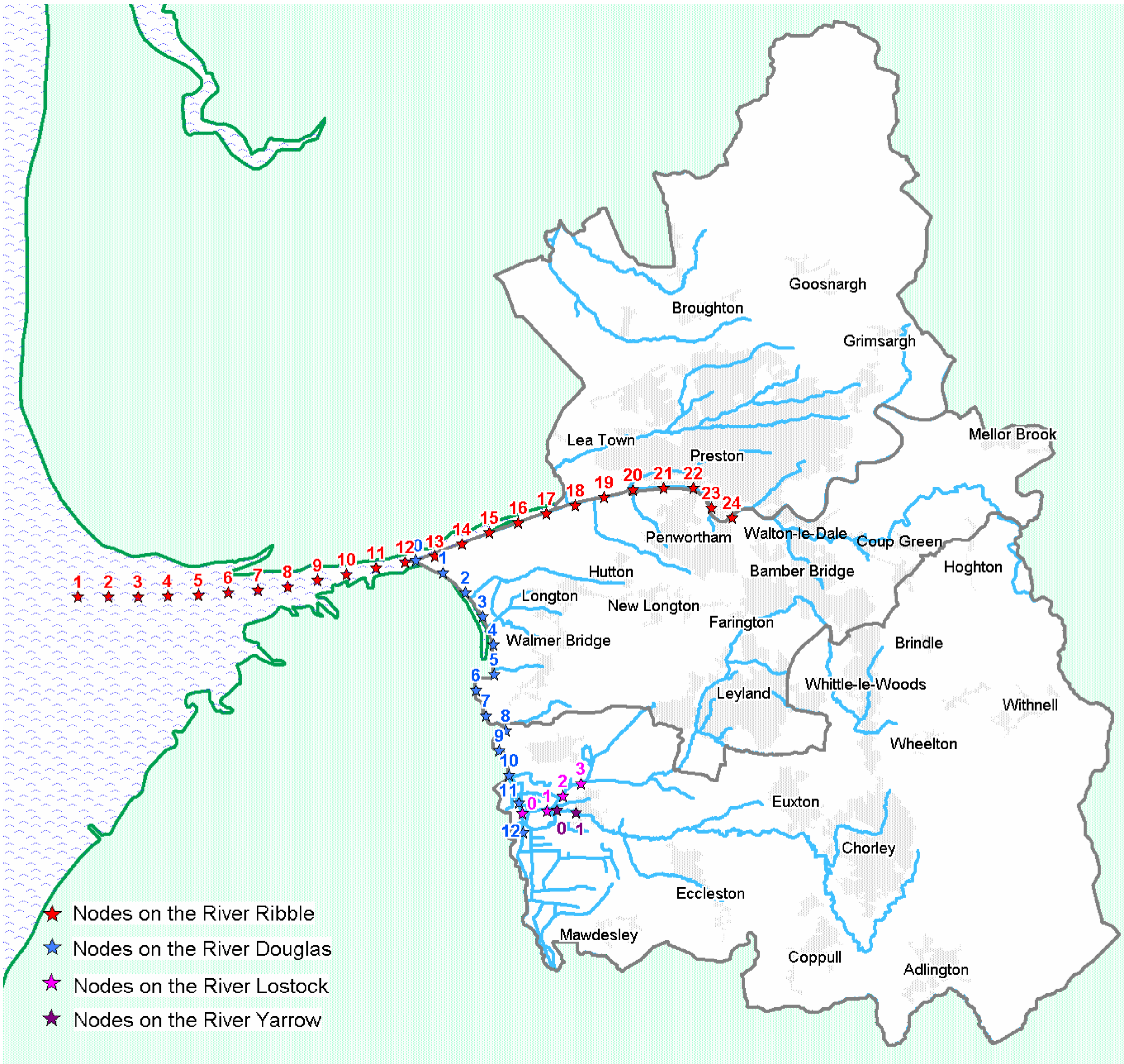
Appendix C: Calculated Increases in Sea Level due to Climate Change

LOCATION	CHAINAGE	NGR		200 yr Level (m AOD)	Cumulative Sea Level (m AOD)		
		Easting	Northing		25	50	100
Ribble	1	332034	425710	6.25	6.25	6.34	6.53
Ribble	2	333020	425710	6.29	6.29	6.38	6.57
Ribble	3	334007	425712	6.34	6.34	6.43	6.62
Ribble	4	334993	425745	6.39	6.39	6.48	6.67
Ribble	5	335979	425778	6.44	6.44	6.53	6.72
Ribble	6	336963	425847	6.48	6.48	6.57	6.76
Ribble	7	337945	425944	6.53	6.53	6.62	6.81
Ribble	8	338926	426042	6.58	6.58	6.67	6.86
Ribble	9	339891	426248	6.63	6.63	6.72	6.91
Ribble	10	340856	426455	6.69	6.69	6.78	6.97
Ribble	11	341822	426653	6.74	6.74	6.83	7.02
Ribble	12	342790	426847	6.79	6.79	6.88	7.07
Ribble	13	343753	427053	6.84	6.84	6.93	7.12
Ribble	14	344656	427450	6.89	6.89	6.98	7.17
Ribble	15	345565	427834	6.94	6.94	7.03	7.22
Ribble	16	346493	428168	7.00	7.00	7.09	7.28
Ribble	17	347436	428459	7.05	7.05	7.14	7.33
Ribble	18	348381	428739	7.10	7.10	7.19	7.38
Ribble	19	349332	429005	7.15	7.15	7.24	7.43
Ribble	20	350290	429237	7.20	7.20	7.29	7.48
Ribble	21	351273	429315	7.26	7.26	7.35	7.54
Ribble	22	352259	429292	7.31	7.31	7.40	7.59
Ribble	23	352868	428640	7.36	7.36	7.45	7.64
Ribble	24	353538	428334	7.38	7.38	7.47	7.66
Douglas	0	343137	426921	6.79	6.79	6.88	7.07
Douglas	1	344018	426498	6.81	6.81	6.90	7.09
Douglas	2	344754	425850	6.82	6.82	6.91	7.10
Douglas	3	345321	425051	6.84	6.84	6.93	7.12
Douglas	4	345683	424146	6.86	6.86	6.95	7.14
Douglas	5	345705	423166	6.88	6.88	6.97	7.16
Douglas	6	345117	422636	6.89	6.89	6.98	7.17
Douglas	7	345449	421804	6.91	6.91	7.00	7.19
Douglas	8	346107	421309	6.91	6.91	7.00	7.19
Douglas	9	345879	420655	6.91	6.91	7.00	7.19
Douglas	10	346213	419861	6.91	6.91	7.00	7.19
Douglas	11	346539	418939	6.91	6.91	7.00	7.19
Douglas	12	346671	417976	6.91	6.91	7.00	7.19
Lostock	0	346629	418609	6.91	6.91	7.00	7.19
Lostock	1	347449	418686	6.91	6.91	7.00	7.19
Lostock	2	347979	419171	6.91	6.91	7.00	7.19
Lostock	3	348569	419579	6.91	6.91	7.00	7.19
Yarrow	0	347767	418715	6.91	6.91	7.00	7.19
Yarrow	1	348410	418633	6.91	6.91	7.00	7.19

