

**An Evaluation of the Legislative
and Policy Processes for Blue Green
Infrastructure in England**

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Doctor of Philosophy

2025

An Evaluation of the Legislative and Policy Processes for Blue Green
Infrastructure in England

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A thesis submitted in partial fulfilment of the requirements of Birmingham City
University, Computer Engineering and Built Environment, Birmingham for the
degree of Doctor of Philosophy (PhD)

July 2025.

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ABSTRACT

As climate change intensifies and urbanisation accelerates, urban flooding has become an increasingly persistent challenge in England. Despite widespread policy recognition of Blue-Green Infrastructure (BGI) as a sustainable response, its implementation remains limited, inconsistent, and frequently tokenistic. This study investigates the legal, policy, regulatory, and institutional barriers constraining the effective integration of BGI into urban flood risk management. Responding to the need for ecosystem-based and integrated planning, the study makes an original contribution to knowledge by developing and empirically validating a governance framework that explains how interactions between legislation and policy, governance structures, resources, and stakeholder engagement shape the practical delivery of BGI. The framework develops conceptual insights by demonstrating how structural mismatches between national policies and local implementation systems generate institutional inertia and constrain adaptive infrastructure planning. The research critically analyses key statutory and policy instruments, including the Flood and Water Management Act 2010 and the National Planning Policy Framework, and examines two contrasting case studies: the Perry Barr and Witton Flood Risk Management Scheme and the Beales Corner project. The case studies include a document analysis, field observations and 30 semi-structured interviews with local authority officials, planners, consultants and community stakeholders. Data were systematically reviewed through a critical realist lens to uncover the structural and institutional mechanisms. Results show that weak legislative alignment, fragmented governance arrangements, constrained resourcing, and policy formulation processes reinforce system inertia and hinder the mainstreaming of BGI. The framework offers

a theoretical contribution as a diagnostic model to analyse governance constraints to climate-resilient infrastructure planning. Additionally, it offers a practical contribution as a tool to support policymakers, planners, and local authorities in identifying institutional bottlenecks and enabling more coordinated, cross-scale and adaptive implementation pathways.

ACKNOWLEDGEMENTS

I thank God Almighty for always being there with me throughout my PhD journey. It is through the strength, wisdom, and grace of God that this work is accomplished. I offer my most sincere gratitude to my God whose divine intervention facilitated my successful completion of this project. I would like to thank my husband Mr. Iwah Awara. The power of your love, encouragement, and selfless support cannot be measured. You are an angel on earth, and I am thankful for the sacrifices you have made to help me get through everything. To my adorable angels, Ariella, Joanna, Zoey and Zarah, I hope I have inspired you to greatness. Your presence and love gave me back the strength I lost when I was weak and discouraged. You constantly reminded me of the reason I desired to pursue a PhD. Mummy loves you all very much.

To my late mother, Pastor Mrs Ekeatte Obasse, you were my biggest supporter. I hope, Mum, you feel proud of me. I draw strength from your prayers and faith in me. Special thanks, my immediate and extended family and friends, for their endless support.

I would like to express my deepest gratitude to my Director of Studies, Professor Claudia Carter. The whole journey would not have been possible without your critical insight, continuous support and belief in my research. Your ongoing support, rigorous feedback and scholarly guidance have shaped this work tremendously and I appreciate your selfless commitment of time and energy. I am grateful to Professor David Proverbs who started this research project and believed in me from the beginning. Your encouragement impacted this journey greatly, and the phrase “keep writing” stuck with me. I appreciate your constant support and guidance. My sincere thanks are also extended to Dr. Hong Xiao, who believed in me and supported me throughout the process of this research. Your guidance and encouragement were invaluable at key moments in the research process.

I would like to express my appreciation to the individuals who participated in the study and generously shared their experiences. Your responses formed a vital part of this research, and I am grateful for your time and openness. I appreciate the funding and support from Birmingham City University throughout my postgraduate research. I am particularly grateful to the Faculty of Computing, Engineering and the Built Environment, and the Doctoral Research College for providing the academic and institutional environment that has made this work possible. To all who walked this path with me thank you. This success is not mine alone.

DEDICATION

I dedicate this PhD to Almighty God, the Lord of nature and the floodwaters, the King of the world forever. His strength became my pillar, his wisdom my guide, and just his presence around me became my constant. This journey would never have been possible without him. I also dedicate this work to the beautiful memory of my late mother, Pastor Mrs Ekeatte Obasse. Mother, your utmost faith in me even during times when I doubted myself has been the light that carried me through. Your voice, your prayers, and your boundless love still echo in my heart. I hope I have made you proud. This is for you my greatest cheerleader, my angel in heaven.

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LIST OF ABBREVIATIONS AND ACRONYMS

BGI	– Blue-Green Infrastructure
GI	– Green Infrastructure
BI	– Blue Infrastructure
SuDS	– Sustainable Drainage Systems
WSUD	– Water-Sensitive Urban Design
NBS	– Nature-Based Solutions
LID	– Low Impact Development
FRM	– Flood Risk Management
BNG	– Biodiversity Net Gain
LLFA	– Lead Local Flood Authority
EA	– Environment Agency
NE	– Natural England
DEFRA	– Department for Environment, Food and Rural Affairs
OEP	– Office for Environmental Protection
NPPF	– National Planning Policy Framework
NPPG	– National Planning Practice Guidance
EIA	– Environmental Impact Assessment
SEA	– Strategic Environmental Assessment
CEMP	– Construction Environmental Management Plan
WFD	– Water Framework Directive
SFRA	– Strategic Flood Risk Assessment
FCERM	– Flood and Coastal Erosion Risk Management
GIA	– Grant-in-Aid
IDB	– Internal Drainage Board
TCPA	– Town and Country Planning Act
HRA	– Habitats Regulations Assessment
PSRA	– Preliminary Strategic Risk Assessment
CIRIA	– Construction Industry Research and Information Association
HE	– Historic England
LPA	– Local Planning Authority
EU	– European Union
GEM	– Green Environmental Management
MLG	– Multi-Level Governance
NGO	– Non-Governmental Organisation

CHAPTER 1: GENERAL INTRODUCTION

1.0 INTRODUCTION

This chapter presents the background and justification of the research. It begins with a critical categorisation of the study within the broader policy and planning landscape to illustrate the significance of the research problem. The rationale is then developed, leading to a clear formulation of the overarching aim and specific research objectives. An overview of the methodological approach is then provided. The chapter also outlines the scope of the research and its intended contribution to scientific understanding and policy practice. The chapter concludes with an account of the thesis structure and the development of its core argument.

1.1 BACKGROUND OF THE STUDY

Floods are one of the most common and economically disruptive environmental hazards, which are increasingly exacerbated by climate change and rapid urbanisation (Shamsudduha, 2025). According to Adedeji (2022), floods are currently responsible for half of the losses caused by natural disasters in the world. Globally, floods are estimated to account for 43% of all natural disasters and 47% of all weather-related disasters, affecting over 3.2 billion people between 1990 and 2022 (Liu et al., 2024). The global increase in the frequency of extreme weather events is also having an impact in England (EA, 2024a). More than 5.2 million properties are currently at risk of flooding, and there is growing concern about the adequacy of existing flood defence infrastructure (EA, 2024a). Recent events such as the floods in Greater Manchester in 2025, the North of England in 2024 and Somerset in 2023 have highlighted both the physical damage and social consequences of surface water flooding, including displacement, damage to

infrastructure and long-term impacts on the mental health of affected communities (FloodList, 2023, EA, 2024a, GMCA, 2025).

Frequent flooding across England has exposed persistent limitations within conventional flood risk management approaches, which have historically prioritised reactive responses and reliance on hard-engineered infrastructure such as flood walls, embankments, concrete channels, culverts, and extensive drainage and sewer networks (Adedeji et al., 2018). While these measures were designed to provide structural protection against predictable hydrological events, growing evidence suggests that they are increasingly misaligned with contemporary flood risk conditions (Adedeji et al., 2018). This misalignment is driven by a set of interrelated pressures namely the intensification of rainfall variability and extreme events due to climate change, the reduced reliability of ageing infrastructure, and ongoing urbanisation that has increased impermeable surfaces, thereby accelerating runoff and overloading drainage capacity (Yıldırım Bayazıt et al., 2020; Aziz et al., 2024). The cumulative effect of these strains illustrates how flood management models are structurally more predicated on control and containment than adaptation and resilience. As these pressures become more intense and weaknesses of hard engineering methods become apparent, there is growing interest in more integrated, adaptive and nature-based approaches that seek to work with natural processes rather than simply contain or divert water (Hansamali et al., 2025; EA, 2025a).

Within this broader shift blue green infrastructure (BGI) has emerged as a key strand of thinking and practice. BGI encompasses solutions like green roofs, rain gardens, and sustainable drainage systems (SuDS), which are designed to manage surface water more sustainably while also delivering wider environmental and social benefits (Almaaitah et al., 2021). In England, BGI and related ideas now feature in a range of statutory and policy documents dealing with planning, water management and climate adaptation (Grace et al., 2025). Yet, despite this visibility in policy texts, the use of BGI on the

ground remains limited, uneven and often marginal to mainstream flood risk practices. This suggests that rhetorical support in policy does not automatically translate into real change in implementation (O'Donnell et al., 2017). This study responds to this situation by separating the underlying governance problems from the proposed solutions. It examines how existing legal, institutional and policy arrangements shape current approaches to flood governance and help to reproduce conventional, engineered responses. It then turns to the question of how BGI is framed, interpreted and implemented within these arrangements, and why, despite its growing prominence in policy discourse, it has not yet become a routine part of practice.

In this thesis, mainstreaming BGI is understood as the process through which BGI shifts from marginal, project-based, or experimental applications to systematic and institutionalised integration within everyday planning practice, inter-institutional coordination, and local flood risk decision-making (O'Donnell et al., 2017; Dhanya et al., 2022). Recognising flood risk as a governance issue, rooted in planning practice, organisational relationships and public engagement, allows for a more systemic understanding of how vulnerability is produced and how resilience can be strengthened (Matczak and Hegger, 2020). On this basis, the study explores how governance arrangements shape the prospects for mainstreaming BGI in England, with a particular focus on local flood risk plans and decision-making processes.

1.1.1 From Hard Defences to Nature-Based Solutions: Rethinking Flood Risk and Vulnerability in England

It is increasingly apparent that the ability to effectively respond to floods is inextricably linked to how flood risk is organised, governed, and managed in existing policy and institutional frameworks (Grace et al., 2025). Flood risk management in England has traditionally focused on measurable physical metrics, such as flood levels and defence

standards, with limited consideration of the wider social and political processes that contribute to creating and sustaining flood risk (Thorne et al., 2015). Consequently, concerns regarding who is most vulnerable, who is most protected, and how decisions are made are frequently overlooked. The recent increase in flood frequency and projected flood risks demonstrate that flood risk in England can no longer be adequately assessed using limited or technical methods (Bang and Burton, 2021).

In addition to an increase in flood event frequency, the current patterns of flood risk represent significant shortcomings in resilience planning, ongoing inequities in flood-related infrastructure, and inadequate coordination among various levels of decision making (Environmental Audit Committee, 2025). Several communities remain vulnerable to repeated flooding due to ageing drainage networks, inconsistent funding for flood control projects, and a reliance on short term engineering solutions instead of long-term planning strategies that account for climate change (Lamond and Proverbs, 2009; Bang and Burton, 2021).

According to the Environment Agency (2024a), there are approximately 6.3 million homes in England that are presently at risk from flooding, and this number is anticipated to grow to 8 million homes by 2050. The figures demonstrate that traditional methods of flood risk management are ineffective and illustrate the necessity for alternative methods of flood risk management that will accommodate the cumulative pressures of climate change, urbanisation and increasing uncertainty. It is crucial to recognise that not all types of vulnerability may be diminished by conventional flood risk management techniques. Alcántara-Ayala et al. (2025) argue that vulnerability based on broader economic, social and institutional conditions is especially challenging to reduce through technical actions. Social, economic and environmental elements frequently interact to produce irregular patterns of flood risk and resilience in various locations and population segments (Alcántara-Ayala et al., 2025). As such, those households that are already impacted by

lower incomes, poorer living conditions, or less access to services generally suffer greater damage from floods and take longer to recover from them (Lamond et al., 2015). Therefore, vulnerability is not merely a technical issue but rather a manifestation of deeper systemic inequalities requiring more equitable planning and governance.

Despite this, flood risk management in England has traditionally centred on hard engineered structures such as dikes, culverts and flood walls, however while these may offer protection in certain areas, they typically fail to decrease total flood risk at either the larger community or watershed level (Burnett et al., 2024). In some cases, they can move risk down-stream, trap decision makers in inflexible management practices, create additional long-term vulnerabilities and ultimately diminish both institutional preparedness and individual risk awareness (Surminski et al., 2020). This phenomenon is called the levee effect and contributes to diminishing long-term flood resiliency (Keenan-Jones et al., 2025). As a direct response to these challenges, flood risk management in England has gradually transitioned towards more adaptive and integrated methodologies that utilise natural processes as opposed to solely depending on engineered barriers (EA, 2025a). This has generated increased interest in Nature Based Solutions (NBS) that employ natural systems to address societal issues while generating additional environmental and social benefits (European Commission, 2021).

Within this broader approach, BGI has emerged as a primary strategy, especially in urban environments, because it provides the opportunity to mitigate flood risk whilst promoting biodiversity, ecosystem services and overall human wellbeing (Polo-Martín, 2025). However, the transition toward BGI in England is both uneven and uncertain, despite an increasing array of supporting policy, statutory plans, and sustainability commitments, and the degree to which it is successfully implemented varies widely in different context (O'Donnell et al., 2017; Grace et al., 2025). The variability does not appear to be solely due to issues of technical capacity, or lack of funding, but rather a broader ambiguity

about how BGI fits into the overall flood risk management and planning systems that currently exist (Mell and Scott, 2023). Therefore, for many local authorities, practitioners, and community groups, BGI exists in a state of uncertainty; while it can be supported at the conceptual level, its practical application is limited by its weak linkages to enforceable statutory authority (O'Donnell et al., 2017; Consumer Scotland, 2023). As such, there continues to be considerable debate regarding the clarity, authority, and ability of current law and policy to support the consistent and effective delivery of BGI, especially given the strong influence that economic development objectives continue to have on the priorities set by the planning system (Mell, 2017).

1.2 RATIONALE OF THE STUDY

Flood risk is increasingly recognised across England, but implementation of local flood risk management remains patchy (Russell et al., 2024). This is often the result of fragmented responsibilities and different levels of strategic integration (Russell et al., 2024). While the development and benefits of BGI, as well as the physical causes of flooding, have been widely studied, far less attention has been given to the governance factors that shape how BGI is implemented in practice (Mell, 2010; Brown and Mijic, 2019; Hardman et al., 2023; Kirby and Scott, 2023; Consumer Scotland, 2023; Scott and Hislop, 2024). BGI is increasingly recognised not only for flood risk reduction but also for delivering wider environmental and social benefits, including biodiversity conservation, urban cooling, and improved well-being (Kabisch et al., 2017). Although political and environmental support for BGI continues to grow, its integration into local flood risk management in England remains constrained by legislative ambiguity, fragmented policy frameworks, and administrative inconsistencies (Scott and Hislop, 2024). As a result, a persistent gap exists between national policy ambitions and local delivery, which this study critically examines.

National strategies are often in favour of nature-based solutions such as BGI in principle, but they lack a binding legal framework that clarifies responsibilities, funding obligations or enforcement mechanisms (O'Donnell et al., 2017). For example, while the National Planning Policy Framework encourages the adoption of sustainable drainage systems through planning policy, its legal influence remains limited because local planning authorities interpret and implement it inconsistently (MHCLG, 2025a). The overlapping mandates at multiple levels such as the national, regional and local levels hinder coordinated implementation and long-term accountability (TCPA, 2023). Governance challenges are exacerbated by short political cycles, insufficient technical capacity and a persistent institutional preference for technical solutions that prevent systemic integration of BGI into local strategies (Consumer Scotland, 2023). Existing studies such as O'Donnell et al. (2017) and Mell and Scott (2023) have made recognised contributions by identifying barriers such as funding and technical limitations to the adoption of BGI. However, these studies have focused on looking at barriers in isolation, without examining the deeper legal and policy framework that fundamentally influences the adoption of BGI. This neglects the complex, multi-scalar relationships between the objectives of these laws, policies, institutional mandates and local decisions that contribute to fragmented, incoherent implementation. Through a critical examination of these laws and policies, this study seeks to develop a deeper understanding of the institutional dynamics and interacting factors that shape why the strategic ambitions invested in BGI are often not translated into effective local action. In doing so, it contributes both to environmental policy theory and to the urgent need for greater coherence in flood risk management in England.

1.3 AIM AND OBJECTIVES

The aim of this research is to evaluate the barriers to realisation and implementation of

national policy and relevant legal frameworks for the adoption of BGI in improving urban flood resilience in England. In line with this overall aim, the following seven objectives have been formulated.

1. To critically evaluate the concept of BGI, its role in mitigating urban flood risk, and its potential to support long-term urban sustainability and resilience.
2. To review existing legislation and policy arrangements for BGI in England to identify their limitations and strengths.
3. To evaluate the adequacy of these regulations and policies to meet the practical needs of BGI for urban flood risk.
4. To analyse governance roles, interactions, and barriers at national, regional, and local levels affecting BGI implementation for flood risk mitigation and its broader multifunctional use.
5. To develop a conceptual framework for identifying barriers and enablers to BGI in the areas of legislation, policy and governance, based on a synthesis of existing literature.
6. To refine the conceptual framework through case studies and assess its relevance to the practical application of BGI in flood risk management.
7. To draw on the findings for the above objectives, to determine the implications for FRM, especially regarding the design and implementation of BGI and make recommendations for further studies.

1.4 RESEARCH APPROACH

Creswell (2009) argues that the type of research method should be chosen in relation to the nature of the research problem and the research aim, rather than according to the advantages and disadvantages (Creswell, 2009; Ormston et al., 2014). The qualitative approach used is driven by the research objective of identifying the governance barriers

to the adoption of BGI for flood risk management in England. Qualitative research is appropriate for this task because it allows for a detailed analysis of complex, contextual issues that are not quantifiable (Denzin and Lincoln, 2018). Through the lens of the subjective experiences and interactions of stakeholders, this study examines the socio-political, legal, and policy issues associated with BGI implementation and management, especially as part of flood risk management projects. The study combines literature reviews with the collection of primary data to provide a solid overview of the topic. The literature review includes an examination of relevant journal articles, books, policy statements, and project reports to understand the gaps in the existing literature. This review provides the theoretical background to the study, with particular focus on the key legal and policy provisions, including the Flood and Water Management Act and the National Planning Policy Framework, and their relevance to BGI projects.

Due to the complexity of the topic of the study and the research objectives, a case study approach was chosen. In selecting these case studies, various parameters were considered and analysed. Many of these were outlined in Chapter Six of this thesis. Although there are numerous BGI sites across England, however, the selection of two case studies was influenced by the requirement to identify sites that met the criteria and conditions of this study. These include: (1) the presence of BGI measures that specifically respond to flood risk, (2) national or local policy objectives, (3) cross-sectoral or multi-agency governance, and (4) the availability of data from planning documents, stakeholder interviews, or site visits. The selected cases provide contrasting yet complementary insights into the ways in which BGI is implemented in different governance contexts. This approach allows for a more focused analysis of specific BGI projects in England through interviews, document analysis, and site observations. Two case studies were carefully selected based on their different geographical, socio-economic, and administrative contexts: the Perry Barr and Witton Project, Birmingham and the Beales

Corner Scheme, Worcestershire were carefully selected due to their different geographical, socio-economic and administrative contexts. These case studies enable the study to explore barriers and facilitators in governance and how laws and policies are translated into practice.

As part of the case study, interviews were conducted with key stakeholders (policy makers, local authorities, urban planners, and community representatives) to capture different perspectives of the governance process, in particular what has worked and what barriers exist in the implementation of BGI. Document analysis also provided insight into the legal and political context of these projects, while site visits gave an impression of how the BGI was physically integrated, implemented and maintained. The qualitative data was analysed using a thematic analysis. By triangulating these data sources, the study has the credibility and integrity to provide a deeper insight into the impact of legislation, governance, and stakeholder engagement on the uptake of BGI. This approach results in practical recommendations to improve the effectiveness of BGI in managing urban flood risks.

1.5 RESEARCH SCOPE

This research examines how the policy, legal, and governance framework in England shapes the use of BGI in urban flood risk management. The focus is not on the technical or engineering performance of BGI, but on the institutional and governance conditions that influence whether and how it is actually used in planning and flood risk decisions. The study sits at the intersection of flood risk management, urban planning, and environmental governance, with a clear emphasis on governance processes rather than engineering or hydrology. The study examines how laws, policies, and institutional arrangements guide decision-making, define responsibilities, and affect coordination across different levels of governance. It pays close attention to the roles of planning

authorities, flood risk management bodies, and other public institutions, as well as the financial and organisational resources that can either support or limit the delivery of BGI. Technical aspects such as hydraulic modelling, engineering design, and quantitative risk assessment are deliberately outside the scope of this study. This is because the aim here is not to test how BGI performs physically, but to understand how governance and planning systems shape its uptake and mainstreaming in practice.

The study focuses on urban and rural areas in England, where flood risk pressures associated with climate change, urbanisation, and development are most evident. The inclusion of a rural case is not intended to shift the study towards rural flood management generally, but to provide a contrasting context through which the governance of BGI can be examined. Key legislative and policy frameworks, including the Flood and Water Management Act, the Environment Act, the Natural Environment and Rural Communities Act, and the National Planning Policy Framework, are examined to understand how they are interpreted and applied in practice.

Empirically, the research draws on two contrasting case studies: the urban Perry Barr and Witton Flood Risk Management Scheme and the rural Beales Corner Flood Defence Scheme. These cases are used to explore how governance structures, legal requirements, and institutional capacity shape the implementation of BGI across different spatial contexts. Consequently, the study identifies recurring challenges such as fragmented institutional responsibilities, inconsistent policy implementation, competing land-use priorities, and limited resources. It then develops a conceptual governance framework to assess how well existing systems support the delivery of BGI in flood risk management.

1.6 CONTRIBUTION

The results of the study can help to improve the governance of BGI, realise the impact on legislation and policy and improve implementation. This study proposes a new conceptual

framework to analyse the existing legal, policy and institutional barriers and enablers that affect the provision of BGI. Using this framework, policy makers, urban planners and practitioners can assess whether the existing governance framework is fit for purpose and fulfils the operational and practical requirements for the implementation of BGI on the ground. By adopting this framework, legislators could align legislation more clearly with the objectives of the BGI and ensure coherence of related policies and regulatory instruments. It can also help to improve co-operation between the different regions or sectors and increase the coherence of multi-level governance in the implementation of the BGI. This framework can help local authorities, urban planners and other stakeholders to make more informed investment decisions and integrate BGI-related policies into the broader urban resilience and spatial planning agenda. The framework can support practitioners in developing and implementing effective BGI projects and make it easier to overcome regulatory hurdles in a more effective and coordinated way.

In addition, many private sector stakeholders, such as insurers and property developers, can benefit from a better understanding of how BGI can reduce flood risk and improve the long-term sustainability of cities. The study also makes a scientific contribution by improving both the theoretical and practical understanding of BGI governance and providing a structured and flexible framework that can be applied in different urban contexts. The findings of this study will also benefit environmental consultants, water managers and other stakeholders by providing an evidence-based approach to identifying, understanding and addressing the regulatory and governance challenges associated with BGI implementation. The study thus provides practical guidance on how such challenges can be anticipated, avoided or managed more effectively in future projects. Whilst the primary outcome of this study is academic in nature, it complements existing frameworks by providing actionable insights that can inform future implementation strategies. To achieve a broader impact, the findings will be disseminated through peer-reviewed journal

articles and conference presentations to reach both academic and practitioner audiences concerned with BGI and urban flood risk management. In this way, the capacity of decision-makers to enable more effective and adaptive flood risk management and support the long-term sustainability and resilience of urban areas will be strengthened. The results of this study will provide policymakers, urban planners and stakeholders with practical recommendations to further promote legislative clarity, policy coherence and co-operation between authorities.

1.7 ORGANISATION OF THE THESIS

The first chapter outlines the context and rationale, followed by the aims and scope of the study. The literature review for this study was roughly divided into three parts, which form the following three chapters. Chapter Two provides a critical review of the existing literature on BGI in the context of urban flood risk management. It examines the key concepts, benefits and challenges associated with BGI and its role in improving the resilience of cities to flooding. Chapter Three looks at the existing legislative and policy framework for BGI in England. The chapter identifies gaps and areas for improvement to adapt the legal and policy framework to the needs of BGI. Chapter Four presents the governance structures that influence the implementation of BGI, including the roles of local authorities, public bodies and stakeholders. Chapter five presents the governance framework developed in this study, which enables better coordination of BGI and better decision-making in urban flood risk management by integrating the dimensions of legislation, policy, institutions, stakeholders and resources. It also provides a logical sequence to guide the analysis and interpretation of the research. This is followed in chapter six by a detailed research methodology, which includes a rationale for the chosen research philosophy. The chapter also includes a rationale for the chosen approach. In addition, the methods used in the study to collect and analyse data are explained and

justified. Chapters Seven and Eight present the empirical data, while Chapter Ten presents the refined conceptual framework developed from the empirical findings. Chapter Eleven concludes the thesis by setting out the overarching conclusions and final recommendations for policy and practice.

1.8 CHAPTER SUMMARY

This chapter set the scene by showing that flooding is becoming more complex and difficult to manage, both globally and in practice. It introduced BGI as a promising approach to flood risk management but also made clear that its implementation remains uneven. While existing studies highlight what BGI can achieve, there is still limited understanding of how it is actually delivered within real institutional settings. What becomes clear in this chapter is that the issue is not simply whether BGI is beneficial, but whether the systems around it allow it to be implemented effectively. There is a gap between what is promoted in policy and what is realised in practice, and this gap cannot be explained by technical factors alone. The chapter also shows that implementation is shaped by the wider institutional context. The way policies are interpreted, how organisations work together, and how decisions are made all influence what is ultimately delivered. This means that BGI cannot be understood only as a design or environmental solution, but as something shaped by governance and institutional processes. From this, four key areas are identified to guide the study: legislation and policy, governance structures, resources, and stakeholder engagement. These areas reflect where the main pressures and constraints around BGI delivery are likely to emerge. Subsequently, the chapter establishes the foundation for the research by showing that BGI delivery is shaped by a mix of regulatory, institutional, and practical conditions. These insights provide the basis for the conceptual framework developed later in the thesis.

CHAPTER 2: THE ROLE OF BLUE GREEN INFRASTRUCTURE IN FLOOD RISK MANAGEMENT

2.0 INTRODUCTION

The chapter discusses the role of BGI in enhancing the flood resilience of urban areas. It traces the development of BGI from the green interventions in the cities of the 19th century to the contemporary use of BGI in urban flood management. It examines the principles of multifunctionality, sustainability, and connectivity that underlie the BGI concept. It further examines how green roofs, wetlands, and permeable surfaces interact at various spatial scales to reduce flooding and provide co-benefits to urban ecosystems and communities. This helps to achieve the first objective of this research, which is to critically evaluate the concept of BGI, its role in mitigating urban flood risk, and its potential to support long-term urban sustainability and resilience.

2.1 Historical Development of Blue Green Infrastructure

This section examines the developing concepts and practices that underpin BGI, focusing on how these have been influenced by and limited within disciplinary traditions of urban planning and landscape architecture. This section also evaluates the work of early green urbanism pioneers such as Ebenezer Howard and Frederick Law Olmsted, not just as individual icons but as some of the first to see a systemic relationship between cities and nature. Their work emphasized that parks and other green spaces contribute to healthy living environments and improve quality of life. They also identified many ecological functions associated with modern BGI. However, rather than viewing Olmsted and Howard's ideas as formative contributions to green urbanism, this section attempts to challenge the degree to which their ideas have shaped current narratives. The section

calls for a broader interpretation of this legacy through an eco-socially conscious assessment that recognizes both the positive contributions made by early planners and their limitations. Furthermore, it advocates for a more thoughtful and context-specific approach to contemporary urban infrastructure development than has been historically evident. Thus, the section will critically examine the original narratives of Olmsted and Howard to challenge what can be referred to as selective memory, or the tendency to portray their ideas as singular and universally accepted, and to support a more inclusive and equitable understanding of BGI.

2.1.1 Frederick Law Olmsted and the Evolution of Urban Green Space Ideals

Frederick Law Olmsted is often presented in urban scholarship as a key figure in the development of urban green space. However, rather than seeing his work as a straightforward foundation for what later became BGI, it is more useful to understand it within the specific planning context of the nineteenth century. His approach was shaped by the need to respond to urban disorder, public health crises, and environmental degradation in rapidly industrialising cities (Eisenman, 2013). As a result, his work reflects a form of green planning focused on order, control, and urban liveability, rather than the adaptive, uncertain, and hydrologically driven logic that defines contemporary BGI. His designs were based on a pragmatic reformist rationale that reacted to the popular health, sanitation, and environmental disasters of the fast-industrialising cities of the nineteenth century (Eisenman, 2013).

Within this framework, parks were seen not as ecological systems but as agents of social order, health, and urban liveability (Harnik and Welle, 2011; Eisenman, 2013). This positioning is significant as it situates Olmsted within a distinctly green planning paradigm directed towards stability, amenity and environmental control, rather than the adaptive and hydrologically responsive logic underpinning contemporary BGI. The

design and construction of his projects physically manifested this orientation. The most famous project, the Boston Emerald Necklace, is often referred to as the most celebrated enactment of this orientation, as it was initially envisioned as a cohesive system of parks, waterways, and parkways, linking landscape design to engineering purposes such as flood control and sanitation (Diep, 2022). A key element of this system was Olmsted's redesign of the Muddy River and neighbouring wetlands, which was intended to mitigate flooding, enhance water quality, and create a public amenity, thereby overcoming the prevailing engineering trend of the era to separate stormwater drainage from normal urban life (Eisenman, 2013; Diep, 2022). In retrospect, this spatial integration has been viewed as a precursor to modern BGI principles of connectivity and multifunctionality (Hansen and Pauleit, 2014; Li and Carter, 2025). However, framing Olmsted as a proto-BGI thinker risks imposing a linear and teleological narrative onto fundamentally different planning paradigms.

Recent scholarship warns against retroactive interpretations of nineteenth-century landscape projects as proto BGI, claiming that such interpretations obscure a more fundamental epistemic break (Anguelovski et al., 2021; Mell and Scott, 2023; Back et al., 2025). Unlike previous green paradigms that were based on environmental control and spatial ordering logics, modern BGI is formed under the conditions of climate non-stationarity, hydrological uncertainty, and increasingly contentious socio-political negotiations of risk, adaptation, and resilience (Anguelovski and Connolly, 2021; Mell and Scott, 2023; Back et al., 2025). This distinction is evident in how water is conceptualised and mobilised in design practice. Consequently, while Olmsted combined water and landscape, water was largely treated as a stabilised, channelled, and aestheticised element, rather than as a dynamic, surface-based, and uncertain component of urban hydrological systems (Eisenman, 2013; Davies and Laforzezza, 2019). This methodology represents a greener logic of order, containment, and visual coherence over

the adaptive, risk-responsive hydrological logic of modern BGI (Davies and Laforzezza, 2019).

Contemporary BGI frameworks differ fundamentally in this regard. They explicitly preempt surface water dynamics, climatic uncertainty, and multi-scalar hydrological processes, arguing that water is not merely a landscape-defining factor, but essential in determining urban resilience and climate adaptation (Hansen and Pauleit, 2014). Although Olmsted's solutions focused on flooding and sanitation, they were not designed for long-term climate change system uncertainty, or adaptive resilience, which are central to current urban climate adaptation and nature-based solutions debates (Meerow and Newell, 2017). The Emerald Necklace, therefore, is a symbol of the heritage and the constraints of early green infrastructure in the face of the modern climate crisis.

Critical scholarship further complicates Olmsted's legacy by foregrounding its socio-political dimensions. Although the park systems of the nineteenth century were commonly framed as a service to the common good, they often had elite forms of governance and middle-class standards of access and behaviour at the expense of the working-class and racialised communities (Loughran, 2014). This historical pattern is echoed in contemporary criticisms of green and blue interventions, which highlight the possibility of such projects to stimulate property value increase, displacement, and other inequitable socio-spatial effects (Anguelovski and Connolly, 2021; Caldern-Argelich et al., 2024). Their continuity implies that, despite BGI representing a conceptual change in the integration of water and ecology into urban systems, it does not necessarily eliminate the governance and equity issues inherent in previous green planning traditions. In this research, the work by Olmsted is not to be interpreted as a direct precursor to BGI but as a critical point of reference that shows the conceptual, hydrological, and political constraints of early green urbanism. His legacy highlights the infrastructural potential of landscape-based planning and the long-term contradictions between environmental

ambition, governance structures, and uneven urban outcomes. These tensions inform modern discussions of BGI, urban resilience, and the socio-political futures of cities.

2.1.1.1 Relational Landscapes: Hydrological Function and Climate Adaptation

Historically, green planning paradigms such as those represented by Olmsted's work were criticized for their early, simplistic, and overly optimistic views of ecological relationships. However, the contemporary relevance of projects like the Emerald Necklace illustrates conceptual tensions rather than historical continuities (Fábos, 2004). The Emerald Necklace was built due to increased flooding caused by unsanitary conditions in the 19th century; however, the hydrological rationale behind the Necklace assumed climatic stability and a controllable relationship between engineering flows, landforms, and urbanisation (Fábos, 2004). These assumptions do not align well with current flood risk governance, which is now characterized by increasing levels of uncertainty, cumulative effects of hazards, and non-stationary climatic conditions that challenge the traditional logic of control and prediction and lead to new ways of framing, measuring, and operationalising resilience (IPCC, 2022).

Contemporary climate scholarship helps explain why legacy systems, regardless of how innovative they may have been at the time they were developed, can be out of sync with today's risk profiles. For example, Back et al. (2025) demonstrate that most current interventions and portfolios fail in response to simultaneous climatic stresses and therefore limit the effectiveness of current framings and strategies for building resilience. Resilience cannot simply mean flood protection when extreme heat, drought, and heavy rainfall interact across various scales and time frames. Climate impacts such as changes in groundwater dynamics and altered precipitation patterns have uncovered the structural flaws in Boston's infrastructure (Dublin, 2024).

These challenges have caused the Emerald Necklace to be redefined as a historical

intervention, which is currently being implemented in conditions other than its original hydrologic conditions, rather than being restored as an immutable infrastructure model. This shift is reflected in Ahern's (2011) distinction between fail-safe and safe-to-fail strategies, which illustrates a move away from confidence in equilibrium towards accepting variability, learning, and adaptation. Furthermore, Ahern et al. (2014) discuss methods of planning and designing that incorporate experimentation, reflexivity, and monitoring as responses to shifting socio-ecological conditions. While the Emerald Necklace has analytical value in understanding the transition in the epistemic basis of urban resilience, and not as a predictive model of what contemporary BGI will look like, contemporary approaches focus on managing uncertainty rather than seeking optimal control. This transition also has social and political implications. Parks are commonly described as a common good, however, there is evidence to indicate that most urban green spaces are a result of asymmetrical development patterns and discriminative investments. According to Loughran (2014), these high-profile park projects can promote development agendas, redistribute unequal benefits, and transform public space. Furthermore, Loughran (2020) situates park-making within a longer history of environmental interventions functioning as cultural fixes for broader urban crises, which do not address the underlying conditions that produce those crises.

Studies on urban climate governance demonstrate that commitments to equity and justice are embedded unevenly in practice, even when such claims are prominently articulated in policy discourses (Chu and Cannon, 2021; Malloy, 2022). This suggests that, for BGI, key considerations extend beyond hydrological performance alone to include broader relational dynamics. It also involves how benefits and burdens are distributed, whose knowledge and priorities drive interventions, and how decision-making power is organised within planning institutions and implementation processes. On a global scale, these issues echo the position of the Intergovernmental Panel on Climate Change (IPCC),

which notes that the impacts of climate and water-related hazards are most heavily borne by the vulnerable populations, and that existing inequalities are often exacerbated by social and economic conditions and governance arrangements (IPCC, 2022). As a result, the Emerald Necklace is best understood not as a proto-BGI exemplar, but as a historically contingent project that demonstrates the challenges of contemporary BGI governance. Its relevance lies in foregrounding the tensions between inherited green paradigms and the demands of adaptation under uncertainty, as well as the political economy through which resilience investments are prioritised, delivered, and experienced.

2.1.2 Ebenezer Howard's Garden City: Reimagining the Urban-Rural Interface for Contemporary Resilience

The concept of the Garden City first appeared in *To-Morrow: A Peaceful Path to Real Reform*, published in 1898 and later reissued under the title *Garden Cities of To-Morrow*, and is often regarded as a seminal moment in contemporary planning history (Ward, 1992; Hall, 2014). Howard reinterpreted urbanisation not only as a design problem but also as a structural one involving public health, and political economy, and spatial inequality (Ward, 1992; Hall, 2014). He thus redirected attention from structure to the conditions responsible for generating the urban crises of industrialism. Significantly, the purpose of creating a garden city was not merely to beautify the industrial city, but rather to restructure and redistribute urban development (Hall, 2014). Through decentralised, collectively managed settlements, Howard proposed a reorganisation of land ownership, housing supply, and access to open space. This directly contradicted the prevailing urban path of the late nineteenth century, which was marked by speculative development, crowding, and social degradation (Ward, 1992). However, the proposal relies on idealised forms of cooperation and is relatively silent on entrenched class and power relations, which raises questions about its transformative potential.

management, it provides valuable analytical insights into current debates around BGI; particularly in highlighting how environmental planning has been shaped by institutional debates on what will be prioritised, for whom, and under what conditions (Anguelovski et al., 2016). The literature on climate justice and urban adaptation reinforces this perspective and emphasises that green interventions in cities are not just design strategies, but are governance projects shaped by institutional capacity, political priorities, and unequal distributions of risk (Davies and Laforzezza, 2019; Kabisch et al., 2017). Similarly, resilience thinking marks a transition from assumptions of ecological stability towards recognising and engaging with uncertainty, representing a distinct theoretical development from earlier notions of ecological balance and order that were central to early Green Reform projects (Ahern, 2011).

Therefore, these prospectives indicate that even when the planning system appears to recognize equity, it continues to produce protection, participation, and benefits in ways that are unevenly distributed among social groups (Shi et al., 2016; Anguelovski et al., 2016). In this context, the contemporary value of the Garden City is not based on its ability to predict future BGI practices, but in demonstrating that environmental ambitions are fundamentally non-technical; instead, they raise fundamental questions concerning the nature of governance arrangements, the distribution of benefits, and how the public good is both defined and realised in practice.

2.2 The Evolution of Green Infrastructure Urban Planning

Since the late 1990s, Green Infrastructure (GI) has emerged as one of the most significant forms of sustainable investment. Understanding urban greening extends beyond the traditionally perceived aesthetic or amenity value of parks and gardens, to encompass its broader ecological, social, and economic functions (Mell, 2025). Current discourses on GI emphasise an integrated, multifunctional approach that brings together ecological

systems and human settlements, building on foundational ideas such as Howard's Garden City and Olmsted's landscape systems (Mell et al., 2013; Janiszek and Krzysztofik, 2023; Mell, 2025). According to Benedict and McMahon (2006), GI plays a fundamental role in urban sustainability strategies, as it provides ecosystem services and addresses socio-ecological challenges such as climate change, biodiversity loss, and increasing inequality in cities.

GI is not just composed of discrete and static green spaces but rather constitutes a spatially connected and functionally diverse network of natural, semi-natural, or artificial elements that operate at urban, peri-urban and rural scales (Tzoulas et al., 2007). In this context, GI is both a planning framework and a governance challenge that requires coordinated, cross-sectoral efforts for cities to realise the full potential of GI for an equitable, adaptive, and ecologically sensitive urban future (Grace et al., 2025). Although traditional GI has provided an important ecological counterpoint to grey urban development, its limited integration of water-sensitive design suggests opportunities for expanding its scope (Wong and Brown, 2009; Lennon, 2015). BGI is therefore not only a technical response but also a socio-ecological argument for more holistic, adaptive, and spatially integrated approaches to urban resilience (Fletcher et al., 2015).

2.3 Conceptualizing Blue-Green Infrastructure in Urban Sustainability

Scholars of urban sustainability and resilience planning are increasingly defining BGI as a more sustainable alternative to traditional grey infrastructure, marking a conceptual and practical shift from conventional approaches to integrated systems that address both ecological and hydrological functions (Ghofrani et al., 2017; Kabisch et al., 2017). BGI aims to mimic and utilize natural processes, including the integration of hydrological (blue) and vegetative (green) systems, to improve ecological resilience and mitigate climate change (Ghofrani et al., 2017; Kabisch et al., 2017) (see Figure 2.2).

Figure 2.2: Blue Green Infrastructure (Ramboll, 2020).



In contrast to the interpretations of GI, which mostly refer to activities related to terrestrial ecology, BGI can be seen as a more systemic perspective that also recognises the hydrological function and multifunctionality of space (Demuzere et al., 2014). At its conceptual core, BGI views urban environments as dynamic, co-evolving landscapes in which natural and man-made systems not only coexist but also are deliberately designed to be functionally synergistic (Ahern, 2011). However, a persistent gap exists between the theoretical possibilities of BGI and its practical implementation (O'Donnell et al., 2017). Table 2.1 illustrates both the overlaps and differences between contemporary approaches to GI and BGI and provides a comparative analysis of their conceptual foundations, functional purposes, and implementation strategies as discussed in the current academic literature. The table was constructed using a structured review and synthesis of key academic sources, drawing on recurring themes and classifications identified throughout the literature.

Table 2.1: Comparative overview of Green and Blue Infrastructure.

Aspect	Green Infrastructure (GI)	Blue Infrastructure (BI)	Blue-Green Infrastructure (BGI)
Primary Focus	Land-based ecological systems and vegetation	Water systems and hydrological processes	Integrated land–water systems
Key Components	Parks, green roofs, urban forests, green corridors	Rivers, canals, wetlands, lakes, SuDS	Hybrid systems combining green and blue elements
Main Functions	Biodiversity, microclimate regulation, recreation, carbon sink	Flood mitigation, water purification, cooling, water storage	Multi-functional resilience, climate adaptation, ecosystem services
Planning Orientation	Conservation and ecological restoration	Water-sensitive urban design, flood risk management	Systems thinking, co-functionality of urban ecological networks
Examples	Urban parks, green belts, green walls	Wetlands, bioswales, retention ponds	Rain gardens, floodable parks, green-blue corridors

(Source: Benedict and McMahon, 2006; Mell and Scott, 2023).

The above table shows that BGI is not only a mere technical addition of the green and blue system but is rather a more ambitious and theoretically far-reaching planning paradigm that aims at multi-scale co-benefits and requires governance structures capable of simultaneously addressing the ecological, hydrological and spatial complexity. Even though BGI has resonance in contemporary practice, the core concepts are not new. Instead, it is a re-tooling of contemporary integrated planning and water-sensitive urban planning traditions (Mell, 2010). Mell and Scott (2023) term BGI as old wine in new

bottles, because it redefines long-standing ideas of sustainable drainage, floodplain rehabilitation and urban greening into a new political discourse.

The re-emergence of socio-ecological concepts in urban planning discourses does not represent a new epistemological opening, but rather a shift in political, economic, and institutional priorities (Mell and Scott, 2023). The emergence of BGI represents a shift towards more adaptive, nature-based approaches to urban planning, in contrast to the technocratic, engineering-focused conceptualisation of urban resilience (Kabisch et al., 2017). This is consistent with wider socio-ecological resilience research, advocating planning approaches accommodating the dynamic interrelations and co-evolving character of human-natural systems (Ahern, 2011). However, the conceptual elasticity of BGI offers both significant opportunities and challenges. According to Matsler et al. (2021), BGI is a green chameleon that can be adapted and adopted across sectors, however, this flexibility also introduces the risk of fragmentation of governance, conceptual dilution, and, in certain instances, greenwashing or symbolic political actions (Wang and Banzhaf, 2018; Mell and Scott, 2023). While BGI has the potential to address climate concerns, it needs to be critically examined to ensure that it goes beyond rhetorical appeals and brings about tangible, systemic change.

2.3.1 Disciplinary Perspectives on BGI and Their Practical Implications

One of the main problems with a coherent conceptualisation of BGI, is the deep embedment of disciplinary silos that produce competing and occasionally contradictory interpretations of purpose, scope and operationalisation (Fletcher et al., 2015; Mell, 2017; Andersson et al., 2019). While the variety of disciplines is enriching, it makes it more difficult to devise integrative, cross-sector strategies to embed BGI in urban governance and planning (Matsler et al., 2021). The conceptual fuzziness reveals deeper epistemological tensions that are frequently manifest in urban environmental planning,

where ecological, hydrological, socio-political and economic paradigms often interact to mutually unresolvable ends (Moss and Newig, 2010). As such, the operationalisation of BGI in policy and practice is not so much a question of technical deployment, but of mediating the divergent priorities, knowledge systems and normative visions of the urban future (Matthews et al., 2015).

There is an important distinction between how BGI is defined conceptually and how it is implemented in practice, a distinction increasingly emphasised in the critical literature on green and blue green interventions (Wright, 2011; Mell and Scott, 2023). While BGI can be defined through a set of principles or components, this definition should not be interpreted as a prescriptive checklist for implementation. In practice, BGI is intended to be applied flexibly, rather than through a tick-box approach. Furthermore, although BGI is commonly defined through shared principles such as the integration of blue and green systems, multifunctionality, and long-term resilience, these conceptualisations offer limited guidance for practice. Rather than translating into clear delivery frameworks, they often sit uneasily alongside the institutional conditions within which planning operates. According to Mell and Scott (2023), implementation is often constrained by policy, governance, and delivery conditions that reframe BGI into a set of procedural obligations, thereby diluting its more transformational aims. Thus, the problem is not just one imperfect application but of how established institutional logic mediates and reshapes the meaning of BGI in practice, often reducing it to a compliance-driven or tick-box exercise rather than a flexible, principle-based framework, even where BGI is conceptually defined through a set of components or principles.

From this perspective, the absence of a single, stable definition is not necessarily problematic. According to Wright (2011), it is unfeasible and undesirable to achieve definitional closure, since BGI is relational in nature and context-dependent depending on the spatial and institutional setting. Conceptual ambiguity may also be understood as

acknowledgement of the various interpretations and applications of BGI. This plurality, however, is not neutral. Efforts to develop typologies or checklists to regulate BGI are more likely to transform flexible principles into fixed forms of technical compliance, constraining the possibility of context-sensitive solutions (Mell and Scott, 2023). In the process, BGI runs the risk of becoming a delivery label instead of a framework that can support more integrated and adaptive forms of planning. The analytical focus, therefore, shifts away from resolving definitional debates towards examining how particular interpretations of BGI gain traction within policy and practice. This requires attention to the governance arrangements through which definitions are operationalised, and to the power relations that shape which forms of knowledge and practice become embedded (Wright, 2011). However, the literature has limited sustained engagement with these dynamics. Definitions are often framed at a rhetorical level, while implementation continues to follow established institutional priorities centred on delivery, compliance, and risk management (Mell and Scott, 2023).

In this sense, the key question is not what BGI is, but how it is framed, by whom, and with what consequences for the distribution of environmental, social, and economic benefits (Matsler et al., 2021). As Wright (2011) argues, the search for a clear definition is problematic because BGI is inherently fluid, and contested and responsive to contextual change. Rather, Wright (2011) emphasised that practitioners and scholars should learn to understand and engage with BGI as a concept in flux, constantly being shaped and reshaped by context-specific negotiations and socio-political dynamics. Understanding how BGI is conceptualised and operationalised in practice, by whom and for what purpose, can help to enhance its transformative potential through reflexive, iterative engagement processes (Wright, 2011). Anguelovski et al. (2016), noted that it is important to recognise that definitions are not neutral but rather contain normative assumptions that determine what knowledge is legitimised, who is included and excluded

in decision-making, and how financial and managerial resources are integrated into infrastructure priorities. Table 2.2 summarises a range of disciplinary engagements with BGI, identified from literature, illustrating how different epistemologies, priorities, and methodologies shape both the conceptualisation and practical application of BGI in different contexts. The sources have been selected for their academic influence, disciplinary diversity and engagement in current debates on urban sustainability, governance and social and environmental justice.

Table 2.2: Disciplinary Applications of Blue–Green Infrastructure

Author(s)	Discipline	Disciplinary Emphasis within BGI	Practical Application
(Hamel and Tan, 2021)	Engineering and Hydrology	Flood risk management and hydraulic performance	Technical flood mitigation and infrastructure efficiency.
(Benedict and McMahon, 2006)	Landscape Ecology	Ecological connectivity and biodiversity	Habitat networks and ecological resilience.
(Dasgupta, 2021)	Environmental Economics	Valuation of ecosystem services	Economic justification for nature-based investment.
(Anguelovski et al., 2016)	Urban Planning and Social Justice	Equity and participatory governance	Inclusive planning and distributional equity.

2.3.1.1 Dominant Ecological and Engineering Perspectives of Blue Green Infrastructure

From an engineering and hydrological perspective, BGI is mainly seen as a technocratic solution for improved flood resilience and urban drainage (Madsen et al., 2019). The paradigm supports large-scale, infrastructure-intensive approaches that are founded on

hydraulic modelling of stormwater and the development of engineered retention basins (Madsen et al., 2019). However, the implementation of these measures is often not feasible due to the limited availability of large open spaces in dense urban areas, competing land uses, and the technical and institutional challenges associated with spatial retrofitting (Madsen et al., 2019). Moreover, the concept is usually evaluated based on quantifiable, technocratic measures such as peak flow reduction, runoff coefficient minimisation, and cost-effectiveness in terms of flood damage reduction (Fletcher et al., 2015). Nonetheless, the limited scope of quantifiable hydrological indicators may lead to the neglect of critical socio-ecological factors, including social equity, long-term adaptive capacity, and the numerous co-benefits that green infrastructure can provide, which are less measurable but equally crucial in the development of just and sustainable urban futures (Kabisch et al., 2016). Also, institutional actors, such as municipal water authorities and civil engineering departments, are more likely to support risk assessment-based approaches that are based on cost benefit analysis, which strengthens a centralised, controlled, and apparently efficient approach to infrastructure management (ODonnell et al., 2017). Although this strategy has hydrological advantages, it is frequently imposed top-down and circumvents local socio-ecological processes by overlooking the contextualised knowledge, needs, and aspirations of impacted individuals and communities (Ward et al., 2020).

2.3.1.2 Ecological and Landscape Perspectives: Systems Thinking and Nature-Based Restoration

Contrary to the technocratic perspective of BGI, landscape ecologists and natural scientists adopt an ecological systems perspective where BGI is not merely a hydraulic engineering intervention, but instead a regenerative framework that seeks to preserve biodiversity, enhance ecological connectivity, and restore ecosystems at the landscape scale (Hansen and Pauleit, 2014; Humphrey et al., 2015). Humphrey et al. (2015) offer a

stringent synthesis of the literature on forest fragmentation and redesign, highlighting the importance of ecological networks in ensuring species persistence and functional connectivity in urban environments. In this view, the resilience and adaptive capacity of urban ecosystems are founded on the design or layout of green spaces. Furthermore, GI is characterized by Benedict and McMahon (2006) as a network of natural and semi-natural elements that are significant in sustaining ecological processes, enhancing urban biodiversity, and delivering a range of ecosystem services. The ecological approach supports adaptive, decentralised interventions that work with nature rather than relying on the controlled, technical predictability of engineering models. The restoration of wetlands, riparian corridors, and urban forests, as well as the provision of permeable green spaces, are advocated as important measures to support climate adaptation and socio-ecological resilience (European Environment Agency, 2011; Haase, 2017). Proponents of nature-based solutions point not only to environmental sustainability, but also to the potential benefits of carbon sequestration, mitigation of the urban heat island, socio-cultural well-being, and strengthening of place identity (Kabisch et al., 2016; Raymond et al., 2017). Nevertheless, researchers caution that in the absence of integrative governance structures and reflexive management, nature-based discourses may be deployed to achieve ineffective greening that cannot overcome deep-seated socio-spatial inequalities and injustices (Wolch et al., 2014; Mell, 2025).

2.3.1.3 Environmental Economic Perspectives: Valuation and Commodification

Within environmental economics, BGI is increasingly theorised as natural capital, a methodology that aims to give an economic value to ecological systems in terms of their capacity to deliver measurable ecosystem services like flood control, carbon sequestration, temperature regulation, air and water purification (Dasgupta, 2021). Proponents of this view argue that the integration of eco-assets into the economic discourse leads to more

rational and cost-effective environmental decisions, the internalisation of externalities, and the strengthening of the political legitimacy of green investments (Natural Capital Committee, 2014; Dasgupta, 2021). Nonetheless, this instrumental framework has been questioned. Spash (2022) posits that monetisation of nature disaggregates complex, interdependent natural systems into discrete and marketable fragments. The natural capital approach strengthens the neoliberal logic that promotes the commodification of ecosystems and integrates them into market-based regimes of valuation and exchange that tend to undermine ecological integrity, local autonomy, and long-term viability (Gomez-Baggethun and Ruiz-Prez, 2011).

Critics also argue that the valuation of ecosystem functions can overlook other important values such as cultural, identity, and intergenerational commitments that cannot be monetised (McCauley, 2006; Norgaard, 2010). The use of ecosystem service metrics often prioritises knowledge aligned with technocratic and financial institutions, marginalising community-based, indigenous, and place-based knowledge on nature (Sullivan, 2017). These tensions demonstrate the impacts of policy-oriented economic valuation and demonstrate that economic valuation is not a neutral act, but a normative act that creates what is legitimate knowledge, what is valued, and who has authority over nature. Although the language of cost benefit analysis and ecosystem service accounting can promote cross-sectoral engagement, it can unintentionally reinforce existing power asymmetries and perpetuate environmental injustice if left unquestioned (Loft et al., 2015). Bateman and Mace (2020) note that although natural capital frameworks can assist in highlighting the role of ecosystems in urban resilience and sustainable development agendas, they should be applied reflexively and regarding their epistemological constraints and socio-political consequences. As a result, there is a risk that BGI becomes just another vehicle for compartmentalisation, market capture, and technocratic governance, rather than a transformative tool for environmental and social renewal (Gomez-Baggethun and Ruiz-

Prez, 2011).

2.3.1.4 Socio-political framing of BGI

BGI is a contested concept from a socio-political perspective, resulting from power relations, institutional arrangements, and existing socio-spatial inequalities (Sanchez et al., 2026). It is not a technocratic or neutral intervention, but a fundamentally political intervention that is entrenched within governance systems and can either strengthen or disrupt established patterns of exclusion (Shokry et al., 2020). The benefits of BGI are not evenly distributed across flood-affected communities, reflecting inequalities and disparities (Meerow and Newell, 2017). BGI initiatives are generally planned and developed with a consensus to improve the economy in the context of sustainability. However, when such a consensus is implemented, there is a risk of green gentrification taking shape, which can eventually lead to the displacement and marginalisation of vulnerable groups (Shokry et al., 2020; Anguelovski et al., 2020). Studies show that governance frameworks should not merely be tokenistic forms of public participation; rather, they should meaningfully centre the voices, knowledge systems, and decision-making agency of marginalised communities to achieve more just and inclusive outcomes (Agyeman et al., 2016; Anguelovski et al., 2020). This change is crucial for making governance processes more just, as well as making the environmental interventions more relevant and resilient to different socio-spatial settings. Furthermore, such inclusive endeavours are crucial for combating exclusionary planning and harnessing the potential of BGI as an urban strategy that would be transformative and socially just (Agyeman et al., 2016; Anguelovski et al., 2016; Shi, 2020). BGI is seen not only as a set of interventions that physically change the environment, but also as a means to achieve environmental justice and better access to urban nature, as well as a mechanism to address structural inequalities in urban development processes (Bulkeley et al., 2014; Haase et al.,

2017; Anguelovski et al., 2020). BGI can achieve its transformational potential through governance that is reflexive, inclusive, and consciously aimed at social and environmental justice (Shi, 2020). However, the mere appearance of environmental progressivism can reinforce power relations, exacerbate socio-spatial inequalities, and undermine public confidence in sustainability agendas that claim to promote a more resilient, equitable, and inclusive urban future (Shokry et al., 2020).

2.3.2 Towards a Coherent Definition

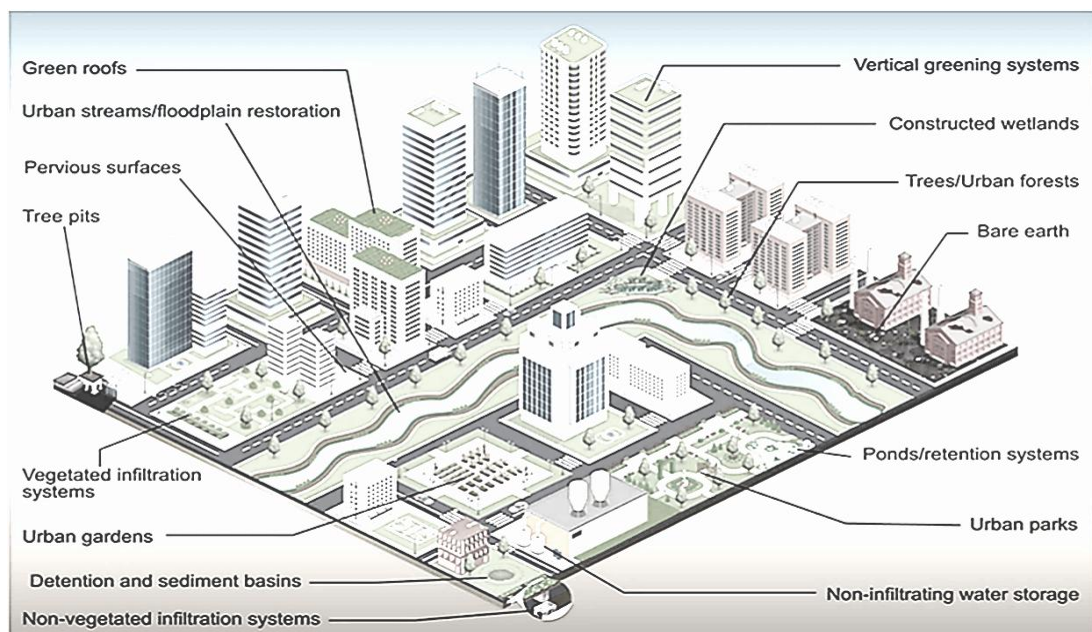
The literature shows that BGI is interpreted differently across disciplinary traditions and policy contexts (Fletcher et al., 2015; Mell, 2017; Meerow and Newell, 2017; O'Donnell et al., 2017; Matsler et al., 2021; Mell and Scott, 2023). While this diversity reflects the interdisciplinary nature of urban environmental governance, it can create ambiguity when analysing how BGI is implemented in practice (Wright, 2011). A clear working definition is therefore required for this research.

In this study, BGI is defined as an interconnected network of green, blue, and drainage-based systems, including sustainable drainage systems (SuDS), designed to manage water, deliver ecosystem services, and support urban resilience (Fletcher et al., 2015; Mell, 2017; Meerow and Newell, 2017; O'Donnell et al., 2017). This definition clearly includes drainage measures and is consistent with the conceptual framework and analysis used throughout the thesis. It reflects how BGI integrates ecological landscapes, water systems, and engineered drainage infrastructure within urban flood risk management. It also provides a clear conceptual basis for examining how BGI is interpreted and implemented through policy, governance arrangements, stakeholder engagement and resource provision in England.

2.4 TYPES OF BLUE GREEN INFRASTRUCTURE

This section presents the main types of BGI and a classification framework that goes beyond technical definitions to encompass broader socio-ecological functions. Rather than viewing BGI simply as technical systems, the typologies shown in Figure 2.3, including water-based, land-based, and hybrid are understood as spatial strategies that shape ecological processes and urban form. Although each typology has its own meaning, they complement one another and contribute to improving climate change adaptation, biodiversity enhancement, and urban water management. These typologies are situated within an institutional and regulatory environment that enables their implementation. It analyses how political narratives, state capacities, and economic constraints influence where and how BGI interventions are deployed. The aim is to improve understanding of how context-dependent and policy-embedded BGI typologies can contribute to a more equitable and resilient city.

Figure 2.3: Typologies of Blue-Green Infrastructure (Cook et al., 2024)



2.4.1 Water-Based BGI: Ecological Necessity or Spatial Liability?

Water-based BGI comprises hydrological and nature-based measures designed to enhance flood resilience, improve water retention, and restore degraded aquatic systems (Dadson et al., 2017) (Figure 2.3). Interventions such as floodplain reconnection, natural and constructed wetlands, retention basins, and coastal or estuarine ecosystems play critical roles in climate change adaptation while delivering a wide range of ecosystem services (Mitsch and Gosselink, 2015; Kabisch et al., 2017). Wetlands are widely recognised for their multifunctionality, including pollutant filtration, carbon sequestration, microclimate regulation, and flood attenuation (Mitsch and Gosselink, 2015). Water-based green infrastructure elements remain threatened by urbanisation and land development despite their ecological significance. Wetlands are among the most endangered ecosystems globally due to ongoing pressure from both urban expansion and agricultural intensification, and infrastructure development (Davidson, 2014; Kabisch et al., 2017). In addition to these physical impacts, wetlands are frequently subjected to fragmented governance arrangements, including inconsistent regulatory enforcement as well as planning systems that allow development under ambiguous land-use classifications (Kabisch et al., 2017). The institutional disconnect between the potential of water-based BGI to improve urban resilience and its actual delivery through urban planning indicates a gap that persists despite its ecological potential. Significantly, water-based components of BGI act as corrective elements of a larger hydrological and ecological network providing urban resilience rather than a standalone intervention (Ahern, 2011). Table 2.3 summarises the main types of water-related BGI identified through a review of academic and policy-oriented literature. The table was constructed by comparing commonly cited water-based BGI interventions across the reviewed studies and grouping them into recurring categories used in urban water management. The associated benefits, implementation barriers, and justifications were synthesised

from these sources, with references provided for each BGI type to demonstrate the evidential basis of the classification.

Table 2:3: Types of Water-Based BGI within Urban Network Systems

Water-Based BGI Type	Key Benefits	Implementation Barriers	Justification
Wetlands & Constructed Wetlands (Mitsch and Gosselink, 2015)	Water purification, flood storage, carbon capture	Land pressure, regulatory gaps, hydrological variability	Runoff control and ecosystem benefits
River & Floodplain Restoration (Opperman et al., 2010)	Natural flow recovery, flood risk reduction, biodiversity gains	Land ownership complexity, legacy engineering, retrofit costs	Ecological restoration and adaptation
Retention Ponds & Urban Lakes (Meerow and Newell, 2017)	Stormwater storage, cooling effects, habitat provision	Water quality issues, maintenance demands	Drainage and amenity integration
Coastal & Estuarine Interventions (Barbier et al., 2011)	Shoreline protection, storm buffering, habitat conservation	Governance fragmentation, land-use conflicts	Nature-based coastal protection
Urban Canal Systems (Ashley et al., 2013; Fletcher et al., 2015)	Flood conveyance, recreation, ecological corridors	Maintenance burden, pollution, spatial constraints	Multi-benefit urban functions

River and floodplain restoration is an integrated strategy to re-naturalise urban hydrology, re-establish longitudinal and lateral ecological connectivity, and offer downstream flood control (Opperman et al., 2010). However, opportunities for large-scale restoration are frequently constrained by existing channelised infrastructure, fragmented ownership, and the financial costs associated with retrofitting dense urban

environments (Nilsson et al., 2005). Consequently, incremental interventions like riparian buffer creation, re-meandering, and controlled floodplain reconnection are increasingly sought, yet their long-term efficacy is context-specific (Fletcher et al., 2015). Furthermore, urban lakes and detention basins have a positive impact on flood control, urban heat islands, and biodiversity (Meerow and Newell, 2017). However, poor management may result in sedimentation, eutrophication, and ecological degradation, especially under conditions of nutrient-rich urban runoff (Fletcher et al., 2015). Water-based BGI such as mangroves, salt marshes, and seagrass meadows have been strongly shown to mitigate storm surge effects, curtail coastal erosion, and promote biodiversity and fisheries and carbon sequestration in coastal and estuarine settings (Barbier et al., 2011). Additionally, urban canals also offer multifunctional advantages, such as flood control, water quality enhancement, and recreational and ecological corridors in the dense urban fabrics (Ashley et al., 2013; Fletcher et al., 2015). However, they are often side lined in urban development agendas because of economic pressures related to real estate development and competing land uses (Kabisch et al., 2017). As a result, the continued underrepresentation of water-based BGI in urban planning underscores the necessity of integrated, cross-sectoral planning strategies that prioritize ecological integrity and socio-economic priorities, making sure that aquatic systems are considered as a vital infrastructure of resilient cities (Ahern, 2011; Kabisch et al., 2017).

2.4.2 Land-Based Blue Green Infrastructure: Ecological Integration and Urban Resilience

Land-based BGI is increasingly recognised as a key component of urban resilience strategies (Hansen and Pauleit, 2014; Mell and Scott, 2023). Green roofs, permeable pavements, urban forests, and green corridors are encouraged not only due to their

potential to prevent flooding, but also due to their various positive effects on air and water quality, biodiversity, and climate adaptation in general (Mell and Scott, 2023). Though the technical efficiency of these measures, which are as diverse as mitigating surface runoff to enhancing urban biodiversity, is well-documented, their application is frequently hampered by the deeply rooted land use conflicts, the time constraints of funding frameworks, and the inability of institutions to introduce systemic change (Cortinovis and Geneletti, 2018; Meerow and Newell, 2019). As shown in Table 2.4, these operational problems manifest against the backdrop of the structural inertia of spatial planning frameworks, which largely preclude ecological infrastructures from the urban development paradigm.

Table 2.4: Types of Land-Based BGI – Functions, Barriers, and Justifications

Type of Land-Based BGI	Key Functions	Implementation Barriers	Justification
Green Roofs & Living Walls (Oberndorfer et al., 2007)	Urban cooling, stormwater retention, air quality improvement, biodiversity support	High cost, limits weak policy	Dense area, retrofit, multifunctional
Urban Woodlands & Green Corridors (Benedict and McMahon, 2006)	Carbon sequestration, ecological connectivity, flood mitigation, recreation	Land-use conflicts, funding gaps	Ecosystem scale, connectivity
Permeable Pavements (Scholz and Grabowiecki, 2007)	Runoff reduction, infiltration, flood risk mitigation	Maintenance, technical issues	Retrofit grey spaces

Rain Gardens & Bioswales (Davis et al., 2009)	Stormwater filtration, biodiversity support, pollution control	Upkeep, low awareness	Decentralised benefits
Private Gardens (Mahmoudi Farahani et al., 2018)	Urban cooling, microhabitats, food production, social well-being	Unequal access, poor planning	Underused green assets
Cemeteries & Burial Grounds (Kowarik et al., 2016)	Habitat provision, cultural landscape, informal recreation	Fragmented governance, heritage constraints	Ecological and cultural value

Land-based interventions are often in direct competition with entrenched development priorities, especially in densely urbanised areas where high land values exacerbate the undervaluation of ecological functions (Demuzere et al., 2014). The interplay of these various elements results in a disjointed and often superficial application of BGI features, which are often perceived as optional add-ons rather than integral components of spatial planning and urban resilience strategies (Kazmierczak and Carter, 2010; Mell, 2016). Their inclusion is discretionary, particularly in high-density markets and urban contexts, reflecting a general institutional reluctance to recognise ecological functionality as a key planning objective (Wright, 2011). A flood risk management measure becomes ecologically functional when it relies on natural processes such as infiltration, retention, and landscape connectivity (e.g. wetlands, riparian zones) rather than relying solely on hard engineering solutions (Raymond et al., 2017). However, until urban priorities are fundamentally reshaped to make ecological function an integral rather than a secondary concern, land-based BGI will merely become a form of technocratic tokenism (Kabisch et al., 2017).

