

flood risk management north and south

David Crichton examines key differences in the approaches taken to flood risk in England and Scotland

Britain has a maritime climate that makes it one of the wettest countries in Europe. The topography and prevailing winds mean that the north and west are wetter than the south and east:

- The average annual rainfall in the Western Highlands of Scotland is 5,100 millimetres, while London's average is 600 millimetres.
- Scotland has 70% of the area and 90% of the volume of all the UK's inland surface water. The water contained in Loch Ness alone is nearly twice the amount found in all the standing waters of England and Wales combined.
- Scotland has more than 27,000 lochs, over 11,800 kilometres of coastal water, and more than 120,000 kilometres of rivers and streams. The River Tay contains more water than the Thames and Severn combined.

All this would suggest that the north and west present a higher flood risk than the south and east. In 1990, Scotland entered a 'flood-rich' period with major floods occurring on the Ness (1990), Tay (1990, 1993), Spey (1900), Moray (1997, 1998, 1999, 2002, 2004, 2008, and 2009) and the Almond (2000), and across Strathclyde (1994), in the city of Edinburgh (2002) and in the Scottish Borders (2006, 2009). In 1993 rainfall combined with snowmelt to cause flows of 2,268 cubic metres a second in the River Tay, a record for the UK. Flows would have been higher but for excellent anticipation and co-ordination with the owner of the reservoirs upstream.

After the 1993 flood, Scotland introduced a number of measures, including working together with the insurance industry to establish Flood Appraisal Groups (later renamed Flood Liaison and Advice Groups, or 'FLAGs') to advise planners on measures to avoid floods. Soon, almost every Scottish local authority, covering 94% of the

population, was involved with FLAGs with insurance representation.

At this time, in England flooding was not yet seen as a major problem. The floods of 1998 in the Midlands were perhaps regarded as an anomaly. The authors of an insurance report in September 2000 were widely criticised for scaremongering when they warned that, based on insurance data collected in Scotland, they had calculated that an inland flooding event in England could cost over £1 billion¹ – the worst Scottish flood had cost less than £100 million. But only three weeks after the report was published, the critics were silenced when the wettest autumn in England since 1766 caused flooding of 10,000 properties from York to Lewes that cost insurers £1.3 billion. The severity could well have been due to climate change.²

In any event, it was a wake-up call for the insurance industry. The insurance costs of the floods of 2007 in England, the most expensive in the world that year – from only the 12th wettest English summer since 1766 – were over £3 billion from 185,000 claims, but insurers were now prepared and dealt with them efficiently.³ These insurance costs do not include uninsured costs such as breaks in electricity supply, and damage to transport networks and infrastructure.

In fact, since 1994, almost all the biggest UK flood events have occurred in England and Wales – Midlands (1998), England and Wales widespread (2000 and 2001), Boscastle (2004), Conwy Valley (2004 and 2005), Carlisle (2005), widespread again (2007 and 2008), Morpeth (2008), Birmingham (2009), and Cocker mouth (2009). In Scotland, only Moray and the Borders have suffered from major flood damage since 1994, despite the fact that winter rainfall increased by over 50% in the West of Scotland between 1961 and 2004. It would seem

Table 1
River and coastal flood exposure in Britain

Country	Number of households in 2011	Population in 2009		Flood exposure in 2009		
		Population	Population per square kilometre	At-risk households	Proportion of existing properties at risk	Proportion of new build in flood hazard areas
		millions	thousands	thousands	%	%
England (100-year return period)	22.52	50,016	383	2,400	10.6	11
Wales (100-year return period)	1.28	2,935	141	153	12.0	Negligible (since 2004)
Scotland (200-year return period)	2.41	5,056	64	99	3.9	Negligible (since 1995)

Note: The Environment Agency suggests that an additional 2.8 million households are at risk of surface water flood in England

Sources: Office for National Statistics, the Environment Agency, Department for Communities and Local Government, the Welsh Assembly, and the Scottish Government. Figures for Northern Ireland are not available

that perhaps Scotland does not present a higher flood risk than England after all. Why is this?

Adaptation

One of the consequences of its geography is that Scotland is used to rain, snow and storms. Scotland has adapted over centuries to manage the risk of flooding from rainfall and snowmelt (it produced the world's first science-based flood maps, published in 1875 by James Croll). This adaptation takes many forms: bigger drains, stronger roof designs, land use planning, building regulations and design, flood risk management, sustainable drainage, sustainable flood management, well equipped and trained flood rescue teams, and so on.

