FRAs and SFRAs and will, at the time of writing, use these revised allowances when providing advice. There have been several updates carried out to the allowances since the release of UKCP18. The allowances are available online via:

https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

The climate change allowances are predictions of anticipated change for:

- Peak river flow by River Basin District (see Table 6-2 for North West RBD allowances);
- Peak rainfall intensity;
- Sea level rise by River Basin District (see Table 6-4 for North West RBD sea level allowances); and
- Offshore wind speed and extreme wave height.

RBD	Allowance Category	Total Potential Change Anticipated for…		
		2020s (2015-2039)	2050s (2040-2069)	2080s (2070-2115)
North West	Upper end	+20%	+35%	+70%
	Higher central	+20%	+30%	+35%
	Central	+15%	+25%	+30%

Table 6-2: Recommended peak river flow allowances per RBD

The peak rainfall intensity allowances apply to the whole of England for small catchments (less than 5 km^2) and urban catchments, though for the North West RBD for large rural catchments. SFRAs and FRAs should assess both the central and upper end allowances to gauge the range of impacts.

Allowance Category	Total Potential Change Anticipated for…		
	2015-2039	2040-2069	2070-2115
Upper end	+10%	+20%	+40%
Central	+5%	+10%	+20%

Table 6-3: Peak rainfall intensity allowances in small and urban catchments for England

Sea level allowances are based on different regions of England. The allowances for the North West of England are shown below in Table 6-4. The number in brackets is the cumulative sea level rise for each year within each range.

Allowance Category	2000 – 2035 (mm)	2036 – 2065 (mm)	2066 – 2095 (mm)	2096 – 2125 (mm)	Cumulative rise 2000 – 2125 (m)
Upper end	5.7 (200)	9.9 (297)	14.2 (426)	16.3 (489)	1.41
Higher Central	4.5 (158)	7.3 (219)	10 (300)	11.2 (336)	1.01

Table 6-4: Sea level allowance for North West England.

The EA will also require consideration, if appropriate, of the 'high++ allowances' for peak river flows and mean sea level rise where a development is considered to be very sensitive to flood risk and with lifetimes beyond the end of the century. This could include infrastructure projects or developments that significantly change existing settlement patterns. The high++ allowances can be found in the EA's *Adapting to*

Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities[23], which uses science from UKCP09. This guidance is based on Government's policy for climate change adaptation and is specifically intended for projects or strategies seeking Government FDGiA funding. However, Risk Management Authorities in England may also find it useful in developing plans and making FCERM investment decisions even if there is no intention of applying for central government funding. This is important for any future large-scale infrastructure used to support the delivery of strategic sites such as flood defence schemes.

Although, it is anticipated that increases in river flows will lie somewhere within the range of the central to upper end estimates of the February 2016 allowances, more extreme change cannot be discounted. The high++ allowances can be used to represent more severe climate change impacts and help to identify the options that would be required.

CLA would request application of the upper end allowance and the LLFA has confirmed it would support the application of the upper end allowances for site-specific FRAs on all major developments.

UKCP18

In November 2018 Defra released a new set of UK Climate Projections (UKCP18). These projections replace the UKCP09 projections which have been used for the past ten years. In February 2019, the EA stated that the 2016 guidance is being revised in line with the UK Climate Projections 2018 and to contact the EA for interim guidance when preparing a flood risk assessment for a development or local plan affected by tidal flooding. A further update was provided in December 2019 whereby the EA stated the following updates to the guidance:

1. Updated the sea level rise allowances using UKCP18 projections.
2. Added guidance on how to
    a. calculate flood storage compensation,
    b. use peak rainfall allowances to help design drainage systems,
    c. account for the impact of climate change on storm surge,
    d. assess and design access and escape routes for less vulnerable development.
3. Changed the guidance on how to apply peak river flow allowances so the approach is the same for both flood zones 2 and 3.

6.6.2 Climate change data in Central Lancashire

At the inception of this Level 1 SFRA, a request was made to the EA for the provision of modelled climate change flood outlines, based on the 2016 allowances, for all applicable fluvial and tidal hydraulic models in the CLA area. This would enable an up to date assessment of the risk from climate change to the potential development sites, as required by the EA's 2019 updated SFRA guidance.

However, such climate change information was not made available for this Level 1 SFRA. A precautionary and pragmatic approach has therefore been adopted to assessing future flood risk in this SFRA, whereby the assumption is that all potential development sites identified to be at existing risk from fluvial and/or tidal flooding, are at risk from the effects of climate change. We have also assumed that any site wholly

23 Environment Agency Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities

within Flood Zone 1 that is within 20 metres of Flood Zone 2 may be at long term fluvial/tidal risk. Appendix E.2 discusses this approach and the sites affected.

The Sites Assessment Spreadsheet in Appendix C indicates the sites that may be at increased risk in the long term, based on the approaches outlined above. Appendix E.2 provides more detail on the approaches taken and discussion on the sites considered to be at long term risk.

6.7 Sustainable Drainage Systems (SuDS)

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and consequently a potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure. Managing surface water discharges from new development is therefore crucial in managing and reducing flood risk to new and existing development downstream. Carefully planned development can also play a role in reducing the amount of properties that are directly at risk from surface water flooding.

The Department for Communities and Local Government (DCLG) (now Ministry of Housing, Community & Local Government (MHCLG)) announced, in December 2014, that the local planning authority, in consultation with the LLFA, should be responsible for delivering SuDS[24] through the planning system. The Town and Country Planning (Development Management Procedure) (England) Order 2015 (as amended) gave provisions for major development (including ten or more dwellings or a building or buildings where the floor space is 1,000 square metres or more) to require sustainable drainage within the development proposals in accordance with the 'non-statutory technical standards for sustainable drainage systems'[25], published in March 2015. These standards are set to be updated in early 2021. A Practice Guidance[26] document has also been developed by the Association of SuDS Authorities (ASA) (previously LASOO) to assist in the application of the non-statutory technical standards.

The Design and Construction Guidance (DCG) for sewers became the new regulated sewerage guidance on 1 April 2020. This allows water and sewerage companies to adopt SuDS components that meet the DCG. Details on the sewerage sector guidance can be found via:

https://www.water.org.uk/wp-content/uploads/2020/01/Water-UK-SuDS-brochure.pdf

Lancashire County Council Sustainable Drainage

LCC encourages prospective developers to first contact the local planning authority to determine whether your development proposal is acceptable in principle and on a planning policy basis.

LCC offers a site-specific pre-application service where developers can receive advice on their development proposals and Land Drainage Consents that may be required for a fee.

https://www.lancashire.gov.uk/council/planning/sustainable-drainage-systems/

A new SuDS pro-forma and accompanying guidance have been created for LPAs to consider adopting as part of their planning documentation. This has been created for the North West, sponsored and endorsed by the North West RFCC, and has been developed by a task group of representatives from UU, North West Local Authorities and the EA. The guidance and pro-forma encourage the creation of high quality SuDS

24 http://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2014-12-18/HCWS161/
25 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf
26 http://www.susdrain.org/files/resources/other-guidance/lasoo_non_statutory_suds_technical_standards_guidance_2016_.pdf

by allowing water quality, amenity and biodiversity as well as water quantity to be properly considered during the design stage and allowing it to be fully integrated into the surface water management and development design process. The new pro-forma supports and encourages SuDS design in line with The SuDS Manual C753 and the DCG for sewers. This is recognised nationally as best practice.

The SuDS pro-forma and supporting guidance are available via:

https://thefloodhub.co.uk/planning-development/#section-4

6.7.1 SuDS and the revised NPPF, 2019

The Revised NPPF (2019), para 165, states:

"Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

a. *take account of advice from the lead local flood authority;*
b. *have appropriate proposed minimum operational standards;*
c. ***have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development;*** *and*
d. *where possible, provide multifunctional benefits*".

All developments, both major and minor, are to include SuDS, providing multiple benefits that contribute to many other NPPF policies, including climate change, biodiversity net gain, amenity and water quality improvements. Where site conditions may be more challenging, the SuDS components used will need to accommodate the site's opportunities and constraints. At a strategic level, this should mean identifying opportunities for a variety of SuDS components according to geology, soil type, topography, groundwater / mine water conditions, their potential impact on site allocation, and setting out local SuDS guidance and opportunities for in perpetuity adoption and maintenance. SuDS can be a fully piped system, but which attenuate underground and restrict discharge to rates agreed with the LPA in consultation with the LLFA. All new developments should be using SuDS unless it can be evidenced that they are unsuitable. This can be achieved by using the SuDS pro-forma.

