FLOOD RISK AND SPATIAL PLANNING REGULATIONS – LESSONS FROM THE UK

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ABSTRACT

Every year we hear news reports in New Zealand of significant flooding event in England causing widespread damage and putting people's lives at risk. A society built around the use of rivers and coastal resources, for a long time England developed with limited understanding or consideration of the risk of flooding. High profile, widespread flooding across England in the early 90's, again in 2000, and then again in 2007 each time led to changes in planning policies and guidance related to flooding. In each instance lessons were learnt regarding the role of spatial planning in flood risk management.

This paper outlines some of the lessons learnt regarding managing flooding in England, such as understanding the full costs of land use planning decisions, planning tools used in England, and the importance of defining terms such as 'safe' with respective to flooding. Although there are some marked differences in both catchments and development pressures between New Zealand and England, this paper also considers how this knowledge and some of the lessons could be applied in the local context.

KEYWORDS

Flood Risk, Land Use Planning, Lessons, England

PRESENTER PROFILE

James is an experienced engineer and project manager having worked for over 13 years on a variety of flood risk management projects in both New Zealand and the United Kingdom, from strategic planning and policy making to detailed design and construction supervision. James has provided flood risk planning advice to developers and local authorities across the UK and has worked on a number of high profile projects including the London 2012 Olympics, Drain London Surface Water Management Plans and the Southampton Flood Risk Management Strategy.

1 INTRODUCTION

Like New Zealand, many English towns and cities have developed around rivers and the coast, usually through the need for water for consumption, agriculture, or transport. Towns were often built as 'bridging points' over rivers, expanding into nearby floodplains. In many cases English town and city drainage has remained largely unchanged since early settlements (White and Howe, 2002).

Due to these location factors, flooding was not a new phenomenon to early Britons. Flooding on the River Thames was recorded as early as 1099 (Environment Agency, 2014). An awareness of the impact of flooding and the need to manage it is recorded in 1531, when an act of parliament affirmed the powers of the Sewer Commissioners, in the context of increasing incidences of flooding (Wynn, 2005).

Over the following centuries, and particularly following the Industrial Revolution, the urbanisation of Britain resulted in expansion of towns and cities and increased development density, with limited foresight into the impact of flooding. The traditional approach was 'protective'. Johnson & Priest (2008) noted that 'In the decades following the Second World War through to the late 1970s, flood management focused on land drainage and flood defence dominated by the structural 'hard engineering' solutions with little regard for environmental impact' as people sought to control flooding and keep the water out.

Protection was particularly focussed on preserving rich agricultural soils on floodplains to improve productivity, with the Government under pressure to protect farm profitability (Johnson & Priest, 2008). The 1953 storm surge along the east coast of Britain, was a trigger for significant expenditure on coastal flood defences, then through the 1980s and into the 1990s flood defence increasingly moved from protecting agricultural land to protecting urban environments (Johnson & Priest, 2008).

The percentage of new houses being built in 'high flood risk' areas has steadily risen from 7-8% in the late 1980s to 9-11% in 2008-2010 (Porter and Demeritt, 2012). Restrictions on available, unencumbered land, mean the number of people at risk of flooding is likely to continue to rise. Today there are approximately 5 million homes (1 in 6 of all homes) at risk from flooding in England (Environment Agency, 2013).

2 THE PLANNING CONTEXT

Historically flooding has been perceived as being something that happened relatively rarely (White & Howe, 2002), however a series of flooding events since the late 1990s has put the spotlight on land use planning, development control and, more generally, how England manages its increasing risk of flooding.

Since 1947 the British Government, supported by river authorities (now in the form of the national Environment Agency), has sought to discourage development in flood risk areas through regular introduction of new, revised, or refined planning guidance; however, it has left local authorities to ultimately make decisions on local land use planning (Howarth, 2002 in Wynn, 2005).

Some felt that the Town and Country Planning Act of 1947 would put a halt to the unrestricted development on floodplains by controlling urban sprawl (Penning-Roswell, 2001). It wasn't until the late 1990s that evidence began to build that this was not the case (Parker, 1995).

Photograph 1: Flooded High Street, Bristol, 1968 (courtesy of Peter Townsend)

From the 1950's to the 1990's England's local authorities have believed intensive development in flood risk areas was undesirable, however they have generally not precluded it. Some adopted a policy of low density development in floodplains (Parker, 1995). Development control and flood warning were

not important flood risk policy matters and insurance was not considered important in regulating development (Johnson & Priest, 2008).

Although local authorities had often identified flooding as an environmental consideration within Local Plans, practical policies to *'restrain floodplain development had been missing'* (Parker, 1995). The major floods in 1998 and 2000 saw a recognition of the need to tighten expectations regarding development in floodplains. Flood risk planning policy has evolved rapidly since (White & Richards, 2007). Lessons have been learnt throughout this period of accelerated policy change, with the spotlight placed again during the 'Summer 2007 floods', and we can expect the same again in the face of Christmas flooding, and January 2014 being the wettest start to the year in southeast England since 1910 (Met Office, 2014).