2.4.3 Hybrid and Multi-Functional Blue-Green Infrastructure

Hybrid BGI systems indicate a conceptual and pragmatic shift in the way urban fabrics interact with ecological layers (Andersson et al., 2022). By integrating blue, green, and grey infrastructure such as SuDS and multifunctional public spaces, these systems can manage urban flood risk in cities (Kapetas and Fenner, 2020). While BGI delivers benefits that grey infrastructure typically cannot, especially in informal urban settlements, the evaluation of hybrid BGI approaches that integrate both ecological and engineered elements continues to be under-researched (Alves et al., 2019). Rather than focusing on individual blue or green components such as wetlands or urban forests, hybrid approaches promote their integration into multifunctional landscapes that provide hydrological, ecological and socio-spatial benefits (Hansen and Pauleit, 2014). Integrated systems are ideal for urban environments where limited space means that infrastructure must fulfil multiple environmental, social, and civic functions (Mell and Scott, 2023).

Consequently, despite their conceptual strengths, these hybrid systems, appear to suffer from the same structural rigidities, such as underinvestment, short planning horizons, they are built to overcome, which stresses the importance of a radical change in planning cultures, institutional arrangements, and investment priorities (Mees et al., 2013; Kabisch et al., 2017). Table 2.5 compares different types of hybrids BGI in terms of their intended multifunctional purpose and the systemic institutional and structural barriers that still limit their wider diffusion. This analysis reveals a persistent gap between the conceptual attractiveness of hybrid BGI and their actual impact, and shows how established governance systems, sectoral fragmentation, and insufficient political will reduce the impact of these interventions.

Table 2.5: Hybrid BGI Types, Functions and Implementation Barriers

Hybrid BGI Type	Key Functions	Justification	Sources
Sustainable Drainage Systems (SuDS)	Stormwater retention, flood mitigation, water quality improvement	Green–grey mix, weak governance	(Fletcher et al., 2015)
Multifunctional Public Spaces	Climate adaptation, social cohesion, biodiversity restoration	Multi-benefit, fragmented delivery	(Mees et al., 2013)
Nature-Based Urban Drainage	Decentralised stormwater control, urban heat reduction, habitat enhancement	Decentralised, system constraints	(Cansian et al., 2025)

A well-known example of a hybrid BGI is SuDS, which transforms stormwater management from a purely hydraulic matter to one with broader socio-ecological co-benefits (Haddad et al., 2025). SuDS strategies such as green roofs, bioswales, and constructed wetlands aim to actively mitigate runoff at source, reduce flood risk, and improve water quality and biodiversity (Woods Ballard et al., 2015). In England, although Sustainable Drainage Systems (SuDS) are conceptually well established and have attracted increasing policy attention, their widespread and consistent implementation has yet to be achieved (Charlesworth et al., 2003). This is due to a lack of binding performance standards, where guidance remains non-statutory and implementation is left to local discretion, resulting in uneven uptake and weak ecological outcomes (Oladunjoye, 2021). Additionally, institutional responsibilities are fragmented, and robust long-term maintenance arrangements are lacking, meaning that pilot projects rarely move into the mainstream (O'Donnell et al., 2017; Haddad et al., 2025).

In addition, green corridors, which are linear systems that connect rivers, wetlands, greenways, and pedestrian networks, are an excellent example of the ability of hybrid BGI to improve ecological connectivity while enhancing quality of life (Meerow, 2020). These connecting pathways ensure the movement of wildlife and people while providing options for green urban integration (Meerow, 2020). However, the successful realisation of their potential is constantly hindered by competing land claims, and the continued prioritisation of short-term economic development over the long-term continuity of ecological networks (Mees et al., 2013). A second emerging model of hybrid BGI is multifunctional public space, which can simultaneously provide recreational enjoyment, seasonally hold water, protect from floods, and create a habitat (Raymond et al., 2017). Climate change adaptation-oriented spaces are useful examples of prototypes of climate-safe multifunctional urban spaces embedded in comprehensive urban planning (Meerow and Newell, 2019). However, unless the governance systems undergo fundamental changes, hybrid BGI approaches are likely to remain isolated experiments and will not become integrated and scalable models required to deliver long-term urban resilience (Anguelovski et al., 2019; Frantzeskaki, 2019).

2.5 CONNECTING BLUE GREEN INFRASTRUCTURE TO RELATED FRAMEWORKS

This section analyses the relationship between BGI and other approaches such as nature-based solutions (NBS), low impact development (LID) and water-sensitive urban design (WSUD). Although these approaches come from different contexts and disciplines, they share the same goals of realising ecological integration, climate change resilience, and sustainable urban transformation. Although they are growing simultaneously, this can obscure the normative foundations of BGI and its advocacy for socio-ecological justice and spatial equity. This section aims to analyse the overlaps to situate BGI in the wider

ecological framework of urban sustainability and ensure better context-sensitive and socially inclusive planning and policy.

2.5.1 Water-Sensitive Urban Design (WSUD) and Blue Green Infrastructure

BGI and WSUD are increasingly recognised as important frameworks for sustainable urban development. Although they share several conceptual foundations, their objectives, disciplinary roots, and implementation pathways differ in important ways, creating both opportunities and tensions for integrated spatial planning (Ernstson and Swyngedouw, 2019). As shown in Table 2.6, both concepts emphasise adaptive and systems-based management, recognising the dynamic interactions between human and natural systems. They also support the preservation and restoration of natural hydrological processes to enhance ecosystem services and reduce flood risk (Matthews et al., 2015; Brears, 2018; Zevenbergen et al., 2017).

The term was first used in Australia and refers to an approach to urban design that considers the water cycle, including rainfall, runoff, and evaporation (Wong, 2006; Fletcher et al., 2015; Sharma et al., 2016). WSUD incorporates a range of practices and technologies, including green infrastructure, to manage stormwater in an integrated and sustainable manner (Brown et al., 2009; Sharma et al., 2016). WSUD, therefore brings sensitivity to water into urban design, as it aims to ensure that water is given due prominence within the urban design process through the integration of urban design with the various disciplines of engineering and environmental sciences associated with the provision of water services including the protection of aquatic environments in urban areas (Morison and Brown, 2011). WSUD treats urban surface water runoff as a resource rather than a nuisance or liability (Burns et al., 2012).

This framework draws on a technocratic conception of hydraulic efficiency and measurable outcomes, which include runoff reduction, pollutant load control, and flood

mitigation (Wong and Brown, 2008). WSUD operates using a management framework which gives priority to control, standardisation, and engineering certainty and places greater emphasis on the water cycle including rainfall, runoff, and evaporation (Avazpour, 2023). In comparison, BGI has a broader socio-ecological vision that values urban infrastructure as part of a socio-political process embedded in the ongoing pursuit for urban justice, equity, and democratic governance (Mell and Scott, 2023). It places emphasis on the integration of multiple benefits such as reducing runoff, improving water quality, increased biodiversity, and increased recreational opportunities and wellbeing for society (Brears, 2018). BGI emphasizes participatory governance, long-term landscape stewardship, and the remediation of historical socio-spatial injustices to go beyond the biophysical performance of infrastructure, making it a contested and relational infrastructural imaginary (Ernstson and Swyngedouw, 2019).

Table 2.6: Comparative Overview of WSUD and BGI

Dimension	Water Sensitive Urban Design (WSUD)	Blue-Green Infrastructure (BGI)
Origin	Australia, 1990s, water sector reform	Europe/North America, spatial/landscape planning
Disciplinary Roots	Environmental engineering, urban hydrology	Landscape architecture, ecology, urban planning
Core Focus	Stormwater quality, urban water cycle restoration	Multifunctional green-blue systems for climate, biodiversity
Techniques Used	Rain gardens, wetlands, swales, permeable pavements	Similar tools, plus urban parks, green corridors, tree canopies
Governance Approach	Top-down, led by water utilities and technical agencies	Multi-actor, collaborative and participatory governance
Evaluation Metrics	Hydrological performance	Broader co-benefits; health, equity, recreation, habitat provision

Public Engagement	Limited, mostly expert-driven	Emphasises co-production, local involvement
Policy Integration	Anchored in technical standards and infrastructure policy	Often diffuse; requires intersectoral alignment
Implementation Challenges	Maintenance gaps, siloed expertise, weak integration	Accountability issues, varied definitions, inconsistent funding
Shared Outcomes	Flood mitigation, enhanced water quality, liveability, urban greening	Flood mitigation, water purification, liveability, biodiversity

(Source: Wong, 2006; Brears, 2018; Mell and Scott, 2023).

Sharma et al. (2016), argue that integrating BGI socio-ecological systems with WSUD technical rationality offers a way to design restorative and inclusive water landscapes for climate-resilient cities.

2.5.2 Nature-Based Solutions (NBS) and Blue Green infrastructure

Although both NBS and BGI seek to reintroduce ecological processes in urban water management, they stem from different conceptual traditions and different policy frameworks. As stated by the European Commission (2021) and IUCN (2020), NBS is a broader, overarching umbrella that encompasses the use of nature-inspired and supported solutions to address a colossal range of societal challenges, from climate adaptation and disaster risk reduction to food security and biodiversity enhancement. It emphasises co-benefits and systemic resilience by considering nature as a partner in finding solutions across scales and sectors (Raymond et al., 2017; Seddon et al., 2021). On the other hand, BGI is spatially anchored in urban infrastructure planning to integrate green (vegetation-based) and blue (water-based) systems to manage surface water and improve urban liveability. It refers to rain gardens, green roofs, bioswales and constructed wetlands

(Fletcher et al., 2015; O'Donnell et al., 2017). Although BGI is a widely used terminology in fields such as civil engineering, landscape architecture and urban planning, NBS has become the flagship in environmental and climate policy (Kabisch et al., 2016; Frantzeskaki, 2019). Table 2.7 summarises the comparative relationship of BGI and NBS. It shows their similarities, but also their key differences in conceptual, operational, and governance dimensions.

Table 2.7: Comparative Overview of Nature based solution and Blue green infrastructure

Dimension	Nature-Based Solutions	Blue-Green Infrastructure
<i>Definition</i>	Actions inspired by nature to address societal challenges	Spatially integrated vegetated and aquatic systems
<i>Primary Aim</i>	Solve societal problems (e.g. climate, health, equity)	Deliver ecosystem services and enhance ecological connectivity
<i>Scope</i>	Broad includes both spatial and non-spatial interventions	Primarily physical/spatial and urban-focused
<i>Examples</i>	Reforestation, green corridors, coastal buffers, community wetlands	Green roofs, bioswales, urban forests, rain gardens
<i>Implementation Model</i>	Transdisciplinary, participatory, and challenge-driven	Technical planning and infrastructure-led
<i>Governance Orientation</i>	Adaptive, inclusive, multi-level governance	Often top-down, sectoral, and expert-led

<i>Monitoring & Evaluation</i>	Includes social, ecological, and governance indicators	Primarily focuses on hydrological or biophysical metrics
<i>Policy Drivers</i>	EU Green Deal, UN SDGs, IUCN Global Standard for NbS	Green Infrastructure Strategy, National policy, Local policy, laws, guidance, Biodiversity Strategy
<i>Relationship</i>	NbS uses BGI components to implement solutions	BGI is often nested within NbS interventions

Source: (Kabisch et al., 2017; Frantzeskaki et al., 2023; Mell and Scott, 2023)

Despite their differences, both ideas converge on the following: they recognise the value of diverging, integrated, and multifunctional responses to complex urban challenges, notably flood risk. (Depietri and McPhearson, 2017). Both concepts support the restoration of natural hydrological processes, ecosystem service improvement, and socially inclusive processes that involve all stakeholders, yet NBS frameworks tend to be more explicit about social equity and community co-benefits (Nesshver et al., 2017). Nevertheless, they are marred by similar governance and institutional issues in their operationalisation. Although these approaches are often called NBS or BGI, they are often entrenched in sectoral policies or constrained by prevailing technical standards that ignore socio-ecological complexity (Wilkinson et al., 2014; Ahern et al., 2014). In order for NBS and BGI to achieve their full potential in flood risk management, not only are technological improvements needed, but also a transformation of planning cultures, regulatory frameworks and participatory governance.

2.5.3 Low-Impact Development and Blue Green Infrastructure

LID and BGI are two important but distinct paradigms in the evolving discourse on sustainable urban water management and climate adaptation (Fletcher et al., 2015; Almaaitah, 2023). Both frameworks aim to reduce surface runoff, improve water quality and increase the resilience of ecosystems. However, they have different conceptual origins, design logics and spatial strategies (Almaaitah, 2023). Low impact development emerged from the North American practice of stormwater management, which aims to mimic natural hydrological processes through decentralised, small-scale interventions (Brattebo and Booth, 2003). Techniques such as permeable pavements, rain gardens, bioswales, and green roofs are used to reduce runoff volumes, promote infiltration and improve water quality at or near the source. According to Almaaitah (2023), LID is primarily performance-orientated, site-specific, and therefore ideal for retrofitting in densely built-up or infrastructure-constrained environments. Its main strength lies in its hydrological precision and technical adaptability at the site and street level.

In contrast to LID, BGI is more comprehensive and multi-levelled. It introduces vegetative (green) and aquatic (blue) systems - wetlands, urban streams, green corridors, blue-green roofs- into the broader urban fabric. While LID mostly operates at the site or block level, BGI functions as an interconnected network that is spatially and ecologically designed and requires city-level planning, strategic land use integration and cross-sectoral governance to fully realise its multifunctional potential (Voskamp and Van de Ven, 2015; Almaaitah, 2023). Their systemic orientation is a major distinguishing factor. LID is more project-oriented and technical, while BGI is conceived as a spatially integrative and strategically planned system embedded in broader urban sustainability agendas (Brattebo and Booth, 2003; Charlesworth, 2003). Nonetheless, these approaches are not mutually exclusive. According to a field study by Almaaitah (2023) in Toronto, a significant number of blue-green roofs and permeable pavements built based on the BGI principles

aligns with LID approaches, especially when multifunctionality is viewed as a major design goal. Table 2.8 compares the two concepts in terms of their differences and operational similarities. While LID and BGI vary in their scope, institutional structure, and strategic goals, most of their elements such as bioswales, permeable pavements, rain gardens, have similar functionality and are frequently applied together in practice.

Table 2.8. Comparative Overview of LID and BGI

Dimension	Low Impact Development (LID)	Blue-Green Infrastructure (BGI)
Definition	Decentralised, site-scale strategies to mimic natural hydrology (Charlesworth, 2003)	Integrated systems of green and blue networks delivering co-benefits
Origin	North America (stormwater engineering focus)	UK, Europe and global planning traditions
Core Aim	Stormwater quantity and quality control	Climate adaptation, ecological resilience, and urban liveability
Scale of Application	Parcel- to neighbourhood-scale interventions	Neighbourhood to city/regional-scale planning
Design Focus	Engineered features for infiltration and retention	Spatial connectivity, ecological restoration, and multi-functionality
Examples	Rain gardens, bioswales, permeable pavement, green roofs	Urban wetlands, greenways, blue-green roofs, floodplains
Monitoring Focus	Hydrological efficiency and pollutant removal	Ecosystem services, thermal regulation, social co-benefits
Implementation Models	Bottom-up, often retrofitted into existing developments	Often integrated into urban master plans or green space strategies
Synergy	Can serve as components of BGI systems	Uses LID-type features to operationalise nature-based approaches

(Source: Voskamp and Van de Ven, 2015 Brears,2018; Almaaitah, 2023; Mell and Scott, 2023).

2.6 PRINCIPLES OF BLUE GREEN INFRASTRUCTURE

This section critically examines how the principles of multifunctionality, sustainability, and connectivity are articulated within planning and policy literature on BGI. These principles are usually presented as normative designs that can balance environmental protection, climate adaptation, and urban liveability in a single planning framework. While these representations do not merely describe BGI, they actively depoliticise it by presenting these principles as inherently beneficial and technically feasible, thereby obscuring the institutional, political, and economic conditions under which they are understood and practiced. Through a governance-based analytical approach, this section argues that BGI principles cannot be presumed to be inherent attributes of the infrastructure itself but instead should be understood as socially constructed ideas that are formed during institutional processes. Here, sustainability, multifunctionality, and connectivity are policy discourses that normalise conceptions of environmental problems, facilitating nature-based, and hybrid BGI forms of intervention as opposed to traditional grey, engineered strategies based on technocratic and control-oriented rationalities. Their operationalisation relies on planning institutions, regulatory frameworks, funding arrangements, and power relations that determine which goals are prioritised and whose interests are promoted.

In this perspective, these principles are not neutral design logics but politically situated constructs, mobilised selectively in planning processes. Although policy discourse frames BGI as integrative, sustainable, and connected, in practice its implementation is shaped by institutional fragmentation, competing priorities, and uneven socio-spatial outcome. This analytical framing focuses less on the technical effectiveness of BGI principles and more on how they are constructed, by whom, and with what material and distributional consequences. The subsequent sections discuss multifunctionality, sustainability, and connectivity as governance constructs, exploring how their definitions

are produced and stabilised within planning systems and how they influence the provision of BGI in urban flood risk management.

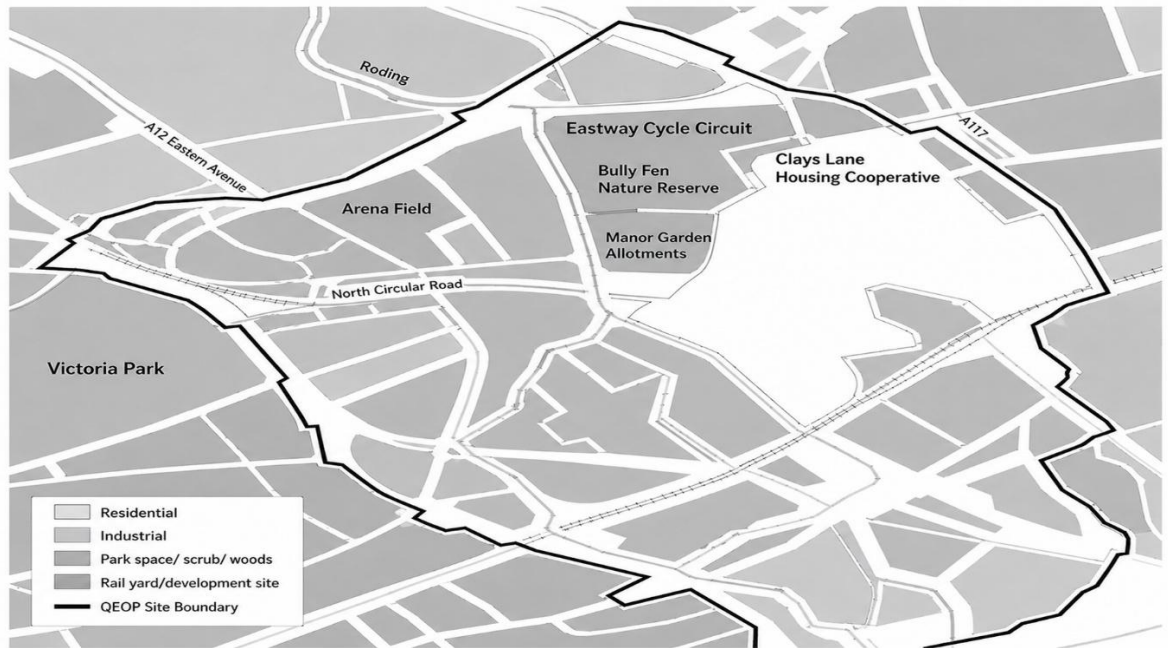
2.6.1 Multifunctionality

Multifunctionality is often introduced as an integrative principle of BGI, however in practice, its results are selectively generated by governance, not by design alone. It is often described as the combination of ecosystem services, including stormwater management, biodiversity, urban heat mitigation, and recreation, in one spatial intervention (Hansen and Pauleit, 2014). This framing makes BGI a reconciliation point between socio-ecological processes and urban infrastructure networks (Mell and Scott, 2023). Nonetheless, this section posits that multifunctionality does not simply occur through BGI design, rather, it is achieved through a complex interaction between institutional priorities, rules, and power relations. These priorities are not neutral but reflect wider political and economic agendas where flood risk management is often privileged over social and ecological objectives. Nevertheless, spatial integration does not necessarily lead to multifunctionality; it is created through the decision-making process that determines which functions are prioritised, and how success is defined (Almasi et al., 2025). Its practical implementation depends on the institutional requirements, regulatory norms, and funding frameworks (Mell, 2010).

These systems are not neutral; they structure the prioritisation of hydrological, ecological, social, and economic values in the planning system (Mell, 2010). In the flood management setting, designers are preoccupied with hydraulic performance indicators and engineering criteria, neglecting the socio-economic and environmental advantages of flood risk management interventions (Almasi et al., 2025). Thus, multifunctionality implies structured trade-offs as opposed to the simultaneous maximisation of all benefits,

which challenges its representation as an inherently integrative planning outcome (Almasi et al., 2025). As such, multifunctionality operates less as a realisable outcome and more as a normative ideal that legitimises certain planning approaches while concealing their embedded trade-offs and exclusions (Almasi et al., 2025). Governance fragmentation further limits the actualisation of multifunctionality. Often, water management, spatial planning, and environmental protection are distributed among various institutions with different goals, budgets, and accountability frameworks; therefore, the implementation of multifunctionality requires coordinated action across institutional boundaries, which is often challenging to realise (Asadzadeh et al., 2023). According to Asadzadeh et al. (2023), the fragmentation of the system is not merely a practical constraint, but rather a manifestation of deeper structural divisions in planning systems, which are characterised by sectoral silos and competing institutional mandates that inhibit integrated delivery. In this regard, its provision is more reliant on the capacity of governance systems to balance competing tensions and address conflicts within policy domains (Asadzadeh et al., 2023). This tension is evident in the Queen Elizabeth Olympic Park (QEOP), which, despite being presented as a leading example of multifunctionality, produces uneven outcomes in practice (see Figure 2.4). The discrepancy in these outcomes raises questions about whose interests are prioritised in the design and governance of such projects, especially within urban regeneration contexts, where environmental improvements might inadvertently trigger processes of socio-spatial restructuring.

Figure 2.4: Queen Elizabeth Olympic Park, London (Snaith, 2015)



Although the site incorporates restored waterways, wetlands, and open spaces, studies indicate that the benefits are not evenly distributed, and access and use patterns are influenced by design decisions, aesthetic standards, and regeneration processes (Snaith, 2015; Snaith and Odedun, 2024). In this sense, multifunctionality acts as a selective result of governance whereby some users and values are given precedence. Therefore, multifunctionality serves to advance property development and investment interests, while the needs of low-income and existing communities are marginalised and excluded (Snaith, 2015; Snaith and Odedun, 2024). The aesthetic unity of the park thus threatens to conceal the latent disparities in the distribution of benefits.

On a broader scale, early GI strategies assumed that multifunctionality could be optimally achieved in individual sites, such as parks or wetlands (Benedict and McMahon, 2006). Existing literature, such as Hansen and Pauleit (2014) and Meerow and Newell (2017), challenges this assumption, indicating that multifunctionality is better achieved through spatial networks and institutional coordination than in isolated interventions. This shift suggests that multifunctionality is not an inherent property of

individual BGI elements but an emergent outcome of coordinated governance, reinforcing the need to understand it as a relational and institutionally contingent process (Meerow and Newell, 2017). Analytically, multifunctionality can be seen as a contentious planning aspiration, not a design achievement, influenced by how governance systems distribute values and resources. This directly applies to the management of urban flood risks, where effectiveness definitions affect the infrastructural performance and the allocation of social and environmental benefits. As a result, multifunctionality should not be seen as a technical accomplishment, but rather as the political outcome that ensues from how the planning system defines effectiveness, allocates resources and manages competing priorities.

2.6.2 Sustainability in Blue–Green Infrastructure

Sustainability is often presented as an inherent feature of BGI; however, its realisation is shaped by the governance conditions through which it is sustained over time. Sustainability is frequently conceptualised in mainstream planning and policy discourses as a product of ecological design and technical optimisation (Mell, 2016). However, these interpretations overlook the social, political, and institutional circumstances under which the long-term operation of BGI relies. According to Meerow and Newell (2017) and Frantzeskaki et al. (2019), sustainability in BGI is not a presupposition of infrastructure, but a process of governance, which is mediated by timeframes, governance capacity, and socio-economic priorities. A fundamental conflict therefore exists between the timescale of ecological systems, and the short-term political and financial cycles that define urban infrastructure investment. While BGI requires ongoing maintenance, dynamic management, and sustained monitoring, the governance structures are frequently typified by fragmented accountability and intermittent funding (Ashley et al., 2013; Voskamp and Van de Ven, 2015). This misalignment is not accidental but rather a result of the short-

termism embedded in political and funding cycles which undermines the presumed long-term sustainability of BGI.

Furthermore, the durability and performance of BGI depend less on initial design and more on the capacity of institutions to sustain interventions over time. In this context, the challenges of sustainability are more appropriately understood as arising from governance and institutional limitations, rather than a technological failure (Meerow and Newell, 2017). This gap is especially pertinent in flood risk management, where BGI needs to be maintained continuously to be effective but often extends beyond political and budget cycles. Moreover, beyond formal arrangements, sustainability is produced through everyday practices and socio-material engagements with infrastructure. For instance, residents contribute to stewardship, informal maintenance, and use practices, which shape the way BGI functions in practice (Baptiste et al., 2015). However, these contributions are not evenly distributed and are not frequently formalised in governance structures, which are indicative of broader inequalities in capacity, knowledge, and access (Frantzeskaki et al., 2019). The long-term performance of BGI may decline, even if technically well-designed, where these forms of participation are neither recognised nor institutionally supported. This shows that sustainability does not depend solely on technical design but also on the uneven distribution of social capacity and institutional support.

This emphasises the importance of social infrastructure and collective practices in maintaining ecological systems, while highlighting the challenges of technocratic solutions, that focus on design at the cost of social embedding (Baptiste et al., 2015; Frantzeskaki et al., 2019). At the metropolitan scale, sustainability is increasingly mobilised as a strategic narrative within urban regeneration and competitiveness agendas. The BGI interventions are commonly presented as the means to enhance the quality of the environment, attract investment, and raise the value of the land, thus

aligning the environmental and development logics (Kronenberg, 2025). For instance, the Green Grid in London, represents a strategic ecological network that facilitates urban resilience in East London and is embedded within broader redevelopment processes, where environmental enhancement and land-value restructuring are mutually constitutive (GLA, 2011; Mell, 2016). In this regard, sustainability is a discursive and material tool of legitimising and promoting types of urban development. In this sense, sustainability can function to justify urban redevelopment agendas, in which environmental improvements serve capital accumulation rather than equitable distribution.

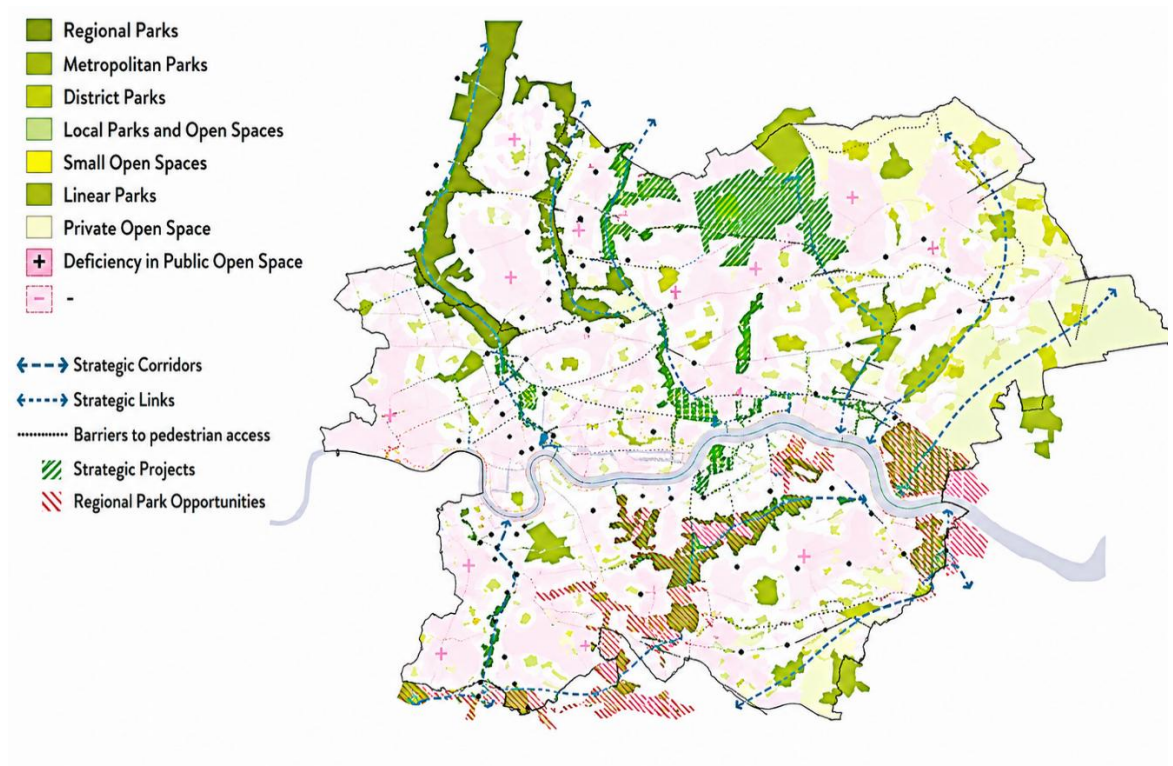
The distributional implications of sustainability-oriented BGI therefore warrant critical attention. The designation of infrastructure as sustainable can obscure uneven socio-spatial outcomes, including differential access to environmental benefits and exclusionary processes associated with rising land values and regeneration pressures (Mell, 2016; Kronenberg, 2025). Therefore, sustainability should not be viewed as a universally beneficial outcome but instead requires interrogation of whose interests it serves and how its benefits and burdens are distributed across urban society (Mell, 2016; Kronenberg, 2025). From an analytical perspective, sustainability is best understood as a contested process that is produced through the interaction of financial arrangements, governance arrangements, and socio-economic practices. Achieving this outcome depends on the extent to which planning systems can manage temporal mismatches, support inter-institutional coordination, and sustain the social conditions that facilitate long-term maintenance and use (Meerow and Newell, 2017; Frantzeskaki et al., 2019; Mell, 2016). In assessing sustainability, it is therefore necessary to go beyond technical or ecological measures, and examine how governance, resource allocation and political priorities shape whose sustainability is realised in practice.

2.6.3 Connectivity in Blue–Green Infrastructure

Connectivity is often presented as a technical and spatial principle; however, in practice, it depends on governance arrangements that determine whether connections are implemented or remain aspirational. It is typically framed as the linking of green and blue spaces to enhance ecological and hydrological functions (Meerow and Newell, 2017). In planning discourse, the term connectivity is usually associated with biological and ecological terms that indicate linking habitats, waterways, and open spaces to enhance biodiversity benefits, water management, and climate resilience. Nonetheless, such representations may run the risk of interpreting connectivity as either a technical or spatial attribute, ignoring the governance processes involved in producing and maintaining connected systems.

In practice, connectivity depends on cooperation across various administrative boundaries, policy areas, and institutional actors (Buijs et al., 2019; Pauleit et al., 2020). Without such coordination, connectivity may become a strategic vision while remaining fragmented in delivery. This fragmentation is not simply a failure of coordination but reflects deeper structural divisions within planning systems, where competing institutional priorities inhibit integrated implementation. The All-London Green Grid (ALGG) illustrates this gap between representation and implementation. The framework proposes a city-wide network of parks, waterways, and green corridors (Greater London Authority, 2021). As shown in Figure 2.5, the East London Green Grid presents a spatially continuous system linking initiatives across boroughs.

Figure 2.5: East London Green Grid Design for London (GLA, 2021).



However, this apparent continuity conceals a fragmented governance landscape. Implementation differs across boroughs due to varying levels of institutional capacity, funding, and priorities, resulting in several proposed links not being completed (CPRE London & Neighbourhoods Green, 2014). Thus, connectivity arises not only from the spatial design but from the alignment or misalignment of governance systems. (Greater London Authority, 2021) The figure thus performs the function of a planning instrument as well as a policy narrative. While it suggests coherence, it conceals the fragmented nature of the relevant institutions, which hampers implementation. As such, the apparent coherence of connectivity strategies may function as a representational device that masks the institutional constraints and governance failures that shape their delivery.

In addition, connectivity has the potential to affect the broader processes of urban redevelopment and capital investment. Green corridors and waterfronts are often the

focus of regeneration, which may lead to increased land value and uneven socio-spatial outcomes (Gould and Lewis, 2016; Anguelovski et al., 2018). These dynamics raise concerns regarding whose interest connectivity-led interventions serve, especially where environmental improvements are intertwined with patterns of urban redevelopment and capital investment. Therefore, connectivity can favour ecological flow as well as capital flow, thus questioning the distributional consequences of BGI investments (Gould and Lewis, 2016; Anguelovski et al., 2018). In this context, it can help achieve capital accumulation and ecological integration, thereby reinforcing socio spatial inequalities (Gould and Lewis, 2016; Anguelovski et al., 2018). Connectivity should be understood as a process conditioned through institutional coordination and political negotiation rather than a spatial quality. Thus, connectivity is not a neutral spatial attribute but rather a politicised outcome that depends on governance structures, resource allocation, and competing urban goals (Gould and Lewis, 2016; Anguelovski et al., 2018).

2.6.4 Concluding Synthesis

Taken together, the principles of multifunctionality, sustainability, and connectivity show that BGI cannot be understood as a neutral or simply technical urban infrastructural solution. Instead, these principles act as tools of governance, influencing the way environmental projects are conceptualised, legitimated, and executed in a specific institutional and political context (Meerow and Newell, 2017, Mell and Scott, 2023). The extent to which their realisation is achieved will depend on planning systems, governance systems, resource mobilisation, and power relations which shape, which objectives are prioritised and whose interests are served. Across these principles, a discernible and consistent pattern emerges, revealing underlying structural and conceptual alignment in their application. Whilst the policy discourse presents BGI as integrative, sustainable, and connected, its implementation is one of trade-offs, institutional fragmentation and

uneven socio-spatial outcomes (Anguelovski et al., 2018, Buijs et al., 2019, Frantzeskaki et al., 2019). This suggests that BGI principles operate less as fixed attributes of infrastructure and more as policy narratives that both enable and constrain urban development, often masking underlying political and economic dynamics (Mell, 2016, Meerow and Newell, 2017). This analytical stance shifts inquiry from whether the principles of BGI are realised in technical terms, to how these principles are interpreted, operationalised, and contested within governance systems. Fundamentally, this section underpins the thesis by examining how these principles shape BGI delivery in urban flood-risk management in England.

2.7 CHAPTER SUMMARY

This chapter examined the development of BGI through the lens of adaptive urban flood risk management. It traced how urban green spaces have shifted from being mainly ornamental and recreational to becoming more multifunctional systems that combine ecological, social, and hydrological roles within the urban environment. In doing so, the chapter situated BGI within a wider discussion of socio-ecological urbanism. One clear lesson from this chapter is that BGI should not be seen as just a design solution, but as something shaped by how institutions operate and make decisions. The way BGI is planned and delivered reflects existing priorities, governance arrangements, and power dynamics. It also shows that ideas like multifunctionality, connectivity, and sustainability are not automatic outcomes, but depend on how different actors and systems work together in practice. These principles only hold when there is alignment across institutions and a shared understanding of long-term goals. Another important point is that the wider conditions around BGI matter more than the design itself. Where there is weak coordination, unclear responsibilities, or competing priorities, even well-designed BGI interventions may struggle to deliver expected outcomes. Overall, the chapter

highlights that BGI is shaped by the broader system within which it sits, including how decisions are organised, how responsibilities are distributed, and how different interests are balanced. These insights set the direction for the rest of the thesis. The next chapter builds on this by examining the legislative and policy context that frames how BGI is interpreted and applied in practice.

CHAPTER 3: THE LEGISLATIVE AND POLICY FRAMEWORK FOR BLUE GREEN INFRASTRUCTURE

3.0 INTRODUCTION

This chapter presents the legislation and policy dimension of the conceptual framework developed in this study, providing a critical analysis of how legal and policy arrangements shape the enabling conditions for the implementation of BGI in England. BGI is gaining more prominence in environmental planning, but its actual realisation depends on statutory powers, regulatory requirements, and the interpretation of policy across scales of governance. Legislative frameworks and policy determine the nature and site of BGI interventions as well as the institutional conditions in which BGI interventions become possible. These frameworks consist of decentralised and multi-tiered systems of laws, national planning policies, strategies, and processes relating to land use, biodiversity, water, and infrastructure. Together, these instruments' structure decision-making processes, distribute institutional responsibilities, and balance environmental goals with development pressures. In this regard, legislative and policy arrangements act as structuring forces that shape implementation outcomes, prior to decision-making at the project level. Hence, this chapter goes beyond a descriptive narrative of environmental legislation to critically assess how these frameworks enable, constrain, and structure BGI delivery. The chapter identifies structural conditions through the mapping of recurrent institutional patterns within legal and policy arrangements that shape governance practices, resource allocation, and stakeholder engagement. In doing so, it operationalises a core dimension of the conceptual framework, providing the legal and policy foundation that underpins the broader analysis of BGI governance.

3.1 OVERVIEW OF KEY INSTRUMENTS

Table 3.1 provides a structured overview of the key legal, policy, and regulatory instruments that shape the legislative and policy context of BGI delivery in England. Rather than attempting to be exhaustive, the table brings together the main governance mechanisms through which environmental objectives are interpreted and translated into planning and infrastructure decisions. The instruments are organised into four categories that reflect their roles within the wider legal and policy landscape: statutory legislation, which establishes binding duties and institutional responsibilities; national planning and policy frameworks, which guide interpretation and decision-making within the planning system; strategic policy instruments, which set longer-term environmental and flood risk priorities; and regulatory and guidance mechanisms, which shape how these priorities are implemented in practice (North, 1990; Scott, 2014; Howlett, 2019). This grouping allows for comparison across instruments, that differ in legal status but remain closely connected in how they influence BGI delivery.

The table is developed through a systematic and iterative review of UK legislation databases, official government publications including Defra, the Environment Agency, Natural England, and MHCLG and relevant academic literature on environmental governance and BGI in England. Instruments were selected based on their statutory relevance, their influence on land-use planning, flood risk management and biodiversity governance, and their role in shaping the practical conditions under which BGI is delivered. The table therefore reflects those frameworks most consistently identified in both policy and academic literature as shaping environmental planning and flood risk governance. While it does not claim to be exhaustive, it provides a robust and representative overview of the key instruments influencing BGI delivery.

By organising instruments according to their legal authority and functional role, Table 3.1 provides a clear basis for analysis. The following sections apply a consistent

analytical lens to examine how these arrangements enable, constrain, and shape BGI delivery in practice. In this way, the table supports a move beyond description, allowing patterns, gaps, and tensions within the legal and policy landscape to be identified. These instruments are then examined using the analytical framework outlined in Section 3.1, enabling systematic comparison and a more detailed understanding of the institutional conditions.

Table 3.1: Analytical Classification of Key Legislative and Policy Instruments Shaping BGI Delivery in England

Analytical Category	Instrument	Purpose and Relevance to BGI	Key Limitations for BGI Implementation
<i>National Legislation</i>	Climate Change Act (2008, amended 2019)	Establishes legal framework for climate mitigation and adaptation supporting long-term resilience.	Adaptation duties weakly enforced; no explicit BGI requirement.
	Environment Act (2021)	Introduces Biodiversity Net Gain and ecological recovery mechanisms supporting nature-based planning.	Delivery dependent on local capacity and metric interpretation.
	Flood and Water Management Act (2010)	Promotes SuDS and decentralised local flood risk management.	Absence of mandatory SuDS Approval Bodies limits implementation.
	Town and Country Planning Act (1990)	Provides statutory basis for land-use planning through which BGI can be secured.	Development pressures frequently override environmental priorities.
	Natural Environment and Rural Communities Act (2006)	Places biodiversity duty on public authorities.	“Have regard” duty weak and difficult to enforce.
	Wildlife and Countryside Act (1981)	Protects habitats and species forming ecological foundations for BGI.	Site-based conservation approach limits multifunctional integration.
	Reservoirs Act (1975)	Regulates water storage infrastructure relevant to flood management.	Engineering-focused; limited integration with nature-based approaches.
	Water Framework Directive (2000) (Retained EU Law)	Promotes catchment-scale ecological water management aligned with BGI principles.	Compliance-focused with weak integration into spatial planning decisions.
<i>National Planning and Policy Frameworks (Interpretive Policy Direction)</i>	National Planning Policy Framework (NPPF, 2024)	Encourages integration of green and blue infrastructure and climate adaptation within planning.	Non-binding; implementation varies across local authorities.
	National Planning Practice Guidance (NPPG)	Provides technical interpretation supporting BGI delivery in planning decisions.	Advisory status leads to inconsistent application.
<i>Local-Scale Legislative and Spatial Governance Instruments</i>	Localism Act (2011)	Enables neighbourhood planning and local participation, creating	Uneven local capacity and growth pressures limit environmental influence.

		opportunities for place-based BGI delivery.	
	Local Nature Recovery Strategies (LNRS) (Environment Act 2021)	Spatially maps biodiversity priorities and identifies areas suitable for ecological restoration and BGI.	Limited statutory weight in development control; resource constraints.
<i>Strategic Environmental Policy Instruments (Long-Term Direction Setting)</i>	25 Year Environment Plan (2018)	Establishes long-term national vision for environmental recovery and nature-based solutions.	Aspirational; lacks statutory enforcement mechanisms.
	National Flood and Coastal Erosion Risk Management Strategy (2020)	Promotes natural flood management and catchment-based resilience.	Strategic guidance only; funding and delivery uncertainties persist.
	Green Infrastructure Framework for England (2023)	Provides national standards and metrics for green infrastructure planning.	Voluntary adoption; implementation pathways still emerging.
<i>Regulatory and Procedural Mechanisms (Implementation Controls)</i>	Environmental Impact Assessment Regulations (2017)	Require assessment of environmental impacts in development proposals.	Often compliance-driven rather than transformative.
	Water Environment Regulations (2017)	Protect water quality and ecological status of water bodies.	Narrow ecological scope; limited spatial planning integration.
	Conservation of Habitats and Species Regulations (2017)	Safeguard designated habitats and species through assessment procedures.	Site-specific focus limits broader BGI integration.

Source: (Defra, 2021a; Yasitli , 2021; Natural England, 2023).

3.2 ANALYTICAL LENS

To move beyond descriptive policy review, the legislative and policy instruments examined in this chapter are systematically classified and evaluated through a structured analytical framework derived from institutional theory, governance scholarship, and planning research (Healey, 2006; Peters, 2012; Pierre and Peters, 2020). This framework provides a consistent basis for comparing instruments and assessing how they shape the governance conditions underpinning BGI delivery.

The various laws and policies are analysed across four interrelated dimensions, which reflect how governance systems structure infrastructure delivery rather than merely describing policy content. First, statutory strength and enforceability capture the extent to which legal provisions create obligatory, clear, and enforceable duties or standards that drive implementation. Attention is given to whether BGI is required, recommended, or simply referenced in legislation. Secondly, policy coherence and alignment evaluate the degree to which legislative and policy instruments are integrated across environmental, planning, and flood risk domains. This dimension assesses whether frameworks operate synergistically or generate fragmentation through overlapping responsibilities and inconsistent guidance. Thirdly, resource and implementation implications assess how legislative and policy frameworks condition funding structures, institutional capacity, and the practical feasibility of delivery. This dimension recognises that policy ambition alone does not translate into implementation in the absence of adequate financial and organisational support. Fourthly, participation implications consider how legal and policy arrangements structure stakeholder involvement, public engagement, and community influence within decision-making processes. This dimension evaluates whether participation operates as meaningful co-production or remains procedural and consultative.

Taken together, these dimensions constitute an analytical classification framework through which legislative and policy instruments are systematically compared and critically evaluated. Rather than describing individual instruments in isolation, the framework enables the identification of recurring institutional patterns, structural constraints, and enabling conditions shaping BGI implementation. These dimensions also directly inform the development of the study's conceptual framework by identifying the structural governance conditions shaping BGI delivery

3.3 NATIONAL LEGISLATIVE FRAMEWORK

England has an extensive environmental and planning legislative framework which could, in theory, support BGI. Over the past two decades, statutory reforms have increasingly recognised biodiversity recovery, climate adaptation, and integrated flood risk management as national priorities. Nonetheless, the presence of legislative provision does not ensure consistent implementation. Instead, the law reveals a recurrent tension between ambitious environmental objectives and institutional arrangements characterised by discretionary interpretation, fragmentation of responsibility, and differential capacity for delivery. This section therefore goes beyond descriptive legal review, to assess how legislation shapes the practical conditions under which BGI can emerge. Taken collectively, the statutory framework demonstrates a gradual shift from reactive environmental protection towards anticipatory resilience. Nonetheless, this shift remains incomplete. Legal obligations often state environmental objectives but lack enforceable mechanisms capable of transforming planning and infrastructure processes. The analysis that follows shows that England's legislative system enables BGI in principle, while simultaneously constraining its implementation through proceduralisation, sectoral fragmentation, and reliance on local institutional capacity.

3.3.1 Environment Act 2021

The Environment Act 2021 is the most significant reform of environmental governance in England since the withdrawal from the EU, introducing domestic oversight mechanisms and benefit-specific long-term environmental targets to replace existing EU governance mechanisms (UK Parliament, 2021; Defra, 2022). The Act represents a significant shift in policy, moving away from earlier framings of green growth, and towards the incorporation of environmental enhancement within economic development, through legally binding environmental targets, BNG, LNRS, and the creation of the OEP (UK Parliament, 2021). From a BGI perspective, the Act is significant because it relocates biodiversity from a discretionary planning consideration to a statutory requirement within development control. The obligation of mandatory BNG (Under Schedule 7A of the Town and Country Planning Act 1990 as inserted by the Environment Act) creates a legally measurable requirement linking land development and biodiversity gain (UK Parliament, 2021; Defra, 2023a). LNRS are intended to provide spatial coordination by identifying priorities for habitat restoration and ecological recovery at county and combined authority scales (Defra, 2023a), which may create potential alignment with catchment scale flood management and climate adaptation planning.

Early implementation evidence, however, highlights structural constraints. The Office for Environmental Protection (OEP) (2023) identifies risks associated with capacity, monitoring, and consistency in implementation, particularly in respect of resourcing and enforcement capabilities in local authorities. While the OEP provides independent scrutiny of environmental law compliance, it does not replace the enforcement architecture previously exercised by the European Commission and Court of Justice of the European Union (UK Parliament, 2021; OEP, 2023). As a result, delivery outcomes are heavily dependent on administrative capacity and planning practice.

Therefore, the Act reflects an established trend in English environmental governance that expands environmental ambition, without fully embedding enforceable implementation mechanisms (National Audit Office, 2023; OEP, 2023). BGI is partially embedded within planning obligations through mandatory Biodiversity Net Gain requirements, however its spatial and qualitative outcomes depend on local authority resourcing, monitoring capacity, and enforcement practice (OEP, 2023; MHCLCG and DLUHC, 2024).

3.3.2 Flood and Water Management Act 2010

The Flood and Water Management Act (FWMA) 2010 arose from recognition of institutional failures exposed by the 2007 floods and the Pitt Review. These failures included fragmented responsibilities, inadequate drainage infrastructure, weak planning controls, limited community engagement, and a lack of coordination across flood governance systems, all of which are summarised in Table 3.2 alongside the ways in which BGI can address these challenges. **As shown in Table 3.2, many of the shortcomings identified by the Pitt Review extend beyond engineering deficiencies to include governance and planning failures, highlighting the need for integrated, multifunctional approaches to flood risk management** (Pitt Review, 2008). The objective of the legislation was therefore to reorganise flood risk management by clarifying institutional roles and encouraging a locally led approach to surface water management (EA, 2021a; Yasitli, 2021).

Table 3.2: Key Issues Identified in the Pitt Review (2008) and Their Potential Address by BGI

Pitt Review Issue	Summary	BGI Potential
Surface Water	Poor management due to	Increases permeability,

Flooding	impermeable surfaces	reducing runoff
Drainage Infrastructure	Under-designed and poorly maintained systems	SuDS relieve pressure on Drainage
Institutional Fragmentation	Lack of coordination among Agencies	Encourages integrated Governance
Planning Controls	Weak flood risk integration in Planning	Embeds resilience through multifunctional design
Community Engagement	Low public involvement	Enhance participation and local ownership
Climate Adaptation	Insufficient future risk Consideration	Provides adaptive, scalable Solutions

(Source: Pitt Review, 2008).

Central to this reform was the designation of Lead Local Flood Authorities (LLFAs), intended to decentralise decision-making and enable place-specific responses to flood risk (UK Parliament, 2010; Thaler and Priest, 2014; EA, 2021a). This institutional shift aligns closely with the logic underpinning BGI, recognising that effective flood resilience depends upon landscape processes, spatial adaptation, and locally embedded knowledge rather than solely engineered defence structures (Nesshöver et al., 2017; O'Donnell et al., 2017). The Act also highlights the limitations of decentralisation in the absence of adequate statutory and financial support, as demonstrated by the failure to implement Schedule 3, which would have created a mandatory Sustainable Drainage Systems approval body and strengthened the transformative potential of the legislation (Ellis and Lundy, 2016; O'Donnell et al., 2017; National Audit Office, 2020; Defra, 2025a). Rather than embedding nature-based drainage into statutory requirements, the responsibility for SuDS delivery was delegated to planning policy guidance, which weakened its regulatory effectiveness and limited its scope to ensure consistent implementation (Defra, 2025a).

Consequently, implementation varies greatly between authorities and is often based on negotiations rather than requirements (Thorne et al., 2015; National Audit Office, 2020). National Audit Office reviews further reveal uneven funding arrangements, which favour authorities with higher technical capacity, thereby perpetuating spatial inequalities in flood resilience (National Audit Office, 2020). The FWMA thus creates a paradox typical of English environmental governance, where responsibility for integrated flood management is devolved locally, while the statutory and fiscal tools required to deliver it remain limited (Benson et al., 2016; Lowndes and Gardner, 2016). In this regard, BGI emerges as a dynamic of optional innovation operating within structurally constrained governance conditions, rather than a mandated infrastructure model (O'Donnell et al., 2017).

3.3.3 Reservoirs Act 1975

The Reservoirs Act 1975 occupies a distinctive position in England's flood risk management framework. The Act emerged due to concerns over dam failures causing catastrophic risks, reflecting a regulatory paradigm focused on technical safety and the containment of structural risk rather than giving due consideration to environmental or landscape-based management (Deane and Warren, 2014; Balmforth, 2020). The primary purpose of the Act is to minimize the hazards associated with large, raised reservoirs through the mandatory inspection, supervision, and certification regime of the Environment Agency and appointed qualified engineers (Deane and Warren, 2014). Subsequent reforms introduced through the Flood and Water Management Act 2010 expanded the scope of regulation by enabling a more risk-based approach to oversight. These amendments strengthened precautionary control in response to the increasing recognition of the vulnerability of infrastructure and severe weather events, particularly

following incidents such as the Toddbrook Reservoir's failure in 2019 (Balmforth, 2020; Defra, 2023b; Environment Agency, 2023).

The Act contributes to flood resilience by preventing structural failure but remains firmly anchored within the limits of engineering logic (Deane and Warren, 2014). According to Deane and Warren (2014) and the EA (2023a), reservoirs are managed mainly as hazards requiring technical control, monitoring for compliance, and emergency planning, thus focusing primarily on the integrity of the asset and the enforcement mechanism rather than catchment processes, ecological integration, or multifunctional land use.

Despite these reforms, the Act contains no provisions that enable environmental enhancement, floodplain reconciliation, or nature-based water retention within the management of reservoirs (Deane and Warren, 2014). Consequently, opportunities for integrating storage infrastructure with wetland creation or upstream natural flood management rely on separate policy initiatives and environmental strategies rather than on a legislative mandate (Defra, 2023b; EA, 2023a). This institutional fragmentation helps reinforce sectoral divisions and maintain a separation between engineered flood protection and ecosystem-based adaptation (Balmforth, 2020). Therefore, although the Act is not explicitly designed to advance BGI, it indirectly aligns with its objectives through the structural integrity and regulatory oversight of major water-retaining assets (EA, 2023a). It establishes a firm infrastructure baseline that enables complementary nature-based interventions to operate alongside engineered storage systems by mandating strong safety standards and requiring reform of risk-based inspection regimes (EA, 2023a).

3.3.4 Natural Environment and Rural Communities Act 2006

The NERC Act 2006 was a significant attempt to mainstream biodiversity issues across the public sector of governance by imposing a statutory duty on public authorities to have

regard to the conservation of biodiversity when exercising their functions (House of Lords, 2018; Defra, 2023c). The Act sought to embed ecological considerations in planning, infrastructure delivery, and environmental management more broadly by extending responsibility beyond conservation agencies (House of Lords, 2018). In principle, this obligation may create a legal pathway through which BGI objectives may influence decision-making across sectors (De Ruyck, 2024). The identification and prioritisation of habitats and species under Section 41 provides an evidence-informed basis for guiding spatial planning and environmental assessment (Defra and Natural England, 2022). Nevertheless, the language of the legislation avoids imposing a prescriptive obligation. The obligation to merely ‘have regard’ is highly subjective, allowing for biodiversity to be weighed against competing development priorities rather than creating effectively enforceable outcomes (Bury Council, 2023; De Ruyck, 2024).

Parliamentary scrutiny and government reviews have observed that implementation varies between institutions, depending on institutional capacity and access to ecological expertise within local authorities (House of Lords, 2018; OEP, 2023). The operational influence of biodiversity duties has been further diminished by a decline in specialist staffing within planning departments, which means that considerations of ecology are often advisory rather than determinative (MHCLG, 2025a). Consequently, the Act makes a symbolic gesture to integrate biodiversity into governance, with practical delivery left to discretionary interpretation (OEP, 2023). The NERC Act thus presents a repeated pattern within the environmental laws of England, where the institutional responsibility for environmental duties is widened, but the ability for this to be enforced legally is restrained, limiting the ability of its biodiversity duties to compel the systematic implementation of BGI (Bury Council, 2023; De Ruyck, 2024).

3.3.5 Climate Change Act 2008

The Act sets out the legislative framework for England's response to climate change, establishing legally binding carbon reduction targets underpinned by five-yearly carbon budgets and subject to independent oversight by the Climate Change Committee (Climate Change Act, 2008; Climate Change Committee, 2023). The 2019 amendment committing the UK to net-zero emissions by 2050 strengthened the Act's long-term strategic authority and positioned climate resilience as a central policy objective (UK Parliament, 2019; Climate Change Committee, 2023). For BGI, the Act is significant primarily through its adaptation provisions. The National Adaptation Programme and the requirement for periodic climate risk assessment identify flooding, overheating, and ecosystem degradation as systemic risks that require anticipatory governance responses (Defra, 2023d; Climate Change Committee, 2023).

Nature-based approaches, such as BGI, can provide flood mitigation and urban cooling with clear co-benefits for ecological resilience (Nesshöver et al., 2017; Seddon et al., 2020). Yet the institutional design of the Act reveals an imbalance between mitigation and adaptation. Emissions targets are mandatory and measurable, while adaptation responsibilities rely mainly on coordination and policy alignment rather than legally enforceable obligations imposed on planning authorities or infrastructure providers (Climate Change Committee, 2023; House of Commons Environmental Audit Committee, 2018). As a result, the Act recognises BGI as a climate adaptation response but does not impose its use in spatial planning systems (Climate Change Committee, 2023). The phenomenon demonstrates a broader governance trend where strategic climate ambition is articulated at the national level while operational responsibility is devolved to local authorities without equivalent statutory mechanisms (Brunetta and Caputo, 2026). Thus,

BGI is rhetorically enabled but weakly legally anchored in climate governance (Seddon et al., 2020).

3.3.6 Town and Country Planning Act 1990

The Town and Country Planning Act (TCPA) 1990 underpins England's spatial planning system as its core legislative foundation. It places responsibility for regulating land use and deciding on development proposals under the jurisdiction of local planning authorities (Allmendinger, 2017). Because planning permission governs how land is developed, the Act represents the principal institutional gateway through which BGI can be embedded within urban form, site layout, and infrastructure provision (TCPA, 2024a). Through development management, local plans, and planning conditions, the TCPA provides the legal framework within which flood mitigation, green corridors, sustainable drainage systems (SuDS), and multifunctional open space can be secured as part of development proposals (TCPA, 2024a).

This statutory framework has not remained static. The planning system has undergone significant transformation in recent years, with reforms under the Planning Act 2008, modified by the Planning and Infrastructure Act 2025, and major changes to the National Planning Policy Framework in December 2024, with further amendments in February 2025, collectively strengthening the legal and policy framework within which BGI will function (DLUHC, 2024a; UK Government, 2025). Specifically, amendments related to the Environment Act 2021 will impose mandatory requirements for Biodiversity Net Gain (BNG) in planning decisions, along with a partial strengthening of ecological aspects of the TCPA (HM Government, 2021; Natural England, 2023). In this context, the TCPA increasingly advocates for high-quality multifunctional green infrastructure to be included

in development design, which aligns with the Green Infrastructure Framework (GIF) launched by Natural England.

Notwithstanding, while these reforms do initiate a pivot towards measurable environmental impacts, they are still actioned through planning processes rather than as a core principle of the Act (Scott and Hislop, 2024). The wider legislative framework continues to favour procedural decision-making, which assesses material considerations and balances competing interests rather than imposing environmental performance criteria (Allmendinger, 2017). The design of these institutions entails a structural tension between the growth orientated objectives of planning and the long-term resilience objectives, particularly where housing delivery pressures and economic development targets dominate the political agenda (TCPA, 2018). Furthermore, despite the Act's prominence within spatial governance, the legislation does not contain the terms green or blue infrastructure (Town and Country Planning Act 1990, as amended, 2024). The lack of legal definition and mandatory environmental standards means that the delivery of BGI is generally dependent on the interpretation of planning policies, negotiated developer obligations, and local authority priorities (Allmendinger, 2017).

Mechanisms such as Section 106 agreements allow for the securing of contributions for environmental infrastructure, including the provision of green space and drainage features. However, the overall outcomes are often tempered by considerations of development viability, housing supply targets, and market-led land values (Crook et al., 2016; Planning Inspectorate, 2023). This results in spatially uneven outcomes in environmental enhancement measures, which are more likely to be secured in high-value markets with greater negotiating leverage. The planning system is thus both an enabler and a constraint: while it offers the statutory mechanism through which BGI can be mainstreamed, it also

constrains consistent and systematic delivery through discretionary implementation and negotiated outcomes (TCPA, 2024a).

3.4 NATIONAL PLANNING POLICY FRAMEWORK

Although the English planning system does not have a formal hierarchical structure of planning documents, the National Planning Policy Framework (NPPF) occupies an important position within this system. Moreover, the NPPF acts as the most important national policy document through which statutory environmental objectives are implemented in spatial planning practice (MHCLG and DLUHC, 2025). While the NPPF does not create legal obligations, it serves as the operational link between legislation and delivery, where local planning authorities interpret sustainability, climate change adaptation, and environmental protection in development decisions (MHCLG and DLUHC, 2025). As such, it serves as a point where the ambitions of national legislation confront the realities of growth-orientated planning. The framework formally embeds sustainable development as the core purpose of planning and increasingly recognises the role of BGI in delivering climate resilience, biodiversity recovery, and flood risk mitigation (Grace et al., 2025). However, despite its influential role, its non-statutory nature creates an inherent tension. The promotion of environmental objectives occurs through guidance rather than enforceable obligation, meaning the effectiveness of such measures largely depends on interpretation, negotiation, and local institutional capacity (Scott and Hislop, 2024). Consequently, the NPPF demonstrates the capacity of national policy to legitimize BGI, while also rendering its implementation contingent upon local planning practices.

3.4.1 NPPF Revisions 2023–2024: Policy Strengthening and Continuity

The NPPF revisions in 2023 and 2024 include increasing references to climate adaptation, flood resilience, and nature-based solutions in spatial planning. As summarised in Table 3.3, the revisions strengthen policy support for sustainable drainage systems (SuDS), flood risk avoidance, biodiversity enhancement, and the integration of BGI within development proposals (MHCLG and DLUHC, 2025). These policy developments reflect increasing national recognition that planning must respond proactively to climate risk rather than relying solely on engineered flood defences (Scott et al., 2020). The revised policy language provides greater clarity and more explicit support for BGI through stronger expectations relating to flood storage, water management, and biodiversity net gain (Grace et al., 2025). However, as Table 3.3 also demonstrates, these changes largely reinforce existing policy principles rather than fundamentally altering the institutional logic of the planning system.

Environmental ambition is articulated more explicitly, yet implementation mechanisms remain unchanged (TCPA, 2024b). Planning authorities are advised but not bound to give precedence to ecological resilience, maintaining the discretion of decision (LGA, 2024a). This connection reflects a long-term feature of English planning policy whereby sustainability is identified as a balancing act rather than as a binding hierarchy of priorities (Scott and Hislop, 2024). The need for economic growth and housing delivery remains a central objective in planning, therefore, environmental requirements often function as material considerations that are weighed alongside viability and feasibility (TCPA, 2024b). As a result, strengthening policies at the national level does not necessarily lead to consistent local outcomes (Hudson et al., 2019).

Table 3.3: NPPF 2023–2024 Policy Shifts and Continuing Constraints

Policy Area	NPPF 2023 Position	NPPF 2024 Revision	Analytical Implication
Blue-Green Infrastructure	Recognised conceptually	Stronger reference within climate adaptation policy	Supportive but non-binding; delivery depends on local interpretation
Flood Risk Management	Sequential approach emphasised	Greater focus on SuDS and flood storage	Enforcement constrained by local capacity
Sustainable Drainage	Encouraged	Stronger expectation for major developments	Viability negotiations frequently weaken outcomes
Green Belt Policy	Protection maintained	Introduction of Grey Belt Concept	Increased planning flexibility creates ecological uncertainty
Climate Adaptation	General policy support	Expanded references to overheating, water stress	Remains guidance rather than statutory duty
Biodiversity	Policy encouragement	Integration with mandatory BNG	Monitoring and delivery mechanisms remain limited

Source: (MHCLG and DLUHC, 2025).

3.4.2 Policy Ambiguity and the Growth–Environment Tension

Despite strengthened environmental language, the NPPF continues to operate within a planning system shaped by competing policy objectives (MHCLG and DLUHC, 2025). The presumption in favour of sustainable development requires authorities to balance environmental protection, housing, and economic growth, which in practice can produce uncertain or ambiguous outcomes (MHCLG, 2025). Given that environmental provisions lack independent statutory force, they are often negotiated or reduced during development management processes where viability considerations dominate (TCPA, 2024b). The changing perspectives on Green Belt land illustrate the extent of this tension. The creation

of the Grey Belt category applies to previously developed or poorer-quality land within the Green Belt to reconcile housing pressures and spatial protection policies (MHCLG and DLUHC, 2025; MHCLG, 2025). Although marketed as a pragmatic planning response, the flexibility of this designation creates interpretive ambiguity and increases discretion, which in regions with high demand risks a gradual erosion of peri-urban green space and may adversely impact long-term BGI integration (LGA, 2024b; TCPA, 2024b).

The NPPF is more widely viewed as a form of policy-led governance where environmental ambition is rhetorically framed yet mediated by negotiation (TCPA, 2024b). In practice, however, those with decision-making power in planning often have limited resources and therefore may not have the ability to impose complex environmental requirements on developers or effectively challenge developer viability (LGA, 2024b). As such, despite national policy encouragement, measures to achieve BGI objectives will likely remain limited or hindered. Therefore, the framework exposes a fundamental structural contradiction in English planning, where strengthening environmental resilience is deemed critical to achieving sustainable development whilst the institutional support needed to secure it is relatively weak (Scott and Hislop, 2024). Thus, BGI becomes an endorsed planning objective, yet not a guaranteed outcome (LGA, 2024b).

3.4.3 The NPPF as the Operational Bridge

Positioned between legislation and local delivery, the NPPF plays a vital mediating role in the governance hierarchy established in previous sections. National legislation defines environmental ambition, while local governance instruments attempt spatial coordination, and the NPPF translates these objectives into planning practice (House of Lords, 2023). However, because this translation relies on policy guidance rather than binding legal obligation, outcomes remain uneven across places (Consumer Scotland, 2023).

Recognising this intermediary role is key to understanding persistent implementation gaps. According to Consumer Scotland (2023) and Scott and Hislop (2024), the challenge of delivering BGI lies not in the absence of a supportive policy language, but in the reliance on discretionary planning systems to deliver it. As such, the NPPF is both a pre-emptive framework and a structural limitation, which facilitates environmental integration while reproducing the growth-environment tensions that are embedded in England's planning regime (MHCLG and DLUHC, 2025).

3.5 LOCALISM ACT 2011

The 2011 Localism Act signalled a major change to England's planning system, with the intention of rebalancing decision-making from central government to local authorities (HM Government, 2011; LGA, 2011). The aim of the Act was to achieve locally determined development outcomes, through reinforcing Local Development Plans as the primary basis for spatial planning, and the introduction of neighbourhood planning rights, which enable communities to take control of planning (House of Commons Library, 2018). According to Parker et al. (2023), this decentralised governance model suggests that local involvement could serve as an ideal means to articulate spatial priorities, thereby establishing a theoretical institutional environment propositionally favourable to place-based environmental planning for BGI implementation.

According to MHCLG (2020a) and RTPI (2023), Neighbourhood Plans and locally led planning processes provide opportunities for incorporating locally defined development priorities, including environmental and landscape priorities, within the statutory planning system. The Act's focus on community involvement aligns with broader policy recognition that effective environmental management draws on local knowledge and stewardship practices (Lawson et al., 2022). Yet, the practical effects of decentralisation

reveal significant structural constraints. The ability of local authorities and communities to effectively engage in neighbourhood planning differs significantly across England, with disparities in resources, expertise, and institutional support (Lawson et al., 2022; Parker et al., 2023). Neighbourhood planning processes often lack the technical resources required to design integrated environmental infrastructure, while statutory planning priorities, particularly housing delivery, continue to carry greater legal and political weight (Parker et al., 2023).

Parliamentary evidence highlights tensions between the Localism Act's principle of local determination and the National Planning Policy Framework's presumption in favour of sustainable development, which has enabled development to proceed even where locally preferred planning outcomes differ (UK Parliament, 2014). Consequently, environmental objectives are often negotiated within development viability and delivery pressures, leaving BGI vulnerable to dilution during planning negotiations. The Localism Act therefore illustrates a central paradox of environmental localism: authority is devolved spatially, but the institutional conditions required for transformative environmental delivery remain unevenly distributed (Featherstone et al., 2012; Parker et al., 2023). Rather than guaranteeing locally embedded resilience, decentralisation risks reproducing spatial inequalities, as neighbourhood planning outcomes are shaped by uneven local capacity and participation across places (Parker et al., 2023).

3.5.1 Local Nature Recovery Strategies (LNRS)

Local Nature Recovery Strategies were introduced under the Environment Act 2021 as a spatial mechanism intended to translate national biodiversity targets into locally coordinated ecological action (HM Government, 2021; Anthony, 2025). Relevant authorities are required to prepare habitat maps and biodiversity priority statements,

identifying areas where conservation, restoration, and environmental enhancement should be prioritised. In contrast to earlier policy initiatives, LNRS attempt to provide spatial coherence by linking ecological evidence directly to planning and land-management decisions (UK Parliament, 2021; Defra, 2023e).

From a BGI perspective, LNRS represent one of the clearest attempts to operationalise national environmental ambition at the landscape scale, reflecting wider policy efforts to embed multifunctional green infrastructure within spatial planning and environmental governance frameworks (Grace et al., 2025). By identifying ecological opportunity areas, the strategies can guide the location of green corridors, floodplain restoration, urban greening, and nature-based flood management interventions. In principle, LNRS offer a mechanism through which biodiversity recovery, climate adaptation, and spatial planning objectives may converge within local decision-making frameworks (Defra, 2023e; Grace et al., 2025). However, their effectiveness remains constrained by their limited statutory force. Local planning authorities are required to have regard to the priorities of the LNRS but are not legally bound to implement them when determining planning applications, which creates weak alignment between strategy formation and development control (HM Government, 2021; OEP, 2026).