Figure C-1: Locations of Nodes / Chainages referred to in Table C-1

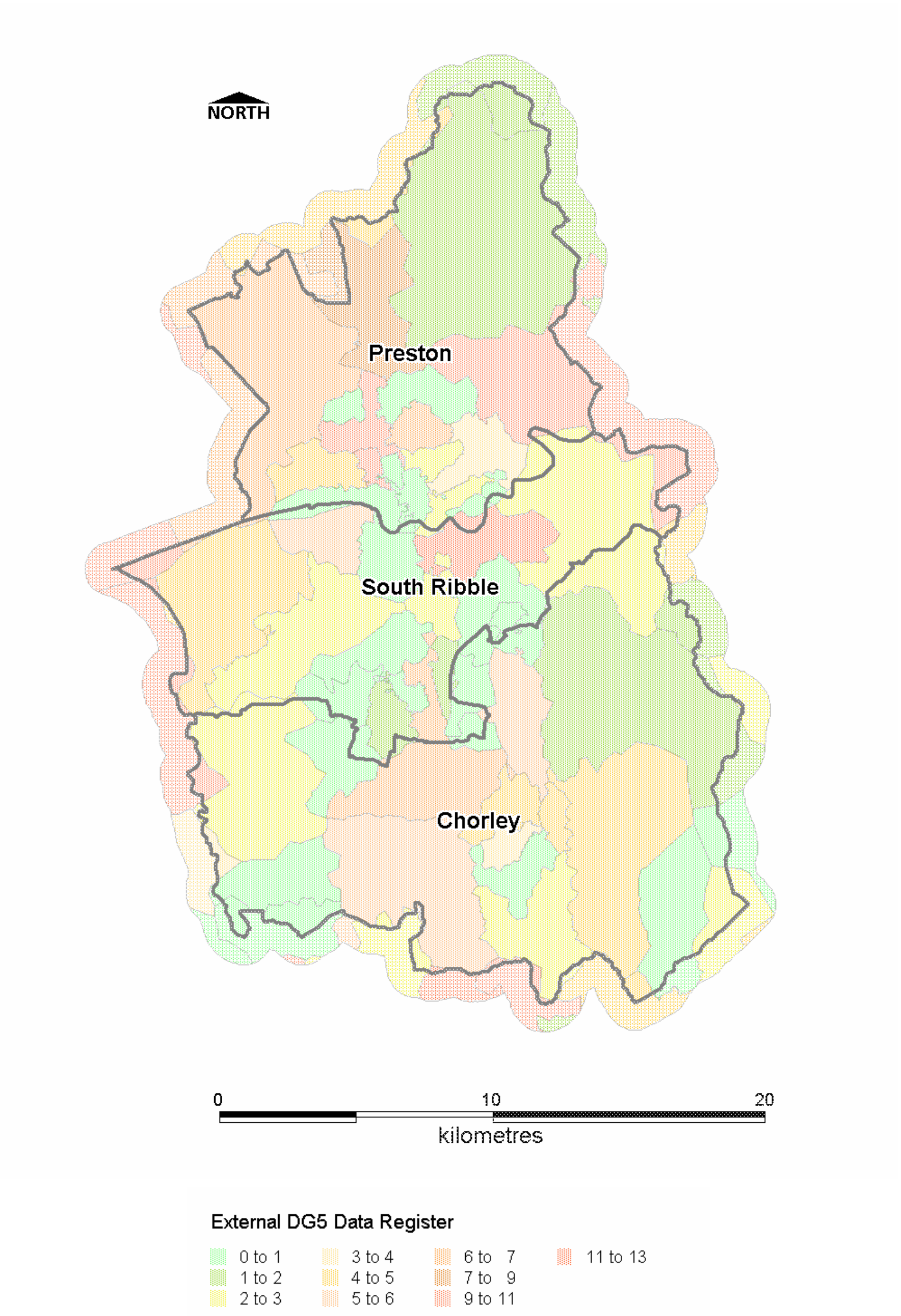


Appendix D: United Utilities DG5 Data

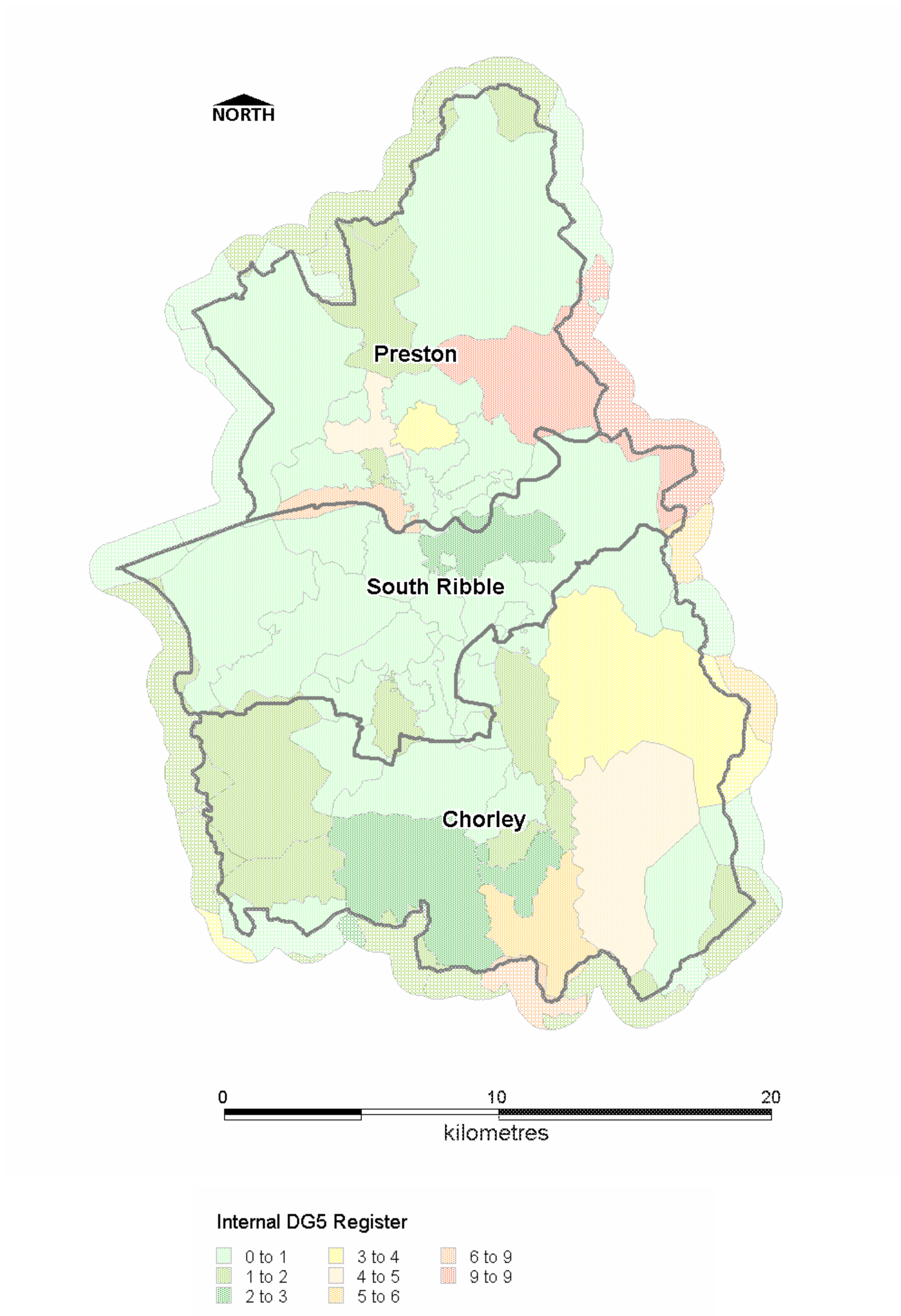
Central Lancashire Level 1 SFRA

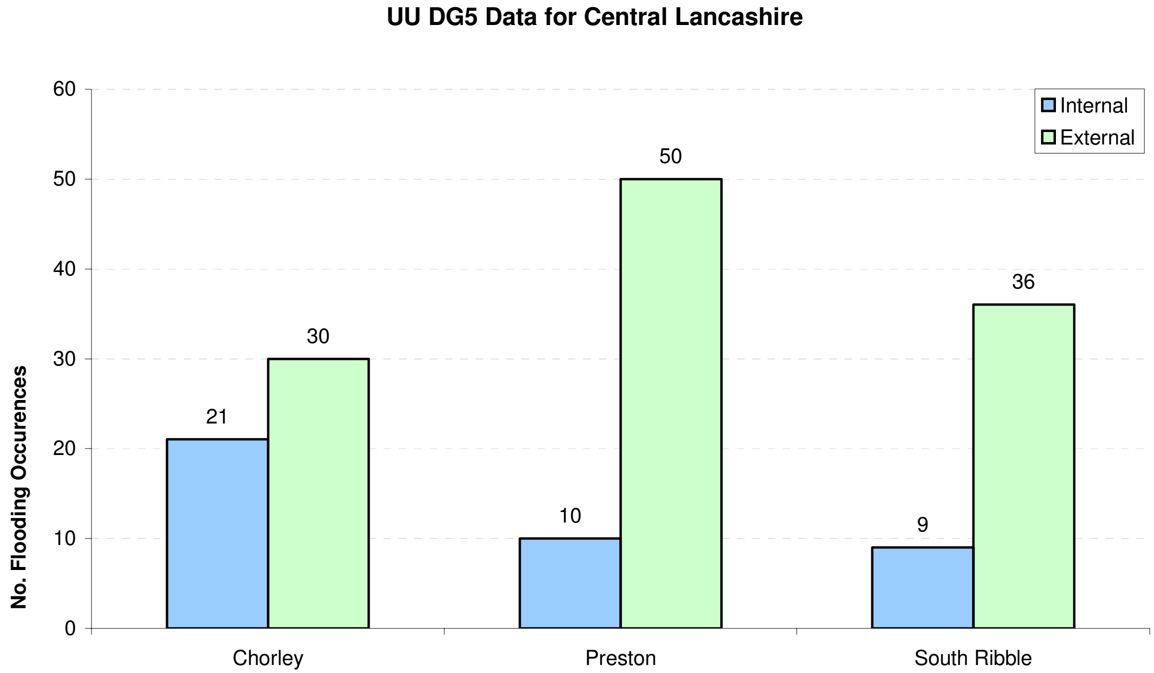
DG5 Thematic Map showing Sewer Flooding Incidents (October 2006 – April 2007)

External DG5 Register



Internal DG5 Register





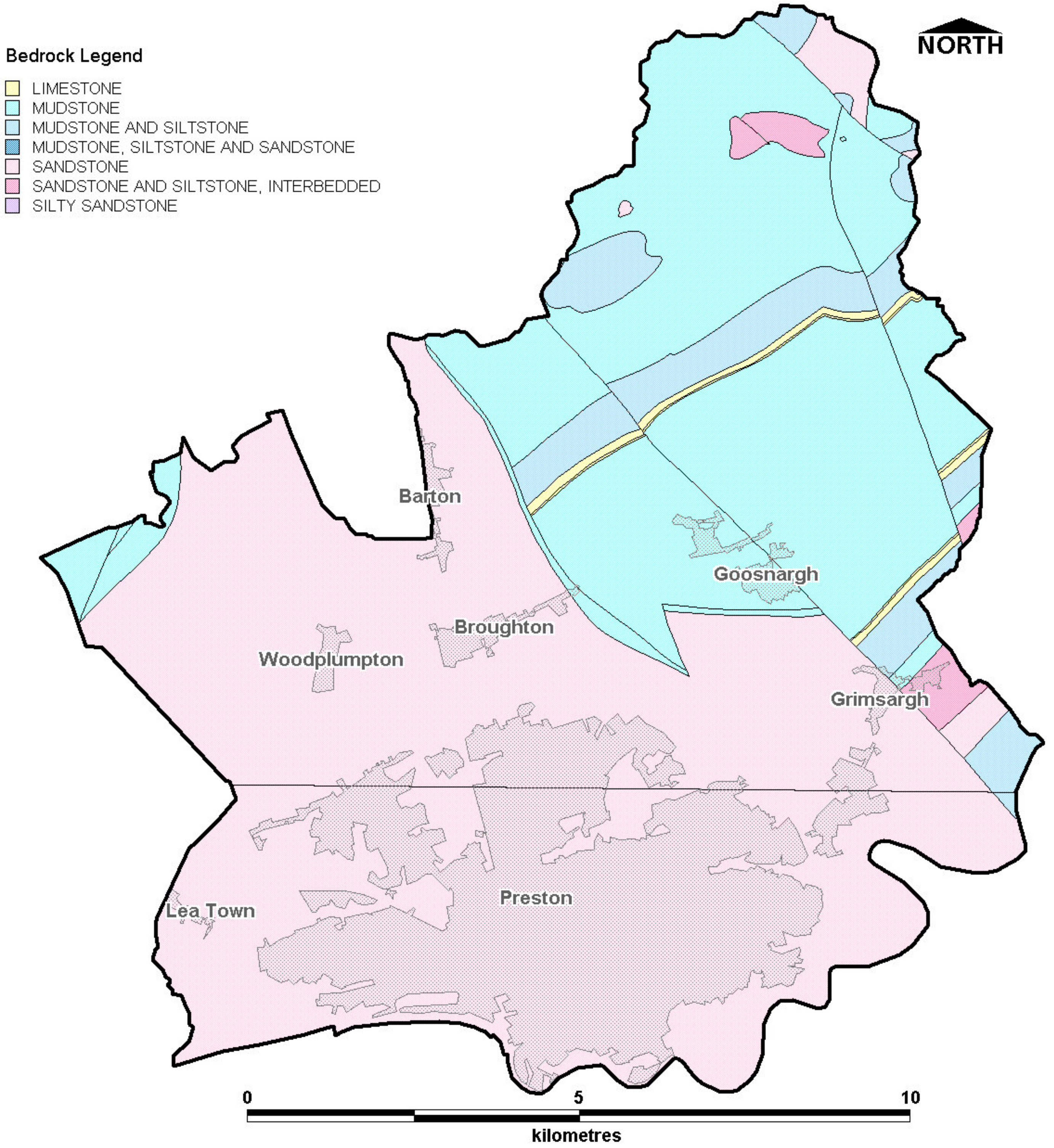
(Data shown in graph was supplied by United Utilities for sewer flooding incidents between October 2006 and April 2007)

Appendix E: Groundwater Vulnerability and Geology

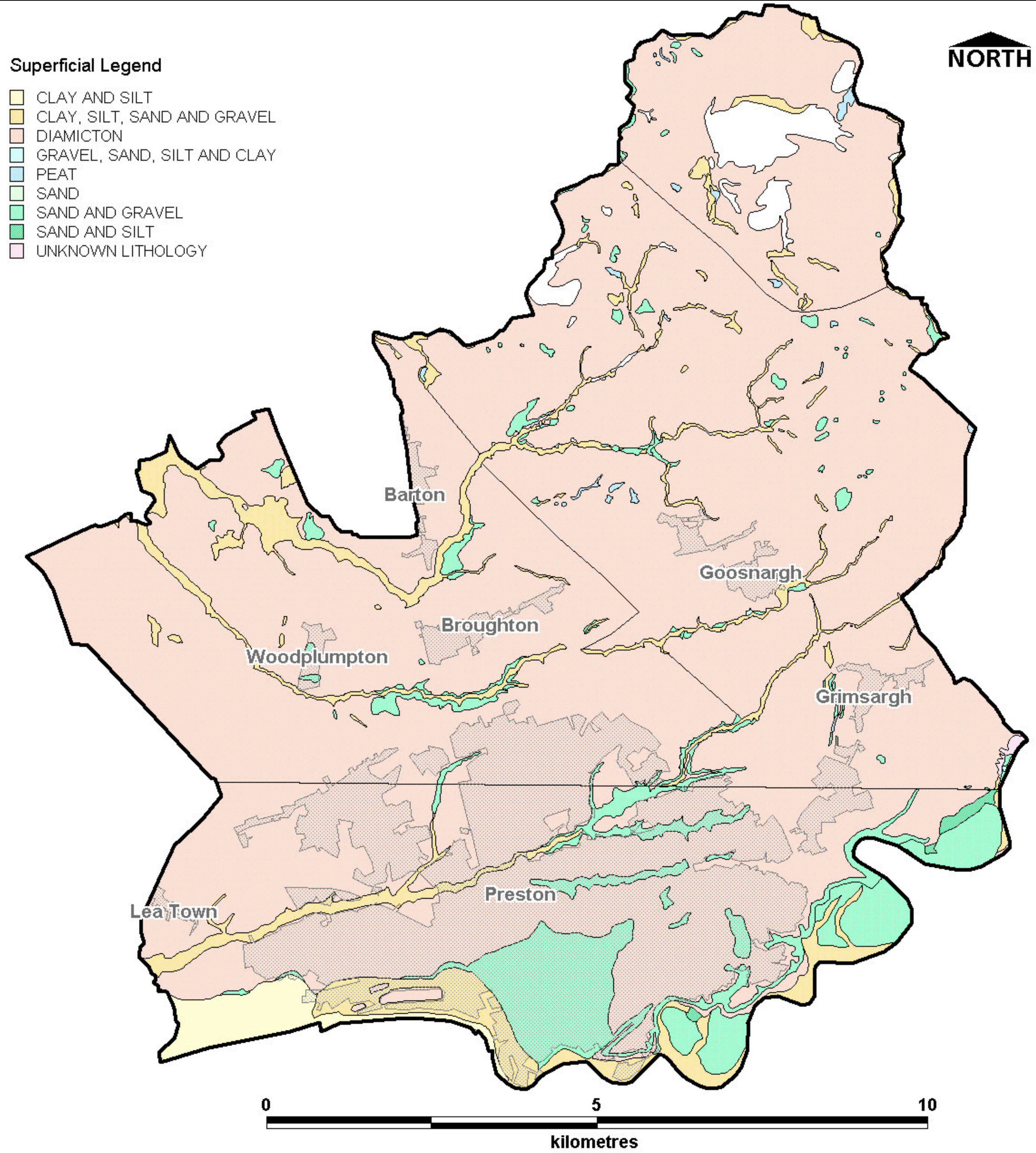
Central Lancashire Level 1 SFRA

Preston BGS Data

Bedrock

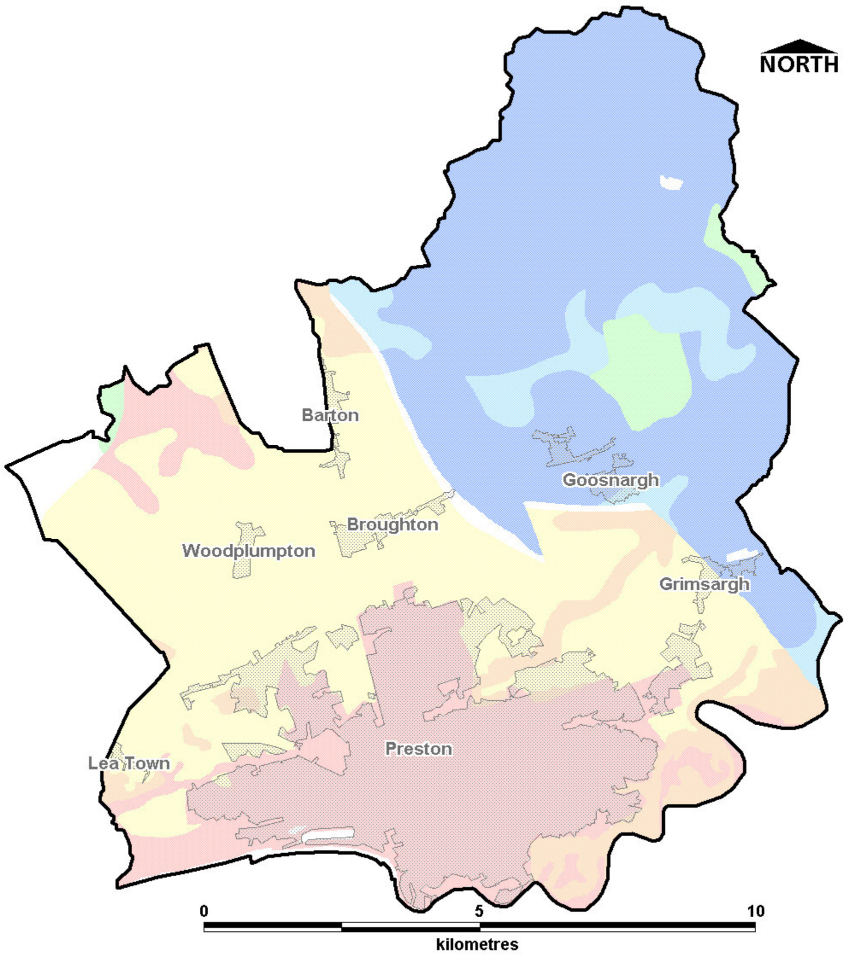


Superficial Deposits



Central Lancashire Level 1 SFRA

Preston Groundwater Vulnerability



Ground Water Vulnerability Map (100k)
Central Lancashire by Vulnerability Classification

