TOWARDS UNIFORMITY IN FLOOD MAPPING

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ABSTRACT

For a country of New Zealand's relatively small size and population, the lack of uniformity in development and presentation of flood maps across the country is striking. In parallel to efforts to promote country-wide uniformity in rainfall-runoff modelling, and drawing on examples and experience from around New Zealand and overseas, a case is presented for greater uniformity in flood mapping and clarity in communicating flood risk.

Flood maps are developed for a range of uses, including high-level hazard identification, integrated catchment management planning and District Plan hazards management. Terminology and the content of information presented on flood maps differ across the country.

Knowing that a map is showing the flood depth and extent does not in itself explain the level of modelling detail and reliability; was the model a simple 2D only rain-on-grid model, or a fully coupled model representing piped networks, open channels, structures and floodplains, and what were the underlying assumptions and constraints? Beyond the raw model output, different approaches are adopted for the inclusion of freeboard or identifying flood sensitive margins.

In addition to their use by stormwater practitioners and planners, the communities we serve are also interested, especially where they are at risk of flooding or it might affect property value and options. Flood maps are a key tool for communication, so communities need to understand the flood maps and have confidence in them.

For this they need to be accessible; an internet search for "flood maps" rarely delivers the desired result. Uniformity of flood mapping terminology and consistency of how councils make their flood maps available would assist, both for community understanding and to assist less well-resourced councils.

Moving towards a uniform approach would result in councils relinquishing local control of flood map specification, but should provide tangible benefits to the country as a whole.

KEYWORDS

Flood mapping, national policy, community communication

PRESENTER PROFILE

Mike has 27 years' experience in flood risk management and modelling, hydrology, and water resources, both in the UK and New Zealand. He joined Beca's Christchurch office in 2009, and has undertaken a wide range of hydrological investigation and flood modelling projects throughout New Zealand, Australia, and the Pacific Region.

1 INTRODUCTION

I arrived in New Zealand in 2009, having spent the previous nineteen years working in the UK. The majority of my work had been in England but I'd also worked on projects in Wales. Following the 'Easter Floods' of 1998, there had been a concerted drive in the UK to deliver country-wide flood mapping and clear planning guidance to steer vulnerable land uses away from areas at risk of flooding. This goal of nationwide consistency was generally met, and accepted. Therefore, it came as a shock to find that New Zealand's approach to flood modelling and mapping is piecemeal; being dependent on the priorities and resources of the local authority.

In this paper, I will first consider the need for flood mapping and look back at the apparent simplicity of mapping that I left behind in England. I will contrast that with the current range of approaches and outputs in New Zealand, before looking forward to what we need to consider if New Zealand is to move towards uniformity in flood mapping, avoiding some of the problems that others have experienced.

2 THE NEED FOR GOOD FLOOD MAPPING

It is assumed that a map is the best method for displaying flood risk or hazard information for an area. That being the case, it is essential that an effective means of communicating the information is used. Flood maps are developed and used for a range of purposes; some part of the planning process and some not. These include:

- High-level flood hazard identification and Integrated Catchment Management Planning;
- District Plan hazards management;
- Owners and prospective buyers checking properties;
- Insurers assessing their exposure to risk;
- Emergency services identifying access and evacuation routes.

So, in addition to their use by stormwater practitioners and planners, the communities we serve are also interested in flood-related information. Flood maps need to allow our communities to understand flood risk and have confidence in the processes that underlie flood mapping and the decisions made because of their use.

The information presented on flood maps depends on the use of the map, and may include flood extent, flood depths, and water surface elevations (Figure 1), as well as water velocities and flood hazard (defined based on a combination of flood depth and water velocity). Areas beyond the modelled flood extent may also be identified, if they are considered at risk due to modelling uncertainties or events larger than the design flood.

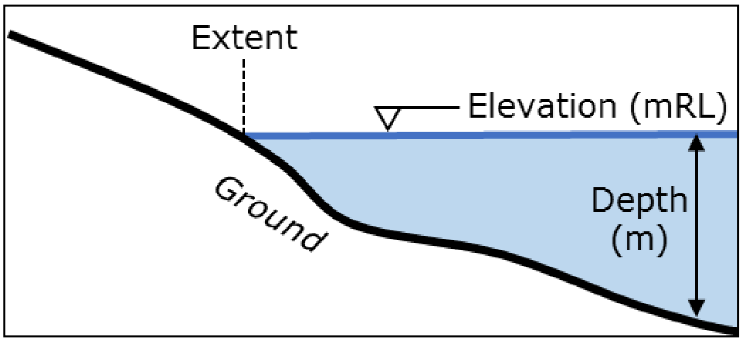

Figure 1: Flood map information

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3 HOW UNITED IS THE UNITED KINGDOM?

3.1 A DIVIDED KINGDOM

This is not a commentary on the current political landscape in the UK in the wake of the votes for Scottish independence and Brexit. Rather it is an appraisal of how hydrological modelling, flood/stormwater modelling, flood mapping, and development control in flood prone areas were managed when I left the country.

Of course, the UK is more than one country; two countries (England and Scotland), one principality (Wales, though many also consider it a country), and one province (Northern Ireland). This complexity is reflected in the governance of the UK. The Houses of Parliament in Westminster govern the UK and all legislation in England, but some powers are devolved to a Scottish parliament, and assemblies in Wales and Northern Ireland. Among the devolved powers are those relating to planning and environmental management; remembering that the European Union also has a say on many matters.

Yet out of this governmental complexity, there comes consistency within each of the four constituent parts of the UK, despite there being 326 districts (including metropolitan and London boroughs, non-metropolitan districts, and unitary authorities) with responsibility for issues such as planning control in England (Figure 2) alone.