Emerging scholarly analysis argues that the LNRS framework remains poorly integrated with broader planning and governance regimes, limiting its practical effect on land use outcomes (Anthony, 2025). Furthermore, delivery is also challenged by capacity constraints. While the strategy's preparation was supported through central government funding, local authorities face long-standing resource pressures, which can hinder implementation, monitoring, and long-term management (LGA, 2024b).

LNRS thus hold an ambiguous position in the governance hierarchy. They enhance spatial coordination in theory but are reliant on the voluntary alignment of policies within a

planning system that remains growth-oriented (Grace et al., 2025). Without statutory integration into local plans or decision-making for development, LNRS risk becoming like previous environmental strategies that were ambitious, but that lacked institutional influence (Anthony, 2025).

3.6 NATIONAL STRATEGIES SHAPING BLUE GREEN INFRASTRUCTURE DELIVERY

In addition to formal planning policies and statutory legislation, national environmental strategies represent an important strategic dimension of the delivery of BGI in England. While these strategies do not have legal force, they shape policy direction through the articulation of long-term government priorities, institutional behaviour, and patterns of investment and coordination within and between sectors. As a result, they serve as an important layer of governance that translates political commitments to sustainable development into higher-level frameworks, which are then implemented through existing regulatory and planning systems. This section will therefore assess how these national strategies set the policy context for BGI implementation, focusing particularly on the Flood and Coastal Erosion Risk Management Strategy (FCERM) (2020) and the 25-Year Environment Plan (25YEP). This analysis aims to examine the extent to which BGI is positioned as a nature-based approach for managing flood risk, addressing biodiversity decline, and supporting climate adaptation.

3.6.1 Flood and Coastal Erosion Risk Management Strategy (2020)

The National Flood and Coastal Erosion Risk Management Strategy represent a major shift in England flood governance framework (EA, 2020a). In contrast to previous

approaches, which were engineering-led, the Strategy aims to promote a broader approach to resilience, which includes natural processes, catchment-scale approaches, and longer-term climate adaptation (O'Donnell et al., 2017; EA, 2020a). Nature-based solutions and Natural Flood Management (NFM) are explicitly identified as essential components of future flood resilience, reflecting growing recognition that hard engineering alone is insufficient to address escalating climate risks (EA, 2020a).

The Strategy promotes a more integrated approach to understanding flood risk management through greater collaboration among national agencies, local authorities, environmental organisations, and communities (EA, 2020a). Interventions like wetland restoration, floodplain reconnection, and sustainable drainage systems are promoted as delivering multiple benefits, including biodiversity and water quality enhancements and flood mitigation (Nesshöver et al., 2017; EA, 2020a). In conceptual terms, this represents one of the most clearly articulated forms of policy support for BGI signalling an evolution in the approach to risk management.

Nonetheless, the Strategy's impact is limited due to its non-binding nature. As a non-statutory document, while it provides strategic direction, it is not legally binding; consequently, the adoption of nature-based approaches by local authorities and developers depends on existing governance and funding structures (EA, 2020a). Research into the wider governance of England's FCERM indicates that national strategies mainly work through strategic steering and coordination, as opposed to enforceable regulatory duties, with delivery outcomes strongly shaped by institutional capacity and funding arrangements (Alexander et al., 2019). Furthermore, an independent assessment reveals that funding and provision remain uneven in nature, whereby investment decisions rely on appraisal techniques that favour engineered flood defences (National Audit Office, 2020).

Additionally, a review by the Environmental Audit Committee indicates that, while calls for an ecosystem-based approach are increasing, they remain insufficiently embedded in operational delivery and funding (Environmental Audit Committee, 2025). The FCERM Strategy therefore illustrates a recurring governance pattern in English environmental policy: strategic discourse shifts toward resilience and ecological integration, yet institutional incentives continue to reinforce established infrastructure practices, reflecting wider evidence that governance systems frequently favour technically predictable grey infrastructure despite policy endorsement of nature-based alternatives (O’Donnell et al., 2017; Nesshöver et al., 2017). As summarised in Table 3.8, the comparison between the 2011 and 2020 strategies indicates a clear conceptual shift towards integrated resilience and Natural Flood Management, however, due to the lack of statutory prioritisation and stable funding mechanisms, adoption remains largely discretionary (EA, 2020a). Therefore, without statutory backing or long-term funding guarantees, the uptake of BGI remains locally initiated and project-specific, rather than systematic.

Table 3.4: Evolution of Flood Risk Management Strategy — 2011 to 2020

Aspect	2011 Strategy	2020 Strategy	Analytical Implication
Flood Management Approach	Engineering-focused	Integrated resilience including NFM	Conceptual shift without statutory prioritisation
Role of BGI	Minimal reference	Central to adaptation narrative	Adoption remains discretionary
Governance Scope	Agency-led	Multi-actor partnerships	Coordination expanded but power asymmetries persist

Funding Model	Central grants	Blended funding encouraged	Accountability and equity unclear
Community Engagement	Limited	Emphasised rhetorically	Participation uneven in practice
Climate Adaptation	Reactive	Long-term adaptive framing	Implementation mechanisms weak

Source: (Adapted from EA, 2020a).

3.6.2 The 25-Year Environment Plan

The 25-Year Environment Plan (25YEP) sets out the overarching strategic vision for long-term environmental improvement in England (Defra, 2023f). Rather than acting as primary legislation, the Plan is a policy instrument that aims to influence the prioritisation of environmental objectives across institutions, encourage cross-sector coordination, and guide environmental governance (Defra, 2023f; Brummitt and Araujo, 2024). Its key role is therefore one of agenda-setting, making national ambitions visible, with actions relying on existing regulatory and planning systems. In the context of BGI, the 25YEP reflects a wider policy shift away from narrowly engineered environmental management towards approaches that recognise the value of ecological systems in climate adaptation and spatial planning (Defra, 2023f). It encourages habitat restoration, landscape connectivity, sustainable land management, and urban greening. This aligns with increasing recognition in the academic literature that nature-based solutions can simultaneously address biodiversity loss, flood risk, and climate resilience in complex settings (Grace et al., 2025). As such, environmental protection is repositioned as an intrinsic element of infrastructure and land-use governance rather than as a separate conservation activity.

Nonetheless, the 25YEP's strategic character imposes significant governance constraints. While goals, targets, and monitoring indicators are established by the Plan, they are not backed by legally enforceable duties (Brummitt and Araujo, 2024). Progress, therefore, relies less on regulatory compulsion and more on institutional cooperation and policy alignment (Defra, 2019a; Brummitt and Araujo, 2024). Within this framework, the Outcome Indicator Framework allows for the tracking of environmental trends but is not a delivery mechanism. This reflects a broader trend in England's environmental governance, where policy ambition often outpaces implementation capacity (Geijzendorffer et al., 2016; Grace et al., 2025).

Moreover, the non-statutory nature of the 25YEP further encourages reliance on institutional discretion. Local authorities and delivery agencies are encouraged but not mandated to implement nature-based approaches when balancing between environmental objectives and development pressures (Hodge, 2024). As a result, policies are implemented based on economic and infrastructural priorities rather than the environmental ambitions set out in the national policy (Fremstad and Paul, 2022; Grace et al., 2025). Despite these limitations, the 25YEP remains influential in shaping England's environmental policy trajectory. Its main policy function is agenda setting, offering a shared policy narrative that connects biodiversity recovery, climate adaptation, and human wellbeing within the national governance discourse (Defra, 2023f; Brummitt and Araujo, 2024). From a BGI perspective, the Plan legitimises the integration of environmental consideration at a strategic level, although practical delivery is still highly dependent on fragmented governance arrangements and non-binding coordination mechanisms.

3.7 NATIONAL GUIDANCE AND SOFT GOVERNANCE INSTRUMENTS

Beyond laws, planning policies, and national strategies, a further layer of governance shaping BGI delivery operates through national guidance documents. These guidance instruments do not create mandatory requirements or statutory policy; however, they instead influence how existing laws are interpreted and applied in practice. In this sense, they are soft governance mechanisms that shape professional norms, planning expectations, and administrative decision-making without binding legal obligation. Within England's planning landscape, the National Planning Practice Guidance (NPPG) and the Green Infrastructure Framework (GIF) serve as influential guidance instruments. Both aim to normalise nature-based approaches within planning and infrastructure delivery through the provision of technical interpretation, standards, and best-practice models. Nevertheless, their effectiveness relies less on formal authority than on institutional uptake, professional capacity, and alignment with statutory planning systems. This dependence on interpretive adoption reveals the flexibility and fragility of soft policy instruments in advancing BGI.

3.7.1 National Planning Practice Guidance (NPPG): Interpretation as Governance

The National Planning Practice Guidance (NPPG), introduced in 2014 and regularly updated online, provides detailed interpretation of the NPPF across a wide range of planning areas (DLUHC, 2024b). The guidance was envisioned to facilitate a consistent approach to the implementation of national planning policy. It translates high-level policy principles into practical advice for local planning authorities and planning practitioners, thus acting as an intermediate level between statutory planning policy and day-to-day development management practice (DLUHC, 2024b; MHCLG and DLUHC, 2025).

Within the context of BGI, the NPPG explicitly recognises the multifunctional role of green infrastructure in supporting biodiversity enhancement, flood risk management, climate adaptation, and public wellbeing (DLUHC, 2025a; 2025b). In relation to flooding and coastal change, it supports risk-based spatial planning and sustainable drainage approaches, while natural environment guidance promotes ecological enhancement and locally responsive environmental decision-making (DLUHC, 2025a; 2025b).

The NPPG clarifies how environmental objectives ought to be interpreted in planning decisions, thereby creating a pragmatic route for the integration of ecological considerations into everyday development control processes (DLUHC, 2025a; 2025b).

Due to its constantly updated digital format, planning authorities can interpret national objectives in relation to local spatial and ecological conditions, which enables flexibility in implementation (DLUHC, 2024b). However, this flexibility also represents a central institutional limitation. According to the *Solo Retail Ltd v Torridge District Council* case (2019), the NPPG has no independent legal force, as it is planning guidance and not statutory policy. According to DLUHC (2024b), decision-takers must have regard to this guidance, but it does not override adopted development plans or statutory material considerations where conflicts arise. Planning scholarship recognizes such instruments as those that operate primarily through interpretative influence and can shape professional judgement without constraining outcomes (Allmendinger and Haughton, 2013; Allmendinger, 2017). As a result, environmental provisions remain negotiable during development management processes, and therefore their implementation varies between local authorities (Haughton et al., 2013).

Consequently, implementation outcomes vary according to institutional capacity, professional expertise, and local political priorities, rather than uniform regulatory obligation (Allmendinger, 2017). Authorities that provide stronger environmental

leadership may be able to leverage the interpretative flexibility of the NPPG to promote ambitious BGI initiatives, while others focus on delivering housing and stimulating economic growth where policy tensions arise (Haughton et al., 2013; DLUHC, 2025a; 2025b). The NPPG is, therefore, indicative of governance through interpretation rather than regulation, which shapes planning culture and professional expectations, but does not have the requisite binding authority to ensure uniform environmental outcomes throughout England's planning system (Allmendinger and Haughton, 2013).

3.7.2 Green Infrastructure Framework (2023)

Published by Natural England in 2023, the Green Infrastructure Framework (GIF) represents the most comprehensive national attempt to mainstream green infrastructure within England's planning system through guidance rather than regulation (Natural England, 2023). The framework provides a coordinated suite of standards, metrics, and assessment tools intended to assist planners, developers, and local authorities in embedding nature within urban and peri-urban development. In doing so, it reflects wider policy efforts to operationalise nature-based solutions within spatial planning and infrastructure governance (Grace et al., 2025). The Framework positions access to nature as a central component of sustainable development and introduces measurable benchmarks relating to urban greening, tree canopy cover, biodiversity enhancement, and access to greenspace (Natural England, 2023). Instruments such as the Urban Greening Factor and accessibility thresholds seek to translate previously aspirational environmental objectives into measurable planning expectations. This shift towards quantified standards reflects broader transformations in environmental governance, where performance metrics

are increasingly used to guide planning practice and improve transparency in decision-making (Grace et al., 2025).

However, the development and implementation of green infrastructure standards introduce significant governance challenges. Establishing standards requires decisions regarding what should be measured, how outcomes should be evaluated, and the level at which expectations should be set, encompassing not only the quantity of green infrastructure but also its quality and integration within planning processes (Natural England, 2023; Grace et al., 2025). The constraints underpinning the achievement of minimum levels of green space in England include a planning regime driven by high-level housing delivery objectives and long-term financial burdens upon local authorities, which limit the ability to maintain existing green assets and create new ones (Hodge, 2024). Additionally, at a national level, there has been an increased emphasis on promoting greater densities of development in areas of limited land availability, which creates inherent contradictions between national growth policies and the need for sufficient physical space to deliver effective levels of green infrastructure (MHCLG, 2025).

These challenges arise within England's permissive planning environment, where development decisions actively shape the provision or loss of GI through local interpretation and negotiation (Grace et al., 2025). As outlined in Table 3.9, while the individual standards contained within the Framework aim to bring greater clarity and consistency to land use decision-making processes and the protection of natural environments, these standards will continue to be constrained by their non-statutory designation and lack of guaranteed funding. While standards such as the Urban Greening Factor and tree canopy cover benchmarks represent quantifiable measures that developers are expected to achieve, their delivery continues to rely on the discretion of local authority planners and viability considerations rather than statutory requirements (Natural England,

2023). However, this reliance highlights a tension between standardisation and place-based approach to planning.

Zuniga-Teran et al. (2020) suggest that the application of standardised metrics can potentially conflict with local ecological realities, social demands, and spatial limitations, thus requiring ongoing dialogue between national guidelines and local flexibility. Although quantitative metrics increase clarity, they could inadvertently encourage compliance-oriented behaviour, whereby minimum thresholds are achieved even when the ecological benefits and social inclusiveness of the intervention are not meaningful (Grace et al., 2025). As a result, although the Framework enhances conceptual coherence and offers practical tools for planning and delivery of BGI, its impact across England remains uneven.

More broadly, the GIF reflects a wider pattern of soft spatial governance in England’s environmental policy. While it outlines what good practice should look like, it lacks the statutory force to enforce BGI delivery (Natural England, 2023). In this regard, the GIF plays an interpretive role rather than a regulatory role, in an institutional context that continues to be strongly shaped by development viability and growth (Haughton et al., 2013). Although the mainstreaming of BGI is legitimised at the strategic level, transformative outcomes depend on how local actors interpret and implement it within existing governance constraints.

Table 3.5: Summary of Green Infrastructure Framework Standards and Governance Implications

Green Infrastructure Standard	Core Purpose	Key Limitation
Urban Nature Recovery	Strengthens biodiversity and ecological resilience	Implementation varies due to non-statutory status

Urban Greening Factor	Integrates greening into development design	May encourage minimum compliance
Tree Canopy Cover	Supports climate adaptation and surface water management	Constrained by land and funding pressures
Accessible Greenspace	Improves public access to nature	Access does not guarantee quality or inclusion
GI Strategy Standard	Promotes long-term planning integration	Adoption depends on local capacity

Source: (Natural England, 2023; Grace et al., 2025)

3.8 REGULATORY MECHANISMS INFLUENCING IMPLEMENTATION

While legislation establishes legal duties and national policy articulates strategic direction, the practical delivery of BGI in England is often shaped most directly through regulatory procedures governing development consent, environmental assessment, and risk management. These regulatory instruments do not mandate any specific planning outcomes, instead, they establish a framework through which decisions are made. As mechanisms of procedural governance, they incorporate environmental considerations into administrative processes through requirements that include assessment, mitigation, and compliance. The key regulatory frameworks that influence the implementation of BGI in England include the Environmental Impact Assessment Regulations 2017, the Conservation of Habitats and Species Regulations 2017, and the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. Taken together, these instruments require environmental effects to be assessed prior to proceeding with development, thereby creating institutional entry points through which ecological and hydrological considerations can inform planning decisions. Nonetheless, their emphasis on procedural compliance over substantive outcomes means their contribution to BGI delivery is indirect and uneven.

3.8.1 Water Environment (Water Framework Directive) Regulations 2017

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 implement Directive 2000/60/EC as a legal requirement in England and Wales, establishing a legally enforceable framework for ecological status, non-deterioration, and river basin management (HM Government, 2017a; European Parliament and Council, 2000; Liefferink et al., 2011). These represent a shift from a sectoral approach to pollution control towards a more integrated, ecosystem-focused form of governance (Mostert, 2020). Although the Regulations do not reference BGI, they reflect similar ecological and catchment-based focus.

The Regulations include elements that support the use of BGI, such as the requirements for River Basin Management Plans and Programme Measures, which can enable landscape-scale and cross-sectoral interventions. The principle of non-deterioration also provides a binding constraint on development or activity within a catchment, to ensure that no harm occurs to the ecological condition (European Parliament and Council, 2000; Liefferink et al., 2011; HM Government, 2017a; Benson et al., 2016; Mostert, 2020).

In practice, most rivers in England do not achieve good ecological status (Environment Agency and Natural England, 2025). This is due to several factors, including limited institutional and financial resource, low political priority, insufficient administrative capacity, and misaligned funding (HM Government, 2017a; Benson et al., 2016; Mostert, 2020; Liefferink et al., 2011). Howarth (2017) states that transposing legislation is simply a means of implementing legal obligations and cannot guarantee ecological improvement. Thus, the Regulations do not deliver BGI directly but create the enabling conditions, for this outcome to be achieved when incorporated effectively into planning systems (Liefferink et al., 2011; Benson et al., 2016; HM Government, 2017a; Mostert, 2020).

Successful implementation requires better coordinated and aligned systems, greater

investment in the water environment, and coordinated funding across agencies. Examples of such funding include the River Basin Management Plans, Water Industry National Environment Programme (WINEP) and Environment Act 2021. Furthermore, effective implementation of the Regulations requires a more robust institutional coordination, and capacity to deliver BGI. Achieving these conditions will enhance the overall effectiveness of BGI. Consequently, while the Regulations imposes significant legal obligations to protect the environment, their contribution to promoting the delivery of BGI remains conditional on institutional coordination, funding alignment, and implementation capacity.

3.8.2 Conservation of Habitats and Species Regulations 2017

The Conservation of Habitats and Species Regulations 2017 transpose the key protective requirements of the Habitats and Birds Directives into domestic law. A core aspect of this framework is the integrity precautionary test, applied through Appropriate Assessment (HM Government, 2017b). Under this arrangement, planning permission is only granted where it can be shown that there will be no adverse effect on the integrity of designated sites (HM Government, 2017b). Consequently, the Regulation enshrine a precautionary approach in planning decisions, that creates a presumption against harm to biodiversity where there is uncertainty, limiting specified forms of land-use change (Duhlbo, 2023). Consequently, these integrity-based approaches create tension for BGI. Firstly, the Regulations protect the conditions necessary for BGI to operate ecologically. Secondly, they limit the potential of BGI intervention in those areas where some change to Site condition may be required. This tension is most apparent within designated habitat such as Wetland, Estuary or River Corridor areas which have significant roles in regulating hydrology, ecological connectivity and climate resilience (Nguyen et al., 2021). While

protecting these places can help maintain the ecological basis of BGI, this same protective rationale may constrain more interventionist approaches, especially where BGI necessitates landscape change, such as floodplain reconnection or wetland enhancement (Adams et al., 2023). Although these interventions may help maintain site integrity and provide broader ecosystem functions, they must operate within a regulatory context that prioritises the minimisation of harm (Adams et al., 2023).

Nevertheless, this does raise concerns regarding the extent to which this framework can allow for more transformative forms of intervention. The regulatory logic continues to be damage averse. Its focus is on protection, rather than actively enabling change. Legal analysis shows that obligations are primarily focused on maintaining or restoring favourable conservation status within designated sites rather than requiring ecological expansion across wider landscapes (Duhlbo, 2023). As a result, governance priorities are oriented towards impact avoidance and compliance with conservation thresholds rather than proactive assembly of integrated blue–green networks (Wildlife and Countryside Link, 2023). This site-centred orientation limits the capacity of the Regulations to drive landscape-scale BGI, particularly in areas beyond formal designations where ecological connectivity and flood resilience interventions are often most needed (Wildlife and Countryside Link, 2023). Overall, the Regulations establish enforceable environmental safeguards that protect critical natural assets essential to BGI delivery, yet their defensive and site-focused design constrains the proactive development of multifunctional BGI at broader spatial scales. BGI therefore emerges within this framework primarily as a compatible conservation enhancement rather than as a systematically required infrastructure approach.

3.8.3 Environmental Impact Assessment Regulations 2017

The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 require certain development projects to assess and disclose significant environmental effects prior to approval (MHCLG, 2020b). Environmental Impact Assessment (EIA) functions as a procedural safeguard, ensuring that decision-makers consider cumulative environmental impacts, including biodiversity loss, flood risk, and landscape change (MHCLG, 2020b). Furthermore, the EIA serves as a principal procedural mechanism through which environmental considerations are introduced into development decision-making (UK Government, 2017). By mandating the assessment of likely significant effects on biodiversity, water environments, landscape, and climate factors, it creates a formal opportunity for the integration of BGI measures within project design, including sustainable drainage systems, ecological connectivity, and nature-based mitigation strategies (MHCLG, 2020b).

However, in practice, EIA is widely characterised as a process of regulatory compliance rather than as a mechanism for spatial transformation (Caro-González, 2023; Onyango, 2024). According to empirical and policy evaluations, assessment processes are often focused on managing and justifying environmental risk rather than restructuring development proposals to improve environmental benefit (Caro-González, 2023; Onyango, 2024). Consequently, environmental interventions are generally portrayed as compensatory mitigation intended to offset expected damage rather than as structuring principles that shape development form and land-use outcomes. Also, the impact of EIA is dependent on the institutional capacity, technical expertise and resourcing of the local planning authorities that review Environmental Statements, often resulting in uneven levels of scrutiny and implementation across planning contexts (DLUHC, 2023; OEP, 2023). Judicial interpretation of the 2017 Regulations is another variable that demonstrates

lack of clarity about what is and is not an environmental effect, which anchors the regime further in proceduralism rather than being transformative. Therefore, while the EIA integrates the environmental component in the planning process, without clear statutory duties and stronger integration in the wider planning system, it does not ensure delivery of BGI outcomes.

3.9 CROSS- CUTTING LEGISLATIVE AND POLICY CONSTRAINTS

The preceding analysis indicates that, while BGI is increasingly recognised within England's environmental and planning policy landscape, persistent implementation challenges are rooted less in local practice than in the legislative and policy framework through which delivery is organised. Despite the increasing articulation of environmental ambitions across legal instruments, national planning policy, and regulatory processes, implementation remains uneven. This demonstrates that there is a structural tension in the system: whilst policy encourages integrative, multifunctional approaches, the institutional mechanisms required to secure consistent delivery are only partially embedded in law and policy. Taken together, these dynamics reveal two related constraints cutting across legislation and policy. First, patterns of resource allocation shape the capacity of institutions to operationalise policy expectations. Furthermore, the development of participatory procedures impacts whose understanding and priorities influence decision-making. Collectively, these parameters do not function as stand-alone implementation barriers but rather serve as the systemic outcome of both legislative design and procedural policy design, thereby influencing administrative behaviour and shaping the infrastructural approach that is feasible in practice. The following sections examine these constraints sequentially, with an initial focus on resource allocation as a structural outcome of the existing framework.

3.9.1 Resource Allocation as a Structural Outcome

Within England's environmental planning system, resource allocation is not just an implementation issue. It is shaped by how legislation and national policy define environmental obligations (OEP, 2023). For example, statutory frameworks such as the Flood and Water Management Act 2010 assign responsibilities for flood risk management and sustainable drainage. At the same time, national planning policy promotes environmentally responsive approaches to development. However, these frameworks mainly set procedural expectations rather than enforceable delivery requirements. They do not provide clear obligations to secure the financial or institutional capacity needed to implement sustainable and nature-based solutions (O'Donnell et al., 2017; Scott et al., 2017). As a result, resource allocation is not guaranteed through legislation. Instead, it is often determined through planning negotiations and discretionary funding arrangements (Consumer Scotland, 2023). This creates a gap between policy ambition and practical delivery.

In practice, while legislative and policy frameworks support environmental integration, the actual delivery of BGI depends heavily on local authority capacity and development economics (Commonwealth Local Government Forum, 2021). This shows that resource allocation is not simply an external constraint, but a product of how legislative and policy systems are designed. Under these conditions, BGI is supported in principle but remains uncertain in practice. Its implementation becomes dependent on local priorities and available resources, leading to uneven outcomes across different authorities (Scott and Hislop, 2024). This also reinforces reliance on conventional flood defence approaches, even where policy signals support for blue-green alternatives.

3.9.2 Participation as Procedural Rather Than Empowering

Across environmental regulation and spatial planning, public involvement is formally required through statutory consultation duties, legislation, and national planning policy. However, participation is largely structured around notification, consultation, and representation rather than shared decision-making authority (Lawson et al., 2022). In England, planning legislation, including the Town and Country Planning Act 1990 and the Planning and Compulsory Purchase Act 2004, requires engagement through Statements of Community Involvement and consultation during the preparation of plans and the management of development, to promote procedural transparency while leaving institutional power largely unchanged (Lawson et al., 2022). The Localism Act 2011 introduced reforms reinforcing procedural orientation by increasing opportunities for community participation in neighbourhood planning while decision-making remains with local planning authorities and planning inspectorate (King's Lynn and West Norfolk Borough Council, 2017). Research on participation in England's spatial planning highlights that the involvement of stakeholders typically occurs through stages of structured consultation rather than participatory governance arrangements capable of redistributing power (Baker et al., 2010).

In addition, development management and Environmental Impact Assessment (EIA) consultation obligations similarly give precedence to opportunities for representation rather than co-production (Consumer Scotland, 2023; González et al., 2023). While communities can make representations and objections, the legislative framework gives evaluative power to certain professional and statutory actors who determine planning outcomes (Lawson et al., 2022). As a result, while participation continues to be embedded in procedures, it is limited in substance; there is an asymmetry between professionals and the public, and between planners and the community knowledge within planning systems

(Deely et al., 2020; Nawrath et al., 2026). This highlights a broader governance implication whereby BGI is often framed in legislation and policy as community centred infrastructure but enacted through mechanisms that constrain meaningful local agency (Chau et al., 2025). In this context, participation often functions as a regulatory compliance tool rather than as a mechanism of collective environmental decision-making (Chau et al., 2025).

3.10 CHAPTER SUMMARY

This chapter looked at how legislation, policies, strategies, and regulations shape the delivery of BGI in England. Instead of just listing these instruments, the focus was on how they set the conditions within which BGI is either allowed to happen or quietly limited. What comes out clearly is that, although policy language increasingly supports nature-based approaches, that support does not always translate into something that can be enforced in practice. A key finding is that there is a gap between what policy says and what the law requires. BGI is often encouraged, but not made compulsory, so in many cases it depends on whether those involved choose to prioritise it or not. Another factor that stands out is how much depends on local interpretation. The same policies can lead to very different outcomes depending on how local authorities apply them, which makes BGI delivery quite uneven. It also became clear that most of the environmental requirements operate through processes like assessments and consultations. These are important, but they tend to focus more on meeting procedural steps than on ensuring that BGI is delivered in a meaningful way. These points fed directly into the conceptual framework, especially in shaping the legislation and policy dimension, while also pointing to the need to include resources and stakeholder engagement as key areas. Overall, what this chapter shows is that the challenge is not that policy ambition is missing, but that the system itself is set up

in a way that makes delivery uncertain. These insights form the starting point for the framework used in the chapters that follow. The next chapter then looks at how governance arrangements play out in practice.

CHAPTER 4: GOVERNANCE STRUCTURE FOR BLUE GREEN INFRASTRUCTURE

4.0 INTRODUCTION

The successful implementation of BGI is embedded in a complex system of governance arrangements that encompass several institutional levels and policy areas. In England, this landscape is characterised by fragmentation, overlapping mandates, as well as unequal capacities of state and non-state actors. This chapter examines BGI as a dynamic, multi-scalar process, which is influenced by changing institutional interactions, rather than a fixed system of governance. These conditions emphasise asymmetry, unclear responsibilities, and misaligned institutions, rather than a linear or coherent process. Thus, creating both barriers and opportunities for achieving integrated, context-sensitive BGI outcomes. The chapter uses a multi-scalar analysis of responsibilities, institutional relationships and policy mechanisms to critically analyse the implementation of BGI at various levels of governance. It underscores the conflict between formal, and informal frameworks and implies that governance systems may either support or limit the potential of BGI, to create a more adaptive and ecologically valuable urban environment.

4.1 JUSTIFICATION FOR INSTITUTIONAL SELECTION

The institutions examined in this chapter were identified through a purposive, literature-informed mapping of England's flood-risk and BGI governance landscape, extending beyond statutory flood-risk management authorities to capture the wider governance system influencing flood-risk outcomes. This mapping was undertaken through a

structured review of national legislation, policy frameworks, and governance arrangements shaping flood-risk management and spatial planning in England, including the Flood and Water Management Act, the Flood and Coastal Erosion Risk Management Strategy, the National Planning Policy Framework, and associated institutional guidance. Organisations exercising decision-making authority over land use, infrastructure systems, drainage, environmental regulation, and investment delivery were identified and iteratively assessed for relevance to BGI implementation.

Drawing on scholarship that conceptualises flood risk as a multi-source, systemic, and cross-sectoral governance challenge (Alexander et al., 2016a; Thaler, 2015; Matczak and Hegger, 2020; Okunola et al., 2026), and consistent with multi-level governance mapping approaches, the analysis recognises flooding as extending beyond fluvial processes and beyond formally designated Risk Management Authorities. Institutional selection was therefore guided by three analytical criteria:

1. Responsibility for managing or influencing different flood sources, including fluvial, pluvial, groundwater, coastal, and infrastructure-related flooding, as articulated within England's post-2007 flood governance framework (HM Government, 2011).
2. Control over spatial planning, infrastructure provision, or land-management decisions that materially shape hydrological behaviour and ecological functioning.
3. Demonstrable influence over funding mechanisms, regulatory arrangements, or implementation pathways relevant to BGI delivery.

This approach reflects environmental governance research that prioritises policy integration, multi-level coordination, and actor influence over formal statutory remit alone (Alexander et al., 2016b; Willems et al., 2021). Consequently, institutions such as National Highways, water companies, and Combined Authorities are included because their

infrastructure assets, investment priorities, and regulatory responsibilities significantly shape runoff generation, flood exposure, and the practical feasibility of BGI, even where flood management is not their primary statutory function. Adopting this broader institutional scope enables a more realistic assessment of how BGI is enabled or constrained in practice within England's fragmented and multi-level flood-risk governance system, recognising that flood-risk outcomes are produced through interconnected governance decisions extending beyond traditional flood management institutions.

4.2 NATIONAL LEVEL GOVERNANCE

England's BGI governance is dominated by a fragmented array of interdependent institutional actors at the national level. Authorities such as the Department for Environment, Food and Rural Affairs (Defra), the Environment Agency (EA) and Natural England (NE) have considerable overlapping roles in BGI in terms of policy, regulation and implementation. Nevertheless, governance does not only happen by the presence of state departments and state-sponsored bodies, but the way they interact with each other, the division of powers and the alignment of strategic direction across sectors and levels (LGA, 2022). Although hierarchical structures remain dominant especially in regulatory oversight it is increasingly recognised that centralised models respond inflexibly to place-based needs and cross-cutting environmental challenges such as flood resilience and climate change adaptation. This tension between the national control and the local autonomy makes the application of BGI complex (Scott and Hislop, 2024). The governance framework at national level needs to be critically assessed not only in terms of policy coherence, but also in terms of its ability to support integrated, adaptive and socially just approaches to BGI.

4.2.1 The Department for Environment, Food and Rural Affairs (Defra)

Defra occupies an influential yet institutionally constrained position within England's environmental governance architecture. While formally designated as the lead department for environmental quality, land use and flood-risk policy, its authority over the substantive decisions that shape spatial development and infrastructure outcomes remains indirect (Environmental Audit Committee, 2025). Defra's role is therefore best understood not as one of regulatory command, but as one of agenda-setting, coordination and facilitation across a fragmented policy landscape. Essentially, the structural positioning significantly affects the extent to which BGI can be incorporated into development and infrastructure systems (Mees et al., 2013; HM Government, 2023). Defra primarily exercises influence by articulating long-term objectives and allocating targeted funding streams, rather than through the imposition of legally binding obligations. The absence of statutory control over planning and infrastructure decision making in other government departments and local planning authorities means Defra lacks a formal power to mandate the systematic inclusion of BGI in development processes (Mees et al., 2013; HM Government, 2023). Consequently, aspirations for environmental progress are enacted mainly through mobilisation, advice, and incentive-based measures, rather than coercive regulatory instruments.

The Environmental Improvement Plan 2025 exemplifies this mode of governance. The plan advocates for nature-based solutions and recognises the essential role of BGI in flood resilience, adaptation and restoration (Defra, 2025b). However, it primarily serves as a framework for strategic narratives rather than a statutory tool, so its delivery relies on voluntary uptake and inter-institutional alignment (Defra, 2025b). In practice, reliance on discretionary implementation renders environmental outcomes vulnerable to dislocation where these have conflicts with entrenched priorities such as housing delivery, economic

growth or infrastructure expansion (Environmental Audit Committee, 2025). The absence of enforceable requirements has resulted in BGI often being framed as an optional extra rather than a mandatory consideration in spatial and infrastructure decision-making (Mell, 2017).

Defra's financial levers further reflect these institutional constraints. While funding programmes like natural flood management and environmental land management schemes are valuable for interventions related to BGI, they are predominantly competitive, with a short-timeframe, and project-based (Environmental Audit Committee, 2025). The Environmental Audit Committee (2025), notes that this funding model encourages short-term planning, favours well-resourced actors and undermines the strategic coupling of flood resilience and environmental objectives across places and sectors. Furthermore, the periodic nature of funding de-motivates sustaining maintenance and cross boundary coordination, further embedding fragmentation in England's multi-scalar system of flood governance.

This dynamic reveals a more substantive governance tension in England's environmental policy regime. Environmental policy is often regarded as a standalone area, articulated through plans and strategies which exist alongside institutional logics that govern development and investment decisions. According to Mees et al. (2013), in the context of climate adaptation, such arrangements favour coordination and consensus-building, while at the same time constraining the capacities of environmental actors to bring about material changes. The result is a sort of governance in which responsibility for environmental outcomes is widely spread but accountability for their delivery is diffuse. Consequently, Defra's influence over BGI should not be overstated. Despite being a leading actor in environmental governance, Defra is constrained by a governance system which hampers further integration and making outcomes more long-term and spatially

embedded (Mees et al., 2013; Defra, 2025b; Environmental Audit Committee, 2025). The disconnect between strategic goals, funding approaches, and institutional authority helps explain why BGI remains unevenly implemented across England, and why its delivery continues to be contingent on local political will, institutional capacity and short-term funding opportunities, rather than an embedded regulatory obligation (Mees et al., 2013; Defra, 2025b; Environmental Audit Committee, 2025).

4.2.1.1 Interdepartmental Fragmentation, Governance Gaps, and Reform Imperatives

The institutional constraints shaping Defra's role are further compounded by persistent fragmentation across central government departments and arm's-length bodies. The agenda for flood resilience and BGI in England is hampered by a patchwork of sectoral policies, competing policy logics, and misaligned statutory responsibilities (Wiering et al., 2015; Alexander et al., 2016; Environmental Audit Committee, 2025). Collectively, these factors obstruct efforts to integrate environmental objectives into spatial planning and infrastructure delivery (Wiering et al., 2015; Alexander et al., 2016b; Environmental Audit Committee, 2025). Over time, the analysis of flood risk governance in England has suggested that responsibilities are spread across many departments and agencies and coordination and accountability mechanisms are weak, leading to a structural gap between national policy ambition and operative decision making (Dieperink et al., 2016; Hegger et al., 2016). The disconnection between strategic environmental goals and the delivery of integrated, place-based solutions identified previously is reinforced by these interdepartmental misalignments.

A central source of tension lies in the differing governance paradigms that structure departmental action. In the past, the Environment Agency's approach to flood risk

management has been based on technocratic risk assessment, economic appraisal and asset-based management (EA, 2010; Thorne et al., 2015). This legacy approach reflects engineering-led flood defence and cost–benefit decision-making (EA, 2010; Thorne et al., 2015). Although there is a growing uptake in policy circles of nature-based solutions and BGI, there is evidence that institutional practice and appraisal frameworks still favour engineered interventions, especially where performance metrics, funding rules and regulatory assurance are aligned with traditional infrastructure delivery models. (Wiering et al., 2015; Environmental Audit Committee, 2025).

These contrasting institutional priorities restrict effective interdepartmental coordination and replicate governance asymmetries where the BGI is treated as being discretionary and not integral to infrastructure and spatial planning. Such fragmentation points to a deeper structural problem of policy integration in complex, multi-actor systems where responsibilities are widely diffused but mechanisms for alignment and accountability are weak (Klijn and Koppenjan, 2016). In this context, Defra’s environmental strategies articulate ambitions for resilience and multi-functionality but lack the statutory coherence necessary to secure consistent implementation across departmental boundaries. The consequences are evident in the uneven uptake of BGI, with reliance on voluntary guidance, short-term funding and informal coordination limiting translation of national policy into practice, particularly where institutional capacity is uneven or environmental objectives conflict with development pressures (Kabisch et al., 2016; Environmental Audit Committee, 2025). Taken together, these dynamics demonstrate that without stronger statutory alignment and cross-departmental accountability, environmental objectives will remain weakly embedded within planning and infrastructure systems, leaving BGI marginal despite its prominence in national policy (Scott and Hislop, 2024).

4.2.2 Environment Agency (EA)

Since its establishment in 1996, the EA has developed into an important but structurally limited player in England's environmental policy system (EA, 2025a). It operates as a non-departmental public body overseen by Defra, and has a hybrid role encompassing regulation, consultation, data collection and emergency response (EA, 2025a). The Agency's functions are supported by a patchwork of legislation, including the Environment Act 1995, the Flood and Water Management Act 2010 and the Environment Act 2021 (EA, 2025b). However, despite this legal basis, the EA's ability to integrate BGI into general policy remains limited (Willems et al., 2021; Scott and Hislop, 2024). This is not due to a lack of strategy, but to the persistence of institutional path dependencies, political-economic constraints and an embedded reliance on grey infrastructure solutions (O'Donnell et al., 2017).

In principle, the EA supports adaptive, ecosystem-based approaches. Its Flood and Coastal Erosion Risk Management Strategy 2020 contain explicit references to nature-based solutions (EA, 2025b). Although the Environment Agency (EA) operates within a well-established legal framework for flood risk management, its ability to meaningfully embed BGI into mainstream flood policy remains limited. This is not for lack of strategic vision indeed, the EA's policies often advocate for nature-based solutions but rather reflects deeper institutional path dependencies and political-economic constraints that continue to privilege grey infrastructure (EA, 2025b). The embedded regulatory culture, influenced by risk aversion and engineering norms, means that traditional hard flood defences remain the default option. (O'Donnell, 2020). This bias is often reinforced by funding streams and performance metrics, which creates barriers to the adoption of more flexible multifunctional green approaches (Thompson et al., 2023). In effect, this institutional inertia poses a major difficulty for the EA's re-framing of flood governance towards more

sustainable, integrated solutions, highlighting the persistent mismatch between policy ambition and governance reality in England's flood management system (O'Donnell et al., 2017).

4.2.2.1 Flood Sources, Institutional Responsibilities and Implications for BGI

Flood risk in England comes from different sources, and each is managed by specific Risk Management Authorities (RMAs) with defined responsibilities under the Flood and Water Management Act 2010 (Defra, 2013; EA, 2023b). These include fluvial flooding from main rivers, coastal flooding, surface water flooding, groundwater flooding, and sewer flooding. Each flood type has different hydrological characteristics and operates at different spatial scales, which is why responsibilities are distributed across institutions (Defra, 2013). The Environment Agency is responsible for flooding from main rivers, the sea, and reservoirs. Lead Local Flood Authorities manage surface water and groundwater flooding, while water companies are responsible for sewer flooding (EA, 2023b). This division of roles creates a fragmented governance system where multiple actors are involved in managing flood risk.

Understanding these differences is important because the type of flooding directly affects how BGI can be applied. BGI is generally more effective for managing surface water and catchment-level flooding but tends to play a more limited or supporting role in coastal and fluvial systems, where engineered solutions are often prioritised (Fletcher et al., 2015; O'Donnell et al., 2017). In this context, the role of the Environment Agency is shaped not only by its statutory responsibilities but also by the type of flood risk involved and the need to work with other RMAs, including local authorities, water companies, highway authorities, and Internal Drainage Boards (Defra, 2013). Table 4.1 therefore brings

together flood sources, institutional responsibilities, and the stages of Environment Agency intervention, showing how these factors influence the extent to which BGI can be applied within England's flood governance system.

Table 4.1: Stages of Environment Agency Intervention, Associated Flood Sources, and Institutional Constraints

Stage	Key Processes	Flood Sources Primarily Involved	Regulatory or Advisory?	Challenges
1. Policy and Legislative Alignment (The Geneva Association, 2020)	Aligns with Defra policy, Environment Act, FWMA; sets national priorities for flood and environmental risk	All flood types (strategic level), with primary focus on fluvial and coastal flooding	Advisory	Funding and ministerial priorities limit BGI mandates.
2. Risk and Environmental Assessment (EA, 2024b)	Flood modelling, EIAs, catchment assessments, climate risk analysis	Main rivers and coastal flooding (EA remit); advisory input on surface water	Regulatory	Fluvial bias: surface and groundwater underrepresented.
3. Stakeholder Consultation & Engagement (EA, 2025a)	Engagement with LLFAs, LPAs, IDBs, developers, communities	All flood sources, particularly where multiple RMAs overlap	Advisory	Dependent on LLFA and planning cooperation.
4. Regulatory Permitting & Decision-Making (EA, 2024a)	Permits for watercourses, flood defences, abstraction, and development near main rivers	Main rivers, reservoirs, coastal systems	Regulatory	Limited authority over surface water and sewers
5. Enforcement & Compliance Monitoring (OEP, 2024)	Inspections, compliance checks, legal action	Main rivers, coastal defences, reservoirs	Regulatory	Enforcement constrained by capacity and resources.
6. Evaluation & Policy Recommendations (The Geneva Association, 2020)	Reporting, lessons learned, advice to Defra and Parliament	All flood types of evaluative role	Advisory	Non-binding advice; BGI remains complementary.

While the staged process outlined in Table 4.1 presents Environment Agency intervention as procedurally coherent and rational, such linear representations risk obscuring the complex realities of governance practice. According to Hajer and Wagenaar (2003) institutional analysis must go beyond formal procedures and investigate how governance unfolds in context. This means investigating how actors interpret rules, negotiate decisions under uncertainty and prioritise competing values in contested political arenas.

According to Table 4.1, the strategic objectives of the Environment Agency are delivered through a multi-agency governance landscape involving Lead Local Flood Authorities, Local Planning Authorities and Internal Drainage Boards. Despite the Environment Agency being the regulator for main rivers and coastal flood risk, it is a statutory consultee in the Planning Process with limited power over local decisions (EA, 2024e). Planning authorities are required to consider the Agency's advice, particularly in relation to flood risk and environmental policy guidance under the National Planning Policy Framework and the Flood and Water Management Act 2010, yet they are not obliged to adopt it when balanced against local development priorities (Gardiner, 2024).

Shokry et al. (2022) argue that this discretionary governance framework creates conditions under which BGI implementation becomes susceptible to competing development pressures with short-term economic growth priorities overriding longer-term resilience/environmental objectives. Consequently, local planning decision-making is often at odds with the national policy goals for adaptive flood governance.

4.2.2.2 Navigating Structural Constraints: The Role of the Environment Agency in Advancing BGI for Flood Resilience

The EA, as a key statutory body in England's environmental governance framework, plays a pivotal role in regulating flood risk and safeguarding environmental quality (EA, 2023b).

Nonetheless, BGI's overall impact is often curtailed by large institutional constraints. This institutional misalignment is reinforced by the political economy of funding. While the Environment Agency's (EA) 2024–2025 budget (£2.086 billion) appears substantial, much of it is allocated to capital-intensive, legacy infrastructure projects (EA, 2024a). Funding sources like the Flood and Coastal Resilience Partnership Funding allow some flexibility however, they still favour projects that deliver at scale, speed, and adhere to easily measurable impacts/benefits criteria which BGI struggles to meet (Defra, 2013). Consequently, BGI initiatives are typically narrow in scale and often function as standalone projects, which lack structural support for system-wide action and integration (Moss and Newig, 2010). The enforcement gap highlighted in Table 4.1, Stage 5 shows that the EA plays a limited role in BGI enforcement. According to reports from the Office for Environmental Protection (OEP), England's environmental accountability regime suffers from an ongoing enforcement gap, relating to combined sewer overflows (OEP, 2026). Despite existing legal frameworks, the OEP has criticised Defra, the Environment Agency, and Ofwat for delays in updating guidance, weak permit conditions, and inadequate regulatory oversight, which risk non-compliance with environmental law (OEP, 2024).

According to Green Alliance (2025), the continuing enforcement difficulties faced by the Environment Agency show not only a problem of capacity but also a deterioration in regulatory independence since Brexit. Despite Brexit being viewed to bolster the Agency's independence from EU scrutiny, in practice, this autonomy has been curtailed by changing political priorities and an institutional rearrangement in the England's governance apparatus (OEP, 2024). The Agency has been working under increasing pressure to balance its regulatory responsibilities with economic growth priorities as external EU accountability mechanisms were removed and scrutiny was diminished

resulting in a more cautious approach and sometimes hesitant enforcement (Environmental Audit Committee, 2023). This tension has generated significant ambiguity within water governance, where the expected benefits of Brexit in terms of strengthened environmental regulation have yet to materialise in practice (Green Alliance, 2025).

In such a climate, BGI whose benefits are often diffuse, long-term, and difficult to quantify is consistently deprioritised in favour of more politically visible interventions (De Silva et al., 2022). Consequently, the EA's ability to promote BGI is structurally undermined by its embeddedness in a governance model that continues to treat flood risk as primarily a hydrological challenge rather than a systemic socio-ecological problem. As Anyanwu et al. (2025) argue, meaningful environmental governance must go beyond procedural compliance and technocratic control. It must address uncertainty, support innovation at the local level and recognise that policy success is shaped not only by institutional design but also by power dynamics, informal networks and cultural attitudes to risk and nature. For EA to play a transformative role in embedding BGI, it requires more than just policy adaptation, but a fundamental reconfiguration of its institutional identity, governance culture and working logic (Consumer Scotland, 2023).

4.2.3 Natural England: Advisory Role and Structural Limitations in BGI Governance

NE is established by the Natural Environment and Rural Communities Act 2006. Natural England occupies a significant yet institutionally marginal position in England's environmental governance system (Natural England, 2025). As the government's statutory adviser on the natural environment, NE has a statutory duty to ensure biodiversity and that ecology networks are maintained and improved (Natural England

2025). In recent years Natural England has sharpened its strategic role in promoting green infrastructure, particularly through the 2023 Green Infrastructure Framework and its alignment with Biodiversity Net Gain and Local Nature Recovery Strategies, however its influence remains largely advisory (Grace, 2025). Importantly, its status as statutory consultee only has limited traction in influencing planning outcomes, as its recommendations are frequently traded off against competing policy priorities for example for housing delivery or economic growth (MHCLG, 2025). This constrained role reflects a structural weakening of the agency's policy influence since the dissolution of English Nature in 2006, which had previously held more targeted authority over biodiversity-related policy and regulatory input (House of Lords, 2018). In transitioning from a conservation-led body to a more integrated advisory organisation, Natural England's remit has broadened but arguably lost its former independence and clout. This change reflects a broader governance landscape that emphasises multi-agency cooperation but risks diffusing the ecological expertise across various agencies in the fragmented planning process (Jordan et al., 2018).

These developments strengthen the argument for more robust cross-sectoral mechanisms, which will embed nature-based principles not as optional extras but as essential elements of spatial and environmental decision-making. NE relies on a polycentric governance framework that comprises multiple actors who have overlapping but different objectives regarding biodiversity, land-use planning, and flood risk management (Natural England, 2024a; Natural England, 2024c). For instance, Natural England has the responsibility for biodiversity and nature recovery strategies, while execution depends on local councils, NGOs, landowners, and land managers, each operating with different levels of capability and commitment (Natural England, 2024a; National Audit Office, 2024).

This decentralised framework allows for ingenuity and adaptation to local contexts, yet it

often results in episodic implementation of environmental priorities, particularly where these priorities conflict with development pressures or housing delivery targets (National Audit Office, 2024; OEP, 2025). The advisory role of national experts requires an emphasis on soft governance mechanisms such as guidance documents, partnership working, and ecological advocacy, reflecting NE's statutory role as adviser rather than regulator within the planning system (Natural England, 2024c; Natural England, 2024d). This reliance on negotiated and voluntary uptake has produced a highly uneven governance landscape in which some local planning authorities actively integrate ecological recommendations, while others ignore or dilute them, especially in politically or economically sensitive contexts (Natural England, 2024a; National Audit Office, 2024). NE's flagship initiatives, such as Biodiversity Net Gain and the Nature Recovery Network, demonstrate attempts to embed ecological considerations within the planning system (Natural England, 2024b; Natural England, 2024c).

Despite some attempts to promote long-term thinking and engagement with communities, efforts remain largely project-based and discretionary, often dependent on financial viability tests for new developments or ties to short-term funding and are politically volatile (Van Raalte and Ranger, 2023; National Audit Office, 2024; OEP, 2025). NE lacks legal backing or capability for enforcement; this limits its capacity and capability to make BGI a fundamental principle regarding infrastructure and development planning (National Audit Office, 2024; Environmental Audit Committee evidence in Natural England, 2024d). Due to its advisory status and not statutory influence, the uptake of the ecological recommendations is determined by political will, institutional capacity and local priorities which tend to favour short-term economic or meeting housing delivery targets (Van Raalte and Ranger, 2023).

4.2.3.1 Projectisation, Funding Constraints, and Structural Vulnerability

NE operational capacity is compromised by persistent underfunding and over-reliance on central government grants. Table 4.2 summarises Natural England's income streams, illustrating the extent of its dependence on Grant-in-Aid funding and the limited contribution from alternative funding sources. In 2020, Grant-in-Aid from Defra accounted for 86% of NE's total income of £173.3 million in revenue and £98.9 million in capital, while only 14% came from external partnerships, fees, and other income sources (Natural England, 2020). This funding structure reinforces a delivery model shaped by centrally defined priorities, leaving little room for locally responsive or innovative approaches to green infrastructure planning and implementation. Gudde (2025) argued that such centralised models often inhibit adaptive, place-based environmental governance, undermining the capacity of agencies like Natural England to proactively lead on cross-cutting agendas such as BGI integration. In this context, the ability to deliver on set tasks particularly those involving complex socio-ecological coordination is not only shaped by funding volume, but by how funding mechanisms enable or restrict discretionary action aligned with longer-term resilience goals (Burns and Carter, 2018; Defra, 2023g). This over dependence has limited NE's ability to maintain long-term programmes, invest in monitoring, or provide sustained technical support to local authorities.

Table 4.2: Breakdown of Natural England's Income Streams (Source: Natural England, 2020)

<i>Funding Stream</i>	<i>Amount (£'m)</i>	<i>Percentage</i>
<i>Revenue Grant in Aid</i>	173.3	55%
<i>Capital Grant in Aid</i>	98.9	31%
<i>Fees & Charges</i>	33.5	11%
<i>External Partnership Funding</i>	7.8	2%
<i>Other Income</i>	2.5	1%

As shown in Table 4.2, the agency's funding structure reflects broader institutional constraints that extend beyond financial resources alone. Despite its strategic alignment with national environmental objectives, NE's influence in spatial planning remains weak. The relationship between NE staff and LPA personnel can at times be strained, particularly where communication breakdowns and unclear expectations persist (Natural England, 2024a). In cases where NE's requirements are not adequately articulated or negotiated, these tend to give rise to misunderstandings or perceived conflicts that impede collaboration (Anderson and McGee, 2025). The ambiguity hampers effective inter-agency partnership necessary for green infrastructure planning (Anderson and McGee, 2025). According to Ayoyan (2023), addressing these challenges requires more open dialogue, clearer articulation of roles, and a commitment to mutual respect to build the trust for genuinely integrated environmental governance.

4.3 REGIONAL LEVEL GOVERNANCE

This section critically assesses the role of regional governance as an intermediary arena through which national environmental policy goals are translated into local practices, focusing specifically on the implementation of BGI and flood resilience. Rather than viewing regional institutions as dispassionate coordination mechanisms, this section investigates how Combined Authorities and Regional Flood and Coastal Committees function within England's multi-level governance arrangements, where integration responsibilities are allocated but powers, resources, and institutions do not align adequately. While these organisations are seen as coordinating mechanisms, overlapping mandates, funding arrangements and political priorities hinder their ability to operationalise policy objectives. Analysing these tensions demonstrates that regional governance does not function as an obvious bridge between policymaking and delivery but rather as a contested site in which institutional facilities, procedural ambiguities and uneven power relations shape the translation of environmental policy into practice.

4.3.1 Combined Authorities (CAs): Governance Hybridity and the Structural Dislocation of Blue green infrastructure

England's current landscape of regional governance, characterised by the rise of Combined Authorities (CAs), reflects a hybrid and internally contradictory model of decentralisation, in which English devolution has unfolded in a highly asymmetric and uneven manner, producing fragmented governance arrangements and reinforcing political spatial inequalities (Warner et al., 2024). Introduced in 2011, CAs were positioned as central vehicles within the Levelling Up agenda, with the stated ambition of rebalancing regional economic disparities through tailored, place-sensitive strategies, although the

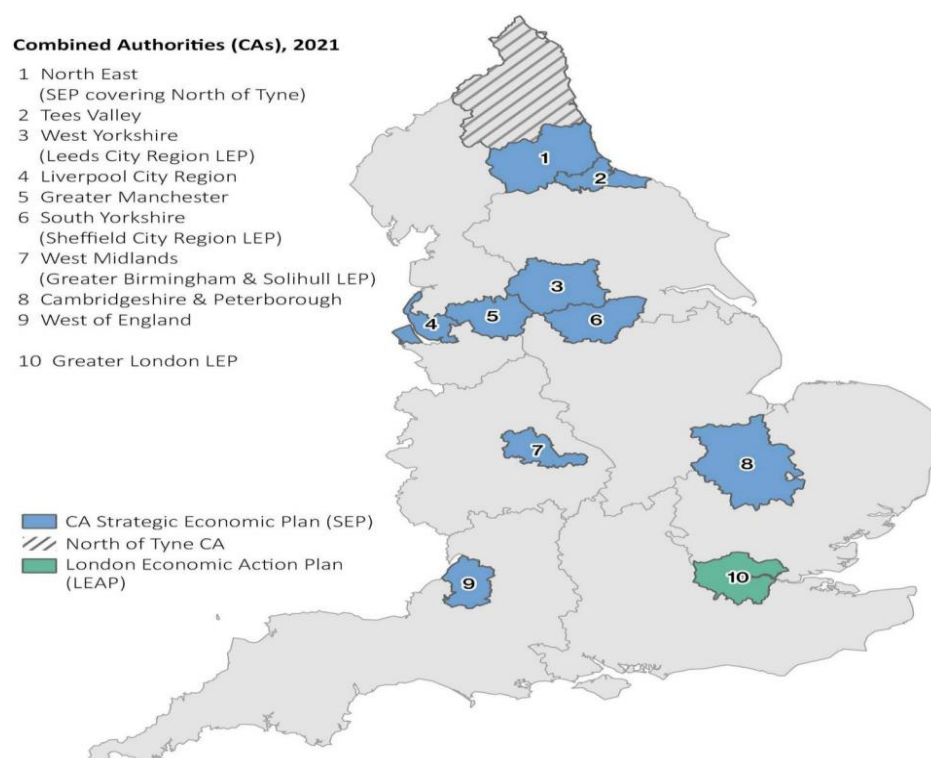
framing of Levelling Up has been criticised for oscillating between place-based approaches and more uniform, centrally driven policy logics (Sickotra, 2024). While this agenda has been praised for introducing a stronger territorial lens into national policymaking, scholars note that the discourse of localism and Levelling Up is characterised by significant ambiguity, with place-based rhetoric frequently masking the persistence of centralised decision-making and limited local autonomy (Hickson and Newman, 2025).

Persistent concerns therefore remain that the model reproduces centralised power structures under the guise of localism, with English devolution operating through negotiated, Whitehall-controlled arrangements that constrain local discretion (The Constitution Society, 2025). Rather than constituting a substantive redistribution of authority, the model has been interpreted as a re-centralised form of control masquerading as devolution, as central government retains discretion over the scope, timing and revocability of devolved powers (The Constitution Society, 2025). This model is further characterised by selective and opaque decision-making processes that lack transparency and democratic accountability, with bespoke devolution deals generating inconsistent powers and limited public clarity over lines of responsibility (HM Government, 2023). England currently comprises 317 local authorities, yet only a small proportion fall within the jurisdiction of the fifteen established Combined Authorities, highlighting the restricted territorial reach of formal devolution arrangements (House of Lords Library, 2023). This uneven spatial reach reinforces institutional asymmetries across the governance landscape, as devolution has been negotiated through place-specific deals in regions such as Greater Manchester and the West Midlands rather than applied uniformly across England (UK Parliament, 2024).

This unevenness is illustrated in Figure 4.1, which maps the distribution of Strategic

Economic Plans across Combined Authorities as of 2021, revealing how extensive areas particularly across the South and East of England remain outside any formal devolution settlement, reflecting the patchwork geography of English devolution (UK Parliament, 2024). Such an incomplete and uneven governance geography constrains opportunities for coordinated cross-boundary environmental strategies, particularly those reliant on large-scale BGI integration, which are difficult to achieve in the absence of coherent regional institutions (Warner et al., 2024). This has direct implications for the delivery of BGI, as fragmented governance limits strategic coordination across hydrological and ecological systems, encouraging piecemeal, locally bounded interventions rather than integrated, multifunctional networks capable of delivering flood resilience, biodiversity enhancement, and climate adaptation at scale (Scott and Hislop, 2024).

Figure 4.1: Combined Authority in England (Sickotra, 2024)



The structural paradoxes of CAs are acutely felt in the governance of BGI, where coordination across environmental and planning domains is essential. While CAs create opportunities for cross-boundary strategic alignment, their coverage is spatially patchy and institutionally uneven. CAs are intended primarily to promote economic development at the regional level, therefore they lack significant legal powers in relation to environmental planning, which has led to a fragmented and uneven system of governance (Sandford, 2017). The Greater Manchester Combined Authority (GMCA) is often recognised as one of the top examples through its 5-Year Environment Plan and the formation of a Natural Capital Group which mainstreams nature-based solutions and blue-green infrastructure in climate resilience (GMCA, 2019). Yet such integrative practices are deviant rather than normative. Most CAs remain active in a limited economic and transport sphere, with the ongoing lack of devolution of planning powers inhibiting their potential to pursue sustainability in a more comprehensive, territorial-sensitive manner (McKee and Allen, 2025). Moreover, there are ongoing concerns regarding democratic legitimacy and inclusivity as mayoral models can concentrate executive powers and lessen more pluralistic and deliberative forms of governance (McKee and Allen, 2025). Such an uneven institutional architecture epitomises the fragmented and incremental nature of English devolution. It creates major obstacles to implementing the cross-sectoral coordination required for genuine transformational environmental governance. (Sandford, 2017)

4.3.1.1 Governance Hybridity and the Structural Dislocation of Blue-Green Infrastructure

The preceding analysis demonstrates that regional governance operates within constrained institutional parameters despite the appearance of decentralisation. The phenomenon can

be understood through meta-governance, which Gjaltema et al. (2019) defines as an indirect steering through which, the central government maintains effective decisive power by having control over resources through financial dependencies, competitive tenders and conditional permits. As such, while CAs may appear as autonomous regional actors, they operate within tightly circumscribed institutional and financial parameters. Thus, 78% of CA funding continues to be centrally sourced, with stringent expectations for alignment with national directives (Newman and Kenny, 2023). This governance hybridity has direct implications for BGI. As demonstrated in the case of Greater Manchester, sustained investment in ecosystem-based planning is only possible where there are sufficient political autonomy and institutional maturity (GMCA, 2019). Conversely, other CAs lack the mandate or capacity to embed environmental objectives, let alone implement multifunctional infrastructure capable of delivering flood resilience, biodiversity enhancement, and social equity (GMCA, 2019).

Moreover, Allmendinger and Haughton (2009) argue that the notion of soft planning and soft spaces provides a useful lens through which to interpret the dual character of CAs. These structures function as hybrids partially bounded by formal jurisdictional authority yet simultaneously operating through informal, strategic processes that are flexible and adaptive. While this could theoretically enhance the capacity for place-based BGI innovation, the absence of a coherent legislative or financial backbone constrains meaningful environmental delivery (Allmendinger and Haughton, 2009). In practice, the governance of BGI by CAs illustrates a systemic fault line: an ecological goal articulated in political rhetoric but structurally undermined by uneven institutional geographies, fragmented funding streams, the continued dominance of central government logic, and by negotiated agreements that include planning powers (Sickotra, 2024). This further points to the need for more territorially responsive forms of governance that connect

ecological resilience with socio-spatial equity and political accountability (Sickotra, 2024).

4.3.2 Regional Water Companies: Financialised Infrastructure, Regulatory Inertia, and the Peripheralisation of BGI

Regional water companies in England are vital providers of environmental services, yet their governance arrangements remain heavily influenced by the history of privatisation (Schmidt et al., 2025). Since their restructuring in 1989, these private businesses have functioned as regionally monopolistic service providers regulated by Ofwat whose role is to achieve a balance between service quality, cost and environmental standards (Ofwat, 2023). Nonetheless, the regulatory framework that underpins the sector is largely dominated by cost-minimisation models and financial performance, with limited capability to enhance either ecological multi-functionality or community-centred innovation (Ofwat, 2022; Schmidt et al., 2025).

The regulatory model places a heavy reliance on cost benchmarking approaches which have a legacy in non-spatial econometrics which assess firm evaluation in isolation, ignoring the actual and statistically significant spatial dependencies between firms (Schmidt et al., 2025). Recent work has attempted to incorporate the spatial econometric model into cost estimates to show that geographic spillovers have an impact on operating costs. However, this approach remains marginal in the mainstream regulatory practice (Schmidt et al., 2025). Thus, investment decisions often ignore the interconnections between infrastructure systems and the catchment-wide systems that are the hallmark of environmental planning problems.

The implications for BGI are profound. While landscape-scale initiatives like those taken by the South Downs National Park Authority demonstrate the potential of integrated,

ecologically rooted planning, much of the BGI remains spatially dispersed and locally embedded (Ofwat, 2022; Ofwat, 2023). This creates tension with the dominant regulatory and investment frameworks which continue to favour engineered, large-scale infrastructure with standardised cost-benefit profiles (Ofwat, 2022; Ofwat, 2023). Regulatory incentives are still focussed on interventions that can demonstrate quantifiable returns within a defined five-year asset management cycle (AMP). This approach systematically disadvantages nature-based, adaptive approaches since their ability to provide specific benefits is less easy to measure, and it takes a longer time to reach full capacity (Schmidt et al., 2025).

Moreover, despite policy commitments to collaborative and catchment-based water management (Ofwat, 2023), in practice the governance of water and associated habitats and resources remain fragmented, with limited cross-agency integration or shared decision-making between water companies, local authorities, and environmental regulators (Schmidt et al., 2025). Although regional planning documents such as Spatial Development Strategies, FCERM regional plans, Local Nature Recovery Strategies, and regional economic and transport strategies often mention BGI as a good co-benefit, its implementation is limited due to risk-averse investment cultures and institutional silos (Scott and Hislop, 2024).

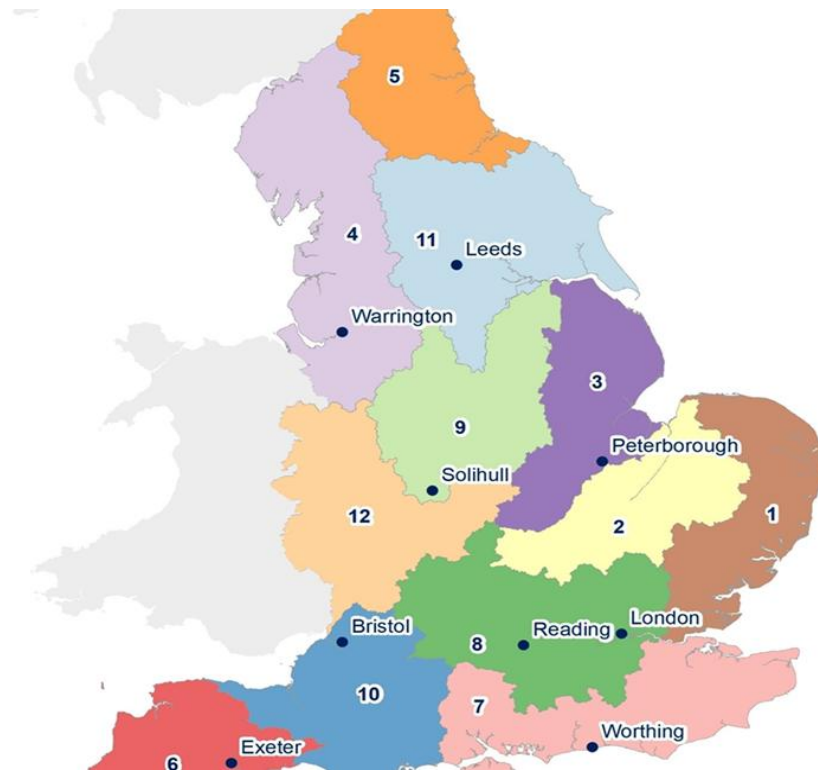
These structural barriers are further reinforced by the democratic deficit inherent in the sector's corporate governance model. The key decision-making powers are granted primarily to shareholders and regulatory board members, leaving little room for community engagement and participatory planning, especially in flood-prone and socio-economically disadvantaged areas (Schmidt et al., 2025; Hegazy et al., 2025). Consequently, despite their ability to enhance local resilience and environmental equity, BGI interventions' potential is often overlooked in favour of traditional infrastructure

developments that align more easily with the regulatory and financial imperatives of the sector (Ofwat, 2023). In light of these limitations, the literature calls for a more pluralistic and reflexive regulatory framework, making spatial interdependence, ecological valuation and inclusion principles part of the decision (de Pater, 2025).

4.3.3 Regional Flood and Coastal Committees (RFCCs)

The establishment of RFCCs reflects a change to flood risk governance in England, indicating a symbolic shift from the centre, engineering-led paradigm toward a more regional and strategic governance architecture (EA, 2025c). England's flood governance regime has evolved from River Catchment Boards established under the Land Drainage Act 1930, to River Authorities in the 1960s, and more recently to the Regional Flood Defence Committees (RFDCs) established under the Water Act 1989 (Johnson and Priest, 2008; Alexander et al., 2016b). The predecessor institutions were established as rather technocratic and hydrologically oriented, which reflects a long tradition of top-down, engineering-led approaches to flood defence that continues to influence the governance context within which RFCCs operate (Butler and Pidgeon, 2011). Following the 2007 floods, and the exposure of systemic weaknesses in flood risk governance articulated by the Pitt Review (2008), this institutional settlement was subject to a period of reconfiguration, as policy discourse began to acknowledge the limitations of narrowly technical models and the need for more integrated forms of governance (Butler and Pidgeon, 2011). Figure 4.2 illustrates the twelve Regional Flood and Coastal Committees (RFCCs) operating across England, each aligned with an Environment Agency regional boundary.