This paper seeks to set out some of the lessons learnt through England's accelerated flood risk policy changes and examines their potential application to land use planning in New Zealand.

3 THE HIDDEN COSTS OF DEVELOPING IN FLOOD RISK AREAS

The first, and probably most obvious, lesson to come out of flood risk planning is regarding *not locating development in flood risk areas in the first place*. English experience has shown that this is easier said than done, and often impractical.

Often wider planning or other environmental constraints divert development towards floodplains (Parker, 1995). There is pressure in many local authorities to release land for development to deliver other Government targets (such as housing, regeneration), or enable wider land use benefits. Consideration of flooding has often received a lower relative weighting (White & Howe, 2002). For example, where floodplains are also greenbelt land, development has not occurred, demonstrating the relative weighting given to greenbelt (Parker, 1995). Often the consideration of flood risk in planning is only given due weight on the local (or political) agenda after flooding has occurred, and generally only for a relatively short period of time (Richards et al., 2008*)*. These competing priorities, which apply to land use planners in New Zealand to a greater or lesser degree, have limited the English planning system from realising its full potential in protecting communities from flooding, *'whilst simultaneously allocating it the blame'*, often driven by the press. In the aftermath of each flood event, the UK Government and local authorities have been on the receiving end of severe criticism for allowing inappropriate development in flood risk areas (White & Richards, 2007; White & Howe, 2002).

In many cases it is unrealistic to think all development on floodplains can be excluded. A UK House of Commons Select Committee referenced an Ernst and Young report noting that local authorities generally stood to gain more from permitting floodplain development than prohibiting it (Wynn, 2005). However, what has not been given full weight in the past in England is the 'whole of life' cost of allowing development in flood risk areas.

England has suffered from a well-documented 'Escalator Effect' of development in flood risk areas, under the Government's overall 'protective' approach to managing flood risk.

Constructing infrastructure to protect existing people and properties often only encourages more development (described in Figure 1 and Figure 2).

Development in flood risk areas creates a demand for flood risk infrastructure, whether it be flood defences, coastal walls or below ground infrastructure. This then increases the attractiveness and safety of these flood risk areas, encouraging further development (White & Howe, 2002).

The cost of providing flood infrastructure is not just the cost of its construction, and the cost of maintaining it, but also the cost of upgrades to manage:

1. Increased consequences of flooding (i.e. more people in the flood risk area),
2. Increased probability of flooding (e.g. the effects of climate change), and
3. Increased public expectation for protection.