Nine leading climate change models all predict even wetter winter weather for the whole of the UK. While Scotland is well prepared for this, in England and Wales there is some way to go. Architects need to be trained in climate change adaptation, but at present there is only one textbook on the subject in the whole world.⁴ What matters will be the extent to which the rest of Britain (especially in the east and the south) will adapt to the increasingly severe rainfall and changing storm tracks predicted with climate change.

Population density

A second factor is population. England is so densely populated that often it can be hard to find new building plots which are not at risk of flooding. In the Highlands of Scotland there are only nine people per square kilometre. The average density in Scotland is 64 people per square kilometre; for England the figure is 383.

Population in England is projected to increase by 18% between 2008 and 2033,⁵ leading to densities of 465 persons per square kilometre. In the South

East, where the highest proportions of new build in flood hazard areas can be found, population densities are projected to increase by 20% by 2033.

Partnerships

The Scottish approach has been characterised by a willingness to work with insurers and other key stakeholders to solve problems together. For example, FLAGs have provided much valuable advice to Scottish planning authorities and have helped to spread best practice and catchment-scale policies. A recent report from Manchester University⁶ stated that in England:

- Local communities and key stakeholders are ignored when forming local planning policy.
- There is a tendency for flood risk to be assessed and mitigated on a site-by-site basis, inhibiting the potential for strategic mitigation solutions.
- There are difficulties in balancing socio-economic and environmental priorities against flood risk concerns.

Land use planning Issues

A growing understanding of engineering and natural systems, combined with a long spell of relatively few UK floods between 1954 and 1990, seems to have made planners more confident that they could use floodplains in ways which would have seemed foolish to previous generations. With hindsight and a growing awareness of the uncertainty about extreme flooding events, these decisions now appear unwise.⁷ Insurers are well aware that the properties at the greatest risk of flooding are often those built during this post-war period. It is only now that there are moves for floodplain restoration in areas such as Berkshire, Conwy Valley, Dorset, and Hampshire. Table 1 shows that while new building in flood hazard areas

has virtually ceased in Wales and Scotland, it has continued in England.

Flood insurance

Most Scottish local authorities follow elements of the 'Insurance Template' (see Table 2) to avoid the situation of allowing the construction of properties which may become uninsurable and therefore blighted. The template suggests higher standards for vulnerable people. An unpublished insurance survey revealed that 89 hospitals in England alone are at a high risk of flooding and 70% of them have no flood defences. There are also 2,374 schools at high risk in England.

Insurers have made huge progress in their ability to map flood hazards. Under the EU Floods Directive,¹⁰ public flood maps only have to show river and coastal flooding. Insurers' maps also include areas at risk of drainage, groundwater, or surface water floods and will no doubt include dam-break inundation maps as these enter the public domain.¹¹

Insurers will also take into account the date of construction. This is an important underwriting factor because buildings constructed after around 1920 are more likely to have been built in flood hazard areas, are more likely to have cavity walls and insulated floating floors which are more costly to dry out, and are more likely to use materials such as plasterboard and chipboard, which are particularly vulnerable to flood damage. Thanks to legislation intended to help the disabled, newer houses are more likely to have ground-floor toilets (a source of sewage back-up floods) and no doorsteps. Insurance research has also found that houses built after 1971 in England and Wales are more likely to be damaged by storms.¹²

There is increasing concern about surface water flooding from heavy rainfall. Provisional estimates published by the Scottish Environment Protection Agency (SEPA) in June 2011 found that 5% of Scottish households are at risk of a 200-year surface water, river, or coastal flood. The corresponding figure in England (even for a 100-year flood) is, according to Environment Agency estimates, a whopping 23% (see Table 1).

The cost of flood damage is often underestimated. Central government has so far chosen to ignore the British National Flood Insurance Claims Database, which is the largest of its kind in the world, with data on thousands of flood claims from the 25 leading UK insurers. Regular analysis reports from the database enable insurers to accurately model the cost of a flood depending on the depth, duration and type of property affected. Examples of the results are shown in Table 3 (even where the depth is below floor level (as in Hull in 2007) the insurance costs are significant).