In terms of what kind of evidence would show SuDS to be inappropriate for a certain site, it is possible that clarity on what evidence is required may be subsequently set out in the revised FRCC-PPG and the SuDS pro-forma, and that these circumstances would be exceptional.

Maintenance options must clearly identify who will be responsible for SuDS maintenance and funding for maintenance should be fair for householders and premises occupiers; and, set out a minimum standard to which the sustainable drainage systems must be maintained.

Sustainable drainage is a fundamental part of integrated design methodology and the proposed design should be secured by detailed planning conditions to ensure that the SuDS is constructed, validated and maintained to a minimum level of effectiveness in accordance with SuDS proposals agreed by the LPA, in consultation with the LLFA.

6.7.2 SuDS hierarchy

The runoff destination should always be the first consideration when considering design criteria for SuDS including the following possible destinations in order of preference:

a) Source control / interception.
1 Into the ground (infiltration);
2 To a surface water body;
3 To a surface water sewer, highway drain, or another drainage system;

4 To a combined sewer.

Effects on water quality should also be investigated when considering runoff destination in terms of the potential hazards arising from development and the sensitivity of the runoff destination. Developers should also establish that proposed outfalls are hydraulically capable of accepting the runoff from SuDS through desktop and site investigations and consultation with the LLFA, EA and UU as appropriate.

The non-statutory technical standards for sustainable drainage systems (March 2015), due to be updated in early 2021, sets out appropriate design criteria based on the following:

1 Flood risk outside the development;
2 Peak flow control;
3 Volume control;
4 Flood risk within the development;
5 Structural integrity;
6 Designing for maintenance considerations;
7 Construction.

Many different SuDS components and techniques can be implemented. As a result, there is no one standard correct drainage solution for a site. In most cases, using the Management Train principle (see Figure 6-4), will be required, where source control is the primary aim.

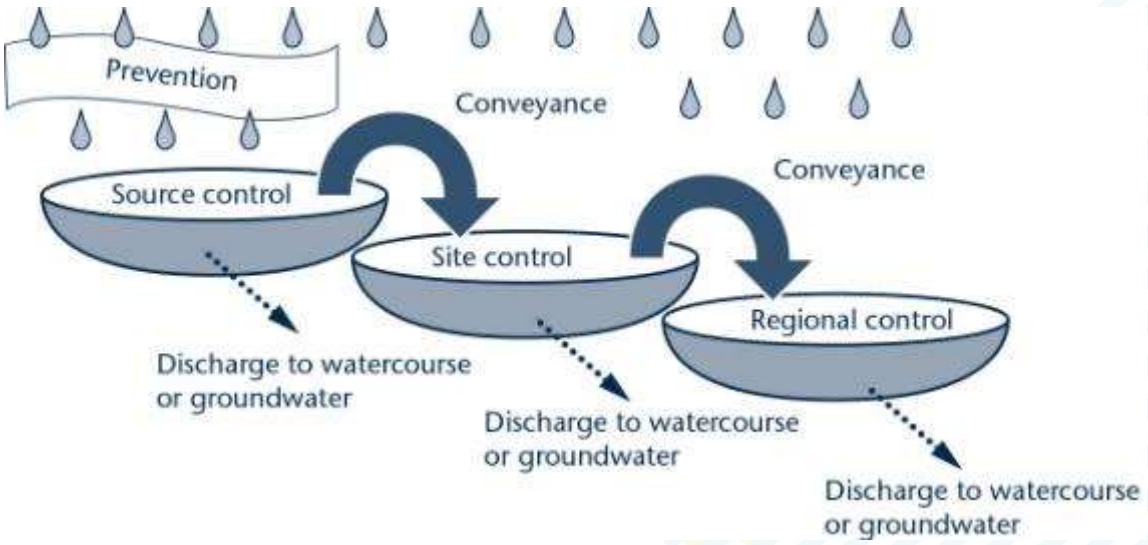

Figure 6-4: SuDS management train principle[27]

The effectiveness of a flow management scheme within a single site is heavily limited by land use and site characteristics including (but not limited to) topography; geology and soil (permeability); and available area. Potential ground contamination associated with urban and former industrial sites should be investigated with concern being placed on the depth of the local water table and potential contamination risks that will affect water quality. The design, construction and ongoing maintenance regime of any SuDS scheme must be carefully defined as part of a site-specific Flood Risk Assessment. A

27 CIRIA (2008) Sustainable Drainage Systems: promoting good practice – a CIRIA initiative

clear and comprehensive understanding of the catchment hydrological processes (i.e. nature and capacity of the existing drainage system) is essential for successful SuDS implementation.

In addition to the national standards, the LPA may set local requirements for planning permission that include more rigorous obligations than the non-statutory technical standards. More stringent requirements should be considered where current Greenfield sites lie upstream of high-risk areas. This could include improvements on Greenfield runoff rates. The LPA should always be contacted with regards to its local requirements at the earliest opportunity in development planning.

The CIRIA SuDS Manual[28] 2015 should also be consulted by the LPA and developers. The SuDS manual (C753) is highly regarded and incorporates the latest research, industry practice, technical advice and adaptable processes to assist in the planning, design, construction, management and maintenance of good SuDS. The SuDS Manual complements the non-statutory technical standards and goes further to support the cost-effective delivery of multiple benefits.

6.7.3 Overland flow paths

Underground drainage systems have a finite capacity and regard should always be given to larger events when the capacity of the network will be exceeded. Hence there is a need to design new developments with exceedance in mind. This should be considered alongside any surface water flows likely to enter a development site from the surrounding area.

All development proposals including masterplanning should ensure that existing overland flow paths are retained within the development. As a minimum, the developer should investigate, as part of a site-specific Flood Risk Assessment, the likely extents, depths and associated hazards of surface water flooding on a development site, as shown by the RoFSW dataset. This is considered to be an appropriate approach to reduce the risk of flooding to new developments. Blue-green infrastructure (BGI) should be used wherever possible to accommodate such flow paths. **Floor levels should always be set above the design flood based on EA guidance and the conclusions of the site-specific FRA** to reduce the consequences of any localised flooding, unless local guidance states otherwise.

The effectiveness of a flow management scheme within a single site is heavily limited by site constraints including (but not limited to) topography; geology and soil (permeability); development density; existing drainage networks both on-site and in the surrounding area; adoption issues; and available area. The design, construction and ongoing maintenance regime of such a scheme must be carefully defined at an early stage and a clear and comprehensive understanding of the catchment hydrological processes (i.e. nature and capacity of the existing drainage system) is essential.

6.8 Property Flood Resilience (PFR)

PFR measures should only be applied retrospectively to existing development that is at flood risk, as new development should not be constructed in areas at flood risk. Paragraph 163 of the NPPF explains that development must only be allowed in areas at flood risk where, following the Sequential and Exception Tests, and supported by an FRA, the development is appropriately flood resistant and resilient.

Flood resilience and resistance measures are designed to mitigate flood risk and reduce damage and adverse consequences to existing property. Resistance and resilience

28 https://www.ciria.org/Memberships/The_SuDs_Manual_C753_Chapters.aspx

measures may aim to help residents and businesses recover more quickly following a flood event.

It should be noted that it is not possible to completely prevent flooding to all communities and businesses.

Research carried out by the then DCLG, now MHCLG, and the EA has recommended that the use of resistance measures should generally be limited to a nominal protection height of 600 mm above ground level, the lowest point of ground abutting the external property walls. This is because the structural integrity of the property may be compromised above this level.

It should be noted that PFR measures would not be expected to cause an increase in flood risk to other properties or other parts of the local community. They will help mitigate against flood risk but, as with any flood alleviation scheme, flood risk cannot be removed completely. Emergency plans should, therefore, be in place that describe the installation of measures and residual risks.

As the flood risk posed to a property cannot be removed completely, it is recommended that PFR products are deployed in conjunction with pumps of a sufficient capacity. Pumps will help manage residual flood risks not addressed by resistance measures alone such as rising groundwater.

6.8.1 Definitions

Flood resilience measures aim to reduce the damage caused by floodwater entering a property. Flood resilience measures are based on an understanding that internal flooding may occur again and when considering this eventuality, homes and businesses are encouraged to plan for flooding with an aim of rapid recovery and the return of the property to a habitable state.