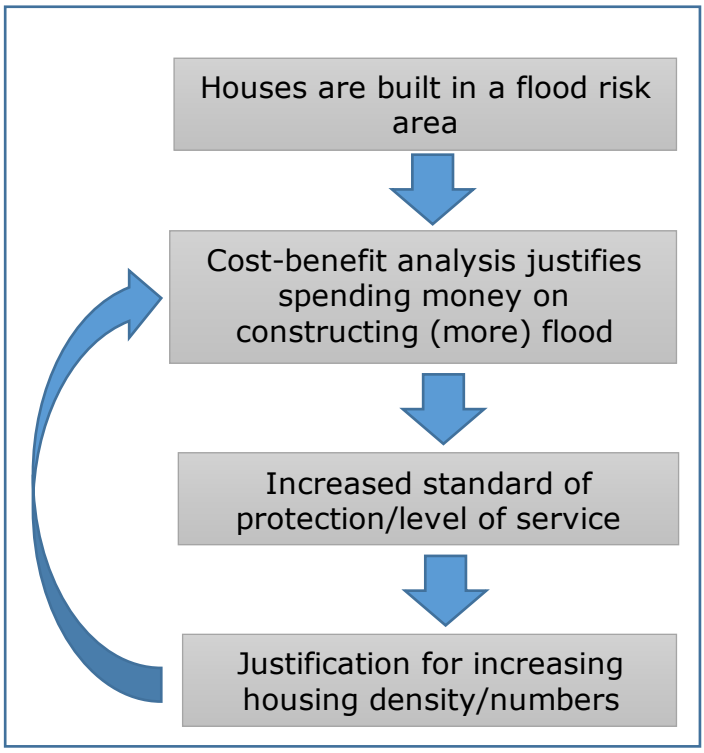

Figure 1: Flood protection justifying development

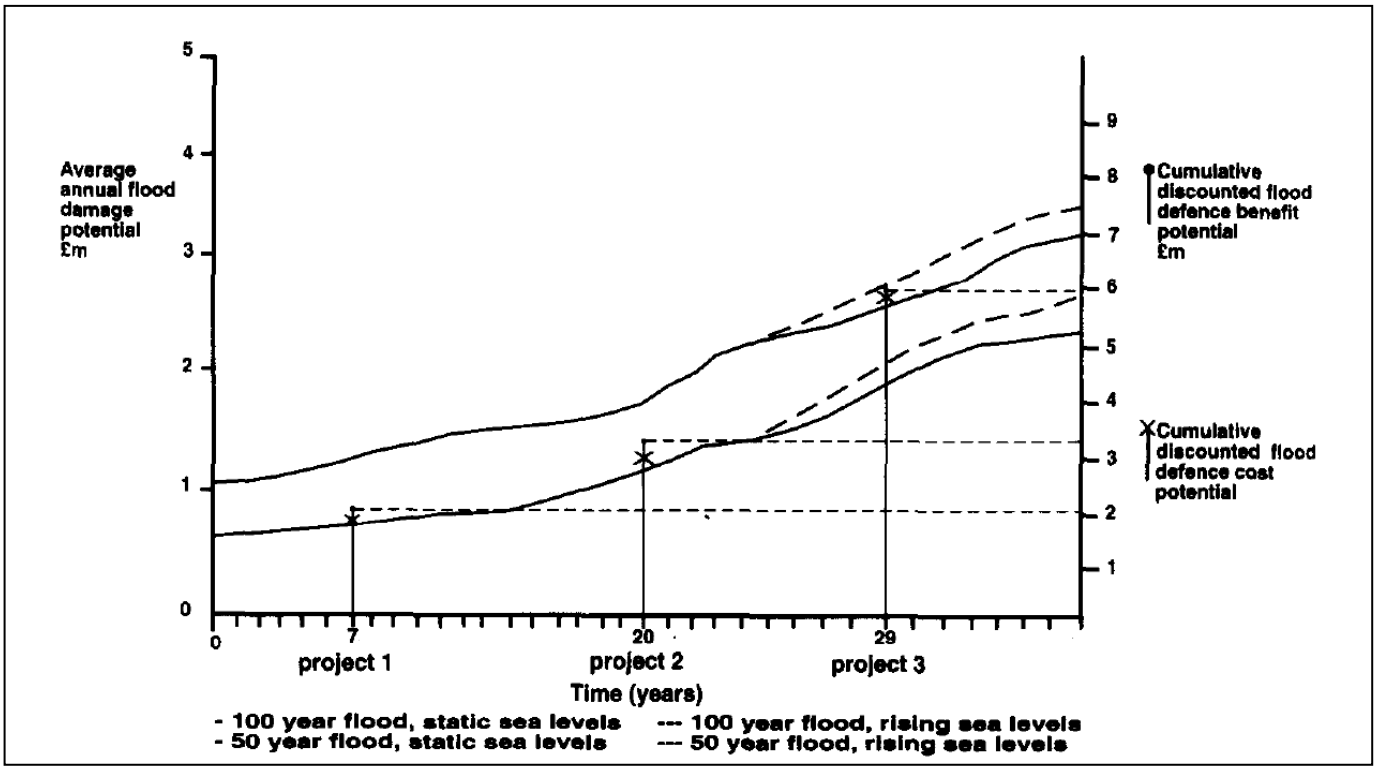

Figure 2: Flood Protection 'Escalator Effect' (source: Parker, 1995)

This Escalator Effect has contributed to spiralling flood defence costs in England. The Environment Agency currently spends £570 million per year (2010-2011) on building and maintaining flood defence infrastructure. The required funding is expected to rise to over £1 billion annually (plus inflation) by 2035 (Environment Agency, 2009). This excludes the risk of managing stormwater or groundwater flooding. At the same time Central Government funding is being reduced (Bennett, 2014).

Taken to the extreme, a local authority that allows one house to be constructed in a currently undeveloped, unprotected floodplain has the potential to set in motion a similar 'escalator effect' where the costs of avoiding flood damages 'escalates' over time, far beyond what was originally envisaged. Particularly when planning appeals in England have regularly approved development on the basis of "you let my neighbour do it" (Parker, 1995).

An indirect cost not often considered is the cost of insuring properties that may be protected now, but may not be in the future (e.g. through improving flood risk information, or increased risk). The UK Government has recently reached a new agreement with the insurance industry to ensure high risk homes (not businesses) can still receive insurance. Although this is not a direct cost for the local authority, it is a cost to all households through additional premiums to cover the highest risk households, and an additional cost to taxpayers where the Government needs to support the fund in extreme flood events. Homes built after 2009 are not supported by the fund, so any built in high risk areas are unlikely to be insurable.

Currently flood insurance is available to New Zealand households regardless of location through the Earthquake Commission (EQC) with private insurance 'top up'. It is reasonable to expect changes to insurance for households in the future, and the insurance industry has warned of this risk following the release of the report on the risk of sea level rise to Christchurch (Conway, 2014). EQC premiums may rise; areas may become subject to 'blight' if unable to be insured; or the local Council may come under pressure to protect the 'at risk' properties (the 'Escalator Effect' of investment). None of these are good options and all can be mitigated to a greater or lesser degree through appropriate land use planning.