Table 2
The 'Insurance Template'⁸

Type of property	Return period	Annual probability
	years	%
Housing for the disabled or elderly	1,000	0.10
Basements	750	0.15
Ground-floor flats	500	0.20
Touring caravans for seasonal occupancy only	50	2.00
Other	200	0.50

Note: Extracts from the residential property section of the 'Insurance Template' showing the levels of risk which may be insurable at normal terms. Higher risks may be accepted with premium loadings, but such risks could become unattractive to insurers under the Solvency II Directive.⁹ This template is not a market agreement, simply mathematics

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Looming deadlines

For the last 50 years, the insurance industry has bowed to government pressure to keep rates low in flood-risk areas. This has meant that policy-holders in safer areas have been overcharged for many years in order to subsidise those in high-risk areas. This is becoming unsustainable. For example, some of the cleverer insurers have realised that they can easily undercut the premiums in low-risk areas such as Scotland. People living in high flood hazard areas may find the availability and affordability of flood insurance affected not only by the erosion of the subsidy, but also by three looming deadlines:

- **1 July 2013:** Currently, those living in many flood hazard areas are protected by an understanding between the Government and the insurance industry (other than Lloyds) that flood insurance will continue to be available in all cases where the property was built before 1 January 2009, provided the flood hazard does not exceed the 75-year return period (1.3% cent annual probability), or in higher hazard areas where flood defences are planned to be in place within five years. Insurers have announced that this understanding will expire on 30 June 2013 and will not be renewed. In the long run this will be a good move, because flood insurance provides economic penalties to discourage building in flood hazard areas. As such it has an important role in sustainable flood management policies. However, in the short term withdrawal of insurance cover is likely to lead to blight and a fall in property values.
- **22 December 2013:** Under the EU Floods Directive, by 22 December 2013 flood maps must

Table 3
Costs of flooding

	Sum insured	Cost	
		0 mm depth	200 mm depth
£			
Buildings	150,000	11,043	23,155
Contents	35,000	7,108	10,059
Alternative accommodation	Where buildings sum insured is £150,000	2,617	4,078
Total		20,768	37,292

Source: A. Black, A. Werritty and J. Paine: *Financial Costs of Property Damages due to Flooding; the Halifax Dundee Flood Loss Tables 2005*. University of Dundee, sponsored by Halifax General Insurance Services, Oct. 2006

be published showing areas at risk of a 100-year return period flood from rivers or coasts. In Scotland, these maps include surface water, groundwater and drainage or sewage flood risks. The first drafts of these maps have already been published.

- **31 December 2013:** Insurers are preparing for the EU's Solvency II Directive,⁹ which will apply to all 5,200 large insurance and re-insurance firms in Europe from 1 January 2014. Among other things, regulations will require insurers and re-insurers to calculate all risks they face up to the 200-year return period event in order to calculate their 'Solvency Capital Requirement'. The more insurers can remove flood risks with a higher risk than the 'Insurance Template' from their books, the less capital will have to be reserved and the less their re-insurance will cost. Insurers will probably prefer such risks to 'go away' owing to high premiums than to have to decline renewal.

Price increases have already started

Even where the flood hazard is less than the 75-year return period, in the run up to the 2013 deadlines insurance in flood hazard areas is increasingly subject to large premium increases and excesses. A survey carried out in 2010 following the flooding of 850 homes in Morpeth in September 2008¹³ showed that by 2010 the average percentage increase of premiums per household for properties that were flooded was over 70%. A quarter of the flooded properties experienced an increase of 100% or more since 2008. This was despite the fact that the event had a 137-year return period and new flood defences were promised (in fact these new defences were deferred indefinitely in January 2011, leaving householders alarmed at what insurers will

do next). In addition, the recent publication of dam break inundation maps¹¹ shows that Morpeth is in a dam-break danger zone.

Excesses have also increased dramatically. One insurer now applies an excess which equates to 10% of the last flood claim payment. More than 40% of those surveyed in Morpeth now have excesses of £1,000 or more, with more than half of them having excesses of £4,000 or more. This compares with less than 5% of respondents who had any flood excess in 2008.¹³ There is anecdotal evidence of excesses up to £50,000 for a household policy. The Council of Mortgage Lenders has advised the author that if the flood excess exceeds £2,500 the insurance policy does not count as security for a mortgage, leading to the very real risk of foreclosure if the mortgage lender discovers the existence of the excess.

It was only in 2007 that a generally applying legal definition of 'flood' emerged for the first time, enabling insurers to exclude flood cover altogether.¹⁴ Although insurers have not generally used their new-found ability to exclude flood cover (and it would probably not be allowed by the insurance regulator anyway), pricing and excess increases will be enough on their own to have serious effects on insurance rationing. Consequent mortgage rationing will cause house prices to fall permanently in flood hazard areas.

