Stakeholder engagement in flood resilience practices in Greater Manchester:

Three local flood resilience initiatives examined

FELICITY STREET
STUDENT NO.: 3693198
DATE: 4th July 2019
MASTER THESIS
FACULTY OF SPATIAL SCIENCES
UNIVERSITY OF GRONINGEN
RIJKSUNIVERSITEIT
ENVIRONMENTAL & INFRASTRUCTURE PLANNING
SUPERVISOR: STEVEN FORREST
CONTACT: FCSTREET95@GMAIL.COM

university of groningen

ABSTRACT

Responding to an increase in pluvial and fluvial flood risk and as part of a wider transition in flood management, Greater Manchester has started to shift away from a traditional flood management approach, towards flood risk management, with an increasing emphasis on flood resilience and stakeholder engagement. Whilst increasingly advocated in theory and policy, flood resilience and stakeholder engagement remain ambiguous concepts with limited research investigating how stakeholder engagement is translated into practice. In an attempt to further the understanding of stakeholder engagement within flood resilience projects, this paper focuses on the main research question: *How is stakeholder engagement understood, perceived and operationalised in flood resilience projects in Greater Manchester?* To gain insights into flood resilience projects, three projects within Greater Manchester were selected to serve as case studies for analysis: Salford second basin (SSB), Howard Street SuDS (HSS) and the RESIN project. The research followed a mixed-method approach within which semi-structured interviews and documents were positioned against scholarly debate. The results reveal that the concept flood resilience is still defined in a number of different ways in both theory and practice, reflecting the heterogeneity of how the concept is operationalised. The results demonstrate numerous but variable examples of stakeholder engagement within the three flood resilience projects. Interviewees reveal that stakeholder engagement is perceived in a positive light, outlining a number of benefits and advantages which should encourage planners to further integrate stakeholder engagement within projects. Results highlight the importance of 1)community groups, 2)integration, 3)self-organisation and 4)maintaining stakeholder engagement post-project completion, as factors which aid in the operationalisation of stakeholder engagement and successful flood resilience projects. By focusing on Greater Manchester, this study aims to provide a greater understanding of stakeholder engagement within flood resilience projects and, given the global nature of an increasing flood, it is proposed that this research will be of further importance to other urban areas following the same path.

Key words: Flood resilience, stakeholder engagement, flood risk management, governance

ACKNOWLEGEMENTS

I would like to express my gratitude to all those who have supported me in this research process, including practitioners, researchers, friends and family. I would like especially like to thank those without whom I would not be able to conduct this research.

First, I would like to express my gratitude to my supervisor Steven Forrest (RUG), who has helped guide my thoughts, inspire my work and challenge me into improving this research.

Secondly, I would like to thank the interviewees who were willing to give up their time, in many cases travel to meet me and explain their respective projects. Without these people this research would not have been possible, as their knowledge, expertise and perspectives have shaped the research findings which are presented in this paper. I hope this research proves useful to researchers and practitioners within the field of flood risk management and flood resilience and I hope that it inspires future projects and research.

Felicity Street

3rd July 2019

CONTENTS

TABLE OF FIGURES

LIST OF ABBREVIATIONS

GM	Greater Manchester
FR	Flood Resilience
SE	Stakeholder Engagement
SSB	Salford Second Basin
HSS	Howard Street SuDS
SuDS	Sustainable Urban Drainage Systems
EA	Environment Agency

1 INTRODUCTION

Over the last few decades, concern over flood risk has risen due to a global increase in intensity and frequency of flood events (White, 2010; European Academies' Science Advisory Council, 2018). This increase is driven by patterns of change including urbanisation (Miller & Hutchins, 2017), deforestation (Bradshaw, et al., 2007), population increase (Neumann, et al., 2015) and climate change (IPCC, 2014), and is exacerbated by a lack of conscientious planning (Zevenbergen, et al., 2008). The extent of future change is dependent on a number of variables, including carbon dioxide emissions, rates of deforestation and the response of the ecosystems to the changing climate (Carter, et al., 2015). Whilst the picture for future carbon dioxide emissions is uncertain, it is expected that there will be further emissions growth given a persistent increase in oil and natural gas consumption and projected economic growth (Le Quéré, et al., 2018). The increasing pressures of climate change alongside other factors, such as urbanisation and population increase, are expected to further exacerbate the existing flood issues into the foreseeable future (Miller & Hutchins, 2017; IPCC, 2014; Kundzewicz, et al., 2013).

Flood events across the globe are responsible for significant economic and social losses, and projected increases in these events further threaten the global community (Kundzewicz, et al., 2013). Globally, it is estimated that under a high emissions scenario (Representative Concentration Pathway 8.5) flood costs could increase to $17 trillion by 2100, exhausting 2.8 percent of global GDP (Jevrejeva, et al., 2018). Amongst the many countries facing flood risk, the UK is expected to see an increase in economic flood costs, rising from around £1.1 billion to as much as £27 billion by 2080 (Evans, et al., 2004). For urban areas, high population density and concentration of infrastructure makes them particularly vulnerable areas to flood risk (Rosenzweig, et al., 2010). Greater Manchester is a good example of such an area, where flooding has been identified as the most significant shock factor facing the area (GMCA, 2017), as recent decades have seen an increase in number of pluvial and fluvial flood events and subsequent economic costs (Kaźmierczak & Cavan, 2011). In 2015, GM experienced its most widespread flood event, with damage from Storm Eva resulting in the flooding of over 2,000 properties and costs of around £11.5 million in infrastructural damage (GMCA, 2016). Climate predictions for GM indicate an increase in high intensity precipitation events and in winter mean precipitation levels by as much as 30% (Cavan, 2018). This, coupled with predicted population increase (Nash, 2018) threatens to further increase flood risk for GM and it is thus imperative that GM act now to protect its future.

The rise in flood probability and risk exposure has paralleled a recent transition in flood management away from 'flood defence' to 'flood risk management' (Nye, et al., 2011; Butler & Pidgeon, 2011; Johnson & Priest, 2008; Turnstall, et al., 2004). In recognition that flooding cannot be wholly protected against, this shift reflects a move away from a flood defence-dominated approach, which aims to reduce the *probability* of flooding, toward a holistic risk-based approach which aims to reduce the *consequences* of flooding through a more integrated policy approach (Mees, et al., 2016; Nye, et al., 2011; Woltjer & Al, 2007). At a European level, the 2007 Floods Directive (2007/50/EC) illustrates the first attempt to administer a common risk approach across EU member states, contributing to the institutionalisation of this paradigm shift (Hartmann & Spit, 2016). Analysis of policy documents in the Netherlands over the past 30 years reveal a transition in water management from a technocratic management style towards an integral and participatory style (van der Brugge, et al., 2005). Similarly, in the UK, this paradigm shift gained momentum in the early 1990s and emphasised the use of soft engineering approaches, integrated water management and the redistribution of responsibility (Butler & Pidgeon, 2011).

Within the context of an increasing flood risk together with a transition in flood management, the concept of resilience has gained increasing prominence within literature and policy (Leichenko, 2011). In a similar manner to risk management, resilience is generally used to refer to the minimalization of flood consequences and implies the broadening of responsibilities of both public and private stakeholders (Restemeyer, et al., 2015). The resilience concept offers a new discourse with ideas that "nothing is considered certain except uncertainty itself" (Davoudi, 2016, p. 8), presenting an appropriate 'solution' for flood risk given its highly uncertain future. Within policy, resilience is used with increasing frequency and is evident at the highest levels, with the most recent IPCC report discussing resilience targets (Connick, et al., 2018) and the 2015-2030 UN conference on disaster risk reduction emphasising the importance of building resilience into policies, planning, programmes and budgets (UNISDR, 2015). In the UK, resilience in respect to emergencies entered government language with the publication of the *Civil Contingencies act* in 2004 and became prominent in relation to flooding after the *2007 Pitt Review* (Pitt, 2008). Since then, resilience has come to play a central role in flood risk management policies and strategies and its importance is evident in key documents such as the *Water and Flood Risk Management Act* (UK Government, 2010). There has also been a growing emphasis on city-level resilience and is reflected by programmes such as *100 Resilient Cities*, of which Greater Manchester became a member in 2016 (100 Resilient Cities, n.d.). As one of the UNISDR's 'role model' cities (Ellis, et al., 2016), GM has identified resilience as a key objective within its most recent *Greater Manchester Spatial Framework*, used as both an overall aim for the city-region and in respect to flood resilience (GMCA, 2019). However, whilst widely used in literature and policy, the term resilience is often used with variable interpretations and its definition remains blurry and contested, complicating its application in practice (Davoudi, 2012; Leichenko, 2011).

The transition within flood management toward flood *risk* management and flood *resilience* involves a shift from "government" to "governance" which reflects a move away from a state-run approach to one in which other organisations, agencies and individuals have an increased role (Mees, et al., 2016; Meijerink & Dicke, 2008). As part of this there is an emphasis on stakeholder engagement which is used to refer to any individual, or group of individuals, who are able to affect or is affected by projects and is involved in the project (Edelenbos, et al., 2017; Lupo Stanghellini, 2010; Freeman, 1984). This acknowledges the value of local stakeholders who possess both the knowledge and resources required to tackle the increasingly complex management of floods (Begg, 2018; Forrest, et al., 2017; Nye, et al., 2011; Johnson & Priest, 2008). This shift is evident in flood resilience strategies in the UK, with the *Flood Resilience Community Pathfinder scheme* for example, aiming to "enhance local responsiveness" and "ownership of flood risk" as part of flood resilience efforts (Mees, et al., 2016, p. 7) and the *Making Space for Water* strategy (DEFRA, 2005) which seeks to widen participation and community engagement (Begg, et al., 2015). In Greater Manchester, as part of the 100 Resilient Cities agenda, 'empowering a broad range of stakeholders' and 'engaging communities' are both identified as key action-areas within the framework (GMCA, 2017). However, when used in policy, stakeholder engagement is often used for responding to shocks and there is little emphasis on stakeholder engagement in 'proactive strategies' such as flood mitigation measures or infrastructure projects (Twigger-Ross, et al., 2015). Moreover, there is limited research investigating how stakeholder engagement is translated from flood resilience policies and strategies into practice.

In the coming decades Greater Manchester will need to respond to an increasing flood risk which is both complex and uncertain in nature. In order to do so, and as part of a wider transition in flood management, GM has started to shift away from a traditional, state-run flood management style towards flood *risk* management with an increasing emphasis on flood resilience. As part of this transition, there has been a shift from 'government' to 'governance' and stakeholder engagement is increasingly advocated within policy documents and project strategies as an important approach that utilises local knowledge, expertise and resources, as well as reducing resistance to projects in an increasingly complex society (Mees, et al., 2016; Peters & Pierre, 2001). Whilst increasingly recommended in theory, policy and project strategies, there is not enough research to demonstrate how stakeholder engagement is exercised in practice within flood resilience efforts, indicating a gap between theory and practice. In light of this, this research will aim to investigate how projects within GM are adopting the concept of flood resilience and whether there is a shift toward governance strategies that promote, encourage and facilitate stakeholder engagement.

1.1 RESEARCH QUESTIONS

Reflecting upon the challenges facing Greater Manchester and the current gap in research surrounding flood resilience interpretations and stakeholder engagement in practice, the aim of this research is to investigate how Greater Manchester is transitioning towards flood resilience and whether there has been a shift in stakeholder's perceptions toward stakeholder engagement over time. To guide this research the main research question is as follows: *How is stakeholder engagement understood, perceived and operationalised in flood resilience projects in Greater Manchester?* Addressing this research question, the following sub-questions will be used to guide this research:

I. How is flood resilience understood in theory?
II. How is flood resilience understood and operationalised in GM?
III. How is stakeholder engagement understood in theoretical understandings of flood resilience?
IV. How is stakeholder engagement perceived and operationalised in flood resilience projects in GM?
V. To what extent do theoretical understandings of flood resilience and stakeholder engagement correspond to how they are operationalised?
VI. To what extent do practitioners involved in flood resilience projects in GM consider stakeholder engagement an important strategy to be utilised within projects and do they think there has been a shift in perceptions toward stakeholder engagement in GM over time?

The following section will begin by exploring the evolution of resilience within the academic sphere and will be followed by current theoretical understandings of flood resilience. Subsequently the paper will address methods and measures to increase flood resilience and will be followed by a discussion on the operationalisation of flood resilience. Following on from this, the paper will continue by exploring how stakeholder engagement has evolved as a concept within the academic sphere and will discuss how stakeholder engagement practices differ and vary over time. The next section will begin to discuss the operationalisation of flood resilience. Reflecting upon theory and practice, a conceptual model will be used to illustrate how these concepts interrelate in an attempt to provide a framework which will be used as a basis for exploration and research into how stakeholder engagement is understood, perceived and operationalised within flood resilience projects in Greater Manchester.

2 THEORETICAL FRAMEWORK

2.1 EMERGENCE OF RESILIENCE

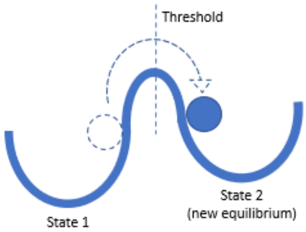
Resilience has a long and diverse history, stemming from the Latin *resilio, resi-lire,* meaning to bounce back (Alexander, 2013) and it was first used by physical scientists to denote the characteristics of a spring, describing its stability and resistance to external shocks (Davoudi, 2012). The resilience perspective emerged in ecological studies between the end of the 1960s and the beginning of the 1970s and was defined as "the persistence of relationships within a system and […] is a measure of the ability of these systems to absorb changes […] and still persist" (Holling, 1973, p. 17). Developed within predator and prey studies this definition emerged in an attempt to understand how ecological systems respond to disturbances (Folke, et al., 2010). In his definition, Holling (1973) identified multi-stable states and non-linear responses to change. However, around the time of his work, the dominant paradigm in ecology was largely based on the assumption of one steady-state equilibrium and consequently much of Holling's work was opposed. As a result, work in ecology continued with the assumption of one equilibrium state and resilience was interpreted as the ability of a system to *return* to its equilibrium state following a disturbance (Folke, et al., 2010), a concept now referred to as *engineering resilience* (Holling, 1996). Engineering resilience largely measures resilience as the time taken for the system to return to its pre-disturbed state, with increased resilience implying a quicker response period (Pimm, 1991). This engineering perspective of resilience is still apparent in various ecology fields today, with examples such as recovery from coral bleaching measured by its recovery rate and speed of return to its previous state (Halford, et al., 2004).

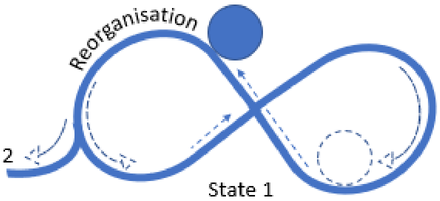
Applying this narrow, engineering definition of resilience to the context of flooding, however, would assume that the goal of recovery is to return to a pre-disturbed state and, if applied in reality, would lead to a reproduction of pre-disturbed vulnerabilities that were susceptible to flooding (Twigger-Ross, et al., 2014). Thus, the engineering resilience definition, based on a static equilibrium, provides little insight into the behaviour of systems that are non-linear and are not near an equilibrium state (Holling, 1973). Simplistically put, static equilibrium systems are closed, simple systems with no internal sources of change (Buckley, 1968). Cities, however, can be described as complex adaptive systems which are non-linear and dynamic in nature (Holland, 1995) and so applying an engineering resilience perspective to the flood resilience of a city would be inappropriate. Ecological resilience on the other hand does accept that there are multiple possible stable states which a system can return to, proposing that a system may reorganise while undergoing change (Walker, et al., 2004). However, ecological resilience, as described by Holling (1995) and more recently by Walker et al. (2004) suggests that a system must retain essentially the same function and structure, and so an ecological resilience definition is not able to deal with a system that is able to change its structure over time (Scheffer, 2009), something that is an inherent property of a complex adaptive system such as a city.

Considering these limitations, a socio-ecological interpretation of resilience, sometimes known as evolutionary resilience (Davoudi, 2012), adds depth to the former ecological resilience definition and acknowledges that the properties and structure of complex adaptive systems are able to change (Folke, et al., 2016). This definition is also more relevant to flood resilience as it considers the interdependency of human and ecological systems rather than seeing human actions as external drivers of ecological systems (Folke, et al., 2010). In this definition of resilience, social change is seen as essential and adaptability and transformability are seen as key ingredients of resilient thinking (Folke, et al., 2010). In this sense adaptability can be understood as the capacity of actors in a socio-ecological system to learn from uncertainty and surprise by adjusting responses and developing *within* the current stability domain (Folke, et al., 2005; Berkes, et al., 2003). By contrast, transformability is the capacity to create a fundamentally new system when the existing structure of the system is no longer defendable, essentially changing the structure of the system by introducing new components and variables (Folke, et al., 2005; Walker, et al., 2004). Socio-ecological resilience is not concerned with a return to normality but rather focuses on maintaining the function of the system so that the system will persist (Spaans & Waterhout, 2017). The three interpretations of resilience have been summarised below in Figure 1.

***Figure 1**. Summary of interpretations of engineering, ecological and socio-ecological resilience.*

<table>
<tr><th>Engineering resilience</th><th>Ecological resilience</th><th>Socio-ecological resilience</th></tr>
<tr><td>


</td><td>


</td><td rowspan="2">


Adaptive cycle: adapted from Gunderson and Holling (2001) illustrating a dynamic system in a constant state of adaptation and reorganisation with the possibility of transformation into an alternative stable state (state 2). The ball represents the state of a system in any given time, with the model illustrating that the system is in a constant state of change.
</td></tr>
<tr><td colspan="2">*Engineering resilience and ecological resilience:* Ball-and-cup model adapted from Holling (1996). The ball represents the state of the system at any given time and the cup represents the region in the state space which the systems tends to remain (Liao, 2012). Engineering resilience assumes only one state of the system at any given time and so the bottom of the 'cup' represents the ideal stable state. Ecological resilience assumes multiple states in which the system can cross the threshold which marks the limit of the original state (Folke, et al., 2010) and enters a new state.</td></tr>
<tr><td>Engineering resilience can be measured by time taken to return to previous state, emphasising that a system has a single stable state.</td><td>Focuses on the persistence of an existing system but acknowledges that the system may adapt and that it has multiple stable states.</td><td>Considers the system within a dynamic state, acknowledging that adaptation and transformation are integral to the persistence of the system. Acknowledges the interconnected nature of social and ecological systems.</td></tr>
</table>

2.1.1 FLOOD RESILIENCE

The application of resilience in hazard management, and consequently flood management, is a relatively recent phenomenon (Berkes, 2007). Since its uptake, there has been a rapid increase in the use of resilience in both theory and practice, however, what defines resilience to floods remains fairly ambiguous and where used by practitioners is done so on a loose basis (Liao, 2012; Berkes, 2007). In hazard management, engineering resilience prevails as the basis for resilience interpretations, with many defining resilience as the capacity to withstand and recover quickly from disasters (Liao, 2012). In flood hazard management for example, resilience is often used in a way which places an emphasis on recovery rate, described as the "rate of return from a state where flood impacts are clear to a normal state" (de Bruijn, 2004, p. 201). However, as discussed previously, using an engineering resilience definition implies a return to pre-disaster state which leads to reproduction of pre-flood vulnerabilities (Twigger-Ross, et al., 2014). Moreover, an engineering perspective implies that there *is* an optimal state to return to, which is something that does not exist in complex socio-ecological systems (Berkes, 2007). An urban environment for example, can be described as a complex adaptive system and so there is not an optimal state in which it resides but rather an evolving system which is dynamic, nonlinear and uncertain in nature (Liu, et al., 2007). Defining the flood resilience of an urban system must therefore move past the dominant ideology in hazard management, which takes an engineering resilience standpoint and seek to incorporate the complex socio-ecological relations within an evolving system.

Considering alternative definitions of resilience, it could be suggested that a socio-ecological resilience definition, focusing on multi-equilibria, complex socio-ecological coupling and persistence in a world of flux, provides a more appropriate framework for flood resilience (Liao, 2012; Adger, et al., 2005). From this perspective, resilience emphasises the accommodation of flooding and living with water, contrasting the traditional flood management discourse based on resistance (Vis, et al., 2003). For some, this involves acknowledging periodic floods as inherent environmental dynamics and accepting that a flood event is effective in helping a city develop knowledge and coping strategies over time (Liao, 2012; Folke, 2006; Smit & Wandel, 2006). This challenges the dominant perspective that floods are terrible, threatening events and rather places an emphasis on preparing society to cope with floods and reduce risk (Liao, 2012). Flood resilience based on a socio-ecological definition emphasises the influence of the social side of flooding, acknowledging both the influence of people upon flooding and the impact flooding has on people. Urban resilience to floods can therefore be defined as the capacity of the city to *tolerate* flooding whilst aiming to prevent damage to infrastructure and people and maintaining the city's current identity (Liao, 2012; Vis, et al., 2003).

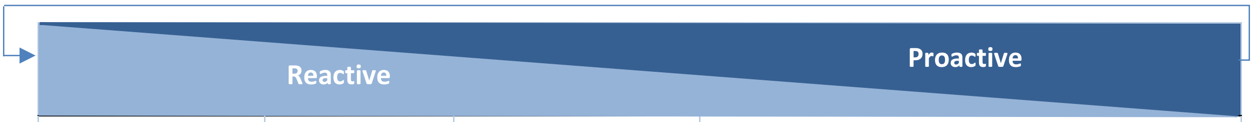
Based on these key ideas from a socio-ecological definition of resilience and an understanding of flood resilience as defined above, flood resilience can be understood in relation to the adaptive cycle as developed by Gunderson and Holling (2001) and illustrated in Figure 1. In this sense, a city or region can be understood as a complex adaptive system because it is in a constant state of flux and is continuously adapting and reorganising its structure (Holland, 1995; Liu, et al., 2007). For example, a city is constantly implementing and changing physical flood defences in response to increased urbanisation or external pressures such as climate change. The city also has the capability of transforming, so that it changes its structure but still maintains its identity. This rapid change could for example be triggered by a large flood event, such as was demonstrated by the 1953 floods in the Netherlands which led to major changes in flood defence (Zevenbergen, et al., 2013); or could be triggered by a change legislation, such as the Scottish 2003 Water Environment and Water Services Act (SUSdrain, n.d.) which enforced inclusion of SuDS into all new developments. A city or region which aims to be flood resilient should therefore be able to adapt and transform, changing its structure to reduce the risk and consequences of flooding. A city should also remain robust, utilising measures that protect people, infrastructure and the identity of the city from being destroyed. Thus a socio-ecological definition of defining resilience to flooding is seemingly applicable for the flood resilience of a city, however there is limited research within this domain with even fewer practical methods for real-world application (Carpenter, et al., 2005; Folke, 2006).