Figure 4.2: Regional Flood and Coastal Committee Map (EA, 2022a).



The RFCCs were institutionalised through the Flood and Water Management Act 2010, tasked with advising on and approving flood risk investment programmes, raising local levies, and facilitating strategic alignment across LLFAs, the EA, and other stakeholders (EA, 2018a). This includes a national openness to multifunctional and nature-based approaches, such as BGI. However, the capacity for RFCCs to disrupt entrenched transitions in England’s flood management regime is significantly constrained by longstanding procedural logics and fiscal instruments (Thaler and Priest, 2014; Alexander et al., 2016a). These factors have been highlighted in the literature as significant

constraints for BGI (as discussed in previous sections) and are also evident in the regulatory frameworks that govern sustainable drainage systems and broader flood risk management practices (Ellis and Lundy, 2016). For instance, Ellis and Lundy demonstrate that despite policy shifts aimed at integrating SuDs into urban water management, fiscal considerations and the non-mandatory nature of these measures framed as economically proportionate obligations persist in shaping implementation in England and Wales. Such fiscal and procedural constraints inhibit RFCCs from enacting transformative changes because they remain embedded in the established planning and legislative systems (Ellis and Lundy, 2016).

While their formal remit remains advisory, RFCCs are positioned as intermediaries tasked with supporting the Environment Agency and its partners in aligning national flood risk management priorities with localised concerns (EA, 2018a). In practice, RFCCs function as consultative forums intended to improve the responsiveness of centralised decision-making to regionally specific socio-environmental contexts (EA, 2019). However, their capacity to influence substantive outcomes is contingent upon institutional configurations that continue to privilege top-down objectives over genuinely place-based adaptation needs (Butler and Pidgeon, 2011; Alexander et al., 2016a). Despite their nominal role in supporting regional flood governance, Regional Flood and Coastal Committees (RFCCs) remain structurally marginal within England's flood risk management framework (Benson et al., 2016). Crucially, they lack statutory authority and possess no formal enforcement powers, operating instead within an advisory capacity that circumscribes their influence on the peripheries of strategic decision-making (Alexander et al., 2018; EA, 2023b).

Furthermore, while positioned as intermediaries intended to align local insight with national priorities, their recommendations especially regarding nature-based solutions such as BGI have consistently been subordinated to the dominant planning and economic-

growth imperatives embedded in every version of the National Planning Policy Framework, from its first iteration in 2012 to the most recent update in December 2024 (Scott and Hislop, 2024). Notwithstanding the 2019 and 2024 revisions, the NPPF has consistently presented larger weight to market-led development trajectories relative to environmental integration, leaving limited room for strategic, ecosystem centred interventions (Scott and Hislop 2024). This structural configuration embodies a much deeper epistemological and institutional conflict between ecological rationality and technocratic modes of governance (Allmendinger and Haughton, 2012). While RFCCs possess an inclusive function, they are limited in terms of procedural architectures that elide performance metrics and funding logics in favour of deliberative, place-sensitive ecological values terms (Thaler and Priest, 2014; Benson et al., 2016; Ellis and Lundy, 2016).

Measures, such as the outcome measures used in flood defence grant aid (FDGiA), continue to prioritise cost-benefit calculations that focus on asset protection and property numbers, leaving limited scope for the inclusion of BGI unless it can be quantified in narrow instrumental terms (Nwankwo, 2022). Empirical evidence from RFCC operations suggests that while committee members often report high levels of trust, constructive engagement and technical learning, these soft governance gains rarely translate into material influence on infrastructure investment (Benson et al., 2016). Conservation and community-based appointees, often occupying non-voting roles within governance bodies, continue to report marginalisation during key decision-making processes such as agenda-setting and resource allocation (Gregg et al., 2025). This reflects enduring critiques of symbolic or tokenistic stakeholder engagement in environmental governance, where meaningful participation is frequently constrained by entrenched institutional power dynamics (Newig et al., 2014).

The above situation can be categorised as a profoundly asymmetric governance landscape in which RFCCs are expected to exercise strategic coordination and participatory legitimacy but are denied the legal or fiscal leverage required to place more than just technical, ecologically informed perspectives at the centre of flood risk decision-making (Thaler and Priest, 2014; Newig et al., 2014; Alexander et al., 2016b; Benson et al., 2016). As Butler and Pidgeon (2011) and Alexander et al. (2016a) noted such conditions foster the reproduction of siloed, infrastructure-centric responses that marginalise socio-ecological complexity and constrain adaptive capacity at the local level. Without a fundamental rebalancing of institutional authority and funding priorities, RFCCs are likely to remain advisory bodies in name and function operating at the margins of policy influence, while the core trajectories of flood governance continue to be shaped by centralised, growth-oriented imperatives (EA, 2022a).

4.4 LOCAL LEVEL GOVERNANCE

Local government plays a vital but often unrecognised role in supporting BGI to respond to increasing flood risk from climate change and urban growth. This section critically looks at the institutional context of local governance including Lead Local Flood Authorities (LLFAs), Internal Drainage Boards (IDBs) and National Highways (NHs). Local institutions do not just act as instruments of national policy. Rather they are seen as sites where regulatory mandate, institutional capacity and place-based knowledge interact. At this level, the structural tensions between strategic aspiration and operational constraints become most evident, revealing both barriers to and possibilities for more adaptive and context-sensitive forms of BGI governance.

4.4.1 Lead Local Flood Authorities (LLFAs)

The establishment of LLFAs as part of the FWMA 2010 was an important attempt to foster flood devolution in England, following the systemic failures associated with the 2007 flood (Defra, 2017). The failures showed a lack of coordination between authorities, unclear local leadership and no clear framework for flood risk management. Currently, the FWMA partly sought to address these issues by down-shifting responsibility from the central government to local authorities (Pitt, 2008). These authorities are better placed to manage the complexities of surface water and groundwater ordinary watercourses (Ellis and Lundy, 2016; Benson et al., 2016). Therefore, in most cases, LLFAs have been tasked by unitary authorities or county councils to develop, implement and monitor local flood risk management strategies that are more localised and responsive to flood risk (Ellis and Lundy, 2016).

While the FWMA strengthens institutional empowerment, it fails to support the transformation necessary for systemic flood risk management (Mehring et al., 2022). LLFAs have a very fragmented governance function, and their roles often overlap, and at time conflict with, those of the Environment Agency, Internal Drainage Boards and other Risk Management Authorities (Mehring et al., 2022). These overlapping tasks lead to confusion, dual roles and power imbalances, and they can also contribute to a more discursive, holistic and critical assessment of risks and options (Mehring et al., 2022). LLFAs are central to managing localised flood risk. But in practice, many find themselves constrained lacking the statutory authority or political influence needed to challenge dominant development agendas or shift investment toward more ecologically integrated approaches (Benson et al., 2016).

Additionally, their limited authority is further compounded by tight budgets, which make it even harder for LLFAs to take a more proactive or transformative role in shaping local

flood responses (O'Donnell et al., 2017). Most of their funding comes from national funding mechanisms, mainly the Flood Defence Grant-in-Aid (FDGiA), which typically favours large capital engineering options above nature-based and BGI choices (Oxfordshire County Council, 2023). The FDGiA framework shows a bias toward conventional flood defences and, while these have been effective in some contexts, they are often incompatible with the sustainability, resilience and environmental objectives promoted by BGI (NFF, 2020). This institutional bias reinforces path dependencies that serve to marginalise the more innovative and environmentally friendly solutions such as BGI which, being less quantifiable, can have hard justifications within the realm of economic appraisal (Ellis and Lundy, 2016; Mehring et al., 2022).

The challenges faced by LLFAs are not merely financial or technical they are deeply political, shaped by competing priorities, power dynamics, and the broader policy environment in which they operate (Porter and Demeritt, 2012). Flood Risk Management is not a neutral process that simply reflects historical inequalities, social injustices, planning failures and actions of development institutions responsible for flood risk management (Defra and EA, 2021). In urban areas, LLFAs are often caught between managing flood risk and competing demands for land as local authorities are pressured to deliver on central government housing targets even where flooding is an issue (Donnelly, 2023). The inclusion of BGI or any other long-term resilience strategy is compromised by this tension in local spatial planning. The contradiction in LLFA governance is revealed by the centralised approaches towards housing policies which necessitate investing in floodplains, while they are expected to manage flood risk but are also subjected to policies of growth which exacerbate flood risk (Donnelly, 2023). The contradictory demands of policy for flood-prone areas can be met through design and strategic negotiated solutions but require clearer political and financial support from the government (Thaler, 2015).

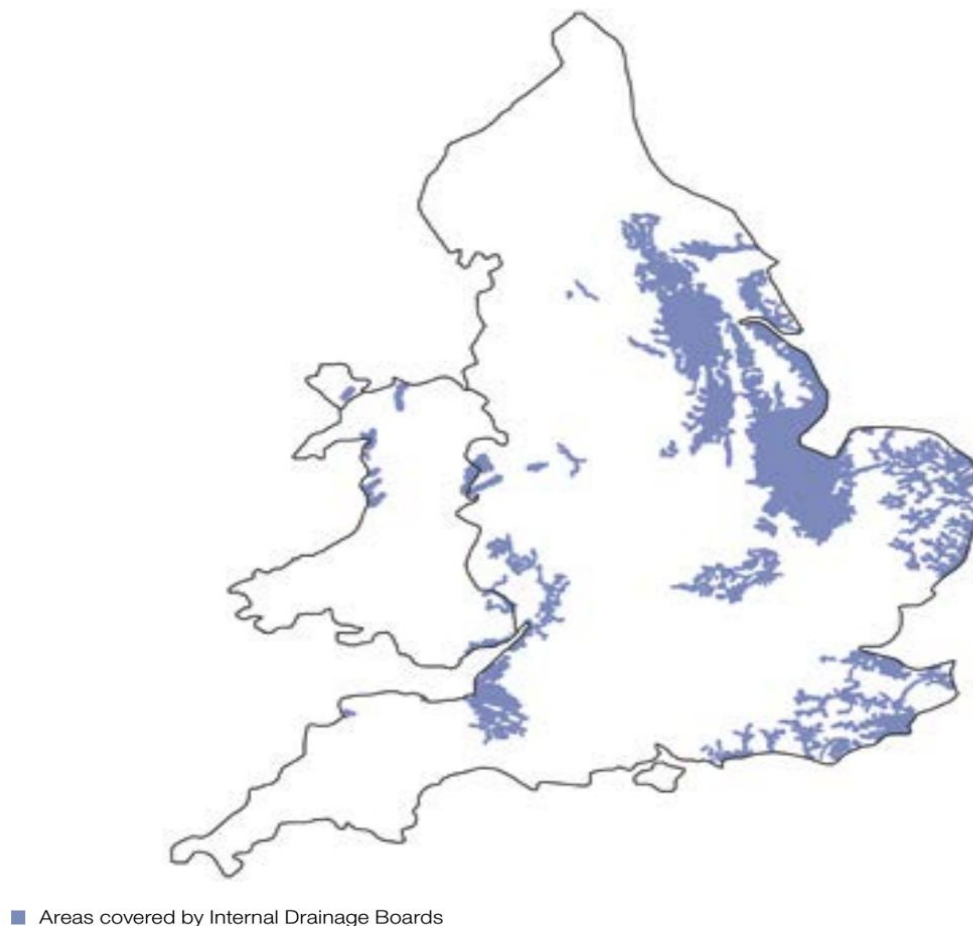
This contradiction highlights a wider problem within LLFA governance, where local authorities are caught between the national policy framework and local needs, ultimately limiting their ability to influence a planning decision that impacts on flood resilience (Ellis and Lundy 2016). According to Ellis and Lundy (2016), the embedded conflict between the necessity of economic growth through urban expansion and the need for sustainable flood risk management is creating a paradox highly limiting LLFAs to perform as independent stewards of local resilience. The embedding of BGI or other nature-based solutions into flood risk management poses challenges in this situation that usually require continued political commitment, inter-departmental cooperation, and long-term financial investments none of which is assured within the current governance arrangement (Ellis and Lundy, 2016; Mehring et al., 2022).

4.4.2 Internal Drainage Board (IDB)

IDBs occupy a paradoxical position within England's flood governance framework: they are operationally indispensable, yet remain strategically marginalised (ADA, 2017). They were established under the Land Drainage Act 1990 to enhance agricultural productivity through systematic water level management. Over time, their statutory remit has gradually expanded to include flood risk management, biodiversity stewardship, and support for water-sensitive agricultural practices (Bedford Group of Drainage Boards, 2024). However, the governance framework within which they operate remains defined by permissive powers, narrow mandates, and institutional inertia. Although recognised as Risk Management Authorities under the Flood and Water Management Act 2010, IDBs are largely excluded from statutory spatial planning and climate adaptation processes and thus limiting their influence on long-term resilience strategies (ADA, 2017). Despite their

extensive operational presence and place-based knowledge, IDBs remain constrained by outdated institutional arrangements that fail to reflect contemporary environmental challenges (Defra, 2021b). Their territorial concentration in the eastern and central lowlands of England, and parts of the SouthEast, reflects longstanding patterns of land reclamation and drainage, as illustrated in Figure 4.3.

Figure 4.3: Areas in England and Wales covered by IDB (ADA, 2017)



The reassertion of IDBs autonomy through the Land Drainage Act 1991 reaffirmed their status as locally empowered water managers, yet this legal continuity has done little to advance their strategic positioning within modern environmental governance (ADA, 2017). Despite their statutory role as Risk Management Authorities under the Flood and

Water Management Act 2010, IDBs operate within a policy architecture that remains highly permissive and fragmented largely excluding them from the formal spatial planning processes where long-term resilience and adaptation are envisioned (Alexander et al., 2016a; ADA, 2017). IDBs often possess deep local knowledge and operational expertise, particularly within low-lying, agriculturally dominated catchments. However, their input into SuDs or Water Level Management Plans (WLMPs) tends to be consultative rather than directive, and is inconsistently embedded across jurisdictions (EA, 2021b). This institutional marginalisation is particularly visible in the context of BGI and Natural Flood Management (NFM) strategies which demand joined-up, cross-scalar planning and an embrace of multifunctional landscapes (Nwankwo, 2022). Yet, IDBs are paradoxically situated: present on the ground, yet peripheral in vision.

As Nwankwo (2022) illustrates, a small number of progressive IDBs such as Black Sluice have participated in collaborative pilots that include berm installations, re-wetting schemes, and integrated habitat restoration. Such initiatives demonstrate the dormant capacity of IDBs to contribute to nature-based solutions. However, such interventions remain the exception rather than the norm. The rise of these institutions frequently hinges on local advocates, serendipitous funding, or customised collaborations, rather than systemic backing or institutional direction. This disconnect happens because of a different type of governance dissimilarity. According to Peck et al. (2022), while the responsibilities to manage flood risk are rhetorically decentralised, the strategic authority, regulatory clarity and resourcing support for adaptation remains centralised or thinly distributed. IDB boards are often made up of landowning members which can create a governance logic focused on engineering efficiency and asset management rather than ecosystem services or the desire for long-term socio-ecological resilience (Defra, 2019b). Crucially, IDBs' structural limitations are compounded by their funding model. Unlike

the Environment Agency, which receives direct financial support from government, the IDBs operate largely through locally raised drainage rates and the special levies mechanism which embeds unequal powers across boards, geography and capacity (UK Parliament, 2025). Although some access to Flood Defence Grant-in-Aid (FDGiA) is possible, smaller boards often lack the administrative bandwidth or co-financing leverage to secure such funds (NFF, 2020). As a result, although some IDBs can pilot landscape-scale nature-based solutions such as BGI, many remain constrained by routine operational practices that prioritise drainage efficiency over ecological enhancement (ADA, 2022; Keech et al., 2023).

Rather than an inevitable failure of decentralisation, this situation reveals the path dependencies embedded in institutional design. IDBs are still connected to a governance framework that was shaped by early 20th century agricultural imperatives frameworks that were not designed to respond to multi-dimensional climate biodiversity and community resilience challenges (Defra, 2021b). As Nwankwo (2022) argues, their continued procedural exclusion from statutory planning, coupled with an absence of dedicated green infrastructure funding and stakeholder-inclusive governance, limits their capacity to act as agents of transformative change.

Despite these challenges, IDBs have long-standing relationships with landowners and are strongly rooted in their local areas, and although they may not always have the resources or capacity, they have shown a willingness to engage with emerging ecological approaches (Nwankwo, 2022). With appropriate institutional reform including statutory integration into spatial planning, clearer mandates for multifunctional water management, and governance renewal to broaden representation IDBs could function as critical intermediaries for the delivery of BGI at both landscape and neighbourhood scales (Nwankwo, 2022; Peck et al., 2022; ADA, 2022). Their long-standing place-based

knowledge, operational reach, and established relationships with landowners position them to translate strategic adaptation objectives into on-the-ground delivery. Without such reforms, however, IDBs are likely to remain institutionally peripheral: operationally indispensable in many lowland catchments yet systematically excluded from the formal spatial planning arenas in which resilient and adaptive futures are defined (EA, 2021b).

4.4.3 National Highways: Infrastructure Expansion, Performative Sustainability, and the Limits of Systemic Adaptation

National Highways (formerly Highways England and prior to that the Highways Agency) occupies a central role within England's Road infrastructure governance, managing over 4,500 miles of motorways and major A roads that constitute the Strategic Road Network (SRN) (Department of Transport, 2025). This position grants it significant influence over spatial development, environmental impacts, and the future of transport systems. As stated in the Department of Transport (2025), National Highways operates under a ministerial licence and has been delivering infrastructure under successive Road Investment Strategies (RIS). This structure sustains a bureaucratic path dependency which gives precedence to network growth and economic performance over adaptive, environmentally integrated or socially just planning (Marsden and Rye, 2010).

The Design Manual for Roads and Bridges (DMRB) is an important tool for standardising infrastructure delivery across the devolved administrations and reinforces technocratic planning cultures that favour the engineering rationality over the socio-ecology complexity (Highway England, 2019). Although established for technical coherence, this institutionalises the epistemological narrowing of key concepts such as risk, resilience, and sustainability (Highway England, 2020). Such analyses are mostly framed in operational terms, abstracted from place-based socio-environmental contexts and

misaligned with the ecological multi functionality required for BGI (Mell, 2016).

The governance constraints affecting BGI delivery are further shaped by the institutional structure of National Highways itself. National Highways is a government-owned company that reports to the Department for Transport and operates within the highly controlled investment and performance framework defined through successive Road Investment Strategies (Department for Transport and Highways England, 2020). The system placed a strong emphasis on delivery certainty, cost and network performance, while environmental objectives are treated as performance requirements rather than a guiding principle of infrastructure planning (Office of Rail and Road, 2026).

The implications of this funding and regulatory architecture are significant for BGI. While National Highways is formally required to meet environmental outcomes including commitments relating to biodiversity and carbon reduction these obligations are largely absorbed into project-level compliance processes, limiting opportunities for strategic, landscape-scale adaptation or institutional experimentation (Office of Rail and Road, 2025). Environmental considerations are therefore routinely subordinated to capital delivery cycles, reinforcing a linear, growth-oriented model of infrastructure provision (Department for Transport and Highways England, 2020). This marginalisation is particularly striking given the organisation's extensive landholdings. National Highways manages over 30,000 hectares of land associated with the Strategic Road Network, commonly referred to as its 'soft estate', which has been identified as a potential asset for habitat creation, ecological connectivity and nature-based solutions (National Highways, 2024b). The organisation's Environmental Sustainability Strategy explicitly positions land as a vehicle for biodiversity enhancement and climate resilience, committing to net biodiversity gain for major projects from 2025 onwards (National Highways, 2021).

High-profile initiatives, such as the A417 Missing Link scheme and the associated

Memorandum of Understanding with Natural England, signal an emerging recognition of landscape-scale environmental governance within major road delivery (National Highways, 2024a). These interventions gesture toward a more ecologically sensitive approach, particularly through commitments to collaboration, habitat enhancement and environmental stewardship. Yet such projects remain exceptional rather than systemic, framed as mitigation strategies within conventional infrastructure schemes.

More broadly, National Highways' sustainability agenda continues to operate within a governance culture that treats environmental objectives as risks to be managed rather than as drivers of strategic transformation. Even where BGI is incorporated, it often functions to secure regulatory compliance or reputational legitimacy, producing discrete instances of environmental enhancement without catalysing a fundamental reorientation of infrastructure priorities (Office of Rail and Road, 2026; National Highways, 2021). Without a substantive shift in institutional logic one that elevates ecological connectivity, climate adaptation and landscape resilience to co-equal criteria within infrastructure appraisal. National Highways risks remaining locked into a path-dependent delivery model increasingly misaligned with the demands of climate resilience and ecological recovery (Department for Transport and Highways England, 2020; Office of Rail and Road, 2025).

4.5 SYNTHESIS: SYSTEMIC CONSTRAINTS MISSED SYNERGIES AND OPPORTUNITIES FOR GOVERNANCE REALIGNMENT

This comparative review reveals a significant and long-standing systemic disconnection at the heart of BGI governance in England. Despite the increasing rhetoric on BGI as a climate-resilient, multifunctional, and cost-effective intervention, its translation from a policy aspiration to an on-ground practice remains significantly constrained within

fragmented institutional architectures, incoherent regulatory frameworks, and entrenched sectoral silos that curtail coordinated action across the governance spectrum (O'Donnell et al., 2017). Research conducted in the UK has found that organisational fragmentation, misaligned statutory responsibilities and inconsistent policy incentives continue to undermine uptake, scalability and cross-sector collaboration in BGI delivery (O'Donnell et al, 2017; Consumer Scotland, 2023).

Crucially, these challenges are not technical in nature but fundamentally political and institutional. According to Frontier Economics and Paul Watkiss Associates (2022), there is a structural misalignment between the integrative, socio-ecological objectives of BGI and the predominant government types that have determined the planning, financing, and regulation of land, water, and urban systems. Research into the governance of nature-based solutions shows that uneven legislative mandates, competing organisational missions and poorly integrated regulatory regimes create a long-standing implementation gap between what is in strategic planning and what is done in practice (Consumer Scotland, 2023). The governance matrix that emerges shows marked asymmetries in terms of statutory power, strategic visioning capacity, financial leverage and operational reach conditions, which systematically enables disjointed action and entrenches accountability gaps across institutional actors (Consumer Scotland, 2023).

No single organisation possesses the comprehensive mandate, resources, or competencies required to deliver BGI at transformative scales. Rather, the capacity to govern is dispersed across an array of actors whose responsibilities are partial, overlapping and often contradictory. Funding mechanisms are disassociated from spatial influence; advisory bodies have no power of enforcement and sectoral mandates actively impede integrative, cross-scalar action (Consumer Scotland, 2023). Research into institutional obstacles to BGI shows that statutory frameworks and investment regimes remain poorly aligned with

the multi-functional and long-term environmental outcomes that BGI aims to deliver and that protective sectoral logics constrain collaboration between planning, water management, transport and environmental governance (O'Donnell et al., 2017; Consumer Scotland, 2023).

Table 4.3 synthesises these institutional asymmetries, illustrating the differentiated roles, capacities, and constraints shaping BGI governance. It shows how even relatively well-resourced actors like National Highways and Water Companies remain locked into asset-based investment paradigms and engineering-centric rationalities which struggle to accommodate multifunctional ecological outcomes at the core of BGI (Consumer Scotland, 2023). Evidence on incentive structures further indicates that mainstream infrastructure appraisal and funding frameworks continue to favour hard-engineering solutions, while nature-based and hybrid approaches receive inconsistent, short-term and fragmented funding (Nawrath, 2026). These patterns are not just failures of coordination. They are also the result of deeply entrenched path dependencies, narrow performance metrics, and institutional cultures that privilege risk aversion, predictability and technical rationality over systemic, place-based adaptation (Frontier Economic and Paul Watkiss Associates, 2022).

Table 4.3: Institutional Capacities and Constraints in BGI Governance

Institution	Role	Statutory Power	Planning Influence	Funding Control	BGI Delivery Capacity	Primary Constraints
Defra	National Policy Leadership	Moderate (policy guidance)	Low (non-spatial)	Strategic grant-making	Agenda-setting; limited enforcement	Non-binding directives; weak spatial integration
Environment Agency	Regulator (Flood, Water Quality)	High (statutory)	High (technical domains)	Major capital funding	Technical authority; narrow risk framing	Grey infrastructure bias; output-driven metrics
Natural England	Environmental Advocacy	Low (advisory only)	Minimal (non-mandatory)	Limited	Biodiversity integration potential	Marginalised in spatial decision-making; chronic underfunding
Lead Local Flood Authorities (LLFAs)	Local Flood Risk Management	Medium (flood remit)	Medium (SuDS promotion)	Moderate (local grants)	Site-based interventions	Resource constraints; minimal leverage in urban planning
Internal Drainage Boards (IDBs)	Local Water Management	Permissive (selective areas)	Weak (non-strategic)	Small levies	Asset maintenance; community links	Marginalised from strategic frameworks; governance capture risks

National Highways	Infrastructure Delivery	High (DfT-licensed)	Project-focused	High (national investment)	Ad-hoc green interventions	Core logic prioritises throughput over ecological functionality
Water Companies	Private Utilities	High (regulated service provision)	Weak (planning interface)	High (regulated CAPEX)	SuDS innovation pilots	Profit mandates; low systemic engagement
Combined Authorities	Regional Integration	Variable (devolved powers)	Medium (depends on deal scope)	Variable	Potential spatial integrators	Uneven statutory basis; patchy political will
Regional Flood and Coastal Committees (RFCCs)	Regional Coordination	Advisory (non-binding)	Advisory only	Local levy influence	Priority-setting in funding	No enforcement powers; consensus dependency

Source: (O'Donnell et al., 2017; Frontier Economics and Paul Watkiss Associates, 2022; Consumer Scotland, 2023; Nawrath, 2026).

Infrastructure delivery agencies like National Highways and water companies are examples of legacy models rooted in engineering rationalities and growth-oriented metrics (Consumer Scotland, 2023). Research on the adoption of green/blue infrastructure in urban areas in the UK notes the deep-seated civil engineering paradigms and organisation mandates that favour conventional drainage and utility systems over multifunctional ecological design (O'Donnell et al., 2017). Even in the presence of strategic coordination mechanisms like Combined Authorities and Regional Flood and Coastal Committees, systemic integration still faces restrictions due to political variation, limited devolution settlements, and non-binding advisory structures that do not compel action across various sectors (Consumer Scotland, 2023). Evidence of governance assessments highlighted that the devolution and advisory frameworks most often lack statutory force and stable funding, hindering the long-term planning of nature-based strategies (Consumer Scotland, 2023). According to Frontier Economic and Paul Watkiss Associates (2022), this leads to an asymmetry of governance in which responsibility for climate adaptation and ecological resilience gets increasingly devolved while power, authority and financing remain highly centralised and fragmented, thereby limiting capacity for integrated action. Additionally, the environmental governance literature has pointed out how centralised policy and fragmented local delivery generate misalignment that impedes multi-scalar nature-based planning (Consumer Scotland, 2023). BGI is consequently being portrayed as a discretionary and context-contingent intervention rather than a systematically embedded infrastructure modality. Notably this institutional fragmentation is not merely a logistical gap, but a structural condition sustained by the mandates of sectors, epistemologies of the professions and funding that are fundamentally misaligned with the distributive, integrative and justice aims of BGI (Consumer Scotland, 2023; Nawrath, 2026). Thus, resulting in a governance systems often reproduce disciplinary silos, limiting equitable and integrated implementation without intentional policy and institutional realignment

(Consumer Scotland, 2023).

4.6 KEY CHALLENGES IN BLUE-GREEN INFRASTRUCTURE IMPLEMENTATION

Drawing directly on the legislative analysis in Chapter Three and the multi-scalar governance assessment developed across Sections 4.1–4.5, this section synthesises the preceding analysis to identify four interrelated governance dimensions that condition the implementation of BGI in England: (1) legislative and policy, (2) governance and institutional coherence, (3) resources and capacity, and (4) stakeholders and long-term stewardship. The dimensions are consistent across the policy design, institutional practice and empirical study of BGI delivery and thus form the basis for a conceptual framework. This section conceptualises these challenges as mutually reinforcing conditions embedded in England’s environmental governance framework rather than as isolated barriers. Chapter Three revealed that BGI has widespread rhetoric endorsement at the policy level but is weakly embedded in enforceable legislations and policies. In addition, chapter four illustrated the way that this uncertain legislation gets mediated by fragmented institutional responsibilities, uneven resource distributions, and constrained participation practices at national, regional, and local levels. Section 4.6 consolidates these findings, moving from descriptive institutional mapping towards an integrated explanation of why BGI delivery remains uneven, discretionary, and context dependent.

4.6.1 Legislative and Policy Frameworks: Weak Mandates and Discretionary Implementation

As demonstrated in Chapter Three, BGI is widely supported rhetorically within policy but remains weakly embedded within enforceable legislative mandates. While national and

local policy routinely presents BGI as a solution to tackling flood risk, climate adaptation, biodiversity decline, and broader urban liveability, these ambitions rarely emerge in an enforceable legal obligation. BGI is mainly seen as an aspirational or additional action promoted through policy language rather than a mandate which is obliged through law (Mell, 2016; O'Donnell et., 2017; Consumer Scotland, 2023). This disjuncture between policy aspiration and legal force is not incidental. This indicates that environmental aims are articulated as contingent and negotiable as well as being routinely subordinated to other statutory priorities, especially housing delivery, infrastructure provision and short-term economic growth (Rayner and Howlett, 2009; Mell, 2016; Consumer Scotland, 2023).

A key characteristic of this settlement is the pervasive use of indeterminate policy language most notably phrases such as “where appropriate” or “where feasible” that systematically assigns discretion for environmental protection decisions to local tier actors (Woods Ballard et al., 2015; O'Donnell et al., 2017). As previously demonstrated in Chapter 3, the ambiguity affords planning authorities and developers the discretion to deprioritise BGI in situations where development viability, infrastructure delivery, or short-term economic priority is implicated. In practice, discretion does not act as an administrative tool but as a governing instrument that routinely trades off, dilutes, or defers environmental considerations (Rayner and Howlett, 2009; Deely et al., 2020). Consequently, the concept is classified more as an optional add-on than as a fundamental component of spatial planning and flood risk management (Mell, 2016).

This legislative weakness reflects epistemological and institutional tensions embedded in environmental governance. Although BGI is an adaptive, multi-functional, landscape-scale system, the regulatory frameworks through which it is evaluated favour predictability, standardisation and permanence, reinforcing risk-averse institutional cultures that favour traditional engineered solutions rather than adaptive nature-based

outcomes (O'Donnell et al., 2017; Deely et al., 2020). These frameworks tend to be poorly aligned with the dynamic, process-based nature of blue-green systems, as well as the long-term, multi-objective outcomes they aim to deliver.

Crucially, this is not simply a matter of regulatory lag or technical misalignment. It instead reflects the enduring presence of governance arrangements that normalise discretion to manage environmental ambition without reallocating authority, resources or responsibility (Rayner and Howlett, 2009). Therefore, in the absence of legislative reform alongside shifts in governance practice, institutional incentives, and professional norms, BGI is unlikely to produce substantive or systemic change. Rather, permissive policy frameworks continue a pattern of rhetorical endorsement and practical marginalisation, not leaving BGI simultaneously valorised in principle but also weakened in practice (Mell, 2016; O'Donnell et al., 2017; Consumer Scotland, 2023).

4.6.2 Governance Fragmentation and Institutional Incoherence

Building on the institutional mapping and governance analysis presented in Sections 4.2–4.5, BGI implementation in England emerges within a highly fragmented institutional setting where integration is repeatedly invoked yet structurally undermined. Fragmentation across policy sectors, governance scales and professional domains is not incidental to but constitutive of how environmental governance is organised and enacted; it has become a constant barrier to coordinated and transformative action (Rayner and Howlett, 2009; OECD, 2019). The duties for flood risk management, spatial planning, biodiversity conservation, transport infrastructure, and water management are spread across a star constellation of organisations with distinct statutory remits, accountability frameworks, and institutional priorities (O'Donnell et al., 2017; OECD, 2019). This dispersal of authority produces structural incoherence, where coordination is nominally

encouraged but procedurally unsupported, and where the conditions necessary for integrated BGI delivery remain absent (O'Donnell et al., 2017; Consumer Scotland, 2023). Although BGI is typically portrayed in national and local policy discussions as an approach which integrates multiple benefits, the actual governance arrangements continue to be based on sectoral logics that privilege containment, technical control and regulatory certainty (Mell, 2016; OECD, 2019). The narrowly defined goals and performance measures of these technocratic rationalities entrench institutional silos and inhibit multifunctional and place-based outcomes (OECD, 2019). Divergent funding logics further entrenches this fragmentation, with financial mechanisms being formed to reflect sectoral mandates and not a relational and cross-cutting ambition associated with BGI delivery (Di Marino et al., 2019; Consumer Scotland, 2023). Thus, integration tends to perform a largely rhetorical function rather than a guiding principle incorporated into institutional design (Rayner and Howlett, 2009; OECD, 2019).

This type of fragmentation is likely to create difficult challenges for adaptive and cross-sector coordination, especially in the absence of formal alignment or binding mechanisms that constrain coordination across institution boundaries (Rayner and Howlett, 2009; OECD, 2019). This is evident in the positional configuration of actors such as the Environment Agency, Lead Local Flood Authorities, Internal Drainage Boards and National Highways, where decisions visually overlap but provision to coordinate or collaborate strategically is limited (O'Donnell et al., 2017; Consumer Scotland, 2023). These overlaps do not encourage integration and instead generate ambiguity, deferral and institutional inertia that enable sectoral priorities to persist with minimal challenge (Rayner and Howlett, 2009; OECD, 2019).

Importantly, institutional fragmentation should not be understood solely as an administrative or operational problem. It is a political condition that structures which forms of knowledge are legitimised, which risks are prioritised, and which interventions

are rendered feasible within decision-making processes (Rayner and Howlett, 2009). Governance arrangements that are fragmented tend to favour well-established technical expertise and sector-specific norms while marginalising integrative approaches that disrupt administrative boundaries or challenge dominant growth-oriented and engineering-led paradigms (OECD, 2019). As shown in Chapter Four, Regional Flood and Coastal Committees as well as Combined Authorities tend to lack the statutory power, enforcement ability and stable resourcing that would allow them to reshape the practices of decision-making or to contest more dominant institutional priorities (Consumer Scotland, 2023).

The cumulative effect is a governance landscape in which the delivery of BGI is contingent upon discretionary judgement, informal collaboration, and individual institutional champions rather than anchored within coherent regulatory frameworks or systematic institutional support (O'Donnell et al., 2017; Consumer Scotland, 2023). Such reliance on discretion reproduces uneven and spatially variable implementation, reinforcing inconsistency and experimentation rather than embedding BGI as a routine or foundational component of infrastructure provision and spatial planning (Mell, 2016; Consumer Scotland, 2023). In the absence of deliberate institutional realignment and binding mechanisms of integration, governance fragmentation therefore persists as a structural constraint, limiting the capacity to scale, stabilise, and normalise BGI within England's climate adaptation and infrastructure systems (OECD, 2019).

4.6.3 Resources

Building on Section 3.9.1 this section examines how resource conditions operate in practice across England's flood-risk governance arrangements. As discussed in the previous chapter, while the legislative and policy framework for flood risk management sets out the formal parameters within which BGI may be articulated, it does not determine

how those parameters are interpreted, prioritised, resourced, and implemented in practice (OECD, 2019). The analysis conducted in this chapters demonstrates that resources are not neutral inputs or passive constraints. Instead, they are instruments of regulation that shape organisational behaviour, stabilise institutional priorities, and legitimatise certain forms of actions while delegitimising others (Lascoumes and Le Galès, 2007).

Across the governance arrangements of Defra, the Environment Agency, Lead Local Flood Authorities (LLFAs), and Internal Drainage Boards (IDBs), resource pressures emerge as structuring conditions rather than merely operational challenges. Constricted staffing, temporary and projectized funding cycles, and greater accountability requirements constrict organisational discretion and give calculability priority over experimentation (O'Donnell et al., 2017). In such conditions, institutions tend to favour interventions consistent with established delivery models, delineated responsibilities, and recognised appraisal systems; not necessarily because they are purportedly more effective, but because they are more defensible (Ambrose-Oji et al., 2017). The above dynamics reveal similarities with those apparent within the broader environmental governance landscape, where limited institutional capacity drives procedural familiarity rather than adaptive or integrative efforts. (OECD, 2019)

Although studies show that green infrastructure can be more cost-effective when assessed over a full lifetime, these assessments are often weakly aligned with dominant appraisal systems in flood risk management (Dhakal and Chevalier, 2017). The challenge lies less in cost per se than in the mismatch between the multifunctional, long-term character of BGI benefits and evaluation frameworks designed for single-purpose, asset-based interventions. A business case for BGI is very difficult to construct when benefits are spatially diffuse, temporally extended and cut across multiple policy domains. These characteristics do not mesh easily with the prevailing valuation logics (Dhakal and Chevalier, 2017). A lack of consistent data, monitoring regimes and valuation tools for

these wider benefits does not just create uncertainty but produces it. Such uncertainty reinforces institutional risk aversion and legitimises the continuation of technically familiar solutions (Raymond et al., 2017). Thus, uncertainty becomes a governing resource that is mobilised to stabilise existing appraisal criteria and justify conservative investment choices. As a result, integrative approaches, such as BGI, often struggle to gain traction, not because it lacks policy endorsement, but because the existing regulatory and organisational frameworks do not provide much incentive or protection for diverging from standard approaches (OECD, 2019). The result is a resource regime that prioritizes continuity over transformation, limiting the ability of BGI to reconfigure either institutional practice or infrastructural imaginaries in the arena of flood risk management.

4.6.3.1 Funding and markets

Building on this understanding of resources as governing instruments, the final barrier category concerns funding and market arrangements, which translate institutional priorities into concrete financial relations and shape how BGI is valued, incentivised, and delivered (Dupras et al., 2015; Di Marino et al., 2019). Funding and market structures do not act as neutral delivery mechanisms, but configure participation by placing residents, landowners, and governments into asymmetrical incentive structures. In this context, residents are often treated as a group of payers for the ecosystem services provided by BGI, most usually through taxation or public finance, whilst landowners are likely to be treated as receivers of payments for hosting BGI interventions or adopting pro-environmental practices (Dhakal and Chevalier, 2017; Cullen et al., 2020).

Governing bodies play an intermediary role managing the transfers between buyers and sellers of ecosystem services and they prioritise arrangements for funding that are administratively easy to manage and politically defensible (Ryan et al., 2016). In this arrangement, landowners are often influenced by opportunity cost, future land use, profit

maximisation rather than being aligned with flood risk and environmental objectives. Funding restrictions are one of the most frequently mentioned obstacles to BGI application (Dupras et al. 2015; Di Marino et al. 2019). Although common across infrastructure sectors, competition for public funding poses unique challenges for BGI due to the nature of funding restrictions such as inability to spend on private land. These restrictions may compromise the spatial integration necessary for effective BGI networks, rendering potentially effective interventions institutionally or financially unfeasible (Keeley et al., 2013). Such financial pressures are multiplied by shortages in human capacity, with practitioners reporting limited time, limited expertise, and limited organisational capacity to engage meaningfully with BGI alongside other responsibilities (Wihlborg et al., 2019). BGI also differs from traditional grey infrastructure regarding costs, especially concerning land acquisition and specialist expertise, and payments to landowners via schemes such as payments for ecosystem services (PES) (Albert et al., 2019). PES refers to policy mechanisms through which beneficiaries of ecosystem services financially compensate land managers or landowners for actions that maintain or enhance environmental functions such as flood regulation or water quality (Engel et al., 2008). While PES schemes are well understood within agri-environment policy, their application to BGI raises complex valuation and governance issues. The benefit of BGI such as flood protection, water quality improvement, carbon capture, and landscape amenity are complex and spatially diffuse, often requiring multiple valuations generating higher transaction costs and institutional complexity (Qiao et al., 2019).

These challenges are especially pronounced in rural contexts. Opportunity costs are affected by what the land is likely to be used for, whether the land will change in the future, market fluctuations, and landowner preference to devote land for BGI under any payment terms (McGurk et al., 2019). The implementation of such schemes is often hampered by the transaction costs that result from negotiating contracts, measuring

ecosystem services and monitoring compliance, especially in cases where benefit attribution and enforcement are uncertain (Schomers and Matzdorf, 2013).

Even where benefits can be estimated, linking users to providers remains problematic. Identifying beneficiaries, obtaining legislative approval for taxation/incentive mechanisms, and countering public resistance to new levies constrains funding mobilisation (Dhakal and Chevalier, 2017). Collective action problems, such as free riding, may worsen these issues. Free riding occurs when individuals benefit from ecosystem services without contributing to the costs of providing them, a common challenge where benefits are non-excludable and shared collectively (Obeng et al., 2018). This is particularly true for non-excludable ecosystem services, such as improved air quality, better water quality and landscape amenity (Obeng et al., 2018). From the provider's perspective, poorly targeted funding mechanisms lead to inefficiencies such as adverse selection, and a lack of additionally, whereby payments are allocated to actors whose practices would have remained unchanged even without the intervention (Engel et al., 2008). Taken together, funding and market arrangements act not only as financial instruments, but as governing structures for the distribution of costs, benefits and power to actors. Instead of facilitating the integration of adaptive delivery approaches, they often serve to stabilise existing preferences for infrastructural solutions and bolster conservative decision-making limiting the ability of BGI to challenge dominant valuation practices or reconfigure resource allocation in flood risk management.

4.6.4 Stakeholder Participation

Extending the participation challenges identified in Section 3.9.2 and the stakeholder coordination issues discussed in Section 4.5, this section examines how participation constraints manifest within governance practice and implementation contexts. Although

the policy and academic environment is becoming increasingly favourable to BGI as a multifunctional climate-resilient approach to urban development, insufficient stakeholder involvement remains a major obstacle. As demonstrated in Chapter Three, legislative and policy frameworks place the emphasis on participation, mainly in consultative and compliance contexts. However, the analysis of governance in Chapter Four shows that effective and impactful BGI delivery requires institutional arrangements capable of enabling cross-sectoral collaboration, shared responsibility, and inclusive decision-making. Nevertheless, in practice, governance arrangements often do not emerge in ways that support these aims, thereby restricting the incorporation of diverse perspectives from stakeholders and limiting the realisation of integrated outcomes.

According to empirical evidence, unclear roles and responsibilities of stakeholders can undermine participation and weaken ownership of BGI initiatives (Keresztúri et al., 2025). Evidence indicates that piecemeal institutional mandates and a weak inter-departmental framework reinforce the preference for traditional grey infrastructure rather than blue-green approaches (O'Donnell et al., 2017, Wihlborg et al 2019). These results compound the governance challenges identified earlier in the chapter, where formal governance frameworks co-exist with siloed organisational structures that inhibit effective sectoral collaboration. These challenges are further exacerbated by a disconnect between the formal commitments to participatory governance and what gets implemented in practice, with public authorities often being risk-averse and retaining control instead of enabling co-production with citizens and private actors (Roth et al., 2025). This disconnect undermines trust and discourages ongoing engagement, particularly where BGI relies on shared responsibility, behaviour change or ongoing maintenance.

According to Handoyo (2024), uncertainties associated with costs, benefits and performance further constrain stakeholder participation, while socio-political issues such as uncertainties over public acceptability, institutional support and accountability often

outweigh technical matters in decision-making. In the absence of early and inclusive engagement, stakeholders may fail to recognise the multiple co-benefits of BGI, including ecosystem services, public health outcomes, and urban liveability, thereby weakening the overall business case for implementation (Zuniga-Teran et al., 2020). Collectively, this evidence indicates that limited stakeholder participation is not merely a procedural shortcoming, but a structural governance challenge shaped by institutional, cultural, and political conditions (Handoyo, 2024). Addressing this barrier, therefore, calls for governance reforms that institutionalise participation across BGI life cycles and promote cross-sectoral collaboration and co-creation of value among stakeholders.

4.6.4.1 Socio-cultural Barriers in Stakeholder Participation

Extending the institutional and procedural constraints discussed above, socio-cultural barriers represent an additional layer shaping stakeholder participation in BGI implementation. Such barriers reflect entrenched values, norms and perceptions around governance arrangements regarding the respective sectors and groups of stakeholders. According to O'Donnell et al. (2017), the tendency of managers and institutional actors to prefer established practices and familiar grey infrastructure solutions over innovative approaches causes a technocratic path dependence that often limits their willingness to adopt new procedures essential for successful BGI delivery. The landowners may also restrict participation due to concerns about forfeiting freedom and flexibility for future land uses, especially when BGI schemes are viewed to constrain alternative uses that are more profitable or socially desirable (Wihlborg et al., 2019). Among residents, low perceived value of the ecosystem services provided by BGI, often linked to limited knowledge or culturally embedded preferences, can reduce public support and willingness to pay, while equity concerns regarding who benefits and who bears the costs further weaken engagement (Thorne et al., 2015). Moreover, limited community empowerment

and tokenistic participation processes can result in misrepresentation of local needs, contributing to unequal distribution of benefit and undermining the long-term legitimacy of BGI initiatives (Deely et al., 2020).

4.7 CHAPTER SUMMARY

This chapter shows that the effectiveness of BGI in England is shaped more by governance conditions than by technical capacity. Four key lessons come out clearly from the findings and feed directly into the conceptual framework. First, fragmented institutional responsibilities across national, regional, and local actors weaken coordination and make accountability less clear in practice. Second, existing resource allocation systems, especially short-term funding and asset-based appraisal, limit the uptake of BGI when compared to grey infrastructure. Third, stakeholder engagement is largely procedural, with limited influence on actual decisions, which affects long-term ownership and stewardship. Fourth, data and monitoring systems are not well integrated into governance processes, making learning and adaptation more difficult. Taken together, these lessons form the basis for the conceptual framework developed in the next chapter, where BGI implementation is examined through legislation and policy, governance structures, resources, stakeholder engagement, and learning processes.

CHAPTER 5: CONCEPTUAL FRAMEWORK DEVELOPMENT

5.0 INTRODUCTION

This chapter develops the conceptual framework that guides the analysis of BGI governance in this research. The design of the framework emerged from an iterative synthesis of findings presented in Chapters Three and Four. The literature review identifies a set of recurring theoretical tensions related to institutional fragmentation and governance coordination; the legislative and policy analysis reveals regulatory ambiguity and discretionary implementation, while the governance analysis demonstrates how uneven resourcing, institutional incentives, and procedurally limited participation shape BGI delivery in practice. These recurring patterns were distilled into four analytical governance domains that structure the framework presented in this chapter.

5.1 THEORETICAL FOUNDATIONS OF THE FRAMEWORK

This section offers a theoretical interpretation of the governance issues associated with the delivery of BGI, as well as the limitations of existing governance arrangements. Theories such as institutional theory, adaptive governance, multi-level governance, and collaborative governance provide a conceptual lens for understanding actors, rules, and scalar interactions that enable and shape the implementation of BGI. While these frameworks are conceptually sound, they do not adequately account for the fragmented, path-dependent, and political contingencies of BGI implementation. While these frameworks provide useful principles and analytical clarity, they do not sufficiently address the dynamic, relational, and place-based aspects of BGI implementation. Therefore, any attempt to apply governance theory in this field must be reflexive and recognise that the tools used to illuminate the complexities of governance may

inadvertently obscure the socio-political and ecological entanglements that shape it.

5.1.1 Institutional Theory

Institutional theory is often valued for its ability to provide a structure through which governance can be understood (North, 1990). Nonetheless, the theory presents some challenges. While the emphasis on formal institutions, regulatory frameworks, and codified norms provides a useful analytical starting point for understanding the architecture of environmental governance, such an approach is limited when confronted with socially embedded, place-specific, and evolving realities of BGI planning and implementation (Kronenberg et al., 2021). The static scope of institutional theory gives preference to formal structures. However, it overlooks the fluid, adaptive, and often informal dimensions that constitute governance in practice (Willems and Van Herk, 2018). As noted by North (1990), institutions, consisting of both formal rules and informal norms, provide the framework upon which society is organised and stabilised. However, formal rules alone rarely operate sufficiently to ensure effective governance or coherent collective action. Instead, it is the interplay between formal institutional arrangements and the informal facets of institutional existence, including embedded power relations, cultural norms, and place-embedded practices, that determines how governance operates in practice (Andersson et al., 2019; Kronenberg et al., 2021). These relational dynamics underscore the need to attend not only to statutory frameworks but also to the lived, situated forms of governance that mediate environmental and spatial outcomes (Foo, 2021). However, institutional theorists often overlook the importance of informal practices, tacit knowledge, and everyday routines, and instead tend to conceptualise governance narrowly as a matter of formal rules and compliance (Willems and Van Herk, 2018). Governance is a complex, relational process that takes place in an environment in which power, culture, and social norms often play a greater role than they do in shaping

development processes (Kuitert and van Buuren, 2022). The implementation of BGI is shaped by politics, institutional capacity, and multi-sectoral contention, which often drive the success or failure of policy measures. These factors lie outside the formal regulatory ambit and are shaped by relations and power dynamics specific to a contextual setting (Kronenberg et al., 2021; Bernaciak and Fortunski, 2025). The excessive reliance on institutional theory not only obscures the crucial role of informal factors but also fails to recognise the path-dependent nature of institutions (Foo, 2021). This omission becomes particularly problematic in the context of BGI, because the nature of infrastructure is based on adaptable, flexible approaches that formal institutions are inherently slow to implement (Andersson et al., 2021).

5.1.1.1 Formal Institutions

Formal institutions are described as the official rules and procedures created, communicated, and maintained by recognised state bodies such as legislatures, courts, and regulatory authorities (North, 1990; Scott, 2014). While institutional definitions often emphasise formal, rule-based structures, such as laws and regulations, this narrow framing overlooks the ways in which institutions acquire significance through day-to-day practices, interpretations, and interactions (Ostrom, 2005; Fustec and Levain, 2023). Institutions do not function in isolation; rather, they are shaped by the regular actions of organisations and entities (Cleaver, 2012). Within this framework, formal rules are interpreted, modified, and applied in practice, influencing decisions and behaviours in ways that may not be immediately visible but are critical to how governance operates in practice (Healey, 2006).

The interplay between formal regulations and the institutional mechanisms that enact them demonstrates that institutions extend beyond technical or legal frameworks; they are fundamentally constituted through social relations, embedded practices, and the exercise

of power (Cleaver, 2012; Fustec and Levain, 2023). This is particularly important in areas such as environmental planning and climate adaptation, where governance is inherently complex and where the values, interests, and knowledge that shape decision-making are often contested (Bulkeley and Betsill, 2005; Crowe et al., 2025). The role of institutions in the regulation of BGI in England is significant, as these institutions provide the legal and regulatory framework and enforcement structures within which BGI policies and programmes are developed and implemented (Narita, 2021). As discussed in Chapter Three, formal institutions, including legislation such as the Flood and Water Management Act 2010 and the Environment Act 2021, play a central role in shaping policy decisions and regulating actions related to BGI. However, North (1990) notes that while formal institutions are important, they are not sufficient on their own. The efforts of responsible organisations are often constrained by bureaucratic inertia, fragmented responsibilities, and weak enforcement mechanisms. Table 5.1 shows that while the main institutions responsible for BGI governance in England have clearly defined roles and policy responsibilities, their ability to deliver BGI effectively is often constrained by fragmented responsibilities, limited enforcement powers, and resource pressures. This suggests that having formal institutions and policies in place is not enough to ensure successful implementation. Rather, effective BGI governance depends on how these institutions work together, interpret their responsibilities, and coordinate their actions in practice.

Table 5.1: Key institutions of BGI governance in England

Institution	Role in BGI Governance	Policies/Regulations	Challenges
<i>Department for Environment, Food & Rural Affairs (DEFRA) (Defra, 2023f)</i>	Sets national policies for environmental management, including BGI. Provides funding and regulatory oversight.	Issues: Environment Act 2021, 25-Year Environment Plan Oversees: Biodiversity Net Gain policy, Green Infrastructure	Policy fragmentation, lack of enforcement at local levels

		Framework	
<i>Environment Agency (EA) (EA, 2023b)</i>	Implements national environmental policies, monitor water quality, flood risk management, and biodiversity. Regulates development projects impacting BGI.	Operates under: Environment Act 2021, Flood and Water Management Act 2010, Water Framework Directive, Flood Risk Regulations 2009 Advises on: NPPF	Limited resources for enforcement, balancing economic development and ecological objectives
<i>Natural England (Grace et al., 2025)</i>	Protects and enhances biodiversity through habitat conservation, including urban green spaces and nature-based solutions.	Advises on: Biodiversity Net Gain, Green Infrastructure Framework Operates under: Environment Act 2021	Conflicts between conservation goals and urban development
<i>Local Authorities (County and City Councils) (DEFRA and EA, 2013)</i>	Responsible for spatial planning, local flood risk management, and implementation of BGI projects.	Operate under: Flood and Water Management Act 2010, SuDS Regulations Influenced by: Local Development Plans, NPPF	Inconsistent approaches across councils, funding constraints
<i>Ofwat (Water Services Regulation Authority) (Ofwat, 2024)</i>	Regulate water companies to ensure sustainable management of water resources, impacting BGI funding and initiatives.	Regulated by: Water Industry Act 1991, Ofwat Influenced by: Price Review Process (PR24), Environment Act 2021	Limited mandate to enforce BGI investment by private water companies
<i>UK Green Building Council (UKGBC) (UKGBC, 2024)</i>	Promotes sustainable urban development, integrating BGI into new housing and infrastructure projects.	Advocates on: Future Homes Standard, sustainability benchmarks Influence through: Consultation responses to NPPF, Building Regulations reviews	Voluntary compliance limits widespread adoption

Although formal institutions set the rules for BGI, the capacity of these institutions is often limited by the complex realities of local governance. In England, BGI policies are often implemented and enforced inconsistently because local responsibilities are fragmented, budgets are limited, and priorities often compete with one another (Scott and Hislop, 2024). Furthermore, practices and political processes at the local level may limit the ability

of a formal institution to achieve this broader function in terms of sustainable infrastructure solutions (Peters and Landström, 2021). North (1990) conceptualises institutions as comprising both formal rules and informal constraints that shape the incentives and behaviour of actors. His analysis shows that these institutional arrangements become deeply embedded within organisational routines, cultural expectations, and governance structures, thereby gradually creating path dependencies that constrain the range of future choices.

Established institutional norms and practices become self-reinforcing phenomena that reproduce existing patterns of decision-making, which limit transformative change. As a result, continuity is generally preferred over innovation, regardless of circumstances that would otherwise render existing approaches inadequate (Pierson, 2000). Additionally, this perspective draws attention to often neglected structures such as organisational routines, professional norms, and cognitive frameworks that constrain adaptive governance (North, 1990). The institutional constraints influencing the implementation of BGI are maintained and reproduced through continuous work practices that favour grey infrastructure over nature-based alternatives. While these constraints may not always be visible or intentional, they are typically embedded in routine work practices, professional rules, and conventional ideas about what is considered safe or practical in practice. According to North (1990), institutions shape behaviour not only through their formal rules, but also through their informal rules. The framework invites a more nuanced understanding of governance that considers the ways in which institutional cultures, history, and power can tacitly constrain the potential for innovation, even in the presence of political commitments to downstream experimentation.

According to Helmke and Levitsky (2004), formal institutions refer to written rules and procedures, while informal institutions are based on unwritten rules such as political habits and social norms. These dimensions cannot be separated from each other, as in practice

they are in constant interaction and influence each other. This interaction is particularly important for BGI governance in England, where national policy frameworks that promote BGI often clash with local decision-making cultures characterised by resource pressures, political interests, and inherited professional assumptions (Helmke and Levitsky, 2004). Informal institutions influence not only what decisions are made, but also how these decisions are interpreted, explained, and implemented locally (North, 1990).

In addition, both Local Development Plans and Green Infrastructure Strategies in England are shaped by formal planning processes, as well as political agendas, stakeholder relationships, and the professional values of stakeholders (Mell, 2016). As Hodgson (2015), argues that no legal system can function without being complemented by social practices and cultural perceptions. In the case of BGI, stakeholder engagement, navigating institutional cultures, and working with locally specific interpretations of policy are critical to embedding more adaptive and inclusive approaches, particularly in relation to urban flood risk. According to Pahl-Wostl (2019), the success or failure of adaptive capacity does not depend merely on formal governance structures, but rather on the interaction between formal structures and informal governance processes. Understanding this interaction, its tensions, its possibilities, and its practical anchoring is central to understanding how BGI can transition from political ambition to meaningful realisation.

5.1.1.2 The Role of Informal Institutions in Shaping BGI Governance: Norms, Practices

Informal institutions are the shared norms, expectations and culturally embedded practices that are not codified but have a significant influence on governance processes (Pahl-Wostl, 2019). They represent an important and controversial dimension of the implementation of BGI, primarily because they influence how formal rules are interpreted, implemented or

resisted in practice (Helmke and Levitsky, 2004). Planning capacities such as cross-sectoral coordination mechanisms, the availability of qualified planners and environmental experts, and adequate funding can either enable more effective and participatory forms of planning in the context of BGI or reinforce power relations and institutional cultures that hinder change (Kotzé and Reyers, 2016). While path-dependent practices and risk-averse governance routines may limit opportunities for experimentation or cross-sectoral integration, informal networks and community norms often provide the basis for local accountability and context-sensitive responses (Benedict and McMahon, 2006). Recognising this dual nature is essential. Informal institutions are not inherently obstacles; rather, they represent the social infrastructure through which both resistance and innovation unfold. Understanding how they interact with formal frameworks enables a more grounded, relational and reflexive approach to BGI governance (Cleaver, 2012). Informal political ideologies play a crucial role in shaping public attitudes towards sustainability and often provide the normative legitimacy required for the acceptance and implementation of BGI measures (Carter et al., 2015). Nevertheless, deeply embedded societal norms particularly preferences for grey infrastructure solutions remain significant barriers to wider adoption (Ostrom, 2015). As Helmke and Levitsky (2004) suggest, informal practices rooted in cultural resistance can undermine formal policies, even where legal frameworks support change. Table 5.2 presents the principal informal institutions and actors that influence BGI governance, illustrating how community networks, cultural norms, and informal political practices shape decision-making beyond formal regulatory structures. In England, a clear example is the implementation of SuDS, which are required under the Flood and Water Management Act 2010 but remain inconsistently adopted (O'Donnell et al., 2017). This is largely because developers, planners and policymakers continue to favour engineered flood defences within prevailing professional and institutional cultures. Studies show that SuDS are often treated as an add-on rather than

an integral component of development. Developers therefore default to conventional drainage approaches unless explicitly required to do otherwise (Woods Ballard et al., 2015).

Table 5.2: The role of key informal institutions in BGI governance

Informal Actor / Group	Role in BGI Governance	Influence on Policy and Practice	Challenges
Community Groups & Grassroots Initiatives	Mobilise local participation in BGI projects, stewardship, and environmental monitoring.	Foster local ownership and embed BGI within social norms and practices.	Limited formal recognition; volunteer dependency; fluctuating engagement.
Citizen Science Initiatives	Collect local environmental data and promote public awareness on BGI issues.	Enhance evidence base through grassroots monitoring, influencing local decision-making informally.	Data quality concerns; sustaining long-term involvement.
Social Networks and Local Informal Leaders	Act as connectors and trusted intermediaries between communities and formal institutions.	Facilitate information flow, negotiation, and consensus-building outside formal channels.	Power imbalances; lack of formal mandate; variable legitimacy.
Cultural Norms and Traditions	Shape community attitudes towards land use, water management, and ecological stewardship.	Influence acceptance and adaptation of BGI practices at local scales.	Resistance to change; embedded behaviours difficult to shift.
Informal Political Practices	Unwritten rules and negotiation styles that guide decision-making and resource allocation locally.	Can enable or hinder collaboration, depending on alignment with formal policies.	Lack of transparency; potential for exclusion or capture.

(Source: Helmke and Levitsky, 2004).

Table 5.2 shows that informal institutions influence BGI governance through a range of

actors, networks, and social practices that shape how decisions are made and implemented in practice. While these influences operate outside formal statutory frameworks, they play an important role in determining how policies are interpreted, accepted, and applied at the local level. This highlights that BGI governance cannot be understood solely through formal legislation and institutional structures, but also through the informal relationships and practices that shape governance outcomes. To understand BGI governance, attention must be given to how formal and informal coordination unfolds in specific socio-political contexts (Pahl-Wostl, 2019). As González and Healey (2005) argue, this interaction between formal and informal elements ultimately determines whether local policies succeed or fail. The informal norms, local dynamics and culturally contingent practices at play can facilitate place-based adaptive policymaking, but they can also impede implementation whenever formal rules confront entrenched interests or conflicting values (Cleaver, 2012). Consequently, analyses of BGI governance should not yield to a distinction between formal and informal, but rather should embrace the complex, hybrid realities of institutional interplay (Helmke and Levitsky, 2004).

5.1.1.3 The Need for Synergy

The relationship between formal and informal governance at the level of BGI cannot be explained simply or mechanistically. These interactions do not take place within a fixed institutional framework. Rather, they are conceived of as dynamic, adaptive and situated processes that are embedded in the socio-political histories, material practices and power relations of a context (Pahl-Wostl, 2019). Table 5.3 highlights the principal ways in which formal and informal governance interact in the implementation of BGI, illustrating how these relationships influence policy translation, institutional behaviour, knowledge exchange, accountability, and decision-making. Formal institutions comprise legal structures, laws, standardised procedures and accountability. In practice, however,

dependency is often mediated and sometimes even undermined by the informal. According to Healey (2006), the process of governance ensues through professionalism, negotiation and experience. Assuming a hierarchy in which the formal dominates the informal would ignore how legitimacy is co-constructed. In addition to being networks of support, informal networks are also generators of meaning, capacity and legitimacy, especially where legal reach is limited or contested (Ostrom, 2015). Informal systems often involve trust, reciprocal skills among participants and implicit coordination that cannot be procedurally designed by institutional experts (Cleaver, 2012). Furthermore, informal actors do not use formal rules in lieu of community logic, but strategically to gain visibility, legitimacy, and material resources (Innes and Booher 2010).

Table 5.3: The Complex Interplay Between Formal and Informal Governance in BGI Implementation

Governance Area	Nature of Interaction	Implications for BGI
Policy Translation	Informal actors reinterpret or selectively engage with formal policy goals	May foster locally appropriate action, but risks inconsistency or dilution of policy
Institutional Behavior	Formal agencies rely on informal relationships to ‘get things done’ beyond procedural limits	Builds flexibility and responsiveness, but may entrench insider dynamics
Knowledge Exchange	Informal, experiential knowledge influences formal planning processes often tacitly	Enhances relevance of BGI interventions, but risks remaining invisible or undervalued
Accountability Norms	Informal expectations of professional conduct coexist with formal monitoring and reporting	Can strengthen trust or, alternatively, lead to blurred responsibilities
Power and Legitimacy	Informal influence may either reinforce or contest formal authority structures	Shapes who are heard and whose interests are prioritised in BGI decision-making

(Source: Helmke and Levitsky, 2004; González and Healey, 2005.; Healey, 2006, Newig and Fritsch, 2009; Innes and Booher, 2010; Cleaver, 2012; Ostrom, 2015; Pahl-Wostl, 2019)

Innes and Booher (2010) explain that the tension between formal and informal structures

should not be seen as a barrier, but rather as a governance space an arena in which competing interests, interpretations and forms of knowledge are continuously negotiated. In this context, synergy is not a by-product of coordination but must be cultivated through inclusive dialogue, relational work and iterative learning processes (Healey, 2006). This is especially pertinent in BGI governance, as policy objectives are often aligned with contested land uses, multiple stakeholder interests and overlapping institutional jurisdictions (Newig and Fritsch, 2009).

5.2 ADAPTIVE GOVERNANCE: THE ROLE OF FLEXIBILITY AND LEARNING IN MANAGING URBAN FLOOD RISK

Adaptive governance can help to overcome uncertainties in urban flood management through flexible decision-making with greater autonomy (Folke et al., 2005). It also enables the participation of different governmental and non-governmental actors (Chaffin et al., 2014). This enables institutions to respond to change, and adapt policies, and develop effective BGI governance. In practice, adaptive governance faces challenges such as institutional breakdown, regulatory silos, and limited capacity, leading to a reduction in learning and coordination, especially across spatial and administrative boundaries (Garmestani and Benson, 2013).

Although participation is a central element of the adaptation model, it ultimately privileges dominant actors while limiting the influence of marginalised communities, who may, however, be most vulnerable to the negative impacts of climate change due to riskier locations and/or lack of knowledge or financial resources to increase their resilience (Few et al., 2007). Instability can thus arise from flexibility without accountability. A strong reliance on informal coordination can hinder investment and slow down long-term planning (Huiteima et al., 2009). Moreover, in the absence of enforceable mandates and strong institutions, adaptive governance can simply become a euphemism for inaction or

withdrawal from regulation. Therefore, while an adaptive approach is promising, its success depends on how responsive it can be, whether rules and regulations are established and applied equally, and how learning can be embedded in strong institutions.

5.2.1 Multi-Level Governance (MLG)

MLG serves as a critical framework for dissecting the allocation of responsibilities for flood risk management and BGI across the supranational, national, regional, and local scales (Piattoni, 2010). While MLG is often celebrated in theory for its promise to embed more nuanced, contextually attuned, and integrative responses to environmental governance challenges (Bulkeley and Betsill, 2013), the empirical realities particularly in England reveal a far more complex and fragmented institutional tapestry. The governance mosaic is made up of various statutory, non-statutory and voluntary organisations. However, it is often plagued by overlapping mandates, conflicting institutional objectives and gaps in implementation that undermine its coherence and strategic impact (Mees et al., 2013). In the absence of strong, institutionalised coordination mechanisms, governance processes are prone to fractures that can prevent BGI interventions from reaching their full potential (Pahl-Wostl, 2015).

Decentralisation is often highlighted for its ability to improve local adaptability and responsiveness, as it is said to enable subnational actors to adapt interventions according to place-specific conditions (Bulkeley et al., 2014). However, this ideal can lead to spatial and institutional inequalities if devolved responsibilities are not matched with resources and capacities (Swyngedouw, 2005). This makes it difficult to conclude that decentralisation improves effectiveness or equity. It is imperative to go beyond a simplistic notion of MLG as a hierarchical stratification of governance actors. MLG should not be viewed as a rigidly defined, static and singularly goal-orientated structure that can be adapted to all scenarios, but rather as a dynamic, contested space in which

roles, responsibilities and capacities are continuously negotiated and reshaped by actors in response to changing political, social and environmental conditions (Hooghe and Marks, 2003). To test the effectiveness of MLG, attention needs to be shifted from institutional proliferation to the extent to which it provides meaningful coordination through common platforms, accountability mechanisms and timing that link intentions to implementation (Jordan and Turnpenny, 2015). In the context of BGI, this means making a conscious effort to align national policy aspirations with locally embedded governance practices that reflect a differentiated socio-political and ecological environment (Mees et al., 2013). Consequently, MLG can deliver governance through top-down arrangements that are interpreted and adapted to place-based outcomes through iterative, reflexive and truly co-produced modes of governance (Newig and Fritsch, 2009).

5.2.2 Collaborative Governance

Collaborative governance has grown in popularity as an approach to overcoming the limitations and problems associated with top-down governance, particularly for complex and place-based issues such as urban flood risk (Ansell and Gash, 2007). Collaborative governance emphasises that both state and non-state actors should be involved in decision-making, mutual accountability, and the co-creation of knowledge (Ansell and Gash, 2007). This method asserts that it is important to engage with various actors from government agencies, community-based organisations, and private actors in a meaningful way so that legitimacy is achieved and policies are aligned with the local context (Ansell and Gash, 2018).