- Major Aquifer - High
- Major Aquifer - Intermediate
- Major Aquifer - Low
- Minor Aquifer - High
- Minor Aquifer - Intermediate
- Minor Aquifer - Low

Appendix F: Records of Historical Flooding

Table F-1: Douglas Catchment Historical Flood Events within the Study Area

Source of Data	River / Catchment	Date of event	Area(s) affected	Details of event
River Douglas CFMP	Douglas (Yarrow)	October 2000	Croston Village	Fewer properties affected than in the 1987 event. See August 1987 event below.
		August 1987	Croston Village	205 properties affected. Flooding in Croston occurs when the Yarrow breaks out of its channel upstream of the village then flows towards the village centre where existing flood defence walls prevent the water returning to the river. The depth of flooding in nearby properties increases as the depth of water behind the walls increases.
	Douglas (Chor)	1999	Chorley	River Chor aqueduct overtopped with water flowing onto the railway line and subsequently affecting properties downstream. Capacity of Chor aqueduct reduced due to weed and sediment likely to have contributed to flooding. Structure owned and maintained by Network Rail. Most flooding in the residential parts of Chorley is thought to be due to poor surface drainage and inadequate sewer capacity rather than river flooding.
		August 1987	Chorley	
		Various since 1940s.	Chorley	-
	Douglas (Lostock)	August 1999	Chorley	Town flooded by un-named tributary of River Lostock. 25 Properties affected
		September 1946	Leyland	Flooded to depth of 4 feet in Cophurst and 3 feet at the gasworks at Leyland.
		1912	Leyland	Town flooded, including its main access road.

Source of Data	River / Catchment	Date of event	Area(s) affected	Details of event
River Douglas CFMP	**Douglas (Lostock / Carr Brook)**	August 1987	Leyland	Industrial units on Mill Lane were affected and the local media reported problems with a 'small' culvert along Swansey Lane, which was rapidly overwhelmed as water levels rose. Flood alleviation works were implemented along Carr Brook (Whittle-le-Woods) in 1986. Swansey Lane culvert was modified and a bypass channel was also constructed.
	Douglas (Carr Brook)	November 2000	Whittle-le-Woods	Flood alleviation works were implemented along Carr Brook (Whittle-le-Woods) in 1986. Swansey Lane culvert was modified and a bypass channel was also constructed. The Lostock flood alleviation scheme also improved defences at Whittle-le-Woods and was completed in 1988/89. 21 properties were affected.
		August 1987	Leyland	See River Lostock event on same date.
	Douglas (Bannister Brook)	September 1998	Leyland	21 properties affected
		August 1987	Leyland	Houses in the Chapel Brow area of the town were evacuated and the town centre was described as a 'giant lake'. Following the severe flooding in Leyland in 1987 the Bannister Brook Alleviation Scheme was approved. Several additional culverts were constructed and open channel improvements were made to improve the capacity of the watercourse. The scheme was completed in 1993 at a cost of £1.5 million.

Table F-2: Ribble Catchment Historical Flood Events within the Study Area

Source of Data	River / Catchment	Date of event	Area(s) affected
River Ribble CFMP	**Ribble**	1824	Preston
	Ribble	1840	Preston
	Ribble	1866	Preston, Walton-le-Dale, Penwortham
	Ribble	1877	Preston
	Ribble	1880	Walton-le-Dale, Preston
	Ribble	1891	Preston
	Ribble	1923	Preston
	Ribble	1936	Preston
	Ribble	1995	Preston, Walton-le-Dale
	Ribble	2000	Preston, Walton-le-Dale
	Ribble	2007	Lostock Hall, Penwortham, Broadgate

Table F-3: Wyre Catchment Historical Flood Events within the Study Area

Source of Data	River / Catchment	Date of event	Area(s) affected	Details of event
River Wyre CFMP	**Wyre**	1980	Catchment-wide	Heavy rain caused widespread flooding in the Wyre catchment.
	Wyre	1983		

Appendix G: Sequential Test

Table G-1: Flood Zones as defined in Table D1, Annex D of PPS25 (full description provided in Appendix D of PPS25).

	Definition		Probability of Flooding
	Fluvial	Tidal	
Flood Zone 1	< 1 in 1000 year (< 0.1%)	< 1 in 1000 year (< 0.1%)	Low Probability
Flood Zone 2	Between 1 in 1000 year (< 0.1%) and 1 in 100 year (1%)	Between 1 in 1000 year (< 0.1%) and 1 in 200 year (0.5%)	Medium Probability
Flood Zone 3a	> 1 in 100 year (> 1%)	> 1 in 200 year (> 0.5%)	High Probability
Flood Zone 3b	Either > 1 in 20 (5%) or as agreed by between the EA and LPA	Either > 1 in 20 (5%) or as agreed by between the EA and LPA	Functional Floodplain

Percentages refer to the annual probability of a flood event occurring in any year

Table G-2: Flood Risk Vulnerability Classification (from PPS25, Appendix D, Table D2)

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes), which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in ‘more vulnerable’ and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants (if adequate pollution control measures are in place).

Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table G-3: Flood Risk Vulnerability and Flood Zone 'Compatibility' from PPS25, Appendix D, Table D.3 (✓ - Development is appropriate, ✗ - Development should not be permitted)

	Flood Risk Vulnerability Classification				
	Essential Infrastructure	**Water Compatible**	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	✓	Exception Test Required	✓	✓
Flood Zone 3a	Exception Test Required	✓	✗	Exception Test Required	✓
Flood Zone 3b	Exception Test Required	✓	✗	✗	✗

Figure G-1: Flow diagram illustrating the application of the Sequential Test (from PPS25 Practice Guidance – April 2007)

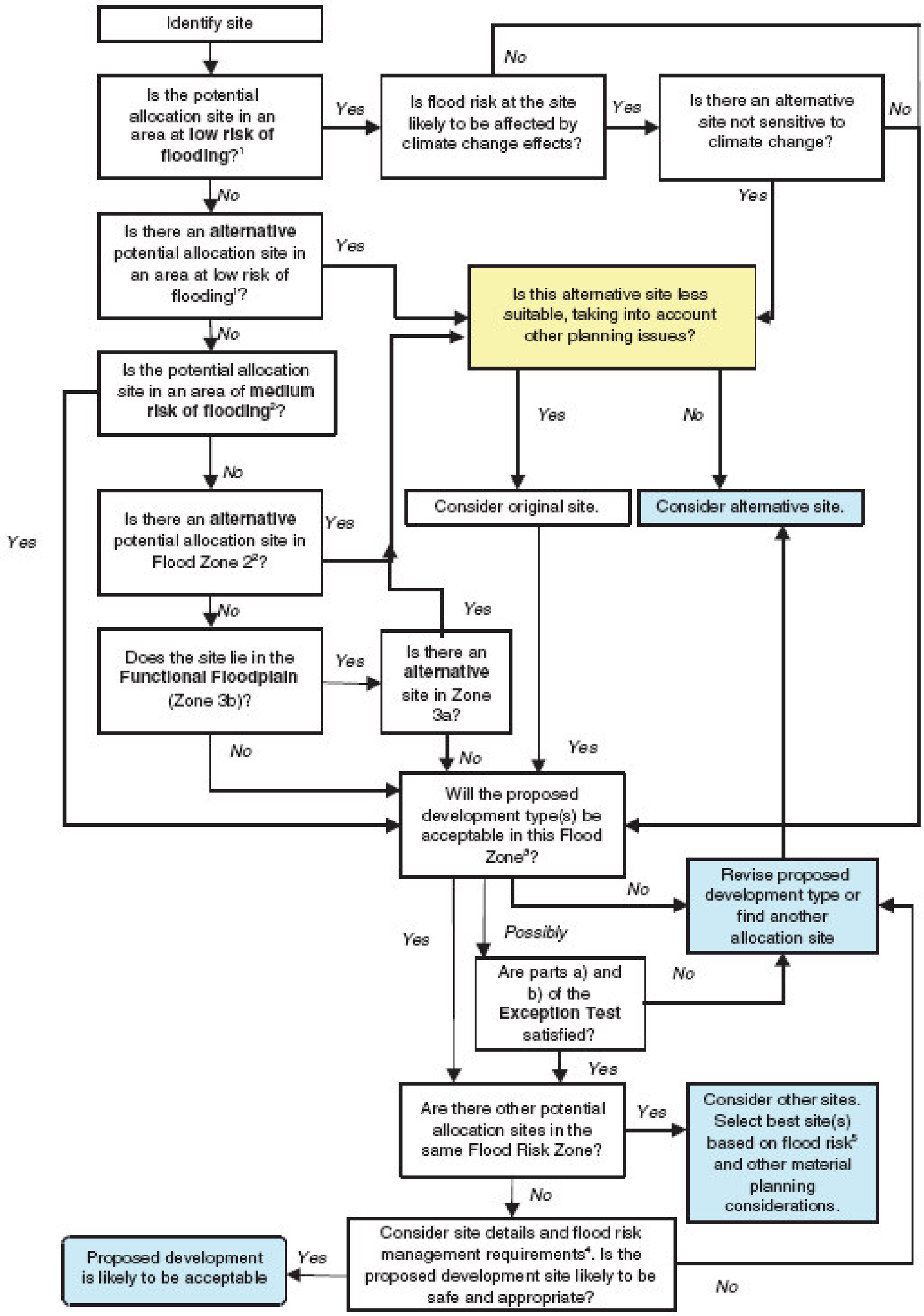


Table G-4: Sequential Test Key - A Guide to using the GIS Layers

Category	GIS Layer	Example Questions
Development Vulnerability	Not applicable refer to Table D2 in PPS25	**Question 1** – Is the proposed development defined as 'highly vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 2 - Is the proposed development defined as 'more vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 3 - Is the proposed development defined as 'less vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 4 - Is the proposed development defined as 'essential infrastructure according to Table D2 in Planning Policy Statement 25?
		Question 5 - Is the proposed development defined as 'water compatible development' according to Table D2 in Planning Policy Statement 25?
Flood Zone Classification	SFRA combined fluvial & tidal FZ2, FZ3a & FZ3b layers. Also examine historical floodplain and take into consideration climate change outlines.	**Question 6** – Through consultation of the Environment Agency's flood zone maps, is the development site located in Flood Zone 1?
		Question 7 - Through consultation of the Environment Agency's flood zone maps, is the development site located in Flood Zone 2?
		Question 8 - Through consultation of the Environment Agency's flood zone maps, is the development site located in Flood Zone 3a?
		Question 9 - Through consultation of the Environment Agency's flood zone maps, is the development site located in Flood Zone 3b?
		Question 10 - Can the development be located in Flood Zone 1?
		Question 11 - Can the development be located in Flood Zone 2?
		Question 12 - Can the development be located in Flood Zone 3a?
	CEH watercourse network & EA main river maps.	**Question 13 -** Is the site located within 20m of a watercourse?

Category	GIS Layer	Example Questions
Other Flood Sources	SFRA combined fluvial and tidal FZ3 & FZ2 outlines plus climate change	**Question 14 –** Is the site impacted by the effects of climate change
	Sewer Flood Layer & Historical Flood Outlines	**Question 15** - Is the site in an area potentially at risk from sewer flooding?
	Historical Flood Outlines, Parish Council data, GEZ, CEH stream network (BFI) and groundwater vulnerability maps	**Question 16** - Is the site in an area potentially at risk from overland flow flooding?
		Question 17 - Is the site located in an area of rising groundwater levels?
		Question 18 - Does the site have a history of flooding from any other source?
Flood Risk Management	Flood Defence Layer (NFCDD), Flood Warning Layer, Areas Benefiting from Flood Defences Layer, Parish Council data	**Question 19** - Does the site benefit from flood risk management measures?
		Question 20 - Can the development be relocated to an area benefiting from flood risk management measures or of lower flood risk?