Another indirect cost is the potential burden on emergency services during a flood event by locating additional development in flood risk areas. Even where development is raised above flood levels, people may not be able to safely exit their home due to the surrounding floodwaters. Although appropriately skilled for such action, the general infrequency of their use means they are usually under-resourced for large-scale flooding.

Avoiding development in undeveloped floodplains is critical. Once development occurs, it is likely to continue. Although many of New Zealand's towns and cities have less development pressure at present than their English counterparts, it remains important that Land Use Planners are mindful of the recent lessons from England in development of flood risk areas and are fully aware of the costs before zoning land – particularly where there is a drive for intensification of development. When weighed against the benefits a development may bring to a community, planners might have arrived at a different decision if all costs had been considered, or at least been able to better prepare now for the future costs.

4 TOOLS AND TECHNIQUES FOR LAND USE PLANNERS

The accelerated change in English flood risk policy over the last decade has introduced numerous national strategies, reviews, policy statements and guidance documents that English planners are expected to take into consideration in local plans and development control decisions. Amongst the overload of information, a few key aspects are highlighted below that appear to be having the biggest influence in the consideration of flood risk in English land use planning, and which have applicability for the robust consideration of flooding in our District and Regional Plans:

1. The precautionary approach
2. Strategic flood risk assessment
3. The Sequential Test
4. Defining safety in a flood

4.1 PRECAUTIONARY APPROACH

The precautionary approach applied in flood risk policy is based on the precautionary principle set out in the Rio Declaration in 1992:

*"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." (*DTLGR, 2001)

The New Zealand Government has already recognised the importance of the precautionary approach with respect to flood risk (MfE, 2010) and importantly it notes *'there is a social responsibility to minimise the exposure of your community to harm as much as possible…'*, placing a burden on the shoulders of land use planners to adopt a precautionary approach to flood risk.

The UK approach suggests four ways the precautionary approach can be applied to flood risk:

1. Lack of available information on flood risk – Improvements in flood mapping covering all sources of flood risk in England demonstrates the lack of information planners historically had to make land use decisions. The significant advancements in hydraulic modelling technology mean broad scale hydraulic modelling can often be produced relatively cheaply over a large spatial scale so planners can apply the precautionary approach in the absence of detailed data. This approach was applied in production of nation-wide, broad scale 'Flood Zones' in England and Wales. Some have argued there is a case for flood risk mapping, at least for land use planning purposes, to only be defined indicatively, to avoid over-confidence in their accuracy (Wynn, 2005). Expensive flood modelling or lack of data can no longer be used as an excuse for not considering flood risk.

2. Climate Change - Research in the UK suggests that a flood defence against a 1 in 100 year flood in the 1990s may only protect against a 1 in 60 year return period event by 2050 (Price & McInally, 2001). Many New Zealand councils are integrating currently predicted climate change increases in sea level and rainfall intensity into flood mapping, where information is available. It is worth noting that predictions on the effects of climate change are regularly being refined by the International Panel on Climate Change (IPCC) as understanding improves - a recognition of the current uncertainty. It would be naïve to expect predicted

effects will not change again. Councils can consider different climate change scenarios as part of a precautionary approach.

3. Uncertainty - there is inherent uncertainty in flood estimation, regardless of whether flood mapping is broad scale or highly detailed. What becomes critical is the scale of the mapping (e.g. not providing small scale mapping for broad scale modelling approaches), and understanding the sensitivity of the modelling and mapping. There is tendency to take the 'line on a map' approach to flood extents – where one side of the line is at risk and the other isn't. In reality there is usually a 'grey area'. The precautionary approach could be applied with consideration of this sensitivity 'grey area'.

4. Precautionary approach in design – The NZ Building Code apply a precautionary approach through requiring a 'freeboard' for floor levels above flood levels (for a 1 in 50 year storm event). However development outside of existing flood maps or overland flowpaths, may currently not trigger this requirement. When flood extents change (e.g. as a result of climate change or improved information), the houses may now be below the new flood level. A precautionary approach in design may account for uncertainty in the specific flood data available, but may not be sufficiently precautionary for more fundamental uncertainty regarding the quality or extent of information available, or the impacts of climate change. As an example, prior to the Summer Floods of 2007, there was sporadic information available on the risk of surface water flooding, compared to good quality and coverage of risk from rivers and the seas). The introduction of national surface water risk maps in the UK increases the quoted number of residential properties at risk from flooding from 1.7 million to approximately 5 million.

4.2 STRATEGIC FLOOD RISK ASSESSMENTS

The historically piecemeal approach to development in flood risk areas is a significant factor in England's flood defence construction 'Escalator Effect'. However, even with appropriate development control policies for flood risk areas, there have been significant challenges in restricting development. Up until the late 1990s the focus in England was trying to apply the UK Government's national flooding guidance at a development control level (Parker, 1995). Notably, the cumulative effect of development on flooding, whether in or outside of the flood risk areas, has been difficult to implement due to the single site emphasis (White & Howe, 2002).