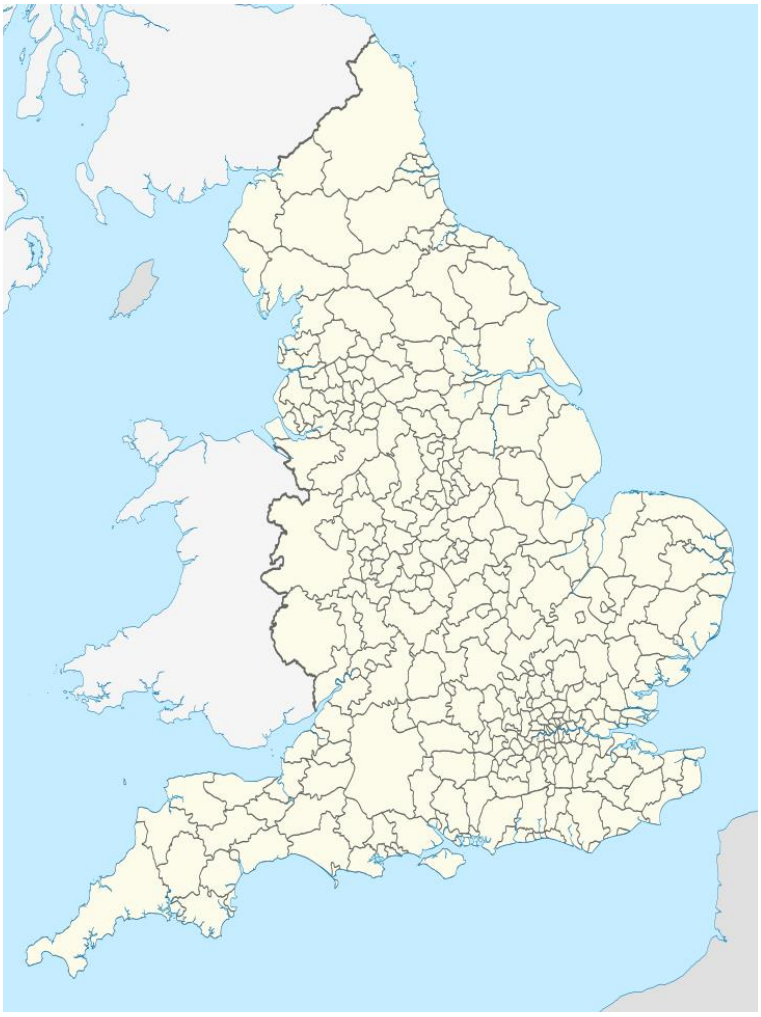

Figure 2: Districts of England

A key organisation in ensuring uniformity of approach to flood risk related issues in England and Wales is the Environment Agency; a non-departmental public body set up in 1996 as a merger of:

- The National Rivers Authority (NRA), which had been set up in 1989 to retain in the public sector the regulatory functions of the ten regional water authorities, when their water supply and sewerage undertakings were privatised;
- Her Majesty's Inspectorate of Pollution (HMIP), and;
- Some local authority functions, including waste regulation and contaminated land management.

The Environment Agency is responsible for flood risk management and is a statutory consultee on applications for planning permission; the equivalent of consents in New Zealand.

3.2 A FOCUS FOR CHANGE

With the NRA in place from 1989 to 1996, and then superseded by the Environment Agency, organisations existed that were well-placed to provide consistency and uniformity of approach to understanding flood risk, and to translating this information into the planning space. And yet, it didn't really happen until after 1998. As so often, it takes a major event to precipitate action in any given area. The 1980s and 1990s were a period with fewer major flood across the UK. Flooding had receded in the consciousness of the public and politicians; being replaced by water quality improvements and managing water resources; the latter coming to the fore during the droughts of 1989-1991 and 1995-1995.

That focus changed dramatically because of the Easter 1998 floods that cut a swath over parts of Wales and Southern England. Five people died and losses were put at more than £350,000,000 (Bye, 1998). This was the wakeup call that flood risk management in the UK was required, and the government and flood sector reacted. Three major developments occurred in the following years, whether directly or indirectly, because of the Easter 1998 floods:

- In late 1999, **Indicative Floodplain Maps (IFM)** of the whole of the UK were published, which identified areas within the 100-year ARI[1] river flood extent or the 200-year ARI extent of coastal flooding. Other than that, the maps gave no indication as to the degree of risk, or whether flood defences existed. Yet they had been delivered within two years of the Easter 1998 flood and provided a useful tool for flood defence practitioners and planners.

  The IFMs were to be replaced with more detailed **Flood Zone Maps** in 2004, and it is those that are presented in Section 3.3 as what I was familiar with on leaving the UK in 2009.

- Coincidentally in 1999, the Centre for Ecology and Hydrology (CEH) published the first edition of the **Flood Estimation Handbook (FEH)**, which provided a new approach to generating flood frequency estimates and hydrographs for gauged and ungauged catchments. FEH was the first major rethink of UK hydrological modelling since the publication of the Flood Studies Report (NERC, 1975) in 1975.

  Central to the FEH methods was the use of a suite of catchment descriptors (area, longest drainage path, % urbanisation, soil hydrological characteristics, etc.) for each reach of the UK's river network. Originally available on CD, and now online, the catchment descriptors were used in conjunction with FEH storm profiles for rainfall runoff modelling, and to identify hydrologically similar gauged catchments to develop robust flood frequency estimates.

- In 2001, the DTLR issued Planning Policy Guidance 25 (**PPG 25**), titled ***Development and Flood Risk***. PPG25 was the document that made the Environment Agency a statutory consultee on planning permission applications in areas at risk of flooding and required planning authorities to follow a sequential risk-based approach to steer vulnerable development away from areas at risk of flooding. Parallel to the adoption of PPG25 in England, the Welsh Assembly brought out Technical Advice Note 15 (TAN15) that covered the same issues in a similar manner.

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[1] ARI: Average Recurrence Interval

PPG25 was replaced in 2006 by Planning Policy Statement 25 (**PPS 25**), also titled ***Development and Flood Risk*** (CLG 2010). PPS25 continued the approach of steering development away from flood prone areas using a ‘Sequential test’, with an ‘Exception test’ to minimise the consequences of flooding where development had to proceed in flood prone areas.

The introduction of the Flood Zone Maps, FEH and PPG25/PPS25 provided consistency of approach of three of the four key aspects of flood risk management (Figure 3). What was missing from this suite of information, tools and guidance was guidance on flood/stormwater modelling.