Table G-5: Sequential Test Summary Table

Use Category	Development	FLOOD ZONE			
		1	2	3a	3b
		FRA (1)	FRA	FRA	FRA
Essential Infrastructure	Essential Transport Infrastructure, Strategic Utility Infrastructure, Electricity Generating Power Stations	Y	Y	E	E
Highly Vulnerable	Police Stations, Ambulance Stations, Fire Stations, Command Centres and telecoms installations required to be operational during flooding, Emergency dispersal points, Basement dwellings, Caravans, mobile homes and park homes intended for permanent residential use, Installations requiring hazardous substances consent	Y	S/E	N	N
More Vulnerable	Hospitals, Residential institutions (care homes, children's homes, social services homes, prisons and hostels), Dwelling houses, Student halls of residence, Drinking establishments, Nightclubs, Hotels, Non-residential health services, Nurseries, Educational establishments, Landfill sites, Sites used for waste management facilities for hazardous waste, Sites used for holiday or short-let caravans and camping (subject to a specific warning and evacuation plan)	Y	Y	E	N
Less Vulnerable	Shops, Buildings used for financial, professional and other services, Restaurants and cafes, Hot food takeaways, Offices, General Industry, Storage and distribution, Non-residential institutions (unless identified as more vulnerable), Assembly and Leisure, Land and buildings used for agriculture and forestry, Waste treatment (except landfill and hazardous waste), Minerals working and processing (except for sand and gravel workings), Water treatment plants, Sewage treatment plants (if adequate pollution control measures are in place)	Y	Y	Y	N
Water Compatible Development	Flood control infrastructure, Water transmission infrastructure and pumping stations, Sewage transmission infrastructure and pumping stations, Sand and gravel workings, Docks, marinas and wharves, Navigation facilities, MOD defence installations, Ship building, repairing and dismantling, Dockside fish processing and refrigeration, Activities requiring a waterside location, Water based recreation (excluding sleeping accommodation), Lifeguard and coastguard stations, Amenity open space, Nature conservation and biodiversity, Outdoor sports and recreation, Essential facilities such as changing rooms, Essential ancillary sleeping or residential accommodation for staff required for water compatible development (subject to a specific warning and evacuation plan)	Y	Y	Y	Y

TABLE G-5 - KEY

Y: Appropriate use
N: Use should not be permitted
S/E: Use only appropriate if it passes the sequential test and exception test
E: Use only appropriate if it passes the exception test

FRA(1): Flood risk assessment should be carried out for sites of 1 hectare or more to consider the vulnerability of flooding from sources other than river and sea flooding, and the potential to increase flood

risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off. May only need to be brief.
FRA: Flood risk assessment required for all developments.

Note; Even where development is appropriate or subject to the sequential or exception tests further flood resistance/resilience may be required in the design and construction of specific developments. Where a proposed development is acceptable within a particular flood zone, a sequential test should still be carried out to identify either possible sites in lower risk zones or whether there are sites within the same zone that could present a lower risk. Such a test should be based on the SFRA.

Sequential Test: Development should be steered first towards the lowest risk areas. Only where there are no reasonably available sites should development on suitable available sites in higher risk areas be considered taking into account flood risk vulnerability and applying an exception test if required.

Exception Test: Exceptionally development should only take place if there are factors that outweigh the risk from flooding. For this test to be passed, the development should demonstrably provide wider sustainable benefits to the community, should be on developable previously-developed land unless there are no reasonably alternative sites on developable previously-developed land, and should be demonstrably safe without increasing flood risk elsewhere and where possible reducing flood risk overall.

Recommended stages for LPA application of the Sequential Test

The information required to address many of these steps is provided in the accompanying Level 1 GIS layers and maps presented in Appendix B. The recommended stages for the application of the Sequential Test by the three Councils are as follows:

1. Assign potential developments with a vulnerability classification (Table G-2). Where development is mixed, this should be moved to the higher classification.
2. The location and identification of potential development should be recorded.
3. The Flood Zone classification of potential development sites should be determined based on a review of the Environment Agency Flood Zones and the Flood Zones presented in this Level 1 SFRA for fluvial and tidal sources. Where these span more than one Flood Zone, all zones should be noted.
4. The design life of the development should be considered with respect to climate change:
5. 60 years – up to 2072 for commercial / industrial developments; and
6. 100 years – up to 2112 for residential developments
7. Identify existing flood defences serving the potential development sites. However, it should be noted that for the purposes of the Sequential Test, flood zones with no consideration of defences should be used.
8. Highly vulnerable developments should be located in those sites identified as being within Flood Zone 1. It should be noted at this stage that Flood Zone 1 represents any area that is not determined as Zone 2 or Zone 3. If these cannot be located in Flood Zone 1 because the identified sites are unsuitable or there are insufficient sites in Flood Zone 1, sites in Flood Zone 2 can then be considered. If sites in Flood Zone 2 are inadequate then the LPA may have to identify additional sites in Flood Zones 1 or 2 to accommodate development or seek opportunities to locate the development outside their administrative area.

9. Once all highly vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as more vulnerable. In the first instance more vulnerable development should be located in any unallocated sites in Flood Zone 1. Where these sites are unsuitable or there are insufficient sites remaining, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate more vulnerable development, sites in Flood Zone 3a can be considered. More vulnerable developments in Flood Zone 3a will require application of the Exception Test. More vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain
10. Once all more vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as less vulnerable. In the first instance less vulnerable development should be located in any remaining unallocated sites in Flood Zone 1, continuing sequentially with Flood Zone 2, then 3a. Less vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.
11. Essential infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is fulfilled.
12. Water compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. They do not require the application of the Exception Test.
13. On completion of the sequential test, the LPA may have to consider the risks posed to a site within a flood zone in more detail in a Level 2 Assessment. By undertaking the Exception Test, this more detailed study should consider the detailed nature of flood hazard to allow a sequential approach to site allocation within a flood zone. Consideration of flood hazard within a flood zone would include:
    - Flood risk management measures,
    - The rate of flooding,
    - Flood water depth and or,
    - Flood water velocity.

Where the development type is highly vulnerable, more vulnerable, less vulnerable or essential infrastructure and a site is found to be impacted by a recurrent flood source (other than tidal or fluvial), the site and flood sources should be investigated further regardless of any requirement for the Exception Test. This should be discussed with the Environment Agency to establish the appropriate time for the assessment to be undertaken, (i.e. Exception Test through a Level 2 SFRA or assess through a site specific flood risk assessment).

The maps presented in Appendix B are designed to assist PCC, SRBC and CBC in determining the flood risk classification for each site and in completing the Sequential Test. This will aid the determination of the most suitable type of development for each site based on development vulnerability and flood risk. Certain sites have been identified as lying within Flood Zones 2 and 3 and, if the sites cannot be relocated, it will be necessary to undertake an Exception Test.

Using the SFRA Maps, Data and GIS Layers

Table G-4 highlights which GIS layers and SFRA data should be used in carrying out the sequential test. The table poses some example questions that are not exhaustive, but should provide some guidance for a user of the SFRA.

Appendix N summarises the steps required to maintain and update the SFRA together with a revision schedule. This should be checked to prior to the SFRA being used at a strategic land allocation scale or on a Development Control level to ensure the most current and up-to-date version of the SFRA is being used. In addition, close consultation with some of the key stakeholders, in particular the EA, may highlight updated flood risk information that may reduce uncertainty and ensure the Sequential Test is as robust as it can be.

As identified in Section 3.6, some watercourses in the study area do not have flood zones associated with them or do not have all flood zones defined. This is not to suggest these watercourses do not flood, moreover that modelled data is not currently available. Therefore, allocations adjacent to un-modelled watercourses or watercourses where all Flood Zones have not been defined cannot be assed against all aspects of the Sequential Test using the existing data.

To temporarily overcome this deficiency in the data and to enable PCC, SRBC and CBC to proceed with application of the Sequential test the following criteria should be considered:

- **For watercourses where no flood zones have been defined –** If a site is within 8m of a watercourse and promoted for development further investigation should be undertaken to determine the suitability of the site for the proposed development. For application of the Sequential Test the site should be considered as lying within Flood Zone 3a until proven otherwise. If following further investigation the site is found to lie within Flood Zone 3b the development may not be appropriate against the polices presented in PPS25.

- **For watercourses where flood zone 3b (functional floodplain) has not been defined –** If a proposed development site is located in flood zone 3, there is a possibility it may also fall within flood zone 3b. Further investigation should be undertaken to define flood zone 3b for the local water course(s). For application of the Sequential test the site should be considered as lying within Flood Zone 3a until proven otherwise. If following further investigation the site is found to lie within Flood Zone 3b the development may not be appropriate against the polices presented in PPS25.

- **For watercourses where the effect of climate change on flood zones has not been defined –** For any development located in or adjacent to a flood zone boundary, there is a possibility that when considering the effects of climate change the site may be at flood risk. For example if a site is clearly identified to be in flood zone 3a (and not within 3b), when the effects of climate change are considered the site may be found to lie within flood zone 3b. For application of the Sequential test, for sites located in flood zone 3 or at the boundary of flood zone 2 and 3, where the effects of climate change are not defined, the sites can be considered to lie within the current flood zone, however the effects of climate change should be investigated further. If following further investigation the site is found to lie within a different flood zone the Sequential test should be reapplied to determine if the proposed development is appropriate.

It should be noted that adopting this approach requires the LPAs to accept an element of risk when reviewing and allocating their development sites. For example, should the LPAs identify a site in Flood Zone 2 as acceptable for more vulnerable development, when considering the effects of climate change on flood zone definition the site may be found to be located in Flood Zone 3 and therefore require application of the Exception Test. Similarly location of more vulnerable development in Flood Zone 3a may be in appropriate if further work identifies those parts of 3a to be redefined as 3b with consideration of climate change.

Appendix H: Sustainable Drainage Systems Review

Traditionally, built developments have utilised piped drainage systems to manage storm water and convey surface water run-off away from developed areas as quickly as possible. Typically, these systems connect to the public sewer system for treatment and/or disposal to local watercourses. Whilst this approach rapidly transfers storm water from developed areas, the alteration of natural drainage processes can potentially impact on downstream areas by increasing flood risk, reduction in water quality, loss of water resource and detriment to wildlife. Therefore, receiving watercourses have greater sensitivity to rainfall intensity, volume and catchment land uses post development.

The up rating of sewer systems to accommodate increased surface water from new development is constrained by existing development and cost. Therefore, the capacity of the system becomes inadequate for the increased volumes and rates of surface water runoff. This results in an increase in flood risk from sewer sources and pollution of watercourses. In addition, the implications of climate change on rainfall intensities, leading to flashier catchment/site responses and surcharging of piped systems may increase.

In addition, as flood risk has increased in importance within planning policy, a disparity has emerged between the design standard of conventional sewer systems (1 in 30 year) and the typical design standard flood (1 in 100 year). This results in drainage inadequacies for the flood return period developments need to consider, often resulting in potential flood risk from surface water/combined sewer systems.

A sustainable solution to these issues is to reduce the volume and/or rate of water entering the sewer system and watercourses.

What are Sustainable Drainage Systems?

PPS25 & The SuDS Manual (2007) indicates that Regional Planning Bodies and Local Authorities should promote the use of Sustainable Drainage Systems (SuDS) for the management of surface water runoff generated by development. In addition, drainage of rainwater from roofs and paved areas around buildings should comply with the 2002 Amendment of Building Regulations Part H (3). The requirements are as follows:

1. Adequate provision shall be made for rainwater to be carried from the roof of the building.
2. Paved areas around the building shall be constructed so that they are adequately drained.
3. Rainwater from a system provided pursuant to sub-paragraphs (1) or (2) shall discharge to one of the following in order of priority:

    a) An adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable;
    b) A watercourse; or where that is not reasonably practicable
    c) A sewer.

SuDS seek to manage surface water as close to its source as possible, mimicking surface water flows arising from the site, prior to the proposed development. Typically this approach involves a move away from piped systems to softer engineering solutions inspired by natural drainage processes.

SuDS should be designed to take into account the surface run-off quantity, rates and also water quality ensuring their effective operation up to and including the 1 in 100 year design standard flood including an increase in peak rainfall up to 30% to account from climate change.

Wherever possible, a SuDS technique should seek to contribute to each of the three goals identified below with the favoured system contributing significantly to each objective. Where possible SuDS solutions for a site should seek to:

1. Reduce flood risk (to the site and neighbouring areas),
2. Reduce pollution, and,
3. Provide landscape and wildlife benefits.

These goals can be achieved by utilising a management plan incorporating a chain of techniques, (as outlined in Interim Code of Practice for Sustainable Drainage Systems 2004), where each component adds to the performance of the whole system:

Prevention	good site design and upkeep to prevent runoff and pollution (e.g. limited paved areas, regular pavement sweeping)
Source control	runoff control at/near to source (e.g. rainwater harvesting, green roofs, pervious pavements)
Site control	water management from a multitude of catchments (e.g. route water from roofs, impermeable paved areas to one infiltration/holding site)
Regional control	integrate runoff management systems from a number of sites (e.g. into a detention pond)

This chapter presents a summary of the SuDS techniques currently available and a review of the soils and geology of the study area, enabling the local authorities to identify where SuDS techniques could be employed in development schemes.

The application of SuDS is not limited to a single technique per site. Often a successful SuDS solution will utilise a combination of techniques, providing flood risk, pollution and landscape/wildlife benefits. In addition, SuDS can be employed on a strategic scale, for example with a number of sites contributing to large scale jointly funded and managed SuDS. It should be noted, each development site must offset its own increase in runoff and attenuation cannot be “traded” between developments.

Planning

All relevant organisations should meet at an early stage to agree on the most appropriate drainage system for the particular development. These organisations may include the Local Authority, the Sewage Undertaker, Highways Authority, and the Environment Agency. There are, at present, no legally binding obligations relating to the provision and maintenance of SuDS. However, PPS25 states that:

‘where the surface water system is provided solely to serve any particular development, the construction and ongoing maintenance costs should be fully funded by the developer.’