2.1.2 FLOOD RESILIENCE OVER TIME

When considering the measures to be taken to improve flood resilience, it is important to consider the temporal context as it helps to distinguish between various measures and methods to improve flood resilience. Following a similar approach to other flood resilience literature (e.g. Messer, 2013; Forrest, et al., 2019) this paper identifies a flood event as the central time component of analysis. Two time periods, one before and one after the flood event, are then identified as important periods which can be used to differentiate between methods of response. The former refers to the time period in which a flood event has been anticipated, which could be signalled by a previous high rainfall event or a weather forecast for example. The latter refers to the time period shortly after the flood event in which an emergency response has to be carried out to protect people and infrastructure from damage. Following the emergency response period, some literature distinguishes between a *recovery period* and a *disaster risk reduction period*, suggesting recovery methods after a flood event are separate processes to reducing future risk (Messer, 2003; Thieken, et al., 2007). However, taking a more integrated resilient approach, this paper suggests that the two processes should be part of the same effort, as building and thus recovering infrastructure should be done in a manner which reduces future risk. This paper will therefore identify one time period following the emergency response, before another flood event is anticipated. This time period will incorporate and integrate recovery and risk reduction in which adaptation and transformation will be key components (Figure 2).

Following this logic, this paper identifies two broad categories of responses, *proactive* and *reactive,* which can be placed within the temporal context as shown in Figure 2. Drawing off the distinction made my Dovers and Handmer (1992), and later by Twigger-Ross (2014), proactive measures refer to those which make the system more capable of adapting to new conditions, highlighting the need to adapt and transform in response to shocks and stresses. The definition of reactive measures used in this paper will diverge from Dover & Handmer's (2012) (and Twigger-Ross's, 2014) understanding which emphasises the importance of maintaining status quo and stability which, as discussed previously, may not improve resilience. Reactive measures in this paper will therefore be used to describe processes which react to a flood event (or an anticipated event) to reduce the vulnerability and maintain the safety of individuals through protection of people and property. This aspect will be largely based on *robustness*, defined as the ability of local structures and infrastructure to withstand the floods, and is largely dependent on proactive measures (Forrest, et al., 2017; Restemeyer, et al., 2015). Following this logic, proactive measures may include flood *risk* reduction and mitigation measures such as green infrastructure which decreases surface runoff and mitigates processes such as climate change (Zimmermann, et al., 2016; Demuzere, et al., 2014). Reactive measures on the other hand, immediately before, during and after a flood event include measures such as using an early warning system (which has been developed as a proactive measure), which aims to protect people and infrastructure from serious damage (Konečný & Reinhardt, 2010). Examples of methods and measures of increasing flood resilience in relation to the above derived time categories and type of responses have been illustrated below in Figure 2.

Figure 2. *Examples of methods to improve flood resilience in relation to time (references in table).*



Anticipate flood event	**Flood event**	Emergency Response period	Integrated recovery and risk reduction period
Engaging emergency response systems, e.g. setting-up demountable defences (Gilissen, et al., 2016)	Civil protection, e.g. utilising fire brigade to evacuate and rescue (Schelfaut, et al., 2011)	Reducing the immediate impacts of flooding and restoring function of system, e.g. repair flood damaged buildings (Messer, 2003)	Mitigation through spatial design- e.g. 'Green-Rivers' (Vis, et al., 2003) Improving community awareness of and preparedness, e.g. supply of sandbags (Schelfaut, et al., 2011).
Robustness (maintaining the function of the existing structure)			Adaptation/Transformation (incremental changes with the existing structure/ major shifts which change the existing structure)

It must be emphasised here that the responses undertaken within each time category will be context dependent and influenced by a number of spatial factors including how flood resilient a city is. For example, a city which has few flood resilience measures in place and is in the early stages of improving resilience may have to employ more resistance-based measures such as a temporary flood barrier as a reactive measure to protect property; whereas, a city which has heavily invested in proactive resilient measures, such as a 'green river' (see Vis, et al., 2003), may rely upon this infrastructure to protect property and people from flood damage. Thus, there is an important relationship between proactive and reactive measures, with the latter largely underpinned by proactive approaches. However, there is not always an easy distinction between resistance and resilience and there are 'grey areas' in which a measure could be considered as both resistant and resilient. For example, a flood basin is a resilient measure as it reduces the consequences and risk of a flood event and is able to adapt and transform to future change; but it is also arguably a resistance approach as it prevents water from entering and flooding the entire flood plain. It should also be highlighted here that flood resilience is both a process and an outcome, where improving flood resilience is a process in its own right and the outcome of flood resilience an ideal state. This ideal state or *utopian flood resilient city* is one in which a flood event is not a 'disaster' but rather a change in conditions which does not result in damage to infrastructure or people.

2.1.3 OPERATIONALISING FLOOD RESILIENCE

The rapid emergence of the resilience concept, in conjunction with the number of potential resilience interpretations, has led to a lack of clarity of flood resilience in policy, where conceptual differences are not acknowledged and resilience is discussed as a singular, optimistic but generally vague term (Restemeyer, et al., 2018; White & O'Hare, 2014). In practice, flood managers find it a difficult concept to operationalise as there is little research surrounding the issue and thus ways of enhancing it are insufficiently known (Restemeyer, et al., 2018; Schelfaut, et al., 2011). This lack of guidance is apparent through a privileging of short-term approaches, in line with engineering resilience interpretations, that focus on a return to normality and include measures such as hard-engineering responses; in lieu of longer-term, transformative measures that are underpinned by socio-ecological definitions emphasising the need to transform and adapt (White & O'Hare, 2014). This is evident in a number of hazard and flood resilience definitions which are akin to engineering resilience, emphasising the importance of quick recovery from the impacts of natural hazards or disasters (e.g. Lamond & Proverbs, 2009; Godschalk, 2003). Birkland & Waterman (2009) for example, propose three features of resilience: speedy recovery, damage prevention and preservation of community functionality, emphasising that the more stresses a community is capable of withstanding, the faster the rate of recovery, which is seemingly in line with an engineering, rather than socio-ecological definition of resilience.

Resilience as a concept from the natural sciences, runs the risk of neglecting the influence of politics and power relations within the planning process which could affect the operation of flood resilience in practice and could lead to a lack of consideration of who are the winners and losers (White & O'Hare, 2014; Davoudi, 2012). In ecological literature, ecologists often discuss the idea that in nature there are "no rewards or punishments, just consequences" (Westley, et al., 2001). In society however, there are rewards and punishments as some people will gain and others will lose in the process of building resilience (Davoudi, 2012). For example, building a green space in a city to reduce flood risk, as was done in Bangkok as part of the 100RC programme, was done so at the expense of local residents as it was carried out through evicting poor slum dwellers from their homes (Laeni, et al., 2019). Thus, increasing flood resilience for some, may be exclusive of, or even detrimental to others, leaving vulnerable individuals and communities exposed to risk (White & O'Hare, 2014). It is thus important that issues of justice and fairness are considered within the flood resilience strategy and both policy makers and practitioners consider how the burdens and benefits of a flood resilient scheme will be distributed, ensuring that the marginalised are not further marginalised.

Despite the challenges facing theorists and planners, there have been a number of theoretical attempts to operationalise resilience in practice (Balsells, et al., 2015). Using different approaches, studies and policy documents have developed tools, methods and detailed objectives to better understand current levels of flood resilience and identify how practitioners can integrate flood resilience into practice (Ibid; Restemeyer, et al., 2015; Spaans & Waterhout, 2017). The 100RC project, for example, has developed a coherent model of resilience which illustrates a number of categories, indicators and qualities involved in identifying and increasing resilience (Spaans & Waterhout, 2017; ARUP, 2014). In Greater Manchester, as part of the spatial strategy, a series of goals and objectives have been set out which aspire to improve the flood resilience within the area (GMCA, 2019). Whilst models and frameworks provide researchers with more operationalizable theoretical grounding, there is little guidance provided to help researchers select the most appropriate model or framework to work from. Moreover, many of the frameworks provide such a large number of categories and indicators (ARUP, 2014) that, whilst coherent and integrated, provide too many areas to focus on which may bring decision makers back to square one-not knowing where to begin.

2.2 STAKEHOLDER ENGAGEMENT

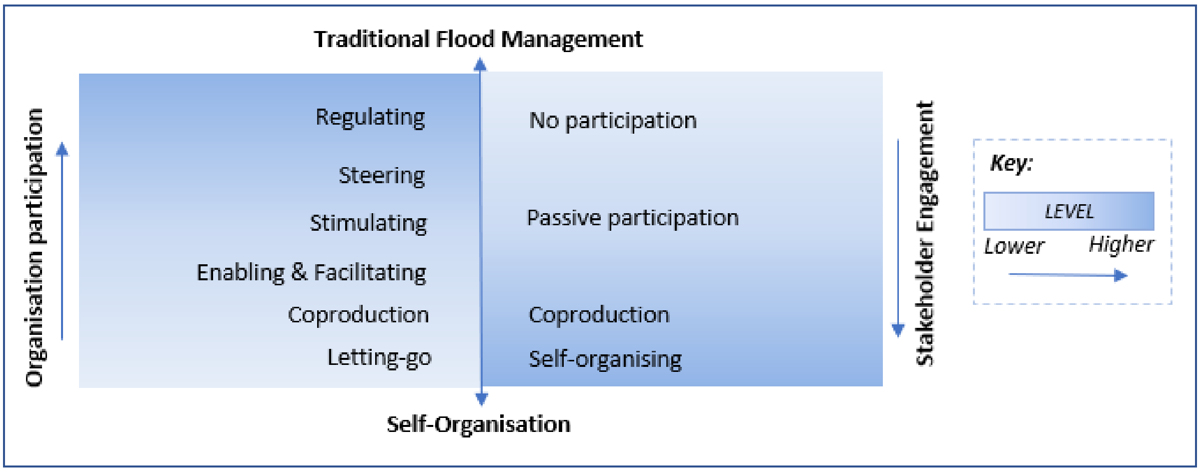
In line with a transition toward flood risk management and flood resilience, there has been a gradual shift away from exclusively top-down interventions managed by a narrow expert group, toward more inclusive and participatory approaches (Edelenbos, et al., 2017). Whilst traditionally the state has been perceived as responsible for flood management (Van Buuren, et al., 2012), a number of pressures, such as climate change and wider societal shifts, such as the disintegration of economic and governance relations (Jessop, et al., 1991), have led to a move by the state toward shared flood responsibility across different levels of society (Begg, 2018; Thaler & Priest, 2014). This is in line with a broader shift in planning theory, in what Healey (1996) would describe as a 'communicative turn', which involves an increasing appreciation of the importance of knowledge and discussion within the public realm and an acknowledgement of the capability of collaboration. In flood risk management this shift is discernible by the increasing number of published policy and academic papers, which recognise that individuals have a huge influence in reducing flood risk and demonstrate the increasing incorporation of participation and stakeholder engagement in practice (Thaler & Levin-Keitel, 2016; Challies, et al., 2016). In 2007 for example, the European Floods Directive (2007/60/EC) made it a legal requirement for countries to incorporate participation within the management of floods in Europe, and in the UK, there has been a growing interest in participation from both government and academia, and is increasingly advocated in practice (Begg, 2018; Thaler & Levin-Keitel, 2016).

The transition toward increased stakeholder engagement is rooted in the assumption that it will lead to better decisions and plans and that it will have beneficial outcomes for society (Lupo Stanghellini & Collentine, 2008; Beierle & Cayford, 2002). By involving a broader range of societal actors within flood resilience projects, there will be an increase in knowledge, perceptions and innovations that can be incorporated into the decision-making process, enhancing the quality of the decisions (Edelenbos, et al., 2017; Michels, 2011; Lupo Stanghellini & Collentine, 2008). Moreover, including more actors aims to improve the democratic legitimacy of the process, which will improve the relationship and trust between individuals and decision-makers and increase the acceptance of decisions and strategies, potentially strengthening flood resilient strategies in practice (Mees, et al., 2014; De Boer & Zuidema, 2014). Giving individuals more responsibility can also reduce barriers for implementation, such as limited resources, capacities and institutional uncertainty, as individuals can contribute valuable resources and knowledge that governments and decision makers lack (Adger, et al., 2009). Individuals also have the potential to implement flood resilient approaches and contribute to the overall flood resilience of a city *independently* of the state or 'flood expert' through, for example, nature-based approaches such as tree planting or through active involvement within community flood groups (Forrest, et al., 2019).

Forms of stakeholder engagement that act to increase flood resilience independently of central-control, exemplify self-organising forms of action, which has received increasing attention in the last few decades (Thaler & Priest, 2014) and is arguably at the opposite end of the spectrum to traditional state-led, top-down flood management approaches (see Figure 3). The concept of self-organisation emerged from complex systems thinking (Wagenaar, 2007) and was originally used to describe the emergence of 'order' out of 'chaos' (Prigogine & Stengers, 1984). Since then the concept of self-organisation has not remained exclusively within natural sciences and has increasingly influenced social sciences and policy making (De Roo & Silva, 2010; van Meerkerk, et al., 2013). In this sense, self-organisation can be defined as the 'emergence and maintenance of structures out of local interaction' (Edelenbos, et al., 2016, p. 2; Cilliers, 1998; Heylighen, 2001). Drawing of these definitions, self-organisation will be used in this paper to refer to *bottom-up initiatives that are initiated and led by local community actors and groups that directly or indirectly advance flood resilience*. It could be argued that self-organising flood resilient groups are one of the most important ways of increasing flood resilience, because they are flexible and therefore able to adapt quickly to changing circumstances, important in the face of climate change (Forrest, et al., 2017). Moreover, by working on a local level, self-organising initiatives are able utilise and incorporate local factors in a more area-based approach (De Boer & Zuidema, 2014).

Whilst traditional participation terminology, such as *public participation,* is grounded in the assumption that citizens can only participate in government initiated and structured policy making (Mees, et al., 2019; Bekkers, et al., 2014); *stakeholder engagement* is a concept which attempts to encompass all forms of stakeholder engagement, notably including self-organising initiatives where the motivation comes from citizens and stakeholders themselves (Edelenbos, et al., 2017). From this perspective, stakeholder engagement as a concept is more focused than public participation as it emphasises the deep personal engagement of the decision-making process (Lupo Stanghellini, 2010; Beierle, 2002). Within the umbrella of stakeholder engagement there is a range of different formats or levels of stakeholder engagement, where on the one hand the government/institution dictates the project decisions, with no or very low levels of stakeholder engagement; and on the other is self-organisation where stakeholders have full responsibility and control of decisions and seemingly high levels of stakeholder engagement. Between these two levels there are a number of other methods of measures of stakeholder engagement, as displayed in Figure 3, such as *passive participation*, where the initiator defines the scope, methods and moments of participation, and *coproduction*, where stakeholders and governments work collaboratively to achieve a shared vision (Edelenbos, et al., 2017). Stakeholder engagement will therefore be used in this paper to describe *any individual, or group, who is able to affect or is affected by projects and is involved in the project* (Edelenbos, et al., 2017; Lupo Stanghellini, 2010; Freeman, 1984).

Figure 3. *Levels of stakeholder engagement and corresponding organisation participation, respective of traditional flood management and self-organisation extremes (Roles of government and stakeholders adapted from Mees, et al.'s (2019) ladder of government participation and corresponding roles, pg. 3).*



Alongside the different forms of stakeholder engagement lie the corresponding roles of government/organisations, as the shift toward increased stakeholder engagement influences a transition in governance structure toward a more network based form of decision making, where the government shift from a regulating and steering role to a more collaborative and responsive role where they enable and facilitate citizen initiatives (Mees, et al., 2019; Michels, 2011; Lupo Stanghellini & Collentine, 2008). As is illustrated in Figure 3, there are various stages between full government control and 'letting go' whereby self-organising groups are given full responsibility and control of flood resilience (see Mees, et al., 2019). It is important to note here that there are a range of circumstances that require different governance structures and it should be recognised that self-organising groups, accompanied by the 'letting-go' of responsibility, is not appropriate for all situations as local stakeholders are not always willing or do not always have the ability to act where needed (Zuidema, 2016). For example, for problems that span multiple boundaries, such as climate change, it is perhaps more effective and efficient for government to enforce rules and regulations to guarantee change, rather than relying on citizens for mitigative and adaptive measures. It could therefore be suggested, that whilst there is a transition alongside flood resilience towards increased stakeholder engagement, it should not be assumed that this is always the most appropriate technique for every flood resilient measure and that the role of the government should not be dismissed entirely from flood resilience measures.

Whilst stakeholder engagement is increasingly advocated in literature and policy, experiments have illustrated that stakeholder engagement often does not immediately yield the results initially hoped for, as there are a number of barriers that limit its effectiveness in practice (Tseng & Penning-Rowsell, 2012). Stakeholder engagement, for example, is often perceived as a threat to the decisive and uncompromised action that is needed for flood management and it is considered that citizens for example, may "contribute to the problem rather than add in the solution", as the engagement process itself requires time and resources (Warner, 2006; Pearce, 2003, p. 218). The process of stakeholder engagement is also open to power imbalances and may lead to the domination of powerful stakeholders, allowing them to dictate decisions, which may lead to further marginalisation of the most vulnerable in society (Lukes, 2005). Stakeholders also do not have equal social capacity and not all stakeholders are willing or capable to contribute to the decision-making process, with research showing for example that the wealthier and more educated stakeholders are more inclined to be involved in flood risk management (Jakobsen & Andersen, 2013; Kuhlicke, et al., 2011). Furthermore, there is often conflict between experts and citizens due to different perceptions, ideas and points of interest, which has the potential to hinder or slow down the decision-making process (Menzel & Buchecker, 2013; O'Toole, et al., 2013). However, whilst stakeholder engagement is a complex process and is confronted by a series of barriers, it is important that these critiques are not used to dismiss stakeholder engagement but rather should be understood and tackled to strengthen the process of stakeholder engagement, as it still has the potential to improve acceptance of flood resilience strategies and increase flood resilience.

2.2.1 STAKEHOLDER ENGAGEMENT OVER TIME

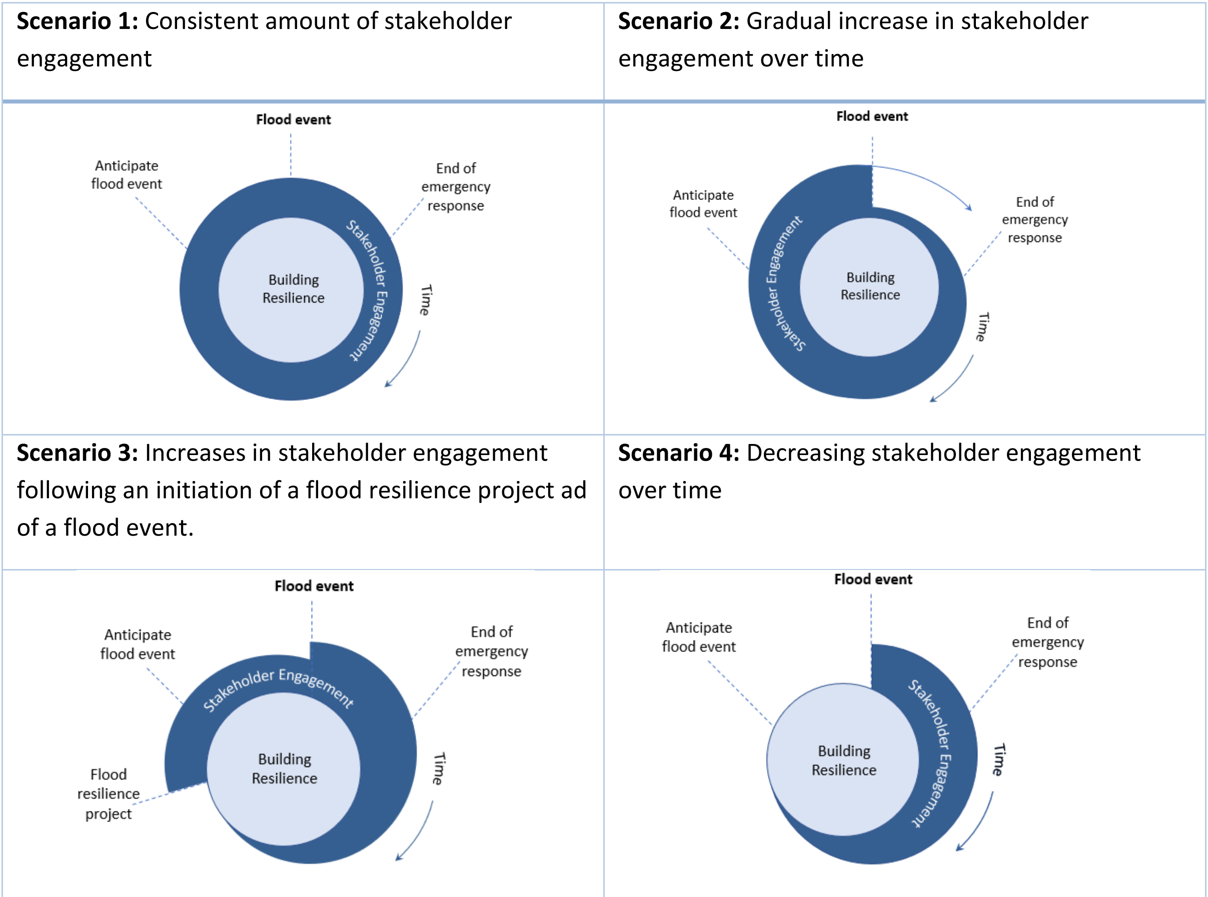
When considering different measures and methods of stakeholder engagement, an important way to distinguish between them is to consider them in relation to time. Following a similar approach to that discussed previously- in relation to the various methods of increasing flood resilience (section 2.1.2), the flood event will be identified as the central time component of analysis, with two distinct time periods, one before and after the flood event identified as *anticipation of flood event* and *end of emergency response*. From here reactive and proactive measures will be used to distinguish between type of response, with the former including *anticipation of flood event, during flood event and emergency response period*; and the latter including *integrated recovery and risk reduction period*. Once a flood event has been anticipated for example, local stakeholders such as residents may act by warning others of the potential hazard event, improving resilience by increasing preparedness. During a flood event, stakeholders may become engaged by evacuating the most vulnerable members of society, protecting people from harm. After the emergency response for example, stakeholder engagement may be through proactive measures such as educating people about the risk of flooding, preparing locals for the next imminent flood. These exemplify a few methods of stakeholder engagement that aim to increase flood resilience and are distinguishable by their temporal relation to the flood event as has been further illustrated in Figure 4 below.