The 'broad-brush' approach

The insurance industry is preoccupied with the problems in England. So, for example, the insurance agreement refers to a 75-year return period, a measure not used in Scotland, where the 200-year return period is the norm for flood mapping. Many insurers use a broad-brush approach and discriminate against property within the 200-year flood map in Scotland, as if it was within the 75-year higher-risk zone in England. However, not all insurers are like this, and it pays those living in Scotland to shop around.

A survey by ISL Ltd (a company which administers quotation systems for household insurance) published in *Scotland on Sunday* on 12 November 2006 found that householders in flood risk areas in Aberdeen, Glasgow, Edinburgh and Perth could significantly reduce their annual building insurance premium without excesses by switching to one of the small number of insurers which recognise that flood risks are being well managed in Scotland, using sustainable flood management methods. Specifically, homeowners in flood risk areas of Perth could save £117.20, in Glasgow £143.46, in Aberdeen £75.11, and in Edinburgh's Stockbridge, which flooded in 2000, £92.36.

Ten ways the market could go after 2013

What will insurers do when the 50-year old commitment to provide flood insurance expires in 2013?

This is still not known, but there are various possibilities:

- Business as usual, i.e. continue to subsidise floodplain development by overcharging in low-risk zones in order to keep premiums low in high-risk zones. This is unsustainable in a free market, where there will always be insurers prepared to reduce prices for low-risk cases – there are already signs of this happening in Scotland.
- Increase the flood excess substantially, especially after a flood claim. This is already happening, but it provides a strong incentive for policy-holders to exaggerate claims costs and commit fraud to cover the cost of the excess. It also reduces any incentive to minimise losses.
- Abolish subsidies and charge the full technical rate for high-hazard properties. This will make the true risk more transparent and may prompt government action – for example, the UK Government may seek the re-introduction of subsidies. This is likely to be strongly resisted, not least in Scotland, which has been paying a disproportionate share of the subsidy for the last 50 years.
- For a substantial increase in premium, introduce a ‘total loss’ option in high flood hazard areas, whereby if the flood exceeds a set depth the insurer buys the property at market value and then demolishes it. In the long term this would operate to restore floodplains and remove people from risk; in the short term it would be expensive and would require government support.
- Litigate against planners, architects, and developers in Scotland to recover claims outlays and further reduce premiums in Scotland (not an option in the rest of the UK owing to different legal precedents).
- Decline to issue any property damage cover to homes or businesses in the highest hazard areas, thus prompting blight and encouraging people to move to safer zones.
- Exclude flood cover for commercial property risks and seek authority from the Financial Services Authority to exclude flood cover from personal property risks, thus creating blight and encouraging migration.
- Discontinue underwriting policies in the highest hazard areas on an indemnity basis. Instead offer a ‘first loss’ policy where the insurer would pay up to the sum insured or the extent of the loss, whichever is less. This would encourage the policy-holder to move property out of the way of the flood and to deploy demountable defences.
- Issue cover in high hazard zones on a benefit basis similar to personal accident insurance. Again the policy-holder would choose what level of cover was required in advance. If the policy-holder chose, say, a benefit of £10,000, in the event of a flood to a specified depth, proved by photographs or tide marks or an Environment Agency report,

the insurer would pay out a flat sum of £10,000 right away, which the policy-holder could spend in any way they wished. The sum might be more than the cost of the damage or it might be less. This would enable speedy claims settlement and encourage the policy-holder to move property away from the flood in time, or to deploy demountable defences.

- Arrange a gaming contract with a bookmaker if the probability of loss is too high for an insurance company. This would operate in the same way as a benefit policy.

Differences between England and Scotland

Table 4 is an attempt to show some of the ways in which, from an insurance point of view, it appears that Scotland may have a lower flood risk than England. It is not intended to be prescriptive – each country is working under very different circumstances, so different solutions are inevitable. However, it is hoped that this table might stimulate some debate.

Conclusions

Scotland seems to be better prepared for flooding in many ways. As yet, there is little sign of recognition of this from most English insurance companies, who do not differentiate. International re-insurers and Lloyds are rather less ‘Anglo-centric’ and may be more willing to recognise territorial differences. This will resolve itself as claims costs escalate. In the meantime, a select few of the cleverer insurers who do recognise the differences are taking advantage of their better knowledge to expand their business in Scotland.