The most appropriate agreement is under Section 106 of the Town and Country Planning Act. Under this agreement a SuDS maintenance procedure can be determined.

SuDS Techniques

SuDS techniques can be used to reduce the rate and volume and improve the water quality of surface water discharges from sites to the receiving environment (i.e. natural watercourse or public sewer etc). Various SuDS techniques are available and operate on two main principles:

- Infiltration
- Attenuation

All systems generally fall into one of these two categories, or a combination of the two.

The design of SuDS measures should be undertaken as part of the drainage strategy and design for a development site. A ground investigation will be required to access the suitability of using infiltration measures, with this information being used to assess the required volume of on-site storage. Hydrological analysis should be undertaken using industry approved procedures, to ensure a robust design storage volume is obtained.

During the design process, liaison should take place with the Local Planning Authority, the Environment Agency and if necessary, the Water Undertake to establish a satisfactory design methodology and permitted rate of discharge from the site.

Infiltration SuDS

This type of Sustainable Drainage System relies on discharges to ground, where suitable ground conditions are suitable. Therefore, infiltration SuDS are reliant on the local ground conditions (i.e. permeability of soils and geology, the groundwater table depth and the importance of underlying aquifers as a potable resource) for their successful operation.

Various infiltration SuDS techniques are available for directing the surface water run-off to ground. Development pressures and maximisation of the developable area may reduce the area available for infiltration systems but this should not be a limiting factor for the use of SuDS. Either sufficient area is required for infiltration or a combined approach with attenuation could be used to manage surface water runoff. Attenuation storage may be provided in the sub-base of a permeable surface, within the chamber of a soakaway or as a pond/water feature.

Infiltration measures include the use of permeable surfaces and other systems that are generally located below ground.

Permeable Surfaces

Permeable surfaces are designed to allow water to drain through to a sub-base at a rate greater than the predicted rainfall for a specified event. Permeable surfaces act by directly intercepting the rain where it falls and control runoff at source. Runoff during low intensity rainfall events is prevented by permeable surfaces. During intense rainfall events runoff generation may occur from permeable surfaces. The use of permeable sub-base can be used to temporarily store infiltrated run-off underneath the surface and allows the water to percolate into the underlying soils. Alternatively, stored water within the sub-base may be collected at a low point and discharged from the site at an agreed rate.

Programmes should be implemented to ensure that permeable surfaces are kept well maintained to ensure the performance of these systems is not reduced. The use of grit and salt during winter months may adversely affect the drainage potential of certain permeable surfaces.

Types of permeable surfaces include:

- Grass/landscaped areas
- Gravel
- Solid Paving with Void Spaces
- Permeable Pavements

Sub-surface Infiltration

Where permeable surfaces are not a practical option more defined infiltration systems are available. In order to infiltrate the generated run-off to ground, a storage system is provided that allows the infiltration of the stored water into the surrounding ground through both the sides and base of the storage. These systems are constructed below ground and therefore may be advantageous with regards to the developable area of the site. Consideration needs to be given to construction methods, maintenance access and depth to the water table. The provision of large volumes of infiltration/sub-surface storage has potential cost implications. In addition, these systems should not be built within 5 m of buildings, beneath roads or in soil that may dissolve or erode.

Various methods for providing infiltration below the ground include:

- Geocellular Systems
- Filter Drain
- Soakaway (Chamber)
- Soakaway (Trench)
- Soakaway (Granular Soakaway)

Table H-1: Suitability of Infiltration Methods towards with respect to the wider aims of SuDS.

Infiltration Method	Reduce Flood Risk (Y/N)	Reduce Pollution (Y/N)	Landscape and Wildlife Benefits (Y/N)
Permeable Surface	Y	Y	N
Sub-surface Infiltration	Y	Y	N

Attenuation SuDS

If ground conditions are not suitable for infiltration techniques then management of surface water runoff prior to discharge should be undertaken using attenuation techniques. This technique attenuates discharge from a site to reduce flood risk both within and to the surrounding area. It is important to assess the volume of water required to be stored prior to discharge to ensure adequate provision is made for storage. The amount of storage required should be calculated prior to detailed design of the development to ensure that surface water flooding issues are not created within the site.

The rate of discharge from the site should be agreed with the Local Planning Authority and the Environment Agency. If surface water cannot be discharged to a local watercourse then liaison with the Sewer Undertaker should be undertaken to agree rates of discharge and the adoption of the SuDS system.

Large volumes of water may be required to be stored on site. Storage areas may be constructed above or below ground. Depending on the attenuation/storage systems implemented, appropriate maintenance procedures should be implemented to ensure continued performance of the system. On-site storage measures include basins, ponds, and other engineered forms consisting of underground storage.

Basins

Basins are areas that have been contoured (or alternatively embanked) to allow for the temporary storage of run-off from a developed site. Basins are designed to drain free of water and remain waterless in dry weather. These may form areas of public open space or recreational areas. Basins also provide areas for treatment of water by settlement of solids in ponded water and the absorption of pollutants by aquatic vegetation or biological activity. The construction of basins uses relatively simple techniques. Local varieties of vegetation should be used wherever possible and should be fully established before the basins are used. Access to the basin should be provided so that inspection and maintenance is not restricted. This may include inspections, regular cutting of grass, annual clearance of aquatic vegetation and silt removal as required.

Ponds

Ponds are designed to hold the additional surface water run-off generated by the site during rainfall events. The ponds are designed to control discharge rates by storing the collected run-off and releasing it slowly once the risk of flooding has passed. Ponds can provide wildlife habitats, water features to enhance the urban landscape and where water quality and flooding risks are acceptable they can be used for recreation. It may be possible to integrate ponds and wetlands into public areas to create new community ponds. Ponds and wetlands trap silt that may need to be removed periodically. Ideally, the contaminants should be removed at source to prevent silt from reaching the pond or wetland in the first place. In situations where this is not possible, consideration should be given to a small detention basin placed at the inlet to the pond in order to trap and subsequently remove the silt. Depending on the setting of a pond, health and safety issues may be important issues that need to be taken into consideration. The design of the pond can help to minimise any health and safety issues (i.e. shallower margins to the pond reduce the danger of falling in, fenced margins).

Various types of ponds are available for utilising as SuDS measures. These include:

- Balancing/Attenuating Ponds
- Flood Storage Reservoirs
- Lagoons
- Retention Ponds
- Wetlands

Table H-2: Suitability of Attenuation Methods towards the Three Goals of Sustainable Drainage Systems.

Infiltration Method	Reduce Flood Risk (Y/N)	Reduce Pollution (Y/N)	Landscape and Wildlife Benefits (Y/N)
Basins	Y	Y	Y
Ponds	Y	Y	Y

Alternative Forms of Attenuation

Site constraints and limitations such as developable area, economic viability and contamination may require engineered solutions to be implemented. These methods predominantly require the provision of storage beneath the ground surface, which may be advantageous with regards to the developable area of the site but should be used only if methods in the previous section cannot be used. When implementing such approaches, consideration needs to be given to construction methods, maintenance access and to any development that takes place over the storage facility. The provision of large volumes of storage underground also has potential cost implications.

Methods for providing alternative attenuation include:

- Deep Shafts
- Geocellular Systems
- Oversized Pipes
- Rainwater Harvesting
- Tanks
- Green Roofs

In some situations it may be preferable to combine infiltration and attenuation systems to maximise the management of surface water runoff, developable area and green open space.

Broad-scale assessment of SuDS suitability

The underlying ground conditions of a development site will often determine the type of SuDS approach to be used at development sites. This will need to be determined through ground investigations carried out on-site. A broad-scale assessment of the soils and underlying geology allow an initial assessment of SuDS techniques that may be implemented across Horsham District.

Based on a review of the following maps SuDS techniques that are likely to be compatible with the underlying strata can be suggested:

- The Soil Survey of England and Wales 1983 – 1:250,000 Soils Maps (Sheet 6), and
- The Geological Survey of Great Britain (England and Wales) 1:625,000 Series Superficial and Bedrock Edition South of England (2000)
- The Soils Map Legend and Geological Survey Memoir were also consulted as part of this assessment.

In the design of any drainage system and SuDS approach, consideration should be given to site-specific characteristics and where possible be based on primary data from site investigations. The information presented in the following table is provided as a guide and should not be used to accept or refuse SuDS techniques. The SuDS and FRA requirements for the three Potential Major Development Sites that have been considered in this Level 1 SFRA are included in Table H-3

Table H-3: SuDS Recommendations and FRA Requirements for Main Potential Development Sites in Central Lancashire

NAME	General Geology	Aquifer Type	Groundwater Vulnerability	SuDS Recommendation	Site Area (Ha)	FRA Requirements
Riversway	Sandstone overlain by alluvium	Major	High	Infiltration and Combined Infiltration/Attenuation Systems	79	FRA including hydraulic modelling undertaken in 2006 prior to the release of the final version of PPS25 and the Practice Guide Companion.
Goosnargh / Whittingham	Limestone and sandstone overlain by till	Minor	Low	Infiltration and Combined Infiltration/Attenuation Systems	50	Full FRA required incorporating suitability of various SuDS techniques.
Buckshaw Village	Mostly sandstone, some mudstone and some millstone grit overlain by till	Part Major, Part Minor	High	Infiltration and Combined Infiltration/Attenuation Systems	308	Since the site is in excess of 1 hectare, an FRA focusing on surface water management is required under PPS25 incorporating suitability of various SuDS techniques.

Appendix I: Policy Reviews

Planning Policy Review

EU POLICY

WATER FRAMEWORK DIRECTIVE (2000)

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

The Directive introduces two key changes to the way the water environment must be managed across the European Community:
1. Environmental & Ecological Objectives: The WFD provides for Protected Areas and Priority Substances to safeguard uses of the water environment from the effects of pollution and dangerous chemicals and, in addition, important ecological goals to protect, enhance and restore aquatic ecosystems.
2. River Basin Management Plans (RBMPs): The key mechanism to ensure that the integrated management of rivers, canals, lakes, reservoirs and groundwater is successful and sustainable. RBMPs aim to provide a framework in which costs and benefits can be properly taken into account when setting environmental and water management objectives.

Each RBMP must apply to a “River Basin District” (RBD) - a geographical area which is defined based on hydrology – see Annex 1, DEFRA & WAG River Basin Planning Guidance (RBPG), August 2006. The RBD that is relevant to the Central Lancashire Sub-Region is the North West RBD (equivalent to the EA North West Region). The river basin planning process involves setting environmental objectives for all groundwater and surface water (including estuaries and coastal waters) within the RBD and designing steps and timetables to meet the objectives. The EA are the body that are responsible for implementing the WFD in England and Wales and aim to have completed draft RBMPs by 2009.

According to the DEFRA and WAG River Basin Planning Guidance (August 2006), a RBMP should be a strategic plan that gives all stakeholders within a RBD some confidence about future water management in their district. It should also set the policy framework within which future regulatory decisions affecting the water environment will be made.

Although RBMPs specifically address sustainable water management issues, the WFD also requires that other environmental considerations and socio-economic issues are taken into account. This ensures that the policy priorities between different stakeholders are balanced to ensure that sustainable development within RBDs is achieved.

As a result of the strategic nature of RBMPs, they are inherently linked to and can both influence and be influenced by planning policy within their areas. The following is extracted from the DEFRA and WAG River Basin Planning Guidance (August 2006).

Spatial Plans Influencing RBMPs

Emerging development plans will be an important source of information on future water management pressures that can inform the EA and refine its understanding of the current status of water bodies, and how this might change if no action was taken. The RBPG stresses the importance of taking into account the continuation of sustainable human development (including ports, recreational uses, water storage and flood risk management schemes) within RBDs and the setting of water management frameworks.

The EAs Catchment Flood Management Plans (CFMPs) and Catchment Abstraction Management Strategies (CAMS) are examples of such high-level planning tools that can inform development of RBMPs. Using CFMPs, the Regional Flood Risk Assessments (RFRA) and Strategic Flood Risk Assessments (SFRAs) will build upon existing flood risk and planning information to present current and potential future development within RBDs in relation to flood risk. In addition, policies that emerge from these studies (for example SuDS, Flood Risk Management procedures and mitigation options) will inform the development of the water management frameworks in RBMPs.

RBMPs Influencing Spatial Plans

As well as being informed by various spatial and catchment wide plans and strategies, RBMPs should produce strategic, regional policy information that is necessary to feed into the spatial planning process such as Local Development Frameworks. For example, where RBMPs have a direct affect on the use and development of land they will have to be material considerations in the preparation of statutory development plans for the areas they cover. It will also be necessary for planning authorities to consider WFD objectives at the detailed development control stage (not least to consider the requirements of Article 4(7) of the WFD in relation to new physical modifications).

To allow local authorities to incorporate WFD objectives into their various statutory development plans, the Environment Agency will provide local authorities with information such as CFMPs, CAMS and other catchment-wide guidance and strategies, to enable effective integration of the water management framework within statutory development plans. In order to address the fact that these plans have different planning cycles and are at different stages in their development, RBMP policies that affect the development and use of land must be considered in the monitoring and review of statutory spatial plans.

In addition, some of the measures necessary to achieve WFD objectives will be delivered through land use planning mechanisms. For example spatial planners can make major contributions to WFD objectives by including appropriate planning conditions and planning obligations in relevant planning permissions for new developments, or by restricting some forms of development. Delivery of these measures is more likely to take place if they are included in Local Development Frameworks/Plans by land use planners. The Central Lancashire SFRA should inform the RBMPs and, as a result, the LDFs being prepared by the Central Lancashire Authorities should already include policies and recommendations relating to flood risk management and development within catchments.