For example, tiled floors are easier to clean than carpets, raised electricity sockets and high-level wall fixings for TVs / computers may mean that that power supply remains unaffected. Raising kitchen or storage units may also prevent damage that may not require replacement after a flood. There is a lot of information available about what items get damaged by floodwater and features that are considered to provide effective resilience measures that can be installed at a property.

Flood resistance measures aim to reduce the amount of floodwater entering the property. Obvious inflow routes, such as through doors and airbricks may be managed, for example, by installing bespoke flood doors, door flood barriers and automatic closing airbricks. However, the property's condition and construction are also key to understanding how floodwater may enter and move between buildings. For example, floodwater can also flow between properties through connecting cavity walls, cellars, beneath suspended floors and through internal walls. Flood resistance measure alone may not keep floodwater out. Building condition is a critical component of any flood mitigation study.

6.8.2 Property mitigation surveys

To define the scale and type of resistance or resilience measures required, a survey will need to be undertaken to pick up property threshold levels, air brick levels, doorways, historic flood levels and a number of ground spot levels required to better understand the flood mechanisms for floodwater arriving at the property (e.g. along road, pavements, etc.). The depth of flooding at each property will help guide the selection of resistance measures proposed. Surveys will need to include consideration of issues such as:

- Detailed property information
- An assessment of flood risk, including property (cross) threshold levels

- Routes of water ingress (fluvial, tidal, ground and surface water flooding)
- An assessment of impact of floodwaters
- A schedule of measures to reduce risk (resistance and resilience)
- Details of recommendations (including indicative costs)
- Advice on future maintenance of measures
- Advice on flood preparedness

All sources of flooding will need to be considered, including a comprehensive survey of openings (doors, windows and air bricks), as well as potential seepage routes through walls and floors, ingress through service cables, pipes, drains and identify possible weaknesses in any deteriorating brickwork or mortar.

7 Emergency planning

The provisions for emergency planning for local authorities as Category 1 responders are set out by the Civil Contingencies Act, 2004 and the National Flood Emergency Framework for England, December 2014[29]. This framework is a resource for all involved in emergency planning and response to flooding from the sea, rivers, surface water, groundwater and reservoirs. The Framework sets out Government's strategic approach to:

- Ensuring all delivery bodies understand their respective roles and responsibilities when planning for and responding to flood related emergencies;
- Giving all players in an emergency flooding situation a common point of reference which includes key information, guidance and key policies;
- Establishing clear thresholds for emergency response arrangements;
- Placing proper emphasis on the multi-agency approach to managing flooding events;
- Providing clarity on the means of improving resilience and minimising the impact of flooding events;
- Providing a basis for individual responders to develop and review their own plans; and
- Being a long-term asset that will provide the basis for continuous improvement in flood emergency management.

Along with the EA flood warning systems, there are a range of flood plans at a sub-regional and local level, outlining the major risk of flooding and the strategic and tactical response framework for key responders. The EA and the Association of Directors of Environment, Economy, Planning and Transport (ADEPT) have produced guidance on flood risk emergency plans for new development[30] (September 2019).

This SFRA contains useful data to allow emergency planning processes to be tailored to the needs of the area and be specific to the flood risks faced. The SFRA Maps in Appendix B and accompanying GIS layers should be made available for consultation by emergency planners during an event and throughout the planning process.

7.1 Civil Contingencies Act

Under the Civil Contingencies Act (CCA, 2004)[31], the LLFA and LPAs are classified as Category 1 responders and thus have duties to assess the risk of emergencies occurring, and use this to:

- Inform contingency planning;
- Put in place emergency plans;
- Put in place business continuity management arrangements;
- Put in place arrangements to make information available to the public about civil protection matters;
- Maintain arrangements to warn, inform and advise the public in the event of an emergency;
- Share information with other local responders to enhance coordination; and

29 https://www.gov.uk/government/publications/the-national-flood-emergency-framework-for-england

30 https://www.adeptnet.org.uk/floodriskemergencyplan

31 https://www.gov.uk/preparation-and-planning-for-emergencies-responsibilities-of-responder-agencies-and-others#the-civil-contingencies-act

- Cooperate with other local responders to enhance coordination and efficiency and to provide advice and assistance to businesses and voluntary organisations about business continuity management.

During an emergency, such as a flood event, the local authority must also co-operate with other Category 1 responders (such as the emergency services and the EA) to provide the core response.

7.1.1 Lancashire Resilience Forum (LRF)

The aim of the LRF is to legally deliver the duties stated in the Civil Contingencies Act 2004 within a multi-agency environment. The LRF is a group of multi-agency organisations that work together to prepare and respond to emergencies in Lancashire. The LRF involves local authorities, emergency services, health agencies, Environment Agency and local businesses.

The LRF's common objectives are to:

- Prevent the situation from getting worse;
- Save lives;
- Relieve suffering;
- Protect property;
- Recover to normality as soon as possible;
- Facilitate criminal investigation and judicial process as necessary.

The LRF's main roles include:

- Assessing the impacts of the risk and providing this information to the public in a Community Risk Register;
- Creating emergency plans
- Responding together in a coordinated way
- Training and testing for preparedness
- Learning the lessons from incidents and exercises.[32]

[32] https://www.stayintheknow.co.uk/EmergencyInfo

7.1.2 Community Risk Register[33]

The LRF produces the Community Risk Register (CRR) which lists possible risks, the probability of occurring and potential impact. The CRR provides information on the biggest emergencies that happen in Lancashire, together with an assessment of how likely they are to happen and the impacts if they do include impacts to people, houses, the environment and local businesses. Each identified risk is then analysed and given a rating according to how likely the risk is to lead to an emergency and their potential impact on safety and security, health, economy, environment and society.

7.1.3 Community Emergency Plan

Communities may need to rely on their own resources to minimise the impact of an emergency, including a flood, before the emergency services arrive. Many communities already help each other in times of need, but experience shows that those who are prepared cope better during an emergency. Communities with local knowledge, enthusiasm and information are a great asset and a Community Emergency Plan can help. Details on how to produce a community emergency plan, including a toolkit and template, are available from the Government's website[34]. LCC have produced guidance and emergency plans on how to prepare and respond to emergencies, these are available from: https://www.lancashire.gov.uk/council/strategies-policies-plans/emergency-planning/emergency-plans/

7.1.4 Local flood plans

This SFRA provides a number of flood risk data sources that should be used when producing or updating flood plans. The Local Planning Authority will be unable to write their own specific flood plans for new developments at flood risk. Developers should write their own. Generally, owners with individual properties at risk should write their own individual flood plans, however larger developments or regeneration areas, such as retail parks, hotels and leisure complexes, should consider writing one collective plan for the assets within an area.

The Flood Hub, a website funded by all of the LLFAs in the North West, has a wealth of materials located within their 'Knowledge Hub' which may support developers and communities at risk available via:

https://thefloodhub.co.uk/knowledge-hub/

This SFRA can help to:

- Update these flood plans if appropriate;
- Inform emergency planners in understanding the possibility, likelihood and spatial distribution of all sources of flooding (emergency planners may however have access to more detailed information, such as for Reservoir Inundation Maps, which have not been made available for this SFRA);
- Identify safe evacuation routes and access routes for emergency services;
- Identify key strategic locations to be protected in flooding emergencies, and the locations of refuge areas which are capable of remaining operational during flood events;
- Provide information on risks in relation to key infrastructure, and any risk management activities, plans or business continuity arrangements;
- Raise awareness and engage local communities;

[33] https://www.lancashire.gov.uk/council/strategies-policies-plans/emergency-planning/risks-in-lancashire/
[34] https://www.gov.uk/guidance/resilience-in-society-infrastructure-communities-and-businesses#community-resilience

- Support emergency responders in planning for and delivering a proportionate, scalable and flexible response to the level of risk; and
- Provide flood risk evidence for further studies.

The following guidance written by the Environment Agency and the Association of Directors of Environment, Economy, Planning and Transport (ADEPT) is aimed at Local Planning Authorities to help assist in setting up their own guidelines on what should be included in the flood risk emergency plans:

https://www.adeptnet.org.uk/floodriskemergencyplan

As the LLFA LCC have produced a Local Flood Risk Management Strategy which explains how local flood risk is managed in Lancashire; this is due to be updated in Spring 2021. The current strategy is available here:

https://www.lancashire.gov.uk/media/900474/lancashire-and-blackpool-local-flood-risk-management-strategy-consultation-draft.pdf

7.2 Flood warning and evacuation plans

Developments that include areas that are designed to flood (e.g. ground floor car parking and amenity areas) or have a residual risk associated with them, will need to provide appropriate flood warning and instructions so users and residents are safe in a flood. This will include both physical warning signs and written flood warning and evacuation plans. Those using the new development should be made aware of any evacuation plans.