A single house raised above flood levels will usually have negligible impact on overall flood levels in a floodplain, however when applied to all development across a wide area and over multiple plan periods, the effects can cumulatively be significant.

Similarly, converting a small area of front garden to impermeable cover (e.g. a driveway), may have negligible impact on overall runoff generated, however when applied across a catchment can have a significant cumulative effect on runoff generated. Unfortunately where a planning permission was refused on grounds such as these (e.g. cumulative flood risk effects), the appeal process has generally favoured the developer (White & Howe, 2002).

In the New Zealand context, these effects are likely to be considered 'less than minor' at the single site level, or if development occurs in a catchments not currently intensively developed, however cumulatively the effect is retained in the system for perpetuity - it is

rare for a surface currently impermeable to be converted back to permeable. The true effects are measured in the following generations.

Cumulative flood risk effects are very difficult for development control personnel to consider on an individual site basis, particularly if catchment modelling is not available and with a focus on planning application process speeds. Cumulative effects can only practically be considered at the strategic scale (e.g. catchment scale, across a whole Plan Area, or for large developments).

Additionally, some English local authorities became severely limited in their ability to grant planning permission where large parts of their developable land was located within flood risk areas. Individual sites would be brought forward, and potentially refused on flood risk grounds.

In England, like in New Zealand, the Local Plan (NZ: Regional or District Plans) is the primary reference in determining planning applications (consents in New Zealand) (White & Richards, 2007). If flood risk has not been given appropriate consideration at the strategic level in Local Plans, it is unlikely to be (able to be) given due consideration at the single site level (Richards et al., 2008).

Enabling this requires a strategic assessment of flood risk to be carried out as part of the evidence base informing the Local Plan. Strategic Flood Risk Assessments (SFRAs) began to be produced in the mid 2000s in England as a tool to be used at the beginning of the Local Plan process.

There are some similarities with Catchment Management Plans (CMPs) in the New Zealand context, however a number of critical differences (Table 1) – most notably the scale of assessment, where a 'local authority boundary' assessment of risk is more useful to land use planning than a 'catchment boundary'. This enables sites to be weighed against each other in terms of flood risk, and wider planning considerations. This has begun to facilitate more locally specific flood risk policies in Local Plans, rather than regurgitating national policy, and incorporate 'closer linkages' between water and development over a larger spatial scale (White & Howe, 2002).

Over the following decade best practice has emerged with SFRAs fulfilling a broader function in not just providing information for decision makers to assess one site against another, but also assessing flood risk to key development sites in more detail across a planning authority. This enables the local authority to more clearly understand the likely mitigation requirements, strategic solutions/policies for flood risk, and importantly the 'flood risk costs' if they decide to proceed with allocating vulnerable land uses in flood risk areas. However, it could still be argued that in many cases the full, long term, costs, as described early in this paper, are only really just starting to be realised. Assessing key development sites also facilities the development of policy guidance that is prescriptive, whilst seen to be deliverable in combination with other policy drivers as it has been demonstrated to work on a site-specific basis.

As a result local policies in England are becoming more detailed and wider in scope as the implications of development and flood risk is understood (White & Richards, 2007).

Table 1: Strategic Flood Risk Assessment (UK) and Catchment Management Plans (NZ) – Similarities and Differences

Content	SFRA	CMP
Main End User	Land Use Planners, Development Control, Developers, the Public	Engineers and planners
Scale?	Local authority boundary – enabling decisions across multiple catchments	Individual catchment decisions
Considers Flooding?	Yes – all forms sea, rivers, stormwater, groundwater, and their interconnection.	Yes – usually focussed on streams and rivers
Flood Mapping?	Yes – all forms. This is important to distinguish (where possible) as different bodies are responsible for different forms of flooding and pre-Summer 2007 there was no national or local body in England responsible for planning for surface water.	Depends on date produced. From mid 2000s more likely to include reasonable mapping of river/stream floodplains.
Assessment of Risk?	Yes – all forms	Yes – but not usually from the sea.
Options for managing flooding	Depending on extent of risk. Often considers 'strategic' solutions across multiple catchments (such as coastal solutions or the location of development)	Usually – focussed on catchment specific solutions.
Water Quality, Erosion and Ecology	No – focus solely on flooding	Yes – considers wider implications of water
Policy Guidance?	Yes – provides strategic planning as well as development control policy recommendations in the context of local authority scale flooding issues.	Indirectly – implementation is left to Capex programmes and statutory documents.

4.3 SEQUENTIAL TEST

England's Local authorities are required by national planning policy to apply a *sequential risk-based approach* to determining the suitability of land for development in flood risk areas (DCLG, 2006). The aim is to steer new development to lowest probability flood risk areas – on the basis that the most appropriate way to manage a risk is to avoid it.