NATIONAL POLICY	PLANNING POLICY STATEMENT 25: DEVELOPMENT AND FLOOD RISK (2006)
	Key planning objectives for Flood Risk Planning Strategies include: • Identifying land at risk from flooding and the degree of risk. • Policies should ensure the location of development avoids flood risk where possible, and that any residual risks are managed. • Policies should only allow development in flood risk areas where there is not reasonable alternative. • Land required for future flood management should be safeguarded • It should be ensured that new development reduces flood risk through design, location, layout and incorporating Sustainable Urban Drainage Systems (SUDS). • Opportunities offered by new development, should be used to reduce the causes and impacts of flooding e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SUDS; re-creating functional floodplain; and setting back defences.
	SFRAs should inform the preparation of Local Development Documents by having regard to catchment-wide flooding issues that affect that area.
	The SFRA should provide the information needed to apply the sequential approach.
	Strategic Flood Risk Assessments (SFRAs) will refine information on the probability of flooding, taking other sources of flooding and the impacts of climate change into account.
	SFRAs should identify the Functional Floodplain (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).
	SFRA should inform the 'Exception Test' where necessary.
	The presence of reservoirs and implications for flood risk should be recognised by the SFRA.
	Where decision-makers have been unable to allocate all proposed development and infrastructure in accordance with the Sequential Test, taking account of the flood vulnerability category of the intended use, it will be necessary to increase the scope of the SFRA to provide the information necessary for application of the Exception Test.

	SFRAs should be prepared in consultation with the Environment Agency, emergency response and drainage authority functions of the LPA and where appropriate Internal Drainage Boards
	SFRA should be informed by broad locations and established locational criteria identified by the RFRA/ RSS.
	Generally, the following principles should be followed by any flood risk assessment (set out in Annex E): • Development should not add to flood risk and should, where possible, reduce it. Minimum requirements for flood risk assessments are that they should: • Be proportionate to risk and appropriate to the scale, nature and location of the development. • Consider risk of flooding to the development and risk arising from the development. • Consider the impacts of climate change. • Be undertaken early, by competent people. • Consider adverse and beneficial effects of flood management infrastructure and consequences of failure. • Consider vulnerability of the those occupying the development, taking account of the Sequential and Exception Tests, the vulnerability classification and safe access arrangements. • Ensure that assessments are fit for purpose by ensuring that different types of flooding are considered and quantified. Flooding would be considered from natural and human sources and joint cumulative effects should also be considered. Flood Risk reduction measures should be identified. • Consider the effects of flooding events (including extreme events) on people, property, the natural and historic environment and river and coastal processes. • Include the remaining residual risk reduction measures. It should be demonstrated that this is acceptable for the particular development/land use. • Consider the ability of water to soak into the ground may change with development, as well as how the proposed layout of the development may affect drainage systems. • Assessments should be supported by appropriate data and information including historical data on previous events.

REGIONAL POLICY	**NORTH WEST REGIONAL SPATIAL STRATEGY REVIEW - PANEL REPORT (MAY 2007)**
	Relevant Recommendations:
	R8.1 Recommendation that certain objectives (set out in report) should be adopted as the objectives for part 3, chapter 11 of the RSS ('Enjoying and Managing the North West') and inserted after paragraph 11.1: The RSS seeks to: *Promote a more integrated approach to delivering a better environment through land and water management, including better relationship of new development to water resources, flood risk and adaptation to the impacts of climate change;*
	R3.10 – 'DP8: Reduce Emissions and Adapt to Climate Change' Rewritten policy states that as an urgent regional priority, plans, strategies, proposals, schemes and investment decisions (including SFRAs) should: *"Contribute to the regional policy to reduce CO2 emissions from all sources …"* And *"Identify, assess and apply measures to ensure effective adaptation to likely environmental, social and economic impacts of climate change."* Measures to reduce emissions, for example: • *Increasing urban density;* • *Encouraging better built homes and energy efficiency, eco-friendly and adaptable buildings, with good thermal insulation, sustainable urban drainage, green roofs and micro generation;* Adaptation measures might include, for example: • *Minimising threats from, and the impact of, increased coastal erosion, increased storminess and flood risk, habitat disturbance and increased pressure on water supply and drainage systems*

R6.9 Recommendation that Table 9.1 (Distribution of Regional Housing Provision 2003-2021) is amended

This amends the requirements for housing provision for "Greater Preston" as follows:

Preston – 9,120 maximum net increase for period 2003-2021, which gives a mean annual increase of 507
South Ribble – 7,500 maximum net increase for period 2003-2021, which gives a mean annual increase of 417
Chorley – 7,500 maximum net increase for period 2003-2021, which gives a mean annual increase of 417

The indicative target for the amount of this increase that should be developed on Previously Developed Land was also amended, reduced to 70%

R8.5 Recommendation that Policy EM5 is amended as follows:

Policy EM5 – Integrated Water Management

In achieving integrated water management and delivery of the EU Water Framework Directive, plans and strategies should have regard to River Basin Management Plans, Water Company Asset Management Plans, Catchment Flood Management Plans, and the Regional Flood Risk Appraisal. Local planning authorities and developers should protect the quantity and quality of surface, ground and coastal waters, and manage flood risk, by:

- *Working with the Water Companies and the Environment Agency when planning the location and phasing of development. Development should be located where there is spare capacity in the existing water supply and wastewater treatment, sewer and strategic surface water mains capacity, insofar as this would be consistent with other planning objectives. Where this is not possible development must be phased so that new infrastructure capacity can be provided without environmental harm;*
- *Producing sub-regional or district level strategic flood risk assessments, guided by the Regional Flood Risk Appraisal. Allocations of land for development should comply with the sequential test in PPS25. Departures from this should only be proposed in exceptional cases where suitable land at lower risk of flooding is not available and the benefits of development outweigh the risks from flooding;*
- *Designing appropriate mitigation measures into the scheme, for any development which, exceptionally, must take place in current or future flood risk areas, to ensure it is protected to appropriate standards, provides suitable emergency access under flood conditions, and does not increase the risk of flooding elsewhere;*
- *Requiring new development, including residential, commercial and transport development, to incorporate sustainable drainage systems and water conservation and efficiency measures to the highest contemporary standard;*
- *Encouraging retrofitting of sustainable drainage systems and water efficiency within existing developments;*
- *Raising people's awareness of flood risks and the impacts of their behaviours and lifestyles on water consumption.*

SUBMITTED DRAFT REGIONAL SPATIAL STRATEGY FOR THE NORTH WEST OF ENGLAND (JANUARY 2006)
Paragraph 5.14 of the plan will promote: *…a more integrated approach to delivering a better environment through land and water management, including better relationship of new development to water resources, flood risk and adaptation to the impacts of climate change*
Policy DP1 – Regional Development Principles States that tackling climate change will be a key regional development principle, and requires that: *Proposals and schemes must take into account the local implications of climate change, particularly in vulnerable areas, coastal zones and locations at risk of flooding.*
Paragraph 6.6 highlights the dangers of climate change and states there is evidence that risk of flooding is increasing, something which the SFRA must consider and prepare for: *The impacts of climate change are already evident and becoming more significant. The North West is experiencing hotter summers, increased winter rainfall, sea level rises and consequential decline in the level of protection from existing flood defences and a growing incidence of severe weather conditions.*

Policy EM5 – Integrated Water Management

Plans and strategies should have regard to River Basin Management Plans and assist in achieving integrated water management and delivery of the EU Water Framework Directive (WFD). They should protect the quantity and quality of surface, ground and coastal waters and manage flood risk by:

- *Phasing development to reflect existing water supply and waste water treatment capacity, unless new infrastructure can be provided ahead of the development without environmental harm;*
- *Implementing the 'Meeting the Sequential Flood Risk Test – Guidelines for the North West Region'144;*
- *Requiring that any development which, exceptionally, must take place in current or future flood risk areas is resilient to flooding; protected to appropriate standards and does not increase the risk of flooding elsewhere;*
- *Requiring new, and where possible, existing development (including transport infrastructure) to incorporate sustainable drainage systems and water conservation and efficiency measures;*
- *Raise people's awareness of flood risks and the impacts of their behaviours and lifestyles on water consumption.*

Policy EM6 – Managing the North West's Coastline

Plans, strategies, proposals and schemes (including Shoreline Management Plans) should take a strategic and integrated approach to the long term management of flood and coastal erosion risk by:

- *Taking account of natural coastal change and the likely impacts of climate change, to ensure that development is sited or re-sited carefully to avoid:*
- *The risk of future loss from coastal erosion, land instability and flooding;*
- *Unsustainable coastal defence costs;*
- *Damaging existing defences and the capacity of the coast to form natural defences or to adjust to future changes without endangering life or property;*
- *Making provision for mitigation of and adaptation to natural coastal change and the predicted effects of climate change over the medium to long-term (100 years) and supporting a 'whole shoreline approach' being taken to coastal risk management;*
- *Minimizing the loss of coastal habitats and avoiding damage to coastal processes;*
- *Promoting managed realignment as a tool for managing flood and coastal erosion risk and delivering biodiversity targets and compensatory habitat requirements under the Habitats Directive.*

SUB-REGIONAL POLICY	THE REPLACEMENT JOINT LANCASHIRE STRUCTURE PLAN 2001-2016 (2005)
	Para 6.1.4. Green Belts High flood risk areas and floodplains as well as statutory designated nature conservation areas will only exceptionally be appropriate locations for new development.
	Policy 24 – Flood Risk (Resource Management Chapter) The high flood risk areas in Lancashire are identified on map 17. In developed high flood risk areas, development will be limited to proposals for which appropriate flood alleviation measures either exist or will be provided by the developer. In undeveloped or sparsely developed high flood risk areas, development will be limited to proposals for which the particular location is essential. In functional floodplains, development will be limited to proposals which comprise essential infrastructure which cannot be located elsewhere. In all areas: (a) Development that could compromise existing flood defences or increase flood risk will be avoided; (b) Development that reduces flood risk or aids the operation of functional flood plains will be promoted; (c) Sustainable urban drainage systems will be used in new development where practicable.
	CENTRAL LANCASHIRE CITY – SUB-REGIONAL STRATEGY (2006)
	In its SWOT analysis of the region the SRS notes flooding as a ‘threat’. It states: environmental constraints, particularly from flooding, constraining development opportunities.

LOCAL POLICY

SOUTH RIBBLE BOROUGH COUNCIL LOCAL PLAN (2000)

Policy ENV19 - Coastal Zone

In the coastal zone as defined on the Proposals Map development will not be permitted unless related to flood protection, navigation, fisheries, amenity, nature conservation and informal recreation and integrates and harmonises with natural features.

Policy ENV20 - Flood Risk

Development will not be permitted in areas liable to flooding and where it would itself increase the risk of flooding or interfere with the ability of agencies to carry out flood control works and maintenance or adversely affect the integrity and continuity of tidal or fluvial flood defences. Development may be considered acceptable provided that the Council is satisfied that suitable measures to mitigate any adverse impact of surface water run-off are included as an integral part of the development proposals.

Revised Flood Zones: Since the Plan was adopted on 16th February 2000, the Environment Agency has revised the boundaries of the flood risk areas in South Ribble.

CHORLEY BOROUGH COUNCIL LOCAL PLAN (2003)

Policy EP19 Development and Flood Risk

Development in areas at risk from flooding will only be permitted where:

(a) It would not cause or exacerbate flooding in other areas; and
(b) A satisfactory standard of flood protection already exists; or
(c) Mitigation measures will be included as part of the planning application.

A Flood Risk Assessment may be required where it is considered that there would be an increased risk of flooding as a result of the development or the development itself would be at risk from flooding.