In relation to new development it is up to the Local Planning Authority to determine whether the flood warning and evacuation plans, or equivalent procedures, are sufficient or not. If the Local Planning Authority is not satisfied, taking into account all relevant considerations, that an indicative development can be considered safe without the provision of safe access and exit, then planning permission should be refused.

Whilst there is no statutory requirement on the EA or the emergency services to approve evacuation plans, LPAs are accountable under their Civil Contingencies duties, via planning condition or agreement, to ensure that plans are suitable. This should be done in consultation with development management officers. Given the cross-cutting nature of flooding, it is recommended that further discussions are held internally to the LPAs between emergency planners and policy planners / development management officers, the LLFA, drainage engineers and also to external stakeholders such as the emergency services, the EA, UU and Canal & River Trust (if applicable).

It may be useful for the EA and spatial planners, and others as necessary to consider whether, as a condition of planning approval, flood evacuation plans should be provided by the developer which aim to safely evacuate people out of flood risk areas, using as few emergency service resources as possible. The Local Resilience Forum is essential to establish the feasibility / effectiveness of such an approach, prior to it being progressed. It may also be useful to consider how key parts of agreed flood evacuation plans could be incorporated within local development documents, including in terms of protecting evacuation routes and assembly areas from inappropriate development.

Once the development goes ahead, it will be the requirement of the plan owner (developer) to make sure the plan is put in place, and to liaise with the LPA and LLFA regarding maintenance and updating of the plan.

LCC have made information about what to do during a flood available online via: https://www.lancashire.gov.uk/flooding/during-a-flood/

This includes information on who to contact, what to before, during and after a flood.

Also, the Flood Hub has information relating to preparing and protecting against flood risk:

https://thefloodhub.co.uk/knowledge-hub/

7.2.1 What should the evacuation plan include?

Flood warning and evacuation plans should include, as a minimum, the information stated in Table 7-1. Advice and guidance on plans are accessible from the EA website and there are templates available for businesses and local communities.

Consideration	Purpose
Availability of existing flood warning system	The EA offers a flood warning service that currently covers designated Flood Warning Areas in England and Wales. In these areas, they are able to provide a full flood warning service.
Rate of onset of flooding	The rate of onset is how quickly the water arrives and the speed at which it rises which, in turn, will govern the opportunity for people to effectively prepare for and respond to a flood. This is an important factor within Emergency Planning in assessing the response time available to the emergency services.
How flood warning is given and occupants awareness of the likely frequency and duration of flood events	Everyone eligible to receive flood warning should be signed up to the EA flood warning service. Where applicable, the display of flood warning signs should be considered. In particular sites that will be visited by members of the public on a daily basis such as sports complexes, car parks, retail stores. It is envisaged that the responsibility should fall upon the developers and should be a condition of the planning permission. Information should be provided to new occupants of houses concerning the level of risk and subsequent procedures if a flood occurs.
The availability of staff / occupants / users to respond to a flood warning and the time taken to respond	The plan should identify roles and responsibilities of all responders. The use of community flood wardens should also be considered.
Designing and locating safe access routes, preparing evacuation routes and the identification of safe locations for evacuees	Dry routes will be critical for people to evacuate as well as emergency services entering the site. The extent, depth and flood hazard rating, including allowance for climate change, should be considered when identifying these routes.
Vulnerability of occupants	Vulnerability classifications associated with development as outlined in the FRCC-PPG. This is closely linked to its occupiers.
How easily damaged items will be relocated, and the expected time taken to re-establish normal use following an event	The impact of flooding can be long lasting well after the event has taken place affecting both the property which has been flooded and the lives that have been disrupted. The resilience of the community to get back to normal will be important including time taken to repair / replace damages.

Table 7-1: Flood warning and evacuation plans

7.2.2 EA Flood Warning Areas (FWA) and flood awareness

The EA monitors river levels within Main Rivers across England and, based upon weather predictions provided by The Met Office, make an assessment of the anticipated maximum water level that is likely to be reached within the proceeding hours (and/or days). Where these predicted water levels are expected to result in inundation of a populated area, the EA will issue a series of flood warnings within a defined FWA, encouraging residents to take action to avoid damage to property in the first instance.

More information on flood warning is provided by the EA via:

https://www.gov.uk/government/publications/flood-warnings-what-they-are-and-what-to-do

There are 19 FWAs in operation across the CLA area. The FWAs are primarily located along the River Ribble; six of these are for the Ribble Estuary for tidal risk with the remaining for fluvial risk; the FWAs are shown on the SFRA maps in Appendix B.

Live information on flood warning and flood alerts for any location in England is available via:

https://flood-warning-information.service.gov.uk/

Emergency planners may also use the outputs from this SFRA to raise awareness within local communities. This should include raising awareness of flood risk, roles and responsibilities and measures that people can take to make their homes more resilient to flooding from all sources whilst also encouraging all those at fluvial and/or tidal flood risk to sign up to the EA's Flood Warning service:

https://www.gov.uk/sign-up-for-flood-warnings

It is also recommended that Category 1 responders are provided with appropriate flood response training to help prepare them for the possibility of a major flood with an increased number of people living within flood risk areas, to ensure that adequate pre-planning response and recovery arrangements are in place.

8 Summary and recommendations

8.1 Summary

This Level 1 SFRA provides a single repository planning tool relating to flood risk and development in Central Lancashire. Key flood risk stakeholders namely the EA, LPAs, LLFA and UU were consulted to collate all available and relevant flood risk information on all sources into one comprehensive assessment. Together with this main report, this SFRA also provides a suite of interactive GeoPDF flood risk maps (Appendix B) and a development site assessment spreadsheet (Appendix C) illustrating the level of risk to potential development sites.

The flood risk information, assessment, guidance and recommendations provided in this SFRA will provide the CLA with the evidence base required to apply the Sequential Test, as required under the NPPF, and demonstrate that a risk-based, sequential approach has been applied in the preparation of the CLAs new Local Plan.

Whilst the aim of the sequential approach is the avoidance of high flood risk areas, in some locations where the CLA is looking for continued growth and/or regeneration i.e. Preston, this will not always be possible. This SFRA therefore provides the necessary links between spatial development, wider flood risk management policies, local strategies and plans and on the ground works by combining all available flood risk information together into one single repository. As this is a strategic study based on current available information, detailed, site-specific local information on flood risk is not fully accounted for. For a more detailed assessment of specific areas or sites, a Level 2 SFRA may be carried out following on from this Level 1 assessment, if required.

The data and information used throughout the SFRA process is the most up-to-date data available at the time of writing (February 2021). Once new, updated or further information becomes available, the LPA should look to update this SFRA. The Level 1 SFRA should be considered to be, and maintained as, a 'live' entity which is updated as and when required (when new modelling or flood risk information becomes available). The LPA and the LLFA can decide when to update the SFRA, and the EA as a statutory consultee on local plans can also advise on when an update is required to inform the local plan evidence base.

8.1.1 Summary of risk

The risk across the CLA is varied:

- The main fluvial risk comes from the River Ribble that flows along the Preston/South Ribble boundary towards the east of the CLA area, the River Darwen that affects Walton-le-Dale and Higher Walton, the River Lostock that affects communities such as Leyland and Cuerden Green, and the River Yarrow in Chorley Borough Council's area affecting Ulnes Walton and just west of Chorley town centre; and
- The main tidal risk comes from the Ribble Estuary and the River Ribble which flows along the Preston/South Ribble boundary affecting Penwortham and just south of Preston City Centre, and the River Douglas which flows northward to the estuary on the west of the CLA area; and
- Surface water risk is spread across the entire CLA area with the area in the south-east of Chorley Borough Council's area to the east of the M61 being of particular risk where there is a collection of reservoirs such as the Anglezarke, Yarrow and Upper Rivington; and
- The areas with the highest levels of groundwater vulnerability are located mainly within Chorley Borough Council's region to the east: Withnell and

along the M61 by Lower Copthurst, High Copthurst, Knowley, and Little Knowley. Also, along the Preston/South Ribble boundary following the River Ribble, and along the South Ribble/Chorley boundary by Higher Walton, Gregson Lane and Hoghton; and

- The main reservoir risk according to the Reservoir Flood Map, affects Preston City Centre, the area just south of Croston, and some risk in Chorley Town Centre and Adlington.