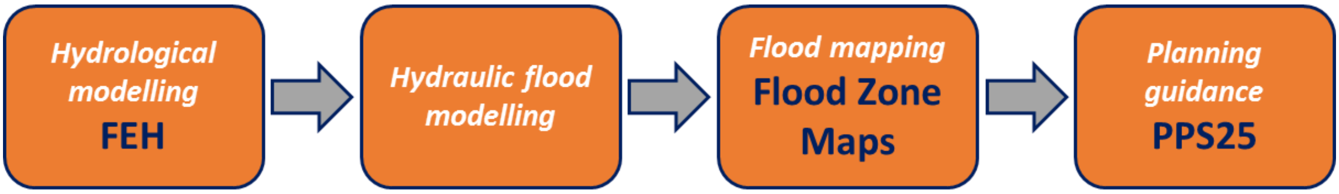

Figure 3: Flood risk management components

3.3 FLOOD ZONE MAPS (ENGLAND)

Figure 4 shows a current Flood Zone Map for York in the North of England.

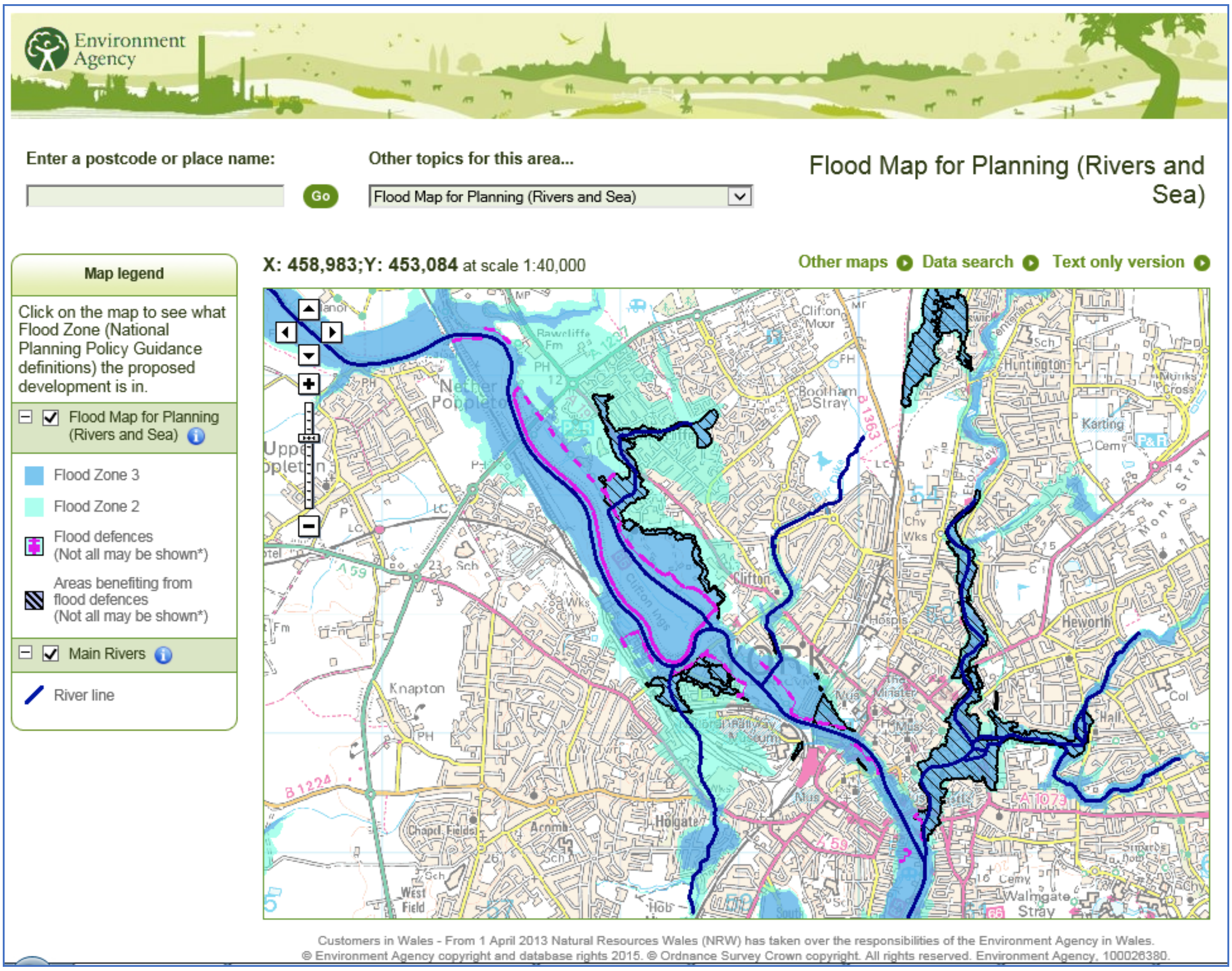

Figure 4: Flood Zone Map

There are two different areas of shading shown on the Flood Zone Map:

- **Dark blue** ■ (Flood Zone 3) shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:
  - from the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening in any year; or
  - from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening in any year.

- **Light blue** □ (Flood Zone 2) shows the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.

Where there is no blue shading, this shows the area where flooding from rivers and the sea is very unlikely. There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring in any year. Most of England and Wales falls within this area. For planning and development purposes, this is the Flood Zone 1.

Figure 5 shows Table D.3 of PPS25 (CLG 2010) that indicates which land use (based on their vulnerability) are appropriate in each Flood Zone. The PPS25 Sequential Test aims to steer vulnerable development away from areas of high flood risk. For example, Essential Infrastructure should not be placed in Flood Zone 2 if a site in Flood Zone 1 is available. The Exception Test provides a method of managing flood risk while still allowing necessary development to occur, when there are no available sites in an appropriate flood zone.

Table D.3[23]: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✔	✔	✔	✔	✔
	Zone 2	✔	✔	Exception Test required	✔	✔
	Zone 3a	Exception Test required	✔	✗	Exception Test required	✔
	Zone 3b 'Functional Flood plain'	Exception Test required	✔	✗	✗	✗

Key:

✔ Development is appropriate

✗ Development should not be permitted

Figure 5: PPS25 Table D.3: Flood Risk Vulnerability and Flood Zone 'Compatibility'

The different land uses within each vulnerability class are defined in PPS25 Table D.2., with some examples listed below:

- ***Essential Infrastructure*** including utilities and transport links (including evacuation routes), which on occasion have to be located in flood risk areas.

- ***Highly Vulnerable*** land uses include emergency services required to be operational during flooding.

- ***More Vulnerable*** land uses include hospitals, residential buildings and institutions, hotels, landfill and sites used for waste management. Sites used for holiday or short-let caravans and camping.