Figure 4*. Examples of methods of stakeholder engagement in relation to time.*

Reactive			Proactive
Anticipate flood event	**Flood event**	Emergency Response period	Integrated recovery and risk reduction period
Civil society actors issue flood warnings and erect temporary barriers (Forrest, et al., 2017). Evacuations planned and led by community groups (Lindell & Perry, 1992; Sorensen & Sorensen, 2007).	Flood wardens and voluntary teams directing people to protect property and evacuate residents from flood prone areas (Forrest, et al., 2017; Taylor, 2015). Individuals or community groups to patrol and maintain dikes (Wachira & Sinclair, 2013).	First line of flood relief provided by community-based organisations, e.g. as first responders (Nishat, et al., 2000; Masterson, et al., 2014). Role of citizens as first responders- e.g. procuring rescue equipment (Wachira & Sinclair, 2013).	Civil society-run flood groups (Trell, et al., 2014). Stakeholder involvement in flood alleviation schemes and community-led efforts in schemes (Nye, et al., 2011; Lane, et al., 2010). Role of public in encouraging land use change to reduce flood risk- e.g. encouraging wetland restoration or afforestation (Rouillard, et al., 2014).
Robustness			Adaptation/Transformation

As discussed, there are various levels of stakeholder engagement (Figure 3) and different methods and measures of stakeholder engagement dependent on the temporal context as illustrated in Figure 4. Considering a longer-term perspective on stakeholder engagement, it can be suggested that the amount of stakeholder engagement can vary over time as stakeholders react to their external surroundings. Whilst there is limited research on the long-term changes in stakeholder engagement, scholars have suggested that experiences such as a flood event or a change in policy can lead to a change in stakeholder engagement (Thaler & Seebauer, 2019; Forrest, et al., 2019). Working from the assumption that stakeholder engagement changes over time in response to internal and external influences, a set of scenarios have been thought out and illustrated below in Figure 5 which visually demonstrate how stakeholder engagement may change over time. Scenario 1 represents a consistent amount of stakeholder engagement where the number of stakeholders engaged in flood resilience projects and programmes does not decrease or increase over time. Scenario 2 represents a situation where stakeholder engagement gradually increases over time which could be influenced by something like a change in regulation which may make it compulsory to engage stakeholders in new flood resilience projects. Scenario 3 illustrates a combination of two scenarios, where the initiation of a flood resilient project provides a catalyst for stakeholder engagement and then a subsequent flood event acts to further increase stakeholder engagement. Finally, Scenario 4 illustrates decreasing stakeholder engagement over time, whereby time after a flood event increases and stakeholders become more complacent as the flood risk becomes a seemingly distant threat

Figure 5. *Potential changes in Stakeholder engagement over time.*



2.2.2 OPERATIONALISING STAKEHOLDER ENGAGEMENT IN FLOOD RESILIENCE

In recent decades there has been a growing appreciation of stakeholder engagement and this is increasingly reflected though the incorporation of stakeholder engagement within multiple levels of policy strategies and programmes related to flood management and resilience. On a European level, stakeholder engagement was incorporated into the EU Floods Directive (2007/60/EC) which states that the public should be fully informed and interested actors should be given opportunity to be involved within the whole process (Newig, et al., 2014). In England, the state's resilience agenda promotes engagement, so that communities have the capacity to "absorb, recover and adapt" and live with floods responsiveness (Mees, et al., 2016, p. 7). Within the UK, the Environment Agency aims to devolve power and responsibility toward local citizens and promote self-organising flood groups to improve flood resilience (Thaler & Levin-Keitel, 2016). In England, policy encourages and creates possibilities for engagement, giving citizens more space and responsibility and creating new funding to give them more opportunities for engagement (Thaler & Levin-Keitel, 2016). Within flood resilient strategies, devolving responsibility is evident in strategies, with the Flood Resilience Community Pathfinder Scheme aiming to engage citizens and enhance local responsiveness (Mees, et al., 2016). In Greater Manchester, engaging citizens is emphasised within key action areas as part of the 100 Resilient Cities agenda (GMCA, 2017).

Whilst stakeholder engagement is increasingly advocated in policy documents and frameworks for flood resilience, there is limited research investigating whether these aims are translated into practice. Where studies do exist, they often consider stakeholder engagement in flood resilience strategies in relation to reactive measures, such as involving citizens in improving risk awareness and preparing homes for a flood event, such as with sandbags (Twigger-Ross, et al., 2015; Schelfaut, et al., 2011). Studies are beginning to emerge which investigate stakeholder engagement within proactive measures and flood resilience strategies, however, as was revealed by Laeni et al., (2019), in practice citizens are not always included in the decision-making process, contradicting the inclusive ambition of the 100RC framework, which in turn can result in adverse consequences for vulnerable citizens. Whilst there is not an extensive amount of research within this area, the studies that do exist are beginning to illustrate a gap between theory and practice. This research will therefore aim to further the understanding of how stakeholder engagement is operationalised and conducted in practice in an attempt to better understand how policy makers and practitioners can encourage and improve stakeholder engagement within food resilience strategies.

2.3 CONCEPTUAL FRAMEWORK

The conceptual model as is illustrated below in Figure 6, incorporates information from the previous discussion and demonstrates methods of stakeholder engagement that seek to increase flood resilience. The methods identified have been categorised in relation to time around a flood event, distinguishing between reactive and proactive measures of flood resilience. It must be noted here that the examples given in the model below are not comprehensive of all potential methods of stakeholder engagement within a flood resilience project and rather serve as examples to help further the understanding of what these could entail. The basic framework of this model will be used in this paper to illustrate how the three selected case selected operationalise stakeholder engagement.

Figure 6. *Conceptual model illustrating examples of different methods of stakeholder engagement within flood resilience in relation to time.*

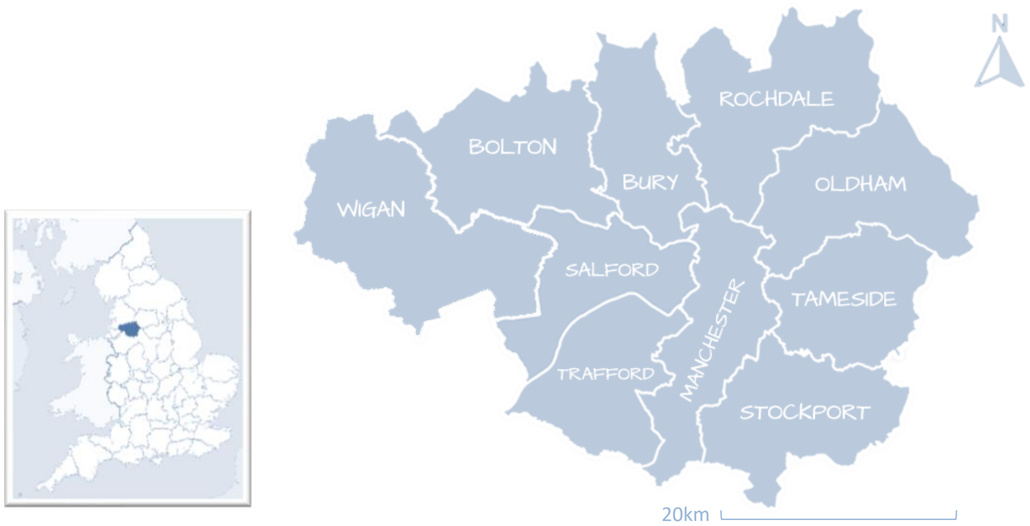
	Reactive			Proactive
	Anticipate flood event	**Flood event**	Emergency Response period	Integrated recovery and risk reduction period
Stakeholder engagement operationalised in a flood resilient project	Preparedness, monitoring and activating emergency response systems.	Safeguarding people and protecting infrastructure.	Reducing the immediate impacts of flooding and restoring function of system.	Engagement in mitigation projects, preparation efforts, flood groups and education.
	Robustness			Adaptation/Transformation

3 METHODOLOGY

3.1 GREATER MANCHESTER

Greater Manchester (GM) is a large city-region in the North-West of England and comprises of ten metropolitan boroughs as displayed in Figure 7. The city grew rapidly in the 19th century during the industrial revolution and was known as the global centre of the cotton industry (GMCA, 2017). Since the industrial decline, GM has emerged to be the economic capital of the North West of England and, with a population of around 2.7 million, is the second most populous urban area in the UK (Ibid.). GM consists of three river catchments, the Irwell, Upper Mersey and Mersey Basin and within the city-region almost 62% of land is characterised as urban (Smith & Lawson, 2012). Floods have become a growing problem in GM as the last few decades have seen an increase in flood events and associated economic costs (Kaźmierczak & Cavan, 2011). This is further threatened by climate change and population predictions which project increases in high intensity precipitation events (Cavan, 2018) and population numbers (Nash, 2018). In line with a paradigm shift in flood management in the UK, a shift in flood management is evident in GM, moving towards flood risk management and flood resilience, reflected in the GM's most recent spatial framework (GMCA, 2019) and adoption of the Rockefeller's 100 resilient cities programme (100 Resilient Cities, n.d.).

Figure 7. *Map of Greater Manchester within the UK and the Greater Manchester boroughs (adapted from-Ordinance Survey OpenData, 2010 and NHS, n.d.).*

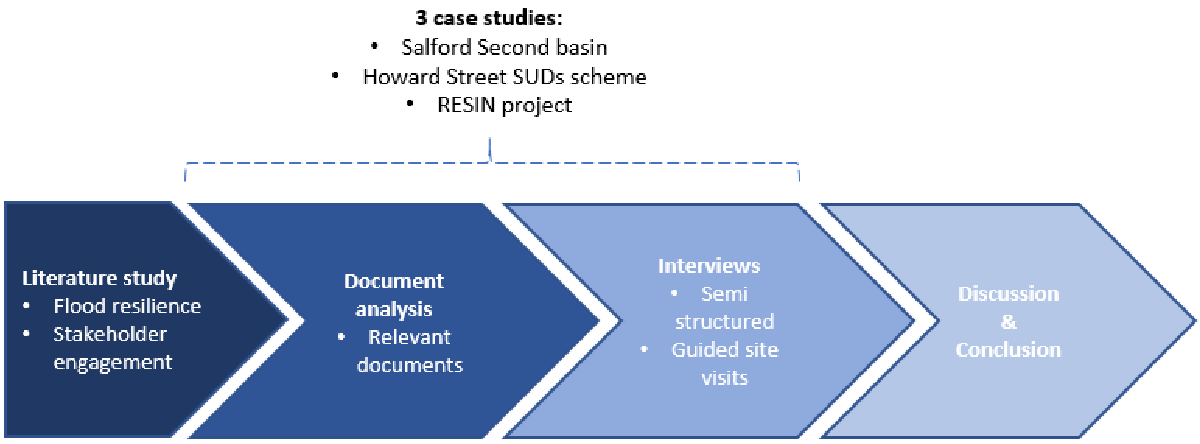


To gain insights into flood resilience projects and investigate how stakeholder engagement is understood, perceived and operationalised, three projects within Greater Manchester have been selected and will serve as case studies for analysis. This number of cases was selected due to the scope of the thesis, as a larger sample could compromise the quality of the data collected and three cases provide a coherent insight into projects in GM. The first criteria for selecting each project was that its aims included increasing flood resilience within GM. Following this, the three cases were chosen based on their diversity, both in scale and approach, providing a more complete outlook on GM flood resilience programmes and projects. The *Second Salford basin* (SSB) was selected as it is a large-scale project with many stakeholders which aims to reduce flood risk, while at the same time provides multiple benefits for the local community (Environment Agency, 2014; University of Salford Manchester, 2018). The *Howard Street SuDS* (HSS) scheme, a small-scale urban approach was selected due to its smaller size and because of its use as an experimental, demonstration study (City of Trees, n.d.; SUSdrain, n.d.). Finally, the RESIN project, a three and a half year interdisciplinary, research-based project, was selected as it was a European project, with a strong strategic focus and direct focus on improving resilience (The University of Manchester, n.d.; RESIN, 2018). The three projects serve as case studies that differ in scale, approach and style and thus offer various perspectives into flood resilience projects in GM.

3.2 RESEARCH DESIGN

To answer the research questions as laid out in 1.1, a mixed-method approach was applied. This consisted of a literature study, document analysis and in-depth, semi-structured interviews with key actors involved in the three case studies as is illustrated in Figure 8 below. The interviews were also substantiated with site visits, providing maps and photographs to better understand the context surrounding the case studies. The framework and models presented in the previous chapter, built off a literature study of flood resilience and stakeholder engagement, were used as reference points to illustrate how stakeholder engagement is operationalised within the three case studies and how stakeholder engagement is shaped and can change over the long-term. The findings from the literature review were compared against the results from the three case studies in an attempt to consider whether theoretical interpretations of flood resilience and stakeholder engagement correspond to how the concepts are understood and operationalised within Greater Manchester. By choosing a mixed-method approach, this research applied a combination of data collection techniques that enabled both quantitative and qualitative analysis which will aim to provide a coherent understanding of flood resilience and stakeholder engagement in Greater Manchester.

Figure 8. *Research strategy.*



3.2.1 LITERATURE STUDY

The literature study performed in chapter 2, provided a basis for the research in this paper. The literature used provided context to flood resilience and stakeholder engagement, introducing their emergence and adoption in theory and practice. The literature study was also used to answer how both flood resilience and stakeholder engagement is understood in theory, providing answers to two sub-research questions. Finally, the literature study and constructed frameworks was used to substantiate the research from the interviews, illustrating how stakeholder engagement is understood, perceived and operationalised in flood resilience projects.

3.2.2 DOCUMENT STUDY

The aim of the document analysis was initially to provide context to the three case studies and to identify key stakeholders involved in the projects who could be contacted for interviews. The documents were selected based on their relevance to the project, the quality of information within the document and whether they were directly produced by one of the main stakeholders involved in the relevant project, as this highlighted the main stakeholders' objectives. In total, 21 documents were sourced directly from interviewees or from the internet (9 from SSB, 6 from HSS and 6 from the RESIN project). Following this selection process, a total of 8 documents were chosen, as summarised below in Figure 9. The selected documents were then used to provide context to each project and were analysed using qualitative analysis software NVivo, as discussed below in section 3.2.4, to gain information about perceptions, understandings and how stakeholder engagement was operationalised within the three projects.

Figure 9*. Policy Documents and corresponding codes from the three case studies.*

Project	Coding ref.	Policy Document
Salford Second Flood Storage Basin	DOCS01EA	Salford Flood Improvement Scheme- Environment Agency (Environment Agency, 2014)
	DOCS02SC	New 13 acre wetland opens in Salford- Salford City Council (Salford City Council, 2018)
	DOCS03US	University partners in £10m flood basin on former Irwell campus- University of Salford Manchester (University of Salford Manchester, 2018)
Howard Street SuDS scheme	DOCH01CT	Case study: Howard Street, Salford: a SuDS project- Manchester City of Trees (City of Trees, n.d.)
	DOCH02SD	Howard Street, Salford, Manchester- SUSdrain (SUSdrain, n.d.)
	DOCH03CT	Howard Street, Salford- City of Trees (City of Trees, n.d.)
RESIN project	DOCR01RP	Our tier 1 cities - Greater Manchester- RESIN (RESIN, n.d.)
	DOCR02UM	Climate Resilient Cities and Infrastructure (RESIN)- University of Manchester (The University of Manchester, n.d.)

3.2.3 SEMI-STRUCTURED INTERVIEWS

The interviews were used to provide insight into how stakeholder engagement was understood, perceived and operationalised within the three case studies. The interviews, including one walking interview, provided further insight and understanding into both the flood resilience project under study and the surrounding contextual circumstances. For the walking interview and one independent site visit, an application on a mobile device- Livetrekker (Livetrekker application, 2019) was used to track the location of the site and was used alongside photographs to visually demonstrate site structure. The interviews followed a semi-structure approach (Wengraf, 2001) whereby a guide was used in which the general structure, themes and key questions were pre-planned and were adapted accordingly to suit each interviewee. This guide comprised of questions about understandings of flood resilience and stakeholder engagement, how these concepts where operationalised within the project and how stakeholder engagement was perceived. The semi-structured interview style gave the interviewees the opportunity to discuss around the issue, elaborate where appropriate and explore any unanticipated themes during the interview (Silverman, 1993). The flexible nature of the interviews also allowed interviewees to express their views in their own terms, important given their different professional backgrounds.

The interviewees were selected either based on them being a direct stakeholder of the project, or on two occasions were selected based on their experience of the project, acting as an 'outsider' that was affected by but not affecting the selected project. A range of interviewees were selected from different positions within and outside the projects, this included the project lead from each case study and various other positions, such as member of community steering group or resident, providing a coherent set of possible viewpoints with which to analyse and compare. The interviews lasted between 30 and 60 minutes, taking place between the 10th and 26th April 2019. In total eleven interviews were held with a range of actors from government organisations, private organisations, community groups and affected community members (Figure 10). Following verbal consent from interviewees to record and use data anonymously, all interviews were recorded and fully transcribed. To ensure anonymity, the roles of each interviewee within the projects has not been disclosed below. A stakeholder map below, Figure 10, illustrates the identified stakeholders and interviewees from the three projects and below this, a table of interviewees has been illustrated in Figure 11.

Figure 10. *Stakeholder map and selected interviewees.*

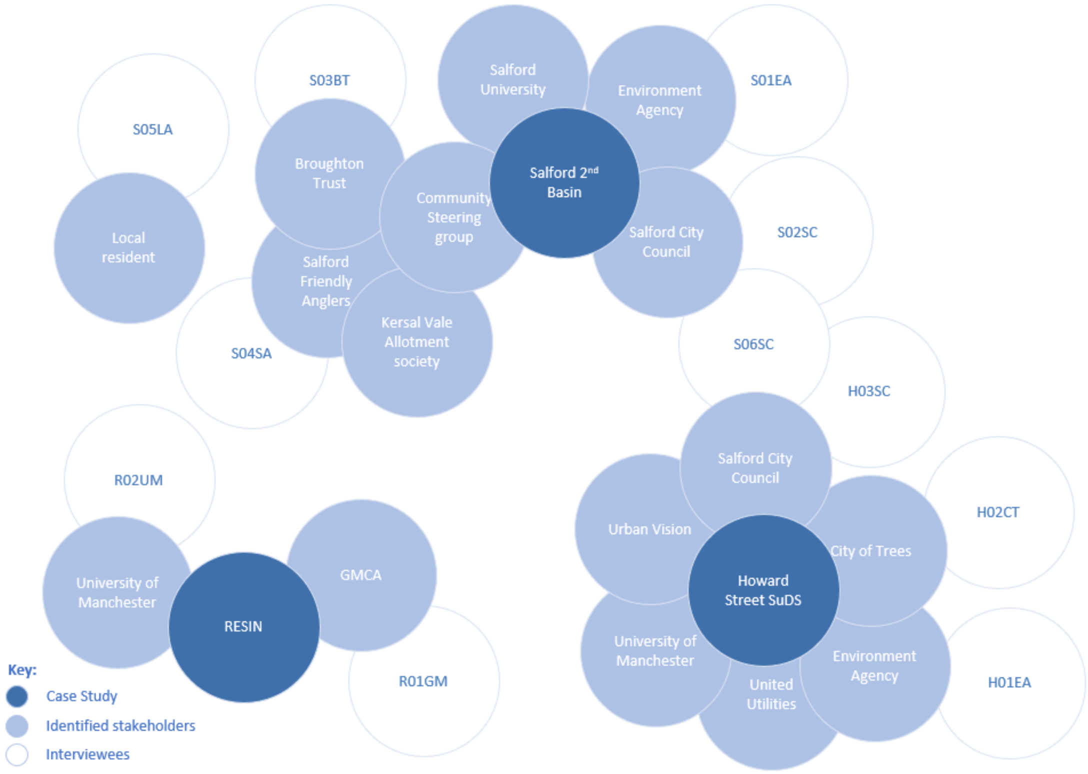


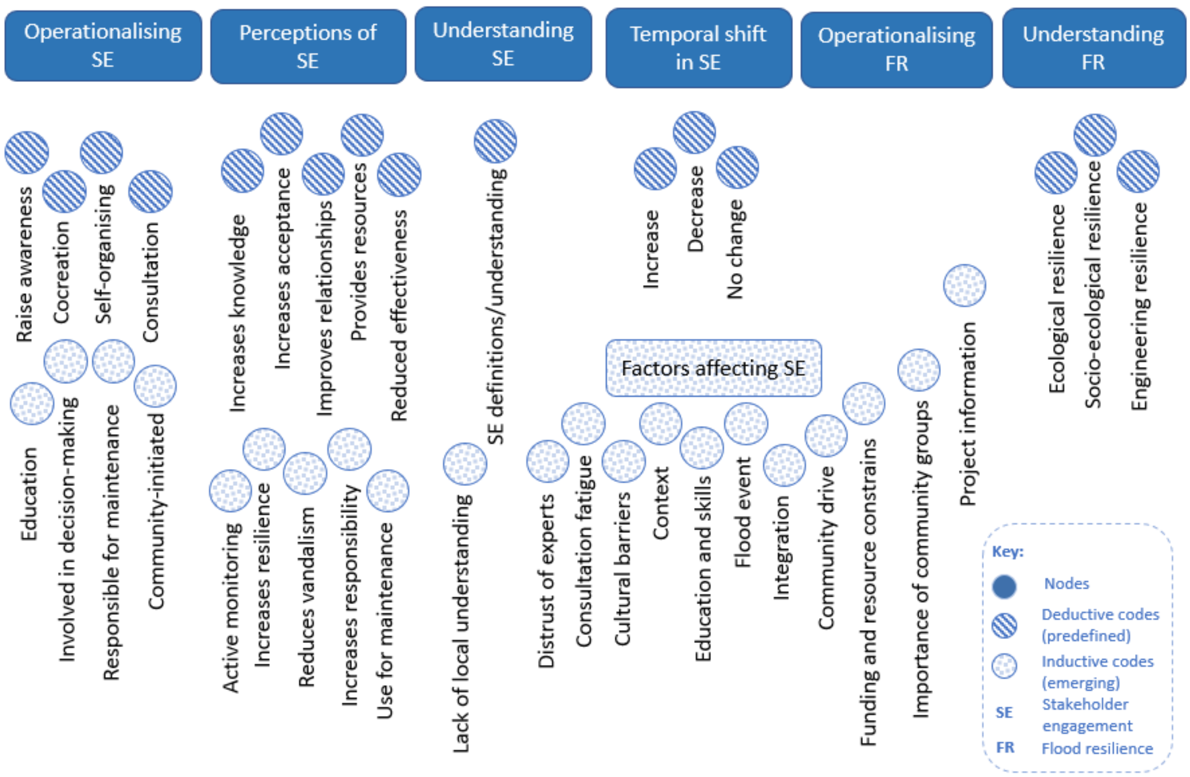
Figure 11. *List of interviewees and roles, with corresponding coding references relating to figure 10.*

Project	Code ref.	Interviewee and representing organisation	Type	Duration	Date
Salford Second Basin	S01EA	Project member from the Environment Agency	Face-to-face	00:48:08	12.04.19
	S02SC	Project member from Salford City Council	Face-to-face	00:39:19	15.04.19
	S03BT	Member of the community steering group representing The Broughton Trust	Face-to-face	00:59:03	18.04.19
	S04SA	Member of the community steering group representing Salford Friendly Anglers	Face-to-face	00:30:04	19.04.19
	S05LR	Local resident representative of local community at the Salford Second Basin	Face-to-face	00:39:32	18.04.19
	S06SC	Representative for Salford City Council for Salford Second Basin and Howard Street SuDS	Face-to-face	00:44:18	15.04.19
Howard Street SuDS	H01EA	Project member from the Environment Agency	Face-to-face	00:45:00	11.04.19
	H02CT	Project member from City of Trees	Face-to-face	00:41:03	10.04.19
	H03SC	Project member to various SuDS and stakeholder education schemes from Salford City Council	Face-to-face	00:40:36	15.04.19
RESIN	R01GM	Project member for RESIN project from GMCA	Skype call	00:39:38	26.04.19
	R02UM	Research associate of RESIN project representing University of Manchester	Face-to-face	00:48:29	11.04.19

3.2.4 DOCUMENT AND INTERVIEW ANALYSIS

Following the collection of key documents and transcripts from each of the three case studies, data was analysed manually using qualitative analysis software-NVivo. First, a set of predefined, deductive codes were developed from the literature study in section 2, as illustrated below in Figure 12 and were used to identify key answers to the research questions. This involved extracting key points from literature, such as ways to operationalise stakeholder engagement, as is displayed in Figure 3. Following analysis of the documents and transcripts, a set of inductive (not pre-defined) codes were then developed which aimed to highlight emerging data from the text as illustrated below in Figure 12. From the marked text passages, codes were grouped into nodes and recurrent themes such as 'operationalising stakeholder engagement' and 'perceptions of stakeholder engagement'. The software-NVivo was also used to 'explore' the data set, from which several 'hierarchy charts of items' were created and used to make pie charts which help to identify and illustrate the results below. The nodes and quotes identified in the software were further analysed and abstracted in the following results.