Here, inclusion is not only seen as a process but also involves recognising and integrating the diversity of perspectives and knowledge systems that contribute to flexible, socially robust solutions (Reed, 2008). Moreover, all stakeholders are held accountable in a fair and transparent manner, irrespective of the institution (Healey, 2006). At the centre of this

is the co-production of knowledge, whereby scientific knowledge and place-based knowledge interact to generate robust and contextualised knowledge (Margerum, 2011). The value of collaboration is well-known in theory, but often complex to realise in practice because of power imbalances, institutional inertia, and contestation over environmental governance (Sørensen and Torfing, 2007). Nevertheless, the persistence of institutional silos in BGI governance implies that compartmentalised departments and agencies remain confined to bounded mandates that do not respond to the integrative demands of BGI governance (Brown and Farrelly, 2009). Moreover, the discrepancy in resources, expertise, and influence among stakeholders creates an uneven ground, often marginalising the voices of the less powerful and undermining the ideals of inclusive co-productive governance (Sørensen and Torfing, 2007). The above complexities indicate the difficulties in practising collaborative rhetoric, and the need for power critiques to stimulate truly adaptive, multi-scalar governance arrangements (Bulkeley and Kern, 2006).

5.3 ANALYTICAL POSITIONING AND ASSUMPTION

Before introducing the framework, it is important to be clear about the position taken in this study. The analysis does not start from the assumption that BGI is always needed, always possible to deliver, or always the most appropriate option in every flood risk management scheme. While BGI is often presented in policy as a desirable and climate-adaptive solution, its role in practice is more complex. In many cases, the inclusion of BGI depends on how it fits alongside other priorities such as flood protection standards, cost, technical feasibility, and site-specific constraints. This means that BGI does not automatically carry equal weight with other objectives, and its implementation is often shaped by trade-offs rather than policy ambition alone.

The study also does not assume that BGI is inherently more effective or more sustainable

than other approaches. Instead, these claims are treated as questions to be examined through real project experience. In this way, BGI is approached as a governance outcome something that is negotiated, shaped, and sometimes limited by the way decisions are made, resources are allocated, and priorities are set. Taking this position allows the analysis to focus on how BGI is actually delivered in practice, rather than how it is described in policy. It also makes it possible to examine the gap between ambition and reality, and to understand how governance arrangements influence when, where, and to what extent BGI becomes part of flood risk management schemes.

5.3.1 The Blue Green Governance Framework

The BGI governance framework did not just appear as an abstract idea; it was developed step by step from both empirical and theoretical work carried out in this study. First, earlier chapters critically examined existing legislation, policy, and governance arrangements relating to BGI in England. Through this review, several recurring issues became clear, particularly around fragmented responsibilities, unclear policy direction, resource constraints, and limited stakeholder influence. These issues were not isolated but kept appearing across different sources and contexts.

Building on this, Chapter Five then brought in relevant theoretical perspectives to make sense of these issues in a more structured way. Rather than treating them as separate problems, the study grouped them into four core governance domains: legislation and policy, governance structures, resources, and stakeholder engagement. These domains reflect the main areas through which governance shapes how BGI is actually delivered in practice. Importantly, the framework recognises that these areas do not operate independently. For example, unclear policy can affect how institutions make decisions, limited resources can reduce coordination capacity, and weak stakeholder engagement can influence how priorities are interpreted on the ground. Therefore, the framework is

designed to capture governance as something interconnected, not something that happens in isolated parts. The framework is therefore both analytically grounded and practically useful. It moves beyond general discussions about BGI and provides a clear way to examine what is happening within real projects. This is where its value becomes more obvious.

5.3.2 How the Framework Will Be Applied in Practice

The framework will be used in this study as a practical tool to understand how governance arrangements shape the way BGI is included, prioritised, or limited within each case study. At this stage, the aim is not to present results, but to explain how the framework will guide the analysis of BGI in real projects. Figure 5.1 presents the conceptual governance framework that underpins the analysis, showing the four governance dimensions that form the basis of the investigation. In practice, the framework will be applied using the analytical questions in Table 5.4. These questions break down the four key areas legislation and policy, governance structures, resources, and stakeholder engagement into things that can be observed in the data. As information is gathered from interviews, documents, and site observations, it will be organised under these areas, so it is clear how each one affects BGI.

For example, under legislation and policy, the analysis will look at how rules, planning policies, and regulations either create space for BGI or make it difficult to include. Under governance structures, the focus will be on how decisions are made, who is involved, and whether BGI is treated as a priority or something secondary. The resources section will look at funding, technical capacity, and practical constraints, and how these affect what can actually be delivered in terms of BGI. In the same way, stakeholder engagement will examine how different groups are involved and whether their input has any real influence on decisions about BGI. Using the framework this way means that both the Perry Barr and

Witton scheme and the Beales Corner scheme will be analysed using the same approach. This makes it easier to compare the cases and see how BGI is handled in different settings. At the same time, the framework allows the study to look at how these areas connect with each other. For example, a policy might support BGI in theory, but in practice, limited funding or tight project timelines might make it difficult to include. In other cases, decisions might be driven more by technical or regulatory priorities, with BGI added later rather than shaping the design from the beginning. In simple terms, the framework helps move the analysis beyond just describing whether BGI is present or not. It provides a clear way of explaining how governance actually shapes when, where, and to what extent BGI becomes part of flood risk management projects.

Figure 5. 1: The Blue Green Infrastructure Governance Framework

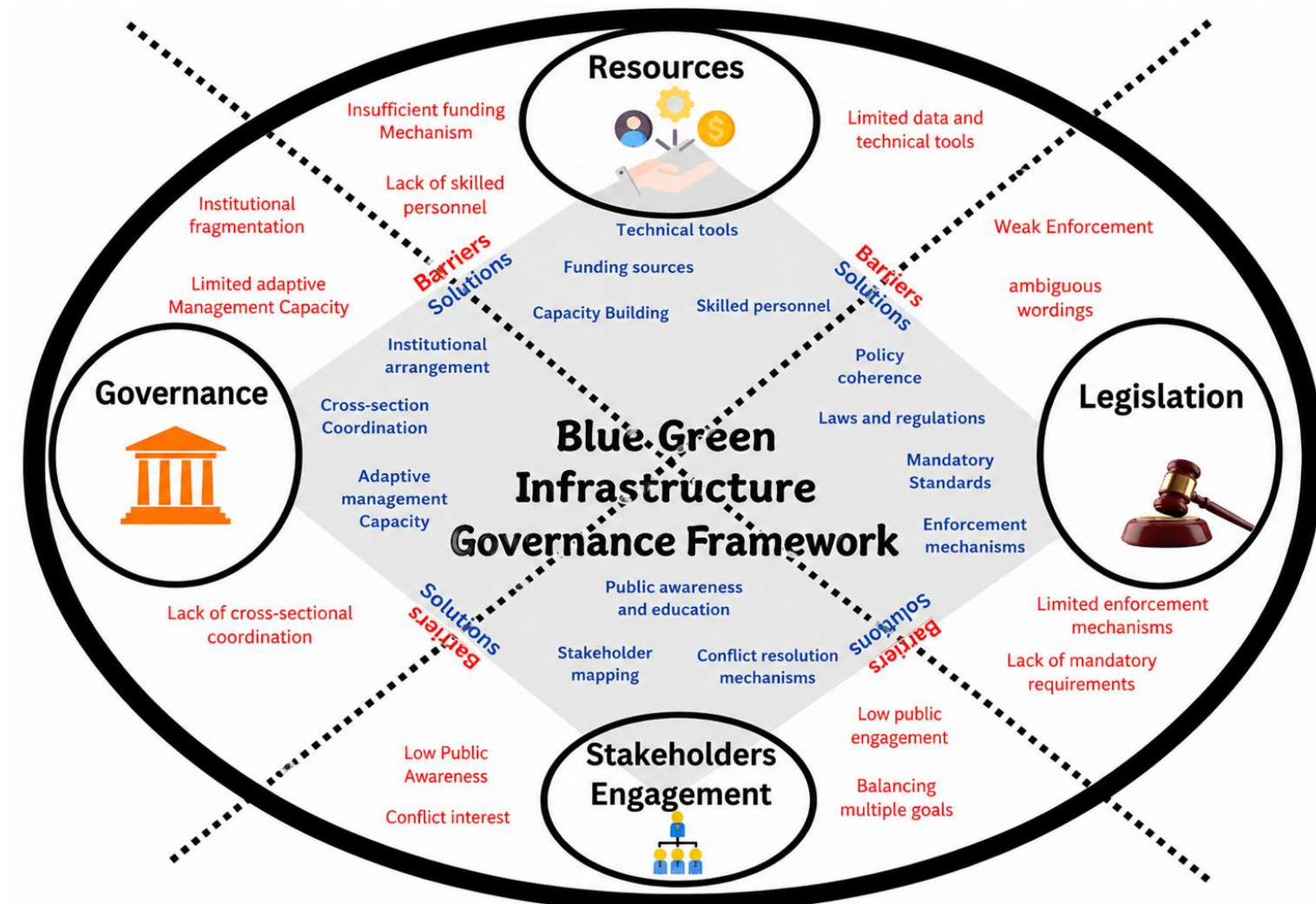


Table 5.4: Diagnostic Application of the Blue–Green Infrastructure Governance Framework

Framework dimension	Diagnostic focus	What to look for in the data	What this helps to identify
Legislation & Policy	How do legislation and policy shape decisions about BGI? Are they supporting or limiting its inclusion?	Reference to planning policy, statutory constraints, policy interpretation by actors.	Whether policy supports or limits BGI
Governance Structures	Who makes decisions about BGI and how are responsibilities distributed? How is coordination managed?	Decision making processes, approval structures, fragmentation between organisations, roles.	How decisions are made and coordinated
Resources	What resources are available to support BGI and how are they allocated?	Funding arrangements, technical capacity, staffing, time constraints, construction priorities.	Whether resources support or hinder BGI
Stakeholder Engagement	Who is involved in decisions about BGI and how much influence do they have?	Consultation, stakeholder input, community involvement, influence on decisions.	Who influences BGI decisions and how

(Source: Author’s synthesis based on governance literature and empirical findings presented in Chapters 3–4).

5.4 CORE COMPONENT OF THE FRAMEWORK

This section elaborates the core components of the conceptual governance framework by examining the governance conditions shaping BGI delivery across four analytical domains. Each domain is grounded in findings developed in earlier chapters. Specifically, the domains consolidate the legislative analysis presented in Chapter Three and the institutional and governance analysis developed in Chapter Four, where recurring challenges relating to statutory design, coordination, resourcing, and participation were identified. The legislation and policy dimension draws on Chapter Three, which highlighted fragmented statutory arrangements and discretionary policies. The governance dimension draws from institutional analysis presented in Chapter Four, where coordination challenges and a fragmentation of responsibilities were shown to have an impact on implementation processes. The resources and capacity domain reflect funding, appraisal, and organisational constraints identified across Chapters Three and Four, while the stakeholder engagement dimension extends the earlier findings demonstrating that participation often remains procedural rather than co-productive. Instead of introducing new themes, this section clarifies how these conditions of governance are conceptually interpreted within the framework. By doing so, it establishes the analytical boundaries of legislation and policy, governance structures, resources, and engagement of stakeholders, thus setting the stage for the subsequent empirical application.

5.4.1 Legislation and Policy

Building on the legislative analysis presented in Chapter Three, this section interprets legislation and policy as structuring governance conditions that shape how BGI is enabled, constrained, and implemented in practice. Legislation and policy are understood within the framework as structuring conditions which define actions, allocate institutional

responsibility, and signal governance priorities that shape BGI delivery. As a result, regulatory and policy arrangements are not considered neutral backdrops, but rather active agents of legitimization, interpretation, and integration across governance domains (Cairney, 2017). Existing statutory and policy systems have largely evolved through sector-specific regulatory traditions oriented toward compliance within discrete policy areas. This orientation creates fragmented legal landscapes, which fail to accommodate the cross-sectoral multifunctional character of BGI (Driessen et al., 2012). The regulatory instruments adopted within water management, spatial planning, and biodiversity governance continue to focus on bounded objectives, resulting in a failure to tackle interconnected socio-ecological issues (Cosens et al., 2017). As a result, the framework considers how misalignment between policy domains, overlapping mandates, and siloed regulatory logics inhibit relational and place-based implementation (Pahl-Wostl, 2007). Policy flexibility is also interpreted analytically in relation to coordination and accountability. While discretionary provisions may allow for contextual adaptation, flexibility without clear institutional accountability can exacerbate uneven implementation and institutional inertia (Turnpenny et al., 2008; Cairney, 2017). Consequently, the framework evaluates if discretionary power facilitates learning and innovation or merely displaces learning, coordination, and oversight (Mees et al., 2012). Beyond coordination and accountability, policy and legislation also determine distributive and procedural outcomes. Environmental justice scholarship suggests that poor integration or inconsistent enforcement could lead to uneven environmental benefits, which marginalise vulnerable communities despite sustainability aims (Anguelovski et al., 2018). As a result, this domain assesses whether the laws explicitly embed mechanisms for inclusion, accountability, and review, or if they leave them to be implicitly negotiated (Lemos and Agrawal, 2006). Legislation and policy are therefore conceived as dynamic governance forces determining whose knowledge is acknowledged, whose interests are

accorded priority, and which BGI futures become institutionally feasible (Driessen et al., 2012).

5.4.2 Governance

Building on the institutional analysis presented in Chapter Four, governance is examined as the institutional context through which authority, responsibility, and legitimacy are negotiated in the delivery of BGI. Governance is regarded as a relational and historical process rather than an administrative arrangement that is generalised through institutional trajectories, professional norms, and relations (Pierson, 2004). Current governance frameworks continue to be shaped by path dependence and organisational routines that favour predictability, stability, and risk management. These characteristics hinder the adoption of adaptive and place-based approaches that are critical for effective BGI implementation through integrative governance across sectors and governance scales (Folke et al., 2005). Consequently, within this framework, governance analysis examines how institutional cultures and decision-making practices recreate siloed responsibilities and hinder coordination and learning.

Also, attention is directed toward the politics of expertise embedded within governance processes. When BGI is framed primarily as a technical fix and not an infrastructure approach for transformation, it limits opportunities for collaboration, innovation, and social learning (Rijke et al., 2012). Thus, the governance arrangements shape which forms of knowledge gain legitimacy and which become marginalised. Scholarship on adaptive governance highlights the importance of deliberation, reflexivity, and cross-scalar coordination as conditions for institutional learning (Folke et al., 2005; Armitage et al., 2009). The framework assesses governance structures that enable experimentation and feedback or reinforce procedural compliance and organisational silos (Pahl-Wostl, 2009). Therefore, governance constraints are not just regarded as coordination failures but rather

as manifestations of deeper institutional constraints that limit epistemic diversity and adaptive capacity. In this sense, governance defines the conditions within which equity, legitimacy, and transformation in BGI delivery can occur (Pierson, 2004; Folke et al., 2005).

5.4.3 Stakeholder Engagement

Extending the participation challenges identified across Chapters Three and Four, stakeholder engagement within this framework is understood not merely as a participatory exercise, but as a fundamental aspect of governance. Engagement influences how a problem is defined, whose knowledge counts as relevant, and which outcomes ultimately become achievable in practice (Emerson et al., 2012). In many governance settings, participation is often limited to consultation and information sharing. Approaches like these tend to reproduce existing institutional power imbalances because they privilege technical and professional expertise over local knowledge and lived experience (Quick and Feldman, 2014). For BGI, whose success relies heavily on local context and long-term stewardship, procedural participation may produce symbolic rather than socially embedded outcomes.

The framework therefore treats engagement as a co-productive and ongoing process through which priorities, knowledge, and responsibilities are negotiated over time. Participation needs to actively counter structural inequalities and forms of epistemic exclusion instead of assuming that all actors have equal capacity to influence decisions (Turnhout et al., 2020). Therefore, meaningful engagement requires institutional arrangements that enable learning, adaptation, and ongoing engagement that are not limited to consultation stages linked to project delivery cycles (Emerson et al., 2012).

Within this framework, conflict is not seen as a failure of governance, but rather as an inevitable outcome of competing interests and misaligned institutions in BGI delivery.

Governance systems that allow negotiation, disagreement, and deliberation are better positioned to manage diverse values and expectations (Emerson et al., 2012). Stakeholder mapping serves as an analytical tool to examine how power flows, how alliances change over time and why particular voices are amplified and others marginalised (Mayers, 2005). As such, engagement serves both as a diagnostic lens for analysing governance dynamics and as a condition to generate more legitimate and inclusive outcomes.

5.4.4 Resources

Drawing on the resource and capacity constraints identified in the previous chapters, resources within the framework are regarded as a governance instrument that translates institutional priorities and political values into practice. The financial, human, and technical capacities shape which forms of BGI are considered feasible, where projects are implemented, and whose needs receive attention over time (Scott and Hislop, 2024). In practice, BGI provision is highly shaped by technocratic funding and appraisal systems that favour predictability, standardisation, and established delivery models. Conventional grey infrastructure is more easily compatible with the dominant investment logics, thereby entrenching a structural bias against decentralised and multifunctional approaches despite their acknowledged climate and social co-benefits (Mell, 2021). As argued by Shi (2020), uneven investment patterns are not merely implementation problems but rather arise from pre-existing governance arrangements.

From the environmental justice perspective, the resourcing decisions affect access to benefit from infrastructure as well as long-term stewardship capacity. The short nature of funding cycles and limited maintenance commitments can reproduce spatial inequalities, and this argues for the repositioning of BGI as an essential public infrastructure which is integrated into mainstream budgetary and asset management systems (Andersson et al., 2019). Beyond financial allocation, the organisational capacity is equally essential.

Effective delivery depends not only on financial investment but also on skilled personnel, institutional memory, and the ability to work across disciplinary and sectoral boundaries. Limited capacity often causes institutions to revert to familiar delivery methods, thereby restricting innovation and organisational learning (Zuñiga-Terán et al., 2020)

Technological resources like GIS and digital modelling tools are also examined in relation to authority and decision-making practices. Although these tools can enhance planning and monitoring, their impact ultimately hinges on the institutional context. Without institutionalised participatory oversight, technological innovation could reinforce technocratic control and narrow the deliberative space for decisions that are inherently political in nature (Shi, 2020; Yang et al., 2024). Resourcing therefore becomes a central analytical dimension through which the equity, legitimacy, and long-term effectiveness of BGI governance can be evaluated.

5.5 CHAPTER SUMMARY

In this chapter, the conceptual governance framework is developed to guide the analysis of BGI governance in this study. Informed by Chapters Three and Four, it addresses the disconnection between ambitions for sustainability and the fragmented governance arrangements shaping urban flood risk management in England. Earlier chapters revealed that the constraints on delivery of BGI are largely institutional and political, rather than technical. The conceptual governance framework is based upon the four interconnected lessons identified in the previous chapters: that the legitimacy of BGI is influenced by the fragmented nature of the legislative and policy frameworks that govern it; that BGI's implementation is subject to the governance arrangements of multiple stakeholders; that resourcing practices are often short term and inconsistent and limit the potential for innovation; and that participation by stakeholders is often procedural rather than collaborative. These lessons are translated into the four analytical domains of the

framework, legislation and policy, governance structures, resources, and stakeholder engagement, which provide a structured basis for examining how governance arrangements shape BGI delivery. Therefore, the framework can serve as a diagnostic foundation for the empirical analysis presented in subsequent chapters. The next chapter presents the study's methodology and analyses how the framework guided the design of the study's research methodology and analytical strategy.

CHAPTER 6: METHODOLOGY

6.0 INTRODUCTION

This chapter presents and justifies the research methodology used to analyse and critically evaluate the legislative and policy context that facilitates the implementation of BGI in the context of flood management. It offers a methodological framework to empirically assess whether current regulatory and policy frameworks can respond to the practical governance needs associated with the delivery of BGI. It helps identify the gaps and the challenges in BGI governance and areas for improvement. The first section of the chapter delineates the epistemology and research philosophy that underpin the overall study to provide a methodological approach. It then justifies the qualitative research design and explains why this approach is best suited to capture the complexity of the legislative and policy implementation processes (with a specific focus on the consideration, design, implementation and maintenance of BGI. Beyond data collection, this chapter explains the analytical strategies that were used to interpret and scrutinise findings. It methodologically explains the sources of data collection and the overall purpose of the research. In addition, this chapter examines how the findings are generated, categorised and placed within the broader discourse on BGI governance. This methodological framework is intended to enable the third objective of the study, which is to evaluate the adequacy of existing regulations and policies in meeting the practical needs of BGI for urban flood risk management. By applying a methodologically sound and rigorous approach, this chapter contributes to the theoretical and practical development of BGI governance and policy application.

6.1 RESEARCH PHILOSOPHY

The research philosophy forms the basis for the methodological design and the interpretation of the results. It defines the underlying beliefs about (ontology), knowledge (epistemology), and judgement (axiology) of the researcher (Crotty, 1998; Saunders et al., 2019). Philosophical coherence is not only important for methodological coherence, but also for ensuring the institutional and socio-political coherence of findings in policy and governance research.

6.1.1 The Philosophical Position of this Research

The research has an interpretivist epistemology underpinned by the ontological assumptions of critical realism. BGI governance in England is complex and layered; this complexity arises from variations across spatial and institutional contexts and from differences in how legal and policy frameworks are interpreted and enacted. These variations become observable through the ways in which actors interpret, negotiate and respond to governance arrangements in a concrete institutional setting. Interpretivism thus offers a suitable foundation for analysing meaning-making as a contextualised, political, and systemically shaped process involving discursive and social interaction (Yanow and Schwartz-Shea, 2014). The purpose of this research is not to produce predictive or universally generalisable theories but to examine how planners, engineers, policymakers and community representatives understand governance and policy implementation as they take shape in practice and specific places (Denzin and Lincoln, 2011; Creswell, 2014). This orientation enables engagement with the everyday realities of political and institutional practice, particularly where ambiguity, uncertainty, and contestation are present.

The research further draws on some constructivist insights, specifically Berger and Luckmann (1966) and Fischer (2003), which underscore that institutional categories,

governance norms or mandates and policy frameworks are continuously produced and reproduced through interaction and discourse. Political meaning is not merely interpreted but generated through situated practice. Additionally, this research takes a critical realist approach to its ontology recognising that structural things such as legal mandates, planning systems and regulatory mechanisms have an enduring existence and causal impact beyond how they are perceived individually. Although structurally real, they do not exert causal force independently of how they are interpreted, how they fit into the institutional logic and the specific local conditions within which they exist (Sayer, 2000). The stratified view of reality that includes empirical experience, observable phenomena and underlying generative mechanisms allows for a way of viewing how governance occurs as both socially constructed and materially determined (Danermark et al., 2019). Rather than seeking abstract causal explanations, the study focuses on how governance mechanisms are perceived, activated, and adapted by actors operating within institutional constraints and opportunities. The analytical emphasis therefore remains interpretative, centred on situated knowledge, actor agency, and the socio-political dimensions of policy implementation (Yanow, 2000; Hajer, 2005). This philosophical orientation enables attention to tensions between formal institutional structures and informal practices that shape outcomes in practice. Accordingly, the study adopts a reflexive methodological stance combining interpretivist attention to meaning making with a critical realist concern for identifying structural and institutional conditions influencing implementation. This stance is supported by the way the analysis was carried out. The open-ended interviews capture how different actors actually interpret policies and make decisions in practice. The thematic analysis then brings out the recurring governance patterns across the cases. In addition, the use of documentary evidence, observations, and interview data together allows these individual experiences to be connected to the wider institutional structures.

Taken together, these elements show clearly that governance outcomes are not driven by fixed rules alone, but by how institutions interpret policies, the resources available, and the negotiations that take place in practice. This is what supports the view of BGI governance as something socially embedded, evolving, and relational, rather than purely technical or procedural. This philosophical positioning also requires reflexivity regarding the analytical stance adopted in the study. While BGI is frequently presented within policy discourse as inherently desirable or universally applicable, this research does not assume that BGI is always necessary, feasible, or appropriate in every flood risk management context. Instead, BGI is treated as a governance outcome shaped by institutional arrangements, competing objectives, and situated decision-making processes. The study therefore examines how BGI is negotiated alongside alternative flood management approaches rather than presuming its equal status or automatic inclusion within schemes. Similarly, assumptions concerning the adaptive or sustainability advantages of BGI are approached as empirical questions to be examined through governance practice rather than normative starting points. In addition to this philosophical positioning, it is important to acknowledge the role of the researcher in shaping the research process. As the study adopts an interpretive approach, the researcher's background and experience can influence how the data is understood. Throughout the research, care was taken to remain aware of this influence and to reflect on how it might shape the analysis, ensuring that interpretations were grounded in the data rather than personal assumptions. Making this position explicit ensures that analysis remains attentive to how evidence, institutional constraints, and actor interpretations collectively shape when and how BGI becomes possible in practice.

6.1.2 Justification of Philosophical Position

The study examines how BGI policy and legislation in England are interpreted and

implemented within the complex and constantly evolving realities of governance. These frameworks span different areas and levels, from national to regional to local, and a variety of actors, from planners, engineers, policymakers, regulators and community groups. These levels are supported by distinctive institutional frameworks and professional cultures, which actively shape the interpretation, operationalisation, and practical implementation of BGI policy. The study chooses a deliberately context-sensitive approach that acknowledges the situated character of policy meaning rather than treating this diversity as a methodological problem. This study therefore seeks to interrogate how institutions construct meaning around policy, how meanings are produced and reproduced through everyday practices, and how they evolve in relation to local constraints, relationships, and contexts. Table 6.1 provides a comparative overview of the philosophical positions considered in this study, summarising their ontological and epistemological assumptions, their relevance to the research, and the rationale for their inclusion or exclusion.

An interpretivist perspective provides a valuable lens through which to engage with this complexity. In this perspective, policy and legislation are not considered fixed or technical objects; rather, they are contingent and evolving artefacts that are always subject to interpretation, negotiation, and situated knowledge (Bevir and Rhodes, 2006). As such, policy implementation is not a linear or deterministic process; policies are negotiated, adapted, resisted, or reconfigured by actors within institutional settings. According to Fischer (2003), interpretivism can be used as a tool for critical interpretation of how policy meanings are constructed, contested, and mobilised in practice. The purpose is not to produce universal or generalisable truths, but rather to examine how meaning-making processes drive and limit outcomes.

Through this lens, the research analyses how BGI governance emerges from the interplay of legal and political narratives, institutional arrangements, and professional judgement.

It explicitly explores how formal legal and policy frameworks are translated into everyday practices and how actors negotiate tensions, use discretion, and reinterpret policy objectives through the constraints of their institutional environments. Such an approach foregrounds the realities of governance by showcasing how law and policy are not just applied but instead constructed through discourse and practice.

In addition, the analysis highlights how power shapes the interpretive strategies that are deployed. This allows for an investigation of how certain narratives become institutionalised while others become marginalised or excluded, highlighting how governance is stabilised and legitimised discursively (Blumer, 1969; Flyvbjerg, 2001).

The analysis reflects critically on how the governance of urban and environmental infrastructure is structured by dominant knowledge systems and institutional logics and goes beyond mere descriptive accounts of such processes and practices. Although the research is based on an interpretivist epistemology, it derives inspiration from a critical realist ontology. It acknowledges that legal and policy frameworks have a materiality and structure, which are more than the sum of individual agency, and which can be traced through institutions, documents, and decisions. Nonetheless, they do not function in isolation, as their ramifications depend on their interpretation, enactment, and negotiation in specific institutional and socio-spatial contexts. This dual positioning allows the research to address not only the structural preconditioning of policy but also the contingent, practice-based ways in which policy is realised.

Although governance is recognised as an integral dimension of the broader institutional landscape, it is not treated as the primary object of analysis. Rather, governance is examined insofar as it shapes the conditions, relationships, and power dynamics through which legislation and policy are interpreted and implemented. The study will use a systematic analytical framework based on governance and institutional theory, ensuring analytical coherence and transparency. Moreover, this will permit the exploration of key

questions, such as how policy is constructed, mediated, and enacted. This framework allows for a comparative analysis of the different cases while taking into account the situational nature of meaning-making. It also helps to mitigate the potential relativism associated with interpretive research by grounding the analysis in clearly articulated conceptual tools. Consequently, the research adopts a reflexive approach that recognises the active role of the researcher in the construction of knowledge. As Berger (2015) and Flick (2014) emphasise, reflexivity enhances both the credibility and transparency of qualitative research. Throughout the study, interpretation was guided by iterative engagement with stakeholder interviews, policy documents and case material in the field to ensure consistency between philosophical stance, methodological design and analytical practice. Table 6.1 shows that interpretivism provides the most appropriate philosophical foundation for this research because it supports an in-depth understanding of how policy and legislation are interpreted and implemented within different governance contexts. It also explains why other philosophical positions were considered but were less suited to addressing the study's objectives.

Table 6.1: Philosophical Comparison and Justification: Adapted from: (Guba and Lincoln, 1994)

Philosophical Position	Ontology	Epistemology	Relevance to Study	Limitations	Justification for Inclusion/Exclusion
Positivism	Reality is objective and measurable	Knowledge is gained through observation and quantification	Useful for detecting patterns across cases	Ignores context and meaning; poor fit for subjective governance dynamics	Excluded cannot capture complex, socially embedded governance of BGI
Critical Realism	Reality exists but is stratified and socially mediated	Knowledge is partial and fallible; seeks causal explanation	Reveals structural influences on agency and institutional inertia	Less effective in capturing lived experience and discursive processes	Incorporated ontologically, but not epistemologically
Interpretivism	Reality is socially constructed	Knowledge arises from understanding subjective meaning	Captures actor perspectives, contextual nuances, discursive practices	Limited generalisability; risk of relativism	Adopted as core philosophy aligns with study's objectives and methods
Constructivism	Reality is co-constructed in interaction	Knowledge is shaped by context, dialogue, identity	Illuminates how stakeholders construct meaning in institutional settings	May risk analytical incoherence if unstructured	Supplementarily reinforces interpretivist insights, mitigated by structured analysis

6.2 RESEARCH APPROACH

This study adopts a qualitative research approach, which is well aligned with the study's underlying interpretivist epistemology and draws selectively on constructivist insights. These philosophical orientations view knowledge as context-dependent, shaped by interaction, discourse, and lived experience (Creswell and Poth, 2018). From this perspective, reality is not taken to be singular or objectively quantifiable; rather, reality emerges from the ways in which actors understand their roles, responsibilities and constraints within specific institutional and policy environments. In light of this viewpoint, a qualitative design represents the most relevant approach, to examining the dynamic and situated nature of the BGI governance framework in England. This study is not focused on measuring variables or identifying statistical correlations but seeks to understand how meaning is constructed. It looks at how laws/policies are interpreted and understood in practice, as well as how actors manage competing expectations, discourses and institutional arrangements. A qualitative approach allows for the necessary depth, flexibility, and attention to context that such inquiry demands particularly when investigating policy implementation processes that are often complex, contested, and shaped by multiple layers of governance (Creswell and Poth, 2018).

6.2.1 Limitations of a Quantitative or Mixed-Methods Approach

Quantitative research is often directed towards causal explanation, hypothesis testing, and statistical generalisation (Bryman, 2016). While useful in tracking policy adoption or compliance rates, they are less good at capturing the lived, negotiated, and value-laden aspects of governance practices (Yanow, 2000; Flyvbjerg, 2001). In the case of BGI, planners, engineers, policymakers and members of the community interact under specific cultural, spatial and institutional settings. Such ideas are influenced by historical

circumstances, public discourses and local priorities which cannot be easily standardised or meaningfully captured in numbers (Hajer and Wagenaar, 2003; Moss and Newig, 2010). In addition, utilising only quantitative methods runs the risk of abstracting governance away from its embedded and situated character, thus flattening complexity in ways that risk undermining the study's aim of producing rich, contextualised insight. The aim is not to generate findings that are universally generalisable, but to develop analytical generalisations which can yield transferable lessons for similar policy or governance contexts (Geertz, 1973). Such insights emerge through close engagement with case-based evidence, actor narratives, and institutional dynamics not through the application of pre-defined variables or metrics.

Mixed-methods approaches can generate interesting tensions if applied together, however. their effectiveness relies on the philosophical consistency and methodological robustness of both qualitative and quantitative components (Creswell and Poth, 2018). In this study, such integration is not warranted. The research questions emerge from interpretivist and constructivist assumptions and address how actors construct meaning, respond to institutional constraints, and engage in discursive practices. Incorporating quantitative aspects would provide minimal analytical value and create philosophical incoherence, constituting a trade-off (Bliss, 2008). Without any strong analytical or practical argument for quantification, adopting a qualitative only design is both epistemologically coherent and methodologically logical. This ensures internal coherence between the research aim, philosophical positioning and methodological choices, which allows for a reflexive and grounded investigation of how BGI-related laws and policies are interpreted, operationalised, and contested across different settings of governance.

6.2.2 Rationale for the Qualitative Approach

This research adopts a qualitative approach as a logical extension of its philosophical

commitments and research objectives. Informed by an interpretivist epistemology and a critical realist ontology, the study seeks to engage deeply with the discursive, institutional, and relational dimensions of BGI governance. Qualitative research enables the investigation of how governance processes are enacted, negotiated, and challenged in place-specific and institutionally embedded settings (Schwandt, 2000; Denzin and Lincoln, 2011). Furthermore, it is well suited to unpack the dynamic ways in which actors construct meaning, assign value, and respond to institutional structures and constraints. This approach is not only methodologically appropriate but strategically necessary. Governance is rarely experienced or operationalised as a fixed or uniform process. It is shaped by competing rationalities, layered institutional histories, and context-specific interactions between legal and policy frameworks and actor agency (Bevir and Rhodes, 2006). Qualitative methods make it possible to explore how governance discourses become stabilised, resisted, or reconfigured through situated practices allowing the study to capture variation in meaning-making across different spatial and administrative settings (Bevir and Rhodes, 2006; Yanow and Schwartz-Shea, 2014). The aim here is not to generalise statistically, but to generate context-rich, analytically transferable insights that speak to broader patterns in governance practice.

A qualitative orientation also foregrounds the importance of voice, context, and reflexivity all of which are central to investigating governance as a socially embedded and politically charged process. The approach acknowledges that the researcher is not a neutral observer but is situated within the research context, actively shaping and being shaped by the research encounter (Finlay, 2002; Berger, 2015). Reflexivity is operationalised in the study through explicitly documenting researcher positionality, keeping reflective notes during interviews and data collection, and revisiting interpretive decisions throughout the coding and thematic analysis process. These practices support ongoing critical reflection by enabling the researcher to examine how personal assumptions and interactions shape

data interpretation, and strengthen the credibility, transparency, and ethical rigor of the research. As a result of the institutional complexity and contested nature of BGI governance, marked by competing priorities, professional cultures, and asymmetries of power, a qualitative design provides the flexibility and depth necessary to respond to emerging insights and shifting field realities. This allows a more context-sensitive and ethical engagement with legal, policy, and planning processes, especially when the goal is to inform more equitable and context-sensitive approaches to urban sustainability. In this context, the choice of a qualitative approach is not merely justified it is essential. By doing this, the research will remain consistent with its philosophical underpinnings and will be able to interrogate how this legislation and policy is interpreted and mobilised in practice. It is also aligned with the broader aim of generating knowledge that is grounded, usable and responsive to governance.

6.2.3 Case Study Approach

The case study serves as the central research strategy for this study because it provides an appropriate means of examining the complex and context-dependent nature of BGI governance. The governance of BGI does not occur within a single institution or policy arena; rather, it involves multiple actors, overlapping mandates, and decision-making processes operating across different spatial and institutional scales. Given this complexity, the study requires a methodological approach capable of capturing how legislation and policy are interpreted and implemented within real governance settings. As noted by Flyvbjerg (2011) and Yin (2014), case study research allows detailed engagement with the people, processes, and institutional contexts through which policy intentions are translated into practice. The aim is therefore not statistical generalisation but the development of contextually grounded explanations of how governance arrangements shape implementation outcomes. In this study, governance is understood as a negotiated

and evolving process shaped by professional norms, institutional constraints, and everyday decision-making practices (Thomas, 2016).

Methodologically, the research adopts a multiple embedded explanatory case study design following Yin (2014). The selected cases function as critical typical explanatory cases. They are typical because both projects were implemented within England's established flood risk management and planning framework, operating under the same national legislative and policy environment. At the same time, they are critical because they reveal continuing governance and coordination challenges despite strong policy commitments supporting BGI. The intention is therefore not to evaluate infrastructure performance but to explain how governance processes influence implementation. In this study, success is not just about how well the infrastructure works, but about how governance arrangements support or limit the inclusion of BGI in practice. This means looking at how legislation, policy, resources, and stakeholder processes shape what is actually delivered on the ground.

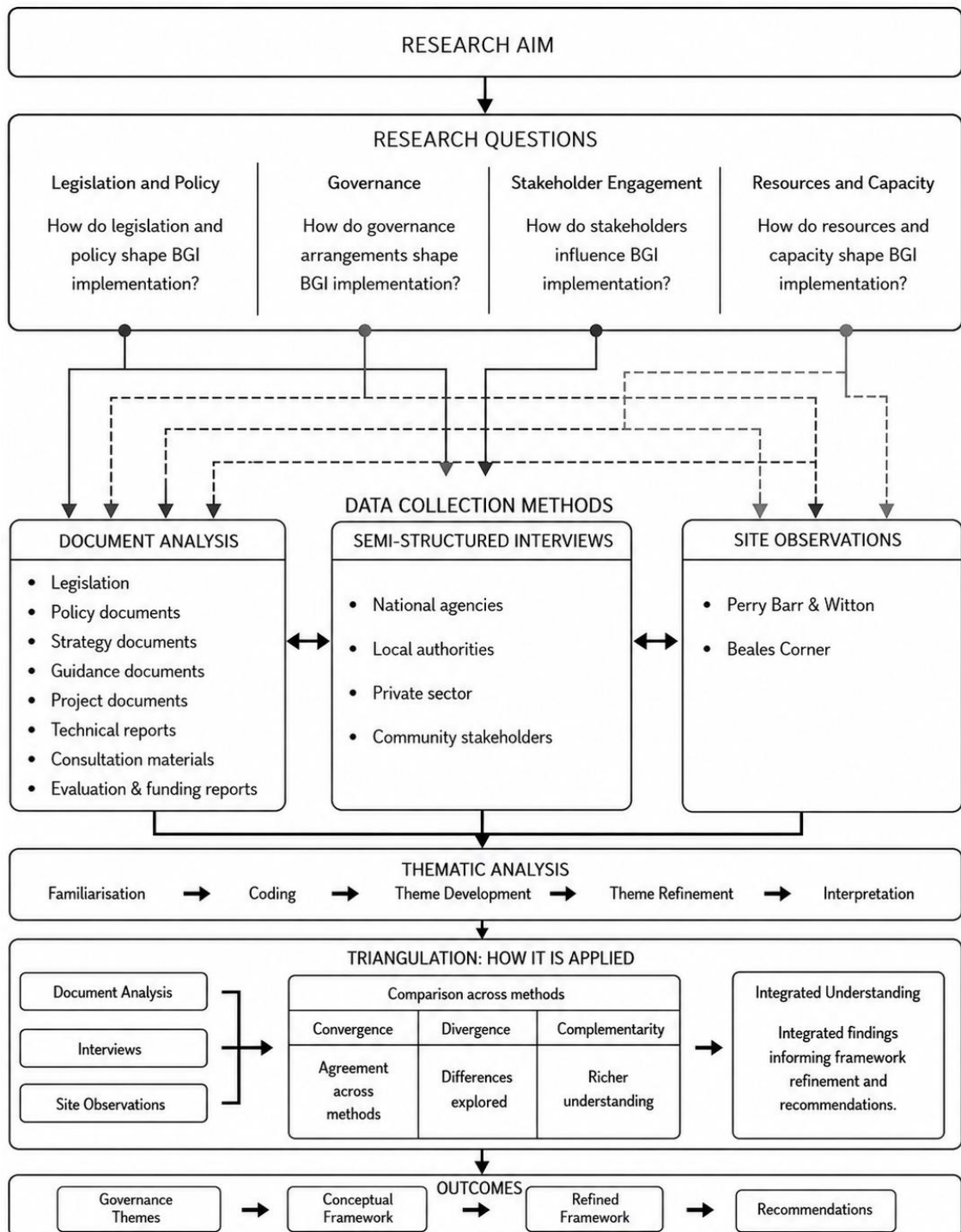
Drawing on Thomas (2016), a distinction is made between the subject and object of the case. The subject of the case is BGI governance practice as it occurs within flood risk management schemes, while the object of analysis is the institutional process through which legislation, policy, resources, and stakeholder relationships shape implementation outcomes. The focus of the research is therefore governance practice rather than the physical infrastructure itself. The primary unit of analysis is governance practice. Each case includes embedded units of analysis comprising of: Legislation and policy interpretation, governance coordination arrangements, resource and institutional capacity conditions, and stakeholder engagement processes. These embedded dimensions guide both data collection and analysis and allow structured comparison within and across cases (Yin, 2014). The investigation of each case is guided by the following analytical questions:

1. How are legislative and policy frameworks interpreted during the implementation of BGI?
2. What role do individual policy instruments play in enabling or constraining BGI adoption?
3. How do governance coordination arrangements influence decision-making processes?
4. In what ways do resource and institutional capacity conditions shape implementation outcomes?
5. How are stakeholders included or excluded within governance processes?
6. Why do implementation challenges persist despite supportive legislative and policy objectives?

The cases are therefore analytically selected rather than statistically representative. Their purpose is to reveal governance mechanisms and institutional tensions that may not be visible through broader policy analysis (Flyvbjerg, 2011). Two cases were considered sufficient because multiple case study research relies on theoretical replication rather than numerical expansion (Yin, 2014). The inclusion of one urban and one rural scheme allows examination of whether similar governance dynamics operate under contrasting spatial and institutional conditions. The second case therefore serves as a replication case, strengthening analytical generalisation by testing emerging explanations across different governance contexts (Eisenhardt and Graebner, 2007). The case study integrates document analysis, semi-structured interviews, and site observations within an interpretive multi-method design (Merriam and Tisdell, 2015; Creswell and Poth, 2018). Figure 6.1 presents the methodological design adopted in this study. It illustrates how the four analytical domains of the conceptual governance framework informed the study design, how document analysis, semi-structured interviews, and site observations complemented one another across the two case studies, and how the evidence generated from these methods

was integrated through thematic analysis and triangulation to refine the conceptual governance framework.

Figure 6.1: Methodological Design of the Study



(Source: Author's illustration).

Each data source contributed a different perspective to the study. Evidence from document analysis, semi-structured interviews, and site observations was systematically compared to identify areas where the findings converged and where they differed across the two case studies. This made it possible to develop a richer understanding of how legislative and policy intentions were interpreted and implemented in practice. Documentary materials, including legislation, national and local policy documents, project plans, governance reports, and consultation records, were analysed to examine the formal responsibilities, institutional arrangements, and governance expectations shaping BGI implementation. The interviews provided insight into how these formal arrangements were understood and applied by different actors, while the site observations helped to place these findings within the practical context of the case studies. Table 6.2 summarises the contribution of each data source and its analytical role in the study.

Table 6.2: Data Sources and Analytical Contribution

Data Source	Type of Data Collected	Governance Dimension Addressed	Analytical Role
Legislation and policy documents	Statutory duties, policy objectives, regulatory requirements, defined responsibilities	Legislation and Policy	Establish formal governance framework and institutional expectations
Project and governance documents	Delivery arrangements, approval conditions, coordination structures, funding allocations	Governance Structures and Resources	Trace decision pathways and institutional configuration
Semi-structured interviews	Actor interpretations, coordination challenges,	All dimensions	Reveal how governance operates in practice

	negotiation processes, perceived constraints		
Site observations	Physical conditions, maintenance evidence, spatial adaptations, signs of stakeholder interaction	Resources and Stakeholder Engagement	Contextualise how governance decisions materialise on the ground

(Source: Yin, 2014, Thomas, 2016; Creswell & Poth, 2018)

6.2.3.1 Triangulation Strategy

In this study, triangulation was used mainly to bring together findings from different sources of evidence rather than simply validating them (Oladunjoye, 2021). As shown in Figure 6.1, triangulation was carried out after the documentary evidence, interview data, and site observations had been analysed separately. Bringing these findings together provided a broader understanding of the governance processes influencing BGI implementation across the two case studies.

Triangulation was carried out by comparing the findings from document analysis, thematic analysis of the interview data, and evidence from the site observations across the four analytical domains of the conceptual governance framework. The comparison examined whether the findings from the three sources supported the same explanation, showed different perspectives, or added further understanding to the governance issues identified in the study. In particular, it examined whether the legislative and policy requirements identified in the documents were reflected in stakeholders' experiences and in the implementation observed at the case study sites, whether governance arrangements influenced decision-making in practice, how stakeholder engagement shaped implementation, and how resource and institutional capacity affected implementation outcomes. The triangulation process was carried out in three stages.

- Within-case triangulation: Findings from document analysis, thematic analysis of the interview data, and evidence from the site observations were compared within each case study. This allowed the findings from one source to be examined alongside the others. For example, governance arrangements identified in legislation, policy documents, and project reports were compared with participants' accounts and observations from the case study sites to understand how these arrangements operated in practice.
- Cross-method triangulation: Findings from the three sources were systematically compared to identify areas of convergence, divergence, and complementarity. Where the findings converged, they strengthened the interpretation of the governance issues identified in the study. Where differences emerged, they helped to explain why legislative and policy intentions, stakeholders' experiences, and implementation outcomes did not always align. Where one source provided additional evidence, it was used to explain or expand the findings from another source.
- Cross-case triangulation: The integrated findings from the urban and rural case studies were then compared to identify common governance patterns as well as differences between the two cases. This made it possible to examine whether similar governance processes occurred across different institutional and spatial contexts and supported theoretical replication.

Rather than treating differences between the data sources as inconsistencies, they were used to provide a better understanding of the governance processes shaping BGI implementation. Bringing the findings together in this way strengthened the interpretation of the results and informed the refinement of the conceptual governance framework presented in Chapter 10.

6.2.3.2 Evaluation of Alternative Methodological Approaches

In selecting the case study approach as the central research strategy, consideration was given to other qualitative methodological frameworks that also enable in-depth engagement with complex, context-sensitive issues. Among the possibilities were phenomenological research; action research; participatory research. While each offers valuable strengths, ultimately, none were selected due to differences in focus, purpose, and methodological fit with the aims of the study.

The aim of phenomenological research is to uncover the essence of lived experience from the perspective of people (Van Manen, 1990). Although this approach shares interpretivist foundations, it is primarily focused on individual consciousness and subjectivity. The study, however, is focused on legislative and policy processes and institutional interactions rather than the phenomenology of experience itself. While the study is participant centric, it seeks not to distil the meaning of experiences, but rather how meaning is negotiated within governance frameworks.

According to Reason and Bradbury (2008), action research provides a powerful mechanism and process for practice-based change through reflection, collaboration and action over an iterative cycle. However, the current study does not involve direct intervention in policy or planning practice. Its aim is analytical rather than transformational, and the research design does not incorporate co-production of knowledge or cyclical stages of action and reflection as required by action research. Participatory research also centres on shared inquiry with stakeholders, often aiming to empower marginalised groups and democratise knowledge production (Cornwall and Jewkes, 1995). While this study values inclusivity and recognises stakeholder voices, it does not fully align with the participatory paradigm. The research is independently led and does not adopt the collaborative governance structure typically required for participatory research to be methodologically sound.

By contrast, the case study approach allows for contextual depth, institutional analysis, and methodological integration without requiring the direct intervention or co-productive orientation of the alternatives (Yin, 2014). It aligns with the study's aim to explore how BGI legislation and policy are interpreted and enacted in practice, within specific institutional settings. As such, the case study strategy offers the most philosophically coherent and methodologically flexible approach for addressing the research aim.

6.2.3.3 Justification for a Case Study Approach

The adoption of a case study approach fits well with the research philosophy of the study, which is interpretivist and critical realist. As BGI governance is inherently situated, actor-driven and contested, it is important to employ a research strategy that can account for institutional complexity, spatial variations and the socio-political conditions under which environmental policies are implemented. According to Yin (2014) and Flyvbjerg (2011), the case study approach enables the study to examine the interpretation, negotiation and mobilisation of BGI site-related policies within the formal and informal dynamics of governance arrangements. The case study allows for a more nuanced understanding of the complex interrelationships between actors, institutions, laws and context, instead of a purely abstract and decontextualised account. This is particularly important in an environment where governance is characterized not only by formal policy instruments, but also by historical legacies, professional cultures and tacit institutional norms (Moss et al., 2015). In this PhD, BGI implementation is seen as a social and spatial process involving actors from the public and private sectors and civil society. Due to overlapping mandates and priorities, coordination and coherence of these actors are particularly difficult. The use of case studies empirically unpacks these dynamics. It identifies obstacles, misalignments of actor responsibilities or institutional gaps that impede their implementation despite the commitment to resilient infrastructure (Head, 2010).

A multiple case study design comparing urban and rural governance contexts allows greater analytical depth and supports analytical generalisation. Two cases were selected and considered sufficient because the study seeks theoretical replication rather than statistical representation (Yin, 2014). The inclusion of one urban and one rural scheme enables examination of whether similar governance mechanisms operate across contrasting spatial and institutional contexts. This comparative logic allows recurring patterns and context-specific differences to be identified without requiring additional cases, as the aim is to explain governance processes rather than achieve numerical coverage (George and Bennett, 2005; Eisenhardt and Graebner, 2007). The comparative component of the study allows for the exploration of governance processes across contrasting contexts. As summarised in Table 6.3, the case study design is underpinned by a number of analytical dimensions, including contextual embeddedness, actor interpretation, institutional dynamics, governance constraints, and comparative insight. Together, these dimensions demonstrate why a case study approach is particularly well suited to examining how BGI policy is interpreted and implemented within different institutional and spatial contexts. Furthermore, it strengthens the explanatory power of research by answering the central questions of “how” and “why”: How do governance mechanisms influence the implementation of BGI policy? Why are there still challenges despite clear legislative and policy objectives?

These questions are best answered using a method that emphasizes depth, interpretative sensitivity and empirical grounding (Yin, 2018). Case studies are often criticized for their limited generalisability, however the aim is not to draw statistical conclusions, but to do analytical generalisation; that is enhance understanding of processes, meanings and mechanisms in specific context to enable thinking beyond them (Yin, 2014). The use of interviews, document analysis and field observations increases the reliability and validity of the research while ensuring a solid empirical foundation and minimizing bias (Creswell

and Poth, 2018). Therefore, this study contributes to the broader debates on environmental policy implementation and institutional arrangements that can support the environmental and social objectives of BGI. Furthermore, it provides a reflexive, grounded account that illustrates how governance mechanisms influence the deployment of BGI in different geographical settings.

Table 6.3: Justification for the Case Study Approach

Analytical Dimension	Rationale
Contextual Embeddedness	Enables analysis of BGI as a site-specific, politically embedded, and institutionally conditioned practice that cannot be reduced to generic models.
Actor Interpretation	Captures how diverse stakeholders interpret, contest, and mobilise policy, highlighting variation in practice and meaning making.
Institutional Dynamics	Illuminates' interactions between overlapping mandates, legal frameworks, and planning cultures across governance tiers.
Governance Constraints	Uncovers informal barriers, coordination gaps, and power asymmetries that limit policy effectiveness despite formal commitments.
Comparative Insight	Supports cross-case learning by analysing rural–urban contrasts and identifying both shared patterns and contextual specificities.
How and Why Orientation	Facilitates deeper exploration of causal processes and institutional drivers behind policy

	translation, success, or stagnation.
Analytical Generalisation	Produces conceptually rich, transferable insights that inform wider environmental governance and institutional theory debates.
Methodological Rigour	Ensures credibility through triangulation of data sources (interviews, documents, observations) and reflexive engagement.

(Source: Eisenhardt and Graebner, 2007; Flyvbjerg, 2011; Yin, 2014).

6.2.3.4 Selection and Justification of Case Study Sites

Choosing case study sites provides the essential basis for examining how the BGI legislative and policy frameworks are interpreted, operationalised and negotiated within different institutional and spatial contexts. The research adopts a purposeful, theory-guided approach to the selection of sites that privileges conceptual depth, contextual diversity, and empirical richness, rather than representative or statistically generalisable cases. Due to the relational and place-based nature of BGI governance, the selection of appropriate sites was pursued analytically, specifically investigating how institutional arrangements, actor interactions and spatial context interface to produce outcomes. The criteria for selection were not arbitrary but based on precedents taken from environmental governance, planning theory and institutional analysis (Ostrom, 2005; Gerring, 2007).

The criteria were chosen to ensure that the case study would offer insights into different dimensions of BGI delivery: from real formal structures and planning instruments to informal practices and localised forms of negotiation. The selection process proceeded in a phased and deliberate manner. There was a broad mapping of BGI schemes using the

Environment Agency's programme information, the academic literature, and national infrastructure planning. The projects were evaluated using the structured selection matrix presented in Table 6.4, which assessed each potential case against key analytical and practical criteria, including governance configuration, diversity of actors, stage of implementation, the availability of policy documentation, and the feasibility of stakeholder engagement. The matrix provided a transparent and systematic basis for selecting case studies that offered both rich empirical evidence and contrasting governance contexts for examining the implementation of BGI.

Consultations with Environment Agency advisors and strategic planners were instrumental in narrowing the focus. Although several sites were considered at the outset, including projects in Derbyshire, Gloucestershire and Nottinghamshire, many were ultimately ruled out because of being on the early stages of implementation, or lacked sufficient documentary evidence, or being inaccessible to key decision-makers and institutional actors. Two case studies were chosen that deal with distinct but analytically rich governance settings. Perry Barr and Witton, which is a multi-agency intervention in Birmingham that works at urban scale and involves complex layering up of policy. Beales Corner in Worcestershire, which is a rural scheme markedly community-led governance that faces distinctive spatial governance challenges. Both cases reflect settings where BGI policy is not merely implemented, but interpreted, contested, and adapted. These cases allow for a critical understanding of how the ambitions of national policies are transformed by local institutional capabilities, political pressures, and spatial pressures, which are useful for theory-building and learning.

Importantly, the urban–rural contrast offers more than geographical variation. It creates the opportunity to investigate how scale, governance models and land uses condition the ability to integrate BGI. As such, the cases are theoretically generative as they bring to the forefront governance tensions, institutional incoherence, and structural bottlenecks that

may be obscured by aggregate policy assessment. The aim is not to assert that these cases are representative of all BGI implementation efforts in England. Rather, their analytical distinctiveness and institutional diversity allow for the development of theory-informed insights that speak to broader governance challenges especially those related to the institutionalisation of nature-based solutions in complex policy environments.

Table 6.4: Project Selection Matrix Based on Governance and Practical Parameters

Project Name	Governance Configuration (Clear / Shared / Fragmented)	Diversity of Actors (High / Medium / Low)	Stage of Implementation (Planning / Ongoing / Completed)	Policy Documentation Available (Yes / Partial / No)	Feasibility of Stakeholder Engagement (High / Medium / Low)
Perry Barr & Witton Scheme	Shared	High	Completed	Yes	High
Beales Corner Scheme	Shared	High	Ongoing	Yes	High
Derbyshire Project (considered)	Fragmented	Medium	Planning	Partial	Medium
Gloucestershire Project (considered)	Clear	Low	Planning	No	Low
Nottinghamshire Project (considered)	Fragmented	Medium	Ongoing	Partial	Medium

(Source: Author's compilation based on Environment Agency programme data and case selection criteria developed for this study).

6.2.3.4.1 Urban Context: Perry Barr and Witton, Birmingham

Perry Barr and Witton lie at the converging axes of Birmingham's post-industrial reinvention and its pressing climate-resilience agenda. Far from a simple green upgrade, this corridor demands the orchestration of at least six agencies: local planning, the Environment Agency, heritage trusts, highways, developers, and community groups each operating behind distinct mandates and performance metrics. Birmingham's entrenched socio-economic divides, contested land-ownership legacies, and the inertia of legacy infrastructure combine here to form a governance labyrinth where BGI must continually negotiate space, funding, and political will. Methodologically, this site was chosen because it lays bare the frictions between national imperatives such as Defra's Urban Adaptation Programme, 2018 and local contingencies from developer profit models that de-prioritise green spaces to conservation statutes that inadvertently stymie wetland restoration. In Perry Barr and Witton, the policy text is only the starting point; its realisation depends on relentless inter-agency brokerage, iterative design workshops, and informal alliances—elements that reveal how urban BGI becomes a battleground of competing rationalities (Mell, 2016; O'Donnell et al., 2017). This case lays bare how the scale of ambition collides with the scale of administration, making visible the political ecology of urban greening in a city still grappling with its industrial afterlives.

6.2.3.4.2 Rural Context: Beales Corner, Worcestershire

Beales Corner, sitting along the Severn's floodplain, illustrates the layered challenges and adaptive possibilities of rural BGI. In this setting, the landscape is expansive, the risks are tangible, and formal planning capacity is limited. Governance often rests with those closest to the local authority, land parish councils, riparian landowners, and local volunteers who step in not only out of commitment, but out of necessity, particularly as

funding and strategic oversight become stretched at higher levels. In response, what emerges is a form of hybrid governance one that blends formal interventions with informal practices and community-led decision-making. In this context, BGI is not driven by top-down mandates but by lived experience, local knowledge, and adaptive responses shaped through necessity and trust. For instance, breaches in flood embankments have acted as starting points for collaborative action triggering co-design conversations, knowledge-sharing, and locally brokered solutions that often sit outside conventional planning frameworks.

This case has been included precisely because it makes visible the kind of relational governance work that sustains BGI in resource-limited contexts. It sheds light on what some scholars such as Frantzeskaki et al. (2019) refers to as; shadow governance the less visible but essential spaces where policy is interpreted, adapted, and enacted through shared understanding and embedded practice. The Beales Corner shows how non-state actors exercise agency and shape policy meaning, particularly where institutional reach is limited, or legitimacy is in question.

6.2.3.4.3 Why These Two?

The selection of Perry Barr and Witton and Beales Corner is intentionally comparative. Two cases are considered sufficient for analytical comparison in this study because the objective is not to achieve statistical generalisation but to examine how the same national legislative and policy framework for BGI is interpreted and operationalised under different governance conditions. In this regard, the use of two cases enables the study to explore variation in governance arrangements within a shared regulatory context, thereby allowing for the identification of both context-specific dynamics and recurring institutional patterns. The cases are treated as explanatory comparative cases, with the unit of analysis clearly defined as BGI governance practice. This refers to how legislation and policy are

interpreted, how institutions coordinate, how resources are allocated, and how stakeholders are involved in shaping implementation outcomes. The purpose of using the two cases is to examine how these governance elements play out in practice across different institutional settings. The focus is not simply to compare urban and rural projects, but to understand how governance processes are organised and applied under different conditions.

By maintaining a consistent analytical focus across both cases, the study enables systematic comparison of governance processes rather than project types. In this way, the cases serve as analytical lenses through which broader questions of policy translation, governance coordination, and institutional adaptation can be interrogated. Comparative design therefore strengthens the explanatory power of the study by showing how governance conditions influence the realisation of BGI within a shared legislative and policy framework in England. The governance setting of Perry Barr and Witton is characterised by high institutional density, the involvement of multiple statutory actors, and formalised decision-making processes. In this context, implementation depends on coordination across planning, flood risk management, regeneration, and transport institutions, making visible how procedural requirements and accountability structures shape the translation of policy into practice. In contrast, Beales Corner represents a setting with lower institutional capacity, where governance relies more on informal coordination, local knowledge, and community involvement. As a result, implementation occurs through negotiated relationships and adaptive practices rather than through highly formalised structures.

6.3 DOCUMENT ANALYSIS

Document analysis formed a core component of this study, not as a means of reconstructing project delivery or corroborating empirical claims, but as a way of

interrogating how flood risk management and BGI are formally represented, justified, and stabilised within policy and institutional texts. In line with critical qualitative methods, documents were not considered neutral records of practice but as constructed artefacts that reflect specific institutional priorities, assumptions and silences (Bowen, 2009). The analysis exclusively focused on publicly available online documents for ethical reasons and to foreground the forms of knowledge that are made visible and legitimate in official flood risk governance (Yin, 2018). The purpose of document analysis in this study was to explore how problems, responsibilities and solutions are described in formal texts, not to examine whether these representations adequately reflect practice, which is explored through the interviews and site observations. Documents were approached as sites where authority is asserted, compliance is normalised, and uncertainty is managed through technical and procedural language. In this sense, documentary material was used to surface the discursive framing of flood risk management and BGI, rather than to provide evidence of how schemes were delivered on the ground.

6.3.1 Documentary corpus, extraction strategy, and analytical role

To clarify the analytical use of documents, each document type was examined for specific forms of information linked to the study's governance framework, not just used as background description. Legal and policy documents were examined to identify mandates, duties, and policy expectations; local strategies were used to see how national priorities are interpreted at the local level; project and technical reports were used to extract approval conditions, design requirements, and compliance criteria; consultation materials were analysed to understand how participation and stakeholder roles are presented; and evaluation and funding reports were used to examine how success and impact are defined. This makes it clear what is being taken from each document and why it matters for the analysis.

The documentary corpus includes six categories of publicly available documents, selected to capture the different areas where flood risk governance is defined and justified. National legislation and policy documents were used to identify formal mandates and objectives; local strategies were examined to understand how these are applied in practice; project documents such as planning applications and environmental statements were used to trace how policy is translated into actual delivery; technical reports were used to identify compliance standards; consultation materials were used to assess how participation is framed; and evaluation and funding reports were used to understand how outcomes are justified after implementation.

Across all these documents, the analysis focused on extracting specific elements such as policy objectives, regulatory thresholds, approval conditions, allocation of responsibilities, environmental measures, and recurring narratives, rather than just describing the content. All documents were systematically logged (including source, organisation, date, and type) and coded using the study's governance framework, covering legislation and policy, governance structures, resources, and stakeholder engagement. This ensures that the extraction process is structured and consistent. Table 6.5 clearly shows each document category, what information was extracted, and how it was used in the analysis, while Appendix B-1 provides a full list of all documents used, ensuring transparency and traceability. Importantly, documents are not used alone. The information extracted from documents is analysed together with interview and observation data to provide a triangulated understanding of governance practice. Documents show how governance is formally presented, while interviews and observations reveal how it works in practice. This allows the study to identify gaps between policy intention and real-world implementation.

Table 6.5: Documentary Sources, Extracted Information, and Analytical Role

Document Category	Examples	Information Extracted	Analytical Purpose
Legislation and National Policy	Flood and Water Management Act, NPPF, Environment Act	Mandates, statutory duties, policy objectives	Identify formal governance expectations shaping BGI
Local Strategies and Policies	Local Flood Risk Management Strategies, council planning policies	Local interpretation, priorities, implementation emphasis	Examine translation of national policy at local level
Project Documentation	Planning applications, design reports, project summaries	Approval conditions, design requirements	Understand operationalisation of policy within projects
Technical and Regulatory Reports	Environmental Impact Assessments, technical assessments	Compliance standards, performance criteria	Analyse regulatory and technical framing
Consultation Materials	Public consultation and engagement reports	Stakeholder roles, participation framing	Examine representation of engagement processes
Evaluation and Funding Reports	Post-project reviews, funding summaries	Definitions of success, impact, and value	Analyse retrospective justification of outcomes

Source: (Author's documentary analysis).

6.4 OBSERVATION AND SITE VISIT

This study utilises direct observation as a sensitive empirical instrument to decipher the embodied practices and hidden frictions of BGI governance that interviews and documents cannot reveal (Yin, 2018; Patton, 2015). After ethics approval from the University, written consent was sought in advance from each maintenance operative, engineer, contractor, and volunteer likely to be met. In January 2025, each site was visited for a full day without interruption. A total of two site visits were conducted, one at each case study location, with each visit corresponding to a single case. The purpose of each visit was to observe how governance arrangements were materially enacted in practice, including maintenance activities, coordination between actors, resource deployment, and evidence of stakeholder involvement. To guide the process, a structured observation guide was used, designed in line with the study's conceptual framework (see Appendix B-4). This allowed the observation to be systematic rather than random. Observations focused on identifying visible indicators of governance practice, such as the condition of infrastructure, evidence of maintenance or neglect, presence of personnel, coordination between agencies, and signs of community interaction or informal intervention. These observations were used to support the analysis by showing how policy and governance decisions translate into real word conditions. In particular, they helped to identify gaps between what is stated in policy and what actually happens onsite, as well as areas of adaptation, challenges and inconsistency in BGI delivery.

This implies using the visits to make sense of what had already emerged from interviews and documents, by seeing how these decisions translated into everyday site conditions and activities. Although the timing of the visits was shaped by the PhD schedule, it coincided with winter conditions, which provided useful insight into issues such as water logging, delayed maintenance, and informal community responses to emerging problems. To guide the process, a structured observation guide was developed from the study's conceptual

framework, focusing on legislation and policy, governance, resources, and stakeholders, and refined through pilot testing at a comparable site (Spradley, 1980; Angrosino, 2007). In practice, this meant paying attention to specific on-site indicators: for example, visible permits and signage indicating compliance with regulatory requirements; how different actors interacted on site, including handovers between project managers, coordinators, and maintenance teams; the presence and use of materials such as sandbags or equipment, indicating resource mobilisation; and evidence of stakeholder involvement, including the presence of volunteers or site engineers. Instances of improvised actions, such as informal clearing of debris or adjustments to drainage channels, were also noted as indicators of how governance arrangements were adapted in practice.

Using these indicators helped to keep the observations focused and analytical, rather than purely descriptive. Observations were recorded through a combination of structured checklists, field notes, sketches, and photographs, allowing different forms of evidence to be captured and later examined alongside interview and documentary data (Yin, 2018; Creswell and Poth, 2018). Access to sites was coordinated with project managers and site coordinators, and although visits were conducted within a relatively short time frame due to logistical constraints, this improved alignment with ongoing site activities and stakeholder availability, adding depth to the observations. Each site was visited once, which was considered sufficient for the purpose of this study, as observation was used to provide contextual and interpretive insight rather than to track change over time or evaluate technical performance (Flyvbjerg, 2011; Yin, 2014). Data collection involved the use of a tablet with GPS-enabled forms to capture structured observations, alongside a handwritten field diary used to record more detailed descriptions of interactions, site conditions, and unplanned occurrences. Photographs were also taken, with appropriate ethical clearance, to document key features such as stormwater infrastructure, erosion control measures, and areas of community activity (Harper, 2002).

All observational data were transcribed within 24 hours into NVivo, ensuring that contextual details such as tone, pauses, environmental sounds, and site conditions were preserved. This supported an iterative coding process, where observational data were analysed alongside interview transcripts and policy documents using a threefold coding schema of confirmations, contradictions, and silences (Flyvbjerg, 2001). This approach made it possible to identify where formal governance expectations aligned with practice, where they diverged, and where important aspects of governance were absent or unrecorded. The use of multiple data sources was therefore intended to provide complementary analytical perspectives, allowing the study to examine the tensions between formal governance narratives and what was actually happening on the ground (Bowen, 2009).

6.5 SEMI-STRUCTURED INTERVIEW

Semi-structured interviews were chosen because they give respondents the opportunity to share their views and experiences of the legislation, policy, governance and implementation of BGI (Kvale and Brinkmann, 2009). Table 6.6 compares the three main interview formats and explains why semi-structured interviews were selected for this study. Unlike structured or unstructured interviews, the semi-structured format provides the flexibility to explore participants' experiences while maintaining sufficient consistency across interviews. In contrast to structured interviews or questionnaires, where responses are fitted into a specific framework that can prevent a deeper exploration of the answers, in the semi-structured interview situation there is a free flow that allows the investigator to ask follow-up questions to integrated responses (Bryman, 2016). BGI requires an understanding of the complex contextual relationships between policy, stakeholders and the environment (Creswell and Poth, 2018). In addition, the semi-structured interview is flexible and adaptable. It provides sufficient consistency between interviews, but also

room for extensive context-specific information (King and Horrocks, 2010).