- ***Less Vulnerable*** uses include police, ambulance and fire stations which are ***not*** required to be operational during flooding, shops and offices, water treatment works which do **not** need to remain operational during times of flood, and wastewater treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

- ***Water-compatible Development*** includes flood control infrastructure, water and wastewater infrastructure and pumping stations, docks, marinas and wharves, water-based recreation infrastructure.

While providing consistency across England, the Flood Zone Maps are relatively simple. Within each flood zone, they do not indicate flood depth, water velocity, or flood hazard (the combination of flood depth and water velocity, as shown in Figure 6). Where flood extents are large, flood hazard maps can be particularly informative; indicating the effect of deep or fast flowing water in defined flow paths or depressions.

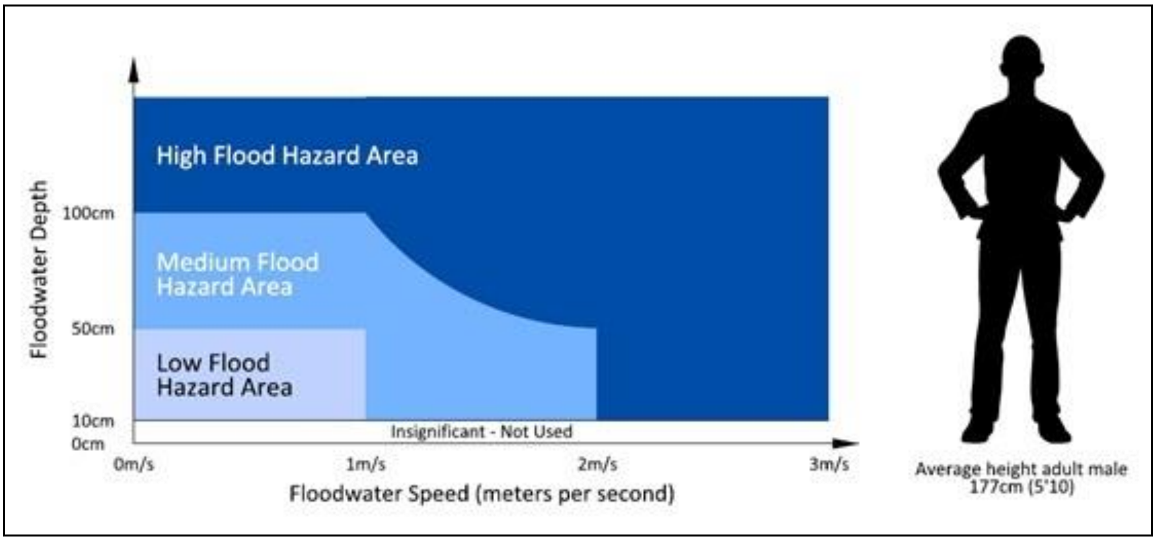

Figure 6: Definition of flood hazard (HCC 2017)

In the absence of more detailed nationwide flood maps in England, maps were developed for individual catchments and flood alleviation schemes by the local authorities or the Environment Agency, or on a site-specific basis for developers. Figure 7 shows an example of a flood hazard map for Canvey Island in Essex (SE England) produced to inform the development of a supermarket on a greenfield site. Though defended by stopbanks, the area is at risk from tidal inundation and the flood hazard map includes the effects of a breach in the flood defences.

Referring to the Flood Zone Maps, it is worth noting that they do not include freeboard to reflect the sensitivity of the underlying modelling to assumption made in the modelling process. Rather, an allowance is made for freeboard when setting floor levels and flood sensitive infrastructure through the development control and planning process.

The overall sensitivity of the area to changes in flood modelling inputs can be inferred by the extent of Flood Zone 2, which represents the area between the 100-year ARI fluvial (or 200-year ARI coastal) and 1000-year ARI flood extents. This is similar to the practice of using an oversize event to represent flood sensitivity, occasionally done in New Zealand.