England faces some difficult problems owing to high population densities, immigration, and a concentration of population in the low-lying flat areas of the South East. Land use planners in the South East are often faced with situations where demand for housing cannot be satisfied without resorting to flood hazard areas. Many English towns grew up because of proximity to rivers, and it is difficult to defend houses from flood using structural defences without damaging the aesthetic appearance of the town centre.

Nevertheless, the Government cannot ignore the suffering of people who cannot escape from the hazard zones owing to loss of equity from big increases in insurance costs, if cover is available at all. Sooner or later, drastic measures may be needed; especially after the UK insurance commitments end in 2013 – perhaps a government-funded insurance scheme for those on Housing Benefit, a campaign to make homes flood-proof, or even a ‘buy-out and relocation’ scheme for the highest risks, as in the USA and Canada. At the very least, some moves towards sustainable flood management, resilient building regulations, and

Table 4

Differences between England and Scotland regarding flood risk

Description	England	Scotland
A Exposure – planning and mapping		
1 Planning policy (see also Table 1)	11% of all new buildings have been allowed in the floodplain between 2000 and 2005. ¹⁵ PPS25 allows building in flood hazard areas if nowhere else is available	Negligible building in floodplain since 1995. SPP7 ¹⁶ forbids building residential property in areas where the flood risk exceeds the 200-year return period
2 Direct involvement of local communities and local knowledge	No system for planners to consult with insurers or other key stakeholders. ⁶ No system for consultations on a catchment-wide basis ⁶	Planners must set up Flood Liaison and Advice Groups (FLAGs) for dialogue with key stakeholders, including insurers and adjoining local authorities. ¹⁶ If developers are asked to commission hydrologist reports they are archived and made available to FLAG members. Almost all Scottish councils (covering 94% of the population) have established FLAGs with insurance representation
3 Can flood victims take action against planners under common law for allowing floodplain development?	No ¹⁷	Yes. ¹⁸ This gives an added incentive to refuse development in flood hazard areas and consult on flood defence proposals
4 Housing density and population density (high density means more pressure to build in floodplains)	Average 40 dwellings per hectare for new developments. Thames Gateway floodplain will have up to 200 dwellings per hectare. Average population density: 383 per square kilometre	30 dwellings per hectare are considered high density. Average population density: 64 per square kilometre
5 Published flood maps	River, estuary and coastal flood, modelled and historic, excluding combined effects	As for England but including combined effects. Drift geology maps show glacier paths and can act as a proxy for very extreme events. Draft maps published in June 2011, which include surface water flood and vulnerability data
6 Maps of areas at risk from reservoir failure (insurers can use these maps to assess flood risks, which may affect premiums)	Secret even from the police on the grounds of national security until 2011 (the police in England were apparently regarded as a security risk). Publication now under way, but no area as yet has proper dam-break contingency plans	Freely available to emergency planners, police and rescue services since January 2008, so that contingency plans can be drawn up. Full publication to start in 2011 ¹¹
B Vulnerability – social justice, financial inclusion, and human welfare issues		
7 Published full record of injury and property damage caused by all flood events and action taken	No formal systems	All non-agricultural flood events, no matter how small, must be recorded by local authorities and details published every two years, along with action taken or proposed to prevent a recurrence – valuable information source for insurers
8 Social housing and ‘pay with rent’ type contents insurance schemes. The social impacts of flooding are severe, especially without insurance	No action to encourage insurance schemes. Sample surveys show a range of 34%-44% average take-up of insurance for social tenants. ¹⁹ Now unlikely to increase as insurers are reluctant to accept new business in flood hazard areas	The Scottish Housing Survey of 2007 shows that, overall, 64% of people in the most deprived 15% of areas of Scotland had home contents insurance, compared with an average of 89% for the rest of Scotland