8.2 Planning and flood risk policy recommendations

The following planning and flood risk policy recommendations are designed to enable the CLA to use the information provided in this Level 1 SFRA to inform Local Plan policy direction:

Recommendation 1: No development within the functional floodplain…

…as per the National Planning Policy Framework (2019) and Flood Risk and Coastal Change Planning Practice Guidance, unless in exceptional circumstances such as for essential infrastructure, which must still pass the Exception Test, or where development is water-compatible.

Development must not impede the flow of water within the functional floodplain nor should it reduce the volume available for the storage of floodwater. Sites within the functional floodplain may still be developable if the site boundary can be removed from the functional floodplain or the site can accommodate the risk on site and keep the area of functional floodplain free from development or obstruction and allowed to flow freely.

Refer to tables 1 to 3 of the FRCC-PPG.

Recommendation 2a: Consider surface water flood risk…

…with equal importance alongside fluvial and tidal risk including possible withdrawal, redesign or relocation for sites at significant surface water risk.

Sustainable Drainage Systems on all new development must adhere to industry standards and to the applicable runoff discharge rate and storage volume allowances stated by the LLFA.

Site specific Flood Risk Assessments should always consider surface water flood risk management and options for on-site flood storage through appropriate SuDS. The LPA and LLFA must always be consulted during this process, as should United Utilities and the EA, if required.

A Sustainable Drainage Strategy should always be submitted which clearly takes account of the findings of the site-specific Flood Risk Assessment and specify the proposed design, constructions, adoption and management and maintenance arrangements of the proposed SuDS components. The LPA and LLFA must always be consulted during this process, as should United Utilities and the EA, if required.

Recommendation 2b: Use of appropriately sourced SuDS…

…required for all major developments of 10 or more residential units or equivalent commercial development. This is in accordance with Para 163 of the National Planning Policy Framework (2019).

As per the NPPF (2019), in terms of SuDS, development in areas at flood risk should only be permitted where SuDS are incorporated into the design, unless clear evidence suggests demonstrates this would be inappropriate.

SuDS scoping and design, as part of a Sustainable Drainage Strategy informed by the site-specific FRA, must be included within the early stages of the site design in order to incorporate appropriate SuDS within the development.

The LPA, LLFA, and United Utilities (if appropriate) must be consulted during the site design stage and the FRA must be submitted to and approved by the LPA, considering all consultation with key stakeholders.

All SuDS must be designed to meet industry standards, as specified below, including any replacement standards/documents which update or are in addition to those listed:

- Lancashire County Council SuDS Guidance / Specification
- Interim national standards published in March 2015
- Technical Standards for Sustainable Drainage Systems (Defra)
- C753 The SuDS Manual
- The Design and Construction Guidance for Sewers (2020).

Recommendation 3: Sequential approach to site allocation and site layout…

…must be followed by the LPA to ensure sustainable development when either allocating land in Local Plans or determining planning applications for development.

The overall aim of the Sequential Approach should be to steer new development to low risk Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, the flood risk vulnerability of land uses and reasonably available sites in Flood Zone 2 should be considered, applying the Exception Test if required.

Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in higher risk Flood Zone 3a, be considered. This should take into account the flood risk vulnerability of land uses, residual surface water and/or groundwater flood risk and the likelihood of meeting the requirements of the Exception Test, if required.

This SFRA, the NPPF and FRCC-PPG must be consulted throughout this process along with the LPA, LLFA, EA and UU.

Recommendation 4: recommended requirements for a site-specific Flood Risk Assessment…

…from a developer when a site is:

- Any site located within Flood Zone 2 and / or Flood Zone 3
- Any site that has an area greater than 1 ha
- Within Flood Zone 1 where any part of the site is identified by the Risk of Flooding from Surface Water maps as being at risk of surface water flooding.
- Identified by the EA as having critical drainage problems (within an Area with Critical Drainage Problems)
- Situated over or within 8 metres of a culverted watercourse or where development will be required to control or influence the flow of any watercourse
- Within 20 metres of a Main River (due to potential increase in risk associated with climate change)
- Identified as being at increased flood risk in future
- At risk of flooding from other sources of flooding or at residual risk
- Subject to a change of use to a higher vulnerability classification which may be subject to other sources of flooding
- Situated in an area currently benefitting from defences

Before deciding on the scope of the Flood Risk Assessment, this SFRA should be consulted along with the LPA, LLFA, EA and United Utilities. The Flood Risk Assessment should be submitted to and be approved by the LPA including suitable consultation with the LLFA and the EA and any other applicable parties.

Recommendation 5: Natural Flood Management techniques…

…must be considered, where possible, to aid with flood alleviation and implementation of suitable SuDS, depending on the location.

The national Working with Natural Processes mapping (included in this SFRA) should be consulted in the first instance, followed by local investigation into whether such techniques are appropriate and whether the benefits are proportionate to the work required to carry out the identified Working with Natural Processes approaches.

Natural drainage features should be maintained and enhanced and there should be a presumption against culverting of open watercourses. Where possible, culvert removal should be explored.

Recommendation 6: Phasing of development…

…must be carried out by the LPA on a site by site basis and also within sites by the developer to avoid any cumulative impacts of flood risk (reinforced by the revised NPPF (2019)).

Using a phased approach to development, should ensure that any sites at risk of causing flooding to other sites or off-site are developed first to ensure that flood storage measures are in place and operational before other sites are developed, thus contributing to a sustainable approach to site development during all phases of construction. It may be possible that flood mitigation measures put in place at sites upstream could alleviate flooding at downstream or nearby sites.

Development phasing within large strategic sites of multiple developments should also be considered where parts of such sites are at flood risk.

The EA states that the optimum approach would be to have all development sites that make up a large strategic site to have all developers sign up to a Flood Risk and Drainage Masterplan from the very start of the planning stage. It is often the case that outline planning permission is given for larger strategic sites with individual developers then submitting further separate site-specific FRAs that are not joined up with the rest of the overall site. These individual FRAs can then often be devoid of all the green SuDS infrastructure touted within the Outline FRA.

Recommendation 7: Planning permission for at risk sites…

…can only be granted by the LPA where a site-specific Flood Risk Assessment and Sustainable Drainage Strategy demonstrates that:

- The NPPF and FRCC-PPG have been referenced together with appropriate consultation with the LLFA, the EA and UU, where applicable
- The effects of climate change have been taken into account using the latest allowances developed by the EA
- There is no loss in floodplain storage resulting from the development i.e. where development takes place in a fluvial/tidal flood zone or is at risk from surface water flooding, compensatory storage must be found to avoid loss of floodplain and subsequent displacement of water which may cause flooding elsewhere
- The development will not increase flood risk elsewhere
- For previously developed sites, the development should look to meet greenfield runoff rates where practicable (in line with the Non-Statutory Technical Standards for Sustainable Drainage (March 2013)), achieved through providing SuDS as appropriate or through the use of appropriate flow and volume control devices.
- There is no adverse effect on the operational functions of any existing flood defence infrastructure
- Proposed resistance / resilience measures designed to deal with current and future risks are appropriate
- Whether the development will be safe for its lifetime and has passed the Exception Test, if applicable
- An appropriate Emergency Plan is included that accounts for the possibility of a flood event and shows the availability of safe access and egress points accessible during times of flood.

8.2.1 Recommendations for further work

The SFRA process has developed into more than just a planning tool. Sitting alongside the SA, LFRMS and FRMP, it can be used to provide a much broader and inclusive vehicle for integrated, strategic and local flood risk management and delivery.