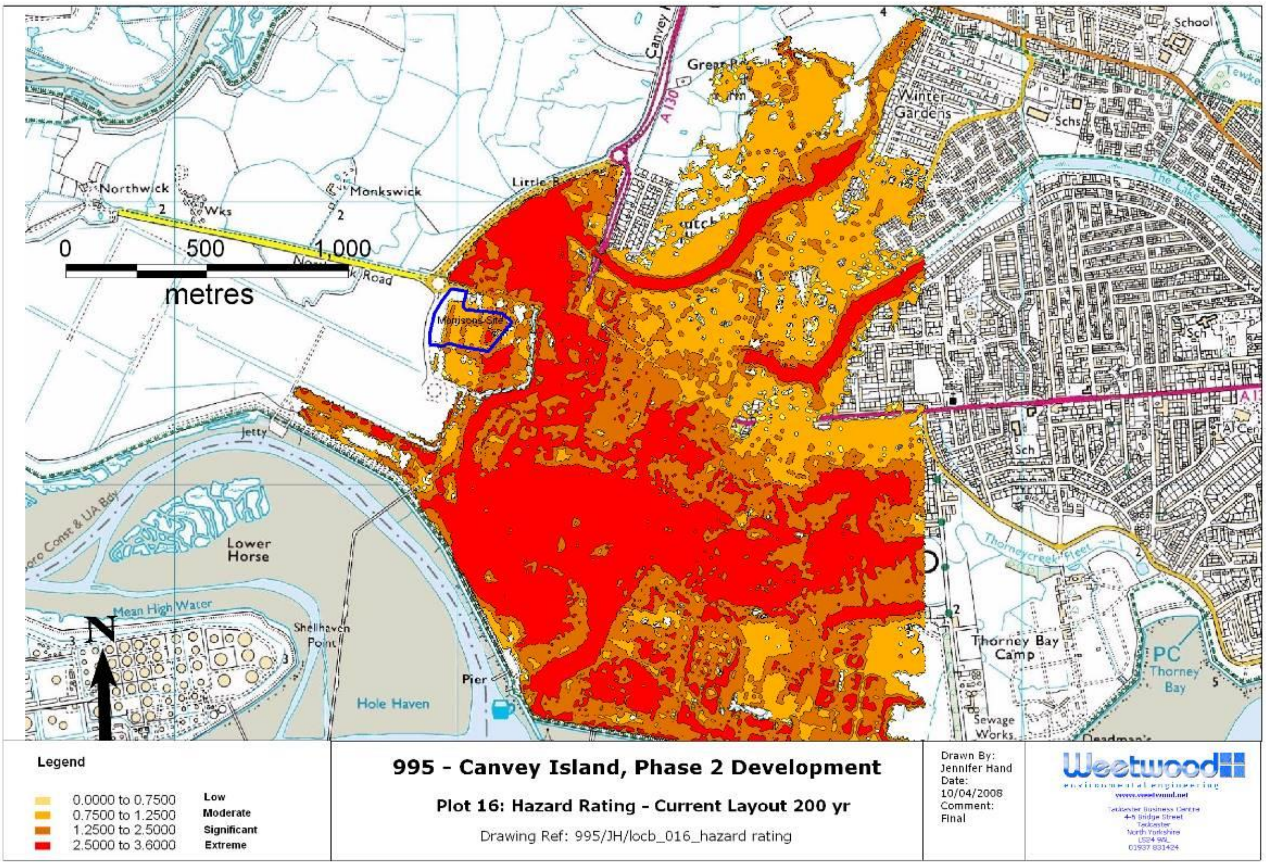

Figure 7: Flood hazard map

Things have moved on since I left the UK in 2009, with updates to PPS25 and FEH, as well as the Environment Agency providing guidance on the application of freeboard and benchmarking flood modelling software. However, the focus remains on providing consistency of approach to modelling, mapping and planning process, albeit with limitations.

4 A DIVERSE NEW ZEALAND

Compared to England, the situation relating to flood modelling and mapping in New Zealand is more diverse. There isn't a nationwide method adopted for hydrological or stormwater/flood modelling. Well-resourced councils are able to develop their own methods; calibrating against local conditions and requiring a 'gold standard' of model build, inputs, reporting and outputs. Councils with smaller ratepayer bases may be forced to adopt their bigger neighbour's methods and hope that the calibration holds for their area, adopt generic approaches, or develop their own methods and guidelines on smaller budgets.

What applies to flood and stormwater modelling also applies to flood mapping; the presentation of model outputs and the key communication tool to communities. Terminology and the content of information presented on flood maps differs markedly across the country.

4.1 THREE REGIONS, FOUR LOCATIONS, FIVE FLOOD MAPS

A snapshot on the variety of flood mapping approaches in New Zealand is through the following maps, from Christchurch, Auckland and Wellington; three of the best resourced councils in the country.

4.1.1 CHRISTCHURCH

Flood maps for Christchurch are found on the city's public floor level viewer (CCC, 2017). An example is provided in Figure 8. *Note that there are only minor differences between the 50-year ARI 'Control Area' and 200-year ARI flood extents, as indicated by occasional patches of dark blue around the margins of the green Control Area outline.*

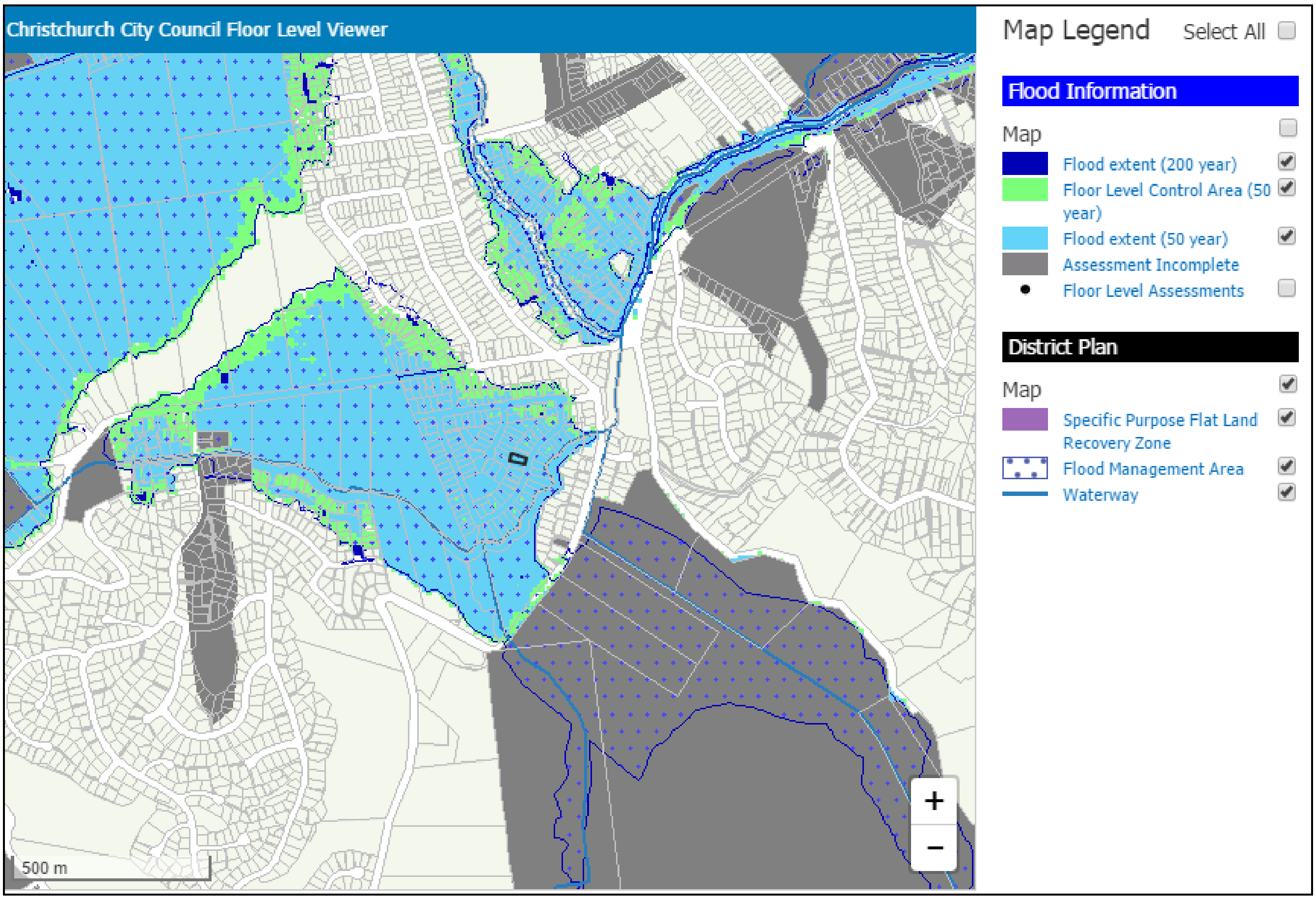

Figure 8: Christchurch Flood Map

The user can choose which map layers are displayed, and these include 50-year and 200-year flood extents and corresponding 'Control' areas. The layers are defined as follows:

- **Floor Level Control Areas** – include the 50-year ARI flood extents plus the area encompassed by an increase in water level of 400 mm (representing the 400 mm freeboard to floor levels that Council applies in these areas).
- **Flood extent (200 year)** – estimated water level in a rainfall event with an average return interval of 200 years or a likelihood of 1/200 (=0.5%) in any one year. This return interval is used in the City Plan Flood Management Areas (FMA) to provide extra protection to areas which are otherwise vulnerable. The viewer shows these areas within the FMA only as they are not used for setting floor levels beyond the FMA.
- **Flood extent (50 year)** – estimated water level in a rainfall event with an average return interval of 50 years or a likelihood of 1/50 (=2%) in any one year.
- **Flood Management Areas** - were identified in a City Plan change before the Canterbury earthquakes and are areas that are prone to flooding as a result of major tidal or rainfall events and are vulnerable to the effects of rising sea levels.

The flood control areas represent those areas beyond the design flood event extent in which measures are appropriate to mitigate against the design event and the residual flood risk associated with extreme flood events, unforeseen blockages, and other factors that could increase flood levels beyond modelled levels. Christchurch use the best estimate of modelled flood levels then explicitly specify the freeboard to be added for setting the finished floor levels in these areas. This approach to applying freeboard is not uniform across the country.

4.1.2 AUCKLAND

Figure 6.2 shows an extract from Auckland Council's GEOMAPS website (AC, 2017)

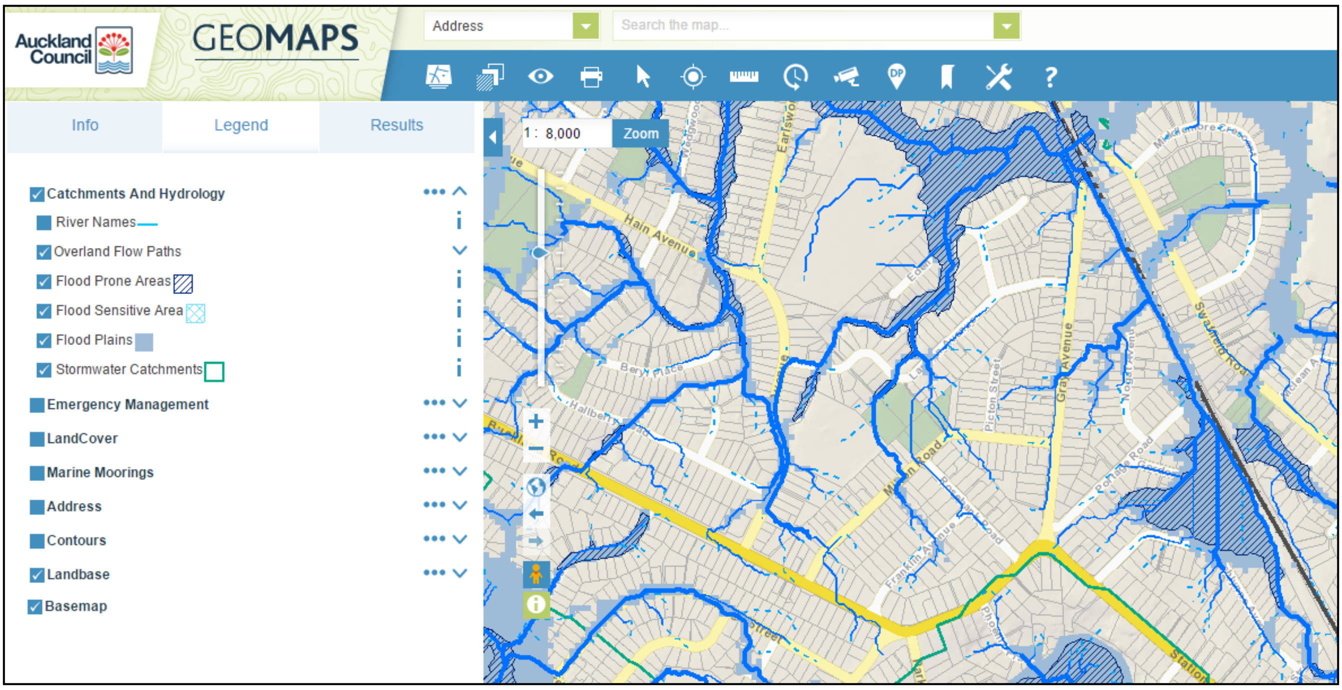

Figure 9: Auckland Flood Map

The map includes layers for floodplains, flood prone areas, and flood sensitive areas, which are defined as:

- **Floodplains** are areas predicted to be covered by flood water as result of a rainstorm event of a scale that occurs on average once every hundred years. These areas have been produced from hydraulic modelling. The floodplain contains the most up to date information for each of the 23 Stormwater Catchments in the Auckland region. Summary data for each catchment is attributed against each floodplain.

- **Flood prone areas** are topographical depressions. The areas occur naturally, or are created by dammed gullies created by man-made features such as roads and railway embankments. The flood prone extent is the area water will pond up to in a 100-year ARI extreme rainfall event assuming the outlet to the topographical depression is blocked.

- **Flood Sensitive Areas** are areas adjacent to the 100yr ARI floodplain that are within 0.5 m of the predicted 100-year ARI flood level. These mapped areas are to ensure the appropriate planning rules are considered for properties developing adjacent to the floodplain

The map also shows overland flow paths, with the line style reflecting the size of surface catchment draining to that area. The overland flow path does not necessarily indicate that flooding will occur along its length, as the stormwater network will convey water, and the overland flow paths may have been developed from 'rain-on-grid' modelling that either ignores the capacity of the stormwater system, or assumes that it is at capacity.

For Auckland, the Flood Sensitive Areas are the equivalent Christchurch's flood control areas.