Description	England	Scotland
9 Deprivation index	The Index of Multiple Deprivation produced by the Office for National Statistics is at electoral ward level and ranks electoral wards based on an assessment of a mix of economic indicators. Boundaries are incompatible with the post code system	The Scottish Index of Multiple Deprivation is calculated at a much higher resolution than England. Scottish 'data zones' average only 200 houses and are similar in size to Census Enumeration Districts. Boundaries coincide with the post code system and so can be used with data from credit referencing agencies
10 Target lists for evacuation of vulnerable people	No action known	Many emergency planning officers have established lists of people requiring special assistance for evacuation
11 Flood rescue	No legal obligation to rescue flood victims. The Chief Fire Officers Association in England and Wales says: <i>'The UK [meaning England and Wales] simply does not currently have the capability to respond to a major flood event.'</i> Many areas do not have trained personnel or appropriate equipment for flood rescues	Statutory duty for fire and rescue services to provide flood rescue cover. Senior officers regularly attend FLAGS and discuss issues with insurers and other stakeholders. There are also 14 well trained and fully equipped specialist rescue teams across Scotland, with rescue boats, pumps, buoyancy aids, survival suits, etc.
12 Population issues and social cohesion. Language or cultural differences can leave immigrants and minorities especially vulnerable to flood	England's population expected to increase from 51.5 million in 2008 to 60.7 million by 2033 according to Office for National Statistics figures published in March 2010. ⁵ A significant proportion of this increase will be driven by immigration	In Scotland, where the birth rate has reached a 13-year high, the population is still expected to increase only from 5.1 million to 5.4 million by 2031
13 Advice and support for flood victims' families and flood survivors	'National' Flood Forum only applies to England and Wales and receives no government funding	Scottish Flood Forum, funded by the Scottish Government
C Hazard – sustainable flood management		
14 Sustainable flood management (SFM)	No legal requirement. Single demonstration project in Ripon discontinued in 2007 due to lack of funding. New scheme started in Pickering in 2010. Some local floodplain restoration now taking place, but not co-ordinated	Required under primary legislation. Major natural flood management demonstration projects have been running for some years. EU-funded research has held Scotland up as an exemplar in making cities more resilient using SFM. ²⁰ Scottish Rural Development Grants available to landowners to store water in in times of flooding to reduce flooding downstream
15 Water Framework Directive ²¹	Adaptation of rivers and lakes to cope with increased rainfall from climate change and thus reduce flooding risks is forbidden ²²	Transposed subject to sustainable flood management requirements. ²³ This means that rivers and lochs can be adapted to cope with increased rainfall (Scotland is the only country in the EU to do this)
16 Cleaning watercourses of weeds and rubbish (EU Waste Directive means cut backs in refuse collection)	No statutory duty and no funding for cleaning watercourses. Habitats Directive and Birds Directive often used as reasons for inaction. Fly-tipping into watercourses now widespread	Statutory duty on local authorities to regularly clean watercourses with central grant funding. Falkirk Council now cleans some watercourses on a weekly basis owing to fly-tipping
17 Land drainage – such schemes often increase the flood risk downstream	5 million hectares drained by 1900. Since accelerated by the wars and farming subsidies. Land drainage still takes place	Figures not available, but Scottish topography is generally less suitable for major land drainage. Land drainage schemes terminated in Scotland in 1997

Description	England	Scotland
18 Sewage and surface water drainage (EU Waste Directive means more waste such as cooking oil, nappies, 'wet wipes', etc. flushed into sewers, leading to blockages. Roads drain into 'gully pots' which can be blocked by leaves, grass cuttings, and winter road gritting)	The householder has a right to be connected to public sewers under Section 106 of the Water Industry Act 1991, even if the sewer has insufficient capacity. At present some 20,000 households are at risk of sewer flooding once in a ten-year period. Howarth points to a 'concerning decline' in performance level in respect of pollution incidents involving water companies in England and Wales. ²⁴ When Hull was flooded in 2007, it was found that street gully pots were under-sized and had been partly tarred over by old road surfacing work, showing they had not been opened for cleaning for a long time	New developments not allowed if the sewage or water supply systems do not have surplus capacity. Scottish Water will not sanction any new developments where surface water drains into watercourses unless the relevant local authority accepts responsibility for the additional discharge, and presumably any flooding and legal liability which might result. Hence the almost universal use of sustainable drainage systems to reduce the risk of storm water overloading sewers or rivers. Street gully pots opened and cleaned annually
19 Sustainable drainage systems (SUDS)	Not always used owing to uncertainty over ownership or responsibility issues. Anecdotal evidence of inappropriate systems which can increase flood risk. The Environment Agency regards SUDS as having a number of applications, including flood management	Considered for every new development. FLAGs have been invaluable in spreading best practice – one has produced award-winning national guidance in consultation with insurers on drainage impact assessments. ²⁵ SEPA regards SUDs primarily as a means of controlling diffuse pollution, rather than an element of flood management because SUDS is of limited value against floods
20 Sustainable drainage systems (maintenance)	No maintenance standards or agreement on who will maintain	Statutory provision for Scottish Water to set standards for SUDS and to adopt and maintain schemes
21 Flooding from agricultural land	No action taken to prevent	Local authorities have the power to require farmers to prevent mud escaping from fields onto roads – by contour ploughing on slopes (where safe), not ploughing to the edge of low-lying fields, and by planting hedges and building embankments
22 Water undertakers	Fully privatised. Emphasis on capital developments to add value for shareholders rather than on maintenance work to reduce leaks and sewage spillages	Publicly owned Scottish Water has additional responsibilities such as the maintenance of SUDS and provision of temporary demountable flood defences pending upgrades on sewage works. Since devolution, leakage has been reduced by more than one-third
23 One key way to reduce flood hazard naturally is to plant woodland upstream of populated areas in the catchment	Percentage of the population with access to over 2 hectares of woodland within 500 metres of their home: England 15%; Wales 18%; Northern Ireland 7% ²⁶	Percentage of the population with access to over 2 hectares of woodland within 500 metres of their home: 28% ²⁶