Table 6.6: Overview and Justification for the Use of Semi-Structured Interviews

Interview Format	Description	Strengths	Limitations	Relevance to this Study
Structured Interviews	Fixed, standardised questions asked in the same order across all participants.	High consistency; easy to compare across respondents.	Limited depth: restricts flexibility and fails to explore unexpected insights.	Not suitable for exploring complex and situated governance dynamics of BGI.
Unstructured Interviews	Informal, open-ended discussions with no predefined structure.	Encourages detailed, personal narratives and reflective responses.	Low comparability across interviews; difficult to analyse systematically.	May provide rich insights, but unsuitable due to lack of thematic consistency required for cross-case institutional analysis.
Semi-Structured Interviews	Guided by key themes but allows flexibility in the sequence, wording, and depth of questions.	Balances depth and flexibility; allows emergence of context-specific insights while retaining comparability.	Requires skill in probing and managing data volume; potential for interviewer bias.	Most appropriate for navigating the diverse institutional roles, interpretations, and lived realities of BGI governance actors across multi-level networks.

(Source: Minichiello et al.,1990; Braun & Clarke 2006; Corbin & Strauss 2008; Bryman 2016)

Purposive sampling and snowballing were used to select participants to select a knowledgeable and useful research sample. Purposive sampling technique is used so that the knowledgeable individuals or those involved in BGI governance and implementation can be purposively selected (Patton, 2015; Creswell and Poth, 2018). However, to counteract the disadvantages of purposive sampling, such as missing important but less visible stakeholders, a snowballing method was also used. This method allowed the original participants to recommend others with relevant expertise. This is particularly useful in specialised areas such as BGI governance, where key stakeholders are not always

easy to locate (Biernacki and Waldorf, 1981; Noy, 2008). Stakeholder mapping was about identifying and understanding all the individuals or organisations whose actions impacted on the Perry Barr and Witton Project and the Beales Corner Scheme. Participants included individuals directly involved in, or with substantive knowledge of, the case study schemes. These comprised flood risk and drainage officers within local authorities, spatial planners, practitioners from the Environment Agency and Lead Local Flood Authorities, representatives of environmental NGOs, leaders of community and volunteer groups involved in BGI stewardship, private-sector consultants, and academic experts specialising in flood risk and BGI governance. A list of participants and their roles is provided in Appendix B-3.

This categorisation ensured a study with multiple perspectives, essential for capturing the essence of BGI governance (Freeman, 1984; Bryson, 2004). Guided by the research objectives, participant selection focused on individuals' roles, expertise, and level of involvement in BGI projects. Table 6.7 presents the inclusion and exclusion criteria used to identify participants with the knowledge and experience required to address the research questions. Applying these criteria ensured that the data collected were directly relevant to the study and suitable for the intended analysis (Yin, 2018). Accordingly, participants were selected based on the following criteria:

Table 6.7: Inclusion and Exclusion Criteria for Interview Participants

Criterion	Inclusion	Exclusion
Role in BGI Governance	Individuals with clear responsibilities in shaping, implementing, or managing BGI policy or projects including planners, engineers, contractors, or community coordinators.	Individuals whose roles are administrative, consultative, or peripheral, without any direct influence on BGI delivery or governance decisions.
Organisational Affiliation	Environment Agency; Lead Local Flood Authorities; local planning departments; NGOs active in BGI; contractors engaged on the case projects;	National-level organisations not involved in local project delivery; private individuals unaffiliated with BGI efforts.

	community representatives.	
Project Involvement	Participants with direct experience working on Perry Barr & Witton or Beales Corner within the last three years.	Individuals with no involvement in either case study, even if active in other BGI projects.
Availability and Consent	Able to commit 45–60 minutes and provide informed consent for participation and audio recording.	Unwilling or unable to participate fully or provide consent.

(Source: Freeman, 1984; Bryson, 2004; Yin 2018).

This approach guaranteed that each interview captured situated knowledge from statutory gatekeepers to the informal practices of on-site volunteers while excluding individuals whose views would add neither depth nor direct relevance to the case analyses. Recruitment was conducted through personalised invitations through emails explaining the purpose of the study and useful for participants' expertise. To maintain ethical standards, an information sheet was presented to all participants explaining the aims and methods of the study and the confidentiality of the results. Official written consent was then obtained from all participants before participation began. The research ensured that ethical considerations and the approved research protocol were followed to protect the rights of the participants - their participation in this research was voluntary, they could withdraw from the research at any time if they wished, and all their personal identities would be kept confidential (BSA, 2017). Purposive sampling and snowballing were used to ensure that different stakeholder groups were represented to collect comprehensive data. As Flyvbjerg (2001) suggests, this approach enhances a study's ability to examine governance structures and socio-political processes. The use of these techniques significantly increases the validity of the results; the combination consequently creates a well-rounded, empirically grounded study of BGI governance.

6.5.1 Interview Sample Size

When conducting qualitative research in governance contexts with complexity and diverse institutions, determining the sample size is not a fixed calculation but a process influenced by the purpose and context of the study (Mason, 2010; Patton, 2015). Qualitative approaches do not aim for statistical representation, but rather a rich, situated understanding of social practice, policy interpretation and relationship to institutions (Denzin and Lincoln, 2018). The principle of data saturation was applied when the researcher realised that enough data had been collected when no new theme emerged from the interviews (Glaser and Strauss, 1967; Morse, 2000).

In multi-actor governance systems, capturing a variety of experiences is essential as policies are interpreted and implemented differently depending on organisational roles, resources and institutional culture (Patterson et al., 2017). In this respect, it is not only saturation, but also the diversity of the actor landscape and the complexity of governance processes that influence sample size. In the context of BGI, actors from the public, private and third sectors each have different value capacities and interpretations of environmental policy (Healey, 2006; Carter and Kazmierczak, 2015). It is important to use a flexible and dynamic sampling strategy that also takes relationships into account. Table 6.8 summarises the key considerations that informed the sample size for this study, demonstrating that the final sample was determined not only by data saturation but also by the complexity of the governance context, the diversity of participants, and practical research considerations.

Table 6.8: Overview of possible justifications for the sample size in a qualitative study

Type of Justification	When is this justification applicable?
1. Data Saturation	When no new themes, insights or variations emerging from additional interviews.
2. Scope and Complexity	When the research involves many institutions, actors, or policy frameworks.
3. Resource Constraints	When limitations in time, funding or logistics

	constrain the number of interviews that can be conducted.
4. Norms and Heuristics	When guided by sample size norms or rules-of-thumb from similar qualitative studies.
5. Iterative/Emergent Design	When the study uses an adaptive approach where data collection and analysis happen in parallel.

(Source: Malterud et al., 2016).

Determining an appropriate interview sample in a study of multi-actor, multi-scalar governance requires more than adherence to arbitrary heuristics; it requires alignment with established criteria for informativeness and empirical evidence of saturation (Malterud et al., 2016). Malterud et al. (2016) argue that in a study involving multiple conceptual domains such as legislation, policy, governance, resources and stakeholders and drawing on a diverse participant pool, the threshold for sufficient information often exceeds twenty interviews. Baker and Edwards (2012) highlighted that unpacking contested policy meanings in the public, private and community sectors typically require between 30 and 50 interviews.

Hennink et al. (2017) further refine these parameters by distinguishing between code saturation, which is often achieved with 12–16 interviews, and deeper meaning saturation, which may require 25–35 in-depth interviews in heterogeneous samples. Accordingly, an initial target of 50 interviews was set. By the 24th interview, no new codes emerged and by the 30th interview, participants were repeating existing themes rather than contributing new insights, indicating complete saturation in both coding and conceptual understanding (Bowen, 2008; Charmaz, 2014). Continuing further interviews beyond $n = 30$ carries the risk of redundancy without contributing new analytical depth, which is consistent with Morse's (2000) warning against redundant data collection. A total of 30 interviews were conducted across the two case studies, not 30 per case. The distribution of participants varied between the cases and was guided by stakeholder relevance and availability within each site. This sample size was considered methodologically appropriate, as it provided

sufficient depth for both within-case analysis and cross-case comparison, while avoiding unnecessary data collection beyond the point of analytical saturation.

6.5.2 Adapting to Changes in Sample Size

According to Patton (2015), many scholars favour adaptive strategies in research that would unexpectedly arise with respect to participants as these are more flexible in terms of design. The interview process was designed to have a high degree of flexibility, to promote participation. Therefore, participants were offered flexible scheduling options, including evenings and weekends, along with a choice of interview formats, including face-to-face, telephone or video. As Creswell and Poth (2018) stated, these measures diminished the restrictions that would have impeded engagement, especially due to time or money. Moreover, the appropriate ethical consideration was maintained when participants cancelled an interview. Participants were also provided with the opportunity of alternative slots or help with any issues regarding the research process, but no undue pressure was applied in accordance with the ethical research process and guidelines. In cases where a participant withdraws after partially completing an interview, the data are kept only if they are sufficiently thorough and consent has been explicitly given to include the data in the study. It ensured that maintaining ethical integrity while also preserving some insight that contributed to the overall research (Bryman, 2016).

Furthermore, the study maintained ongoing checks for data saturation. The data collection was terminated after sufficiency was achieved; that is, further interviews were not anticipated to reveal any new or additional data (Guest et al., 2006). Although the initial target sample size was not strictly imposed, the study proceeded with a theoretically and methodologically justified sample size, ensuring the robustness, validity, and reliability of the findings (Mason, 2010). Moreover, this approach was consistent with qualitative research and strengthened the credibility of the findings.

6.5.3 Interview Design

The study's data was collected in accordance with the study's objectives using a well-structured interview guide (Kvale and Brinkmann, 2009; Turner, 2010). Structured surveys ensure consistency, but interviews especially for qualitative research, require a fluid and conversational style to best engage participants. Using existing best practices of qualitative interviewing, a semi-structured guide was developed to facilitate conversations and to elicit rich, context-specific evidence (Gill et al, 2008; King and Horrocks, 2010; Seidman, 2013). The research's conceptual framework guided the design of the guide and aligned the questions with the research's central ideas. The guide was arranged in such a way that development followed the order from open-ended questions to build rapport and elicit background information, to experience questions. According to King and Horrocks (2010), structuring allows participants to ease into the conversation, thus establishing trust and enhancing reflexivity.

To ensure clarity and reduce the risk of bias or misinterpretation, the development process was purposefully adapted (King and Horrocks, 2010; Patton, 2015). By utilising open-ended questions, participants were able to voice their standpoints in their own words. Such method is particularly suited in exploring a contested and variable phenomenon like governance arrangements (Rubin and Rubin, 2012). Moreover, the guide was written in a language that would be easily understandable by persons of different professions and education. This helped to make it inclusive and further reduce the potential for confusion, which is important when dealing with cross-sector stakeholders (King and Horrocks, 2010).

Expert review refined the interview guide. Question relevance and methodology were verified with respected researcher's feedback. According to Turner (2010), including experts in this process improves the clarity, fit and overall rigor of the research instrument. Maxwell (2013) stresses that this feedback will help bring the interview tool together with

theoretical goals without making it hard for participants. The changes made resulted in a guide that was analytically sound and practically useful. The final version included prompts and follow-up questions to encourage participants to elaborate on key concepts. This flexibility of the research approach proved to be very useful for the researcher during the data collection stage. According to Rubin and Rubin (2012), qualitative interviewing can be adapted due to the new narratives, tensions and themes that emerge during the discussion.

6.5.4 Structure of the Interview

In this study, the design and structure of the interviews were critical to the depth, contextualisation and reliability of the data set. Given the complex institutional landscape and stakeholder groups that characterise BGI governance in the selected case study areas, the interviews followed a carefully organised logical sequence. This helped to guide the conversation, avoid confusion and maintain cohesion across a variety of contexts that are both organisational and political (Roopa and Rani, 2012; Patton, 2015). Table 6.9 outlines the key stages of the interview, the focus of each stage, and the rationale for its inclusion, demonstrating how the interview structure was designed to generate comprehensive evidence across the main governance dimensions examined in this study.

Table 6.9: Structure of the Interviews – Key Stages and Justification

Stage	Focus	Justification
Introductory Context	Role and agency overview	Establish rapport and institutional framing (Rubin & Rubin, 2012)
Policy and Legal	Institutional-policy alignment	Explore how mandates shape implementation (Nowell et al., 2017)
Governance Dynamics	Responsibilities and coordination	Examine fragmentation and inter-agency collaboration (Kvale & Brinkmann, 2009; Mell, 2017)

Stakeholder Engagement	Inclusion of communities and NGOs	Assess participatory depth and legitimacy (Patton, 2015; Anguelovski et al., 2019)
Resource Constraints	Funding, staffing, expertise	Identify operational barriers (Thorne et al., 2015)
Reflections & Reform	Improvements to governance	Capture values, constraints, and system critiques (Seidman, 2013)

As outlined in Table 6.9, the interview protocol was designed to guide participants progressively from their specific institutional roles to broader reflections on BGI governance. The interview began with questions on the organisational context, including participants' roles, responsibilities, and strategic priorities within their organisations. This provided a focused starting point for discussion, allowing participants to reflect on their professional responsibilities while establishing rapport and clarifying institutional mandates before moving to more exploratory questions (Sabatier and Weible, 2014). Establishing such a foundation also helped to build rapport and clarify institutional mandates before asking further exploratory questions.

In the next part of the interview, participants were asked to note which legal and policy instruments (e.g. legal requirements, regulatory frameworks, local planning policies) they felt had most influenced the Perry Barr & Witton or Beales Corner projects. Participants reflected on the gaps, inconsistencies or ambiguities in these instruments and described how these were addressed/dealt with/researched in the fieldwork. This section was important in understanding how formal frameworks interact with local realities, revealing points of friction or adaptation when policy meets place (Angrosino, 2007).

The focus then shifted to governance dynamics. Questions covered how the responsibilities were allocated between the institutions, what mechanisms were made available for cooperation between the authorities, and whether there were institutional silos or power asymmetries leading to a challenge. Moss et al. (2015) state that such inquiry is necessary to comprehend the fragmentation that often occurs which complicates

the effective implementation of environmental infrastructure for cross-sectoral integration. Also, questions focused on the degree to which organisations, local communities, NGOs and other voluntary groups are involved in stakeholder engagement. Discussions were focused on participatory process like procedural fairness, transparency and legitimacy. These elements are becoming acknowledged as essential for the effectiveness and social sustainability of BGI interventions (Agyeman et al., 2016; Anguelovski et al., 2019).

6.5.5 Interview Procedure and Analytical Handling

Following the interview structure outlined above, the concluding set of interview questions dealt with the realities of institutional capacity, funding streams, staff shortages, access to technical expertise, but also provided room for normative reflection. Participants were invited to contemplate necessary changes in the present arrangements and the future overhaul of those arrangements towards achieving the desired objectives. The aim of this section was to gain a deeper understanding of the values, constraints and practical issues that influence governance processes involved in BGI (Corbin and Strauss 2008; Seidman, 2013). Each interview lasted for 45 to 60 minutes. This duration was sufficient to hold attention but not long enough to cause pressure. In advance, participants were provided with an information sheet and consent form. The sheet included further information about the voluntary nature of participation, confidentiality and that they could withdraw at any time (Kvale and Brinkmann 2009; Rubin and Rubin 2012). Interviews were recorded after consent was given and transcribed verbatim within 48 hours to preserve tone, inflexion and context (Emerson et al., 2011).

Utilizing the NVivo software, the data were subjected to analysis using a three-phase coding process which tagged descriptively phase and tagged thematically phase along with critical reflection. This approach led to the generation of new insights along with the study

framework while maintaining data-centric analysis (Charmaz 2014; Saldaña 2021). The dataset presented formal BGI governance dimensions as well as the everyday negotiations, relational work and institutional cultures that shape the understanding and enforcement of law and policy in practice. Given the robust body of existing literature identifying governance challenges in BGI implementation, explicit steps were taken to mitigate confirmation bias throughout the interview design and analysis. The interview questions were designed to be open-ended and process orientated rather than deficit led. This allowed participants to articulate successes, constraints and priorities from their own institutional perspective before being prompted with any critiques (Patton, 2015).

To minimise potential researcher bias and the influence of prior theoretical expectations, a reflexive approach was consciously and consistently applied throughout the research process. Reflexive notes were taken after each interview to capture immediate impressions, assumptions, and possible biases, and these were revisited during the coding process to ensure that the analysis remained grounded in participants' accounts rather than being driven by pre-existing expectations (Charmaz, 2014). Additionally, interview data were subjected to continuous comparison, with deliberate attention paid to contradictions, silences, and counter-narratives across the data (Bowen, 2009). This was done to ensure that the analysis did not simply confirm what was already suggested in the literature, but instead reflected the complexity and diversity of participant experiences. Furthermore, the coding process was carried out in stages, beginning with open coding and progressing to more focused thematic development, allowing themes to emerge from the data rather than being imposed in advance. At each stage, interpretations were revisited and questioned to ensure that they were supported by the data, thereby reducing the risk of bias influencing the findings.

6.5.6 Interview Administration

Determining the type of interview is not just a logistical consideration, but a methodological decision that affects the type and quality of the data collected. According to King and Horrocks (2010), interview strategies can be divided into three categories: Face-to-face interviews, remote interviews (telephone or online) and hybrid interviews (both face-to-face and remote). The various approaches essentially have advantages and disadvantages, which should be critically evaluated in relation to the epistemological assumptions, the objectives of the research and contextual requirements of the research (Seitz, 2016; Creswell and Poth, 2018). Face-to-face interviews have long been recognised as the main standard in qualitative research due to their ability to build rapport, obtain non-verbal cues and place participants in their social and material conditions (DiCicco-Bloom and Crabtree, 2006; Kvale and Brinkmann, 2009). While these characteristics prove particularly beneficial in policy and governance research studies, where power relations, institutional narratives and tacit knowledge play a major role, they are logistically intensive, geographically limited and further constrained by access issues, particularly in the case of high-level stakeholders and widely dispersed respondents (Gillham, 2005; Novick, 2008).

Remote surveys, including telephone and web-based formats (e.g. Zoom, Teams), offer greater flexibility, cost-efficiency and access to geographically diverse participants (Opdenakker, 2006; Weller, 2017). However, they can also reduce opportunities to build trust and interpret paralinguistic cues, potentially impacting data richness (Sturges and Hanrahan, 2004). Recent research suggests that digital relationship building is possible but often requires more conscious effort on the part of the interviewer (Irvine, 2011; Archibald et al., 2019). Hybrid strategies combining remote and face-to-face interviews are increasingly recognised for their pragmatic advantages, particularly in studies with long time periods or participants with variable availability (Sullivan, 2012). In the context

of this study, which explores the governance of BGI at institutional and geographical levels, the interview design was informed by a critical appraisal of these modalities. Table 6.10 provides a comparative assessment of the interview methods, evaluating their suitability in terms of accessibility to participants, sensitivity of the topic and the need for analytical depth and logistical feasibility.

Table 6.10: Comparative Evaluation of Interview Modalities in Qualitative Research

Interview Method	Advantages	Limitations	Suitability for BGI Governance Research
Face-to-Face	Builds rapport, Captures nonverbal cues	Time and cost intensive	High: Deep, complex discussions
Remote (Telephone/Online)	Flexible and cost effective.	Weaker rapport, Limited nonverbal cues	Moderate-High: Dispersed or busy stakeholders
Hybrid (Mixed Approach)	Combines depth and flexibility	Requires coordination; Variable data consistency	High: Complex or multi-site studies

(Source: Kvale and Brinkmann, 2009; King and Horrocks, 2010; Creswell and Poth, 2018; Seitz, 2016).

The study used a hybrid interview method that combined web-based interviews via Microsoft Teams with face-to-face interviews during site visits and observation. The reasons for choosing this method were pragmatic and methodological in nature and aimed to optimise the survey and fully capture the experiences of the study participants. In addition, web-based interviews are flexible, cost-effective and suitable for involving dispersed participants. Microsoft Teams enabled spontaneous participation with audio and video and the ability to observe facial expressions or hear tone of voice (King and Horrocks, 2010). A unified digital platform helped to standardise interview conditions and prevent them from varying too much.

However, web-based interviews alone have their limitations, particularly the inability to

capture the physical and environmental context of participants' experiences (Opdenakker, 2006; Sedgwick and Spiers, 2009). Therefore, interviews were combined with observations to achieve greater depth and contextualisation of the operational challenges of BGI (Yin, 2014; Creswell and Poth, 2018). By interviewing participants in their natural environment, it is possible to observe behaviours, interactions and attitudes that would not be possible in a normal interview. This is in line with the principle of qualitative research to investigate phenomena in the context in which they occur (Creswell and Poth, 2018). In addition, participants were more relaxed and gave more natural responses as the interviews were conducted while they were going about their normal activities.

Importance of ethical considerations in research design Before participating in the study, participants were given information sheets and consent forms to explain the study, the process and how the data would be used (Kvale and Brinkmann, 2009). The interviewees gave their consent for the interview to be recorded. The transcripts of the online interviews were recorded using Microsoft Teams, while the face-to-face interviews were recorded using a secure audio recording device. Due to the limitations of the automated transcription process, all transcripts were reviewed and corrected by hand to ensure accuracy, particularly regarding accents, terminology and overlaps (Creswell and Poth 2018).

6.6 THEMATIC ANALYSIS

Thematic analysis was the most suitable technique from the methods available in the literature due to the qualitative nature of the data. Thematic analysis offers sufficient flexibility and structure to facilitate critical engagement with complex governance processes while providing a structured way of interpreting empirical material (Braun and Clarke, 2006; Nowell et al., 2017). The analysis began by getting acquainted with the qualitative data. To code qualitative data an immersive process of reading and re-reading

transcripts, listening and viewing recordings, and annotating initial impressions. At this stage, some preliminary patterns and contradictions were identified, which set the stage for more systematic analysis. This phase was critical to developing contextual sensitivity as well as helping the researcher stay alert to the explicit content and any underlying institutional tensions in the data.

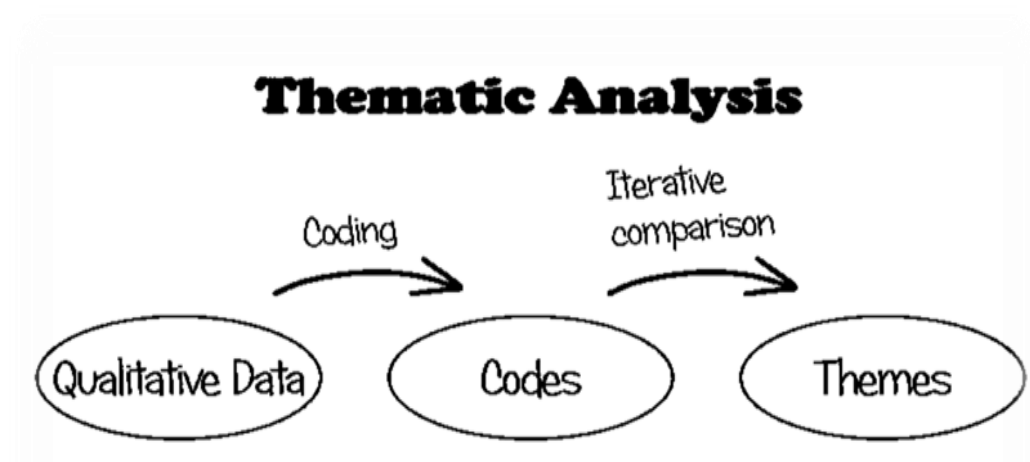


Figure 6.2: Thematic Analysis Process; Source: (Braun and Clarke, 2006)

The process of generating codes was the next step. Codes are discrete labels that capture the meaningful features of data. The codes used were not pre-determined but were instead developed from the data through an inductive process. The researcher's bottom-up approach kept him close to the participants' interpretations and institutional language while allowing him to start detecting recurring challenges, enablers and tensions in BGI implementation. Coding was done through hand coding to be engaged closely with the data, which was supported through the analytical memos to document evolving thoughts and new conceptual links. After coding was completed, the codes were examined and grouped into larger themes. This phase went beyond describing meaning to interpreting meaning. Codes were grouped together based on similarity in concept or their relevance to specific dimensions of governance such as fragmentation of institutions, regulatory

ambiguities etc. The clusters were then evaluated for internal consistency and external distinctiveness (Braun and Clarke, 2019). The objective was to formulate themes, broadly revealing deeper patterns across the dataset but always sufficiently grounded in the data. At this point, the themes were treated not just as summaries of the data, but as analytical constructs that reveal structural or institutional dynamics around BGI governance. For example, several codes relating to limited collaboration, fragmented responsibilities and overlapping mandates were summarised into one theme of ‘fragmentation of governance’. The refinement of the themes was facilitated by the research aim and the conceptual framework. The next step was to analyse the themes in relation to the overall data set and conceptual framework of the study. Where overlaps were identified, the themes were refined, renamed or merged. The thematic structure was assessed to ensure the coherence and explanatory power of the data analysis. At this stage, the data extracts were linked to the themes to ensure that the interpretations were empirically sound and analytically defensible.

The final step was to define and name the themes and then develop the narrative synthesis. This narrative explanation was organised around the key governance issues to show how the implementation of BGI is influenced by institutional contexts, stakeholder perspectives and political mechanisms. By relating the issues to the original literature and conceptual framework, the analysis provided theoretical and practical relevance. The analysis also consistently met the recognised criteria for qualitative rigour. Triangulation of interview, documentary and observational data was sought to ensure credibility; iterative coding and ongoing reflexive note-taking were utilised for reliability; and a thick contextual description of governance processes and institutional dynamics was achieved for transferability (Nowell et al., 2017; Lincoln and Guba, 1985). This approach helped to ensure interpretative depth while being sensitive to the socio-political and institutional context of BGI governance in England. Most importantly, the development of themes was

guided by the study's conceptual framework, which encompasses policy translation, institutional structure and governance fragmentation in the provision of BGI. As a result, the final thematic structure was empirically grounded, analytically coherent and theoretically informed.

6.7 ETHICAL CONSIDERATIONS

Ethical considerations are a concern for every researcher and every institution conducting research. As far as practicable, any research involving human participants should be based on the voluntary consent of the participants (SRA, 2003). Research into the legal and policy framework for BGI on flood management requires information on the experiences of participants. Therefore, the method of data collection chosen for this research must be subject to rigorous ethical scrutiny. Consequently, the main ethical concerns raised by this research are ensuring integrity and confidentiality. Participation in this study was primarily on a voluntary basis. Participants are under no obligation to take part in the study and have the option to decline participation at any stage of the study. Therefore, participants were given a consent form at the beginning of the data collection. They were also informed about the purpose of the interview and the potential benefits of the study. The consent form and introductory letters can be found in Appendices A 3 and A-4 respectively. Names, locations and organisational characteristics that could reveal the participant's identity will be deleted during transcription and analysis. The results are provided in such a way that only the research team has access to the raw data and individual participants cannot be identified, so that participants can speak without fear of potential consequences (Bryman, 2016).

The retention and disposal of data are also an important ethical consideration. In line with BCU data management guidelines and the UK GDPR, all data are retained for 5 years. As

part of institutional practices, the retention period allows for review, publication of results and follow-up work, while preventing indefinite storage without purpose (UK Data Service, 2026). All data will be permanently deleted and securely destroyed at the end of this period in line with BCU policy. This erasure may include deletion from secure servers or shredding of paper copies so that they cannot be retrieved or misused (Van den Eynden et al., 2011). The ethical steps taken in the research design of the study enabled the scientific integrity of this study. Careful planning ensured that the rights of the participants were protected, the data were secure, and the integrity of the study was maintained. This study has developed a solid framework that ensures appropriate methodology and sound scientific research. In line with the established trend, Birmingham City University (BCU) has implemented a rigorous ethical validation process to help researchers maintain an appropriate standard. Full ethical approval was therefore granted by the University's Ethics Committee before the study commenced. The approval letter can be found in the Appendix.

6.8 CHAPTER SUMMARY

This chapter has outlined and justified the methodological approach adopted to investigate how BGI governance operates in practice within flood risk management. Grounded in an interpretivist epistemology and critical realist ontology, the qualitative multiple case study design enabled examination of how legislation, policy, and governance arrangements are interpreted and enacted across contrasting urban and rural contexts. Through a combination of interviews, documents analysis and site visits, the research methodology can capture the institutional, organisational, and relational factors influencing BGI adoption while providing analytical rigour through triangulation and reflexivity. This approach will allow for direct empirical insight into the study's conceptual governance framework. This approach provides an opportunity to analyse aspects such as legislative

and policy conditions; governance coordination; resource capacities; and stakeholder engagement. The next chapter applies the framework to the case studies, examining how these governance dimensions shape BGI delivery in practice.

CHAPTER 7: THE PERRY BARR AND THE WITTON FLOOD DEFENCE SCHEME

7.0 INTRODUCTION

This chapter looks at the Perry Barr and Witton Flood Risk Management Scheme as a case study, focusing on how it was developed, designed, and delivered within current flood risk management practice. The scheme, located near the River Tame, was introduced to address flooding in an area that has experienced repeated flood events. The analysis is guided by the conceptual framework developed in Chapter Five, which is based on four key dimensions: legislation and policy, governance, stakeholder engagement, and resources. These dimensions are used to organise the chapter and to explore how different factors influenced the delivery of the scheme in practice.

The chapter draws on document analysis, semi-structured interviews, and site observations. Documentary sources included scheme reports, planning documents, and Environment Agency publications, with further details provided in Appendix B-1. Interview participants were anonymised and are presented using participant codes alongside their roles. Table 7.1 provides an overview of the participants by role, organisation, and sector, illustrating the breadth of perspectives represented in the case study, while Appendix B-3 provides the full anonymised participant list. The interview questions were developed from the four dimensions of the framework and are provided in Appendix B-2. The findings are presented in line with these areas, drawing on participants' responses and supported with relevant explanation to show how the scheme was delivered. Through this approach, the chapter gives a clear picture of how the framework can be applied in a real project setting. The specific contribution of this case study is discussed in the chapter summary. Overall, the chapter is organised around the

four dimensions of the framework, while the more detailed interpretation of the findings is presented later in Chapter Nine

Table 7.1: Summary of Interview Participants (Source: Author's compilation from interview data)

Interviewee No.	Organisation	Sector
1	National Agency	National Agency
2	Engineering Consultancy	Private Sector
3	Engineering Consultancy	Private Sector
4	Local Authority	Local Authority
5	National Agency	Public Sector
6	Local Authority	Local Authority
7	Environmental Consultancy	Private Sector
8	Engineering Contractor	Private Sector
9	Local Authority	Local Authority
10	Local Community	Resident
11	National Agency	National Agency
12	Local Authority	Local Authority
13	Engineering Contractor	Private Sector
14	Environmental Consultancy	Private Sector
15	Planning Consultancy	Private Sector
16	Utility Company	Private Sector
17	Environmental Consultancy	Private Sector
18	National Agency	Public Sector
19	Local Authority	Local Authority
20	Engineering Contractor	Private Sector
21	Local Authority	Local Authority
22	National Agency	National Agency
23	Utility Company	Private Sector
24	Engineering Consultancy	Private Sector
25	Local Authority	Local Authority
26	Local Community	Resident
27	Local Community	Resident
28	Environment Agency	Public Sector
29	Consultancy	Private Sector
30	Community Group	Community Stakeholder

7.1 BACKGROUND OF THE SCHEME

The Perry Barr and Witton Flood Risk Management Scheme represent a significant addition to Birmingham's network of flood infrastructure, to tackle the fluvial flood risk along the River Tame. The scheme aims to address the history of severe flooding along the Perry Barr and Witton corridors which has dramatically disrupted social, economic

and physical infrastructure. The project will build flood protection for more than 1,400 residential and commercial properties. This reflects the extent of exposure and vulnerability within this highly urbanised catchment. The scheme comprises a series of interconnected structural flood defence measures distributed across catchment. The Forge Mill flood retention reservoir is the largest upstream component of the River Tame and is located at Sandwell Valley Country Park, around 5 km north-east of West Bromwich (Figure 7.1). The reservoir functions as a flood detention basin intended to store excessive surface water generated during high flows and to release the water in a controlled manner. As a result of lessening peak flows, it reduces hydraulic pressure from downstream and flood risk on the lower River Tame where urban development is most concentrated.

Figure 7.1 situates the Forge Mill flood retention reservoir within the wider Perry Barr and Witton Flood Risk Management Scheme. The spatial configuration is important for understanding how upstream storage interventions were positioned to reduce downstream flood risk in highly urbanised areas, and it provides geographical context for key planning and delivery decisions discussed later in the chapter. The diagram illustrates the connectivity between the reservoir site, the River Tame, upstream and downstream flood pathways, and the surrounding residential areas. This spatial arrangement shows that Forge Mill functions as an upstream intervention designed to regulate river flows before they reach more densely developed urban zones. The figure also highlights the reservoir's location at the urban fringe, where open green space transitions into residential neighbourhoods.

The Forge Mill reservoir site is in a semi-rural setting on a multi-use public landscape, which is made up of recreational, ecological and cultural assets. According to Figure 7.1, the reservoir is situated within Sandwell Valley Country Park with adjacent footpaths, lakes and open land, while at the same time having good access to major transport infrastructure and surrounding housing estates. This spatial context illustrates the need for

flood risk management infrastructure which must co-exist with a wide range of land-use pressures and non-flood functions. Consequently, the scheme's performance depends not just on the structural behaviour of engineered components but also on a wide variety of operational and contextual issues. This includes the long-term upkeep of hydraulic works, reliability of automatic gate systems, and coordination between flood control and emergency management authorities and adjacent land uses. The location of the reservoir in a public place raises issues of public access, environmental stewardship and land use compatibility. In this sense, while this infrastructure is essentially static, it must work under a constantly changing urban and hydrological situation. Without sustained monitoring, adaptive management, and integration into wider urban systems, there is a risk that the scheme functions as rigid infrastructure, potentially limiting its responsiveness to changing climatic conditions, evolving land-use pressures, and long-term sustainability objectives.

Figure 7.1: Location of the Forge Mill Flood Retention Reservoir (EA, 2023c)



As shown in Figure 7.1, the Forge Mill flood retention reservoir is located in Sandwell Valley, along the River Tame, surrounded by a mix of open green space and residential areas. The illustration shows the placement of the reservoir in a larger multi-use landscape of parkland, water and urban neighborhoods. It also shows the relationship between the reservoir, the river corridor, and the surrounding transport-settlement system. This spatial context is important for understanding how the scheme developed in different sites within the catchment. Specifically, the sequencing of project stages reflected in the decision timeline in Section 7.2.1 reveals how BGI is positioned as an upstream intervention in a wider flood risk management system.

7.1.1 Decision Timeline of the Perry Barr and Witton Flood Risk Management Scheme

The development and delivery of the Perry Barr and Witton Flood Risk Management Scheme followed a clear sequence of stages, with decisions taken at different points shaping how the project was defined and carried out to completion. The main phases of the scheme are summarised in Table 7.2. At the early stage of the project, before 2015, the focus was on identifying flood risk along the River Tame through hydrological modelling and developing suitable options for managing fluvial flooding. At this point, the scheme was outlined, with proposals prepared alongside environmental assessments and stakeholder consultation. Although environmental considerations were recognised at this stage, BGI was not a central feature of the initial scheme design. This stage essentially set the direction for everything that followed.

The first phase of construction, delivered between July 2015 and Spring 2017, involved putting in place flood defence infrastructure within the urban areas of Perry Barr and Witton. This included the construction of flood walls and conveyance improvements aimed at reducing flood risk to residential and commercial properties along the River

Tame corridor, in line with statutory requirements. During this phase, delivery was largely engineering-led, with limited integration of BGI elements.

The second phase, which was delivered between early 2018 and March 2022, introduced the construction of the Forge Mill flood storage reservoir as an upstream intervention. This phase extended the scope of the scheme to include flood storage capacity for regulating downstream flows. It was at this stage that opportunities for incorporating BGI became more visible, particularly through landscape integration, environmental mitigation, and multifunctional use of the reservoir site. During this period, design adjustments were made, and environmental mitigation measures, as well as provisions for public access, were incorporated in response to planning requirements, environmental regulation, and stakeholder engagement.

The final stage, between 2022 and 2023, covered completion and commissioning, including final landscaping and the establishment of operational arrangements. At this point, the scheme became fully operational as a flood risk management system. BGI elements were incorporated primarily as complementary features, supporting but not fundamentally reshaping the overall engineering-led design. Overall, the timeline presented in Table 7.2 provides an illustration of how the scheme moved from planning to delivery across different stages.

Table 7.2: Decision Timeline and Delivery Stages of the Perry Barr and Witton Flood Risk Management Scheme

Project Stage	Time Period	Duration (Approx.)	Key Activities	Outputs / Infrastructure Delivered	Decision Context
Scheme Development and Planning	2014 – 2015	~1–2 years	Flood risk identification and scheme planning	Flood risk delineation and option selection	Environment Agency–led with stakeholder input
Detailed Design and Pre-Construction	2015	~1 year	Detailed design and technical preparation	Approved engineering designs	Multi-agency coordination
Phase 1 Construction (Urban Flood Defences)	July 2015 – Spring 2017	~2 years	Construction of urban flood defences	Urban flood defences delivered	Statutory compliance framework
Operational Performance (Early Testing)	2017 – 2020	~3 years overlapping	Operational testing and performance monitoring	System performance demonstrated	Centralised operational oversight
Phase 2 Construction (Forge Mill Flood Storage)	Jan 2018 – March 2022	~4 years	Construction of upstream flood storage infrastructure	Forge Mill reservoir constructed	Cross-authority coordination
Final Completion and Commissioning	2022 – 2023	~1 year	Final completion, landscaping, and commissioning	Fully operational scheme (~1,400 properties protected)	Formal commissioning by Environment Agency

Source: (EA, 2018b; EA, 2021; EA 2023c; and Interview data)

7.2 OBSERVATION OF SITE INFRASTRUCTURE AND SPATIAL LAYOUT

Observation was used to examine how the scheme is physically configured and how it operates in practice, in line with the approach outlined in Chapter Six. The site conditions observed were used to support and complement the interview and documentary evidence, helping to ground the analysis of how BGI is actually implemented within the constraints of the site.

The visit focused on documenting the existing physical infrastructure, operating conditions, safety measures, and access patterns visible on site, with particular attention to how green-blue elements interact with engineered flood defence structures. Photographs were taken to capture specific features encountered during the visit and to support the documentation of observable site conditions (Figure 7.2).

Figure 7.2: Site observations at the Forge Mill flood retention basin (Author's field photograph)



(a) Primary spillway and associated control structures; (b) Debris accumulation at outlet gates during winter conditions; (c) Flood defence safety signage and restricted access; (d) Public use of the circular footpath across the embankment during winter conditions.

The main spillway, together with the associated control structures, is clearly visible at the centre of the basin (Figure 7.2a). These structures allow water to be stored and released in a controlled way when river levels increase. While these are mainly engineered features, they sit within a wider green landscape made up of vegetated embankments, open space, and public access routes. This shows that BGI is present in the scheme, but mainly as part of the wider landscape setting rather than as the main organising feature of the infrastructure.

During the visit, debris accumulation was observed around the outlet and gate structures under winter conditions (Figure 7.2b). Organic material and litter were present at these

control points, showing how natural processes and everyday site use interact with engineered flood defence components. These observations point to the maintenance demands that come with combining green-blue settings with operational flood infrastructure, particularly where vegetation, water movement, and debris can affect control structures.

Site visits also documented access control and safety measures within the publicly accessible environment. Safety signage identifying the area as a flood defence structure was present across the site, alongside fencing and restricted access around key infrastructure components (Figure 7.2c). These measures show how public access is managed where flood defence infrastructure operates within a landscape that also serves recreational and amenity functions.

Patterns of public use and access were also noted during the visit. Maintained pathways and clearly defined access routes indicate that public movement through the site has been incorporated into the layout of the basin, while physical barriers separate operational infrastructure from publicly accessible areas (Figure 7.2d). These observations show that the site performs both flood management and public amenity functions, although the operational requirements of flood defence remain dominant. Overall, the observation data provide contextual evidence of how BGI is incorporated into the Perry Barr and Witton scheme. The site demonstrates some green-blue qualities through its vegetated landscape, flood storage function, and public access arrangements, but these elements operate alongside and in support of the main engineered flood defence system.

7.3 EMPIRICAL FINDINGS STRUCTURED BY THE CONCEPTUAL FRAMEWORK

7.3.1 Legislation and Policy

This section presents findings on the legislative and policy context shaping the Perry Barr and Witton Flood Risk Management Scheme, drawing on semi-structured interview data and documentary evidence.

Participants were asked about the policy and legislative frameworks influencing the scheme, they described the project as being developed in line with statutory flood risk management requirements. The early stages of development were associated with achieving defined flood protection standards and securing regulatory approvals prior to construction. Interviewee 3, a consultant stated that *“we were focused on defining flood zones and specifying the structural elements needed to manage flow at that stage; BGI was not part of the conversation.”* Scheme documentation identifies flood risk performance and statutory compliance as key considerations during early design stages. BGI features were not described as forming part of the initial design approach. This indicates that statutory requirements played a key role in shaping the initial design of the scheme, with other considerations viewed as secondary.

Regarding how legislative responsibilities were organised, participants referred to roles being distributed across national and local authorities in relation to flood risk management, drainage, and planning. These roles were described as formally defined but carried out across separate organisational areas in practice. Interviewee 4, a local authority officer, stated that *“the roles were clear in theory, but in practice, everyone focused on their own bit; there was not much joint working.”* Responsibility for different aspects of the scheme was therefore associated with separate institutional functions. This suggests that while the roles were established at formal level, their implementation reflected fragmented working practices across institutions.

In relation to how legislation influenced design decisions, participants described statutory safety and engineering requirements as shaping the technical configuration of the scheme. These included requirements linked to reservoir safety, embankment design, and storage capacity. Interviewee 2, a consultant, stated that *“the legislation dictated the design before any other elements, including ecological features, really came into play.”* Project documentation identifies engineering standards and safety requirements as forming part of the design specifications for the scheme. Ecological and BGI-related features were described as being considered after these requirements had been addressed. This shows that legislative and safety requirements were prioritised in determining the core technical design of the scheme.

With respect to the role of policy and guidance, participants referred to national planning policy as providing an overall framework for the scheme, while detailed design decisions were linked more directly to statutory requirements. Non-statutory guidance was referenced in relation to drainage and layout during later stages of the project. Interviewee 6, a local authority officer, stated that *“we used the manual to guide how we integrated drainage features into the urban layout.”* Documentary sources include reference to technical guidance such as the CIRIA SuDS Manual in relation to drainage and design considerations. These elements were described as being incorporated alongside the main infrastructure. This indicates that policy and guidance supported the implementation of design elements but did not determine the core structure of the scheme.

Environmental regulation was also described as influencing the inclusion of ecological and biodiversity measures. Participants working in ecological roles referred to these features as being introduced in response to regulatory requirements. Interviewee 5, a national agency officer, stated that *“many of the ecological features were not part of the original design vision; they were added later to meet regulatory requirements.”* Interviewee 7, a consultant, stated that *“for every one tree that was*

removed during the works, five trees were replanted to support biodiversity.” Environmental and biodiversity requirements are also identified within project documentation and regulatory guidance. These measures were described as part of compliance with environmental regulations. This indicates that ecological measures were primarily driven by regulatory compliance rather than being embedded within the initial design strategy. The legislative, policy, and regulatory instruments identified through interview accounts, and supported by documentary evidence, are summarised in Table 7.3. The table brings together the principal statutory and policy frameworks that influenced the scheme, illustrating how legislative requirements, planning policy, and environmental regulation collectively shaped its implementation.

Table 7.3 Key Legislative, Policy and Regulatory Instruments Shaping the Perry Barr and Witton Scheme (Source: Author's analysis based on interview data and documentary evidence)

Instrument	Status	Research Question Focus (Relevance to the Scheme)
Flood Risk Regulations (2009)	UK legislation	How flood risk assessment and mapping requirements were applied during scheme planning and design
Flood and Water Management Act (2010)	UK legislation	How statutory responsibilities between the Environment Agency and Lead Local Flood Authorities were understood and enacted
Reservoirs Act (1975)	UK legislation	How reservoir safety legislation shaped embankment design, storage capacity, and engineering decisions
National Planning Policy Framework (NPPF)	National planning policy	How national planning policy was considered within the overall framing of the scheme
Birmingham Flood Risk Management Strategy	Local policy	How local flood risk strategy informed understanding of flood risk within the urban area
Worcestershire Flood Risk Management Strategy	Local policy	How upstream flood risk considerations were reflected in scheme planning
CIRIA SuDS Manual (2015)	Technical guidance	How non-statutory drainage guidance informed detailed drainage and layout decisions
Water Framework Directive (2000)	EU regulation	How ecological and water quality requirements were addressed within scheme delivery
Biodiversity Net Gain requirements	Statutory requirement	How compensatory planting and habitat replacement measures were incorporated into the scheme

Across the accounts provided, the legislative and policy framework was associated with the sequencing of decisions within the scheme, where statutory flood risk and safety requirements were addressed at earlier stages, and planning and environmental considerations were incorporated at later stages. Within this process, BGI features were described as being included alongside the main flood defence infrastructure. Thus, the findings show that legislation and policy played a structuring role in shaping design priorities, institutional responsibilities and the incorporation of additional features within the scheme.

7.3.2 Governance

This section presents findings on the governance arrangements of the Perry Barr and Witton Flood Risk Management Scheme, based on semi-structured interview data.

When asked about how governance responsibilities were organised within the scheme, participants consistently referred to the Environment Agency (EA) as the lead authority. The EA was described as holding decision-making responsibility, particularly in relation to flood risk management along the designated main river. Interviewee 1, a national agency officer, stated that *“as the lead agency for flood risk on a designated main river, the Environment Agency retained decision-making authority, with local stakeholders consulted rather than empowered.”* These accounts position the EA at the centre of governance arrangements, with other organisations operating within its oversight. This indicates that governance was structured around a centralised authority, where decision-making power remained concentrated rather than distributed across stakeholders.

When discussing the range of actors involved in the scheme, participants referred to the involvement of multiple organisations with defined roles. These included local authorities,

utility companies, contractors, and private landowners. Responsibilities were described as distributed across these actors, with local authorities associated with planning and surface water management, utility companies with infrastructure coordination, contractors with construction delivery, and landowners with access arrangements. Interviewee 5, a national agency officer, stated that *“LLFAs handled surface water, utilities managed mains connections, councils managed planning consents, and contractors delivered on-site works.”* This distribution of roles reflects a multi-actor governance arrangement in which responsibilities are clearly defined but separated across organisations. This suggests that governance was managed through separate institutional roles, requiring coordination rather than integrated working across organisations.

When describing how coordination and decision-making were carried out, participants mentioned formal approval processes and ongoing interactions between organisations. Instances were described where agreements with local authorities were revisited during the project lifecycle. Interviewee 2, a consultant, stated that *“agreements with Sandwell Council were repeatedly revisited as leadership changed, but final approvals always required EA sign-off.”* Participants also referred to coordination across administrative boundaries, particularly between Birmingham City Council and Sandwell Metropolitan Borough Council, where project activities overlapped. These accounts indicate that coordination was managed through formal structures but required ongoing adjustment during delivery. This shows that governance was based on formal approval processes, but in reality, needed to be flexible and negotiable between actors.

When referring to governance processes guiding implementation, participants described the use of formal procedures such as Project Safety and Risk Assessments (PSRAs). These were associated with decisions relating to safety measures and public access around scheme infrastructure. Interviewee 4, a local authority officer, stated that *“PSRAs dictated barrier placement near schools and estates; without them, compliance would be*

impossible.” Regular meetings involving delivery and regulatory actors were also described as part of governance arrangements. Interviewee 1, a national agency officer, stated that *“formal meetings preserved accountability but added lead-times of several weeks for routine approvals.”* These processes were described as supporting compliance and coordination within the scheme. This indicates that governance processes functioned as mechanisms for ensuring compliance, while also introducing procedural constraints to decision-making.

When discussing technical coordination within governance arrangements, participants referred to hydrological modelling carried out by Worcestershire County Council at earlier stages of the project. This data was incorporated into Environment Agency modelling during scheme development. Interviewee 6, a local authority officer, stated that *“their runoff data was crucial for storage calculations; it was incorporated into EA modelling outputs even after handover.”* This reflects the role of shared technical inputs in supporting decision-making within the governance structure. This suggests that technical expertise and shared data played a key role in informing decisions across organisations. The governance actors identified through these accounts, and their roles, are summarised in Table 7.4.

Table 7.4: Governance Actors, Roles, and Evidence Interviews in the Perry Barr and Witton Flood Risk Management Scheme (Source: Author’s analysis of semi-structured interview data)

Governance Actor	Role / Responsibility	Scale	Evidence Interviews
Environment Agency (EA)	Lead delivery body; regulatory oversight; statutory compliance	National / Regional	Interview participants stated that the EA held decision-making authority and issued final approvals for the scheme.
Birmingham City Council	Lead Local Flood Authority; flood planning and approvals	Local	Participants reported involvement in surface-water management and planning approvals, with coordination

Sandwell Metropolitan Borough Council	Planning consents; community liaison; land coordination	Local	required with the EA. Interview accounts referred to planning consent responsibilities and coordination relating to construction activity within Sandwell.
Worcestershire County Council	Upstream catchment planning; technical input	Regional	Participants reported that hydrological modelling data were provided during early stages and incorporated into EA modelling outputs.
Lead Local Flood Authorities (LLFAs)	Surface-water management; SuDS responsibilities	Local	Interview participants described LLFA involvement in surface-water considerations alongside EA-led flood risk management.
Utility Companies	Infrastructure coordination; asset protection and access	Regional / Private	Participants referred to coordination requirements related to existing utility assets and access constraints.
Private Landowners	Land access agreements; easements	Local / Private	Interview participants reported negotiations to secure land access and easements for scheme delivery.
Community Groups	Engagement and consultation; local knowledge	Local	Participants described community group involvement through consultation and engagement activities.
Contractors and Developers	Construction management and delivery	Project level	Interview accounts referred to contractors delivering works in accordance with EA instructions and contractual arrangements.

Participants described governance of the scheme as involving multiple organisations with defined institutional responsibilities, with the Environment Agency holding a central role in decision-making. Responsibilities were distributed across actors, with each organisation associated with specific aspects of planning and delivery. Within this

arrangement, BGI features were incorporated alongside the main flood defence infrastructure, within the existing governance structure. Overall, the findings show that governance was characterised by centralised authority, formalised processes, and coordinated but fragmented institutional roles.

7.3.3 Stakeholder Engagement

This section presents findings on stakeholder engagement during the Perry Barr and Witton Flood Risk Management Scheme, based on semi-structured interview data.

When asked about how stakeholders were engaged during the scheme, participants described a range of activities involving residents, landowners, businesses, and statutory bodies. Different communication methods were used to share information about the project and its expected impacts. These included leaflets, public sessions, and direct engagement with affected groups. Interviewee 9, a local authority officer, explained that *“some residents liked the leaflet on their doorstep; others attended library sessions.”* From the accounts given, engagement approaches were adjusted to suit different stakeholder preferences. This shows that engagement was quite flexible, but in reality it was more about keeping people informed than actually involving them in decisions.

When describing how engagement influenced the scheme, participants referred to changes made during delivery following stakeholder interactions. These included measures such as noise-reducing embankments, adjustments to the golf course layout, and ecological features like nesting islands. While stakeholders did influence some changes, this was mostly at a detailed level rather than shaping the overall design of the scheme. These were discussed in relation to ongoing engagement during construction, including areas where BGI features were introduced.

When discussing the role of stakeholders in enabling delivery, participants often referred to land access. Interviewee 8, a contractor, stated that *“without these stakeholders we would not have been able to build the reservoir where we did; access was absolutely critical.”* Participants also described difficulties in negotiating with some landowners. Interviewee 8 further noted that *“one landowner would not talk to us at all; months of negotiation and senior-level intervention were required to get access.”* These accounts describe how engagement was linked to securing access needed for the project. This really highlights how important engagement was, especially when it came to getting access to land and making the project possible.

When asked about differences in engagement, participants described variations in how stakeholders took part. During the COVID-19 period, engagement moved online, which did not work for everyone. Interviewee 10, a resident, stated that *“virtual calls did not suit everyone, and we lost a lot of engagement.”* Participants also mentioned that some stakeholders were less involved than others. Interviewee 9, local authority officer, stated that *“we reached out repeatedly, but some people just didn’t have the time to take part in our activities.”* This also suggests that not everyone was equally involved, and some stakeholders had more opportunity to influence things than others.

When discussing factors affecting engagement over time, participants referred to changes in local political leadership and the length of the project. Interviewee 4, a local authority officer, stated that *“changes of leadership meant that agreements were constantly revisited.”* This shows that engagement was not just about the process itself but was also affected by things like leadership changes and how long the project went on for. Participants also referred to the timing of construction and the communication provided during delivery. Interviewee 10, a resident, noted that *“the five years of works seemed long, but updates told us the purpose of each phase.”*

When describing the range of actors involved, participants referred to the number of groups engaged throughout the project. Interviewee 8, a contractor, stated that “*local councils, water companies, landowners, community groups and contractors all had a piece of the puzzle.*” Participants described stakeholder engagement as involving consultation, information sharing, and communication with affected groups across different stages of the scheme. Engagement activities were linked to specific adjustments made during delivery, including areas where BGI features were incorporated. Engagement was described as consultative in nature within the overall delivery of the scheme. Consequently, engagement seems to have been more about communication and small adjustments, rather than having a real influence on key decisions.

7.3.3 Resources

This section presents findings on the physical, operational, and financial resources supporting the Perry Barr and Witton Flood Risk Management Scheme, based on semi-structured interview data and documentary evidence. In discussing the physical resources used in the scheme, participants described the main components of the flood retention system. These included the earth embankment, inlet and outlet structures, culverts, and control equipment. Interviewee 13, a contractor, stated that “*the embankment, inlet and outlet structures, and the control equipment are the major components of the system.*” These elements were described as forming the core infrastructure of the scheme. This makes it clear that most of the resources went into delivering the main flood defence structures. Participants also referred to vegetated embankments and landscape features associated with the site, which were linked to BGI elements within the wider scheme layout.

Participants also referred to the operational systems used to manage and monitor the scheme. These included downstream gauges and a control building where sluice gates are

operated once set thresholds are reached. Measures were also described to ensure continuity during system failure. Interviewee 1, a national agency officer, explained that *“the telemetry feeds into the control building, so when levels hit the trigger points the gates operate automatically, and if there’s a power cut the backup systems keep everything running.”* In simple terms, these systems were there to make sure the scheme worked properly and could keep running without issues. These systems were described as supporting the management of water flows, including areas where green-blue features interact with engineered infrastructure.

In relation to maintenance and day-to-day management, participants described routine activities such as inspection, vegetation clearance, and debris removal. These tasks were carried out by contractors, particularly at key control points. Interviewee 13, a contractor, stated that *“we examined the automated options, but manual clearance is what we use, being the more viable choice for this site.”* This shows that decisions around maintenance were mainly based on what was practical and affordable on site. Operational oversight was also described as being coordinated through the control building, where alarms are monitored and response teams are deployed when necessary. Interviewee 1, a national agency officer, noted that *“the alarms come into the control room, so if something triggers, the team is called out to check it and make any adjustment.”* Participants also referred to vegetation management and site maintenance associated with the landscape, including areas linked to BGI features.

When asked about financial resources, participants described the funding structure supporting the scheme. Funding was mainly provided through Flood and Coastal Erosion Risk Management Grant-in-Aid, alongside contributions from local authorities and other public sources, which required formal approval, this is also reflected funding guidance in Environment Agency funding guidance and project documentation. Interviewee 5, national agency officer, stated that *“the core funding was Flood and Coastal Erosion Risk*

Management Grant-in-Aid with added support from the councils.” So overall, the project relied heavily on public funding to be delivered.

Participants also referred to changes in project costs during delivery, including increases linked to inflation, design changes, and delays. Interviewee 7, a consultant, explained that *“costs went up because materials and labour became harder to secure, so additional funding had to be agreed to keep the project moving.”* These accounts describe how financial resources were allocated to support the delivery of the scheme, including both core infrastructure and associated environmental and landscape elements. It also shows that things do not stay fixed, and costs had to be adjusted as the project progressed.

With respect to financial management, participants referred to processes such as annual budget submissions, cost monitoring, and audit requirements linked to the funding framework. Interviewee 5, a national agency officer, stated that *“every pound invested returns multiple pounds in avoided damages.”* This reflects how important accountability was in managing the project finances. The funding sources identified through these accounts are summarised in Table 7.5. These processes were described as part of how financial resources were managed throughout the project. Overall, participants described the resources supporting the scheme as including physical infrastructure, operational systems, and financial inputs. These resources were primarily associated with the delivery and management of the flood defence system, with BGI features incorporated within the wider scheme, particularly through landscape elements, vegetation, and environmental measures. Consequently, most of the effort and resources were focused on the main infrastructure, with other elements added alongside it.

Table 7.5: Disaggregated Funding Streams and Their Allocations

Funding Source	Type	Purpose
Flood and Coastal Erosion Risk Management (FCERM) Grant-in-Aid	Government Grant	Core flood defence infrastructure

Local Authority Contributions	Local Government	Financial and in-kind support from Birmingham and Sandwell Councils
Departmental Funding (Education, Transport)	Government Grants	Targeted funding for components benefiting schools and transport infrastructure
Private Sector Contributions	Private Investment	Investments from developers and infrastructure providers
Additional Emergency Funding	Government Grant	Top-up funding from central government addressing cost overruns and COVID-19 delays

Source: (Author's analysis based on interview data and documentary evidence).

7.4 CHAPTER SUMMARY

This chapter has examined the Perry Barr and Witton Flood Risk Management Scheme using the four dimensions of the conceptual framework, namely legislation and policy, governance, stakeholder engagement, and resources. The findings were drawn from interviews, document analysis, and site observations, and they show how these different elements influenced the planning and delivery of the scheme. From the findings, it is clear that legislation and policy played a strong role in shaping how the scheme was designed, especially at the early stage where the focus was mainly on meeting flood risk requirements. Governance of the scheme was largely driven by the Environment Agency, working together with local authorities and other actors involved in delivery. Stakeholder engagement took place throughout the project, mainly through consultation and communication with affected groups. In terms of resources, the scheme relied heavily on existing funding structures and technical systems that are commonly used for flood defence projects. The chapter shows that the four dimensions of the framework do not work separately but are closely linked in practice. Decisions made under legislation influenced governance arrangements, governance shaped how stakeholders were engaged, and all these affected how resources were used in delivering the scheme. The findings also

show that while BGI features were included in the scheme, they were not the main focus at the start but were brought in alongside the main flood defence infrastructure as the project developed. This case therefore adds to the framework by showing how it can be used to understand real-life BGI flood risk projects, especially how different factors come together to shape the way BGI is implemented in practice. The next chapter presents findings from the Beales Corner Flood Scheme, which will allow for comparison between the two case studies and support the wider analysis in Chapter Nine.

CHAPTER 8: THE BEALES CORNER FLOOD DEFENCE SCHEME

8.0 INTRODUCTION

This chapter examines the Beales Corner Flood Scheme in Bewdley, Worcestershire, as a comparative case to the Perry Barr and Witton Risk Management Scheme presented in Chapter Seven. Whereas Perry Barr and Witton represent a large-scale intervention delivered within a highly urbanised catchment through a centralised and technically led governance arrangement, Beales Corner is a smaller town-centre project shaped by spatial constraints, heritage protection requirements, and close interaction with local communities. These contextual differences also influence how BGI components are prioritised and integrated alongside conventional engineered flood defences. Unlike the completed Perry Barr and Witton scheme, Beales Corner was still under construction during the period of field observation. Despite these differences, both cases operate within the same national legislative and policy framework and involve similar institutional actors, including the Environment Agency, local planning authorities, and environmental regulators. Examining both cases enables analysis of how shared governance frameworks are interpreted across contrasting local contexts and how these conditions shape flood risk management delivery and environmental integration.

The chapter draws on document analysis, semi-structured interviews, and site observations. The documents used include scheme reports, planning materials, and Environment Agency publications (see Appendix B-1). Participants are anonymised and identified by their roles (Table 7.1; Appendix B-3). The interview questions were developed from the four dimensions of the framework (Appendix B-2), and the findings are organised along these same lines, using participants' responses alongside explanation to show how the scheme was actually delivered in practice. This approach makes it clear

how the framework works in a real setting, with the key contribution of the case study summarised at the end of the chapter.

8.1 BACKGROUND OF THE SCHEME

The Beales Corner Flood Defence Scheme is located on the eastern bank of the River Severn in the town of Bewdley, Worcestershire, an area with a long history of fluvial flooding. Beales Corner forms part of a densely developed riverside corridor where residential properties, transport routes and heritage assets are closely aligned with the river channel, increasing vulnerability to high-flow events. The scheme was initiated following the major flood event of February 2020, during which river levels reached approximately 5.48 metres above Ordnance Datum. During this event, existing demountable flood defences were overtopped and undermined, resulting in extensive flooding of properties in Beales Corner and surrounding areas (Figure 8.1). The failure of these temporary measures exposed limitations in the existing flood risk management approach and prompted a reassessment of long-term protection options.

Figure 8.2: Flooding impacts and emergency flood defence measures at Beales Corner, Bewdley(a) Overtopping and failure of temporary defences during flood conditions; (b) Temporary demountable barriers deployed along the riverside frontage.



Source: (EA, 2020b)

Prior to 2020, flood protection at Beales Corner relied primarily on temporary and demountable interventions, including modular barriers, mobile pumping equipment and property-level protection. These measures were operationally dependent on advance warning, rapid deployment and favourable site conditions. Evidence from the 2020 event demonstrated that such arrangements offered limited reliability during prolonged or extreme flooding, particularly where access constraints and deployment times could not be met. In response, the event was identified by delivery agencies as a catalyst for transitioning from reactive flood response measures towards permanent flood defence infrastructure, aligned with revised national flood risk management priorities (Figure 8.2).

Figure 8.3: The Beales Corner Scheme Plan (EA, 2022).

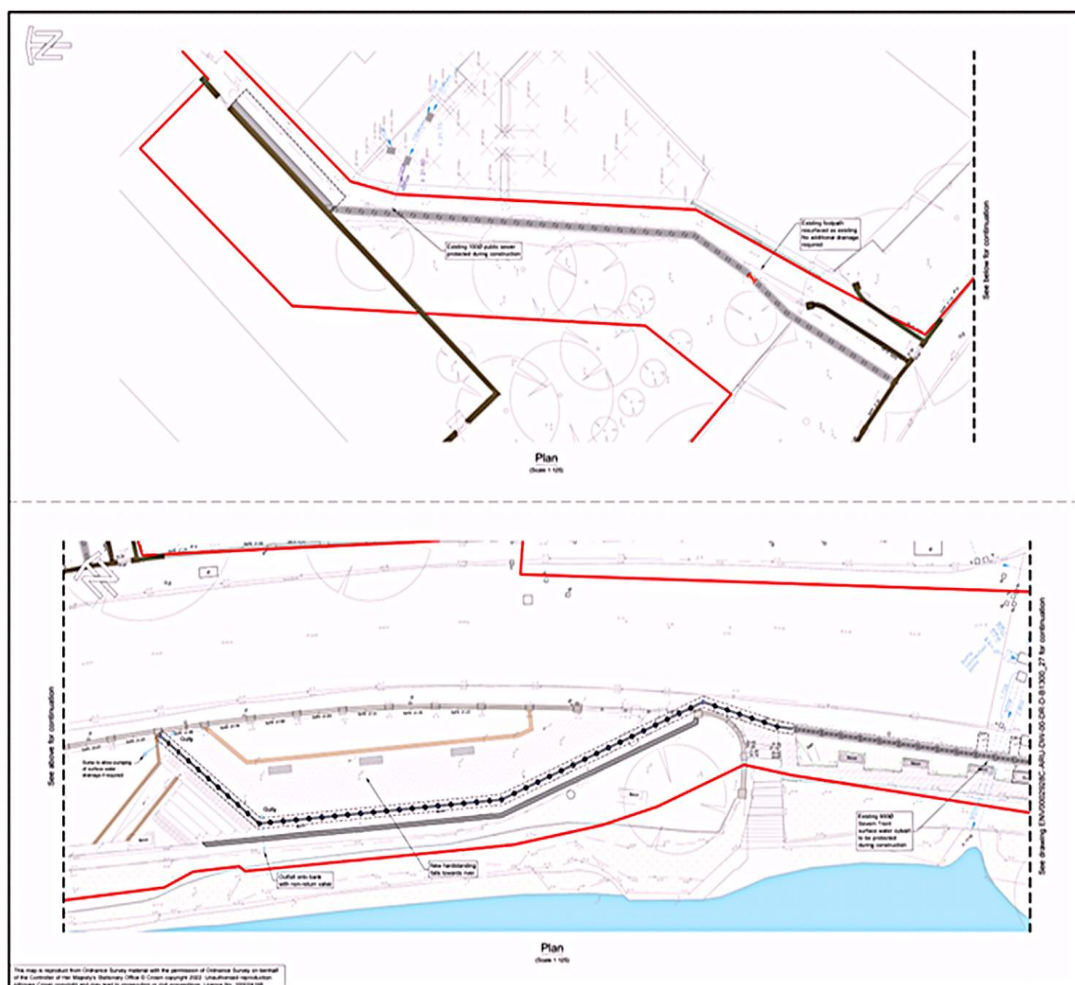


Figure 8.3 presents the scheme plan and identifies the principal structural elements proposed within the constrained river corridor. These include a permanent reinforced concrete flood defence wall with heritage brick cladding and removable flood gates at road and pedestrian crossings. In addition to the key engineered elements, the plan also shows limited BGI elements, which include surface water management features such as drainage gullies and sustainable drainage systems (SuDS) components designed to manage local runoff and attenuate surface water on the riverside alignment. The flood defence line is aligned to follow existing built form, utilities, topography and access routes which reflects the need for new infrastructure to fit within a tightly bounded historic urban environment. BGI features are peripheral to the core scheme design and do not shape its overall configuration. Rather, they support the main structural defences and do not act as standalone or multifunctional landscape features.

8.1.1 Decision Timeline – Beales Corner Flood Defence Scheme

The development and delivery of the Beales Corner Scheme followed a clear sequence of stages, with decisions taken at different points shaping how the project was defined and carried through to completion. The main phases of the scheme are summarised in Table 8.1. The first stage involved moving the scheme from a conceptual proposal to a deliverable project. At this point, a permanent flood defence option was clearly defined and funding was secured through central government flood risk management programmes. At this stage, BGI was not a central design driver, with priority given to establishing a technically viable engineered solution. This stage effectively established the foundation upon which the implementation of the scheme was based.

The next stage centred on planning approval and regulatory consent. Planning permission was granted by Wyre Forest District Council in February 2023, which set out the

conditions guiding the delivery of the scheme and formally enabled the commencement of construction. BGI considerations at this stage were shaped largely by planning, heritage, and environmental requirements, rather than forming the basis of the scheme design. This stage marked a clear transition from planning into execution.

Construction commenced in September 2023, beginning with preparatory works such as site clearance, traffic management, and the diversion of underground services. These initial activities highlight the practical realities of delivering infrastructure within a constrained town-centre environment, where enabling works were necessary before the installation of core infrastructure could take place. Within this constrained setting, opportunities to incorporate BGI were limited and secondary to the delivery of core structural elements.

The main construction phase extended through 2024 and into 2025. During this period, the primary components of the scheme were delivered, including flood walls, demountable barriers, glass panels, and associated drainage infrastructure. BGI elements, such as surface water management features, were integrated in a supporting role and did not shape the overall configuration of the scheme. The phased approach to construction reflects the need to manage access, maintain functionality within the area, and respond to site-specific constraints as they arose.

The final stage was reached in September 2025, marking the completion of construction and the transition of the scheme into an operational flood defence system. At this point, the scheme became fully functional as part of the wider flood risk management arrangement for the Beales Corner area, with BGI remaining a complementary rather than central component of the overall design.

Table 8.1: Decision Timeline and Delivery Stages of the Beales Corner Flood Defence Scheme

Project Stage	Time Period	Key Activities	Outputs / Infrastructure Delivered	Decision Context
Flood Risk Identification	Pre-2020	Repeated flooding; temporary measures	Need for permanent solution identified	Environment Agency review
Scheme Development & Funding	2020–2022	Scheme design; funding secured	Approved defence scheme	Government funding support
Planning Approval	2023	Planning approval obtained	Permission granted	Local authority approval
Initial Construction	2023	Site preparation; utilities; traffic control	Site ready for works	Urban site constraints
Main Construction	2023–2025	Installation of defences and drainage	Flood defence system delivered	Multi-agency coordination
Completion & Operation	2025	Final works and commissioning	Operational flood defence system	Scheme completed by EA

(Environment Agency, 2019; Environment Agency, 2023; Environment Agency, 2025 and Interview data).