Where there are no *reasonably available sites* in areas at low probability of flooding, land use decision-makers should consider reasonably available sites in higher flood probability areas, whilst taking into account the vulnerability of proposed land uses.

The key term applied here is "reasonably available". Not all land in low probability flooding areas may currently be available for development. Land use planners might then need to consider higher flood probability areas, or alternatively alter the land use classification of the low probability land to enable development.

Undertaking this process, using information contained in a SFRA, provides a robust evidence base that enables land use planners to ensure development is sustainable and safe and, where development is exceptionally required in flood risk areas, the 'whole of life' costs are understood and balanced against other development drivers.

4.4 WHAT IS SAFE?

England's national flood risk planning policy also states that development in flood risk areas 'must be safe, for the lifetime of development' (DCLG, 2006). Similar wording is represented in some local policies in New Zealand.

Flood hazards are often mapped showing areas of 'low', 'medium', and 'high' hazard, however this is usually based on depth and velocity and does not define which category is 'safe'. Many planning appeals in England have been argued through a lack of definition on what 'safe' means, despite policy guidance becoming more prescriptive and detailed.

Photograph 2: Emergency Services rescuing the vulnerable with no safe access in Tillicoultry (Source: John Chroston)

This contributed to the emergence of a national 'Practice Guide' in which the Department of Communities and Local Government (DCLG) clarified the definition of 'what is safe'. Safe development is not just considered to be keeping floor levels above flood levels, but also includes:

- Safety of people in and around the development
- The structural safety of the building
- Impact on services provided to the development

And importantly, safety considers safe access and egress:

"Access considerations should include the voluntary and free movement of people during a design flood, as well as the potential for evacuation before a more extreme flood" (DCLG, 2009).

In the English context, raising floor levels above flood levels in isolation is not sufficient if people cannot safely exit from their home during a flood. 'Waiting out' a flood may not be acceptable if the flood is long duration, or an emergency occurs that requires the person to leave the property. In England it is generally not considered appropriate for

new development to be reliant on the emergency services for escape. Emergency services are often already overloaded dealing with trapped people in existing developments. In New Zealand it is less common for safe access to be considered in District Plans, however there is a strong case for its inclusion in avoiding additional pressure (an indirect cost) on emergency services.

5 ENGLAND'S CHANGING APPROACH TO FLOODING

Allowing development in England's flood risk areas has led to construction of ever increasing structural flood mitigation over the last century. This in turn has encouraged further encroachment into flood risk areas, an expectation from the public regarding protection and a false sense of security regarding the level of risk.

The 'traditional' approach to flood risk areas '*has emphasised economic efficiency rather than wise decision making'* (Penning-Roswell, 2001), with emphasis on the role of Government to provide protection, rather than individual responsibility (Johnson & Priest, 2008). Increased flood risk due to climate change and the pressure of development limits the capacity of structural flood infrastructure (Butler & Pidgeon, 2011). This realisation began to dawn in the early 1990s (Parker, 1995), however it was in the wake of the Global Financial Crisis in the late 2000s, and despite the recent flooding, that the British Government advised it was unable to continue to increase funding for 'flood defence' (Defra, 2014). However, with falling approval ratings (Wintour, 2014), the British Government has come under significant public and media pressure to take action regarding the recent January 2014 flooding. It is likely the UK Government will again have to make expensive promises in the coming weeks and months regarding future investment.

In the context of a fiscally-constrained economy, an alternative approach is taking shape in England - loosely titled "Flood Risk Management" - that is likely to place increased pressure on land use planners (Figure 3).

"Flood Risk Management" is a change in emphasis from managing flood water, to managing the citizens at risk (Butler & Pidgeon, 2011) – encouraging people to 'live with floods' (ICE, 2001). It is also a shift in policy away from defence to an approach with increased emphasis on spatial planning and development control (Turnstall, et al., 2009). In his review of the Summer 2007 floods, Sir Michael Pitt identified that "current legislation provides for a bygone era of flood defence, not modern flood risk management" (Pitt, 2007).

Flood Risk Management

- Climate change and/or development pressures place limitations on funding and practicality of flood protection infrastructure.
- Learning to Live with Flooding and 'Making space for water' - ownership of flood risks increasingly sits with the public (the individual).
- Spatial planning process becomes even more critical - avoiding new development in flood risk areas.
- Education, flood warning and emergency planning play a key 'mitigation' role in supporting individual ownership of risk (Figure 5).
- Improved resilience of buildings and structures to flooding – faster recovery after a flood (Figure 4).
- Use of 'water sensitive design'/sustainable

Figure 3: A new approach to "Flood Risk Management"?

Some Local authorities have come to realise that the Government cannot continue to build walls to keep the water out, but at the same time acknowledge there isn't scope for stopping to defend some areas due to the potential for significant flooding risks putting lives in danger or regular flooding/insurability resulting in urban 'blight' (Butler & Pidgeon, 2011). Local authorities are placed in a difficult position, particularly when there is a history of protecting and 'manipulating' waterways, which complicates a shift to a different approach to flooding.