D Hazard – flood defences

24 Detailed information on flood defences	Not readily available	Scottish Flood Defence Asset Database shows type, standard of protection, and area protected. Available online to members of FLAGs and hydrologists ²⁷
25 Minimum standard of service for new flood defences	No minimum standard outside the centre of London	100-year return period plus climate change allowance. ²⁸ Effect of the latter is the equivalent of designing for the 200-year return period or better ²⁷

Description	England	Scotland
26 Cost-benefit assessment for grant aid for flood defences	Spending on flood defences is rationed by a 'priority scoring' method, meaning that benefits have to be at least six times the costs. There can be delays of many years before a scheme is built. Often, schemes only protect against small-scale floods. In practice benefits have had to be seven times costs for recent projects. Proposals for a new system were set out for consultation in November 2010. ²⁹ Treasury rules require the economic appraisal to consider only economic losses and not financial losses, thus rationing grants for flood defences. Financial (or 'real') losses are around 2.5 times higher than economic losses. For example, economic losses assume that a ten-year-old carpet will be replaced by another ten-year-old carpet	Benefits must exceed costs. In England benefits are based on estimated losses to the local economy. In Scotland, calculations can be based on actual financial loss data. Tables of average costs for different flood depths and types of property are calculated from many thousands of British flood claims from 25 leading insurers since 1993. The British Flood Insurance Claims Database (see Table 3) is the biggest database in the world on flood damage costs and results in benefits some 2.5 times higher than the English method ³⁰
27 Authority to build flood defences	Around 600 separate bodies, under the general supervision of the Environment Agency. Planners and elected councillors have no disincentive to allow developments in hazard zones, as they do not need to fund flood defences	Only the local authority and relevant riparian owners. Discourages planners from floodplain development because they know their council will have the problems and costs of defending it and will be democratically accountable
28 Completing of flood defences	No target for completion. New buildings are being constructed in hazardous areas faster than defences can be built	Targets announced for the completion of flood defences for the 100-year return period event by 2008 for both river and coastal floods. ³¹ Climate change is taken into account
29 Condition of flood defences	According to the National Audit Office, only 61% of flood defence structures in England and Wales are in 'good' condition or better, and an extra £150 million needs to be spent each year just on maintenance ³²	An independent survey in 2007 of flood prevention schemes shows the schemes provide over 90 kilometres of assets, including 35 kilometres of embankments, 21 kilometres of walls, 16 kilometres of culverts and 18 kilometres of channel improvements. Of those surveyed, 87% are in 'good' and 'very good' condition, and a number of the rest can readily be improved through maintenance improvements ²⁷
30 Annual average flood defence spend per household at risk	£219. Spending per capita in England is higher than in Scotland, but there are 5.2 million properties at risk in England compared with Scotland's 99,000	£454

E Hazard – flooding caused by storm conditions

31 Sea levels are rising, thus increasing the risk of flooding from storm surge	More low-lying coastal areas. Land south of a line from Dundee to Abersoch is sinking in response to tectonic uplift north of that line. For example, Lowestoft mean sea level rise is 2.57 millimetres/year	Glacio-isostatic uplift is occurring as the land recovers from glacier weight. The rate is declining, but has partially compensated for sea level rise. For example, Aberdeen mean sea level rise is 0.87 millimetres/year
32 Percentage of coastline subject to erosion, making it vulnerable to flooding	30%	7%
33 The PRUDENCE climate change model suggests that storm tracks could move south of 55° latitude	Carlisle is approximately 55° latitude	Scotland suffered from a storm in 1993 which broke the European record for low atmospheric pressure at 912 millibars (followed by the 1993 Tay floods). Since then, major storms in 1999, 2005 and 2007 have mainly affected England and Wales