4.1.3 WELLINGTON REGION

Flood maps for two catchments in the Wellington Region are considered.

(A) Pinehaven

Figures 10 and 11 are 100-year ARI (Q100) flood extent and hazard maps produced in 2011 for part of the Pinehaven catchment in Upper Hutt. The maps are:

- Figure 10: **Q100 design scenario including partial blockages, freeboard and predicted impacts of climate change**: 100-year ARI flood depth and extent. This scenario does not include future development.

- Figure 11: **Flood Hazard Zone and erosion set back line**: Flood Hazard Zone extent defined by the 'Q100 design scenario including partial blockages, freeboard and predicted impacts of climate change' extent. Erosion hazard zones and setback shown along channels.

The extent of the Flood Hazard Zone is the same as the extent of the Q100 design scenario including partial blockage, freeboard and predicted impacts of climate change. The Q100 flood depth and extent map includes an allowance for 'freeboard'. In this case freeboard is the additional depth (500 mm in the upper catchment and 300 mm on the flatter lower catchment) added to the modelled water levels, and is an allowance for:

- Uncertainty in the modelling process or parameters, such as limited survey, lack of recorded flow data, and assumptions regarding stream and floodplain roughness, and antecedent conditions.

- The residual risk of flooding from extreme events (i.e. those greater than the design event), although this is not an element included in freeboard applied to GWRC Flood Hazard Maps.

- Local wave action and obstructions.

The application of freeboard extends the potential floodplain beyond the modelled flood extent, and is used by the planning authority to flag that flooding is an issue to be considered at the site and to assist in the setting of levels for floors and vulnerable services. Including freeboard in the mapped flood extent was a factor in community concerns about the validity of the flood modelling and mapping in the Pinehaven catchment, because the mapped flood extent extended well beyond the observed extent of flooding in the 1976 100-year ARI flood. This apparent discrepancy compromised the acceptance of the flood maps and the regional council's proposals for flood mitigation.

This led to an audit of the flood modelling and mapping for the catchment in 2015, which in turn led to revision to the flood mapping to differentiate between the modelled flood extents and those areas included once freeboard had been applied.

Figure 10: Pinehaven 100-year ARI Flood Depth and Extent Map (2011)

Figure 11: Pinehaven Flood Hazard Zone Map (2011)

(B) Waiohine River

The Waiohine River is in the Wairarapa, part of Greater Wellington Region. The river emerges from the Tararua Ranges and flows east and south before joining the Ruamahanga River. The Waiohine surrounds Greytown on two sides, with historic overland flow paths through the town. Figure 12 shows the current 100-year ARI flood map used to inform planning decisions along the Waiohine River and Greytown (centre of the map). The shaded areas are:

- Red: River Corridor
- Yellow: Overflow Paths
- Blue: Ponding

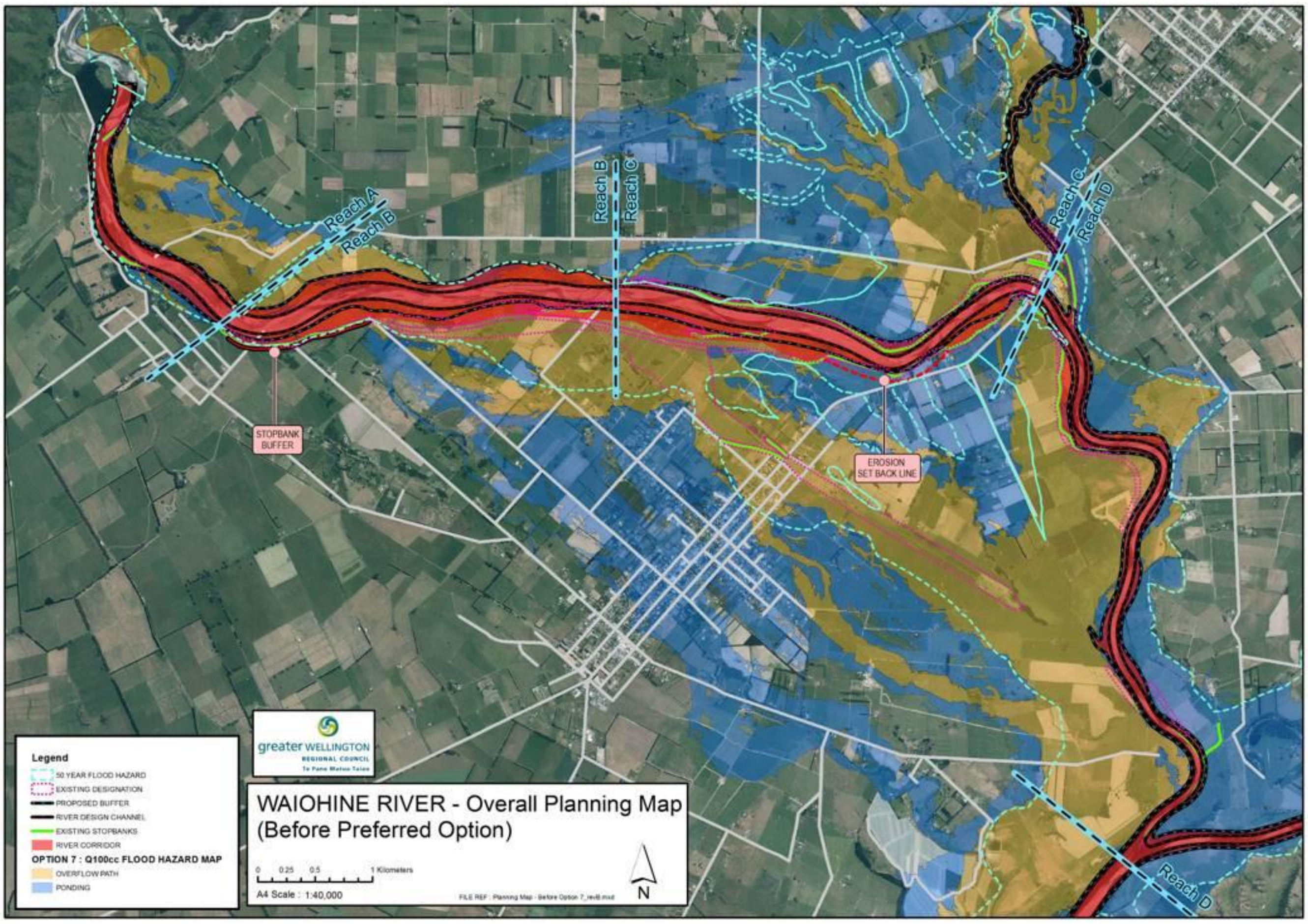

Figure 12: Waiohine River – Overall Planning Map

The flood extents shown in Figure 12 have been derived from flood modelling of the Waiohine River and its tributaries, but include an allowance for 'model freeboard'. Rather than applying a set increase in water levels to account for freeboard (as was done in Pinehaven), an alternative approach was taken.