***Figure 12**. Code tree illustrating predefined codes and nodes, and codes which emerged from data using NVivo software.*



3.2.5 POSITIONALITY

As a researcher I understand and I am aware of my own position as both a Mancunian (a person from Manchester) and an academic in shaping this research, the interpretation of and understanding of the following results. As a Mancunian and thus a local to interviewees, I believe that this has helped forge an initial relationship with interviewees and create a common ground which hopefully put interviewees at ease during interviews, encouraging them to discuss more openly the relevant flood resilience projects. My position as an academic researcher however, had the potential to alter interactions, as it may have put interviewees under pressure to 'say the right things'. Taking both these positions I was therefore both an insider and an outsider to the interviewees, affecting the responses within this research (Sultana, 2007; Mullings, 1999). I also acknowledge that as a researcher I have preconceived ideas about the research outcomes which has the potential to lead to biased results (Mahtani, et al., 2017). To reduce this impact, the interview style was chosen to be semi-structured, which aimed to give interviewees space to expand their responses and discuss topics and themes deemed relevant to them. Finally, I understand that the way in which I interpret and evaluate the results has an influence on the outcome of this study, often known as citation bias (Pannucci & Wilkins, 2010). As a way to reduce this to the best of my ability, I will try to present the results initially without inference before I discuss the relationship of the results to initial research questions.

4 RESULTS

4.1 SALFORD SECOND BASIN

4.1.1 PROJECT INFORMATION

Salford Second Basin (SSB) is an offline flood storage basin which, alongside the first storage basin built in 2005, reduces flood risk and provides a 1:100 year standard of protection to around 2,000 homes and businesses in Lower Broughton and Lower Kersal in Salford, GM (Environment Agency, 2014). The basin, which is situated within the inside of a meander loop, is capable of holding more than 650 million litres of water during flood conditions (University of Salford Manchester, 2018) when the water is diverted from the river into the basin at the inlet weir which can be seen in Figures 13 and 14. Salford, an area within Greater Manchester, has a long history of flooding, with the most recent floods on 26th December 2015 (boxing day), flooding over 700 properties in the Lower Broughton area (Salford City Council, 2018). The flood storage basin is designed to increase flood resilience, which reduces flood risk to surrounding properties, and is built in a way in which it can be adapted to the increasing flood risk threatened by climate change (Environment Agency, 2014). The wetland area, in the north of the basin, further improves flood resilience, slowing water flow whilst providing additional benefits such as capturing carbon, filtering water and providing a habitat for a number of plants and animals (University of Salford Manchester, 2018). In addition to reducing flood risk, the site offers a number of benefits to the local community, delivers a set of multi-use sports pitches, a new 2.5km path around the basin for runners, cyclists and walkers and provides various new habitats to increase biodiversity (Ibid). The project was a collaboration between Salford City Council and the Environment Agency (EA), two organisations, who worked alongside a local community steering group, consisting of representatives from The Broughton Trust, Salford Friendly Anglers, Kersal Vale Allotment & Horticultural Society and the University of Salford (Salford City Council, 2018).

***Figure 13**. Map showing site plans of Salford second basin. Courtesy of The Broughton Trust (Per comms., 2019).*

***Figure 14.** Map showing aerial image of the site prior to construction. With arrow pointing out location of wetland site. Courtesy of The Environment Agency (Per comms., 2019).*

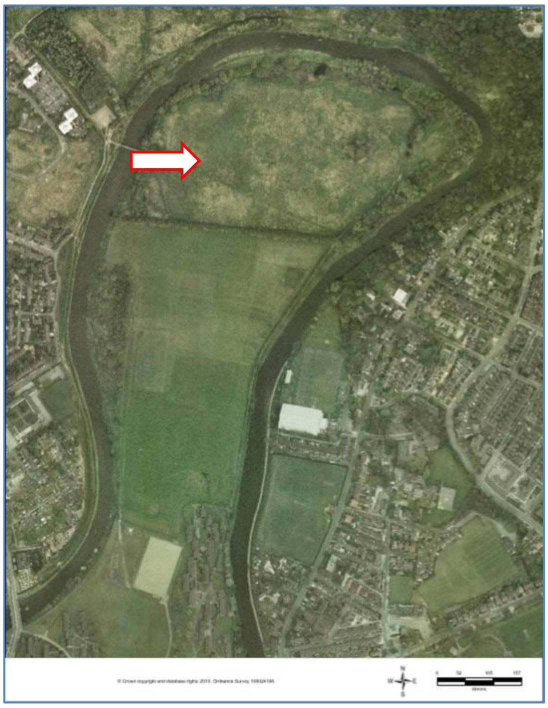
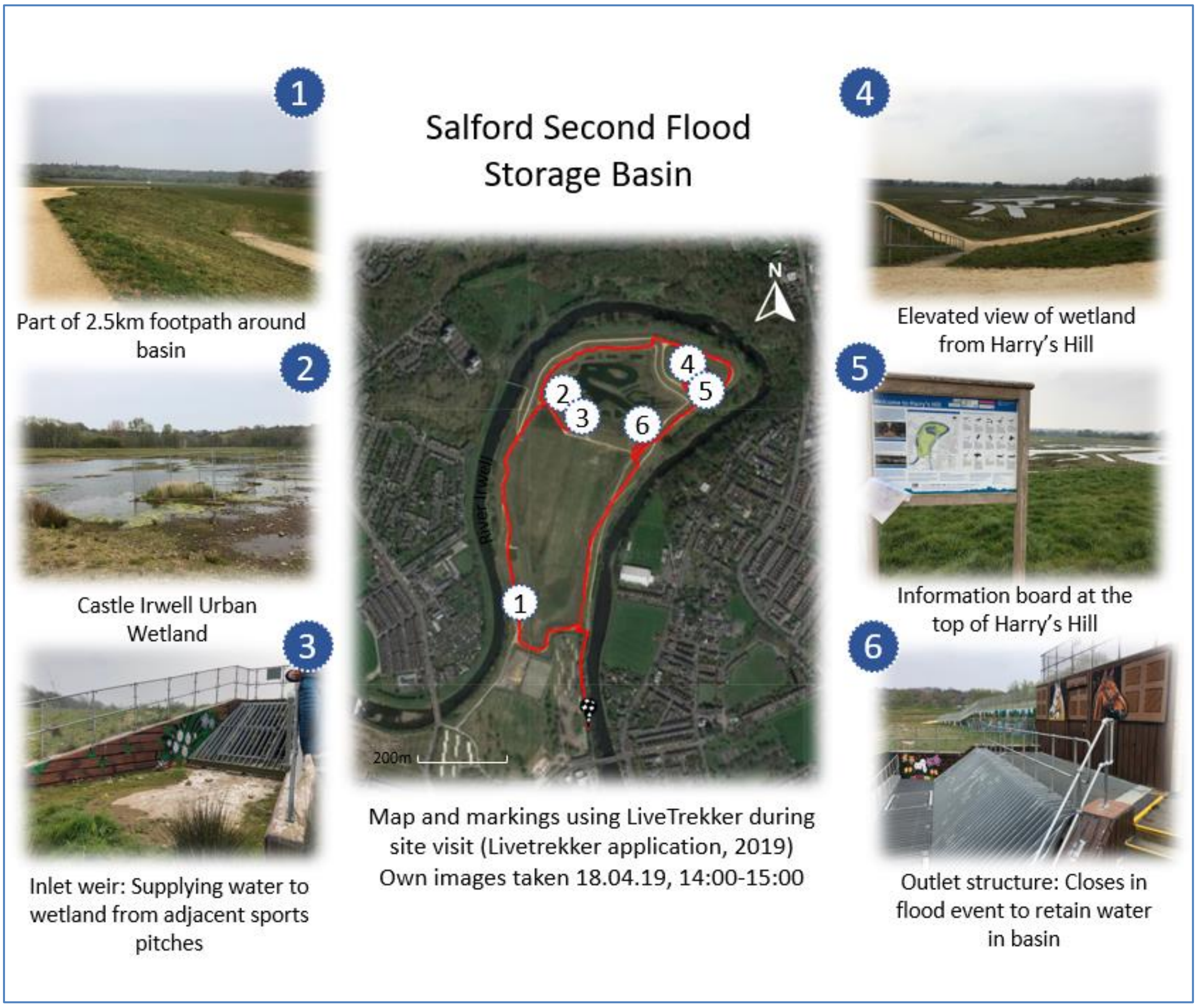


Figure 15. *Map of Salford Second Flood Storage Basin and photographs taken during site visit.*



4.1.2 FLOOD RESILIENCE

Analysis of interview transcripts for flood resilience definitions revealed a number of different interpretations of the concept flood resilience. Some interviewees discussed resilience as a local awareness to flooding (S04SA, S06SC), whilst others discussed resilience in relation to buildings and property (S01EA, S06SC). The results illustrate a clear differentiation between resilience interpretations, with many interviewees suggesting that flood resilience has multiple meanings and understandings.

4.1.3 OPERATIONALISING STAKEHOLDER ENGAGEMENT

Analysis of interview transcripts and documents revealed multiple levels and types of stakeholder engagement that have been operationalised in and around the SSB. These have been summarised in Figures 16 and 17 below which illustrate the various levels of stakeholder engagement and associated organisation participation and how these relate to a flood event. The stakeholder engagement includes both organisational level stakeholders, such as the EA and the council, and community level stakeholders, such as community groups and residents. The following text will discuss the projects in greater detail, substantiated by references from interview transcripts and relevant documents.

__Figure 16.__ Methods of stakeholder engagement in and around the Second Salford Basin in relation to level of stakeholder engagement and organisation participation (model based off Figure 3).

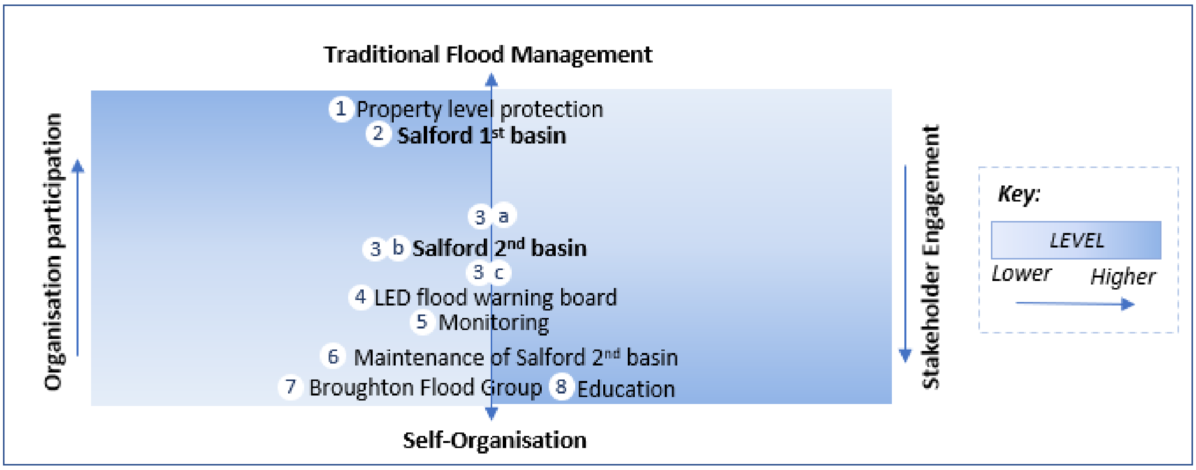


__Figure 17.__ Model of methods of stakeholder engagement within the Salford second basin project in relation to time.

	Reactive			Proactive
	Anticipate flood event	**Flood event**	Emergency Response period	Integrated recovery and risk reduction period
Stakeholder engagement operationalised in flood Salford second basin	Active voluntary monitoring by community groups and residents (S01EA, S03BT, S05LR) Flood warnings on LED board (S06SC, S03BT, S05LR)	Community groups have location information for vulnerable people, to protect in case of flood event (S03BT, S06BT)	Community initiated cleaning projects aimed at clearing rubbish from the basin following a flood event (S01EA, S03BT)	Community group involvement in second Salford basin (S01EA, S03BT, S05LR, S06SC, DOCS02SC, DOCS03US) Resident initiated and run flood group (S06SC, S03BT, S05LR) Educational maps and signs to help educate about purpose of flood basin (see figure 16- picture 5 for information board). (S01EA, S03BT, S02SC) Community group-initiated education sessions with local schools, e.g. local school ownership of pond. (S03BT) Maintenance of the wetland (S01EA, S03BT) Community group helped to sign up local community to flood warning service. (S01EA, S03BT)
	Robustness			Adaptation/Transformation

Within the SSB project, results revealed that there was a high level of stakeholder engagement with community level stakeholders (see Figure 16), with multiple interviewees suggesting that it was self-initiated engagement (S01EA, S04SA, S06SC), where one interviewee stated;

"I remember quite distinctly it wasn't the EA asking to consult with the community, it was the community telling the EA- if you want a serious project you have to consult with the community." (S04SA).

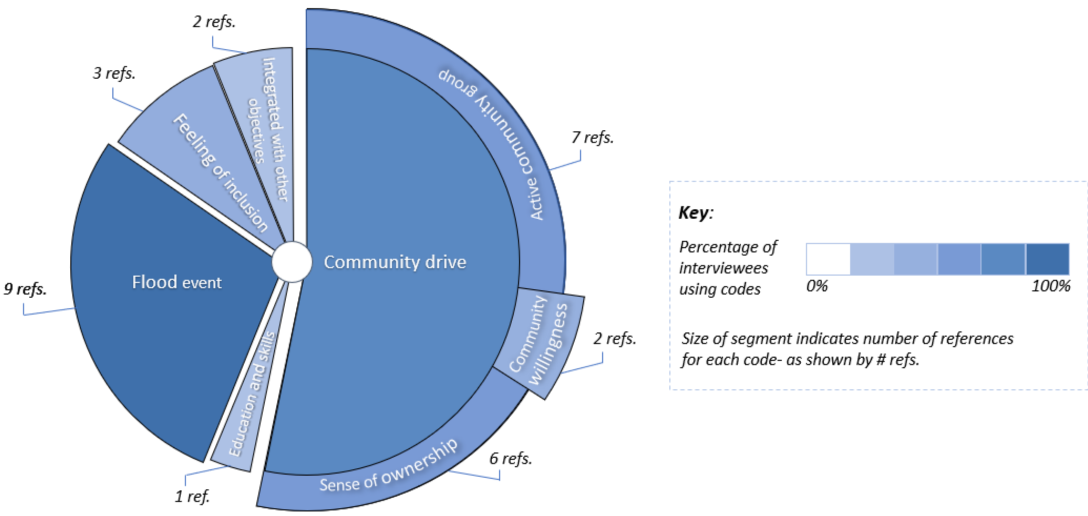
Following a push from the community groups to be part of the SSB project, evidence from documents and interviews suggested that the community groups worked closely alongside the EA and Salford City Council to make decisions about the basin, pushing for a wetland area for the local community (DOCS02SC, S01EA, S04SA, S03BT). From these results, it could be proposed that the SSB was a process of coproduction between the local community groups and the local authorities (3c in Figure 16). However, not all aspects of the SSB project demonstrate coproduction as the initial design process, and discussions regarding issues such as planning permission and land swaps did not always include all stakeholders (S02SC, S03BT) visualised as 3a in Figure 16.

In and around the SSB, interview analysis revealed several other proactive measures of community level stakeholder engagement, including maintenance of the wetland (S01EA, S03BT, S06SC), education and techniques to increase awareness within the local community through, for example, the allocation of onsite ponds to schools and construction of an information board (S02SC, S03BT, S03SA, S05LR, S06SC), as displayed in Figure 15. Interviewees suggested these examples of stakeholder engagement were initiated by community groups and individual community residents (S03BT, S01EA) exemplifying self-organising forms of stakeholder engagement, as indicated by numbers 6 and 8 in Figure 16. Reactive measures of community engagement included community group action in post flood clean-ups and more work by the community groups in monitoring and providing flood warnings to the local community (S03BT, S05LR, S01EA), increasing preparedness and making the community more robust in case of a flood event, indicated as 4, 5 and 7 in Figure 16 . A recently executed example was an LED board, pushed through by the local community, which is used to warn residents of potential flood risk and raise awareness about the SSB itself (S03BT, S05LR, S06SC).

Whilst the interviews and documents provide a strong evidence base for community level engagement, interviewees suggested there was a lesser amount of engagement with the residents, who are directly affected by the basin (S01EA, S06SC, S05LR). Interviewees suggested there is both a lack of resident engagement and understanding, with interviewees from the council, community group and from the wider community disclosing that residents don't understand the scheme (S05LR, S03BT) and "struggled to get engaged" (S06SC). Whilst results do indicate a gap between community groups and the residents, several interviewees suggested that community groups are strong influencers and have a lot of trust from residents (S03BT, S04SA, S02SC). Interviewees also discussed the importance of one community member who, through self-initiated interest has initiated and organised a flood group and who now attends meetings with the council to act as an intermediary between the decision makers and the wider community (S05LR, S03BT, S02SC).