PRESTON LOCAL PLAN 1999 – 2006 (2004)
Para 6.13 - … *The Ribble Estuary has been identified by the Environment Agency as an area where there is a risk, but the City Council is advised that the existing flood banks are adequate. New development may still take place, therefore although its design should be such as to reduce the potential for damage from floods.* *…It is also important that there must be no increase in rates of surface water run-off to both the Savick Brook and Sharoe Brook catchments, because this could result in localised flooding further downstream. The Environment Agency has stressed the importance of ensuring that run-off from the industrial sites at Red Scar must not exceed existing levels to prevent the risk of flooding elsewhere.*
Policy DP3 – Development and Flood Risk *Development in areas at risk from flooding (including tidal inundation) will be permitted only where appropriate flood alleviation measures already exist or will be provided by the developer.* *In other areas development that will generate increased rates of surface water run-off will only be permitted where there will be no adverse impact, for example an increased risk of flooding, river channel instability or damage to natural habitats.* *Developers will be expected to submit assessments of the impact of the development on surface water drainage systems and include proposals for mitigation works and their long-term maintenance, where these are required.*

CFMP Review

River Douglas CFMP	
Main Watercourses	• River Douglas • River Tawd • River Yarrow • Calico Brook • Smithy Brook • Pearl Brook
Main Flood Risk Issues	The main flood risk in this area is from rivers overtopping their banks following prolonged rainfall, or from intense rainfall exceeding the drainage and channel capacity. This is particularly true in urban areas in steeper parts of the catchment. The Douglas is mostly a small, steep catchment, which means flooding is by fast-flowing and often deep water, which poses a major risk of life.
Properties at Risk	Across the catchment there are 367 properties at risk in a 10 % event, 1639 in a 1 % event and 4,286 in a 0.1 % event.
Flood Defences and Standard of Defence	The Standard of Protection (SoP) for most of the catchment is 1 in 40 years. However, in the lower reaches of the Douglas, Lostock and Yarrow where the SoP ranges between 1 in 75 and 1 in 150 years.
Policy Unit Summaries	Fluvial Douglas: Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from urban development, land use change and climate change) Fluvial Yarrow: Take action to increase the frequency of flooding to deliver benefits locally or elsewhere. Fluvial Lostock: Continue with current or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline). Tidal Douglas: Take action to increase the frequency of flooding to deliver benefits locally or elsewhere. Built Up Areas: Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from urban development, land use change and climate change).
Future Flood Risk / Climate Change	The CFMP's have considered flood risk for the next 50-100 years and have taken into account flood risk drivers of climate change, urban development and changes in land use. Catchment models and MDSF have been used to test sensitivity to

	the flood risk drivers across the catchments in the district. Defra/UKCIP guidance on climate change has been used in the sensitivity analysis. This includes an increase in up to 20% of peak flows and runoff in rivers. Flows at the 10%, 1% and 0.1% event were modelled. Results showed an average of an increase in flows of 20% across the Douglas catchment. The Douglas catchment has shown to be sensitive to changes in agricultural drainage and intensification. It has been shown to be marginally sensitive to urban development due to limited opportunity. It is sensitive to catchment wide afforestation. Again, opportunities for this are limited. MDSF was used to estimate changes to people and property at risk due to these changes. The flood extent in the Douglas catchment was shown to be similar to the current extent under all scenarios,
River Ribble CFMP	
Main Watercourses	• River Ribble • River Hodder • River Calder • River Darwen
Main Flood Risk Issues	The main sources of flooding in the Ribble catchment are associated with high rainfall and to a lesser extent sea level. Snowmelt is known to have contributed to some flood events in the past. Flooding in the estuary in the west is caused by tidal flows combined with storm surges in the Irish Sea. Flooding can also result from wave action in the estuary area, but this is considered to be limited in extent. Flooding along watercourses in urban areas is typically associated with the surcharge of subsurface drainage systems or structures being blocked (for example culverts, outfalls or bridges). This type of flooding is generally localised and of less relevance to a catchment-wide view of flood risk in the Ribble catchment, though the potential impacts can be significant.
Properties at Risk	In the Lower Ribble (including Preston, Fulwood, Cadley and Walton-le-Dale), 2590 properties are at risk during the 1 % event and 3890 during the 0.1 % event (Note: Fulwood & Cadley are outside of the study area)
Flood Defences and Standard of Defence	Few of the fluvial defences have a Standard of Protection (SoP) of greater than 1 in 40 years. In Walton-le-Dale, SoP is 1 in 75 years

Policy Unit Summaries	Lower Ribble: Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change) Lower Ribble (urban): Take further action to reduce flood risk.
Future Flood Risk / **Climate Change**	The increase in flood risk under climate change predictions is uncertain. In some parts of the CFMP area the impact of climate change may be greater than estimated and this may need further actions in the future.
River Wyre CFMP (Scoping)	
Main Watercourses	• River Wyre • River Calder • River Brock
Main Flood Risk Issues	The time to peak of the River Brock and River Wyre are similar and so coinciding events on these watercourses may result in significant flooding at Garstang near the confluence. Fluvial flooding events coinciding with tidal events are less likely but the consequences would be severe flooding in the lower Wyre.
Properties at Risk	Within the Wyre catchment there are 28,300 properties at risk in Flood Zone 3 and over 33,000 properties within Flood Zone 2.
Flood Defences and Standard of Defence	There are approximately 422 km of defences in the CFMP area along around 90.6 % of its length. The average SoP is 1 in 40 years
Policy Unit Summaries	To be determined at Final CFMP stage.
Future Flood Risk / **Climate Change**	To be determined at Final CFMP stage.

Appendix J: GIS Layers

Type	Layer	Source	Description of Layer	Included (Y/N)	Comment	Benefits	Limitations
Fluvial	Environment Agency Broad-scale Flood Zone Maps	Provided as GIS layer by EA	Polygon layer showing EA flood zone maps including Flood zone 2 and 3	Y		A quick and easy reference that can be used as an indication of flood risk.	Flood zones may not give an accurate representation of flood risk. The models do not take into account defences; are commonly based on 5m resolution DTM; JFLOW software is commonly used that is generally thought to have inaccuracies. Typically watercourses with a catchment area less than $3km^2$ are omitted from Environment Agency mapping unless there is a history of flooding affecting a population. Consequently there will be some locations adjacent to watercourses that on first inspection, it is suggested there is no flood risk.
	Main Rivers Centrelines	Provided as GIS layer by EA	Polyline layer showing all watercourses designated Main Rivers	Y		Identification of the watercourses for which the EA have discretionary and regulatory powers	There are other watercourses that may be a significant flood source.
	Hydraulic model outputs: Ribble tributaries 25 year & 100 year for various tributaries	Provided as GIS layers by EA	Polygon data showing the modelled outlines of tributaries (Liggard, Longton & Mill, Longton, Mill, Penwortham, Savick Brook & Wrongway Carr).	Y	Limited data	Detailed and calibrated hydraulic model outlines that have been mapped using LiDAR (1m and 2m resolution). These outlines provide a much greater degree of accuracy and therefore confidence than the broad-scale flood zones.	There are watercourses within the study area that have not been modelled and therefore the flood risk from these cannot be as accurately assessed.
	Hydraulic model outputs: Upper Wyre catchment 25 year & 100 year flood outlines	Provided as GIS layers by EA	Polygon data showing the modelled outlines for the Upper Wyre catchment	Y			
	Hydraulic model outputs: Yarrow, Lostock & Douglas 25 year & 100 year flood outlines	Provided as GIS layers by EA	Polygon data showing the modelled outlines of the Yarrow, Lostock and Douglas and their tributaries.	Y			
Fluvial & Tidal	Combined Flood Zone 3b - Functional Floodplain	EA Flood Zone Maps & EA Hydraulic Modelled Data	Polygon layer created using best available data for whole district. Where 1:25yr modelled outlines available, these have been used to represent FFP (with agreement from EA and three Councils). Where modelled data is not available, EA broad-scale FZ3 has been used.	Y	Combined data	A single GIS layer created using best available information at time of publication.	Assumption made that where modelled data for 20/25yr event is not available, the 100yr FZ3 broad-scale outline has been used. This could be overly conservative and, where possible, data should be updated as and when available.
	Combined Flood Zone 3a	EA Flood Zone Maps & EA Hydraulic Modelled Data and outline derived from 200 yr tidal flood levels & LiDAR data	Polygon layer created using best available data for whole district. Where 1:100yr modelled outlines available, these have been used to represent FZ3a (with agreement from EA and three Councils). Where modelled data is not available for fluvial reaches, EA broad-scale FZ3 has been used. Where modelled data is not available for tidal reaches, the EA 200 year tide levels (derived from Posford Duvivier's Coastal Modelling, 2001) have been used to determine an outline using LiDAR data.	Y	Combined data	A single GIS layer created using best available information at time of publication.	Assumption made that where modelled data for 100yr event is not available, the 100yr FZ3 broad-scale outline has been used. This could be overly conservative and, where possible, data should be updated as and when available.

Type	Layer	Source	Description of Layer	Included (Y/N)	Comment	Benefits	Limitations
	Combined Flood Zone 3 + CC	EA Flood Zone Maps, EA Hydraulic Modelled Data and outline derived from calculated Sea Level Rise & LiDAR data	Polygon layer created using best available data for whole district. Where 1:100yr + CC modelled outlines available, these have been used to represent FZ3 + CC (with agreement from EA and three Councils). Where modelled data is not available for fluvial reaches, EA broad-scale FZ2 has been used. Where modelled data is not available for tidal reaches, sea level rise calculations prescribed in PPS25 have been used to determine projected levels and the outline has been determined using LiDAR data.	Y	Combined data	A single GIS layer created using best available information at time of publication.	Assumption made that where modelled data for 100yr+CC event is not available, the 1000yr FZ2 broad-scale outline has been used. This could be overly conservative and, where possible, data should be updated as and when available.
	Combined Flood Zone 2	EA Flood Broad Scale Flood Zone Maps	Polygon layer of 1:1000yr FZ2 outline created for whole district.	Y	Combined data	A single GIS layer created using best available information at time of publication.	All based on FZ2 broad-scale mapping
	Historical Flood Outlines	EA FERS data	Polygon data for whole district showing historical flooding incidents and events	Y		Shows areas previously affected by flooding.	Will require updating as and when flooding incidents occur and are recorded
	Flood Defence Locations (NFCDD)	EA / DEFRA - National Flood & Coastal Defence Database.	Point and polyline data with meta-data showing defence locations, standard of service and condition	Y		Shows where there are existing defences, heights, type and design standard.	Dataset not fully completed or up-to-date. Many fields contain default values.
Tidal	Environment Agency Broad-scale Flood Zone Maps	Provided as GIS layer by EA	Polygon layer showing EA Flood Zone 3, which includes 200 year tidal outline.	Y		Shows the zones of the study area at risk from the current 1 in 200 year tidal flood	All based on FZ3 broad-scale mapping. Does not distinguish between tidal (1 in 200) and fluvial (1 in 100) reaches.
Tidal	Flood Defence Locations (NFCDD)	EA / DEFRA - National Flood & Coastal Defence Database.	Point and polyline data with meta-data showing defence locations, standard of service and condition	Y		Shows where there are existing defences, heights, type and design standard.	Dataset not fully completed or up-to-date. Many fields contain default values.
Groundwat er	Groundwater Vulnerability Maps	Provided as GIS layer by EA	Polygon layers showing major aquifers and their vulnerability	Y		Broadly shows extents of aquifers in the district. Where aquifers are highly vulnerable, they often have a more permeable covering and, together with dry valley and watercourse networks, potential groundwater flooding areas can be identified.	Coarse assessment of potential areas where GW flooding could occur. This is not foolproof and is based on assumptions. Where necessary, detailed groundwater flooding studies should be undertaken at SSFRA.
Other	Sewer Flooding History	DG5 data registers provided by United Utilities	Data layer showing points of flooding with records of date of incident, location, extent, source, cause.	Y		Indicates areas that are most prone to flooding as have experienced flooding within a postcode area due to hydraulic incapacity.	The postcode areas cover relatively large areas and it is not possible to determine the exact location of the incidents from this dataset. Data only covers October 2006 – April 2007 and it is therefore difficult to determine long-term trends.
Other	Reservoirs and Large Water Bodies	GIS Layer created from EA records (Exeter Office).	Polygon layer showing large water falling under Reservoirs Act	Y		Allows identification of areas downstream of large reservoirs and water bodies. Delineation of residual risk to potential future sites.	Condition and capacity of water bodies not known at this time. Breach/overtopping scenarios not available.
Mitigation	Flood Warning areas	Provided as GIS layer by EA	Polygon layer showing areas benefiting from flood warning and emergency plans with query details presenting what is involved in each.	Y		Indicates which areas the flood warning system covers.	
Mitigation	NFCDD	EA / DEFRA - National Flood & Coastal Defence Database.	Point & Polyline layer showing NFCDD entries within the study area protecting from all flood sources and unofficial defences, providing details of the type of structure, operating/responsible authority	Y		Shows where there are existing defences, heights, type and design standard.	Dataset not fully completed or up-to-date. Many fields contain default values.
Mitigation	Areas benefiting from defences	Provided as GIS layer by EA	Polygon layer showing areas benefiting from flood defences	N			The polygon data does not cover the entire study area.