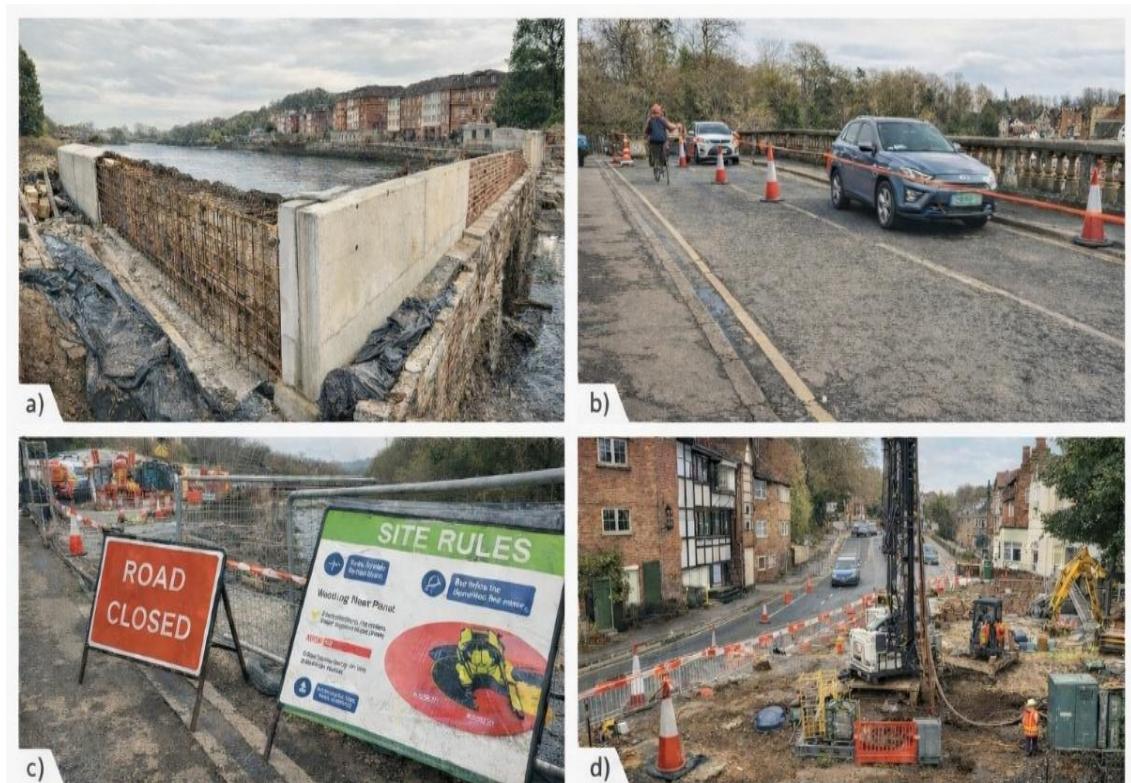
8.2 OBSERVATION OF SITE INFRASTRUCTURE AND SPATIAL LAYOUT

Observation was used to examine how the scheme is physically configured and how it operates in practice, in line with the approach outlined in Chapter Six. The site conditions observed were then used to support and complement the interview and documentary evidence, helping to ground the analysis of how BGI is actually implemented within the constraints of the site.

The visit focused on understanding the physical layout of the scheme, the construction activities going on, safety arrangements, and how the flood defence structures relate to the surrounding urban and heritage environment. Particular attention was given to how any green-blue elements sit alongside the main engineered works. Photographs were taken to

capture key features observed on site (Figure 8.4). These observations made it easier to connect what was seen on the ground with what was described in interviews and documents, especially in terms of how BGI is being delivered in reality, not just in plans.

Figure 8.4: Site observation photographs showing construction works and spatial conditions at the Beales Corner Flood Defence Scheme: (a) Installation of reinforced flood defence wall structure along the riverside corridor; (b) Temporary traffic management arrangements during construction; (c) Site safety controls and access restrictions; (d) Active construction works within the constrained town-centre environment.



Source: (Author's observations)

The flood defence wall clearly stood out as the main feature along the riverside. It consists of reinforced concrete finished with heritage brick cladding, along with removable gates at crossing points (Figure 8.4a). At the time of the visit, parts of the structure were still under construction. The wall follows the approved design closely, shaped by planning and

heritage requirements. Sitting directly between the river and public walkways, it works mainly as a continuous engineered barrier, and the overall layout is driven by engineering needs, with BGI elements fitted in around it rather than leading the design.

The space available on site is quite tight, and this really limits what can be done in terms of broader BGI features. The wall runs very close to footpaths, bridges, and nearby buildings, leaving little room for landscape changes or ecological expansion. In this kind of setting, the only visible BGI elements are mainly drainage features linked to SuDS. Even these are quite small in scale and are mainly there to manage surface water, not to deliver wider environmental or social benefits you would normally expect from a more fully integrated BGI approach.

The way construction is being managed also shows how tight the space is. As seen in Figure 8.4b, there are lane closures, barriers, and controlled crossings to keep both vehicles and pedestrians moving safely. Fencing, warning signs, and restricted access areas are used to manage safety around the active work zones (Figure 8.4c). In this kind of environment, the priority is clearly on safety, access, and compliance, and this naturally limits how much room there is to properly integrate BGI beyond basic features.

There was also a lot of active construction going on during the visit. Heavy equipment, drilling, and excavation were all happening within a very confined area, close to historic structures and main roads (Figure 8.4d). Some drainage elements and surface treatments were visible alongside the main works, showing that water management is being considered. But even here, these BGI-related features are clearly playing a supporting role, while the main focus remains on delivering the structural flood defence. The predominance of engineered flood protection, together with the limited scale and subordinate role of green-blue elements, materially demonstrates how these features were inserted within the scheme design rather than structuring the overall design reinforcing the marginal role of BGI within the governance and delivery priorities of the scheme.

8.3 EMPIRICAL FINDINGS STRUCTURED BY THE CONCEPTUAL FRAMEWORK

8.3.1 Legislation and Policy

This section presents findings on the legislative and policy context shaping the delivery of the Beales Corner Flood Defence Scheme, based on semi-structured interviews and documentary evidence (see Appendix D). In discussing the legislative and policy requirements guiding the scheme, participants described heritage designation as a major factor influencing the planning and approval process. Participants described the scheme's location close to Bewdley Bridge, a Grade I listed structure, and within the Bewdley Conservation Area as central to design decisions. Interviewee 3, a consultant, stated that *“every design decision, from materials to height, was scrutinised by multiple agencies to ensure it met heritage standards.”* Interviewee 4, a local authority officer, also noted that *“even small elements like railing profiles and wall finishes had to go back through conservation approval.”* The Bewdley Conservation Area Appraisal and relevant heritage regulations also refer to these requirements as part of the approval process. These were described as applying to both structural and design elements within the scheme. This really shows how much heritage requirements shaped the scheme, with most design decisions tightly controlled from the outset.

When referring to national planning policy, participants described the National Planning Policy Framework (NPPF) as providing the general policy direction for the scheme. Participants referred to the need to balance flood protection with heritage considerations. Interviewee 5, a national agency officer, stated that *“everyone agreed on the need for flood protection, but there were different views on how far we could push design changes without affecting the historic setting.”* The Wyre Forest District Local Plan also sets out requirements relating to heritage and environmental considerations. These were described in relation to how planning decisions were made

during the scheme. In practice, planning was not straightforward, it was more about balancing flood protection with the need to preserve the historic setting.

In relation to environmental and flood risk regulations, participants described how biodiversity requirements influenced scheme delivery. Participants described measures such as compensatory planting and mitigation. Interviewee 8, a contractor, stated that *“by the time biodiversity net gain came in, the wall alignment and structure were already fixed, so we had to look at planting and mitigation around it.”* Interviewee 2, a consultant, also described these measures as *“something we had to fit in around the main works rather than redesign the scheme.”* The Environment Act 2021 (Biodiversity Net Gain) and associated guidance also refer to these requirements. These were described in relation to environmental and BGI-related features included alongside the main works. This makes it clear that environmental measures were added around the main scheme, rather than shaping it from the beginning.

In discussing flood risk planning tools, participants described the use of flood risk mapping in defining the extent and design of the scheme. Participants described how mapping informed design parameters. Interviewee 2, a consultant, stated that *“the mapping gives a broad picture of flood risk extent and predicted water levels, but it doesn’t always match what actually happens on the ground during a flood.”* It also shows how flood mapping helped fix the design early, leaving little room to rethink things later. Interviewee 1, a national agency officer, also noted that *“once the flood zones were fixed, there was not much scope to rethink the layout.”* The Strategic Flood Risk Assessment (SFRA) and Environment Agency flood mapping outputs also identify flood mapping as part of the design process. These were described in relation to how design parameters were established.

Participants also referred to environmental protection controls during construction, including restrictions on timing and site access linked to ecological

requirements. Environmental regulations and guidance also identify these controls as part of construction requirements. These were described as part of the conditions guiding construction activities during delivery. These regulations did not just shape the design; they also influenced how the scheme was actually delivered on site. The legislative, policy, and regulatory instruments identified through interview accounts, and supported by documentary evidence, are summarised in Table 8.2. Participants described the legislative and policy context as including heritage, environmental, and flood risk requirements that guided the planning and delivery of the scheme. Overall, legislation and policy seem to have played a strong role in shaping both the design and delivery, setting clear limits on what could realistically be done.

Table 8.2 Key Legislation and Policy Instruments at Beales Corner (Source: Interview data participant-identified and Documentary evidence)

Instrument	Type	Research Question Focus	Participant References
Grade I Listing – Bewdley Bridge	Heritage Regulation	How heritage designation requirements were addressed within the flood defence scheme	Participants referred to design reviews and approval stages associated with works near the bridge
Conservation Area Policy – Wyre Forest Local Plan	Local Planning Policy	How local planning policy requirements were applied to new flood defence works	Participants referred to requirements relating to appearance, materials, and visual considerations
National Planning Policy Framework (NPPF)	National Policy	How national planning policy objectives were reflected in scheme planning and approval	Participants referred to differing interpretations of policy objectives by regulatory authorities
Environment Act 2021 – Biodiversity Net Gain (BNG)	Statutory Requirement	How statutory biodiversity requirements were incorporated into the scheme	Participants referred to compensatory planting and mitigation measures associated with the scheme
Strategic Flood Risk Assessment (SFRA)	Risk Planning Tool	How flood risk mapping informed scheme extent and planning approval	Participants referred to flood risk mapping when describing design parameters
Environmental Protection Zones	Environmental Regulation	How environmental protection controls were applied during construction	Participants referred to restrictions on construction timing and site access

8.3.2 Governance

This section presents governance-related findings drawn from semi-structured interviews with participants involved in the delivery of the Beales Corner Flood Defence Scheme. In relation to how governance arrangements were organised within the scheme, participants described a structure involving multiple statutory bodies and formal approval processes. The Environment Agency, local planning authority, conservation officers, ecological regulators, and highways authorities were identified as key actors responsible for oversight. Interviewee 13, a contractor, explained that “*every step had to go through the EA, the planners and the conservationists,*” indicating that decision-making involved several layers of approval. This gives a sense of how many different organisations were involved, and how decisions had to move through several layers before anything could progress.

When referring to approval processes and decision-making, participants described the requirement for sign-off from different authorities before construction could proceed. Planning conditions relating to materials and design were also highlighted, including brick types, stone finishes, and railing details. Interviewee 13 noted that “*approval for every material brick, stone, even railing had to comply with heritage and planning policy before anything could be built.*” Participants also referred to ecological requirements, including surveys and formal clearance procedures. Interviewee 7, a consultant, stated that “*even tree roots or fish spawning windows required formal clearance.*” These processes were described in relation to how governance requirements shaped the delivery of the scheme. In reality, this meant decisions were quite tightly controlled through formal approval processes.

In relation to additional governance controls, participants referred to archaeological oversight and highways regulation. Archaeological investigation was required prior to excavation, while approvals were needed for road closures and traffic

management. Interviewee 9, a local authority officer, stated that “*nothing could move even with teams and materials on site without highways authority approval.*” Participants also referred to public engagement activities, including consultations and communication with local residents. Interviewee 4, a local authority officer, noted that “*the design was largely fixed by the time of consultation.*” These were described in relation to how governance processes operated during implementation. It also shows how different requirements had to be worked through, shaping when and how work could actually happen.

When discussing the role of BGI within governance processes, participants referred to the inclusion of SuDS and habitat-related features. These were described alongside other design priorities within the scheme. Interviewee 4 explained that “*if it came down to heritage or green infrastructure, heritage won,*” while Interviewee 5, a national agency officer, stated that “*SuDS were strategic tools for planning approval rather than intrinsic to the design.*” These accounts were described in relation to how BGI features were considered within the governance framework. So while BGI was considered, it often came second to heritage concerns.

In relation to how decisions were managed over time, participants described approval sequencing involving multiple organisations. This was linked to project timelines, including delays associated with final approvals. Interviewee 8, a contractor, stated that “*teams and materials were ready, but final heritage consent was delayed,*” while Interviewee 4 noted that “*one unsigned form could pause the entire programme.*” These processes were described in relation to how decisions progressed during scheme delivery. This makes it clear how the approval process could slow things down, even when everything else was ready to move forward.

Participants also referred to governance documentation, including meeting minutes, approval records, and decision tracking systems. Interviewee 13 explained that “*the process recorded every decision and prevented assumptions,*” while Interviewee 1, a

national agency officer, stated that “*it guaranteed that each element was appropriate and compliant.*” These were described in relation to formal governance procedures supporting the scheme. It also highlights how much the process relied on formal records to keep track of decisions and make sure everything stayed compliant.

The governance arrangements identified through these accounts are summarised in Table 8.3. Participants described governance as involving structured approval processes and defined institutional roles, within which BGI related elements were considered alongside the main flood defence works. Overall, governance here feels quite structured and controlled, with decisions shaped by formal processes and multiple organisations.

Table 8.3 Institutional Governance Structures and Functional Implications – Beales Corner Scheme

Governance Feature	Institutional Function / Actor	Operational Implication
Statutory Procurement	Environment Agency-led public tendering for design (Arup) and delivery (Jackson CE)	Extended timelines
Heritage Regulation	Historic England; Wyre Forest District Council (Conservation Team)	Design constraints
Biodiversity Compliance	Natural England; Ecological Consultants; Environment Agency	Delayed works
Highways Regulation	Worcestershire County Council (Highways Authority)	Restricted access
Public Engagement	EA Community Engagement Officers; Local Liaison Officers	Limited influence
Green Infrastructure (SuDS/Biodiversity)	Lead Designers; Planning Officers; Natural England	Reduced scope
Approval Sequencing	EA, Local Planning Authority, Historic England, Natural England	Approval delays

(Source: Author’s compilation from semi-structured interview data).

8.3.3 Stakeholder Engagement

This section presents findings from semi-structured interviews on stakeholder engagement activities related to the Beales Corner scheme, with particular attention to how engagement addressed environmental considerations and BGI components.

In relation to how stakeholders were engaged on environmental and BGI aspects of the scheme, participants described engagement as involving statutory bodies such as the Environment Agency, Worcestershire County Council, Wyre Forest District Council, Historic England, Natural England, and Severn Trent Water. Participants described regular coordination meetings where planning requirements, environmental constraints, and design issues were discussed. Interviewee 8, a contractor, stated that *“stakeholder involvement was vital from day one as each organisation had different responsibilities in heritage, ecology and planning.”* Communication with residents and businesses was also described through letters, newsletters, and public events linked to planning and environmental approvals. This shows that engagement was mainly about coordinating between organisations and keeping people informed.

When referring to the focus of engagement discussions, participants explained that most conversations centred on design-related issues such as wall height, appearance, and impacts on the heritage setting. Interviewee 10, a local community resident, stated: *“people wanted to have the certainty regarding what the riverside will look and function like after the wall was up.”* Participants also referred to BGI related discussions, particularly around Sustainable Drainage Systems (SuDS). Interviewee 2, a consultant, stated that *“SuDS could only be suitable where they meet regulatory and spatial requirements alongside engineering.”* This suggests that BGI discussions were quite limited by technical and regulatory constraints. These discussions were described as taking place within statutory and design constraints rather than being driven by wider GI

objectives. In practice, most discussions focused on how the scheme would look and function, rather than wider environmental ideas.

In relation to how stakeholder input influenced decisions, participants described engagement as operating within fixed legal and design boundaries. Interviewee 1, a national agency officer, stated that *“we listened to access and aesthetics concerns, but the legal and design requirements ultimately defined the boundaries.”* Participants also referred to changes in institutional leadership, which required some discussions to be revisited. Interviewee 4, a local authority officer, stated that *“leadership changes meant revisiting discussions about environmental impacts and conservation requirements.”* It also shows how changes in leadership could affect how these discussions progressed. These accounts were described in relation to how engagement operated within formal planning and regulatory frameworks. There were clear limits to how much influence stakeholders actually had on decisions.

Participants described stakeholder engagement as involving communication and coordination across different groups, but largely within predefined constraints. While stakeholders were involved throughout the process, the evidence indicates that their influence on BGI-related design decisions remained limited, with most outcomes shaped by regulatory and engineering requirements. Overall, engagement seems to have been more about consultation than having a real influence on the final design.

8.3.4 Resources

This section presents findings from semi-structured interviews on the physical, financial, and human resources involved in the delivery of the Beales Corner Flood Defence Scheme, including those linked to BGI components.

In relation to the physical resources used in the scheme, participants described construction materials and equipment associated with the delivery of the flood defence

works. Participants described the use of reclaimed brick, steel reinforcement, prefabricated flood gate sections, and modular formwork, alongside heavy machinery such as excavators, concrete mixers, and cranes. Interviewee 13, a contractor, explained that *“most of the work relied on prefabricated sections and heavy plant already positioned on site, so sequencing the equipment and materials was critical to keeping construction moving.”* Participants also referred to drainage installations and surface treatments delivered alongside the main works, which were described in relation to surface water management and the limited inclusion of BGI elements within the scheme. This makes it clear that most of the resources were focused on delivering the main flood defence structures.

When referring to financial resources, participants described funding arrangements supporting the scheme. Participants referred to Flood and Coastal Erosion Risk Management Grant in Aid (FCERM GiA) as the main funding source. Interviewee 1, a national agency officer, stated, *“the funding was through the GiA stream; we had to go through a full business process first before it was approved.”* Participants also described increases in material costs during delivery. Interviewee 2, a consultant, stated: *“everything was more expensive than expected,”* which participants described in relation to prioritising core flood defence infrastructure over expanded BGI or landscape-based elements. This also shows how rising costs affected decisions as the project progressed.

In relation to how resources affected delivery, participants described interruptions to construction linked to funding and material availability. These pauses were described as limiting opportunities to revisit or expand BGI-related features within the scheme. Participants also referred to additional funding approvals during the project. Interviewee 1 stated: *“it was thorough, but it slowed everything down.”* These accounts were described in relation to how resource constraints influenced implementation decisions. It

highlights how resource constraints could slow things down and limit what could be changed along the way.

Participants also referred to human and organisational resources, including specialist construction teams and workforce coordination. Interviewee 13, a contractor, remarked that *“different specialist crews rotated through the site depending on what phase they were doing; coordination between teams was important to keep moving.”* Financial management processes, including budget submissions and cost monitoring, were also described. Interviewee 1 referred to the requirement that *“every pound”* had to be accounted for. These were described as part of the formal resource management processes supporting scheme delivery. It also shows how important coordination between teams was to keep everything moving. Thus, the scheme relied heavily on public funding to move forward.

Overall, participants described the resources supporting the scheme as being primarily directed towards core flood defence infrastructure, with BGI-related elements incorporated within these constraints. Resource allocation and financial processes were described in relation to how they shaped the extent to which additional BGI features could be included. Together, most of the effort and resources went into the core infrastructure, with other elements added where possible.

8.4 CHAPTER SUMMARY

This chapter has looked at the Beales Corner Flood Defence Scheme using the four parts of the conceptual framework: legislation and policy, governance, stakeholder engagement, and resources. Using documents, interviews, and site observations, it explored how these factors came together during the delivery of the scheme, especially within a heritage-sensitive setting. The findings show that legislation and policy played a major role in

shaping how the scheme was designed and approved. Governance involved several organisations, each with its own responsibilities, which meant that decisions had to move through multiple stages before anything could be finalised. Stakeholder engagement did take place, but it was mainly limited to consultation, with little opportunity for stakeholders to directly influence decisions. In terms of resources, most of the funding and effort were focused on the main flood defence works. Although BGI features were included, they were not a central priority and were instead fitted around the core design. What this case highlights for the framework is that strong heritage rules and regulations can end up shaping almost every aspect of the project from how decisions are made to how resources are allocated. As a result, many of the key design decisions are locked in quite early, leaving little room to properly integrate BGI at later stages. It also shows how closely connected the four elements of the framework are in practice, and how their combined influence can limit the extent to which BGI is meaningfully delivered. The next chapter will compare these findings with the Perry Barr and Witton scheme to see how things play out in a different setting and to further develop the framework.

CHAPTER 9: DISCUSSION

9.0 INTRODUCTION

The previous chapters have presented the findings from the case study analysis. This chapter explores this empirical evidence in relation to existing literature. It analyses the meanings, limits and practical relevance of the identified themes, mainly in relation to objective 7, which addresses improvement of the BGI governance model for its application in flood risk management (FRM). The discussion is focused on key factors highlighted in the governance framework that impact the implementation of BGI including legal and policy framework, governance, stakeholder and resource constraints and how each converges or diverges from existing academic debates.

9.1 LEGISLATION AND POLICY

This section examines the legal and policy frameworks that influence the delivery of the Beales Corner and Perry Barr schemes. Specifically, it will assess how the regulatory design enables or constrains BGI delivery. While legislation and policy intend to create consistency, accountability, and control of risk, empirical evidence suggests that tensions persist between national regulatory expectations and the local realities of implementation. Instead of viewing legislation and policy as a fixed or neutral backdrop within which decision-makers operate, the analysis conceptualises this legislation and policy as a contested, negotiated space that is interpreted by actors operating with different and often conflicting institutional logics, professional norms, and political pressures. This section is guided by three interrelated questions that structure the comparative analysis of the two case studies. The focus is on the following:

1. How differences in statutory duties, regulatory requirements, and policy guidance

shape the scope and form of BGI solutions across the two case studies.

2. The extent to which compliance-driven legislative and policy frameworks restrict flexibility and local adaptation in project delivery.
3. How existing legislative and policy arrangements enable or constrain the integration and delivery of BGI.

These questions provide a basis for examining how legislative and policy conditions differ across the two cases and how these differences shape the delivery of BGI in practice. The analysis demonstrates that laws and policies are not merely an institutional backdrop, but they also constitute a material structuring of design choices, sequencing logics, and institutional behaviour. In both cases, the engineering-focused imperatives and procedural inflexibility were embedded in the statutory frameworks, limiting the adaptive and multifunctional infrastructure performance. Together, these lessons contribute to the policy and governance discussions, emphasising the need to have regulatory frameworks that enable a suitable ecological integration, flexible procedures and learning-based implementation channels. More broadly, the findings raise important questions about how legislative and policy systems could be reconfigured to promote infrastructure planning that is more adaptive, inclusive, and accountable under climate uncertainty and fragmented governance.

9.1.1 Engineering-Centric Statutory Design Mandates

The analysis of the Perry Barr and Beales Corner flood defence schemes demonstrates that legislative frameworks do far more than provide a neutral regulatory backdrop. Rather, they play an active role in shaping governance practices and materially affecting the way flood risk interventions are conceived, configured, delivered, and maintained in practice. The Flood Risk Regulations 2009 (SI 2009/3042) and the Reservoirs Act 1975

(as amended) are foundational regulations that impose a technocratic rationality on flood risk governance, by demanding structural safety, quantifiable risks, and technical certainties. The statutory requirements lead to design decision-making in a specific direction that favours conventional grey infrastructure solutions.

This reinforces a dominant flood containment paradigm and marginalises ecological complexity, multifunctionality, and adaptive resilience early in project design. Particularly, the Perry Barr statutory focus on floodplain mapping and designing engineered defences to a 1-in-100-year standard reinforced a predominantly grey-infrastructure response. The outcome suggests broader trends within flood risk governance in England, where existing legal and institutional path dependencies have continued to favour engineered solutions, marginalising the mainstreaming of BGI (O'Donnell et al., 2017). Such path dependencies were evident in the Perry Barr scheme through the way statutory safety requirements shaped design decisions. Interview participants consistently described reservoir safety legislation as setting fixed design parameters that could not be adjusted during implementation. For example, participants explained that embankment gradients, material specifications, and structural reinforcement standards were determined by statutory safety provisions and had to be strictly adhered to. As a result, opportunities to incorporate ecological or multifunctional features within the embankment design were limited, with the scheme primarily focused on meeting hydraulic and safety requirements. Here, legislation is not merely a constraint but a constitutive power that recreates an engineering-centric conceptualisation of risk and precludes other imaginaries of governance. This is in line with the argument by Jasanoff (2004) that regulatory and legal frameworks, are co-producers of dominant epistemologies of risk and intervention, which dictate which types of knowledge and solutions are institutionally legitimate.

At Beales Corner, legislative requirements relating to heritage conservation added another layer of restriction, further restricting design flexibility. The flood wall beside Bewdley

Bridge, though seemingly sensitive to heritage aesthetics, was essentially informed by statutory requirements of structural integrity and mitigation of flood risk. In this case, the legal requirements determined not only the technical performance, but also the shape and significance of the intervention, and ecological or multifunctional considerations were to be considered, at best, by retrofitted design features. Secondary legislative requirements, such as adherence to the Water Framework Directive (Directive 2000/60/EC) and Biodiversity Net Gain requirements under the Environment Act 2021, were a major driver of ecological improvements, as opposed to being structurally integrated into the underlying design rationale. This sequencing highlights the way in which statutory hierarchies give precedence to some policy goals over others, putting ecological concerns in the background as auxiliary to flood defence infrastructure, instead of central to it.

These empirical trends are consistent with existing critiques in environmental law and governance literature, which stress that law is not a neutral procedural scaffold, rather legislation serves as an epistemic boundary that defines what type of knowledge, risk perception, and intervention are considered legitimate in the decision-making processes (Kulovesi et al., 2011). Statutory frameworks have the effect of marginalising ecologically dynamic, localised, and long-term adaptable forms of knowledge by prioritising certainty, predictability, and control. As a result, they stabilise technical orthodoxies poorly suited to the complexities and uncertainties of climate change, despite offering legal clarity and accountability.

However, there are also cases of statutory ambivalence, which are limited yet significant in the Perry Barr and Beales Corner schemes. The late adoption of ecological aspects due to the necessity to comply with the Water Framework Directive and the Biodiversity Net Gain policy reflects a certain, though limited, awareness of the importance of environmental improvement in the legal system. Even though these actions are usually retrofitted and subordinated to overall safety aims, their presence can indicate that there

are leverage points in the current statutory architecture in which ecological factors may be more substantially incorporated in long term objectives. This tension between constraint and possibility is reflected in the broader literature. Research on GI and sustainable drainage shows that under some institutional and political circumstances, statutory regimes can be mobilised to achieve more integrated and multifunctional results, but in practice these remain secondary priorities in engineering-dominant regimes (Gill et al., 2007; Fletcher et al., 2015).

Similarly, Carter and Sherriff (2011) highlight the importance of legislative flexibility and effective inter-institutional coordination in enabling climate adaptation measures to move beyond tokenistic inclusion. Taken together, these insights suggest that while current statutory design mandates largely reproduce an engineering-centric flood risk paradigm, they also contain latent capacities that could be harnessed to support more adaptive, ecologically informed approaches if governance practices and interpretative cultures were to evolve.

9.1.2 Legal Formalism and the Burden of Compliance

The Perry Barr and Beales Corner schemes show that legislation can shape flood infrastructure through the complexity of procedures even if it does not mandate technical design solutions. Legal frameworks not only establish what is permissible, but also when and how decisions are taken, thus structuring the governance logic and the timing of infrastructure delivery. This reflects broader environmental governance literature that sees law as a constitutive force that actively shapes decision-making pathways and institutional behaviour rather than simply constraining predefined outcomes (Ebbesson, 2010; Fisher, 2017). In relation to flood infrastructure, procedural formalisation produces governance scripts that are rigid in order, timing, and authorisation of decisions, often foreclosing more iterative, co-productive, or place-based approaches.

Although the previous section illustrated how legislation gives effect to engineering-led performance logics, this section illustrates how the sequencing of statutory approvals is a structural barrier that locks in early decisions and limits scope for innovation and the incorporation of blue-green infrastructure (Wamsler and Pauleit, 2016). The Perry Barr and Beales Corner cases serve as examples of the practical application of this dynamic, albeit in different regulatory and procedural configurations.

In Perry Barr, governance was largely shaped by statutory planning processes and legally required risk assessments, which were integral to the project from the start. Compliance mechanisms such as Flood Risk Activity Permits, Environmental Impact Assessment, and planning permission were not just mechanisms; they were also active in the way flood risk was conceptualised, quantified, and reduced. The processes established risk as a technical object to be evaluated and dealt with in terms of predetermined standards, rather than a dynamic socio-environmental situation that could be negotiated, researched, and amended. These processes were linear, which made it impossible to design and co-produce iteratively, and entrenched grey infrastructure solutions before ecological alternatives could be pursued in any meaningful manner. This is reflective of wider criticisms of the flood risk management practice, which claim that formal assessment and mapping tools depoliticise risk and favour expert-led technocratic solutions over adaptive and locally responsive strategies (Brown and Damery, 2002; Porter and Demeritt, 2012).

Procedural constraint at Beales Corner was different in nature but had similar effects. The scheme was regulated under the Planning (Listed Buildings and Conservation Areas) Act 1990 due to its location within a conservation area and close to listed buildings. The legal formalism in this case was protection of heritage; there was a statutory requirement regarding materials and appearance, and compatibility with historic character. Even slight modifications to the design involved a lot of consultation, clearances, long waits and little room to intervene in an adaptive manner. These procedures were to preserve cultural

value. Nevertheless, they established a continuous planning bottleneck, which placed visual continuity and procedural certainty over future resilience. This tension has been well-documented in studies and underscores how heritage protection regimes may come into conflict with climate adaptation agendas by prioritising preservation and procedural orthodoxy over flexibility and innovation (Pendlebury, 2008; Aylett, 2015). Moreover, the case of Beales Corner shows that the legal structure of planning laws can result in a complex process that disrupts the process of making decisions that are inclusive and adaptive (Davoudi and Madanipour, 2015).

Furthermore, while both schemes encountered a measure of legal proceduralism, the critical analytical point is that the forms of procedural constraint were dissimilar but produced similar outcomes. In Perry Barr, constraint was mainly a result of the technocratic understanding of risk and safety inherent in regulatory evaluations. In Beales Corner, it arose as a result of legal requirements that were motivated by conservation that determined allowable forms, materials and methods of intervention. However, in both cases, procedural sequencing entrenched initial design decisions, delayed the exploration of multifunctional or adaptive options, and eventually resulted in ecological aspirations being retrofitted rather than being structurally embedded in project design. The trend supports the claim that regulatory regimes strengthen disciplinary compartmentalisation through their division of technology and ecology, risk and place, and law and governance, despite the policy discourse being formally supportive of integration (Benson et al., 2013; Heyvaert, 2021).

Taken together, the Perry Barr and Beales Corner cases highlight a central tension within contemporary flood risk governance. While legal processes can promise certainty and accountability, as well as procedural legitimacy, they can also hamper adaptive, inclusive, and environmentally responsive processes. Ensuring compliance with planning consents, heritage requirements, and safety assessments results in what Jasanoff (2004) has called

epistemic closure, which refers to the validation of only certain types of knowledge, risk interpretations, and interventions being formally sanctioned. Within both schemes, this closure reinforced a dominant paradigm of grey infrastructure and marginalised socio-ecological alternatives, which were either sidelined or incorporated only after procedural compliance had been secured.

9.1.3 Tension between Policy and Development Planning

The governance challenges experienced in the Perry Barr and Beales Corner flood schemes are not due to lack of an environmental or planning policy, but due to ongoing conflict between policy aspirations and institutional practices of infrastructure delivery. The two cases demonstrate the structural incompatibility between the top-level strategic goals such as the NPPF and Local Flood Risk Management Strategies (LFRMSs) and the disjointed and sectorally structured system that controls implementation. This situation reflects what Carter and Sherriff (2011) refer to as institutional maladjustment, whereby the governance system is procedurally and culturally misaligned with the policy goal it is expected to deliver.

In Perry Barr, the NPPF provided a strong strategic rationale for the incorporation of multifunctional green infrastructure and long-term resilience thinking. Nonetheless, these principles had little impact on the early-phase design of projects, which remained primarily guided by technical rationalities and legal flood defence standards. Consequently, both the spatial and environmental objectives of the NPPF acted more as tools to justify or validate design intervention rather than formative design drivers. This evidence accords with Davoudi and Madanipour (2015), who argue that planning policy is frequently without procedural mechanisms that shape infrastructure decisions at formative stages, but works rhetorically rather than instrumentally. Consequently, despite the presence of sustainability and integration narratives in strategic planning documents,

these aspirations are not always realised in practice, especially in nationally-based delivery agencies such as the Environment Agency.

Local Flood Risk Management Strategies also played a minor role. Although the LFRMSs prepared by the Birmingham and Worcestershire authorities identified the local surface water risks and catchment priorities, they did not affect the project sequencing, investment decisions, and cross-sector integration. The results of Rydin (2010) and Wilkinson et al. (2010) support the idea that local strategies are usually inferior to national delivery logics, technical standards, and funding frameworks, and are of non-statutory nature, which do not have the authority to affect significant infrastructure outcomes. The location of the projects in Perry Barr across Birmingham and Sandwell also added to the complexity of governance. Without proper coordination mechanisms, the decision-making mandates overlapped, the pressure on the administration was heightened and the planning regulations were construed differently by each authority. According to Jordan and Turnpenny (2015), these dynamics are examples of fragmented environmental governance, and they caution that the decentralisation of decision-making without institutionalised coordination can destroy, instead of enhancing, regulatory coherence.

Conversely, the governance constraints at Beales Corner were not influenced by inter-authority complexity but by the inflexibility of heritage planning regimes. The scheme was subject to heavy regulation by the Planning (Listed Buildings and Conservation Areas) Act 1990 because it was in a conservation area and was close to listed buildings. As a result, design choice was constrained by a culture of planning that alluded to the aesthetic continuity and character of the existing buildings as opposed to adaptive and future resilience. This is in line with Cowell and Owens (2006) research of heritage governance that emphasises the stifling nature of conservation regimes to innovation and their intolerance of procedural orthodoxy, where formal compliance is more important than functional and adaptive performance, such as climate response.

In both case studies, there was a broad range of interpretive discretion in the implementation of national policy frameworks, especially the NPPF. Although the NPPF was designed to be adaptable and accommodating to sustainable development, its generality results in a high degree of variation in local interpretation and application. Clifford and Tewdwr-Jones (2013) argue that local institutional culture, capacity, and resource constraints are equally important as national guidance in the process of planning practice. The different interpretations of policy goals in Perry Barr and Beales Corner led to lengthy negotiations, uneven implementation of the principles of sustainability, and contradictory visions of the delivery actors. These challenges were exacerbated where flood risk management, heritage protection, and land-use planning intersected without mechanisms for policy integration.

The legal and policy requirements sequencing further limited the possibility of multifunctional results. In line with the project, ecological surveys, heritage assessments, and community consultations were conducted on timelines not aligned with the design and approval process, creating procedural and structural delays. The trend aligns with the idea of asynchronous governance by Newig et al. (2018): the temporal misalignment of regulatory processes interferes with coherent and integrated results. This misalignment in both cases reduced institutional responsiveness and precluded possible opportunities of early-stage innovation, particularly in the case of BGI that depends on cross-sectoral coordination and early integration. This observation is in line with Mees et al. (2012) who highlights that policy integration is common due to incremental, negotiated compliance between sectoral systems and not planned coordination; this creates fragmentation and suboptimal results.

Collectively, the results suggest that current governance structures are not adequately equipped to deal with the complexity, uncertainty, and temporal nature of climate change adaptation and flood infrastructure provision. Despite progressive national and local

policies, the institutional structures of implementation remain biased towards legal certainty and procedural order instead of flexibility and integration. Garmestani et al. (2017) assert that adaptive governance that changes with complexity and is legitimate and accountable is increasingly in demand. This opinion is further supported by Cowell and Owen (2006) and Mell (2016), who note that institutional designs should be balanced between legal certainty and adaptive capacity, particularly in those areas of policy that are interconnected, such as flood risk management, heritage protection, and climate adaptation.

9.2 GOVERNANCE STRUCTURE

This section examines the governance arrangements for the Perry Barr and Beales Corner systems and positions the findings within wider debates on environmental governance, infrastructure provision, and adaptive institutional design. Governance is not a model or best practice, but a contested process of struggles over authority and control, fragmented coordination, claims to procedural legitimacy, and uneven processes of institutional learning and adaptation. The challenges identified across both cases, including leadership fragmentation, operational misalignment, procedural opacity, and knowledge asymmetries, are not unique to BGI. They reflect broader issues within infrastructure governance, where multiple institutions, regulatory requirements, and delivery processes shape how projects are planned and implemented. However, the findings show that these challenges tend to play out more strongly in BGI contexts. This is because BGI delivery requires coordination across different sectors, the integration of ecological and engineering knowledge, and engagement with a wider range of local stakeholders. In this sense, while the challenges are not specific to BGI, their effects are more pronounced in BGI-focused projects. These increased demands render institutional silos, inflexible processes and coordination gaps more apparent, which may not be as evident in more

limited technical infrastructure settings. Accordingly, the governance failures and adaptations observed in these cases are best understood as reflections of broader institutional conditions that become intensified in the delivery of BGI. This section, therefore, aims not only to describe but also to assess the performance of existing governance arrangements and how they shape the capacity for reflexive, inclusive, and coherent planning of infrastructure under climate uncertainty. This view is in line with the growing literature, which calls not simply for reform of the governance system but for institutional designs that can function across complexity, uncertainty, and socio-ecological interdependence. In this context, governance is envisaged less as one of technocratic coordination and more as a contested political process in which power, legitimacy, and epistemic authority must be foregrounded to achieve adaptive and resilient infrastructure.

9.2.1 Strategic Leadership and Institutional Reflexivity

The leadership weaknesses in Perry Barr and Beales Corner reveal a central limitation in existing governance structures that prevent the embedding of institutional learning, political accountability and genuine adaptability in the operational norm. In these contexts, leadership cannot simply be equated with formal authority, as the mismatch between decision-making power and political legitimacy remains a salient feature of many leadership contexts in the region, particularly where there is no institutionalised mechanism for feedback and challenge that translates into strategic recalibration of any kind. Although strategic leadership existed in both case studies, it was formally constituted but functionally disempowered, either by technocratic rigidity or by a rather fragmented diffusion. This double flaw makes the commonly accepted normative dichotomy of centralised and polycentric leadership less useful. Instead, it emphasises the need for

hybrid models of governance that incorporate reflexivity, political embeddedness and good governance into the complex institutions that govern them.

In Perry Barr, the Environment Agency's has consolidated leadership oversight of resource allocation, regulatory compliance and technical strategy has led to excellent procedural efficiencies including the use of standardised project management frameworks such as PRINCE2. This has led to internal consistency and operational clarity. Nevertheless, balanced technocratic management comes at a political and epistemic cost. By isolating key decision nodes from substantive stakeholder challenge and delaying meaningful public participation until the later stages of a project, the governance process becomes one where project dynamics are prioritised over democratic responsiveness. The marginalisation of Sandwell Town Council, local political instability and the discontinuity of working practices exacerbated this technocratic closure. The dynamics is consistent with Meadowcroft's (2007) critique of the prevalence of instrumental rationality in environmental politics and Flyvbjerg's (1998) notion of the politics of closure, whereby large-scale infrastructure projects effectively hide complexity, dissent and contestation in order to maintain momentum and legitimacy.

In contrast, Beales Corner exemplifies leadership by omission and fragmentation. Decision-making power was dispersed among a variety of actors (including local authorities, consultants, state agencies and the Environment Agency), but there was no single empowered convener who could orchestrate, mediate or enforce strategic coherence. In contrast to the technocratic concentration in Perry Barr, there was no political leadership or administrative coordination at Beales Corner. The disparity in management led to a strategic drift that was evident in the repeated revisiting of design decisions, prolonged stakeholder disputes and a failure to install local knowledge and learn from what emerged. The lack of formal decision-making processes and feedback mechanisms weakened the capacity for adaptive governance, although there were some

areas where reflexivity emerged. This supports Sabel and Zeitlin (2012) contention that authentic institutional reflexivity requires the procedural capacity for repeated assessment and recalibration, which were missing in this instance.

Overall, these cases highlight a structural contradiction in leadership arrangements that separate authority from adaptability, leading to either the rigidity of centralised control or the incoherence of decentralisation. This finding is at odds with governance discourses that valorise either hierarchically clear or polycentric resilient configurations (May et al., 2005; Ostrom, 2010; Mees et al., 2012; Termeer et al., 2016). The evidence is more in line with Jessop's (2002) meta-governance framework, which argues that reflexive governance capacities are essential for orchestrating, integrating and realigning across multiple scales and competing demands. The absence of such meta-governance capacities in Perry Barr and Beales Corner limited the possibilities for conflict management, mutual adaptation and strategic realignment in the face of new institutional constraints and political contestation.

The continuous presence of leadership was an essential factor for reflexive capacity. The relative stability of the Environment Agency's internal structures in Perry Barr provided some protection from disruption but was not sufficient to address the imbalance between the organisations exacerbated by the political change in Sandwell Council. In contrast, the lack of a coordinating centre in Beales Corner meant that the change in leadership had a particularly destabilising effect institutional memory was fragmented, decision-making destabilised and accountability diffused. This observation is consistent with the view of Thelen (2004) and Lowndes and Roberts (2013), that governance resilience is relational trusting relationships and shared interpretive frameworks, as well as enduring institutionalisation, help to build adaptive capacity over time.

Neither site had embedded procedural architectures that systematically incorporated feedback to reflect on trade-offs or change strategy. Once approved, management

followed a linear, project-based logic that limited reflexive adaptability. Flyvbjerg (1998) argues that the provision of infrastructure favours compartmentalisation over responsiveness. Without institutional learning loops, leadership becomes entrenched as a brittle authority that delivers results but cannot respond to complexity, uncertainty or changing public values. Therefore, leadership needs to be reconceptualised as dynamic orchestration rather than static control a distributed institutional capacity that balances competing pressures, facilitates iterative learning and maintains political legitimacy in complex, multi-stakeholder implementation processes (Jessop, 2002; Head and Alford, 2013).

In this context, hybrid governance architectures are required that combine hierarchical clarity and deliberative inclusivity, formal mandates and relational trust, rigorous project management and procedural flexibility. Continuity of leadership must become institutionalised through strong knowledge management and cross-organisational protocols to ensure that staff changes do not compromise protocol in the organisation. The political voice must be ethically reintegrated and not only used as a symbolic tool but must be able to counteract technocratic closure (Swyngedouw 2005; Fung 2006). The operationalisation of such reflexive governance requires the embedding of reflexivity architectures in infrastructure governance: structured processes for review, learning and repeated adjustments throughout the life of a project (Pahl-Wostl 2009; Emerson and Nabatchi 2015). This could include governance boards with rotating leadership, prescribed cycles for development stakeholder engagement, and planned opportunities for design iteration. The Perry Barr and Beales Corner case studies show that authoritative but adaptive, accountable and politically anchored leadership is needed to steer infrastructure in these times of unpredictable climate change.

9.2.2 Centralised Control and Procedural Rigidity

Both the Perry Barr and Beales Corner flood risk management schemes were regulated in a way that highly centralised decision making, with statutory support and standardised processes. The Environment agency took the lead in both cases and was able to coordinate through existing legal powers and technical obligations, prioritising mitigation and compliance. Although this model established useful lines of accountability and continuity of operations, its rigidity raised concerns about responsiveness, adaptive learning and broad citizen and institutional involvement. The Environment agency leadership in both cases was seen less as co-operative management and more as directive oversight. In Perry Barr, for example, decision-making power was devolved to the environment agency and stakeholder input was largely post hoc. Design and implementation followed technical logic and regulatory checklists, often preventing practical engagement on amenity, accessibility or cultural landscape.

At Beales Corner, a series of statutory approvals between planning consent and listed building consent made sure that compliance was met but reduced flexibility and caused additional delays. These findings resonate with the long-standing criticism in the literature on environmental policy. According to scholars like Newig and Fritsch (2009) and Meadowcroft (2007), although formal procedural structures are needed to enhance accountability, they may also contribute to ossification of technocratic decision-making at the cost of deliberate participation and place-based knowledge. At both study sites, infrastructure measures confronted competing land uses and identities as well as cultural heritage. Although interest groups were formally registered, the governance model was biased towards verifiability and legal defensibility rather than co-design or institutional reflexivity. Furthermore, the centralisation here is indicative of what Jasanoff (2004) refers to as the supremacy of technologies of control over technologies of humility where institutional actors in their efforts to cope with uncertainty, reinforce their reliance on

procedural mechanisms rather than engaging with a diversity of ways of knowing and valuing.

In Perry Barr, early-stage engagement was largely instrumental, aimed at achieving statutory obligations rather than shaping substantive outcomes. In Beales Corner, although the governance environment was more multi-layered, with conservation and ecological constraints embedded into planning stages, these often-reinforced administrative rigidity rather than enabling more flexible, place-sensitive innovation.

This form of proceduralism is not without merit. Findings from both case studies pointed to the importance of consistent documentation, structured governance meetings and risk assessments to ensure safety and maintain the legitimacy of the project. From a compliance perspective, formality reduces any liability and ensures continuity in terms of leadership changes. However, according to Legacy (2016) and Rydin (2010), procedural robustness should not be confused with institutional reflexivity. In both contexts, the governance model was rather robust in risk management and compliance. However, it had limited adaptability to changing social or environmental issues. These results align with the argument of Flyvbjerg (1998), which highlights that the formal rationality and managerial control prevail over the democratic responsiveness in the governance of large infrastructure projects. Despite considerable institutional engagement, the general outcome was one of operational closure, where alternative narratives or design adjustments had little traction once the statutory pathway was established. Moreover, sustainability considerations regarding SuDs or biodiversity were occasionally incorporated into the process, but were perceived as means of obtaining planning permission, and not as part of the design ethos.

This brings more profound questions concerning the epistemologies that governance processes are based on. The decision-making framework was not grounded in iterative dialogue, but rather oriented towards programmatic compliance that constrained learning-

by-doing and collaborative experimentation. Stirling (2010) indicated that the limited definition of one form of evidence-based governance ends up excluding the very kind of uncertainty and pluralism that adaptive governance is designed to embrace. Moreover, the centralised model had a disproportionate impact on the actors at the local level especially when jurisdictional asymmetries arose. In Perry Barr, the construction pressure was shifted to the neighbouring Sandwell, which had limited influence in the design process but had to incur the political and environmental costs. This geographical disconnect between power and influence further weakened the sense of procedural fairness emphasising the significance of scale-sensitive and relational governance of infrastructure (Bulkeley and Castn Broto, 2012). Consequently, the results indicate that although centralised and procedural forms of governance offer some operational benefits particularly in high stakes, technically complex projects, they do so at the expense of adaptive potential, place responsiveness and democratic legitimacy.

With the growing salience of the governance of climate-responsive infrastructure, the issue is not merely to streamline processes, but to reconsider what type of knowledge, power, and institutional relationships are relevant in the determination of decisions. A more reflexive, inclusive model of governance would go beyond procedural compliance to co-learning, pluralism of values, and long-term adaptability in the face of increasing environmental uncertainty.

9.2.3 Political and Cross-Jurisdictional Complexity

The governance of the Perry Barr and Beales Corner flood risk management schemes was shaped not only by institutional structures, but also by the political and territorial contexts in which these structures operated. Both projects have highlighted the significant challenges that arise when responsibilities are spread across multiple public organisations such as the EA, local authorities, landowners, developers, utility companies, residents,

contractors etc., each with different mandates, governance structures and planning cultures. The result has been a fragmented authority landscape with shifting power relationships and constant negotiation over institutional boundaries. In Perry Barr, the cross-border nature of the project between Birmingham and Sandwell councils led to inherent asymmetries in the distribution of project benefits and the allocation of burdens. Whilst the residents of Birmingham benefited directly from the improved flood defences, Sandwell suffered most of the physical and social disruption such as construction works, land use impacts and loss of quality of life. The resulting imbalance led to political tensions that required ongoing engagement and, in some cases, efforts at inter-agency alignment. As the data showed, reaching agreement was often dependent on political goodwill and personal relationships rather than governance protocols. This is reminiscent of the work of Bulkeley and Kern (2006) and their discussions of 'networked urban governance', where informal coordination emerges when institutional authority is uncertain, unclear or overlapping. Such misalignment of responsibilities is common in environmental governance. As Healey (2006) notes, spatial planning tends to take place in fragmented institutional terrain without integrative structures, especially where infrastructure cross administrative boundaries. In the case of Perry Barr, the changing political leadership at the local authority level complicated matters.

According to the findings of the case study, there were repeated changes in political position, personnel and procedural expectations, which required a re-examination and renegotiation of previous decisions. This slowed down the dynamics but also led to a certain fatigue and risk aversion at the institutional level, which further reinforced the centralising tendency of the Environment Agency. Beales Corner was less spatially fragmented but more institutionally intensive, requiring close working relationships between district authorities, conservation authorities, utility companies and national bodies. Due to the historic sensitivity of the site, oversight by Historic England and the

local planning authority led to lengthy approval processes and frequent stalling of the project. Although the stakeholders were nominally committed to the outcomes, their different procedural cultures and legal obligations often led them in different directions. The conditions attached to planning applications, particularly in relation to the use of materials, conservation impacts and ecological mitigation, have created a rigid and procedural environment in which one approval is dependent on the prior resolution of another. This sequential dependency is indicative of what Ostrom (2005) refers to as a polycentric trap, where the mere existence of multiple decision-making centres does not automatically lead to innovation or accountability, but rather reproduces inertia when mechanisms for coordination are either weak or absent.

There were repeated project delays in both projects, which were not due to technical deficiencies or local opposition. Instead, the delays were primarily due to administrative obstacles such as internal approvals, inter-agency documentation and a lack of synchronisation between levels of government. The findings echo Van Breugel and Scholten (2019) critique of governance-by-procedure, in which the administrative rationality of modern planning systems supersedes more strategic or inclusive forms of spatial coordination. At Beales Corner, the need to obtain overlapping consents (from planning, highways, conservation, ecology and archaeology) significantly extended the project timetable, with even the smallest changes setting the process back across departments. The delays were not just technical inconveniences, but had serious consequences for stakeholder confidence, budget control and the long-term feasibility of the project. In addition, it was a challenge for the governance structures to accommodate the different timelines of the organisations involved. Whilst the project teams worked within set delivery timescales, the statutory planning authorities adhered to fixed timescales for public consultation, statutory reporting deadlines and departmental review timetables. These time differences were rarely taken into account in project planning,

leading to constant conflict and lack of co-ordination. Hajer and Wagenaar (2003) also emphasise that effective environmental policy requires the coordination of institutions and time, an element that was clearly lacking in both cases. It is important to point out that the complexity in both sites was not simply a case of several actors, but the inability of existing governance arrangements to support shared learning, conflict resolution and adaptive strategies across organisational silos. The project context called for an infrastructure of collaboration but in reality, a fragmented and reactive system developed in which formal processes were poorly integrated and informal workarounds were essential for driving projects forward. The resulting institutional fatigue is not only a procedural problem, but also a political one. It raises broader questions about the ability of contemporary planning systems to create integrated, climate-resilient infrastructure amid growing institutional fragmentation.

Perry Barr and Beales Corner shows that the issues surrounding the management and provision of flood infrastructure are as much political as technical. The existence of multiple authorities can improve consultation and spread accountability, but this requires a strategic approach to coordination that goes beyond simple compliance with procedures. The findings underscore calls in the governance literature such as Termeer et al. (2016) and Jordan and Huitema, (2014) for institutional architectures that are not only polycentric but also connective, bridging organisational divides, synchronising timelines and managing asymmetries of power, interests and responsibilities. Without such architectures, environmental governance remains at risk of becoming a patchwork of disconnected mandates, where strategic vision is undermined by procedural disarticulation and political fragility.

9.2.4 Accountability, Resilience, and Institutional Learning

Across both flood risk management schemes, governance arrangements were

characterised by a high degree of procedural discipline and regulatory compliance. Such arrangements are widely recognised as central to clarifying institutional responsibility, managing legal liability, and ensuring public safety in high-risk infrastructure contexts (Power, 2007; Aven and Renn, 2009). The findings nevertheless indicate that prioritising accountability frequently constrained adaptive capacity and limited opportunities for institutional learning. In practice, accountability was primarily operationalised through procedural control rather than reflexive or learning-oriented governance, reproducing the structural tension between managing risk and responding to changing local conditions widely documented in adaptive governance literature (Pahl-Wostl, 2009; Huitema et al., 2009).

At Perry Barr, accountability was instituted through detailed recording of events, the statutory requirement of reports, and formal decision-making. These systems ensured transparency and auditability, particularly with respect to safety-critical infrastructure, and have been described as an audit-driven model of public risk governance (Power, 2007). Risk was managed through technology-heavy measures such as telemetry-controlled systems, back-up power supplies, and regimented inspection regimens, reflecting an idea of resilience based on engineering reliability, redundancy, and fail-safe design (Walker et al., 2004; Aven and Renn, 2009). Although this method is effective in minimising operational uncertainty, it resulted in a governance environment with limited opportunity for recalibration post-project delivery. The institutional framework provided limited mechanisms for including this new knowledge in decision-making as contextual conditions changed, particularly in response to community concerns about access, heritage impacts, and disruption. The emphasis on delivery over predetermined technical and contractual parameters assumed a dominant role, thus limiting the possibility of policy learning and adaptive change. This disposition echoes long-standing criticisms of infrastructure governance as path-dependent and delivery-oriented (Flyvbjerg, 2014).

A similar dynamic was observed at Beales Corner; there, governance was organised around a highly stratified system of approval that included heritage, planning, ecological, and transport authorities. Although such multi-layered structures are often explained by the need to increase accountability and procedural legitimacy, they may also delimit decision-making by restricting discretion and reducing the room to innovate (Jasanoff, 2004; Stirling, 2007). The elimination of sustainable design features, such as urban greening and sustainable drainage, was justified as necessary to meet heritage and planning requirements, instead of being considered in terms of long-term resilience or co-benefits. Under this structure, accountability was largely vertical, with an emphasis on statutory responsibilities and regulatory oversight, instead of being aligned horizontally with place-based values, future users, or broader socio-environmental impacts (Newman et al., 2001; Bovens, 2007).

The implications for institutional learning are significant. Even though the language of learning was often invoked, it was rarely operationalised in a manner that challenged the dominant assumptions or altered governance trajectories. Rather, experience was used to alleviate established design practices, as opposed to serving as a reflexive basis for challenging prevailing conceptualisations of risk, resilience, and value (Argyris and Schön, 1978; Pahl-Wostl, 2009). Although extensive, inter-organisational coordination was largely transactional, focusing on securing approvals rather than on shared problem definition or collective learning. Lessons identified by practitioners, such as strategies for managing inter-agency relationships or sequencing technical consents, were rarely formalised in organisational memory or project frameworks, thereby reinforcing the well-documented constraints of institutional learning in public-sector infrastructure systems (Boin and van Eeten, 2013).

Such patterns indicate a more structural feature of infrastructure governance: institutional practices become sedimented within routines, metrics, and professional standards that

favour stability and predictability over experimentation and learning (Drew, 2020). Within such systems, resilience is reduced to technical performance and regulatory compliance, while other dimensions, including social equity, ecological enhancement, and community co-benefits, are marginalised (Folk et al., 2005; Stirling, 2007). Importantly, this should not be interpreted as a lack of governance capacity. Rather, the institutions involved demonstrated a high level of capacity to manage complexity within existing statutory and organisational constraints. The rigidity observed was not incidental but actively produced and institutionally valued, particularly in high-risk contexts where legal defensibility, auditability, and reputational considerations are paramount (Power, 2007; Huitema et al., 2009).

This is a key paradox in climate-resilient infrastructure governance. The institutional structures that minimise risk and promote accountability can also limit the types of learning and adaptation necessary to respond to uncertainty, climate variability, and contentious social values (Walker et al., 2004; Folke et al., 2005). As a result, the progression of adaptive governance cannot be narrowed down to the implementation of participatory processes or minor improvements in coordination. Instead, it requires more fundamental restructuring of the construction of knowledge, risk, and legitimacy in infrastructure decision-making processes. This involves the establishment of protected spaces of reflexivity, the establishment of controlled forms of experimentation, and the expansion of assessment criteria beyond those that uphold standardisation and measurability (Stirling, 2007; Pahl-Wostl, 2009). Without such shifts, resilience runs the risk of being reduced to a technical accomplishment, instead of being perceived as a changing social process capable of adapting to change.

9.2.5 Instrumental Participation and Procedural Opacity

Despite the apparent commitment to stakeholder consultation and engagement in the Perry

Barr and Beales Corner schemes, participation was not collaborative, but rather an instrumental and procedural tool. In both contexts, engagement occurred through controlled forms such as newsletters, open exhibitions, statutory notices and information sessions which were focused on information dissemination and regulatory compliance, and not deliberation or mutual influence. Participation was thus more of a tool to affect decisions in a co-production manner rather than a tool to legitimise pre-determined results. These dynamics echoes an established body of criticism of the literature of participatory governance that draws a distinction between participation as a democratisation tool and participation as a technocratic operation to achieve institutional ends as opposed to the empowerment of the people (Arnstein, 1969; Cooke and Kothari, 2003).

At Perry Barr, although formal responsibilities were divided and statutory approvals obtained, the room to make a significant contribution decreased significantly. While local authorities and community actors were engaged during the early stages, the designation of the Environment Agency as the lead statutory authority concentrated decision-making power and progressively curtailed opportunities for contestation or revision. The governance structure provided technical control and regulatory conformity, but it did not provide much institutional capacity to make adjustment in the design process over time or to review previous decisions relative to changing local interests. Resident concerns, especially loss of amenity, restricted access, and heritage implications were recognised procedurally, but not substantially factored into decision-making procedures. In this context, such participation conforms to Fung's (2006) understanding of thin or low-influence participation, where the public is invited to contribute, but the contribution has tenuous ties to authoritative outcomes.

A comparable pattern emerged at Beales Corner. In this case, while engagement activities were observable and continuous, the substantive impact of public feedback was severely constrained, especially where matters of design intersected with heritage and planning

codes. Materials and public meetings were designed to communicate decisions that had already been fixed through expert and regulatory processes, rather than to open them up for collective deliberation. While this method fulfilled the requirements set out in the legislation for consultation, it did not create the kind of participatory spaces within which citizens could meaningfully shape problem framings, priorities, or trade-offs. Hence, engagement took place within invited spaces which, as Cornwall (2004) points out, are confined by the institution, asymmetric, and incapable of challenging the dominant logic or expert authority.

This instrumentalisation of participation was further compounded by procedural opacity surrounding how public input was processed, evaluated, and acted upon. In both cases, people were unsure who mattered, how competing claims were decided, and whether there were any avenues for appeal or reparation once formalised decisions were issued. The governance processes were expert-led, highly proceduralised, and legally valid, but socially obscure. As Hajer (2003) argues, contemporary environmental governance is often characterised by institutionalised ambiguity, in which formal procedures obscure rather than illuminate the sites and moments of decision-making. Participation can happen in those contexts, but the channels through which this participation influences decision-making are often obscure to outsiders of institutional networks.

This opacity was particularly evident in the handling of design trade-offs at Beales Corner. The initial proposal incorporated sustainable drainage systems, urban greening, and a range of co-benefit-oriented interventions. However, these elements were later minimised or eliminated to comply with heritage requirements, and although justified internally for statutory approval, they were not publicly framed as value conflicts or strategic choices but as technical or regulatory necessities, thereby constraining deliberation and reinforcing a governance rationality that prioritises institutional defensibility over participatory legitimacy. This trend reflects a broader criticism in the literature, which argue that in a

complex and uncertain environment, public institutions will revert to procedural certainty and the role of experts, instead of adopting more dialogic or experimental forms of governance (Voß and Bornemann, 2011). This procedural orientation is also reflected in the dependence on predefined processes and the centralisation of decision-making structures, both of which create a risk-averse governance environment. In this context, compliance becomes performative and consultation becomes a formal obligation and no longer a significant process of engagement. The act of participation is thus reframed as a limited administrative practice, which is not tied to the dynamic course of the project. This is consistent with known criticisms of proceduralism in adaptive governance that emphasise the ways in which formalised procedures may suppress reflexivity, limit institutional learning, and reduce responsiveness to social feedback (Newig and Fritsch, 2009; Huitema et al., 2009). Participation in these environments is not mobilised as a form of questioning or reworking decisions but as a form of stabilising and legitimising decisions.

What emerges is a governance architecture that is procedurally dense yet participatorily thin. Despite the high degrees of regulatory compliance and technical competence shown by both schemes, they do not create the institutional conditions for reflexivity, understood as the ability to re-open and revise decisions in light of new knowledge, values, and contestation. The lack of clear feedback systems and the relative lack of transparency regarding how the input of the population shapes decision-making support an instrumental attitude towards consultation that is ultimately detrimental to social legitimacy. In complex systems of governance, legitimacy is not merely a matter of procedural accuracy, but rather an issue of perceived transparency, justice, and responsiveness in the decision-making processes (Dryzek, 2005). These limitations cannot be tackled through minor changes to the current engagement practices. They demand a redesign of participation as a constitutive component of governance, not a supplementary procedure that is attached

to technical decision-making. This includes embedding participatory practices earlier and more iteratively within project lifecycles as well as developing institutional cultures that promote shared problem definition, negotiated trade-offs, and shared responsibility. The sustainability transitions and climate governance literature makes it clear that participation should be perceived as a prerequisite to the provision of socially sound and politically acceptable infrastructure (Meadowcroft, 2009; Adger et al., 2011). Without this shift, flood risk governance will tend to reproduce infrastructures that are technically resilient but socially weak and therefore undermine their long-term legitimacy and efficacy.

9.3 STAKEHOLDER ENGAGEMENT

The section examines stakeholder engagement in the Perry Barr and Beales Corner flood infrastructure schemes. Stakeholder engagement is typically regarded as one of the central concepts in contemporary infrastructure delivery, particularly in cases where the interests of the public, long-term community effects, and environmental trade-offs collide. However, the research shows that the existence of engagement activities does not necessarily imply their effectiveness or legitimacy. The effectiveness of engagement depends not simply on its occurrence, but on its design, its timing within the project cycle, the inclusivity of participants, and its capacity to enable genuine influence and mutual learning. Both case study results integrate stakeholder involvement into their project delivery models. However, this tends to mask underlying procedural tensions, which suggest a combination of informative, consultative, tokenistic, and administrative practices. The results showed that the processes of engagement were frequently conditioned by institutional capacity constraints, political contingencies, and structural imbalances of power and influence, which cast important doubts on the nature and democratic quality of participatory governance within an infrastructure setting. This section is structured based on the interrelated themes that surfaced as a result of the data

analysis of stakeholder engagement practices. By unpacking these dimensions, the section seeks to move beyond a checklist of procedural engagement. Rather, it positions stakeholder engagement as a place of contested meaning, which must be negotiated in terms of legitimacy, equity, and adaptability.

9.3.1 Asymmetrical Stakeholder Incentives

Empirical analysis from both case studies reveal that stakeholder engagement was influenced less by formal alignment of institutions and more by asymmetries in perceived costs, benefits, and accountability. Although institutional actors were formally embedded in governance arrangements, the commitments of these actors hinged upon pragmatic assessments of political exposure, administrative capacity, reputational risk, and the immediacy of local impacts. When expected benefits become vague, delayed, or occur beyond the direct local or organisational boundary of responsibility, engagement weakens and, in some instances, fades altogether.

This was particularly evident in Sandwell Council's experience at Perry Barr. Even though the council was framed as a delivery partner, it found the scheme to be more externally imposed than co-produced. Construction disruption was spatially confined and politically visible at the local level, while the principal benefits of strategic flood risk reduction and regulatory compliance were realised at a wider catchment and regional scale. This spatial and temporal decoupling of costs and benefits exemplifies distributive injustice (Penning-Rowsell and Pardoe, 2012) and helps explain the limited institutional ownership observed. As Andreasen et al. (2022) argue, disruptions to accessibility and everyday functioning of stakeholders in flood-prone and infrastructure-fragile contexts can undermine stakeholder confidence and willingness to invest political or organisational capital, particularly when compensatory benefits are weakly articulated and/or externally realised.

Beales Corner also showed a similar but different pattern. Engagement at an early stage produced relatively high levels of participation among residents, elected members, and heritage groups. However, this engagement eroded as stakeholders perceived their contributions, particularly those relating to landscape quality and cultural heritage, to be systematically overridden by technical and regulatory imperatives. Significantly, it was not a case of formal exclusion, but rather of participatory marginalisation. Stakeholders were present, but they were increasingly irrelevant to the decision trajectory. According to Chilvers and Evans (2009), engagement processes can become performative if stakeholders' values are not visibly translated into decision outcomes, and such processes can then erode trust and legitimacy over time.

Collectively, these cases build on the current academic discourse on environmental justice and risk governance by showing that participation should be evaluated not only in procedural terms, but also by perceived distributive equity (Sikor and Newell, 2014; Anguelovski et al., 2016). This is further nuanced by the analysis of Penning-Roswell and Pardoe (2012) which highlights that even formally collaborative arrangements can unravel when local benefits remain intangible or politically unrewarding. In a wider context, the results undermine optimistic participatory theories by showing that initial engagement does not ensure long-term cooperation in the presence of power asymmetries, veto, and misaligned incentive structures (Pahl-Wostl, 2009; Ostrom, 2010). In this context, stakeholder involvement is contingent, fragile, and reversible.

9.3.2 Engagement as Compliance, Not Collaboration

In both case studies, stakeholder engagement was mostly framed as a compliance mechanism as opposed to a collaborative governance mechanism. The consultations, public exhibitions, and information sessions were primarily conducted to fulfil statutory planning requirements and had limited influence on the substantive direction of the

projects. Consequently, these formal participatory mechanisms were only activated downstream of key design decisions, limiting the ability to meaningfully influence outcomes. As several interviewees stated, discussions often happened after key parameters had already been set, effectively relegating stakeholders to respondents of pre-determined options rather than co-creators of project pathways.

This pattern draws on Healey's (2006) critique of participatory planning practices in which consultation becomes merely symbolic, an administrative necessity with limited deliberative space for learning, negotiation, or exploration of alternatives. When engagement is conceptualised in this context, its ability to uncover latent conflict, incorporate plural forms of knowledge, or aid adaptive decision-making is restricted. For instance, at Perry Barr community concerns regarding multifunctional land use and long-term access to GI were identified but seldom incorporated into design modifications. Also, sidelining locally generated options, especially those that foregrounded heritage sensitivities, at Beales Corner strengthened the perception that engagement was about perception management rather than the informing of decisions. This dynamic is echoed by Quick and Feldman's (2011) discussion of participation without collaboration, in which institutional actors retain decisional power but open restricted spaces.

The broader body of work on co-production and adaptive governance points to the challenges of such strategies. Fung (2006) argues that engagement that is framed with compliance as the main feature produces an illusion of openness without shared authority. Similarly, Stirling (2007) states that participatory processes must be reflexive and reversible, so that they can absorb dissent and re-calibrate direction to maintain legitimacy. Without this ability, involvement may be counterproductive, despite being well-intentioned. According to Innes and Booher (2004), effective participation is not merely a matter of the people involved, but also of the extent to which participation facilitates the transformation of shared conceptions, generates new spaces of options, and

shapes outcomes.