Some local authorities experiencing regular flooding are *'more likely to favour traditional methods of protecting against flooding'* (White & Richards, 2007), constructing larger infrastructure in the search for 'quick political wins'. This often runs hand-in-hand with a *'lack of understanding or confidence in the effectiveness of more modern, sustainable approaches to flood management'* (White & Richards, 2007).

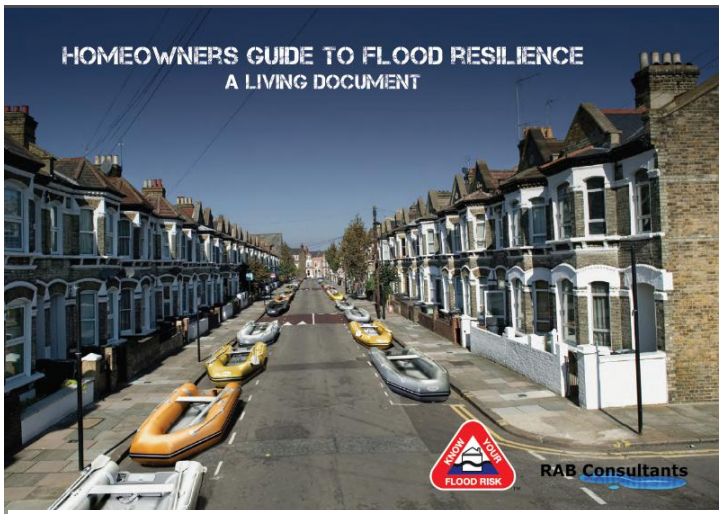

Figure 4: Homeowners Guide to Flood Resilience – helping the community 'live with flooding'?

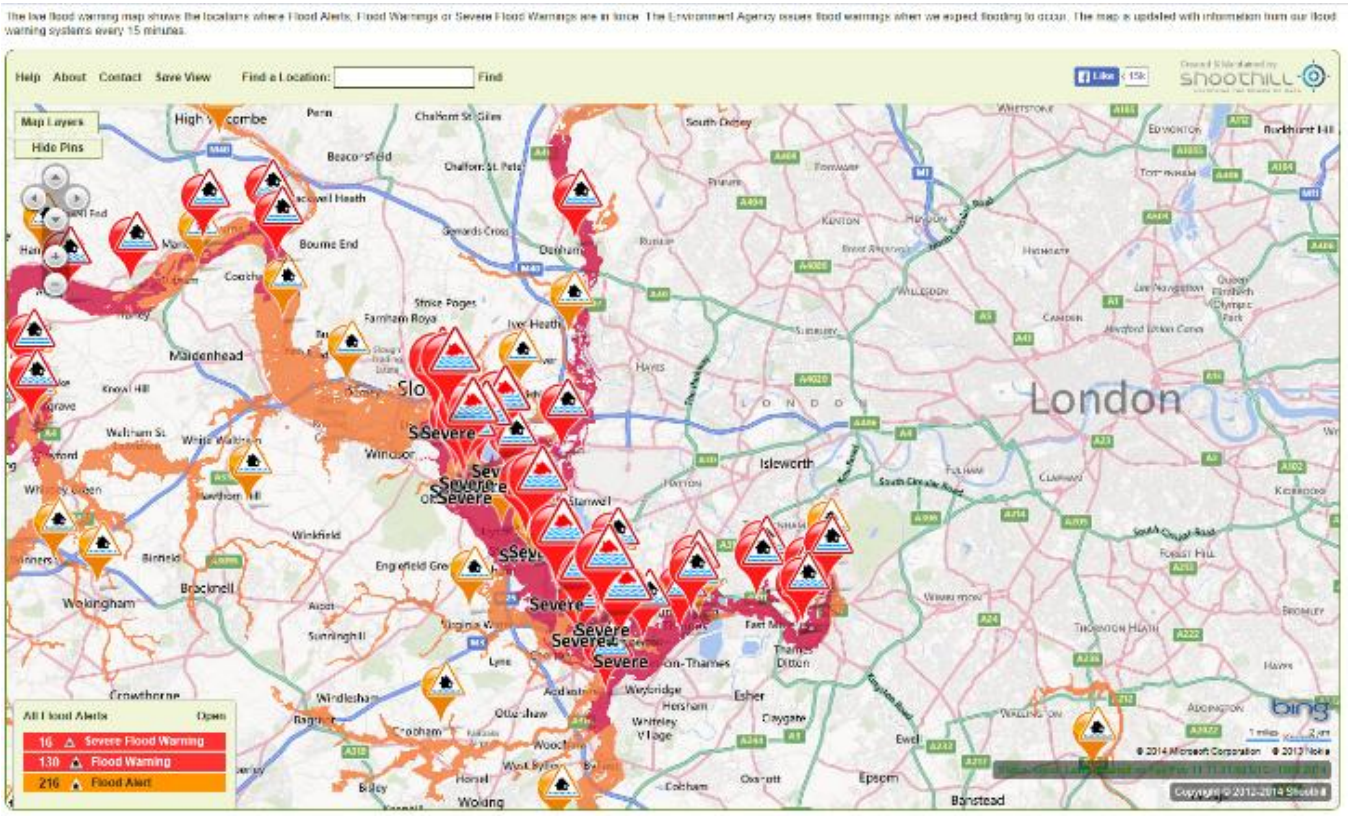

Figure 5: Environment Agency Flood Warning Map, February 2014 provides 'live' updates to communities