Description	England	Scotland
F Regulations		
34 Building Regulations	The Building Regulations for England and Wales currently set some provisions for flood mitigation in Approved Documents C, H and J. Approved Document C provides practical guidance on site preparation and resisting contaminants and moisture, but does not provide information on preventing or reducing the impacts of flooding; H provides practical information on drainage and waste disposal and deals with mitigation of flood risk associated with the surcharge of drains and sewers; J identifies the need for secondary containment where there is a significant risk of oil pollution, but does not contain recommendations for ensuring storage above the predicted flood level	Building Standards deal with mitigating damage to buildings and removing threats to the health and safety of occupants as a result of flooding. Guidance is given on the use of building materials not adversely affected by flood water. The Scottish Building Research establishment is expert in testing new materials for flood resilience and techniques in resilient repairs. Scottish primary legislation on Building Standards already includes provisions which would allow for resilient standards to be made retrospective after flood or storm damage, as already happens with fire precautions. A compulsory resilient reinstatement would be an excellent first move to adapting existing building stock to be less vulnerable to future flooding
35 Reservoir safety enforcement	Environment Agency – owns 169 reservoirs itself (a possible conflict of interest?) ¹¹	SEPA – does not own reservoirs itself. The Scottish Parliament recommended compulsory public liability insurance for reservoir owners, but certain London insurers objected owing to their ignorance of Scottish legal principles and their lack of experience in underwriting such risks. Such a move could have dramatically improved Scottish safety standards, at no cost to the taxpayer. Similar moves would be difficult to implement in England because of different legal precedents
36 Reservoir safety inspection threshold	Compulsory for reservoirs greater than 25,000 cubic metres in volume	Compulsory for reservoirs greater than 10,000 cubic metres in volume. Reservoirs (Scotland) Act 2011
37 Communications in an emergency	No special treatment	Planning policy specifies that mobile phone base stations and electricity substations be located in such a way that they cannot be disabled by flood events ¹⁶
38 Waterborne pathogens. Between 1993 and 2003, there were over 4,000 cases of waterborne disease in Britain, half of which were from cryptosporidium	No controls known	Statutory controls and monitoring. Cryptosporidium and E. coli were found in only 14 of Scotland's 32 council areas in 2004
39 Following the SEA Directive ³³ the person commissioning a plan or programme which is likely to have environmental impacts must produce an EA	No requirement in England and Wales to produce a strategic flood risk assessment. Although proposed in December 2005 in draft planning guidelines for PPS25, this did not appear in the final version	In Scotland, insurers can claim damages from a local authority if they fail in their obligation to undertake a strategic flood risk assessment
40 Legislation to transpose the Floods Directive ¹⁰	New powers and duties for local authorities and the Environment Agency in response to the Pitt Review and the Floods Directive, but reduced funding will limit their effectiveness	Emphasis on co-ordination, co-operation and the involvement of stakeholders and public

training of architects in adapting housing design for flood and storm risks would be sensible.

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Notes

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- 18 *Hedley Byrne v Heller* 1963 [1964] AC 465, [1963] 2 All ER 575, [1963] 3 WLR 101. Although this was an English case, the Law Reform (Miscellaneous Provisions) (Scotland) Act 1985 Section 101(1) adopted the decision into statute in Scotland and declared that damages are recoverable in respect of negligent misrepresentation. This means that the Hedley Byrne position still stands in Scotland, despite subsequent English case law which has reversed it for planning authorities
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- 22 The Directive has been transposed into English law by three Statutory Instruments, the main one being SI 2003 no. 3242 – *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003*, which came into effect on 2 Jan. 2004. A further two SIs deal with cross-border river basin districts. As far as 'flood' is concerned, it is only mentioned once in each of these sets of Regulations, which simply impose a duty to 'consult' those who, in the opinion of the relevant agency, 'have an interest in the promotion of flood management'. So far, no insurers have been consulted as far as the author is aware
- 23 The Scottish Parliament considered the Directive so important that instead of Statutory Instruments, primary legislation to transpose the Directive was enacted in the form of the Water Environment and Water Services (Scotland) Act 2003. In respect of flood risk management, the Act (Subsections (3) and (4)) requires 'Scottish Ministers, SEPA and the responsible authorities to work in an integrated fashion and co-operate with each other to promote sustainable flood management'. Subsequently the insurance industry has been frequently consulted through FLAGS
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