4.1.4 FACTORS AFFECTING STAKEHOLDER ENGAGEMENT

Figure 18. *Pie chart showing factors affecting stakeholder engagement as perceived by interviewees from SSB.*



The results highlighted a number of factors that affect stakeholder engagement within and around the SSB which included community drive, education and skills, a flood event, feelings of inclusion, and project integration with other objectives. As is illustrated in Figure 18, community drive was mentioned the highest number of times within the interviews, with subfactors including an active community, community willingness, and ownership of an area. Interviewees comments from the EA and a community group included;

> *"I think it works when you have an active community group who know what they want and want to work with us to get that." (S01EA)*

> *"[…] the community owning it has probably spread the word far better than we could have." (S06SC).*

A flood event, highlighted by a darker colour in Figure 18, was discussed by a broader selection of interviewees, who suggested that flood events were pivotal to promote stakeholder engagement (S01EA, S04SA, S06SC) with statements such as;

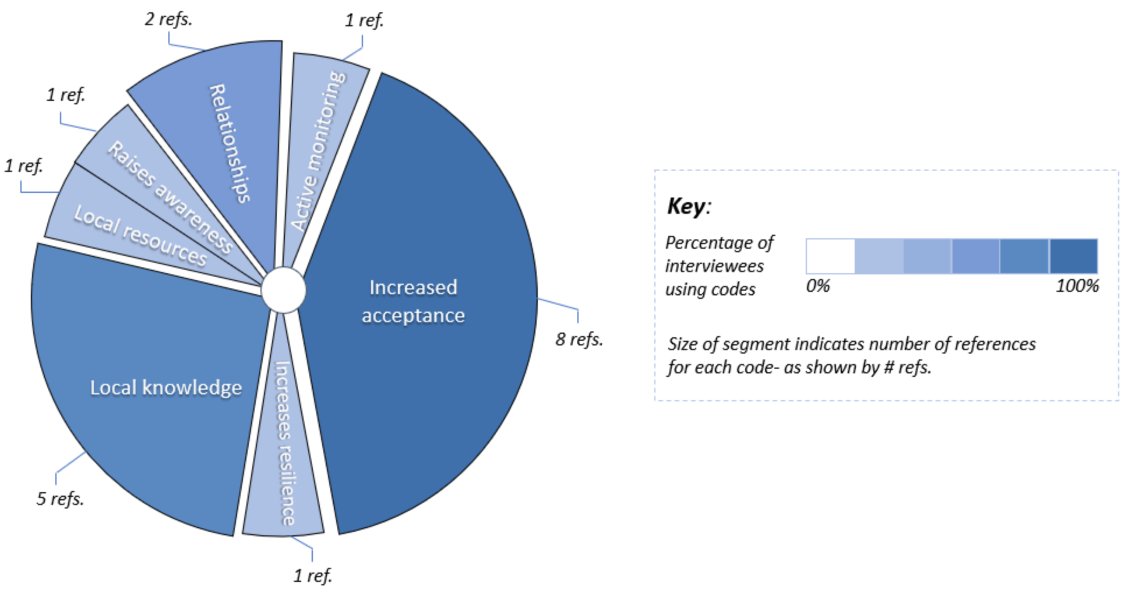
> *"[…] the community group organised an open session, how to prepare for a flood, and 3 people turned up, I think. A month later after the flood, 300 people turned up to the public meeting." (S06SC)*

4.1.5 PERCEPTIONS OF STAKEHOLDER ENGAGEMENT

All stakeholders involved in the SSB project emphasised that it was important to engage stakeholders in the project and that it had several beneficial outcomes which have been displayed below in Figure 19. These benefits included; use of local knowledge, increased acceptance of projects, improved relations between multiple stakeholders, increased resilience, use of local resources, improved awareness of the project and use of local stakeholders for active monitoring (S01EA, S02SC, S03BT, S04SA, S06SC). An interviewee from the EA suggested that stakeholder engagement has led to:

> *"A far better outcome than if we had been left to our own devices […] [which] helped to reduce the backlash from people after they flooded […] with wider benefits from working with the community group, which has meant that other things that we wouldn't normally achieve with a scheme were being achieved."(S01EA).*

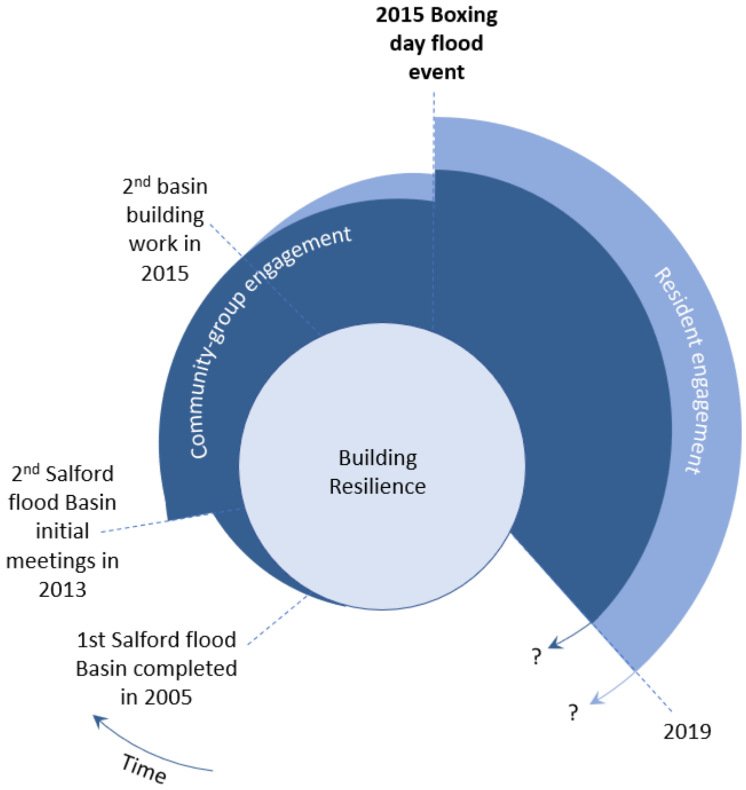
Figure 19. *Pie chart showing perceptions of stakeholder engagement as perceived by interviewees from SSB.*



4.1.6 STAKEHOLDER ENGAGEMENT OVER TIME

It emerged from interview analysis that there has been a shift in stakeholder engagement over the last 15 years or so, influenced by various internal and external factors as illustrated below in Figure 20.

Figure 20. *Long-term visualisation of changes in stakeholder engagement in and around the Salford second flood basin. Not to scale.*



Several interviewees stated that during and after the construction of the Salford First Basin (built in 2015), there was very little stakeholder engagement (S04SA, S06SC) with a top-down approach of design and implementation. Several years later, funding was granted for the SSB and interviewees suggested that this led to an increase in stakeholder engagement, as community groups became more and more engaged alongside the EA and the council (S01EA, S03BT, S04SA, S06SC). However, results suggested there is a clear differentiation here between community groups and the residents as discussed in 4.1.2, with a distinction between the two bodies as shown by different colour schemes and segments in Figure 20. However, the SSB did spark a small amount of resident engagement as discussed in 4.1.2. Research evidence then revealed that following the 2015 boxing day flood there was an increase in resident engagement as well as in community groups (S01EA, S04SA, S06SC). Finally, several of the interviewees suggested that following the flood there has been a continual increase in engagement, as residents that were flooded have become aware of the flood risk which has led to action such as community-led construction of an LED flood warning board and initiation of the Broughton flood group, ran by a local resident (S01Ea, S03BT, S04SA, S05LR, S06SC). As is illustrated by the two question-marks in Figure 20, it is uncertain what the future holds for stakeholder engagement in and around the SSB, however interviewees remained hopeful, with an interviewee from the Environment Agency stating that;

> *"I hope it will inspire future projects; it's certainly inspired me to think about how we engage with communities." (S01EA).*

4.2 HOWARD STREET SUDS

4.2.1 PROJECT INFORMATION

The Howard Street SuDS (HSS) tree planting scheme involved the planting of three London plane trees within a specifically designed trench in Salford (SUSdrain, n.d.). The aim of the project was to act as a demonstration study, illustrating the impact that the trees have on managing levels of surface water and cleaning polluted water from road runoff (City of Trees, n.d.). The project was a partnership between the Environment Agency, The University of Manchester, City of Trees, United Utilities, Urban Vision and Salford City Council, and was completed in June 2015 (SUSdrain, n.d.). Since implementation, the University has been monitoring the quality and quantity of rainwater and initial findings have revealed that the average flow rate reduction has been around 70% during summer months, with storm flows slowed by up to two hours (SUSdrain, n.d.). Results are still being gathered at the University, but initial findings from the project have helped illustrate how SuDS improve flood resilience and have helped to inspire a number of similar projects since. In addition to providing a water management function, the trees provide addition benefits such as cleaning and cooling air, providing habitats for wildlife and improving surrounding quality of life (City of Trees, n.d.).

Figure 21*. Map of Howard Street SuDS tree planting scheme and pictures taken during site visit.*

4.2.2 FLOOD RESILIENCE

All interviewees referred to flood resilience as a way to reduce the vulnerability of both people and property (H02CT, H01EA). Interviewees also discussed the different aspects of flood resilience which include, individual properties, individuals taking responsibility and on a 'more landscape scale', which can be protected through engineering solutions and nature-based solutions (H02CT, H01EA).

4.2.3 OPERATIONALISING STAKEHOLDER ENGAGEMENT

Figure 22. *Model of methods of stakeholder engagement within and related to the Howard Street SuDS project in relation to time.*

	Reactive			Proactive
	Anticipate flood event	**Flood event**	Emergency Response period	Integrated recovery and risk reduction period
Stakeholder engagement operationalised in flood resilience	No information.			Local engagement in tree maintenance (not Howard Street project). Partnership between the EA, The University of Manchester, City of Trees, United Utilities, Urban Vision and Salford City Council to create HSS. Site visits with business and school groups to HSS, raise awareness and improve understanding. Consulted local residents about Howard Street trees. Education- signs and boards to illustrate community members purpose of SuDS tree planting.
	Robustness			Adaptation/Transformation

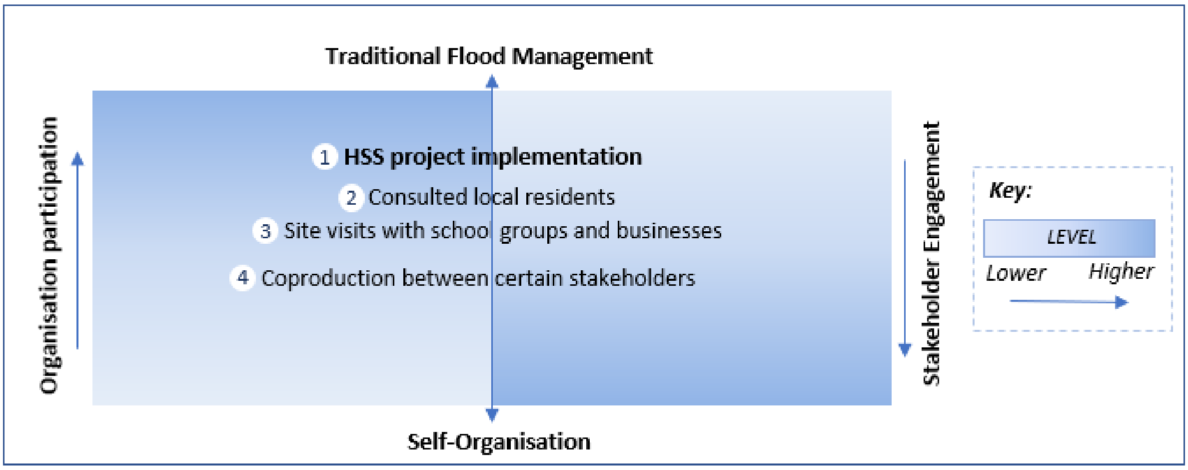
Analysis of the interviews and selected documents revealed several methods of community level stakeholder engagement within the HSS project. These included consulting residents, utilising various methods of raising awareness and educating groups from local schools, colleges and businesses (DOCH01CT, HD01SD, H01EA, H02CT). Interviewees and documents also stated that the project itself, serving as a demonstration study, aimed to prove a concept, raise awareness and demonstrate the potential outputs and benefits of a flood resilience project such as the HSS (H02CT, H02EA, HD01SD, DOCH03CT), with interviewees suggesting the project objectives aimed;

> *"To publicise it, to get as many people to see it and to hopefully get people to start mainstreaming it." (H02CT).*

As is illustrated in Figure 22 above, the stakeholder engagement strategies associated with the HSS project are either between organisation level stakeholders such as the EA and Council (HD02CT) or are organised by these stakeholders and exemplify passive participation techniques such as consulting local stakeholders on the purpose of the HSS scheme (H01EA, H02CT). The HSS project itself does not exemplify self-organising engagement by residents or community members. The project lead suggested that the contextual circumstances of the HSS justify why there was not high levels of community level stakeholder engagement;

> *"It wasn't actually outside anyone's front door; it was effectively on dead space." (H02CT).*

__Figure 23.__ Methods of stakeholder in the HSS project in relation to level of stakeholder engagement and organisation participation (model based on figure 3).



When discussing similar projects to the HSS, interviewees (H01EA, H02CT) discussed more active stakeholder engagement strategies that they suggested were more appropriate within these projects, for example;

> *"When it comes to things like woodland planting, woodland management or street tree planting, we will do as much engagement work as we can." (H02CT).*

Interviewees also revealed that stakeholders do often get involved in similar projects through maintenance and sometimes self-initiate interest in similar projects;

> *"[…] get contacted from residents, they want us to help them get trees planted on their street." (H02CT).*

RESIN

4.2.4 PROJECT INFORMATION

The RESIN project was an interdisciplinary research project, investigating resilience within European cities, running from May 2015 until November 2018 (RESIN, 2018). The project aimed to develop a set of practical tools to support cities in designing and implementing climate adaptation and resilience techniques in their local contexts and to encourage the market deployment of innovative climate adaptation and resilience approaches (The University of Manchester, n.d.). The Greater Manchester city-region was selected to be one of the four case study areas, known as 'Tier 1' cities, with the expectation that learning generated within these cities could be transferred to a number of 'Tier 2' cities (Ibid.). Within the Greater Manchester case study, flooding was identified as a key challenge facing the city, with the project discussing Salford Second Basin and Howard Street SuDS as key flood resilience and adaptation measures (The University of Manchester, n.d.). Greater Manchester Combined Authority (GMCA) and The University of Manchester worked in unison on the project and delivered a set of publications, intending to assess the current resilience situation in GM and to develop tools and methodologies to support urban planning and decision making (Ibid.).

4.2.5 FLOOD RESILIENCE

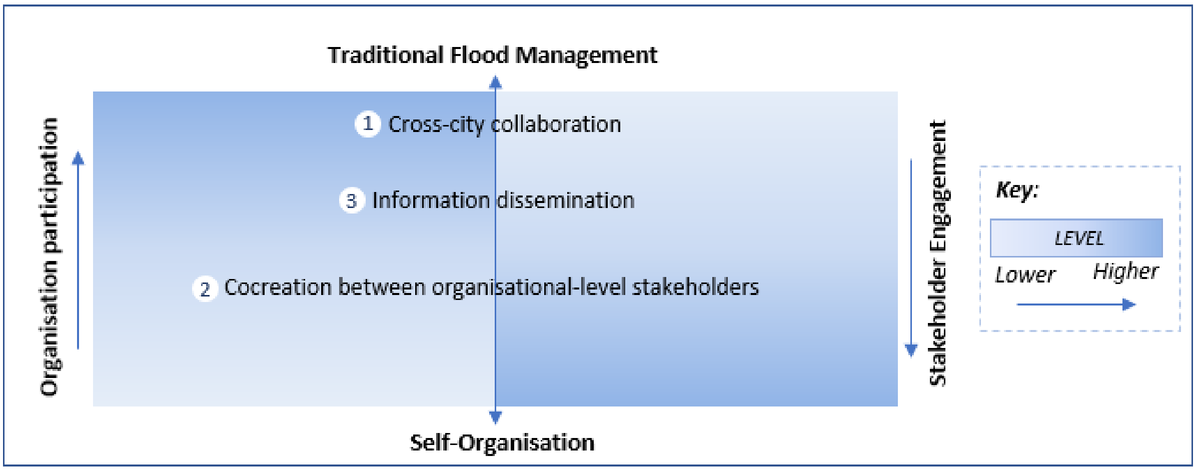
Both interviewees interpreted flood resilience in relation to recovery following a flood event, with definitions as follows;

> *"The ability of the communities or infrastructure or whatever, to either not be affected in the first place or recover quickly, and it's not just about the physical recovery." (R01GM)*

"[…] ensuring that individuals and communities can still continue to function, whilst there has been a major or any kind of flood event. But also enabling them to respond quickly and where possible adapt and transform over time as well." (R02UM)

4.2.6 OPERATIONALISING STAKEHOLDER ENGAGEMENT

***Figure 24**. Methods of stakeholder engagement in the RESIN project in relation to level of stakeholder engagement and organisation participation (model based on figure 3).*



Within the RESIN project, interviewees discussed stakeholder engagement largely in the form of cocreation, which is defined by one interviewee as;

"[…] *between the city practitioners and decision makers and the research partners, the technical partners within RESIN." (R01GM).*

Further discussion with interviewees (R01GM, R02UM), however, revealed a discrepancy between definition and application, where an interviewee suggested that;

"We *weren't really working with the definition of cocreation…a lot of them (partners) were just like developing a tool and test[ing] it and [assuming] that's cocreation. That's not cocreation to me." (R02UM)*

Later the interviewee defined cocreation as;

"Having all the people that are going to be affected or you want to engage with, being involved from the very start in terms of helping set the aims and objectives, then to work through the project to the outputs…so in an ideal world it's about bringing everyone together" (R02UM).

When asked whether this definition of cocreation was achieved the interviewee answered; "*No, it is quite difficult as well because it is resource intensive, its time intensive.*" *(R02UM)*. When asked if the wider community were aware of the RESIN project, it was stated that; "*I'm almost 100% certain that no one has any idea what it is…" (R01GM).* The RESIN project, however, did demonstrate some aspects of stakeholder engagement as was working to engage stakeholders from different cities which led to information dissemination within the city through events. An interviewee also stated that; *"it didn't fund any actual projects" (R01GM)*, explaining why it was difficult to engage community level stakeholders. Policy document analysis revealed a number of aims and objectives to operationalise stakeholder engagement, including; *"extensive consultation and testing in a 'real life' urban setting" (DOCR02UM)*, "*involving different stakeholders" (DOCR02UM*) and *"multilateral cooperation […] working with community groups" (DOCR01RP).*

Figure 25. *Model of methods of stakeholder engagement within the RESIN project in relation to time.*

	Reactive			Proactive
	Anticipate flood event	**Flood event**	Emergency response period	Integrated recovery and risk reduction period
Stakeholder engagement operationalised in flood resilience	No information.			Cocreation between city practitioners, decision makers and the research partners to create tools to understand and make the city more flood resilient. Cross-city collaboration to share and transfer knowledge about adaptation and resilience. Information dissemination within the city through events and research papers- e.g. city assessment report.
	Robustness			Adaptation/Transformation

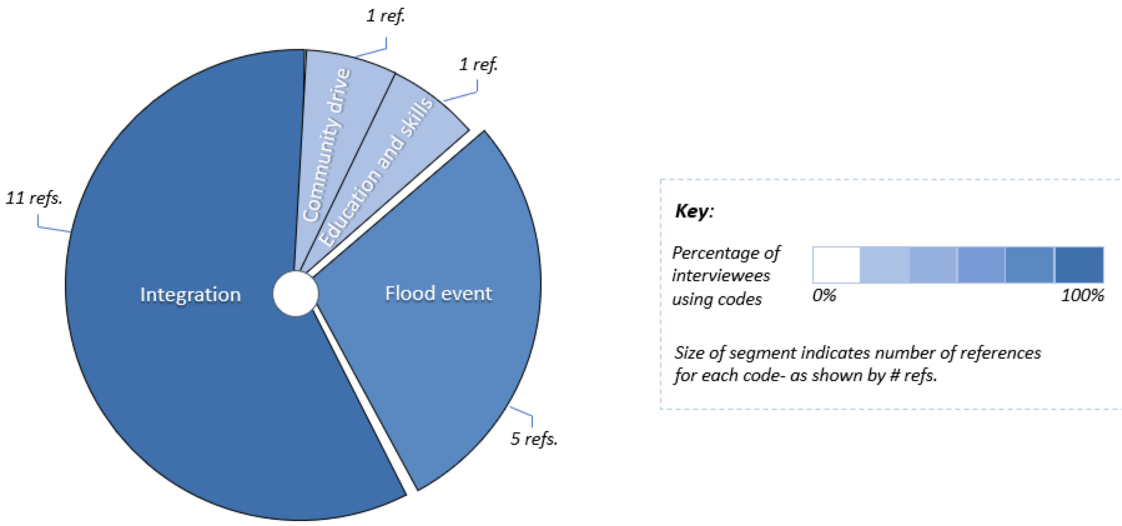
4.3 HSS & RESIN

As there was a strong overlap between some of the results from the HSS and RESIN project they have been combined and discussed in this section as follows.

4.3.1 FACTORS AFFECTING STAKEHOLDER ENGAGEMENT

Interview analysis for HSS and the RESIN project revealed a number of factors which affect stakeholder engagement, including integration of other functions, a flood event, the contextual situation, community drive and education and skills of participants (H01EA, H02CT, R01GM, R02UM) as displayed below in Figure 26.

Figure 26. *Pie chart showing factors affecting stakeholder engagement as perceived by interviewees from the HSS and RESIN projects.*

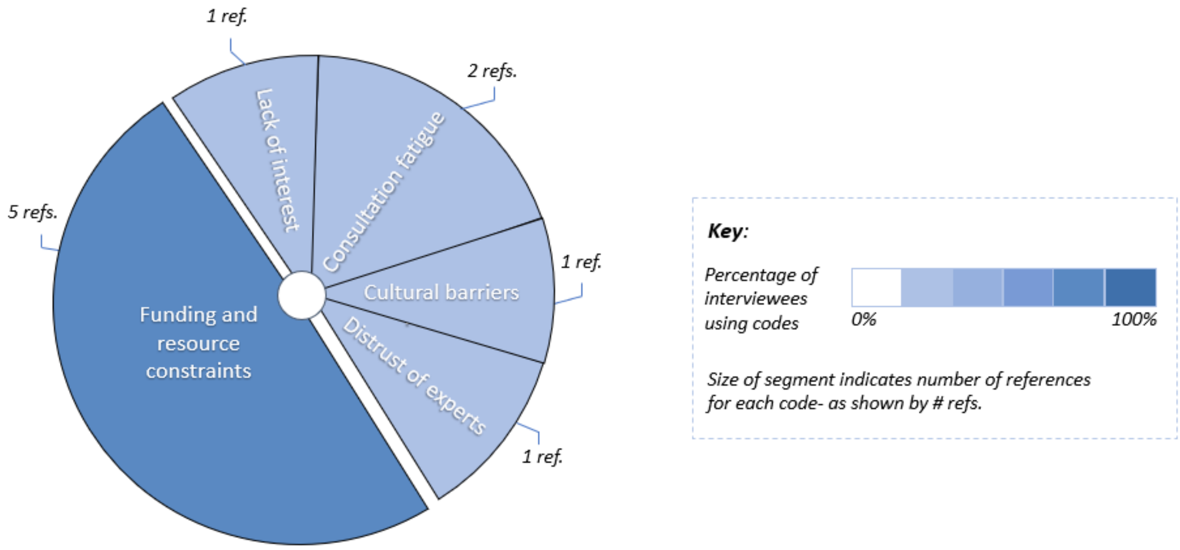


Interviewees suggested that integrating flood resilience objectives alongside other objectives provides multiple benefits, including engaging stakeholders who would otherwise not be interested and, reducing both disruption and costs (H01EA, H02CT, R01GM). Interview analysis also revealed the importance of a flood event in affecting stakeholder engagement, suggesting that action often happens in response to a flood event, and following this flood event, interviewees identified a gradual decline in engagement and interest over time (R01GM, R02UM). Interviewees highlighted the importance of maintaining stakeholder engagement beyond the project end to make sure that relationships built, and stakeholders engaged are not lost once the project is finished (R01GM, H02CT). An interviewee suggested that practitioners should try to maintain stakeholder engagement by employing people like 'rangers' to continually engage with the communities, further stressing that whilst it may be expensive initially, the wider value and potential long-term cost savings make it 'incredibly cheap' (R01GM).

