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Foreword

Much has been written in recent years about resilience in many sectors of our society and, equally, many definitions of resilience have been suggested. The one by van Weelen *et al.* (2015) is among the best, and is perfectly applicable to the flooding context: resilience is the ‘capacity of a system to buffer natural variations, recover from disturbances and return to its previous state without experiencing changes to the system as a whole; however, when certain thresholds are reached (“tipping points”), systems are no longer able to recover and need to adapt to face changing circumstances’. It is useful also to stress that one of the key features of resilience is the ability to learn from previous events and build in adaptation.

Flood events in the last decade – in Europe and worldwide – have brought to light the pressures that increased population and urban development, as well as climatic change, pose for existing traditional flood defences. The efficacy of traditional methods has quite rightly been questioned, and increased efforts and resources have been made available to research new ideas and approaches that focus on resilience rather than attempting to resist floods. New approaches include technologies and methodologies that allow a smoother passage through flood events and promote a quicker recovery, enabling populations to resume their normal activities faster. These approaches, which are particularly important for the increasingly expanding urban areas, span across various stages of flood management from before the flood event (preparedness, assessment of vulnerability and criticality), during the flood (implementation of protection measures, emergency evacuation) and post the flood (reinstatement). They also span a range of subject areas including urban design and planning, urban drainage, building construction, asset management of infrastructure networks, etc.

The idea of collating research outputs in a themed issue on Flood Resilience of Proceedings of the ICE Water Management arose in 2013, and the intention was to capture the breadth of research and practice in the field of flood resilience in a single journal volume. In this issue, readers would be able to find papers on topics that would not normally be published in *Water Management* (e.g. urban planning), and through that hopefully be exposed to new concepts and ways of thinking. The response was extremely positive, so much so that two themed issues (in 2015 and 2016) were necessary to do justice to the quality of the

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papers received for publication. With contributions from the USA, Thailand, the Netherlands, France and Norway as well as the UK, these were also truly international issues, demonstrating the wide-ranging topicality of flood resilience.

Given the diversity of the papers, it was thought useful to organise the book into sections according to the topic covered. This was not as straightforward as it seemed at first since some papers branch across more than one topic, so the categorisation and the order of the topics should be seen as indicative only. Section 1 is the most extensive one, dealing with *Flood risk and resilience*; Section 2 includes two papers on *Building flood resilience*; Section 3 presents two papers on *Urban drainage flood resilience*; and one paper is presented in Section 4 on *Urban planning and flood resilience*.

As expected in a fast evolving field which is also closely linked with sustainability and climate change issues, research and development have taken place since the original publication of the papers in 2015 and 2016, both in the UK and worldwide. It is not possible in this Foreword to summarise these activities in detail and therefore a selection is given here as an illustration of recent developments and initiatives. Recognising that flooding does not originate only from rivers or the sea, researchers and practitioners have devoted significant effort into promoting resilience of our urban drainage systems. An example of this is the chapter on *Drainage and flood resilience* in the ICE Publishing book *Sustainable Water* (edited by C. Ainger and R. Fenner, 2016). In this chapter David Balmforth proposes a new paradigm for sustainable urban drainage which will concomitantly promote flood resilience. This firstly requires an understanding of the performance of the existing drainage system, followed by the recognition that systems have a finite capacity, and that planning for exceedance is necessary. This then leads to building in resilience against flooding in the drainage system. This approach (combined with stakeholder engagement) can be applied to other assets from flood defences to buildings; that is to say, it is not the sole domain of urban drainage and can therefore be a general illustration of resilient design.

Resilience to extreme weather has moved up the UK Government agenda in recent years in response to several severe winters in the early to middle part of the 2010s. Following the trend set by the summer 2007 floods, these events continued to break many records when compared to

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the historical evidence, both in terms of the intensity and duration of the flooding and other impacts. The National Flood Resilience Review (HM Government, 2016) was instigated to understand the extreme, but plausible, weather events that could impact on the UK economy, given the predicted impacts from climate change. Were such events in line with current assumptions on the extreme weather we should be planning for, and how resilient was our defence, response and recovery infrastructure and systems to deal with such stresses? This analysis showed that the resultant flooding would be somewhat more severe than anything experienced to date but that ‘extreme flooding remains overwhelmingly within the areas and depths defined by the current Environment Agency Extreme Flood Outlines’. This provides welcome comfort in the rigour of our modelling methods.

The year 2016 also saw a separate initiative on how to increase the use of resistant and resilient approaches in building design, construction and retrofit, with the publication of the Property Flood Resilience Action Plan. Increased adoption of such approaches is imperative if our building stock is to keep pace with the predicted impacts from climate change. The Plan is being taken forward by a wide group of stakeholders, via the Defra Property Resilience Roundtable. This is making great progress in improving community and business resilience to flooding, with current initiatives being resilience demonstration projects in Cumbria and the development of a new CIRIA Code of Practice and standards on property flood resilience. This new guidance will cover the complete property resilience process, covering survey, product specification, installation, audit and operation/maintenance.

Finally, property resilience remains a key component in our flood risk management portfolio, with increased government promotion as noted above. The purchase of flood resistance devices remains the main focus for this activity, covering the installation of flood doors and barriers, air brick covers, and non-return valves for pipework. The Environment Agency has also invested in extensive temporary barriers that can be deployed when needed through a national resource network. BSI Standards provide an important role in ensuring that this wide, and developing, range of protection methods meets required levels of leakage reduction and durability (for example, BS 85500:2015 which deals with flood resistant and resilient construction). A major update of PAS 1188

(the current specification for flood resistance measures) (BSI, 2014) began in January 2018, with the aim of turning this industry-sponsored specification into a full British standard. This, and the CIRIA Code of Practice mentioned above, will ensure there is far better information available to the public and designers to help promote the effective uptake of property flood resilience in the coming years.

This book has been compiled from papers previously published by ICE Publishing (purposely diverse and complementary but by no means exhaustive) and aims to provide readers with an overall view of the areas where flood resilience approaches are relevant as well as a snapshot of the advances in research and practice. They illustrate the breadth of ideas, new ways of thinking, and practical implementation in the field of flood resilience, and highlight the absolute need and benefit of working collaboratively with a variety of partners and engagement with the public.

We are grateful to the contributing authors for their new insights and hope readers will find this book a useful reference and further motivation for their studies and research as well as for implementation of improvements in the way we deal with flood risk.

Manuela Escarameia and Andrew Tagg

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