There are a number of plans and assessments listed in

Type	Study	Reason	Timeframe
Understanding of local flood risk	Level 1 SFRA update	When there are changes to: • the predicted impacts of climate change on flood risk • detailed flood modelling - such as from the EA or LLFA • the local plan, spatial development strategy or relevant local development documents • local flood management schemes • flood risk management plans • shoreline management plans • local flood risk management strategies • national planning policy or guidance	As required

Type	Study	Reason	Timeframe
		Or after a significant flood event.	
	Level 1 SFRA update; Level 2 SFRA; site-specific FRA	Reviewing of EA flood zones in those areas not covered by existing detailed hydraulic models i.e. the Flood Map for Planning does not cover every watercourse such as those <3km^2 in catchment area or Ordinary Watercourses. If a watercourse or drain is present on OS mapping but is not covered by the Flood Map for Planning, this does not mean there is no potential flood risk. A model may therefore be required to ascertain the flood risk, if any, to any nearby sites.	Short term
	Level 2 SFRA	**Further, more detailed assessment of flood risk to high risk sites, large strategic sites, as notified by this Level 1 SFRA. Dependant on the availability EA river model data.**	**Short term**
	Preliminary site-screening FRAs / outline drainage strategy	Further, more detailed assessment of larger strategic sites such as 19P031, 19P131, 19S107 and 19S322 which all have an area of over 100 ha in size.	Short term
	Local Flood Risk Management Strategy Review	It is recommended that the LFRMS is updated to ensure it remains consistent with the National Flood and Coastal Erosion Risk Management Strategy that is due to be published later this year, at the time of writing.	Short term
	Water Cycle Study	The Central Lancashire and Blackpool Water Cycle Study, produced in 2011, should be updated to the capabilities of the water and sewerage drainage networks. And where new capacity is needed to accommodate planned new development and urban expansion.	Short to Medium term
	Climate change assessment for Level 1 update or Level 2 SFRA	Modelling of climate change, using the EA's 2016 allowances. It was found that none of the EA's fluvial or tidal models had modelled climate change.	Short term
Flood storage and attenuation	Community Infrastructure Levy (CIL) and Blue-Green Infrastructure (BGI)	For new developments, BGI assets can be secured from a landowner's 'land value uplift' and as part of development agreements. The LPA could include capital for the purchase, design, planning and maintenance of BGI within its CIL programme.	Short term

Type	Study	Reason	Timeframe
	Working with Natural Processes	Promote creation of floodplain and riparian woodland, floodplain reconnection and runoff attenuation features where the research indicates that it would be beneficial in Central Lancashire.	Ongoing
Data collection	Flood Incident data	LCC, as Highways Authority, has a duty to investigate and record details of significant flood events within their area. General data collected for each incident, should include date, location, weather, flood source (if apparent without an investigation), impacts (properties flooded, or number of people affected) and response by any Risk Management Authority.	Short term
	FRM Asset Register	LCC has a responsibility to update and maintain a register of structures and features, which are considered to have an effect on flood risk.	Ongoing
Capacity	SuDS review / guidance	The LPA should work with the LLFA to clearly identify its requirements of developers for SuDS in new developments. The LLFA would encourage the creation of a SuDS SPD and robust policy in the DPD to secure maximum weighting is applied to surface water management and sustainable design of new drainage systems to prevent flooding from surface water.	Short Term / Long Term
Partnership	United Utilities	The LLFA should continue to collaborate with United Utilities on sewerage and surface water projects. The liaison meetings between United Utilities and the Local Planning Authorities should continue to inform the LPAs of any operational limitations and current resilience of the catchment and assets in regard to new connections from development.	Ongoing
	EA	CLA and LCC should continue to work with the EA on fluvial and tidal flood risk management projects. Potential opportunities for joint schemes to tackle flooding from all sources should be identified.	Ongoing
	Community	Continued involvement with the community through LCC's existing flood risk partnerships.	Ongoing

Table 8-1 that may be of benefit to the CLA, in developing their flood risk evidence base to support the delivery of the Local Plan, or to the LLFA to help fill critical gaps in flood risk information that have become apparent through the preparation of this Level 1 SFRA.

Type	Study	Reason	Timeframe
Understanding of local flood risk	Level 1 SFRA update	When there are changes to: • the predicted impacts of climate change on flood risk • detailed flood modelling - such as from the EA or LLFA • the local plan, spatial development strategy or relevant local development documents • local flood management schemes • flood risk management plans • shoreline management plans • local flood risk management strategies • national planning policy or guidance Or after a significant flood event.	As required
	Level 1 SFRA update; Level 2 SFRA; site-specific FRA	Reviewing of EA flood zones in those areas not covered by existing detailed hydraulic models i.e. the Flood Map for Planning does not cover every watercourse such as those <3km^2 in catchment area or Ordinary Watercourses. If a watercourse or drain is present on OS mapping but is not covered by the Flood Map for Planning, this does not mean there is no potential flood risk. A model may therefore be required to ascertain the flood risk, if any, to any nearby sites.	Short term
	Level 2 SFRA	**Further, more detailed assessment of flood risk to high risk sites, large strategic sites, as notified by this Level 1 SFRA. Dependant on the availability EA river model data.**	**Short term**
	Preliminary site-screening FRAs / outline drainage strategy	Further, more detailed assessment of larger strategic sites such as 19P031, 19P131, 19S107 and 19S322 which all have an area of over 100 ha in size.	Short term
	Local Flood Risk Management Strategy Review	It is recommended that the LFRMS is updated to ensure it remains consistent with the National Flood and Coastal Erosion Risk Management Strategy that is due to be published later this year, at the time of writing.	Short term
	Water Cycle Study	The Central Lancashire and Blackpool Water Cycle Study, produced in 2011, should be updated to the capabilities of the water and sewerage drainage networks. And where new capacity is needed to accommodate planned new development and urban expansion.	Short to Medium term
	Climate change	Modelling of climate change, using the EA's 2016 allowances. It was found that none of	Short term

Type	Study	Reason	Timeframe
	assessment for Level 1 update or Level 2 SFRA	the EA's fluvial or tidal models had modelled climate change.	
Flood storage and attenuation	Community Infrastructure Levy (CIL) and Blue-Green Infrastructure (BGI)	For new developments, BGI assets can be secured from a landowner's 'land value uplift' and as part of development agreements. The LPA could include capital for the purchase, design, planning and maintenance of BGI within its CIL programme.	Short term
	Working with Natural Processes	Promote creation of floodplain and riparian woodland, floodplain reconnection and runoff attenuation features where the research indicates that it would be beneficial in Central Lancashire.	Ongoing
Data collection	Flood Incident data	LCC, as Highways Authority, has a duty to investigate and record details of significant flood events within their area. General data collected for each incident, should include date, location, weather, flood source (if apparent without an investigation), impacts (properties flooded, or number of people affected) and response by any Risk Management Authority.	Short term
	FRM Asset Register	LCC has a responsibility to update and maintain a register of structures and features, which are considered to have an effect on flood risk.	Ongoing
Capacity	SuDS review / guidance	The LPA should work with the LLFA to clearly identify its requirements of developers for SuDS in new developments. The LLFA would encourage the creation of a SuDS SPD and robust policy in the DPD to secure maximum weighting is applied to surface water management and sustainable design of new drainage systems to prevent flooding from surface water.	Short Term / Long Term
Partnership	United Utilities	The LLFA should continue to collaborate with United Utilities on sewerage and surface water projects. The liaison meetings between United Utilities and the Local Planning Authorities should continue to inform the LPAs of any operational limitations and current resilience of the catchment and assets in regard to new connections from development.	Ongoing
	EA	CLA and LCC should continue to work with the EA on fluvial and tidal flood risk management projects. Potential opportunities for joint schemes to tackle	Ongoing

Type	Study	Reason	Timeframe
		flooding from all sources should be identified.	
	Community	Continued involvement with the community through LCC's existing flood risk partnerships.	Ongoing

Table 8-1: Recommended further work for CLA or developers

8.2.2 Level 2 SFRA

The CLA should review the sites where they expect the main housing numbers and employment sites to be delivered, using Section E.1 of Appendix E, the SFRA maps in Appendix B and the development site assessment spreadsheet in Appendix C. A Level 2 SFRA may be required for sites where any of the following applies:

- The Exception Test is required,
- Further evidencing i.e. climate change modelling is required at the strategic level in order to allocate,
- A large site, or group of sites, are within Flood Zone 3 and have strategic planning objectives, which means they cannot be relocated or avoided,

A cluster of sites are within Flood Zone 2 or are at significant risk of surface water flooding. A Level 2 SFRA should build on the source information provided in this Level 1 assessment and should show that a site will not increase risk elsewhere and will be safe for its lifetime, once developed.

As discussed in Section 0, a Level 2 assessment can be used to model the February 2016 climate change allowances, where current EA models are available. A Level 2 study may also further assess locations and options, in more detail, for the implementation of open space, or Green Infrastructure, to help manage flood risk in key areas, and also to assess residual risk.