Type	Layer	Source	Description of Layer	Included (Y/N)	Comment	Benefits	Limitations
	Groundwater Vulnerability Maps	Provided as GIS layer by EA	Polygon layers showing major aquifers and their vulnerability	Y		Broadly shows extents of aquifers in the district. Where aquifers are highly vulnerable, they often have a more permeable covering and, together with dry valley and watercourse networks, potential groundwater flooding areas can be identified.	Coarse assessment of potential areas where GW flooding could occur. This is not foolproof and is based on assumptions. Where necessary, detailed groundwater flooding studies should be undertaken at site-specific FRA.
Planning	LPA/study area Boundary	Provided as GIS Layer by the three Councils	Polygon layer showing administrative boundaries	Y		Clearly identifies the study boundary	
	Urban Areas	Provided as GIS Layer by the three Councils	Polygon Layer showing urban areas	Y		Defines urban areas	
	OS Mapping	CBC provided OS Mapping under contractor license	1:10k (limited coverage), 1:50k and 1:250k OS raster maps for use in GIS	Y		Provides background mapping to other GIS layers.	Designed for use at 1:10k, 1:50k, 1:250k scales

Appendix K: Parish Council Consultation

Local Authority Area	Parish Council
Chorley Borough Council	Adlington
	Anderton
	Anglezarke
	Astley Village
	Bretherton
	Brindle
	Charnock Richard
	Clayton le Woods
	Coppull
	Croston
	Cuerden
	Eccleston
	Euxton
	Heapey
	Heath Charnock
	Heskin
	Hoghton
	Mawdesley
	Rivington
	Ulnes Walton
	Wheelton
	Whittle le Woods
	Withnell
Preston City Council	Barton
	Broughton
	Goosnargh
	Grimsargh
	Haighton
	Lea and Cottam
	Whittingham
	Woodplumpton
South Ribble Borough Council	Farington
	Hutton
	Little Hoole
	Longton
	Much Hoole
	Penwortham
	Samlesbury & Cuerdale

Parish Council Response	Addressed / Comment
1. Level 1 SFRA: Draft Executive Summary	
a. Does the draft Executive Summary clearly explain the background of SFRA's with regards its relevance to the planning process?	
Not very plain English. Some Councillors find it difficult to disentangle	Reviewed draft Executive Summary and reworded some parts to make it simpler.
Yes, generally speaking, although it is felt the layman may have difficulty understanding some of the jargon and terminology	Reviewed draft Executive Summary and reworded some parts to make it simpler.
I think derivation of the flood zones is OK but the flood zone terminology is somewhat confusing	Reviewed and reworded some parts to provide better explanation. Terminology is explained in more detail in the main Level 1 report.
b. Is there any other information that could be included in the draft Executive Summary that would assist in the understanding of the SFRA?	
It would be helpful to have outline rainfall data to indicate times of heavy rainfall, frequency and variability	Isohyets showing Standard Annual Average Rainfall and Mean Monthly Rainfall are available from CEH and the EA. However, intense thunderstorms are difficult to predict and are the cause of most rainfall related surface water flooding events.
Not just about future development planning but also useful for current maintenance or preventative measures.	The purpose of an SFRA is to inform future strategic level development. Catchment Flood Management Plans (CFMPs) and site-specific FRA's should look detail at defence maintenance issues. The main body of the report provides advice on site-specific FRAs and SuDS and advises on preventative measures.
The draft Executive Summary is very clear regarding the study of past flood zones and possible 'climate change'. No mention is made of a programme of maintenance of rivers in flood zones - obviously lacking in the areas surrounding Croston - Yarrow & Lostock	CFMPs address maintenance issues in detail. The scale of this study is strategic, hence detailed defence maintenance is not covered here but should be addressed in a site-specific FRA.
Potential for dangerous trees on river banks which could cause floods.	Site-specific FRAs should take account of such information.
Reference to underlying geology	Underlying geology is referred to in the main body of the report. BGS data is presented for each Local Authority area in Appendix E.
c. Do you have any additional comments regarding the draft Executive Summary?	
Map is almost impossible to read for any man with red / green colour-blindness. I have to rely on my wife. It would be helpful to give symbols such as various styles of hatching.	The use of hatching could make the maps complicated and difficult to read. The GWV layer has been taken off settlement maps and presented separately. This has made the existing information much clearer and may help people with colour-blindness to decipher the information.
Mention is made of the urban sewer network. Outline of main sewer network and potential flood points within specific districts could be included	Data on sewer flooding incidents has been obtained from UU and is presented as a standalone map in an appendix of the main report. Due to licensing issues it is not possible to represent the whole UU sewer network. However, this data is available from UU at local scales.
Would have liked some mention of a maintenance programme	Defence maintenance programmes are detailed in Catchment Flood Management Plans (CFMPs). Site-specific FRA's should look in detail at the maintenance programme of defences.
Consulting with residents living in the floodplain may prove beneficial. The use of 20% allowance for climate change (which appears to be unsustantiable as it involved 'predictions') is extremely worrying as it may be used by insurers to increase premiums or decline cover. The adverse impact of new housing developments does not appear to be taken into consideration.	Consulting with all residents living in flood risk areas would be a large task and is outside of the scope of this brief. The 20% allowance for climate change has been adopted by both DEFRA and the EA and is stipulated by PPS25. In the main body of the report, advice is given on the requirements of a site-specific FRA. Mitigation measures for site allocations should be considered in a Level 2 SFRA.
Impact of development of neighbouring areas should be accounted for in this same way as climate change effect is guestimated	A site-specific FRA should look at the effects of the development on neighbouring areas. It is difficult to 'guestimate' the effects as this would be dependent upon the location and size of the development. This is something that should be considered in a Level 2 SFRA.

2. Level 1 SFRA: Parish Flood Information Map	
a. Is the information on the Parish Flood Information Map useful in highlighting any potential future flooding problems and the areas most at risk?	
Omits flooding problems on Ellerbeck where it passes in a conduit under the A673, under the railway line and under the A6. All three points are known to flood when debris blocks the pipes.	The flood outlines have been provided by the EA and represent the best information available at present. The scale of this assessment is strategic and this is rather localised information. Site-specific FRAs should take account of this information.
The map is far too detailed. An overall Parish map containing essential information of the worst affected areas on a larger scale would be better. It is virtually impossible to differentiate areas due to the usage of similar colours and shading. Again, separate information would help	In many cases, the scale of GIS layers are not designed to be viewed at this scale. In the main report, maps are at settlement level rather than Parish Council level. The GWV layer has been taken off settlement maps and presented separately. This has made the existing information much clearer.
Yes it is useful but the difference between Zone 2 and 3 is not particularly clear. Greater shading would be an advantage.	The GWV has been layer taken off settlement maps and presented separately. This has made the existing information much clearer.
b. Are there any particular discrepancies on the Parish Flood Information Map?	
Needs consideration of problems with the Ellerbrook. [Three points that flood regularly]	The flood outlines have been provided by the EA and represent the best information available at present. The scale of this assessment is strategic and this is rather localised information. Site-specific FRAs should take account of this information.
Not very clear map and shading not clear or correct with key	The GWV layer has been taken off the maps and presented separately. This has made the existing information much clearer.
Small area which regularly floods not shown. Unable to understand methodology used to identify area shown to be 'minor aquifer - intermediate' for groundwater vulnerability on the map.	The flood outlines have been provided by the EA and represent the best information available at present. The scale of this assessment is strategic. This small area is rather localised information. Site-specific FRAs should take account of this information.
The River Chor is shown as originating from west of the M61. It actually originates north east of the M61 in a moss area that retains water	The river centrelines that show the watercourses were provided by the EA. However, the area of Flood Zone 3a associated with the River Chor shows that the source is to the north west of the M61, hence this comment is correct.
c. Do you have any additional comments regarding the Parish Flood Information Map?	
Would be useful to differentiate between 'normal' water areas (I.e., reservoirs) and floodplains.	In the main report, Table 3-2 details which information is 'informative' and which is 'flood risk'.
Difficult to interpret different colours on map with corresponding legend - needs to be more distinct.	The GWV layer has been taken off settlement maps and presented separately. This has made the existing information much clearer.
The use of similar colours and shading makes differentiation of 'functional floodplain' and floodplain 3 difficult.	The GWV layer has been taken off settlement maps and presented separately. This has made the existing information much clearer.

Appendix L: Data

TITLE	DESCRIPTION	CONFIDENCE
EA Data (Exeter)	Reservoir Data for study area and surrounding area - including risk rating	VERY GOOD
EA Flood Data	Douglas CAMS	VERY GOOD
EA Flood Data	Ribble ICMP	VERY GOOD
EA Flood Data	Ribble CFMP	VERY GOOD
EA Flood Data	Douglas CFMP	VERY GOOD
EA Flood Data	Groundwater Vulnerability Maps	VERY GOOD
EA Flood Data	Critical Ordinary Watercourse Maps	VERY GOOD
EA Flood Data	Hydrometric Data	GOOD
EA Flood Data	Flood event outlines	VERY GOOD
EA Flood Data	200 year tide levels	VERY GOOD
EA Flood Data	Flood Warning Areas	VERY GOOD
EA Flood Data	Areas benefiting from defences	VERY GOOD
EA Flood Data	NFCDD	VERY GOOD
EA Flood Data	Asset systems	VERY GOOD
EA Flood Data	R. Yarrow, Lostock, Douglas Tribs SFRM - Digital deliverables inc mapping, model	VERY GOOD
EA Flood Data	Ribble tributaries SFRM study - Digital Deliverables	VERY GOOD
EA Flood Data	Wyre Phase 2 SFRM Study, Ribble S105 model	VERY GOOD
EA Data	Aerial photography	GOOD
EA LiDAR Data	4 CD's containing LiDAR data for the C Lancs study area	VERY GOOD

EA Flood Data	S105 modelling report for the R Ribble	VERY GOOD
CBC Data	Contractor OS License, 10k rasters, 50k rasters, 250k rasters	VERY GOOD
PCC Data	OS mastermaps	VERY GOOD
PCC Data	Preston Riversway Development FRA (Halcrow)	VERY GOOD
Ribble Valley BC Data	SFRA Information from neighbouring councils	GOOD
United Utilities Data	DG5 Data Sets for internal and external registers	VERY GOOD
CBC Data	Map with built up area and likely Potential Major Development Sites shown	GOOD
SRBC Data	Housing and employment allocations	VERY GOOD
PCC Local Plan	PCC Local Plan Maps	VERY GOOD
BGS Data	Artificial, bedrock, linear features, mass movement, superficial	VERY GOOD

Appendix M: List of Contacts

Organisation	Contact	Tel	E-Mail
PCC	Mike Molyneux		M.Molyneux@preston.gov.uk
SRBC	Jennifer Tunney		Jtunney@southribble.gov.uk
CBC	Julian Jackson		Julian.Jackson@chorley.gov.uk
EA	Ian Southworth	01772 714043	Ian.Southworth@environment-agecny.gov.uk
Lancashire County Council (Highways)	Bill Dawson	01772 530260	
British Waterways	Leah Coburn	0207 985 9200	Leah.Coburn@britishwaterways.co.uk
Highways Agency Area 13	Sam Smith	0161 9305631	
Amey Mouchel (Highways Area 13)	Mike Stevens	0845 601628	
United Utilities	Brian Morrow	01925 537177	Brian.Morrow@uuplc.co.uk
BGS	Jane Smalley	0115 9363224	jsmalley@bgs.ac.uk

Appendix N: SFRA Maintenance and Updates

How to maintain and update the SFRA

For an SFRA to serve as a practical planning tool now and in the future, it will be necessary to undertake a periodic update and maintenance exercise. This section clarifies what specific actions are recommended to ensure correct maintenance and updating of the SFRA.

GIS Layers

As described in Section 3.6 and in Appendix J, the GIS layers used in the SFRA have been created from a number of different sources, using the best and most suitable information available at the time of publishing. Should new Flood Zone information become available, the data should be digitised and geo-referenced within a GIS system. A copy of the current dataset should be created and backed up and the new data should then be merged or combined with the current data set.

For other GIS layers such as the Historical Flood Outlines or the Sewer Flooding Information, it is likely that data will be added rather than be replaced. For example, where a new sewer flooding incident is reported in the catchment, a point should be added to the sewer flooding GIS layer rather than creating a new layer.

All GIS layers used in the SFRA have meta-data attached to them. When updating the GIS information, it is important that the meta-data is updated in the process. Meta-data is additional information that lies behind the GIS polygons, lines and points. For example, the information behind the SFRA Flood Zone Maps describes where the information came from, what the intended use was together with a level of confidence.

For any new data or updated data, the data tables presented in Appendix L should be checked to ensure they are up-to-date.

Broad-Scale Assessment

If the flood zones are changed, it may be necessary to amend the broad-scale assessment presented in Appendix A. This should be carried out by querying the relevant GIS layers to determine the areas and percentages at risk of flooding in the district.

Updates or Additions to Development Sites

Although unlikely at the time of publication, should any updates or additions to development sites become necessary (for example, due to new flooding information), a detailed Level 2 SFRA may be required. This should be carried out according to the guidance given in PPS25 and this document. Once a Level 2 Assessment has been completed, this should be appended to a new version of this document.

For any new or updated sites, the FRA and SuDS tables and recommendations presented in Appendix H should be updated.

OS Background Mapping

The SFRA has made use of the OS 1:50,000 and 1:250,000 digital raster maps. Periodically these maps are updated. Updated maps are unlikely to alter the findings of the SFRA.

Data Licensing Issues

Prior to any data being updated within the SFRA, it is important that the licensing information is also updated to ensure that the data used is not in breach of copyright. The principal licensing bodies relevant to the SFRA at the time of publishing were the Environment Agency (North West Region), Ordnance Survey, United Utilities and the British Geological Survey. Updated or new data may be based on datasets from other licensing authorities and may require additional licenses.

Flooding Policy and PPS25 Practise Guidance Updates

This SFRA was created using guidance that was current in December 2007, principally PPS25 and the accompanying Practise Guidance. The Practise Guidance was a "living draft" at the time of publication and it is expected that the final version of the will be available in 2008. When the final version of the guidance is released, it should be carefully checked to ensure that the SFRA is still relevant to the guidance. If necessary, an update may be required.

Similarly, should new flooding policy be adopted nationally, regionally or locally, the SFRA should be checked to ensure it is still relevant and updates made if necessary.

Stakeholder Consultation and Notification

The key stakeholders consulted in the SFRA were Preston City Council, South Ribble Borough Council, Chorley Borough Council, the Environment Agency and United Utilities. It is recommended that a periodic consultation exercise is carried out with the key stakeholders to check for updates to their datasets and any relevant additional or updated information they may hold. If the SFRA is updated, it is recommended that the EA and the County Council Emergency Planning Department are notified of the changes and instructed to refer to the new version of the SFRA for future reference.

Frequency of Updates and Maintenance

It is recommended that the SFRA is maintained on an annual basis. Should any changes be necessary, the SFRA should be updated and re-issued.

Appendix O: SFRA Version Register

Version	Date Issued	Amendments Made	Stakeholders Notified	Amendments undertaken by:	Document Checked by:	Document Approved by:
1	August 2007	Original Level 1 Draft SFRA	NA	NA	NA	NA
2	November 2007	Original Level 1 Final SFRA	Y	FT	MT	DOB

Continue on new page if necessary