In addition to local authorities' own views, more importantly there is also the need to alter the mind-set of the public, the media and the insurance industry that favours structural flood mitigation (Johnson & Priest, 2008). As demonstrated by the public reactions and expectations in the wake of the January 2014 flooding in England, this requires a focus on 'societal change' more than any direct action from a government department or local authority, to form the basis of a sustainable approach to 'flood risk management' (Butler & Pidgeon, 2011).

Land use planning and development control play a key role in sustainable "Flood Risk Management" (Porter & Demeritt, 2012). The UK Government is expecting local authorities to construct additional houses to boost economic growth, in turn 'relaxing' planning legislation to encourage developers. At the same time they are advising less money is available from central government for flood defence. A softer 'flood risk management' approach also makes spatial planning even more challenging, as the 'black and white' of 'defended or undefended', becomes many shades of grey with consideration of hazard, safety, access, flood resilience, emergency planning, and so on.

Photograph 3: Days of continually increasing flood protection heights could be numbered

In the currently evolving meteorological and economic climate England appears to have little choice in adopting "Flood Risk Management" over "Flood Defence", however its success will hinge on public buy-in. This challenge cannot be underestimated given "flood defence" has been the status quo for generations; and given the January and February 2014 flooding, advising of such a change would be political suicide. Although "Flood Risk Management" is the probable way forward for England, the change in approach will take generations to undo the mistakes of the past, with taxpayers picking up the tab in the interim in one form or another.

6 CONCLUSIONS

England's period of accelerated flood risk policy change over the last decade is now turning into a period of change in "Flood Risk Management". New Zealand can watch on in a collective sympathy as decision makers struggle with 'no win' flood risk management decisions and the British public suffer at the hands of the climate.

In New Zealand we should also assume there will not be a bottomless pit of money to 'engineer' our way out of flooding. Learning lessons from England's experiences, we should place increased emphasis on 'front loading' our flood risk planning - strategically assessing flooding across the full local authority boundary as part of a robust evidence base for our Regional, Unitary, and District Plans. This could then lead to developing district, city or regional wide strategies to manage all forms of flooding, recognising their inter-connectedness, but sometimes differing responsibilities for management.

We should be applying a precautionary approach while doing this – recognising both flood data limitations and the understanding of climate change will be refined in the future. Land use planners should seek to understand the sensitivity of the flooding information they are using by understanding the upper limits of predicted climate change.

We should seek to avoid flood risk areas. Positively, there are signs that New Zealand is now learning this critical lesson. In Auckland the Council is seeking to preclude residential floodplain development in the notified Unitary Plan.

Alternatively, if we need to provide 'structural' flood protection, due to the many other competing development drivers communities experience, have we considered the 'whole of life' costs to our future society and sequentially sought out all reasonably available sites at the lowest probability of flooding before zoning a flood risk area for development? There will always be a role for infrastructure to provide flood protection, however it should not be used as an enabler and should form part of an integrated approach to flood risk management.

As well as providing planners with the tools to sequentially locate development outside flood risk areas, strategically assessing and developing solutions across the local plan area, not the catchment, provides a basis for development of robust development control policies and guidance.

In the future much of our flood infrastructure may become obsolete as a result of climate change, as it becomes at best unsustainable, at worst unaffordable to continue to build bigger. It may be necessary to let some places flood more frequently in the future (Defra, 2009 in Porter & Demerrit, 2012). At present this is not a legislated change in England, but is gathering momentum supported by Government policy documents such as 'Making Space for Water'. There is understandably significant concern about what this means for existing communities in flood risk areas (Clover, 2004). "Flood Risk Management" is no 'panacea' for dealing with floods, but is a reality of the fiscally constrained and changing 'climate' we now live in.

Whether we choose to or not, we will find ourselves learning to live with increased flooding in New Zealand. The responsibility on the shoulders of our land use planners in this regard cannot be underestimated. England is finding land use planning decisions of the past have placed them in 'no win' situations; with people to protect, more houses to build, and not enough money for flood protection. Whilst we have had similar experiences in parts of New Zealand, land use planning still offers significant opportunity for us to learn from the experiences of our Commonwealth cousins and ultimately limit the level of risk we expect our future communities to 'live with'.

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