Ultimately, the CLA will need to provide evidence in its Local Plan to show that housing numbers, economic needs and other sites can be delivered. Proposals within the Local Plan may be rejected if a large number of sites require the Exception Test to be passed but with no evidence that this will be possible.

As sites within this Level 1 assessment have been reviewed by the CLA in the consideration of planning applications, then further advice or guidance may be required to establish how best to progress future development proposals, possibly by a further review of the SFRA.

Table 8-2 highlights those sites that should or could go through a Level 2 SFRA. All Strategic Recommendation B sites **should** have a Level 2 SFRA completed assuming the LPA want to allocate. Those sites with Strategic Recommendation A **could** go through a Level 2 assessment in order to assess depths and hazards of flooding. Certain Strategic Recommendation C sites may also benefit from a more in-depth assessment through a Level 2 SFRA.

Site Ref	Site Name	Proposed Use	Strategic Rec	Should/Could
19C007	Land at Corner of Pompian Brow and South Road, Bretherton, PR26 9AQ	Residential	A	Could
19C021	Land off Hall Lane, Mawdesley, L40 2QY	Other	B	**Should**
19C024	Land on the East side of Chapel Lane, Coppull	Residential	A	Could

Site Ref	Site Name	Proposed Use	Strategic Rec	Should/Could
19C042	Land South of Springfield Road, Coppull, Chorley, PR7 5EJ	Residential	A	Could
19C056	Whittle Hill Quarry, Hill Top Lane, Whittle-le-Woods, Chorley	Residential	A	Could
19C073	Former Ministry of Defence Land, Cocker Bar Road, Ulnes Walton, PR26 9AZ	Residential	B	**Should**
19C075	Land South of Dunrobin Drive, Esuton, PR7 6LP	Residential	A	Could
19C076	Land East of Tincklers Lane, Eccleston, PR7 5QW	Residential	A	Could
19C081	Land Between Carr House Lane and Pompian Brow, Bretherton, PR26 9AQ	Residential	A	Could
19C083	Westhead Road, Croston, Leyland, PR26 9RR	Residential	B	**Should**
19C090	Land Between Carr House Land and Pompian Brow, Bretherton, Pr26 9AQ	Residential	A	Could
19C094	Land South of Springfield Road, Coppull, Chorley, PR7 5EJ	Residential	A	Could
19C100	Land at Bagganley Lane, Chorley, PR6 0EA	Mixed Use	A	Could
19C103	Land off Babylon Lane, Adlington, Chorley, PR6 9NP	Residential	A	Could
19C106	Land off Towngate, Eccleston, PR7 5QL	Residential	A	Could
19C157	Land off Moulden Brow, Blackburn, BB2 5JA	Residential	A	Could
19C158	Land South of Moulden Brow, Blackburn, BB2 5JA	Residential	A	Could
19C164	Euxton Lane, Chorley, PR7 1BF	Employment	A	Could
19C171	East of M61, Chorley, PR6 9AR	Mixed Use	B	**Should**
19C185	Land off Bolton Road, Abbey Village, PR6 8DP	Residential	A	Could
19C233x	Land south of South Road	Residential	A	Could
19C259x	Westhead Road	Residential	B	**Should**
19C272x	Babylon Lane	Residential	A	Could
19C279x	West of M61 – Whittle Hill Quarry	Residential	A	Could
19C287	Land East of Rawlinson Lane, Heath Charnock, Chorley, PR7 4DE	Residential	A	Could
19C299	Land to North of Moor Road, Croston, Leyland, PR26 9HN	Residential	A	Could
19C307	Land to the South of the A581 Euxton PR76DD	Residential	A	Could
19C327	Lower Bank Street, Withnell, Chorley, PR6 8SE	Mixed Use	A	Could
19C334	Land off Smithy Lane Brindle PR6 8NN	Residential	A	Could

Site Ref	Site Name	Proposed Use	Strategic Rec	Should/Could
19C340	Land North of Drink House Road PR26 9JE	Residential	B	**Should**
19C341	Land North of Drink House Road PR26 9JE	Residential	B	**Should**
19C343	Latvian Consulate, Pemberton House Farm, Park Hall Road, Charnock Richard, Chorley, PR7 5LP	Residential	B	**Should**
19C350	Former Gasworks, Bengal St, Chorley, PR7 1SA	Residential	A	Could
19C367	Land to the east of station road Croston	Residential	B	**Should**
19C370	Land immediately South of 182 Preston Road, Coppull, PR7 5ED	Residential	A	Could
19C371	Land of East Side of Bretherton Road, Croston, PR26 9RF	Residential	B	**Should**
19P003	Land at Willowfield Barn, Cottam Lane, Preston, PR2 1JS	Residential	A	Could
19P006	Land North of Derby Road, Fulwood, Preston, PR2 8JJ	Other	A	Could
19P009	Ingol Lodge, Cottam Avenue, Preston, PR2 3XH	Residential	A	Could
19P019	Land on North Side of Eastway (B6241) and West of 421 Garstang Road, PR3 5JD	Residential	A	Could
19P036	Land Opposite Swainson House Farm, Goosnargh Lane, Goosnargh, Preston, PR3 2JU	Residential	A	Could
19P041	Land off Cumeragh Lane, Longridge, Preston, PR3 2AJ	Residential	A	Could
19P053	Land at Anderton Fold Farm, Bilsborrow, Preston, PR3 5AD	Residential	A	Could
19P055	Preston Technology Centre, Marsh Lane, Lancashire, PR1 8UQ	Residential	A	Could
19P066	Springfield Training Ground, Dodney Drive, Lea, Preston, PR2 1XR	Residential	B	**Should**
19P067	Land off Tudor Avenue, Lea, PR2 1YB	Residential	A	Could
19P116	Land North and West of School Lane, Catforth, PR4 0HL	Residential	A	Could
19P138	Land North of Eastway (formerly Broughton Business Park), Eastway, Fulwood, PR2 9ZB	Employment	A	Could
19P150	Deepdale Mill, Deepdale Mill Street, PR1 5BY	Residential	A	Could
19P162	Avenham Street Car Park, PR1 3BN	Residential	A	Could
19P164	North of Shepherd Street, PR1 3YH	Residential	A	Could
19P170	Stoneygate Opportunity Area, Preston, PR1 3XT	Mixed Use	A	Could

Site Ref	Site Name	Proposed Use	Strategic Rec	Should/Could
19P213	3 and 5 Tyne Street, Preston, PR1 8ED	Residential	B	**Should**
19P215	Lower House Farm, Lewth Lane, Woodplumpton, Preston, PR4 0TE	Residential	A	Could
19P254	Savick House, Whittingham Lane, Grimsargh, Preston, PR2 5RP	Residential	A	Could
19P255	Land Opposite, Gleafield, Cumeragh Lane, Preston, PR3 2AJ	Residential	A	Could
19P280	Land west of Ashton and Lea Golf Club	Residential	B	**Should**
19P281	Land east of Ashton and Lea Golf Club and north of Savick Brook	Residential	B	**Should**
19P282	Dobsons Farm, Sandygate Lane, Broughton, Preston, PR3 5LA	Residential	A	Could
19P293	PR4 0RX	Residential	A	Could
19P302	Land to the west of Garstang Road, Broughton	Residential	B	**Should**
19S016	Land Opposite Aurora Brambles School, 159 Longmeanygate, Leyland, PR26 7TB	Residential	A	Could
19S029	St Catherine's Park, Lostock Lane, Lostock Hall, Preston, PR5 5XU	Other	A	Could
19S033	Land at Pope Lane (Opposite Merlewood), Abutted by Wham Lane and Pope Lane, PR4 4JR	Residential	A	Could
19S043	Land Surrounding Smith's Farm, Farington, PR26 6RB	Residential	B	**Should**
19S044	Land Adjacent to Wam Cottage, 153 Longmeanygate, Leyland, PR26 7TB	Residential	A	Could
19S047	Land West of Shuttling Fields Lane, Hoghton, Preston, PR5 0LH	Residential	A	Could
19S050	Land South of Higher Walton Road, Walton-le-Dale, Preston, PR5 4HS	Residential	B	**Should**
19S054	Land off Fowler Lane, Farington, PR26 6RH	Residential	B	**Should**
19S058	Land West of Liverpool New Road, PR4 5JJ	Residential	A	Could
19S060	Land West of Liverpool New Road, PR4 5JJ	Residential	A	Could
19S070	Land off Victoria Road, Walton-le-Dale, PR5 4AU	Residential	B	**Should**
19S076	Land Between Marsh Lane and Hall Carr Lane, Longton, PR4 5YL	Residential	A	Could
19S096	Land Adjacent 120 Longmeaygate, Midge Hall, Leyland, PR26 6TE	Residential	A	Could
19S105	Land off Higher Walton Road, Walton le Dale, PR5 4HD	Residential	B	**Should**