Interviewees discussed a number of barriers to stakeholder engagement, including funding and resource constraints (R02UM, H01EA, R01GM), consultation fatigue (R02UM), lack of interest (H02CT), distrust of experts (H01EA), and cultural barriers (R02UM) as displayed in Figure 27. An interviewee from the University of Manchester stated;

> *"People are sick of being contacted…and [sick of] officials coming around to the houses all the time." (R02UM).*

Figure 27. *Pie chart showing barriers to stakeholder engagement as perceived by interviewees from HSS and RESIN project.*



4.3.2 PERCEPTIONS OF STAKEHOLDER ENGAGEMENT

All interviewees from the HSS and RESIN project discussed a number of beneficial outcomes of stakeholder engagement which included, a sense of ownership, reduction of vandalism, sense of responsibility, use of local resources and increased awareness of the resilience project outcomes (H01EA, H02CT, R01GM, R02UM). Interviewees also emphasised the long-term benefits of stakeholder engagement, suggesting that it;

> "[…] *saves money in the long term by reducing vandalism, encouraging a great degree of responsibility to look after what it is that is being delivered." (H02CT)*

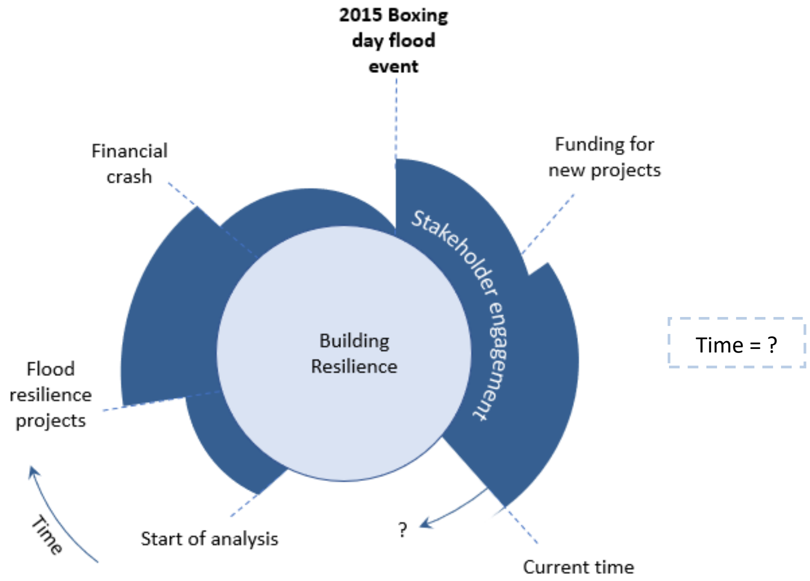
However, an interviewee suggested that stakeholder engagement may have made the project "*harder to manage" (R02UM),* who further stated that;

> *"It's probably easier if you have something like a basin and a wetland […because] the communities become engaged if they see it operating." (R01GM).*

4.3.3 STAKEHOLDER ENGAGEMENT OVER TIME

Where stakeholder engagement over time was discussed by interviewees from HSS and RESIN, it was largely in relation to flood events and the challenge of maintaining stakeholder engagement as discussed above (R01GM, R02UM). Considering a strong overlap in interviewee statements from both the HSS and RESIN projects about stakeholder engagement over time, a model has been developed which draws together results from both these studies and has been illustrated in Figure 28 and explained below.

Figure 28. *Long-term visualisation of changes in stakeholder engagement within Greater Manchester. Not to scale.*



Interviewees from both the HSS and RESIN project stated that stakeholder engagement increases with the initiation of a flood resilience project (H01EA, R02UM). Following on from this it was suggested that a financial crash, such as the one around 2008, has the potential to rapidly decrease stakeholder engagement, as projects stop and stakeholders become frustrated with the lack of action (H03SC, H01EA), with one interviewee stating;

> *"Schemes have been going on for that long and they were promised one thing and then the crash happened, and they did not get what they were promised." (H03SC).*

Following this, most interviewees within the three case studies stated that the 2015 flood event led to an increase in stakeholder engagement as individuals become concerned about their area and new projects were funded on the back of monetary investments (e.g. S01EA, H01EA, R01GM). Stakeholders then suggested that there is currently an increase or 'resurgence' in stakeholder engagement (H01EA, H02CT, H03SC, S01EA), with statements discussing an institutional shift toward stakeholder engagement;

> *"I have seen us as an organisation change […] at one time we were just saying, this is what we are going to do, we're going to go in and do it and fight the consequences when all the locals are saying we don't want that. And so, we have become far more collaborative […] I can't see that we are going to get away from that and we have to do that in order for us to be successful." (H01EA).*

5 DISCUSSION

In this section, results from section 4 are discussed in detail and developed in relation to the research question(s), revealing how stakeholder engagement is understood, perceived and operationalised in flood resilience projects within Greater Manchester. The results are positioned against current literature and scholarly debate on flood resilience and stakeholder engagement, as discussed in section 2, to enable a greater understanding of the results and position them within the wider context of theoretical debate and current standards in practice.

5.1.1 FLOOD RESILIENCE

The following table illustrates a number of flood resilience definitions as given by the interviewed stakeholders from the three case-studies. The definitions given have been compared against pre-defined definitions as laid out in section 2.1 (see Figure 1) and are further discussed and elaborated upon in this section.

Figure 29. *Table illustrating interviewee definitions of flood resilience in relation to the predefined definitions.*

Project	Interviewee definition	Pre-defined de.					
		En		E	SE		?
		A	B	C	D	E	
SSB	*"It's about being aware of when a flooding event takes place, what level of river heights do people need to start panicking" (S04SA)*				x		x
SSB	*"about a more resilient community because people are more aware of the risks" (S06SC)*						x
SSB	*"There's a sort of property level flood resilience which is designing properties so that they will still flood and they're able to function very quickly after the flood has receded" (S01EA)*	x		x			
SSB	*"flood resilience is used to distinguish between resistance, resistance as the ability to resist it, resilience the ability to bounce back, after a flood" (S06SC)*		x				
HSS	*"I think it's about making sure that whatever asset it is, whether it is property or land is less vulnerable to flooding through a variety of measures." (H02CT)*						x
HSS	*"…it's about combining all the different things to reduce the risk of flooding…" (H01EA).*				x		x
RESIN	*"the ability of the communities or infrastructure or whatever, to either not be affected in the first place or recover quickly, and it's not just about the physical recovery." (R01GM)*	x					
RESIN	*"ensuring that individuals and communities can still continue to function, whilst there has been a major or any kind of flood event. But also enabling them to respond quickly and where possible adapt and transform over time as well" (R02UM)*			x		x	

Key

En- Engineering Resilience
- A- Time taken to return to previous state (quick recovery)
- B- Ability to bounce-back

E- Ecological Resilience
- C- Ability adapt into a new state following disturbance and maintain function

SE- Socio-Ecological Resilience
- D- Interdependence of human and ecological systems
- E- Adaptation and transformation of system

?- Definitions which seemingly do not fit within any of these pre-defined definitions

First insight into stakeholder definitions of flood resilience from the three case studies revealed that there was a range of given definitions and interpretations of flood resilience, with a lack of consistency within and between the projects as is illustrated in Figure 29. This supports the dominant premise in literature which proposes that it still remains a fairly ambiguous concept, where practitioners struggle to define and use it consistently in practice (Restemeyer, et al., 2018; White & O'Hare, 2014; Liao, 2012; Berkes, 2007). Some researchers also suggest that when the concept of flood resilience is used in practice, engineering resilience prevails as the basis for definitions as discussed in section 2.1. However, it is evident from Figure 29, above, that the majority of definitions provided by stakeholders within these three projects do not manifest from an engineering resilience definition as previous research may suggest (Liao, 2012), but rather offer varied definitions which also manifest from ecological and socio-ecological definitions. Further analysis into these definitions reveal that all the definitions present ways of increasing flood resilience, with some definitions offering a broader perspective of the concept (e.g. H01EA, R01GM) and others offering a more focused view of flood resilience (e.g. S06SC, S01EA). It could therefore be suggested, that whilst the definitions presented by interviewees do differ, they all illustrate ways of increasing flood resilience and so perhaps vary based on individual experience, job specialisation or role within a project.

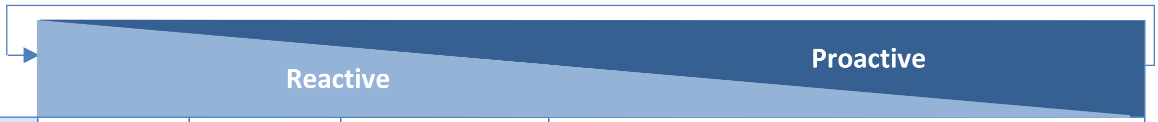
Considering how flood resilience is operationalised, it is apparent from the three projects that attempts to increase flood resilience can be realised in a number of ways. The SSB project operationalises flood resilience by providing a flood storage basin which reduces the risk of flooding whilst simultaneously increasing the awareness of locals to the flood risk, as well as prompting individual and group action to implement other flood resilience measures. Furthermore, the project is adaptable and is able to respond to future changes such as increased precipitation, as is threatened by climate change (Cavan, 2018). The HSS increases flood resilience by decreasing surface water runoff, respectively reducing flood risk and increasing the time for the water to reach drainage. The trees themselves provide multiple benefits such as carbon retention, which also mitigates against climate change. Moreover, HSS serves as an exemplar project which, if successful will initiate more flood resilience projects. Finally, the RESIN project increases flood resilience through its cross-city collaboration which increases knowledge flow about flood resilience strategies and creates a set of tools and strategies to identify vulnerable areas of Manchester which may help practitioners develop real-life solutions to increase flood resilience in the future. It could be suggested that the various ways in which the projects attempt to increase flood resilience corresponds with the variety of flood resilience definitions revealed by the stakeholders (see Figure 29). Thus, just as the projects increase flood resilience in numerous ways, it could be suggested that, contrary to common theoretical assumptions (e.g. White & O'Hare, 2014) multiple definitions of flood resilience are not necessarily problematic but rather together represent the potential ways in which projects can increase resilience. It could therefore be recommended that rather than aiming to find one definition of flood resilience, researchers seek to combine projects and practitioners with different definitions, in order to achieve a more complete and heterogenous flood resilience ideology.

Previous research suggests that flood resilience runs the risk of neglecting the influence of politics and power relations which can lead to unjust advantages for decision makers and further marginalisation of the marginalised (Laeni, et al., 2019; White & O'Hare, 2014; Davoudi, 2012). The results from this research however do not support these arguments, as the benefits of the three case studies seemingly target the residents most disadvantaged and at risk from flooding. For example, the outcome of the SSB project was the construction of a basin and wetland which according to multiple interviewees- directly benefited the community-level stakeholders, including both the community groups and residents. In a similar way, the HSS project reduced flood risk and improved quality of life for local residents. It could be suggested, especially for the SSB project, that the inclusion of community level stakeholders in the decision-making process and the high levels of stakeholder engagement evident throughout the project, led to a fairer process which resulted in an even distribution of outcomes. It could therefore be advocated that some of the fairer outcomes and lack of power disparities in these projects, that have been seen in other flood resilience projects (See Laeni, et al., 2019), are the outcome of the high levels of stakeholder engagement within the project. This argument could be used to further advocate the benefits of community level stakeholder engagement.

5.1.2 STAKEHOLDER ENGAGEMENT

The following table illustrates the different methods of stakeholder engagement realised within the three case studies. As can be seen, due to the nature of the projects, only the SSB illustrates both proactive and reactive measures of stakeholder engagement, whereas the HSS and RESIN projects are focused on project specific outcomes which only include proactive flood resilient strategies and thus stakeholder engagement.

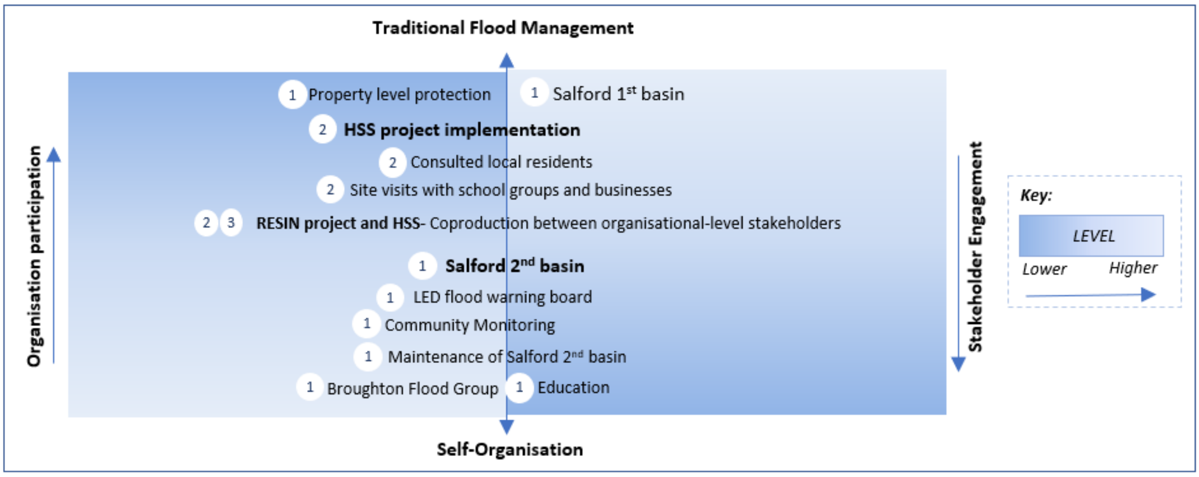
Figure 30. *Model of methods stakeholder engagement in and around the three case study projects in relation to time.*



Project	Anticipate flood event	**Flood event**	Emergency Response period	Integrated recovery and risk reduction period
Salford Second Basin	Active voluntary monitoring by community groups and community members. Flood warnings on LED board.	Community groups have location information for vulnerable people, to protect in case of flood event.	Community initiated cleaning projects in SSB following a flood event.	Community initiated involvement in second Salford basin. Community member initiated and run flood group. Educational maps and signs to help educate about purpose of flood basin. Community group-initiated education sessions with local schools. Community group helped to sign up local community to flood warning service.
Howard Street SuDS	No information.			Local engagement in tree maintenance. Cocreation with organisational level stakeholder in HSS. Site visits with business and school groups to raise awareness. Consulted residents about Howard Street trees. Education- signs and boards to illustrate purpose of SuDS.
RESIN	No information.			Cocreation between city practitioners and research partners. Cross-city collaboration to share and transfer knowledge. Information dissemination within the city through events and research papers.
	Robustness			Adaptation/Transformation

The results reveal that within the three case studies, there are various stakeholders, with different backgrounds, who are engaged within the projects, as has been illustrated above in Figure 30. These include community-level stakeholders such as residents and community groups, alongside organisational level stakeholders from organisations such as the Council, the Environment Agency and local universities. The numerous examples of stakeholder engagement discussed within the three case studies support the theoretical premise which emphasises that flood risk management is moving toward a more inclusive and participatory approach (Begg, 2018; Edelenbos, et al., 2017; Thaler & Priest, 2014). The evidence of stakeholder engagement within GM also suggests that changes in policy at both a European and UK level toward increasing stakeholder engagement (Begg, 2018; Thaler & Levin-Keitel, 2016) is having an effect at a local level. Comparison of the three case studies, however, reveals that types of stakeholder engagement still vary significantly between different flood resilience projects, indicating that increased stakeholder engagement is not a consistent trend within GM. SSB, for example, displays numerous examples of proactive and reactive stakeholder engagement, and whilst the other two projects demonstrate some stakeholder engagement, there are fewer examples and of those that are used, they are only within the proactive aspect of flood resilience, as displayed in Figure 30. It should therefore be noted that whilst this research has found particularly high levels of community level stakeholder engagement in the SSB project, this project may not be representative of flood resilience projects across Greater Manchester.

Figure 31. *Methods of stakeholder engagement in and around the three case studies in relation to level of stakeholder engagement and organisation participation (model based on figure 3) with numbers identifying the project (1. SSB, 2. HSS, 3. RESIN).*



On closer inspection, it is evident that the stakeholder engagement strategies demonstrated within the three case studies notably differ in the *level* of stakeholder engagement as illustrated above in Figure 31. Within and around the SSB project, it is evident that there are high levels of stakeholder engagement, with multiple examples of self-organisation including the Broughton Flood Group, community-run education techniques and to an extent the SSB project itself, where interviewees suggested that there was bottom-up pressure from community groups to influence the decision making process. This evidence of self-organisation is pivotal as it supports recent theoretical propositions that the concept should be incorporated into understandings of stakeholder engagement in flood risk management (Edelenbos, et al., 2016; Thaler & Priest, 2014). It also supports the use of the term stakeholder *engagement* as opposed to *participation*, as, in line with theoretical interpretations (Edelenbos, et al., 2017), it sufficiently acknowledges that these forms of self-organising stakeholder engagement do exist in practice. Conversely, the majority of stakeholder engagement techniques within the HSS and RESIN project are more toward the traditional flood management end of the Figure, where community engagement measures involve more passive participation techniques such as consultation and education, and, where there is coproduction, it involves organisational level stakeholders.

Whilst the SSB provides examples of self-organising community level stakeholder engagement- such as the Broughton Flood Group and the community run maintenance of the wetland, one must question here the extent to which the groups and initiatives are completely self-organising. Upon closer analysis of the Broughton Flood Group for example, whilst it was initiated and maintained by a resident, it is not completely independent of input from organisational level stakeholders. When the river levels rise around the SSB, the resident who is responsible for the flood group does go and check the basin themselves and does provide warnings and information to residents who would be affected by flooding (S01EA, S03BT, S05LR). However, this resident does also contact a member of the EA for more detailed information about rising river levels and is therefore partly reliant on them for the running of the flood group. Conversely, where it appears that organisational level stakeholders are solely responsible for an aspect of SSB, such as activating the flood basin after anticipating a flood event, interview analysis revealed that the EA relied upon residents and members of the flood group to provide live videos and photographs of the current river levels (S01EA, S03BT). Therefore, whilst the results sometimes present a situation where either community level stakeholders or organisational level stakeholder are responsible for a project, the distinction between the two is not always clear cut.

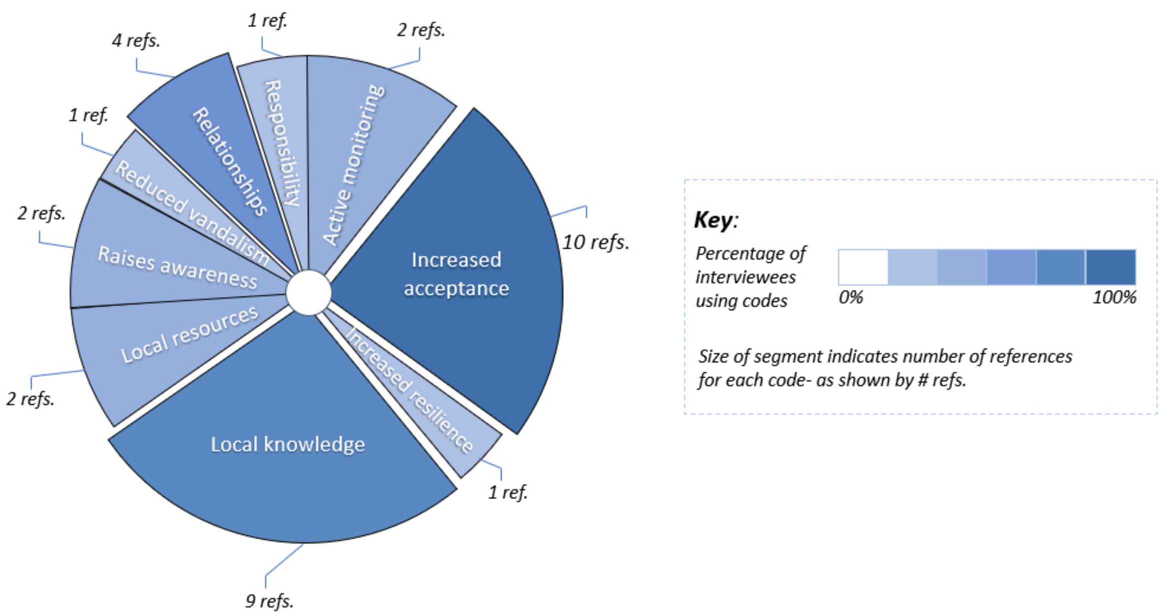
Analysis of interview data reveals several proponents of the proposition that; varying types and levels of stakeholder engagement are related to the strength of community group(s). This was not explored in the theoretical framework and the importance of community groups emerged from analysis of interview transcripts where interviewees from SSB and HSS (S01EA, S03BT, S06SC, H02CT, H03SC) discussed the 'strong sense of community' and placed emphasis on the importance of community groups as influencers and trusted intermediaries between the community and organisational institutions. This was further supported by an interviewee from the EA when considering a project subsequent to the SSB who stated that when trying to implement similar methods of stakeholder engagement, a lack of community cohesion and strong community groups thwarted its success. It is therefore important to note that a type of stakeholder engagement successful in one project is not always transferrable to another project, supporting a discussion within the theoretical framework which emphasises that not all projects warrant the application of stakeholder engagement. Interviewees from all three projects further discuss the impact the type of project has on stakeholder engagement, emphasising that projects which are more 'tangible', such as the SSB which includes a physical basin, are more likely to successfully engage community-level stakeholders. This would also help to explain why the RESIN project, which did not deliver any physical projects, was not suitable for the same level of community-level stakeholder engagement that the SSB was able to incorporate.

Results emphasise a difference between types of stakeholders engaged within and between projects, with interviewees from SSB for example, highlighting a difference between community groups and residents. This is noteworthy because, even though community *group* members felt included in the SSB project, results reveal that residents, who are directly affected by the scheme, were much less involved and in many cases did not understand the purpose of the scheme or its capabilities in improving flood resilience. Interviewees from all projects discussed the challenges of engaging residents, revealing that lack of ability or unwillingness to participate prevented these stakeholders from being engaged. This supports the theoretical premise that citizens do not have equal social capacity and that not all citizens are willing or able to engage in certain projects (Zuidema, 2016; Jakobsen & Andersen, 2013). Whilst this research categorises both community groups and residents as *community-level stakeholders*, the apparent differentiation in engagement between the two groups highlights the challenges that such categorisations face. It is therefore important to note here, that where stakeholder engagement has been found within the three projects, the stakeholders involved will not necessarily be representative of all affected stakeholders as not all stakeholders are always included in the engagement process. This challenges the idea that community is a cohesive group of people, as people do not always feel responsible for engaging in projects and are sometimes happy to rely on community groups.

As discussed in the theoretical framework, research has suggested that more educated and wealthier citizens are more inclined to be engaged in flood risk management (Jakobsen & Andersen, 2013; Kuhlicke, et al., 2011), however, the research from this study does not support this premise, with findings suggesting that residents and community groups from lower income neighbourhoods are more likely to be engaged. This comes from interview data where, for example, an interviewee from the EA (S01EA) explained that the success of engagement in the SSB project was a result of close community relationships and strong community groups, further stating that when trying to implement a similar project in a more wealthy neighbourhood, lack of community cohesion prevented the same levels of engagement. Furthermore, one resident from the SSB project worked to educate *themselves* to be part of the project, demonstrating that previous education is not always directly correlated with stakeholder engagement. Interviewees from the SSB also present the argument that residents trust community groups and are willing to hand over the responsibility of engaging in the SSB project, to them, so rather than directly being involved, they rely on the community groups. However, these statements came from interviews from the community groups or organisational level stakeholders and so it would further this research to speak to more residents and see if they support this statement.