Once the best estimate of the 100-year ARI flood level was modelled, the flood model was re-run to incorporate flood freeboard using the following approach. The starting condition for the re-run model was the 100-year ARI water level on the floodplain and the 100-year ARI water level plus 600 mm in the river channel. No additional flow from upstream was added.

The model was then set running to determine where the additional 600 mm of water in the channel would go, and how that would affect flood extents on the floodplain. This is a more sensitive approach to applying freeboard and accounting for uncertainty within the flood modelling. However, it is a difficult concept for the community to grasp and the inclusion of model freeboard is not noted on the flood maps.

The flood modelling and mapping of the Waiohine River is subject to an independent audit as part of the Waiohine River Floodplain Management Plan (FMP) process, and that may lead to refinements in the presentation of the flood maps.

4.2 FLOOD MAP THEMES

The common theme of the Christchurch and Auckland flood maps is that users can clearly differentiate between the modelled flood extents (or floodplain) and the areas included when freeboard is applied, and in which flood risk should also be considered and mitigated against. This assumes that users, including the local community, can understand the difference between modelled flood extents and the 'buffer' zones (Flood Control Areas in Christchurch and Flood Sensitive Areas in Auckland).

With the areas differentiated, users can see how the flood maps are drawn up, which will increase understanding of the maps' purpose, and hopefully acceptance of the flood maps and underlying modelling. With this approach, flood sensitive margins (beyond the best estimate of the modelled flood extent) requiring consideration from a flooding point of view can still be defined, and the distinct process of adding freeboard up to floor levels can also be understood.

Terminology varies between the maps presented above. The outer extents of the maps enclosed:

- Flood Control Areas in Christchurch;
- Flood Sensitive Areas in Auckland;
- Flood Hazard Areas in Pinehaven (though updated following the 2015 review)
- Ponding areas on the Waiohine map

Though there may be differences in the way that freeboard has been applied and how these areas are defined, they all being used for the same purpose; informing planning decisions and consent conditions.

Linked to varying terminology, are the differences in legends and written information provided on the flood maps. The Waiohine River – Overall Planning Map and Pinehaven maps do not indicate the ARI of the flood event used to define the flood extents, whereas the web-based maps for Christchurch and Auckland do.

At a more detailed level, the maps presented don't indicate the level of detail in the underlying flood modelling, or indeed whether the flood extents were defined from 1D or 2D modelling. The stormwater modelling specifications for councils including Auckland, Hamilton, and Waikato District, define different levels of modelling detail for Rapid Flood Assessments (RFA), Integrated Catchment Management Planning (ICMP), etc. These differences will affect accuracy of the model results and mapped flood information. Results that are appropriate at a catchment-wide strategic planning level, may not be appropriate when zoomed down to individual properties.

Accessing flood maps is another point of difference across New Zealand. It should be easy for the community to find flood map information. Internet searches for "Flood Map" for Wellington, Auckland and Christchurch yield varying levels of success in finding flood maps.

Some links lead to web pages stating that flood mapping has been carried out, but all too often there is no link to a map viewer. In other cases, PDF versions of maps are provided at a scale that does not allow close examination of specific addresses or location (although this might be an appropriate approach if the modelling is high-level rapid flood modelling).

5 TOWARDS UNIFORMITY IN FLOOD MAPPING

For a country of New Zealand's relatively small size and population, the lack of uniformity in the development and presentation of flood maps across the country is striking. In parallel to efforts to promote country-wide uniformity in rainfall-runoff modelling, greater consistency and uniformity in flood mapping would assist in communicating flood risk to stakeholders and the community.

I have provided the example of how flood maps were presented in England when I left in 2009, and they are essentially the same in 2017. Uniformity of mapping and close linkage to planning guidance, improves clarity and reduces confusion. Yet in their simplicity of only showing flood extents, the Environment Agency's Flood Zone Maps do not contain the detail of information that is evident in many of New Zealand's flood maps, and which is useful.

There is a place for maps showing flood depths, water velocities and flood hazard. However, this needs to be balanced against the danger of producing such a large suite of flood maps that confusion is the inevitable outcome. A balance needs to be struck.

There are differences across New Zealand as to whether (or how) freeboard is applied, including set increases in depth above modelled water levels, applying 'model freeboard' as done for the Waiohine, or modelling oversized events. We need to find a single method that is technically robust, yet transparent and clearly communicated to stakeholders and the general public.

I have touched on the differences in flood mapping terminology used across the country, and the difficulties in accessing current flood maps at the necessary level of detail. In a digital age, flood maps should be readily accessible online.

So, I put out the call for uniformity in flood mapping across New Zealand, which would include:

- An agreed number of critical design (ARI) events to be mapped. *That may mean a review of performance standards for stormwater systems, stopbanks, etc.*
- A uniform approach to applying freeboard and/or defining 'flood sensitive' areas beyond the best estimate of the modelled flood extent;
- Maps available online, <u>and</u> easily found;
- Standard terminology and colour pallets;
- Map text that identifies appropriate uses for (and limitations of) the maps;

Moving towards a uniform approach for flood mapping would result in councils relinquishing local control of flood map specification. This loss of control may be felt most by the larger councils that have invested heavily in preparing their own guidance on flood modelling and mapping. However, there should be tangible benefits for smaller councils that are not currently resourced to develop council-specific guidelines.

For those working nationwide and across council boundaries, the benefits of a national approach to modelling and mapping are greater. Anomalies and discrepancies at council boundaries, and potential confusion over terminology and planning implementation, should cease to exist.

We are small country with a small population. As such, we should put our limited resources to the most effective use. One such way of doing that is to adopt a uniform approach to flood mapping.

ACKNOWLEDGEMENTS

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