Site Ref	Site Name	Proposed Use	Strategic Rec	Should/Could
19S128	Land off Chapel Meadow, Chapel Lane, Longton, PR4 5DG	Residential	A	Could
19S129	Walton Gall Farm, Walton Green, Higher Walton, PR5 4JL	Residential	A	Could
19S134	Lands either side of 172 Higher Walton Road, PR54HR	Residential	B	**Should**
19S140	Land South of Marsh Lane, Longton, Preston, PR4 5ZL	Residential	A	Could
19S147	Land adjoining 153 and 155 Longmeanygate, Midge Hall, Leyland, PR26 7TB	Residential	A	Could
19S154	Turbary House Nursery, Chain House Lane, Whitestake, PR4 4LB	Residential	A	Could
19S157	Near Old School Drive, Longton, PR4 5DL	Residential	A	Could
19S161	Coupe's Factory, PR26 7UN	Residential	A	Could
19S182	Land Rear of Church and 249-251 Leyland Lane, Leyland, PR25 1XL	Residential	A	Could
19S198	HPH Mayfield House Haulage Yard (Formerly Pickfords), Chorley Road, PR5 4JN	Residential	A	Could
19S203	Land Adjacent to 20 Ladyacre, PR5 6XN	Residential	A	Could
19S207	Land to Rear of Pine Direct, Station Road, PR5 6LA	Residential	B	**Should**
19S234	Darwenside Nursery, PR5 4HT	Residential	B	**Should**
19S235	Hoghton Cottage, Preston New Road, PR5 0UP	Residential	A	Could
19S257	Land at the end of Fowler Lane, Farington Moss, Leyland, PR26 6PR	Residential	B	**Should**
19S265	Two parcels of land extending to 1.4 hectares, immediately to west of West View (PR4 4SJ), Brownhill Lane and extending to the Longton Bypass. Bordered by Bridge End Farm to north and Ranch House to south	Residential	A	Could
19S289	Land off Hollins Lane, PR26 8LJ	Residential	B	**Should**
19S295	Land East of Bannister Hall Drive, PR5 4DB	Residential	A	Could
19S309	Land off Emnie Lane, Leyland	Residential	A	Could
19S320	Higher Walton Mill, Cann Bridge St, Higher Walton, Preston PR5 4DJ	Mixed Use	B	**Should**
19S323	Darwenside Nurseries, Higher Walton Rd, PR5 4HT	Residential	B	**Should**

Table 8-2: Sites that should or could go through a Level 2 SFRA based on their strategic recommendation

The EA should always be consulted as to whether a Level 2 SFRA is required.

Appendices

A Planning Framework and Flood Risk Policy

Following the introduction to the planning framework and flood risk policy located in Section 4, the remainder of the policy information is located within Appendix A and gives background into the policy documents that are relevant to the CLA.

B SFRA Maps

Interactive GeoPDF maps

The SFRA Maps consist of all flood risk information used within the SFRA, by way of interactive GeoPDFs. Open the Overview Map in Adobe Acrobat. The Overview Map includes a set of five squares; clicking on one of these squares will open up on of the Index Maps. The Index Maps then contains a set of Index squares covering the authority area at a scale of 1:10,000. Clicking on one of these index squares will open up a more detailed map of that area (scale = 1:10,000) by way of a hyperlink.

Within the detailed maps, use the zoom tools and the hand tool to zoom in/out and pan around the open detailed map. In the legend on the right-hand side of the detailed maps, layers can be switched on and off when required by way of a dropdown arrow. The potential development site reference labels can also be switched on and off if, for example, smaller sites are obscured by labels.

The table below shows the datasets that are included in the maps with a short description of what they show.

Dataset	Description
Areas Benefitting from Defences	This dataset shows those areas that benefit from the presence of defences in a 1 in 100 (1% AEP) chance of flooding each year from rivers; or 1 in 200 (0.5% AEP) chance of flooding each year from the sea. Note: in mapping these areas, it is assumed that flood defences and other operating structures act perfectly and give the same level of protection as when the assessment of the area was done.
CLA Boundary	A shapefile showing the CLA's administrative area.
Detailed River Network	Dataset from the Environment Agency symbolised to show the Main Rivers and Ordinary watercourses flowing through the CLA region.
Flood Alert Areas	Geographical areas where it is possible for flooding to occur from rivers, sea and, in some locations, groundwater. Flood Alerts are issued to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early/low impact preparations for flooding.
Flood Warning Areas	Geographical areas where we expect flooding to occur and where the Environment Agency provide a Flood Warning Service.
Flood Zone 3b (functional floodplain)	The functional floodplain was delineated as part of this 2020 SFRA (see Appendix D for methodology note) as it is not included in the Flood Map for Planning. This zone is for the use of LPAs and developers.
Flood Zones 2 and 3	The flood zones that are included within the Environment Agency's Flood Map for Planning. Note: Flood Zone 3b was delineated so Flood Zone 3 is therefore classed as Flood Zone 3a.
Historic Flood Map	Dataset from the Environment Agency showing the maximum extent of all individual Recorded Flood Outlines from river, the sea

Dataset	Description
	and groundwater. It differs from the Recorded Flood Outlines dataset as the HFM only contains outlines that are 'considered and accepted'.
JBA Groundwater Map	The JBA 5m Groundwater map provides a general broad-scale assessment of the groundwater flood hazard and is categorised into grid code which is explained in Section 5.4 of the report.
LCC boundary	A shapefile showing the administrative area of LCC.
Main River buffer	EA guidance states that a buffer is required along all watercourses, which may be needed for access, maintenance or future flood risk management to make sure development in these areas does not increase flood risk. An 8-metre buffer, either side of each watercourse, has therefore been used in this SFRA, based on typical EA advice. Note: this buffer area is indicative and any plans for development should, through an FRA, further investigate the area required for the buffer zone.
Recorded Flood Outlines	Dataset from the Environment Agency showing all records of historic flooding from rivers, the sea, groundwater and surface water. This dataset contains a consistent list of information about the recorded flood.
Risk of Flooding from Rivers and Sea (RoFRS)	Dataset from the Environment Agency showing the chance of flooding from rivers and/or the sea, based on cells of 50m. Each cell is allocated one of four flood risk categories, taking into account flood defences and their condition.
Risk of Flooding from Surface Water (RoFSW)	Previously known as the updated Flood Map for Surface Water (uFMfSW); shows the extent of flooding from surface water that could result from a flood. Note: this data cannot be used at property level.
Shoreline Management Plan	A shapefile showing the Shoreline Management Plan that affects the Ribble Estuary to the west of the CLA area.
Spatial Flood Defences	Dataset from the Environment Agency showing all flood defences currently owned, managed or inspected by the EA. It has been symbolised to show raised flood walls and embankments within the CLA region.
UU boundary	A shapefile showing the administrative area of United Utilities.
Working with Natural Processes	There are 6 shapefiles located on the maps showing working with natural processes interventions that can be used across the district as more natural forms of flood management.

C Development site assessment spreadsheet

Excel spreadsheet containing an assessment of flood risk to the potential development sites based on Flood Zones 2, 3a and 3b, as delineated through this SFRA, and also the Risk of Flooding from Surface Water (RoFSW).

D Functional floodplain delineation

Technical note explaining the methodology behind the delineation of the functional floodplain (Flood Zone 3b) for this SFRA.

E Strategic recommendations of the proposed sites

Following on from the introduction to the strategic recommendations for sites and the site assessment spreadsheet in Appendix C, this Appendix details the strategic recommendations for sites.

F Strategic recommendation figures

Figures mapping the sites across the CLA area categorised by strategic recommendation to easily show which sites may be allocated and those that may need more work before that is possible.

G Central Lancashire Level 1 SFRA User Guide

A support document to provide guidance on the use of the SFRA to developers, spatial planners, development management, flood risk management and emergency planners.

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