Results reveal that perceptions of stakeholder engagement are largely positive, with interviewees discussing multiple benefits that stakeholder engagement brings to a project, as is illustrated above in Figure 32. A fair amount of the benefits discussed here are in line with theory; such as that it will increase knowledge (Lupo Stanghellini & Collentine, 2008), increase acceptance of decisions and strategies (De Boer & Zuidema, 2014; Mees, et al., 2014) and help contribute to resources (Adger, et al., 2009) as outlined in section 2.2. Interviewees from the three case studies revealed several additional emerging benefits of stakeholder engagement such as; that it reduces vandalism, increases responsibility, that local stakeholders can get involved in ongoing maintenance and that it increases resilience. These results highlight a general positive attitude toward stakeholder engagement with all interviewees from the three case studies acknowledging the benefits of stakeholder engagement. The results revealed few interviewees with negative perceptions surrounding stakeholder engagement, with only one interviewee (R02UM) suggesting that it would have made the project (RESIN) harder to manage. This could then be linked back to the nature of the project, as discussed earlier, which made the project not as suitable for stakeholder engagement.

Figure 32. *Pie chart illustrating perceived benefits of stakeholder engagement from all three case studies.*



A concept that emerged when considering the operationalisation of stakeholder engagement was that of integration. Interviewees suggested that integrating flood resilience with other outcomes was a way to engage more stakeholders within the process and maintain those stakeholders once the initial project has been completed. Both the SSB project and HSS demonstrated this in practice, with the former incorporating a wetland and footpath around the basin, which attracted the engagement of local stakeholders who could reap the benefits of these products; and in the latter project, interviewees discussed how trees and SuDS fostered the interest of local residents who were interested in improving their quality of life. This is in line with the shift toward flood risk management and flood resilience, where researchers suggest the need to integrate water management with spatial planning and other socio-cultural functions (e.g. Woltjer & Al, 2007). Thus, not only should integration be an inherent quality to flood risk management and flood resilience, but it should also be an integral technique for engaging stakeholder within these projects.

5.1.3 SHIFT IN STAKEHOLDER ENGAGEMENT OVER TIME

Results from the three case studies indicate that stakeholder engagement has shifted over the last 15 years in GM and has been influenced by internal and external factors such as a flood event, a flood resilience project and a financial crash. Interviewees from all three case studies stated that a flood event, for example, has a significant influence in increasing various types of stakeholder engagement, which supports the theoretical premise that a flood event can be a focusing event in which local stakeholders become actively engaged (Thaler & Seebauer, 2019; Forrest, et al., 2019). The results from the SSB project offer a clear model of stakeholder engagement over time which has seen a step-by-step increase in engagement, influenced by the SSB project and later by the 2015 boxing day flood (Figure 20). Stakeholders from the HSS and RESIN project, however, were less certain about changes in stakeholder engagement, although interviewees did emphasise that a flood event and a financial crash were significant factors affecting stakeholder engagement. Stakeholders from these two projects also discussed a few factors that had led to a decrease in stakeholder engagement which particularly focused upon funding issues that had led to a slowing down of projects, subsequently frustrating stakeholders who were not witnessing results for their efforts. These findings are particularly relevant for practitioners who want to increase stakeholder engagement and could utilise the window of opportunity a flood event offers and who should be aware that a lack of project activity has the potential to frustrate engaged stakeholders.

Further analysis of stakeholder engagement over time revealed that maintaining engagement beyond the project boundaries is a significant challenge facing current practitioners. This was discussed by interviewees from all projects who emphasised the need for organisational level stakeholders to maintain relationships with community level stakeholders and to find ways to encourage them to retain an interest in the project beyond its completion. Benefits for all stakeholders in maintaining stakeholder engagement post-project completion are illustrated within the SSB project, whereby community level stakeholders continue to work with the EA to monitor the river levels around the basin and still work on wetland and site maintenance. By including community-level stakeholders within the decision-making process for SSB, the community were able to request a wetland within the basin. It could therefore be suggested that because the community had got what they wanted out of the project, due to high levels of stakeholder engagement, they are willing to take responsibility of the site and continue to maintain it. This further emphasises why including community level stakeholders in the decision-making process is important, as it may help to address losses in stakeholder engagement as stakeholders become less interested in flood risk management as the risk perception decreases as discussed in previous research (Thaler & Levin-Keitel, 2016; Kuhlicke, et al., 2011).

6 CONCLUSION

6.1.1 METHODOLOGICAL REFLECTION

Several models have been used within this study as a basis for analysis and later as a tool to help understand, compare and contextualise the results of stakeholder interviews and document analysis. These models include a diagram which illustrates various levels of stakeholder engagement within a flood resilience project (Figure 3), a conceptual model- which identifies how stakeholder engagement methods fit in relation to a flood event (Figure 4) and finally, a model which visualises how stakeholder engagement within flood resilience projects changes over time (Figure 5). These models helped to categorise large amounts of collected data and provide a clear visualisation of how stakeholder engagement has been achieved within each flood resilience project. The models from each project were then used as reference points for discussion and also provided an efficient way of comparing the three case studies with one other. The models helped to contextualise the data collected in relation to both the temporal context and the level of stakeholder engagement within each flood resilience project and this helped to frame the findings within current theoretical debate and the wider context. The models however should be used carefully, as in reality, the categories and boundaries defined in each model are not as clear cut as they are presented. It must therefore be assumed that the models are not accurate representations of reality and should only be seen as tools to help contextualise and understand the data collected.

Whilst the methodology laid out in section 3 was selected carefully for the proposed research and, as discussed, aimed to provide a coherent set of qualitative and quantitative results, the strategy is not without limitations and has shifted accordingly with the research. For example, the original plan for interviewees was to select an equal number of stakeholders from all three projects, however, following further project research it became apparent that there was a higher number and wider variety of stakeholders from the SSB project than the other two projects. As a result, there were more interviews conducted with stakeholders from the SSB project than the other two projects and as such it should be noted that the results offer a more in-depth representation of the SSB. Whilst interviews from the SSB included community level stakeholders, it would have added depth to the research to have had interviews with community level stakeholders from the HSS project and RESIN project, as it would have widened the perceptions beyond those held by organisational level stakeholders. It could therefore be proposed that including a set of questionnaires for residents for example, would have added depth to the project, illustrating for example how residents understand and perceive each project. Finally, whilst it was not possible in this research, future research would benefit from a higher number of case studies, to increase the comprehensibility and representativeness of flood resilience projects within GM.

6.1.2 CONCLUDING REMARKS

This research explores how stakeholder engagement is understood, perceived and operationalised in flood resilience projects in Greater Manchester. This is done through in-depth analysis of three flood resilience case studies within Greater Manchester; Salford Second Basin, Howard Street SuDS and the RESIN project. The results derived from a series of semi-structured interviews and document analysis have been positioned against current literature and scholarly debate on flood resilience and stakeholder engagement, with the aim of widening the understanding of stakeholder engagement within flood resilience projects, which remains under researched in practice.

Analysing the conceptual understandings of flood resilience reveals that in both theory and practice, the concept is regularly assigned different definitions. In theory there is a vast amount of research underlying flood resilience definitions, highlighting engineering, ecological and socio-ecological resilience as three prominent interpretations (Folke, et al., 2016; Davoudi, 2012; Holling, 1996). The results of interview and document analysis demonstrate the difficulties of categorising stakeholder definitions within these three theoretical classifications, revealing a disconnect between theory and practice. Further analysis of stakeholder definitions reveals differences between and within the case studies, indicating that there is not one concrete definition and interpretation of flood resilience across GM. In practice, the three projects themselves reveal very different ways of operationalising flood resilience and could be used to explain why various definitions of flood resilience exist in theory and practice. If further research supports this trend, it could be suggested that flood resilience as a concept should remain ambiguous and open as a way to encourage practitioners to increase flood resilience in different forms, utilising the surrounding context and the skills of the involved stakeholders.

The results reveal that stakeholder engagement is operationalised within flood resilience projects in Greater Manchester, supporting the literature studies which suggest that stakeholder engagement is prevalent in practice (Begg, 2018; Edelenbos, et al., 2017). Types and levels of stakeholder engagement, however, differ within and between projects, with the highest levels of community level stakeholder engagement evident in and around the SSB, which included various forms of self-organisation. The difference between the projects demonstrates that the type of project and local context affect stakeholder engagement, with influential factors including tangibility of project and active community groups. This is useful for practitioners who must be aware that successful stakeholder engagement in one project cannot be directly transferred to another and should be developed in a context specific way. Interviewed stakeholders from all projects were highly supportive of stakeholder engagement and discussed a number of associated advantages and benefits. Further analysis revealed several additional benefits of stakeholder engagement which included maintaining relationships and engagement post-project completion; and reducing potential problems of flood resilience projects, such as unequal outcomes and power imbalances, further emphasising the importance of stakeholder engagement within flood resilience projects.

Assessing the long-term changes in stakeholder engagement, interviewees from the projects reveal a number of key factors influencing changes in types of stakeholder engagement, many of which are supported by theoretical research (e.g. Mees, et al., 2014; Adger, et al., 2009). Interviewees suggested that beyond the initial task of engaging stakeholders, one of the main challenges facing practitioners is that of maintaining engagement post-project completion. The SSB is presented by interviewees as a project which has successfully addressed this challenge; as by engaging community level stakeholders within the decision-making process, these stakeholders have developed a sense of ownership and responsibility for the site, which has led to their continual engagement in educating residents, maintaining the basin and initiating other flood resilience projects. Further analysis reveals that integrating project goals with other objectives may be a way to first engage stakeholders and later maintain their engagement in the long term, acknowledging that stakeholder's interests differ. In line with a shift toward flood risk management which encourages an integrated policy approach (Nye, et al., 2011; Woltjer & Al, 2007), practitioners and planners looking to increase flood resilience must therefore seek ways to broaden the agenda of a flood resilience project, capitalising on the various benefits and objectives a project can additionally deliver.

To further this research, there are several opportunities for future researchers to explore stakeholder engagement in flood resilience projects within Greater Manchester. First, whilst this research did find examples of community level stakeholder engagement, especially in and around the SSB, findings indicate a disparity between residents and community groups within this category. Whilst not explored in great detail within this study, current findings could be used to suggest that 'community' may not represent a cohesive group of people, which could have implications for the categorisation of 'community level stakeholders' as was used in this research. It is therefore recommended that future research should investigate what it means to be a community level stakeholder, with the aim of understanding power relations, capacity and willingness of individuals and groups to engage in flood resilience projects. Such research could be carried out, for example, by conducting a study which interviews a wider selection of community level stakeholders, including particularly residents, who were underrepresented in this research, to find out whether they are fairly represented in flood resilience projects. Furthermore, this study found that it is often difficult to engage residents, and so future research could add depth to this by addressing stakeholders who are not willing to engage in projects and find out the reasons for withholding. The aim of this proposed research focus is to ensure the needs and values of all community level stakeholders are represented in the decision-making process to ensure that flood resilience projects benefit those most in need.

The apparent disparity in stakeholder engagement between the three flood resilience projects within this research could indicate that stakeholder engagement within flood resilience projects is inconsistent across Greater Manchester. Furthermore, within this research, an interviewee from the EA, who participated in the SSB project, stated that it was difficult to engage community level stakeholders in the decision-making process of a similar flood resilience project, suggesting that stakeholders in this other location (within GM) were reluctant to get involved (S01EA). To further evaluate the validity of these statements, it is proposed that future research attempt to increase the sample size of flood resilience projects to assess whether stakeholder engagement identified within this study is indeed representative of other flood resilience projects across the city-region. To further develop this, it could be suggested that future research attempts to find out the reasons why stakeholder engagement is more successful in one project than another, considering not only the type of project but also the location within GM, the type of community which facilitates stakeholder engagement and the type of stakeholders who are most willing to be engaged within such a project. Finally, whilst this research has investigated stakeholder engagement in flood resilience projects in GM, it would be beneficial to further investigate whether these findings can be utilised by other cities also facing increased flood risk. To do this, research could assess whether the factors which enabled high levels of stakeholder engagement in GM are comparable to other contextual situations.

This research demonstrates a number of benefits gained by engaging community level stakeholders within the decision-making process of a flood resilience project. This is particularly relevant for organisational level stakeholders and practitioners responsible for flood resilience projects, who could reap the benefits offered by encouraging and facilitating community level stakeholder engagement. Moreover, the research presented in this paper suggests that community level stakeholder engagement has the potential to improve flood resilience itself in the long term, as community level stakeholders often have the capacity to maintain a project post-competition and could initiate localised flood resilience projects in the future. Thus, it should be emphasised that community level stakeholder engagement has the capacity to both improve the long-term prospective of an organisation-ran project, as well as the potential to lead to community organised flood resilience projects. This has further implications for theorists who, in reflection of the identified significance of self-organisation, could further research the potential techniques which may encourage and facilitate self-organising community level stakeholders, amid the numerous examples for further research identified above.

By exploring stakeholder engagement in flood resilience projects within GM, this research aims to understand how GM is reorganising itself to become more flood resilient in the face of projected increases in flood risk threatened by climate change (Cavan, 2018) and population increase (Nash, 2018). The results discussed in this paper illustrate an increase in stakeholder engagement within flood resilience projects, through the operationalisation of both flood resilience and stakeholder engagement within the city-region. The research highlights various challenges facing practitioners within the field and aims to identify key strategies to alleviate and resolve these. Notably, the results highlight the distinct advantages that stakeholder engagement can bring to a flood resilience project, reiterating the importance of stakeholder engagement with the ambition that it will encourage practitioners to further incorporate it into future projects. The research further demonstrates the importance of involving community level stakeholders in the decision-making process, utilising local community groups, and being aware of factors which influence long-term goals of flood resilience. Whilst this research has focused on Greater Manchester, increasing flood risk is not unique to this city-region and it is proposed that this research will be of further importance to others following the same path.

7 REFERENCES

100 Resilient Cities, n.d. Greater Manchester's Resilience Challenge. [Online] Available at: https://100resilientcities.org/cities/greater-manchester/ [Accessed 06 03 2019].

Adger, W., Hughes, T. P., Folke, C., Carpenter, S. R. & Rockström, J., 2005. Social–ecological resilience to coastal disasters. Science, 309(5737), pp. 1036-1039.

Adger, W. N., Dessai, S., Goulden, M., Hulm, M., Lorenzoni, I., Nelson, D, R., Naess, L, O., Wolf, J., Wreford, A., 2009. Are there social limits to adaptation to climate change?. Climate Change, 93, pp. 335-354.

Alexander, D. E., 2013. Resilience and disaster risk reduction: an etymological journey. Natural Hazards Earth System Science, 13, pp. 2707-2716.

ARUP, 2014. City resilience framework, s.l.: The Rockefeller Foundation and ARUP International Development.

Balsells, M., Barroca, B., Becue, V. & Serre, D., 2015. Making urban flood resilience more operational: current practice. Proceedings of the Institution of Civil Engineers, 168(2), pp. 57-65.

Begg, C., 2018. Power, responsibility and justice: a review of local stakeholder participation in European flood risk management. The International Journal of Justice and Sustainability, 23(4), pp. 383-397.

Begg, C., Walker, G. & Kuhlicke, C., 2015. Localism and flood risk management in England: the creation of new inequalities?. Environment and Planning C: Government and Policy, 33, pp. 685-702.

Beierle, T., 2002. The quality of stakeholder-based decisions. Risk Analysis, 22(4), pp. 739-749.

Beierle, T. C. & Cayford, J., 2002. Democracy in Practice: Public Participation in Environmental Decisions. Washington, DC: Resources for the Future.

Bekkers, V. J. J. M., Edelenbos, J., Nederhand, J., Steijn, A. J., Tummers, L. G. & Voorberg, W. H., 2014. The social innovation perspective in the public sector: Co-creation, self-organization and meta-governance. In: J. Edelenbos, V. Bekkers & A. J. Steijn, eds. Innovation in the public sector: linking capacity and leadership. New York: Palgrave Macmillan, pp. 223-244.

Berkes, F., 2007. Understanding uncertainty and reducing vulnerability: lessons from resilience thinking. Natural Hazards, 41(2), pp. 283-295.

Berkes, F., Colding, J., Folke, C. & (Ed.), 2003. Navigating social-ecological systems: building resilience for complexity and change. Cambridge: Cambridge University Press.

Birkland, T. A. & Waterman, S., 2009. The politics and policy challenges of disaster resilience. In: C. P. Nemeth, E. Hollnagel & S. Dekker, eds. Resilience engineering perspectives. 2: preparation and restoration. Surrey: Ashgate Publishing Limited, pp. 15-38.

Bradshaw, C. J., Sodhi, N. S., Peh, K. S.-H. & Brook, B. W., 2007. Global evidence that deforestation amplifies flood risk and severity in the developing world. Global Change Biology, 13(11).

Buckley, W., 1968. Modern Systems Research for the Behavioural Scientist: A sourcebook. Chicago: Aldine Publishing Company.

Butler, C. & Pidgeon, N., 2011. From 'Flood Defence' to 'Flood Risk Management': Exploring Governance, Responsibility, and Blame. Environment and Planning C: Politics and Space, 29(3), pp. 533-547.

Carpenter, S., Westley, F. & Turner, M., 2005. Surrogates for resilience of social–ecological systems. Ecosystems, 8, pp. 941-944.

Carter, J. G., Cava, G., Connelly, A., Guy, S., Handley, J. & Kazmierczak, A. 2015. Climate change and the city: Building capacity for urban adaptation. Progress in Planning, 95, pp. 1-66.

Cavan, G., 2018. Climate change projections for Greater Manchester. Version 2. Manchester: EcoCities project, University of Manchester.

Challies, E., Newig, J., Thaler, T., Kochskämper, E. & Levin-Keitel, M., 2016. Participatory and collaborative governance for sustainable flood risk management: An emerging research agenda. Environmental Science Policy, 55, pp. 275-280.

Cilliers, P., 1998. Complexity and postmodernism: Understanding complex systems. London: Routledge.

City of Trees, n.d. Case study: Howard Street Salford: A SUDS project. [Online] Available at: https://www.sustainabilityexchange.ac.uk/files/howard_street.pdf [Accessed 28 April 2019].

City of Trees, n.d. Howard Street, Salford. [Online] Available at: https://www.cityoftrees.org.uk/project/howard-street-salford [Accessed 28 April 2019].

Davoudi, S., 2012. Resilience: A bridging concept or a dead end?. Planning Theory and Practice, 13(2), p. 299–307.

Davoudi, S., 2016. Resilience and Governmentality of Unknowns. In: M. Bevir, ed. Governmentality after neoliberalism. New York: Taylor & Francis, pp. 152-170.

De Boer, J. & Zuidema, C., 2014. Towards an integrated energy landscape. Urban Design and Planning, 163(5), pp. 231-240.

De Bruijn, K. M., 2004. Resilience indicators for flood risk management systems of lowland rivers. International Journal of River Basin Management, 2(3), pp. 199-210.

De Roo, G. & Silva, E. A., 2010. A planner's encounter with complexity. Farnham, UK: Ashgate.

DEFRA, 2005. Making space for water - Taking forward a new Government strategy for flood and coastal erosion risk management in England (Government response March 2005), London: UK Department for Environment, Food and Rural Affairs.

Demuzere, M., Orru, K., Heidrich, O., Olazabal, E., Geneletti, D., Orru, H., Bhave, A, G., Mittal, N., Feliu, E. & Faehnle, M., 2014. Mitigating and adapting to climate change: Multi-functional and multi-scale assessment of green urban infrastructure. Journal of Environmental Management, 146, pp. 107-115.

Dovers, S. R. & Handmer, J. W., 1992. Uncertainty, sustainability and change. Global Environmental Change, 2(4), pp. 262-276.

Edelenbos, J., Van Buuren, A., Roth, D. & Winnubst, M., 2017. Stakeholder initiatives in flood risk management: exploring the role and impact of bottom-up initiatives in three 'Room for the River' projects in the Netherlands. Journal of Environmental Planning and Management, 60(1), pp. 47-66.

Edelenbos, J., Van Meerkerk, I. & Schenk, T., 2016. The Evolution of Community Self-Organization in Interaction With Government Institutions: Cross-Case Insights From Three Countries. The American Review of Public Administration, 48(1), pp. 1-21.

Ellis, M., Carter, J. & Connelly, A., 2016. RESIN: City Assessment Report Greater Manchester, Greater Manchester: RESIN.

Environment Agency, 2014. Salford Flood Improvement Scheme: Non-Technical Summary, Bristol: Environment Agency.

European Academies' Science Advisory Council, 2018. New data confirm increased frequency of extreme weather events: European national science academies urge further action on climate change adaptation. [Online] Available at: https://www.sciencedaily.com/releases/2018/03/180321130859.html[Accessed 30 01 2019].

Evans, E., Ashley, R., Hall, J., Penning-Rowsell, E., Saul, A., Thorne, C. & Watkinson, A., 2004. Foresight future flooding scientific summary. s I and II, Office of Science and Technology: London.

Folke, C., 2006. Resilience: The emergence of a perspective for social-ecological systems analyses. Global Environmental Change, 16, pp. 253-267.

Folke, C., Biggs, R., Norström, A, V., Reyers, B. & Rockström, J., 2016. Social-ecological resilience and biosphere-based sustainability science. Ecology and Society, 21(3).

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T. & Rockström, J., 2010. Resilience thinking: integrating resilience, adaptability and transformability. Ecology and Society, 15(4).

Folke, C., Hahn, T., Olsson, P. & Norberg, J., 2005. Adaptive Governance of Social-Ecological Systems. Annual Review of Environment and Resources, 15(30), pp. 441-473.

Forrest, S., Trell, E.-M. & Woltjer, J., 2017. Flood Groups in England: Governance arrangements and contribution to flood resilience. In: E. Trell, B. Restemeyer, M. Bakema & B. van Hoven, eds. Governing for Resilience in Vulnerable Places. Oxon: Routledge, pp. 92-115.

Forrest, S., Trell, E.-M. & Woltjer, J., 2019. Civil society contributions to local level flood resilience: Before, during and after the 2015 Boxing Day floods in the Upper Calder Valley. Transactions of the Institute of British Geographers, 44(2), pp. 1-15.

Freeman, R. E., 1984. Strategic Management: A Stakeholder Approach. Boston: Pitman.

Gilissen, H. K., Meghan, A., Matczak, P., Pettersson, M. & Bruzzone, S., 2016. A framework for evaluating the effectiveness of flood emergency management systems in Europe. Ecology and Society, 21(4).

GMCA, 2016. Flood Investigation Report: Greater Manchester 26 December 2015, Manchester: GMCA.

GMCA, 2017. Greater Manchester agenda-setting workshop summary report, Manchester: GMCA.

GMCA, 2019. Greater Manchester's Plan for Homes, Jobs, and the Environment: Greater Manchester Spatial Framework, Greater Manchester: GMCA.

Godschalk, D. R., 2003. Urban hazard mitigation: creating resilient cities. Natural Hazards Review, 4(3), pp. 136-143.

Gunderson, L. & Holling, C., 2001. Panarchy. Understanding Transformation in Human and Natural Systems. London: Island Press.

Halford, A., Cheal, A. J., Ryan, D. & Williams, D. M., 2004. Resilience to large-scale disturbance in coral and fish assemblages on the great barrier reef. Ecology, 85(7), pp. 1892-1905.

Hartmann, T. & Spit, T., 2016. Implementing the European flood risk management plan. Journal of Environmental Planning and Management, 59(2), pp. 360-377.

Healey, P., 1996. The communicative turn in planning theory and its implications for spatial strategy formation. Environment and Planning B: Planning and design, 23(2), pp. 217-234.

Heylighen, F., 2001. The science of self-organization and adaptivity. In: L. D. Kiel, ed. Knowledge management, organizational intelligence and learning, and complexity. The encyclopedia of life support. Oxford: Eolss Publishers, pp. 126-146.

Holland, J. H., 1995. Hidden Order: How adaptation builds complexity. New York: Addison-Wesley.

Holling, C. S., 1973. Resilience and stability of ecological systems. Annual Review of Ecology and Systematics, 4, pp. 1-12.

Holling, C. S., 1996. Engineering resilience versus ecological resilience. In: P. Schulze, ed. Engineering Within Ecological Constraints. Washington DC: National Academy Press, pp. 31-44.

IPCC, 2014. Summary for Policymakers. In: Field, C, B., Barros, V. R., Dokken, D. J., Mach, K. J., Mastrandrea, M. D., Bilir, T. E., Chatterjee, K. L., Ebi, K. L., Estrada, Y.O., Genova, R. C., Girma, B., Kissel, E. S., Levy, A. N., MacCracken, S., Mastrandrea, P. R. & White, L. L. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, USA: Cambridge University Press, pp. 1-32.

Jakobsen, M. & Andersen, S. C., 2013. Coproduction and Equity in Public Service Delivery. Public Administration Review, 73(5), pp. 704-713.

Jessop, B., Kastandiek, H., Nielsen, K. & Pedersen, O., 1991. The politics of flexibility: Restructuring the State and Industry in Britain, Germany and Scandinavia. Aldershot: Edward Elgar.

Jevrejeva, S., Jackson, L, P., Grinsted, A., Lincke, D. & Marzeion, B., 2018. Flood damage costs under the sea level rise with warming of 1.5◦C and 2 ◦C. Environmental Research Letters, 13.

Johnson, C. & Priest, S., 2008. Flood risk management in England: a changing landscape of riskresponsibility. International Journal of Water Resources Development, 24, pp. 513-525.

Kaźmierczak, A. & Cavan, G., 2011. Surface water flooding risk to urban communities: Analysis of vulnerability, hazard and exposure. Landscape and Urban Planning, 103(2), pp. 185-197.

Konečný, M. & Reinhardt, W., 2010. Early warning and disaster manafement: the importance of geographic information (Part A). International Journal of Digitial Earth, 3(3), pp. 217-220.

Kuhlicke, C., Steinführer, A., Begg, C., Bianchizza, C., Bründl, M., Buchecker, M., De Marchi, B., Di Masso Tarditti, M., Höppner, C., Blaž, K., Lemkow, L., Luter, J., McCarth, S., Pellizzoni, L., Renn, O., Scholobig, A., Supramaniam, M., Tapsell, S., Faulner, H., 2011. Perspectives on Social Capacity Building for Natural Hazards: Outlining an Emerging Field of Research and Practice in Europe. Environmental Science and Policy, 14(7), pp. 804-814.

Kundzewicz, Z. W., Pińskwar, I. & Brakenridge, G. R., 2013. Large floods in Europe, 1985–2009. Hydrological Sciences Journal, 58(1), pp. 1-7.

Laeni, N., van den Brink, M. & Arts, J., 2019. Is Bangkok becoming more resilient to flooding? A framing analysis of Bangkok's flood resilience policy combining insights from both insiders and outsiders. Cities, 90, pp. 157-167.

Lamond, J. & Proverbs, D., 2009. Resilience to flooding: learning the lessons from an international comparison of the barriers to implementation. Urban Design and Planning, 162(2), pp. 63-70.

Lane, S., Odoni, N., Landström, C., Whatmore, S. J., Ward, N. & Bradley, S., 2010. Doing flood risk science differently: an experiment in radical scientific method. Transactions of the Institute of British Geographers, 36(1), pp. 15-36.

Le Quéré, C., Andrew, R, M., Friedlingstein, P., Sitch S., Hauck, J., Pongratz, J., Pickers, P, A., orsbakken, J. A., Peters, G, P., Canadell, J, G., Anneth, A., Arora, V. K., Barbero, L., Bastos, A., Bopp, L., Chevallier, F., Chini, L. P., Ciais, P., Doney, S. C., Gkritzalis, G., Goll, D, S., Harris, I., Haverd, V., Hoffman, F. M., Hoppema, M., Houghton, R. A., Hurtt, G., Ilyina, T., Jain, A. K., Johannessen, T., Jones, C. D., Kato, E., Keeling, R. F., Goldewijk, K. K., LLandschützer, P., Lefèvre, N., Lienert, S., Liu, Z., Lombardozzi, D., Metzl, N., Munro, D. R., Nabel, J. E. M.. S., Nakaoka, S., Neill, C., Olsen, A., Ono, T., Patra, P., Peregon, A., Peters, W., Peylin, P., Pfeil, B., Pierrot, D., Poulter, B., Rehder, G., Resplandy, L., Robertson, E., Rocher, M., Rödenbeck, C., Schuster, C., Schwinger, J., Séférian, R., Sckjelvan, I., Steinhoff, T., Sutton, A., Tans, P. P., Tian, H., Tilbrook, B., Tubiello, F. N., van der Laan-Luijkx, I. T., van der Werf, G. R., Viovy, N., Walker, A. P., Wiltshire, A. J., Wright, R., Zaehle, S. & Zheng, B., 2018. Global Carbon Budget 2018. Earth System Science Data, 10(4), pp. 2141-2194.

Leichenko, R., 2011. Climate change and urban resilience. Current Opinion in Environmental Sustainability, 3(3), pp. 164-168.

Liao, K.-H., 2012. A Theory on Urban Resilience to Floods—A Basis for Alternative Planning Practices. Ecology and Society, 17(4).

Lindell, M. K., & Perry, R. W., 2001. Community innovation in hazardous materials management: Profess in implementing SARA Title III in the United States. Journal of Hazardous Materials, 88, pp. 169–194.

Liu, J., Dietz, T., Carpenter, S. R., Alberti, M., Folke, C., Moran, E., Pell, A. M., Deadman, P., Kratz, T., Lubchenco, J., Ostrom, E., Ouyang, Z., Provencher, W., Redman, C. L., Schneider, S. H. & Taylor, W. W., 2007. Complexity of Coupled Human and Natural Systems. Science, 317(5844), pp. 1513-1516.

Livetrekker application, 2019. [Online] Available at: /www.livetrekker.com [Accessed 18 April 2019].

Lukes, S., 2005. Power. A Radical View. London: Palgrave Macmillan.

Lupo Stanghellini, P. S., 2010. Stakeholder Involvement in Water Management: The Role of the Stakeholder Analysis Within Participatory Processes. Water Policy, 12(5), pp. 675-694.

Lupo Stanghellini, P. S. & Collentine, D., 2008. Stakeholder Discourse and Water Management: Implementation of the Participatory Model CATCH in a Northern Italian Alpine Sub Catchment. Hydrology and Earth System Sciences, 12, pp. 217-331.

Mahtani, K. & Spencer, E. A., 2017. Catalogue of Bias Collaboration. [Online] Available at: https://catalogofbias.org/biases/observer-bias/ [Accessed 20 June 2019].

Masterson, J. H., Peacock, W, G., Van Zandt, S. S., Grover, H., Schwarz, L. F. & Cooper, J. T., 2014. Planning for community resilience: A handbook for reducing vulnerability to disasters. Washington, DC: Island Press.

Mees, H., Crabbé, A., Alexander, M., Kaufmann, M., Bruzzone, S., Lévy, L. & Lewandowski, J.,2016. Coproducing flood risk management through citizen involvement: insights from cross-country comparison in Europe. Ecology and Society, 21(3), p. 7.

Mees, H. L., Driessen, P. P. & Runhaar, H. A., 2014. Legitimate adaptive flood risk governance beyond the dikes: the case of Hamburg, Helsinki and Rotterdam. Regional Environmental Change, 14(2), pp. 671-682.

Mees, H. L., Uittenbroek, C. J. & Hegger, D. L., 2019. From citizen participation to government participation: An exploration of the roles of local governments in community initiatives for climate change adaptation in the Netherlands. Environmental Policy and Governance, 0(0), pp. 1-11.

Meijerink, S. & Dicke, W., 2008. Shifts in the Public-Private Divide in Flood Management. Water Resources Development, 24(4), pp. 499-512.

Menzel, S. & Buchecker, M., 2013. Does participatory planning foster the transformation toward more adaptive social–ecological systems?. Ecology and Society, 18(1), p. 13.

Messer, N. M., 2003. The role of local institutions and their interaction in disaster risk management: A literature review, s.l.: FAO Corporate Document Repository, Economic and Social Development Department.

Michels, A., 2011. Innovations in Democratic Governance: How Does Citizen Participation Contribute to a Better Democracy?. International Review of Administrative Sciences, 77(2), pp. 275-293.

Miller, J. D. & Hutchins, M., 2017. The impacts of urbanisation and climate change on urban flooding and urban water quality: A review of the evidence concerning the United Kingdom. Journal of Hydrology: Regional Studies, 12, pp. 345-362.

Mullings, B. 1999. Insider or outsider, both or neither: some dilemmas of interviewing in a cross-cultural setting. Geoforum, 30, pp. 337-350.

Nash, A., 2018. Statistical bulletin: Subnational population projections for England: 2016-based, s.l.: Office for National Statistics.

Neumann, B., Vafeidis, A. T., Zimmermann, J. & Nicholls, R., 2015. Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding - A Global Assessment. PLoS One, 11(3).

Newig, J., Challies, E., Jager, N. & Kochskämper, E., 2014. E. What role for public participation in implementing the EU Floods Directive? A comparison with the Water Framework Directive, early evidence from Germany and a research agenda. Environmental Policy and Governance, 24, pp. 275-288.

NHS, n.d. Greater Manchester Shared Services. [Online] Available at: https://www.gmsharedservices.nhs.uk/ [Accessed 02 April 2019].

Nishat, A., Reazuddin, M., Amin, R. & Khan, A. R., 2000. The 1998 flood: impact on environment of Dhaka city. Dhaka. Department of Environment and IUCN Bangladesh.

Nye, M., Tapsell, S. & Twigger-Ross, C., 2011. New social directions in UK flood risk management: moving towards flood risk citizenship?. Journal of Flood Risk Management, 4, pp. 288-297.

Ordinance Survey OpenData, 2010. Greater Manchester UK locator map 2010. [Online] Available at: https://www.ordnancesurvey.co.uk/business-and-government/products/finder.html?Licensed%20for=OpenData%20(Free)&withdrawn=on [Accessed 02 April 2019].

O'Toole, K., Keneley, M. & Coffey, B., 2013. The participatory logic of coastal management under the project state: insights from the Estuary Entrance Management Support System (EEMSS) in Victoria, Australia. Environmental Science & Policy, 27, pp. 206-214.

Pannucci, C. J. & Wilkins, E. G. 2011. Identifying and Avoiding Bias in Research. Plastic and Reconstructive Surgery, 125(2), pp. 619-625.

Pearce, L., 2003. Disaster Management and Community Planning and Public Participation: How to Achieve Sustainable Hazard Mitigation. Natural Hazards, 28(2-3), pp. 211-228.

Peters, B. & Pierre, J., 2001. Developments in intergovernmental relations: towards multi-level governance. Policy & Politics, 29(2), pp. 131-135.

Pimm, S. L., 1991. The balance of nature?. Chicago, Illinois: Chicago Press.

Pitt, M., 2008. Learning lessons from the 2007 floods: and independent review by Sir Michael Pitt (The Pitt Review), London: Cabinet Office.

Prigogine, I. & Stengers, I., 1984. Order out of chaos: Man's new dialogue with nature. New York: Bantam Books.

RESIN, 2018. Our Tier 1 cities- Greater Manchester. [Online] Available at: http://www.resin-cities.eu/greatermanchester/ [Accessed 18 11 2018].

RESIN, n.d. Our tier 1 cities- Greater Manchester. [Online] Available at: file:///C:/Users/fcstr/Documents/RUG/Thesis/Policy%20Documents/RESIN%20project/RESIN%20website%20page.html [Accessed 30 April 2019].

Restemeyer, B., van den Brink, M. & Woltjer, J., 2018. Resilience unpacked – framing of ‘uncertainty’ and ‘adaptability’ in long-term flood risk management strategies for London and Rotterdam. European Planning Studies, 26(8), pp. 1559-1579.

Restemeyer, B., Woltjer, J. & van den Brink, M., 2015. A strategy-based framework for assessing the flood resilience of cities – A Hamburg case study. Planning Theory & Practice, 16(1), pp. 45-62.

Rosenzweig, C., Solecki, W., Hammer, S. & Mehrotra, S., 2010. Cities lead the way in climate-change action. Nature, 467, pp. 909-911.

Rouillard, J. J., Reeves, A. D., Heal, K. V. & Ball, T., 2014. The role of public participation in encouraging changes in rural land use to reduce flood risk. Land Use Policy, 38, pp. 637-645.

Salford City Council, 2018. New 13 acre wetland opens in Salford. [Online] Available at: https://www.salford.gov.uk/your-council/news/news-archive/news-from-may-2018/new-13-acre-wetland-opens-in-salford/ [Accessed 30 April 2019].

Scheffer, M., 2009. Critical transitions in nature and society. New Jersey: Princeton University Press.

Schelfaut, K., Pannemans, B., van der Craats, I., Krywkow, J., Mysiak, J. & Cools, J. 2011. Bringing flood resilience into practice: the FREEMAN project. Environmental Science & Policy, 14(7), pp. 825-833.

Silverman, D., 1993. Interpreting qualitative data: methods for analysing talk, text and interaction. London: Sage.

Smit, B. & Wandel, J., 2006. Adaptation, adaptive capacity and vulnerability. Global Environmental Change, 16, pp. 282-292.

Smith, C. & Lawson, N., 2012. Identifying extreme event climate thresholds for greater Manchester, UK: examining the past to prepare for the future. Meteorological Applications, 19, pp. 26-35.

Sorensen, J. H. & Sorensen, B. V., 2007. Community Processes: Warning and Evacuation. In: Handbook of Disaster Research. New York: Springer, pp. 183-199.

Spaans, M. & Waterhout, B., 2017. Building up resilience in cities worldwide – Rotterdam as participant in the 100 Resilient Cities Programme. Cities, 61, pp. 109-116.

Sultana, F. 2007. Reflexivity, positionality and participatory ethics: Negotiating fieldwork dilemmas in international research. ACME, 6(3), pp. 374-385.

SUSdrain, n.d. Howard Street, Salford, Manchester. [Online] Available at: https://www.susdrain.org/case-studies/pdfs/suds_awards/034_18_03_27_susdrain_suds_awards_howard_street_salford.pdf [Accessed 29 April 2019].

SUSdrain, n.d. Scotland legislation & regulation. [Online] Available at: https://www.susdrain.org/delivering-suds/using-suds/legislation-and-regulation/scotland.html [Accessed 22 May 2019].

Taylor, M., 2015. Hundreds evacuated after further flooding in northern England - Latest updates. [Online] Available at: https://www.theguardian.com/environment/live/2015/dec/27/hundreds-evacuated-flooding-northern-england-latest-updates [Accessed 17 May 2019].

Thaler, T. & Levin-Keitel, M., 2016. Multi-level stakeholder engagement in flood risk management—A question of roles and power: Lessons from England. Environmental Science & Policy, 55(2), pp. 292-301.

Thaler, T. & Priest, S., 2014. Partnership Funding in Flood Risk Management: New Localism Debate and Policy in England. Area, 46(4), pp. 418-425.

Thaler, T. & LeBauer, S., 2019. Bottom-up citizen initiatives in natural hazard management: Why they appear and what they can do?. Environmental Science & Policy, 94, pp. 101-111.

The University of Manchester, n.d. Climate Resilient Cities and Infrastructure (RESIN). [Online] Available at: https://www.seed.manchester.ac.uk/planning/research/impact/resin/ [Accessed 13 May 2019].

Thieken, A. H., Kreibichm, H. & Müller, M., 2007. Coping with floods: preparedness, response and recovery of flood-affected residents in Germany in 2002. Hydrological Sciences Journal, 52, pp. 1016-1037.

Trell, E.-M., Restemeyer, B., Bakema, M. M. & van Hoven, B., 2014. Governing for resilience in vulnerable places. London and New York: Routledge.

Tseng, C. P. & Penning-Rowsell, E. C., 2012. Micro-Political and Related Barriers to Stakeholder Engagement in Flood Risk Management. The Geographical Journal, 178(3), pp. 253-269.

Turnstall, S., Johnson, C. & Penning-Rowsell, E., 2004. Flood hazard management in England and Wales: from land drainage to flood risk management, New Delhi: World Congress on Natural Disaster Mitigation.

Twigger-Ross, C., Brooks, K., Papadopoulou, L. & Orr, P., 2015. Community resilience to climate change: an evidence review, York: Joseph Rowntree Foundation.

Twigger-Ross, C., Kashefi, E., Weldon, S., Brooks, K., Deeming, H., Forrest, S., Fielding, J., Gomersall, A., Harries, T., McCarthy, S., Orr, P., Parker, D. & Tapsell, S., 2014. Flood resilience community pathfinder evaluation: Rapid evidence assessment, London: Defra.

UK Government, 2010. Flood and Water Management Act 2010. [Online] Available at: http://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf [Accessed 07 03 2019].

UNISDR, 2015. Sendai Framework for Disaster Risk Reduction 2015-2030, s.l.: United Nations Office for Disaster Risk Reduction.

University of Salford Manchester, 2018. University partners in £10m flood basin on former Irwell campus. [Online] Available at: https://www.salford.ac.uk/news/articles/2018/university-partners-in-10m-flood-basin-on-former-irwell-campus [Accessed 30 April 2019].

van Buuren, M. W., Klijn, E. H. & Edelenbos, J., 2012. Democratic Legitimacy of New Forms of Water Management in the Netherlands. International Journal of Water Resources Development, 28(4), pp. 629-645.

van der Brugge, R., Rotmans, J. & Loorbach, D., 2005. The transition in Dutch water management. Regional Environmental Change, 5(4), pp. 164-176.

van Meerkerk, I. F., van Boonstra, B. & Edelenbos, J., 2013. Self-organization in urban regeneration: A two-case comparative research. European Planning Studies, 21, pp. 1640-1653.

Vis, M., Klijn, F., De Bruijn, K. & Van Buuren, M., 2003. Resilience strategies for flood risk management in the Netherlands. International Journal of River Basin Management, 1(1), pp. 33-40.

Wachira, J. W. & Sinclair, A. J., 2013. Public Participation in the Emergency Response Phase of Flooding: A Case Study of the Red River Basin. Canadian Water Resources Journal, 30(2), pp. 145-158.

Wagenaar, H., 2007. Governance, complexity, and democratic participation how citizens and public officials harness the complexities of neighbourhood decline. The American Review of Public Administration, 37, pp. 17-50.

Walker, B. H., Holling, C. S., Carpenter, S. R. & Kinzig, A., 2004. Resilience, adaptability and transformability in social–ecological systems. Ecology and Society, 9(2).

Warner, J., 2006. More Sustainable Participation? Multi-Stakeholder Platforms for Integrated Catchment Management. International Journal of Water Resources Development, 22(1), pp. 15-35.

Wengraf, T., 2001. Qualitative Research Interviewing: Biographic Narrative and Semi-Structured Methods. London: Sage.

Westley, F., Carpenter, S. R., Brock, W. A., Holling, C. S. & Gunderson, L. H., 2001. Why systems of people and nature are not just social and ecological systems. In: L. H. Gunderson & C. S. Holling, eds. Panarchy: Understanding Transformations in Human and Natural Systems. Washington, DC: Island Press, pp. 103-199.

White, I., 2010. Water and the City: Risk, resilience and planning for a sustainable future. Abingdon and New York: Taylor & Francis.

White, I. & O'Hare, P., 2014. From rhetoric to reality: which resilience, why resilience, and whose resilience in spatial planning?. Environment and Planning C: Government and Policy, 32(5), pp. 934-950.

Woltjer, J. & Al, N., 2007. Integrating water management and spatial planning - Strategies based on the dutch experience. Journal of the American Planning Association, 73(2), pp. 211-222.

Zevenbergen, C., van Herk, S., Rijke, J., Kabat, P., Bloemen, P., Ashley, R., Speers, A., Gersonius, B. & Veerbeek, W., 2013. Taming global flood disasters. Lessons learned from Dutch experience. Natural Hazards, 65(3), pp. 1217-1225.

Zevenbergen, C., Veerbeck, W., Gersonius, B. & Van Herk, S., 2008. Challenges in urban flood management: Travelling across spatial and temporal scales. Journal of Flood Risk Management, 1(2), pp. 81-88.

Zimmermann, E., Bracalenti, L., Piacentini, R. & Inostroza, L., 2016. Urban flood risk reduction by increasing green areas for adaptation to climate change. Precedia Engineering, 161, pp. 2241-2246.

Zuidema, C., 2016. Chapter 3: Navigating the plural. In: Decentralization in environmental governance; a post-contingency approach. Abingdon: Routledge.