Stakeholder engagement in this light ought to be understood as a governance process rather than merely a communicative action (Innes and Booher, 2004). This requires initiating engagement before major decisions are made, integrating visible feedback loops, and demonstrating how stakeholder contributions are absorbed, challenged, or transformed within decision-making processes (Quick and Feldman, 2011). Specific methods for fostering co-ownership and pre-emptively addressing conflict include stakeholder steering groups, co-design workshops, and scenario-based deliberation (Beierle and Cayford, 2002; Sanders and Stappers, 2008; Welp et al., 2006). As Chilvers and Kearnes (2015) argue, the legitimacy of participatory infrastructure planning, ultimately depends on the capacity of institutions themselves to adapt through engagement, particularly in climate resilience contexts characterised by uncertainty and value-based trade-offs (Few et al., 2007; Newig and Fritsch, 2009).

9.3.3 Uneven Stakeholder Capacity and Participation Gaps

The results of Perry Barr and Beales Corner further highlight that participation gaps are not merely a problem of access alone but are instead structured by the uneven distribution of capacity, expertise, and institutional position. As noted by Newig et al. (2005) and Fung (2006), participatory mechanisms sometimes favour actors equipped to deal with complex governance systems and marginalise those who lack technical expertise, time, or organisational capacity. Without deliberate intervention, participation risks reproducing existing inequalities rather than mitigating them (Cornwall, 2008). Furthermore, the formal inclusiveness of engagement structures is not sufficient for substantive equity. At Perry Barr, the Environment Agency led the project, and Sandwell Council played the role of a delivery partner. Nevertheless, engagement with local actors often occurred within a

largely predetermined strategic and technical framework, limiting the scope for influencing major design decisions. While they were invited to participate in consultation, these actors did not have the technical leverage or institutional authority to effectively challenge or alter flood design decisions. At Beales Corner, civic groups, small landowners, and heritage advocates met with similar restrictions due to procedural and technical framings which prioritised compliance over locally grounded knowledge. Thus, participation remained visible but weakly consequential.

These patterns reinforce the argument of Reed et al. (2009) that meaningful engagement is dependent on enabling conditions rather than just open invitations. Structural asymmetries in terms of time, expertise, and administrative support systematically privilege national agencies and consultants over local actors. Quick and Feldman (2011) characterise this phenomenon as differentiated participation, where institutional design favours those with substantial pre-existing embeddedness in governance networks, although formal equality may persist.

From a practical perspective, the findings suggest the need for differentiated engagement strategies that explicitly recognise and engage with capacity disparities. Support mechanisms, such as technical translation, facilitated deliberation, and iterative briefing, can help broaden the range of actors able to participate substantively (Few et al., 2007; Reed, 2008). In a more fundamental sense, power-balancing measures, such as reserved representation for non-institutional actors or co-producing accessible project documentation, are essential in preventing engagement from becoming a site of procedural reproduction rather than a site of democratic innovation. As Stirling (2008) and Fraser (2009) argue, justice in participation requires equity, not merely access a principle that both case studies demonstrate is critical to the legitimacy of flood infrastructure governance.

9.3.4 Communication Constraints in Crisis Contexts

The COVID-19 pandemic represented yet another limitation, restricting established methods of stakeholder engagement and accelerating the move to digital consultation formats. The transition altered the parameters of participation and the conditions under which people could engage. Participation increasingly privileged actors with dependable digital access, institutional connectivity, and procedural fluency, while excluding others through a lack of infrastructure and capacity rather than intent.

At a relational level, the shift to digital platforms eroded many informal dynamics that the building of trust and mutual understanding relies on, including face to face conversations, embodied cues, and opportunities to clarify or dissent. Structurally, engagement processes came to assume digital literacy and connectivity as baseline conditions, assumptions that are unevenly distributed across age, socioeconomic status, and organisational capacity. As Hacker and van Dijk (2000) note, digitally mediated participation reshapes democratic practice in ways that often advantage already empowered actors, reinforcing rather than alleviating inequality.

The result was a more technocratic and less representative form of consultation. Although institutional actors remained involved, community voices became fragmented and unevenly represented. Even though engagement continued formally, it was less legitimate and less inclusive. Hacker and van Dijk (2000) argue that such dynamics, are consistent with longstanding critiques of digitally mediated participation, which reveal how procedural consistency can disguise substantive exclusion where participation is filtered through unequal access, capacity, and embeddedness in institutions. These findings show that crisis governance does not merely assess institutional adaptability. Rather, it lays bare inherent assumptions embedded in the design of engagement. This occurs most prominently in relation to who is presumed able to participate and the conditions of participation. As illustrated here, continuity of process does not imply continuity of

participation, particularly where accountability and inclusion are not actively protected in collaborative governance arrangements (Papadopoulos, 2024).

The implications for future practice are significant. Hybrid engagement models that combine digital and analogue formats should become standard, rather than exceptional. Investments in digital inclusion should go beyond infrastructure to include support, facilitation, and relational capacity. Furthermore, as argued by Papadopoulos (2024), accountability and participation should be considered core conditions of collaborative governance even in crisis conditions. The cases of Perry Barr and Beales Corner show that resilient engagement needs institutional designs that expect difference, not designs that assume equivalence. Without such attention, digital tools risk narrowing the democratic field, transforming crisis adaptation into a vector for exclusion rather than resilience.

9.4 RESOURCES

The literature on infrastructure governance has focused on various elements like institutional design, stakeholder coordination, regulatory complexity, however the issue of financial, human, and procedural resources is often underexposed or treated as operational rather than structural. Nonetheless, the case studies of Perry Barr and Beales Corner show how resource constraints determine what can be built. In both instances, challenges were not only technical or political; they arose from capacity constraints, rigid funding mechanisms, and cumbersome procedures, which inhibited flexibility and resilience in the implementation frameworks. This section critically examines how funding challenges have influenced the development of the two flood risk programmes. The challenges include rising costs due to inflation, slow funding approvals, and shortages of qualified staff, especially at the local authority level. The constraints mentioned above did not occur in isolation but interacted with governance fragmentation and stakeholder asymmetry, resulting in delays in implementation and limiting the scope for innovation

and adaptive learning. Based on empirical evidence and a wide-ranging body of literature, the study finds that infrastructure delivery is governed not only by the design of governance but also by the availability, distribution, and flexibility of the supporting resources. This section provides a justification for conceptualising infrastructure delivery models that consider resources not as an administrative afterthought, but as a key variable for legitimacy, efficacy, and resilience.

9.4.1 Funding Volatility and Inflationary Pressure

The Perry Barr and Beales Corner cases highlight the essential imbalance between the solidity of financial management and the liquidity and uncertainty of infrastructure provision. The financial volatility and inflation associated with the two projects were not merely external shocks but instead acted as stress tests revealing deeper institutional inflexibility. Cost overruns or administrative errors were not isolated incidents; rather, they indicate an overall inability to align static budgeting with dynamic delivery conditions. In Perry Barr, the Environment Agency submitted four different funding applications because of inflationary pressures after COVID and disruption to the global supply chain. All the bids required justification and internal approval, diverting the organisation from delivery to defending an internal process. Operational difficulties encountered by government bodies including Western Power and BT worsened the issues. At Beales Corner, the contingency margin fell short as inflation increased more quickly than expected. The institutional fragmentation between Historic England, Natural England and Wyre Forest District Council created further delays in procurement, as there was no dynamic response mechanism. In both cases, the existing financial architecture proved unable to evolve in real time. The lag between recognising new needs and mobilising resources became a space of institutional inertia where the will to adapt was checked by procedural rigidity. The dynamic has remained the subject of criticism in the public

administration and infrastructure governance literature.

According to Skelcher and Torfing (2010), inflexible institutional tools can actively inhibit adaptive governance by placing an emphasis on compliance over responsiveness. Peters (2010) also cautions that strict financial rules cause organisations to be risk averse and institutions are locked into mitigation strategies that inhibit innovation. The practice implications are not only procedural, but conceptual. The error of misdiagnosing the nature of infrastructure delivery in the face of uncertainty is to consider cost volatility as an aberration. A more resilient model would incorporate financial responsiveness into project lifecycle design to take into account shifts and not treat them as exceptions. Tools such as rolling contingency envelopes, inflation-indexed budgets, and modular procurement frameworks offer pathways toward this goal (Infrastructure and Project Authority, 2021; National Infrastructure Commission, 2026). Institutional actors that support these approaches are the Infrastructure and Projects Authority (2021) and the National Infrastructure Commission (2026), which claim that financial systems must be iterative and adaptable to the modern circumstances of infrastructure delivery. Most importantly, the financial disruptions experienced in Perry Barr and Beales Corner did not only slow progress but also damaged institutional trust, limited collaborative capacity and reduced the scope for adaptive learning. Furthermore, budget amendments were not incorporated into the normal practice but were considered as political and procedural crises. This responsive approach slowed down the delivery momentum and restricted opportunities for collaborative problem-solving. According to Peters (2010) and Davoudi (2012), public infrastructure resilience does not merely occur due to a solid technical design, but through the institutional capacity to learn, adapt and fund change.

9.4.2 Procedural Burdens and Bureaucratic Funding Mechanisms

The conflict between bureaucratic accountability and responsive provision in

infrastructure delivery was most apparent in the funding structures of Perry Barr and Beales Corner. Though financial control is necessary in public sector governance, the structure of funding systems, which entailed multi-level approvals, narrowly defined justifications, and rigid allocation rules, was structurally incompatible with the iterative and uncertain character of flood risk management. Rather than enabling responsiveness, these arrangements imposed procedural burdens that constrained the capacity for timely response and innovation. These tensions in Perry Barr were reflected in the inability to adopt promising changes, including automated grab systems that would enhance future maintenance efficiency. These rejections were not based on financial constraints; rather, the procedural requirements necessary to justify their inclusion exceeded what could be accommodated within the delivery schedule. Sequential and fragmented budget reallocations at Beales Corner led to delays, constraining design flexibility and undermining institutional confidence among actors across institutions. Funding governance in both cases functioned more as a stabilising mechanism aimed at protecting established business cases than as an enabling mechanism. This, in turn, impeded adaptation to emerging risks and new knowledge.

These results further substantiate criticisms found in the adaptive governance literature. Mees et al. (2016) argue that risk-averse funding systems prioritise control over reflexivity, thus restricting innovation. Similarly, Gersonius et al. (2013) argue that traditional financial planning models are inherently incompatible with the uncertain and learning-based nature of flood-resilient infrastructure. The Perry Barr case demonstrates that prescriptive approval processes can constrain opportunities for strategic experimentation. The case of Beales Corner, however, adds a significant dimension by demonstrating that this rigidity is not limited to centralised control systems. Procedural burdens can accumulate and create the same constraints even in fragmented, multi-actor governance arrangements. This implies that current adaptive governance scholarship is

poorly equipped to theorise the interaction between institutional fragmentation and procedural load (Christensen and Lægreid, 2014; Mees et al., 2016), especially in terms of how these dynamics interactively shape the limits of adaptive capacity.

Overcoming these limitations is not a matter of incremental administrative reform, but rather of a reconfiguration of the logics of financial governance. Approaches that include discretionary spending, rapid escalation processes, and rolling contingencies are better aligned with outcomes-based funding models associated with experimentalist governance (Sabel and Zeitlin, 2012; Infrastructure and Projects Authority, 2021). Importantly, these approaches do not signal a relaxation of accountability, but rather a transformation of accountability from static compliance-based oversight to more dynamic forms of governance that facilitate learning, responsiveness, and institutional adaptation.

9.4.3 Human Resource and Institutional Capacity Constraints

At the core of the formal architecture of governance frameworks lies a more subtle, rarely discussed substrate: the human and institutional capacities that underpin delivery. In both the Perry Barr and Beales Corner schemes, the limit of delivery was not defined by governance architecture in the abstract, but by the availability, stability, and interdependence of human resources. While dominant accounts of governance of infrastructure places emphasis on coordination mechanism, regulatory tools and inter-agency agreement (Ostrom, 2010; Ansell and Gash, 2018), these case studies show that the viability of this mechanism is inseparable from institutional stamina, staff continuity and operational discretion.

In Perry Barr, a succession of changes in Sandwell Council's senior leadership created a collective amnesia, damaging relational trust and shared understanding. This aligns with the findings of Lowndes and McCaughie (2013), which argue that staff turnover impedes

strategic governance and organisational learning. In Beales Corner, capacity constraints was revealed through fragmentation and staff overload rather than turnover. The fragmentation of responsibilities among various statutory bodies led to successive, redundant reviews that reflected Hill and Hupe's (2009) analysis of governance under resource scarcity. These dynamics resonate with broader critiques of public-sector capacity erosion. Head (2010) finds that capacity constraints are under-theorised barriers to collaboration, while Christensen and Lægreid (2007) document how fragmentation weakens integrative state functions. Jordan and Turnpenny (2015) also note vertical disjunctions in environmental governance, where responsibility is transferred without capacity.

Addressing these issues requires deliberate institutional design. Models of pooled resourcing and joint delivery advocated by the Infrastructure and Projects Authority (IPA, 2021) and OECD (2019) can stabilise capacity across organisational boundaries. Procedurally, investments in institutional memory lessen the effects of turnover (Thelen, 2004; Sabel and Zeitlin, 2012). Adaptive capacity is fundamentally enhanced through organisational learning and knowledge retention (Pahl-Wostl, 2009). Thus, institutional capacity acts as an infrastructure for engagement. When there is no continuity and relationship depth, governance becomes performative rather than substantive. According to Hajer (2003), effective policy work not only relies on formal authority, but also on deliberative capacity. Authority may initiate projects, but it is institutional capacity that sustains them.

9.5 CHAPTER SUMMARY

This chapter examined the governance processes shaping the Perry Barr and Beales Corner flood risk management schemes and situated the findings within broader discussions on environmental governance and institutional practice. Four key lessons

come out clearly from the comparative analysis and directly inform the development of the conceptual framework. First, institutional effectiveness depends on everyday operational capacity, including the ability to retain knowledge, sustain relationships, manage ongoing activities, and maintain continuity in decision-making. In Perry Barr, frequent changes in management disrupted institutional memory and reduced local authority influence, while at Beales Corner, fragmented responsibilities and staff pressures led to delays and weak coordination. Furthermore, governance arrangements across both cases show clear coordination gaps, with responsibilities spread across multiple actors but without strong mechanisms to align actions in practice. Also, accountability systems were mainly compliance driven, while stakeholder engagement remained largely consultative, with limited influence on actual decisions. Additionally, resource and operational arrangements tended to prioritise control and procedural certainty, which limited flexibility and constrained adaptive responses during delivery. Consequently, these lessons form the basis for refining the conceptual framework presented in Chapter Ten, where governance is understood through the interaction of legislation and policy, governance structures, resources, and stakeholder engagement as key conditions shaping BGI delivery in practice.

CHAPTER 10: REFINEMENT OF THE CONCEPTUAL FRAMEWORK

10.0 INTRODUCTION

The chapter consolidates and enhances the conceptual contribution of the thesis by refining and operationalising the BGI governance framework that has been developed in the project. The framework is not intended to enforce best practice or to be a universal model of governance. Rather, it is designed as a diagnostic and reflexive analytical tool that enables critical interrogation of how BGI governance is assembled, constrained, and stabilised in practice. The framework is based on empirical evidence from the Perry Barr and Witton and Beales Corner case studies, which conceptualise governance as a relational and socio-political process, influenced by the interplay of legislation and policy, governance architecture, resource conditions, and stakeholder engagement. Unlike technocratic or procedural approaches to infrastructure governance, the framework anticipates the role of power, institutional design, regulatory interpretation, and participation in determining which forms of BGI become possible, prioritised, or marginalised over time. The chapter has three interconnected objectives. Firstly, it reflects on the purpose and refinement of the conceptual framework, explaining how empirical findings necessitated modifications to the original model. Secondly, it reflects on the presentation and use of the refined framework, clarifying how it should be applied as an analytical device. Thirdly, it demonstrates the practical application of the framework through a focused empirical illustration, highlighting governance dynamics that are not readily visible in policy wording or project documentation alone.

10.1 Purpose of the Conceptual Framework

The purpose of the refined conceptual framework is to go beyond simply describing governance arrangements and to provide a clear, critical way of explaining how BGI outcomes are actually produced in practice. While the original framework, developed from the literature, helped to highlight issues of institutional design, coordination, and policy intentions, the evidence from the Perry Barr and Witton and Beales Corner case studies showed that these assumptions do not always hold in reality. In practice, governance was not as coherent, flexible, or participatory as the literature suggests. Instead, what shaped outcomes were how policies were interpreted, how decisions were sequenced, and how different constraints built up across institutions over time. Because of this, the refined framework redefines governance as something dynamic and relational, where outcomes emerge from the continuous interaction between legislation and policy, governance structures, resources, and stakeholder engagement. The framework is therefore not meant to judge performance or simply map out structures, but to critically examine how governance pathways are formed, how they become fixed, and why certain outcomes persist. This analytical role is made clearer in Table 10.2, where the framework is broken down into practical diagnostic questions, key areas of focus, and governance dynamics, making it easier to systematically examine how these interactions shape BGI delivery across the case studies.

By repositioning these four domains as interconnected and evolving, the framework serves as a practical diagnostic tool that captures the real, everyday complexities of governance and helps to explain why BGI delivery often ends up limited, incremental, or constrained within specific institutional settings.

10.2 Presenting and Using the Refined Framework

The BGI governance framework is presented in Figure 10.1, where BGI delivery is

positioned at the centre, surrounded by four key domains: legislation and policy, governance architecture, resources, and stakeholder engagement. The visual arrangement is important because it shows that BGI delivery does not depend on one single factor but rather emerges from the interaction of these domains. Looking at the figure, the domains are not arranged in a step-by-step sequence, instead, they are placed around the centre to show that they operate simultaneously and are closely connected. This means that governance is not a linear process where one stage follows another. Rather, it is something that develops over time through continuous interaction between policies, institutions, resources, and stakeholders.

The diagram also highlights barriers and enabling conditions across the different domains. This is significant because it shows that a challenge in one area for example, rigid policy requirements can create pressure in other areas, such as limiting how resources are used or how stakeholders can participate. In the same way, strong coordination or adequate resources in one domain can support better outcomes in others. The framework makes it clear that these domains do not operate in isolation; they influence each other in very practical ways. What this figure is really emphasising is that governance should be understood as a social and political process. It is shaped by decisions, institutional practices, and power relations, and these factors interact over time to produce outcomes. So, when a particular form of BGI delivery is observed in practice, it is not accidental, rather, it is the result of how these different domains have come together and reinforced each other. To make this framework usable for analysis, it is then translated into a diagnostic tool in Table 10.2. The table takes each of these domains and breaks them down into specific questions and areas of focus, making it possible to systematically examine how governance operates across the case studies.

Figure 10.1: The Modified Blue Green Infrastructure Governance Framework

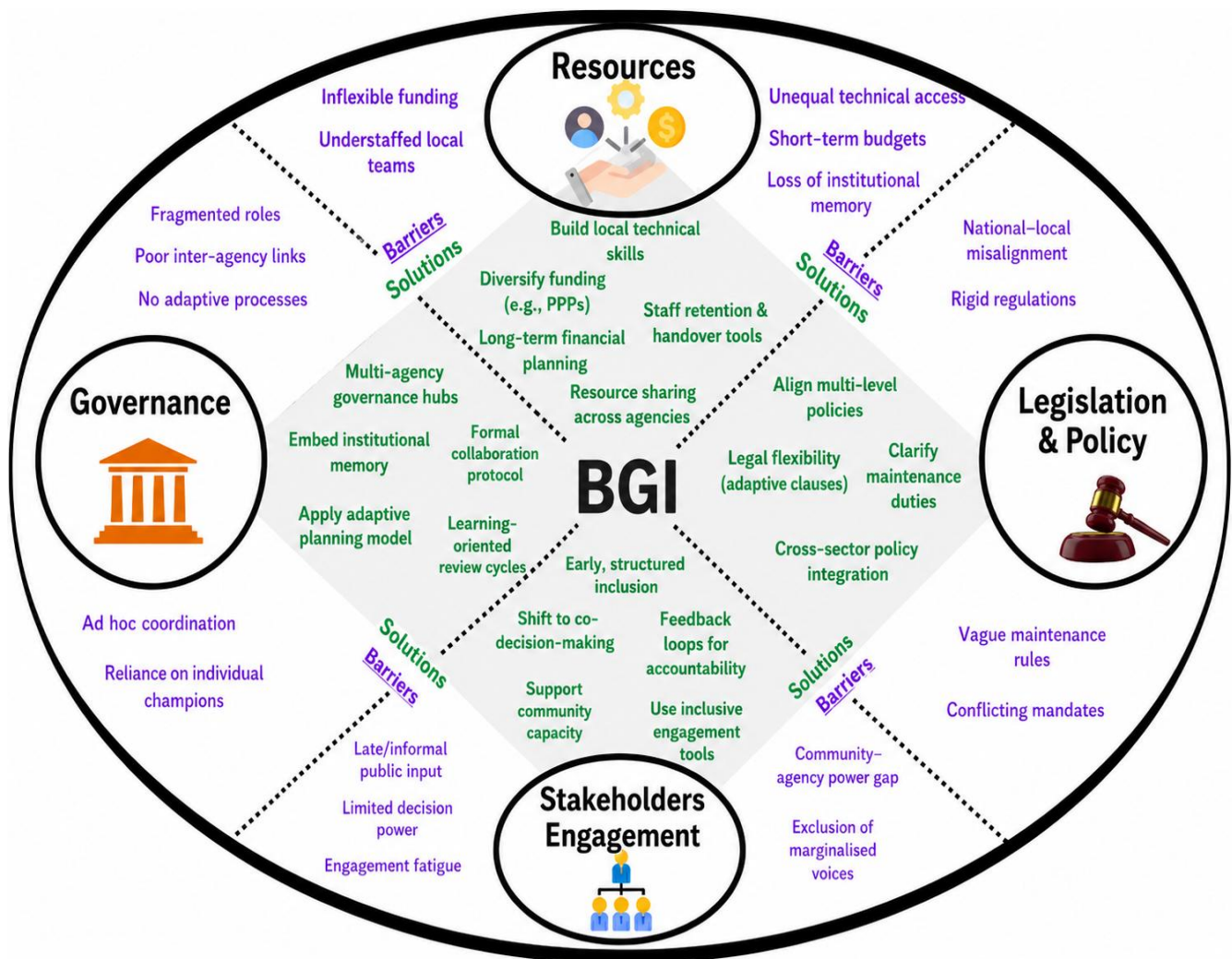


Table 10.2: Diagnostic Application of the Refined BGI Governance Framework

Framework domain	Diagnostic question	Analytical focus	Governance dynamic identified	Illustrative insight from the case studies
Legislation and Policy	How do statutory and policy frameworks shape the range of permissible BGI interventions?	Regulatory thresholds, interpretive guidance, approval conditions	Degree of flexibility or rigidity in policy application	Heritage and flood regulations constrained design options at Beales Corner
Governance	How is authority distributed and coordinated across institutions?	Decision-making structures, coordination mechanisms, approval sequencing	Centralisation, fragmentation, or procedural dominance	Perry Barr exhibited strong coordination alongside technocratic control
Resources	How do resource conditions influence governance capacity?	Funding duration, staffing continuity, access to expertise and data	Structural capacity constraints and institutional lock-in	Short-term funding cycles limited adaptive design pathways
Stakeholder Engagement	Who participates, at what stage, and with what influence?	Timing of engagement, scope of influence, representation	Procedural inclusion versus substantive influence	Community input shaped peripheral design features rather than core decisions
Cross-domain interaction	How do dynamics in one domain affect others?	Feedback loops, sequencing effects, cumulative constraints	Reinforcing or compounding governance effects	Regulatory rigidity reinforced resource prioritisation towards engineered solutions
Governance outcome	What form of BGI delivery emerges from these interactions?	Adaptability, multifunctionality, social legitimacy	Incremental versus transformative governance pathways	Both cases produced predominantly incremental BGI outcomes

Source: (Author's own analysis, developed from the conceptual framework and empirical case study findings).

Table 10.2 represents a clear shift in this study from conceptual framing to empirical application, by transforming the framework into a practical diagnostic tool for analysing the case studies. Rather than leaving the four domains as abstract categories, the table operationalises them through focused diagnostic questions. These questions go beyond description; they guide how the empirical material is engaged, making it possible to carry out a structured and comparative analysis across the cases. Each domain is linked to a specific analytical focus such as regulatory conditions, institutional coordination, resource capacity, and patterns of stakeholder participation thereby grounding the analysis in the realities of governance practice. This approach makes it possible to identify key governance dynamics, including fragmentation, centralised control, and capacity constraints. As a result, the table supports a more critical and detailed understanding of how governance operates in practice, rather than how it is assumed to function in theory. It is important to emphasise that the framework is not intended to evaluate governance in terms of effectiveness or performance. Instead, it functions as an explanatory tool, allowing the study to trace how governance arrangements emerge, how they become stabilised over time through institutional routines and practices, and how particular forms of BGI delivery come to be seen as normal, expected, or even difficult to challenge within specific institutional contexts. A key strength of Table 10.2 is that it does not treat each domain in isolation. By incorporating cross-domain interactions, it recognises that governance outcomes are produced through interconnected and mutually reinforcing processes. For instance, rigid policy frameworks may shape how resources are allocated, while limited stakeholder influence can reinforce existing institutional priorities. This interconnected perspective is essential for capturing the complexity of BGI governance in practice. Overall, Table 10.2 gives the framework practical and analytical value. It provides a clear and systematic approach to examining governance across different contexts, while remaining sensitive to issues of power, institutional constraints, and local

realities. In doing so, it bridges the gap between conceptual understanding and empirical analysis, making the framework both applicable and analytically robust.

10.2.1 Practical Application of the Refined Governance Framework

To ensure the research makes a meaningful contribution to professional practice, the refined framework combines conceptual understanding with practical application. When considering how the framework is used, it is important to distinguish between the roles of the visual diagram in Figure 10.1 and the structured matrix in Table 10.2. The diagram provides an overall picture of how the four governance dimensions legislation and policy, governance, resources, and stakeholder engagement are connected and influence one another. It helps users understand how a weakness in one area, such as inadequate long-term funding, can affect other areas, such as stakeholder engagement or project delivery. However, although the diagram clearly illustrates these relationships, it remains a conceptual representation that cannot easily be used on its own to assess a specific BGI project. This is where Table 10.2 becomes important. It translates the relationships shown in the diagram into practical questions and clear areas for assessment. Rather than simply presenting the four governance dimensions, the table breaks them down into practical indicators that allow users to assess a project, gather evidence, and identify the institutional barriers affecting BGI implementation. By using the diagram and the table together, the framework combines conceptual understanding with a practical method for governance assessment.

In practice, urban planners, local authority officers, environmental managers, and other practitioners can use the framework throughout the life of a BGI project. During the planning and design stage, the questions in the table can be used as an institutional readiness checklist. This allows decision-makers to assess whether existing legislation and planning policies provide sufficient support for BGI, determine whether relevant

organisations are working together effectively rather than operating in isolation, and ensure that stakeholder engagement is inclusive before implementation begins. Carrying out this assessment at an early stage helps identify governance weaknesses and resolve them before they affect project delivery.

The framework can also be applied to existing BGI projects that are experiencing poor performance, inadequate maintenance, or other implementation challenges. Instead of treating these problems as purely technical or financial issues, the framework helps users identify the underlying governance factors contributing to them. For example, poor project performance may result from outdated regulations that restrict adaptive management, short-term funding arrangements that do not support long-term maintenance, or limited community ownership because local people were not meaningfully involved during project planning. By linking the overview provided by Figure 10.1 with the structured assessment in Table 10.2, the framework provides a practical decision-support tool that helps practitioners identify governance barriers, improve implementation, and support the long-term success of BGI projects.

10.3 Applying the Framework: A Focused Empirical Illustration

The practical application of the refined governance framework is demonstrated through the Perry Barr and Witton Flood Risk Management Scheme. Following the diagnostic process outlined in Section 10.2.1 and operationalised through the diagnostic questions in Table 10.2, the framework was applied by examining the project across the four governance domains: legislation and policy, governance arrangements, stakeholder engagement, and resource and institutional capacity. Evidence from document analysis, thematic analysis of the interview data, and site observations were then brought together to examine how interactions across these domains shaped BGI implementation. This demonstrates how the framework can be used in practice to identify governance barriers,

recognise enabling conditions, and support a more systematic understanding of implementation.

The analysis begins with the policy and legislative context, which sets the boundaries for what can be considered acceptable intervention through flood risk management and reservoir safety requirements. These conditions provided a strong regulatory basis and justified the scale of the scheme. However, they also framed the problem largely in hydraulic terms, which directed the focus towards engineered flood defence solutions. In effect, this limited the scope for more integrated and multifunctional BGI approaches, showing that regulation does not only enable delivery but can also constrain how BGI is conceptualised and implemented. As a result, decision-making authority was concentrated within technical and regulatory institutions, while coordination between organisations followed established procedures. Although several actors were involved, there was little room to revisit or challenge decisions once the main direction had been set. This had clear implications for BGI, as opportunities for its meaningful integration were already restricted at an early stage. The role of resources further reinforced this position. The availability of significant funding and technical expertise supported delivery at scale but also aligned priorities with engineering-led solutions and funding expectations. Consequently, BGI features were included, but largely as supporting elements rather than as central components of the scheme.

Stakeholder engagement followed a similar pattern. Participation occurred at a stage where most of the key decisions had already been taken. While stakeholders were able to influence some aspects of the design, including certain BGI features, they had limited impact on the overall direction or objectives of the scheme. This meant that BGI was introduced within pre-defined boundaries, rather than being fully integrated through a more open and collaborative process. Viewed through the framework, it becomes clear that BGI delivery is not simply a technical or design matter. Rather, it is shaped by the

interaction between legislation, governance structures, resources, and stakeholder engagement over time. In this case, these interactions led to a form of BGI delivery that is largely constrained, rather than fully incorporated.

10.4 CHAPTER SUMMARY

The chapter developed and operationalised a conceptual framework for the analysis of BGI governance in urban and peri-urban contexts. This framework was developed through iterative engagement with theory and empirical material. It provides a diagnostic lens for conceptualising how governance pathways are assembled through interaction across legislation and policy, governance architecture, resources and stakeholder engagement. When applied to the case studies, the framework reveals that governance outcomes emerge through relational and cumulative processes, highlighting the limitations of technocratic or procedural interpretations of BGI delivery. This framework offers a context-sensitive and reflexive tool for critical analysis which could contribute to ongoing discussions on adaptive planning and multi-scalar governance. The next chapter draws together the overall conclusions of the study and sets out practical recommendations informed by these insights.

CHAPTER 11: CONCLUSION AND RECOMMENDATIONS

11.0 INTRODUCTION

This chapter consolidates the findings of the research and evaluates the extent to which the original aim and objectives of the study have been achieved. Based on the theoretical, policy and empirical analyses provided in the previous chapters, this chapter synthesises the main insights from the analysis of BGI governance in urban flood risk management. The chapter revisits the research objectives stated in Chapter One and shows how each research objective was successfully accomplished through the literature review, policy analysis, development of the conceptual framework and empirical case studies. The chapter then sets forth the main conclusions of this study highlighting the governance, legislative, institutional and resource-related factors shaping the implementation of BGI in England. It then highlights the practical implications of the findings to policymakers, planners, practitioners, and other stakeholders involved in flood risk management and urban resilience. The chapter also recognises the limitations of the study and then suggests future research that will advance scholarly understanding and practical application of BGI governance. Taken together, these sections provide a summary of the contributions of the thesis and place the findings within broader debates on governance and sustainable flood resilience.

11.1 EVALUATION AGAINST ORIGINAL AIM AND OBJECTIVES

Chapters One to Four provided the foundation for this research, showing how governance challenges have shaped and constrained the effective application of BGI in flood risk management. One important issue was identified as the disconnect between national policy objectives and local implementation. This has resulted in inconsistent enforcement,

regulatory failings and financial constraints that limits the large-scale implementation of BGI. Most existing governance frameworks are unable to deal with these structural barriers, making it difficult to mainstream BGI for flood resilience.

As BGI is increasingly recognised as a viable sustainable flood risk management approach, effective governance arrangements are essential to enable its implementation.

In this study, a governance framework refers to an analytical structure that clarifies how institutions, policies, actors, resources, and decision-making processes interact to shape the planning and delivery of BGI. Rather than prescribing a fixed institutional model, such a framework provides a systematic way of examining roles, coordination mechanisms, regulatory conditions, and power relations that influence implementation outcomes. Policymakers, urban planners, environmental agencies, and local authorities all have a vested interest in ensuring that BGI is governed, coordinated, and financed effectively.

This study responds to this need by critically assessing the policy and legislative landscape for BGI, identifying governance challenges, and proposing ways to strengthen coordination, accountability, and long-term financial sustainability. The primary aim of the research was to develop a governance framework that supports BGI implementation by providing a structured lens for diagnosing institutional barriers and identifying enabling conditions across legislation and policy, governance structures, stakeholder engagement, and resources. To achieve this, several research objectives were formulated to guide different phases of the study. These objectives have been systematically examined throughout the research, with empirical findings offering practical insights into how governance processes can be strengthened to support BGI delivery in flood risk management. The extent to which these objectives have been met is discussed in detail in the following sections.

11.1.1 Review of Research Objectives

The following overview of the research objectives explains how they were achieved in this study.

Objective One: To critically review BGI, its contribution to urban flood risk reduction and its potential for long-term urban sustainability and resilience.

To address this objective, Chapter Two presents a critical conceptual review of BGI aimed at clarifying its definition, theoretical foundations, and claimed contributions to flood risk mitigation and long-term urban resilience. The literature shows that BGI emerged partly in response to the limitations of traditional grey infrastructure in managing increasing urban flood risks. While earlier planning approaches treated green space as aesthetic and recreational, contemporary BGI reframes it as a multifunctional system integrating ecological resilience, climate adaptation, and flood regulation.

However, the review moves beyond description by identifying key conceptual and practical limitations. BGI is interpreted differently across engineering, ecology, planning, economics, and political science, resulting in definitional inconsistency and conceptual ambiguity. Although this flexibility supports multifunctionality, it weakens policy clarity and complicates implementation. In flood risk management, the absence of a standardised definition creates uncertainty in regulatory interpretation and performance expectations.

The review also critically examines how BGI is framed within different resilience perspectives. Engineering approaches prioritise infrastructure reliability and rapid recovery, ecological approaches emphasise connectivity and decentralised solutions, environmental economics focuses on ecosystem service valuation, while socio-political perspectives foreground governance, equity, and power. Although these perspectives enrich understanding, they also reveal tensions that hinder operational coherence in practice. To ensure analytical consistency, a working definition was adopted for this thesis, selected for its policy relevance and conceptual clarity. The review further positions BGI

not only as a technical solution but as a spatial and governance strategy embedded within socio-ecological and political systems. Its effectiveness depends on institutional capacity, regulatory alignment, spatial equity, and governance arrangements.

Core principles such as multifunctionality, resilience, and connectivity are examined in relation to both functional strengths and implementation complexity requiring cross-sector coordination and sustained institutional support. Common BGI components are therefore assessed in terms of both technical benefits and governance implications. Overall, the review concludes that while BGI represents a significant conceptual advancement in flood risk management, its effectiveness is constrained by definitional ambiguity, institutional fragmentation, and governance limitations. Its value lies not only in technical performance but in its integrative ecological and governance potential.

Objective 2: To review existing legislative and policy arrangements for BGI in England, to identify limitations and strengths.

This objective is addressed in Chapter Three, which provides a review of the legislative and policy framework that applies to BGI in England. The analysis identified essential policies, regulations and strategies shaping BGI governance with their strengths and limitations in the context of urban flood risk. While national frameworks are increasingly recognising the role of BGI in resilience, they often fail to provide mechanisms through which effective local implementation can take place.

The study revealed a notable shift towards a more sustainable flood management approach through the implementation of policies that actively promote green infrastructure, including the incorporation of green roofs and permeable pavements. Nonetheless, inconsistent regulations, fragmented governance, and difficulties in long-term upkeep and financing hamper practical implementation. Furthermore, the incorporation of BGI is limited by conflicting urban demands like housing and infrastructure. Identification of key

barriers and enabling factors in existing legislative and policy frameworks for BGI is an achievement of third and fourth objective of this research, because it was used for the development of a conceptual model which has the potential to enhance BGI governance.

Objective 3: To examine how existing legislative and policy arrangements shape the practical implementation of BGI for urban flood risk management, with particular attention to areas of overlap, tension, and constraint.

This objective was addressed through Chapters Seven and Eight, which presented empirical case studies of the Perry Barr and Witton scheme in Birmingham and the Beales Corner scheme in Bewdley. The chapters analysed the implementation processes in practice through the lens of the analytical dimensions of the conceptual framework specific to legislative and policy arrangement. In the Perry Barr case, statutory instruments such as the Flood Risk Regulations (2009) and the Flood and Water Management Act (2010) enabled coordination and provided a supportive framework for action. However, these pursued a technical compliance approach which hampered early integration of BGI considerations. Interview evidence showed that national regulatory requirements shaped design decisions and constrained ecological and participatory elements.

In Beales Corner, construction delays and design changes were caused by the influence of heritage and conservation protocols on material choice, design alignment and sequencing. The Water Framework Directive's environmental regulation added to statutory requirements, imposition of procedural requirements which impacted the delivery of the project. In both instances, the evidence reveals how policy and legal frameworks created the formal conditions for the inclusion of BGI while simultaneously constraining its practical operationalisation through regulatory conflicts, competing statutory priorities, procedural requirements, and institutional expectations.

Objective 4: To analyse governance roles, interactions, and barriers at national, regional, and local levels affecting BGI implementation for flood risk mitigation and its broader multifunctional use.

This objective was addressed through Chapters Four, Seven, and Eight, with further synthesis provided in Chapter Nine. The theoretical foundation was established in Chapter Four by reviewing governance literature to identify variables involved in BGI delivery at national, regional, and local level. The review has highlighted issues like fragmented institutional mandates, regulatory inconsistencies, and limited engagement with stakeholders that hinder coordination. The theory of network governance highlights collaborative relationships between public, private and civil society actors; while adaptive governance theory stresses the need for flexibility in response to changing flood risks. The empirical case studies investigated governance arrangements in practice by analysing their institutional roles, responsibilities, and interactions. The multi-actor governance networks present in Perry Barr and Beales Corner featured overlapping jurisdictions and conflicting priorities. At Perry Barr, the Environment Agency exercised a dominant coordinating role because it has statutory authority over main rivers and local authorities and community actors were mainly consultative.

In Beales Corner, governance was more fragmented as there was no single actor with overarching power. This meant that designs were continually revised; procedures were delayed; and consensus was limited. In both cases, turnover of politics, ambiguous mandates and weak coordination mechanisms constrained integrated BGI planning. National frameworks provided legal guidance, yet their conversion into local operational frameworks remained minimal. Regional actors often align more closely with local priorities but lack authority and resources while local authorities face financial, technical, and competing policy pressures. These interactional dynamics are examined through the conceptual framework's relational structure, which treats governance as an

interconnected, multi-scalar process rather than a set of isolated institutional roles. The framework captures vertical interactions between national policy mandates and local implementation, horizontal coordination across agencies, and cross-domain influences between legislation and policy, governance architecture, resource conditions, and stakeholder engagement. By analysing how authority, resources, and participation intersect across these domains, the framework makes visible the institutional overlaps, power asymmetries, and coordination gaps shaping BGI implementation. Governance roles, therefore, are understood not as static positions but as relational functions embedded within evolving institutional networks.

Objective 5: To develop a conceptual framework for identifying barriers and enablers to BGI in the areas of legislation, policy and governance, based on a synthesis of existing literature.

This objective was addressed through Chapters Five and Ten. Chapter Five developed the initial conceptual framework through a critical synthesis of interdisciplinary literature on environmental governance, planning systems, and infrastructure delivery. The review identified a key limitation in existing approaches: most frameworks examine technical, participatory, or institutional elements in isolation and do not adequately capture how governance processes interact to shape implementation outcomes in practice. To address this gap, an integrated framework was developed structured around four interacting domains: legislation and policy, governance architecture, stakeholder engagement, and resources. The framework provides a diagnostic structure for systematically identifying barriers and enabling conditions affecting BGI implementation within complex institutional settings.

Chapter Ten further refines and operationalises the framework, clarifying how it can be used analytically and demonstrating its application through an empirical case illustration.

The framework is designed as a practical analytical tool that guides case study evaluation, supports cross-case comparison, and reveals how governance dynamics produce implementation pathways over time. Its value lies in moving beyond descriptive governance mapping to provide a structured, transferable method for diagnosing institutional constraints, identifying leverage points for reform, and supporting more adaptive and integrated BGI delivery.

Objective Six: To refine the conceptual framework through case studies and assess its relevance to the practical application of BGI in flood risk management.

This objective was addressed in Chapters Seven, Eight, and Ten through the application of the conceptual framework to the empirical case studies of Perry Barr and Witton and Beales Corner. The framework was used analytically to examine enabling and constraining factors shaping BGI governance in practice. Engagement with the case study evidence enabled refinement of the framework to better reflect observed governance conditions, including institutional fragmentation, legal rigidity, procedural disconnections, and limited stakeholder influence. The findings demonstrated that the four analytical dimensions operate as interdependent rather than discrete categories, with weaknesses in one domain reinforcing constraints in others. Although the framework was not validated through predictive or statistical testing, its empirical application across two contrasting cases demonstrated its analytical relevance and practical utility. The framework further emerged as a potential boundary object capable of supporting cross-sector dialogue, institutional reflection, and shared learning in the governance of BGI implementation.

Objective Seven: To draw on the findings for the above objectives, to determine the implication for FRM, especially regarding the design and implementation of BGI and

make recommendation for further studies.

This final objective was addressed in chapter Eleven, which summarised the findings from the empirical and analytical chapters to draw broader implications for policy, practice and future research. By integrating the theoretical foundations with the empirical findings, the chapter fulfilled this objective through a structured discussion as presented in the following sections.

11.2 MAIN CONCLUSIONS

The following key conclusions are drawn from this research, based on the overarching aim of assessing the barriers in translating and implementing policy and legal frameworks for BGI in England, with a focus on flood resilience.

- This research indicates that BGI remains underutilised within flood risk management policy and practice, despite widespread endorsement in national strategic frameworks. Although BGI frequently finds mention in policy, its actualisation often turns out to be merely symbolic or limited to pilot projects. The findings suggest that in the absence of a legal requirement, BGI is rarely favoured over traditional grey infrastructure.
- A key finding is that BGI governance is characterised by widespread institutional fragmentation. Responsibilities are spread over several governments and agencies and function through broken coordination mechanisms. The institutional siloing hampers integrated delivery, and evidence suggests efforts to mainstream BGI, without a centralised coordinating authority, remain disintegrated.
- The study further reveals that the implementation of BGI is hampered by policy incoherence and legal ambiguity. The research shows that although these laws and policies recognise the significance of BGI, no clear enforceable duties are provided. Unlike Biodiversity Net Gain (BNG), which has a clear statutory and

measurable requirement, BGI is still mostly treated as optional within planning and flood risk governance. Because of this, its use is quite inconsistent, even though everyone agrees on its benefits. In reality, the lack of clear legislation makes it difficult for local authorities to properly embed BGI into development planning. It also raises a key question about whether BGI should be made more mandatory, like BNG, to ensure it is consistently delivered. But at the same time, this is not so straightforward, because BGI is very context-specific and does not easily fit into a rigid, one-size-fits-all rule.

- The funding landscape for BGI was found to be inconsistent and short-term. The research shows that most BGI projects are funded through competitive grants or short-term programmes, rather than being built into the core capital and maintenance budgets of local authorities, flood risk management bodies such as the Environment Agency, and national infrastructure investment programmes. This funding pattern limits the scalability, continuity, and long-term maintenance of BGI interventions and weakens institutional commitment to their sustained implementation.
- The study shows that while stakeholder engagement is a key outcome that plays a crucial role in the effective implementation of BGI, it is limited in its depth and diversity. Although consultation is mandated by policy, meaningful engagement generally only occurs with statutory beneficiaries. Community groups, marginalised populations and third sector organisations are rarely empowered to influence the design and management of BGI. This imbalance constrains the democratic legitimacy of governance processes and limits the capacity of BGI to function as an inclusive socio-ecological strategy capable of advancing equity, environmental justice, and community resilience. As a result, the ability of BGI to address issues of equity and justice is limited.

- A key contribution of this research is the development of a practical governance framework that can be applied beyond the two case studies examined in this thesis. Rather than simply describing governance arrangements, the refined framework provides a structured way of examining how legislation and policy, governance arrangements, stakeholder engagement, and resource and institutional capacity interact to influence BGI implementation. As demonstrated in Chapter 10, the framework can be used by policymakers, planners, local authorities, and other practitioners to identify governance barriers, compare projects in a systematic way, and highlight areas where governance arrangements and institutional practices may need to be strengthened. Its contribution therefore goes beyond explaining the governance challenges affecting BGI implementation. It also provides a practical tool that can support governance analysis and inform decision-making across different BGI projects and governance contexts.
- The study also shows that current BGI planning is not equity orientated. Communities at high risk of flooding are often excluded from decision-making, while the benefits are unequally distributed. Without a deliberate focus on equity, BGI can promote green gentrification instead of advancing environmental justice. This equity concern is examined in Chapters Four, Seven, Eight and Nine, which show how procedural participation, unequal influence, and governance fragmentation limit the ability of flood-prone and marginalised communities to shape outcomes, raising risks of distributive injustice and green gentrification.
- One contribution of the research is to conceptualise implementation challenges as reflecting profound weaknesses in governance, not just technical or procedural inadequacies. This diagnosis shows how failures in legal mandates, financing structures and participatory mechanisms are interlinked and reinforce marginalisation and policy inertia. By moving from the identification of a gap to a

system critique, the study sheds new light on the scaling failure of BGI, which is repeatedly affirmed in policy.

- Another unique contribution is the positioning of the conceptual framework as a possible boundary object with the potential to bridge institutional silos, illuminate contestation and stimulate dialogue between stakeholders. The framework has the potential to act as a mediating tool that stakeholders can use to think critically about their roles, assumptions and institutional constraints, rather than merely serving as a descriptive tool. As a result, it offers new avenues for deliberative governance, equity-focussed planning and adaptive institutional learning.

Consequently, this research concludes that BGI cannot be effectively mainstreamed within England's flood risk management system without addressing the systemic barriers identified. Legal mandates must be strengthened, governance structures must be coordinated, funding must be made predictable, and planning processes must become more inclusive. Only through such an integrated and reflexive approach can BGI move beyond rhetoric to become a practical, equitable, and sustainable component of urban flood resilience.

11.3 PRACTICAL IMPLICATION OF THE RESEARCH

The findings of this research hold key implications for stakeholders involved in the governance of BGI, particularly urban planners, policymakers, national agencies such as (DEFRA and the Environment Agency), Local Authorities, developers, NGOs, and communities. The BGI Governance Framework developed in this study can help support flood resilience planning that is more effective and inclusive.

1. The framework can help urban planners and local authorities identify institutional gaps and improve coordination between different departments, addressing how to integrate BGI into long-term urban strategies. This helps in aligning BGI

objectives with sustainability and flood resilience.

2. For agencies and national policymakers such as DEFRA and EA, the framework could be a useful tool to direct policy review and reform by highlighting misalignments in governance. It can also encourage cooperation between sectors and provide a structured, adaptive approach to climate risk policymaking.
3. The framework can assist in assessing regulatory clarity and governance readiness for BGI investment by private sector (developers & investors). This can lead to stronger public-private partnerships with reduced uncertainty and better private sector alignment with public resilience goals.
4. Environmental NGOs and Civil Society can use the framework, as an advocacy tool to assess the effectiveness of governance and demand a more inclusive participatory planning. It can help strengthen equity and accountability in the implementation of BGI.
5. While community perspectives were captured through interviews with affected residents and local stakeholders, the study did not explicitly centre lived experience or undertake participatory research focused on community voice. Rather, engagement was examined primarily as a governance process shaping infrastructure delivery. Nonetheless, the framework developed here may inform future efforts to engage residents particularly in flood-prone areas in shaping local flood resilience agendas and governance arrangements that are more inclusive and context-sensitive.

11.4 LIMITATIONS

While this research provides useful insights into BGI governance, it has several limitations that need to be recognised.

1. Firstly, the practical application of the BGI Governance Framework was limited

to only a few urban locations. While these geographies illustrate a diversity of flood risk profiles and urban infrastructure, its findings cannot reflect all possible governance dynamics in another location. The applicability of the framework in diverse geographical contexts, such as countries with different regulatory and institutional set-ups, has not been tested. As a result, the study's findings may not be generalisable to areas that have different urbanisation and governance paradigms.

2. Furthermore, the study focused on established or completed BGI schemes. While this enabled reflection on the full governance cycle, opportunities to observe governance processes as they unfolded in real time were limited. Conducting embedding research as part of another ongoing BGI project could provide further insight into decision-making, negotiation, and implementation dynamics not captured here.
3. Also, the involvement of stakeholders was predominantly limited to professionals in the planning, policy and consultancy fields. Although these actors provided important insights, there was a lack of community-level representation, particularly from residents of flood-prone or underserved areas. This makes it harder to assess how governance structures are experienced from the ground up. Future studies will require more inclusion of local people to get their views and their experiences.
4. Additionally, a potential limitation of this research is that the BGI governance framework developed has yet to be tested in a real-world policy or planning scenario. While the framework was informed by a combination of literature, expert interviews, and case study analysis, it remains a conceptual tool.

Consequently, this study could not evaluate the functionality of the framework if utilised by local authorities, policymakers, or developers within the context of a live BGI project.

Further research is needed to test its practical application, specifically in terms of decision making and policy coordination and implementation results.

11.5 RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the findings and limitations of this study, the following suggestions are made to help guide future research and support the application of the BGI Governance Framework.

1. Future research should use the framework in live or in-progress BGI schemes. Such an approach provides insights into decision-making and stakeholder engagement dynamics, and implementation challenges in real-time that may not be captured in case studies done retrospectively. The live projects should have longitudinal engagement to capture these processual subtleties.
2. Future research should include the voices of a wider range of stakeholders, especially local communities, grassroots organisations and other marginalised voices. This will increase the social relevance of the framework and ensure that governance solutions are inclusive and context sensitive.
3. Future research could adapt the framework into a mobile or web-based platform to improve practical accessibility and usability. Such work should explore how digital implementation can preserve the core principles of the framework while enhancing interaction and ease of use. Further studies may also examine how digital tools could be used to simulate governance scenarios, test stakeholder engagement approaches, and support decision-making across different urban contexts.
4. Given the increasing global recognition of BGI as an important strategy for urban resilience, future research should examine the extent to which the governance framework developed in this study is applicable in different cultural, political and institutional contexts. A cross-cultural comparative study will be

useful to understand the universal principles for successful application of BGI while identifying region specific challenges. Research could focus on developing countries or areas with limited financial and technical resources and explore how the governance framework can be adapted to local needs and conditions and the potential for cross-jurisdictional learning.

The above recommendations relate not only to theoretical gaps and knowledge deficits, but also to practical issues of governance of BGI and flood resilience research and practice. Scholars are encouraged to explore how the BGI Governance Framework can be adapted, how this framework can be applied in varied contexts and how it can be operationalised for effective urban flood resilience. Exploring each of these areas will progressively develop understanding and governance mechanisms for nature-based flood defence strategies.

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APPENDICES

APPENDIX A-1: - RESEARCH INFORMATION

Project Title: An Evaluation of the Legislative and Policy Framework for Blue Green Infrastructure

Researcher: Ruth Awara

Department: Computing, Engineering and the Built Environment (CEBE)

Supervisors: Prof. Claudia Carter, Dr Hong Xiao, Prof. David Proverbs.

PROJECT OVERVIEW

This PhD research seeks to evaluate the barriers to the effective implementation of national policy and legal frameworks that support the adoption of Blue-Green Infrastructure (BGI) for improving urban flood resilience in England. The project critically examines how current legislative and governance arrangements shape the planning, delivery, and long-term management of BGI in practice. Particular attention is given to the institutional, regulatory, and interpretive factors that influence how BGI policies are understood and enacted across multiple levels of governance. The study aims to uncover the constraints embedded in existing systems and provide insight into how these might be addressed to support more integrated, place-sensitive approaches to urban flood risk management.

Although the national policy landscape forms the overarching context, the research is grounded in detailed case study analysis. Two contrasting case studies one urban (Perry Barr and Witton, Birmingham) and one rural (Beales Corner, Worcestershire) have been selected to explore how legislative and policy frameworks are interpreted and operationalised in different settings. This comparative approach allows for an in-depth

examination of the practical challenges and institutional negotiations that shape BGI delivery on the ground. The research aims to support policymakers, planners, and practitioners by offering a clearer picture of what enables or inhibits effective BGI delivery. Through its case study approach, the project also seeks to make visible the role of context, agency, and interpretation in shaping policy outcomes—insights that are critical for building more resilient and inclusive urban environments in the face of climate change.

PARTICIPANT ROLE AND TIME INPUT

Their primary role will be to share insights and experiences through semi-structured interviews, focusing on how policy and legislation related to BGI are interpreted, operationalised, and negotiated within their institutional context. The interviews will explore governance dynamics, institutional capacity, stakeholder engagement, and the translation of national frameworks into local practice. Each participant will be invited to take part in a single interview, lasting approximately 45 to 60 minutes. Interviews will be conducted either in person or online, depending on the participant's preference and availability. Participants will receive an information sheet in advance outlining the purpose of the research, how their data will be used, and their rights, including confidentiality and the option to withdraw at any stage without consequence. There are no anticipated follow-up commitments beyond the interview. However, participants will be offered a summary of key findings upon completion of the study, should they wish to receive it.

CONFIDENTIALITY

All information provided by participants are treated with strict confidentiality. Personal identifiers, including names, job titles, and organisational affiliations, will be anonymised

during transcription and data analysis. Any quotations used in research outputs will be fully anonymised to prevent identification of individuals or their institutions. Audio recordings of interviews will be stored securely on an encrypted, password-protected device and transferred to a secure university server accessible only to the researcher and supervisory team. Recordings will be transcribed within 48 hours, after which the original audio files will be deleted. Transcripts will be anonymised and stored securely in accordance with the university's data protection policies and the General Data Protection Regulation (GDPR). Participants have the right to withdraw from the study at any time, without explanation or penalty, and may request the deletion of their data up to the point of analysis. Participation is entirely voluntary, and all data will be handled with care, ensuring that individuals' views are respected and protected throughout the research process. No identifiable information will be included in any publication, presentation, or report arising from the study unless explicit written consent has been obtained. The confidentiality of all participants will be upheld to the highest ethical standards in line with the university's research ethics guidelines.

ETHICAL APPROVAL

This research project has been reviewed and approved by the Faculty Research Ethics Committee at Birmingham City University. The study complies with the university's ethical guidelines and follows established principles of good research practice, including respect for participant autonomy, informed consent, confidentiality, and the responsible handling of data.

APPENDIX A-2: CONSENT FORM

RESEARCH PARTICIPANT CONSENT FORM

TITLE OF RESEARCH PROJECT: Evaluating the Legislative and Policy Framework for Blue Green Infrastructure

RESEARCHER(S): Ruth Awara (BCU)

PARTICIPANT DETAILS:

Name:

Area/discipline of professional experience:

Years of professional experience:

PARTICIPANT DECLARATIONS: Tick as applicable

I have been informed of and understand the purposes of the interview Yes ☐ No ☐

I have been given an opportunity to ask questions Yes ☐ No ☐

I understand that any information which might potentially identify me will not be used in any published material unless I have given my written consent Yes ☐ No ☐

I understand that I may request access to any data collected by the researcher(s) that relates to me Yes ☐ No ☐

I give my consent to the interviews being audio-recorded I agree to participate in the study as outlined Yes ☐ No ☐

I understand I may withdraw at any time "without prejudice" Yes ☐ No ☐

Date: Signature:

APPENDIX A-3: TYPICAL COVERING LETTER FOR INTERVIEW SESSION

Dear Invitee,

Participant Invitation Letter

My name is Ruth Awara, and I am a PhD candidate at Birmingham City University. I am supervised by Prof. Claudia Carter, Dr Hong Xiao, and Professor David Proverbs. My research evaluates the effectiveness of the legislative and policy frameworks for Blue- Green Infrastructure (BGI) in England, with a specific focus on the Perry Barr and Witton Flood Risk Management Scheme as case studies. I am reaching out to invite you to participate in my study, as your expertise with the Environment Agency and your knowledge of legislation, funding mechanisms, and stakeholder engagement are directly relevant to these projects and my research objectives. The interview can be conducted online via Microsoft Teams or face to face depending on your preference and will last approximately 45–60 minutes. During the session, I would like to explore your insights into the challenges and opportunities associated with the governance, funding, and implementation of BGI projects like Perry Barr and Witton. Could you kindly let me know a date and time that would be convenient for you? I am flexible and happy to accommodate your schedule. Thank you for considering this request. Your participation would provide invaluable insights and significantly contribute to the depth of my research. I look forward to your response and hope to discuss your availability soon.

Kind Regards, Ruth Awara

Doctoral Researcher Birmingham City University

Ruth.awara@mail.bcu.ac.uk

APPENDIX B-1: PUBLICLY AVAILABLE DOCUMENTS ANALYSED ACROSS CASE STUDIES

A1. National Legislation and Policy Documents

<i>Document</i>	<i>Issuing Body</i>	<i>Access Point</i>
Flood Risk Regulations 2019	UK Government	https://www.legislation.gov.uk/ukxi/2009/3042/contents/made
Flood and Water Management Act 2010	UK Government	https://www.legislation.gov.uk/ukpga/2010/29/contents
Reservoirs Act 1975	UK Government	https://www.legislation.gov.uk/ukpga/1975/23
National Planning Policy Framework (NPPF) (2025)	MHCLG/DLUHC	https://www.gov.uk/government/publications/national-planning-policy-framework-2
Water Environment (Water Framework Directive) (England and Wales) Regulations 2017	UK/ European Union	https://www.legislation.gov.uk/ukxi/2017/407/contents
Biodiversity Net Gain (BNG) Guidance	MHCLG /DLUHC	https://www.gov.uk/guidance/biodiversity-net-gain

A2. Local and Regional Flood Risk Policy Documents

Document	Issuing Body	Access Point
Birmingham Flood Risk Management Strategy	Birmingham City Council	Local authority website
Worcestershire Flood Risk Management Strategy	Worcestershire County Council	Local authority website
Wyre Forest Local Plan (Conservation Policies)	Wyre Forest District Council	Local authority website

A3. Project-Level Scheme Documentation

Perry Barr and Witton Flood Risk Management Scheme

Document	Issuing Body	Access Point
Perry Barr and Witton Flood Risk Management Scheme Overview	Environment Agency	https://www.gov.uk/government/publications/perry-barr-and-witton-flood-risk-management-scheme/perry-barr-and-witton-flood-risk-management-scheme
Planning Committee Report- Forge Mill Flood Storage Reservoir (Application Ref: DC/17/60630)	Sandwell Metropolitan Borough Council	Sandwell.mordengov.co.uk

Beales Corner Flood Defence Scheme

Document	Issuing Body	Access Point
Beales Corner Flood Defence Scheme Plan	Environment Agency	https://www.gov.uk
Planning Application Summary – Beales Corner Scheme (Ref: 22/1034/FUL)	Wyre Forest District Council	https://planningpa.wyreforestdc.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=RNLS8HSILF100
Environment Agency Approval – Beales Corner Scheme	Environment Agency	https://www.gov.uk/government/news/environment-agency-welcomes-approval-of-its-planning-application-to-protect-beales-corner-in-bewdley-worcestershire-from-flooding

A4. Technical and Professional Reports

<i>Document</i>	<i>Issuing Body</i>	<i>Access Point</i>
<i>CIRIA SuDS Manual (C753)</i>	CIRIA	https://www.ciria.org
<i>Forge Mill Reservoir Site Report</i>	British Dam Society	Publicly available report

A5. Public Consultation and Engagement Materials

Document Type	Description	Issuing Body	Access Point
Consultation summaries and newsletters	Public engagement materials for scheme delivery	Environment Agency / Local Authorities	https://www.gov.uk and local authority websites
Public information leaflets and updates	Information provided to residents and stakeholders	Environment Agency	https://www.gov.uk and local authority websites

APPENDIX B-2: INTERVIEW QUESTIONS

Exploring Barriers and Enablers in BGI Implementation – Perry Barr & Witton Scheme and Beales Corner Scheme.

Professional and Organisational Context

Main Question	Follow-up Prompts	Checklist / Notes
Could you describe your current role and how it relates to flood risk management or BGI?	N/A	Understand institutional position and practical involvement in scheme delivery.
What are the key priorities or mandates of your organisation in this area?	N/A	Identify organisational focus (e.g. flood protection, planning, regulation).
How does your organisation typically approach BGI within flood risk management projects?	N/A	Explore whether BGI is central, supporting, or not prioritised.

Legislation and Policy

Main Question	Follow-up Prompts	Checklist / Notes
Which policy documents, legal instruments, or planning frameworks most influenced this scheme?	How did these frameworks shape design and delivery decisions? Were they enabling or restrictive?	FWMA (2010), NPPF, Environment Act (2021), BNG, FCERM, Local Plans.
How were these policies interpreted or	Were they applied strictly, or adapted in practice?	Look for flexibility vs rigid application.

applied during the project?		
Did policy or regulatory requirements influence the design of the scheme from the early stages?	Were BGI elements considered from the start or introduced later?	Link to finding: BGI often added later.
Were there any tensions between different policy requirements?	For example, between flood protection, heritage, or environmental objectives?	Look for trade-offs (clear in Beales Corner).
Did planning or regulatory conditions affect how BGI was integrated?	Were BGI features shaped by approval requirements?	Link to “BGI fitted around main works”.
Do current policies support multifunctional BGI delivery?	What changes would improve this?	Identify gaps and reform needs.

Governance and Institutional Dynamics

Main Question	Follow-up Prompts	Checklist / Notes
How was the scheme governed and coordinated across organisations?	Which organisations were involved and what roles did they play?	EA, Local Authorities, planners, contractors.
How were decisions made during the project?	Was there a clear lead authority?	Link to EA-led or approval-heavy systems.
Did governance arrangements affect how the project was delivered?	Were there delays, repeated approvals, or coordination challenges?	Reflect Beales + PBW findings.

How did governance influence the inclusion of BGI elements?	Were there constraints due to approvals or institutional roles?	Link to fragmented governance.
What helped or hindered coordination between organisations?	Examples of collaboration or conflict?	Identify practical governance issues.

Stakeholder Engagement

Main Question	Follow-up Prompts	Checklist / Notes
Which stakeholders were involved in the project?	Were all relevant groups included?	Residents, landowners, agencies, community groups.
How was stakeholder engagement carried out?	Meetings, consultations, newsletters?	Reflect what you reported in Chapters 7 & 8.
Did stakeholder input influence project decisions?	Can you give examples where feedback changed anything?	Link to “limited influence” finding.
Were BGI elements discussed during engagement?	If yes, did they shape outcomes?	Important for your BGI argument.
Were there challenges with stakeholder participation?	Any resistance, disengagement, or constraints?	Link to access issues, COVID, etc.

Resources and Capacity

Main Question	Follow-up Prompts	Checklist / Notes
What resources were available for the project?	Financial, technical, human resources?	Identify scale of investment.

Were resources specifically allocated to BGI elements?	Or mainly focused on core flood defence infrastructure?	Matches your findings.
Did financial or resource constraints affect design decisions?	Were priorities shifted because of cost?	Link to “core infrastructure first”.
Was there sufficient expertise to deliver BGI?	Internal vs external consultants?	Capacity issues.
What challenges exist for long-term maintenance?	Funding, responsibility, management?	Operational sustainability.

Closing Reflections

Main Question	Follow-up Prompts	Checklist / Notes
What were the main challenges in delivering this scheme?	What aspects were most difficult in practice?	Open reflection.
What factors helped successful delivery?	What worked well?	Balance discussion.
What limited the integration of BGI in this project?	Was it policy, governance, resources, or site constraints?	Directly links to your thesis argument.
What changes would improve future BGI delivery?	Policy, governance, funding, or engagement?	Reform-focused insight.
What lessons from this project would you apply elsewhere?	What should others take away?	Transferability.

APPENDIX B- 3 CLASSIFICATION OF INTERVIEW PARTICIPANTS

Analytical Category		Participant Codes	Institutional Position	Role in Scheme Delivery	Relevance to BGI Analysis
Strategic Governance/ Regulatory Actors		1, 5, 11, 18, 22, 28	National Agency	Oversight, regulatory approval, project coordination, environmental compliance	Central role in shaping policy implementation and determining design constraints affecting BGI
Planning/ Authorities	Local	4, 6, 9, 12, 19, 21, 25	Local Authorities	Planning approval, drainage management, stakeholder engagement, local policy delivery	Influence on spatial planning decisions and integration of BGI within urban contexts
Technical/ Engineering Professionals		2, 3, 13, 20, 24	Engineering Consultancies /Contractors	Design, modelling, and construction of flood defence infrastructure	Primary influence on engineering-led design, often determining the scope for BGI integration
Environmental/ Ecological Specialists		7, 14, 17, 29	Environmental Consultancies	Environmental assessment, ecological compliance, landscape design	Responsible for integrating biodiversity and environmental mitigation within scheme constraints
Infrastructure/ Utility Stakeholders		16, 23	Utility Companies	Management of existing infrastructure and service coordination	Influence on technical feasibility and spatial constraints affecting BGI delivery
Project Delivery Actors		8, 15	Contractors/ Planning Consultants	Project management, implementation coordination, planning strategy	Mediate between design, governance, and delivery processes

APPENDIX 8-4: OBSERVATION GUIDE

1. BGI Presence and Physical Expression

Identification of BGI Elements

- ☐ Presence of green-blue features (e.g. SuDS, vegetated areas, drainage features, retention basins)
- ☐ Type and scale of BGI components (extensive / limited / absent)
- ☐ Evidence of multifunctionality (e.g. flood storage, recreation, ecological function)

Relationship with Engineered Infrastructure

- ☐ BGI integrated within overall design
- ☐ BGI positioned alongside or around engineered structures
- ☐ BGI appears secondary to core flood defence infrastructure

2. Spatial Constraints Affecting BGI

Availability of Space for BGI

- ☐ Adequate space for landscape or ecological features
- ☐ Limited or constrained space due to existing urban form
- ☐ BGI restricted to narrow or fragmented areas

Impact of Site Conditions

- ☐ Infrastructure closely aligned with roads, buildings, or river channel
- ☐ Evidence that spatial constraints limit expansion of BGI
- ☐ BGI confined to small-scale or functional elements (e.g. drainage only)

3. Policy and Regulatory Influence on BGI

Evidence of Policy-Driven BGI Features

- ☐ Presence of SuDS or drainage features linked to planning requirements
- ☐ Environmental mitigation measures (e.g. planting, surface treatments)

Constraints on BGI Design

- ☐ BGI appears added after core infrastructure design
- ☐ Design reflects strict regulatory or planning constraints
- ☐ Limited flexibility for alternative or nature-based solutions

4. Governance and Implementation of BGI

Control and Delivery of Infrastructure

- ☐ Evidence of controlled or phased construction processes
- ☐ Multiple organisations or contractors visible on site
- ☐ Segmented or clearly defined areas of responsibility

Influence on BGI Delivery

- ☐ BGI features appear constrained by delivery priorities
- ☐ Evidence that engineered infrastructure is prioritised over BGI
- ☐ BGI implemented as supporting rather than leading component

5. Resource Allocation and BGI Prioritisation

Investment in BGI Features

- ☐ BGI features appear fully developed and integrated
- ☐ BGI features limited in scale or functionality
- ☐ Evidence of prioritisation of core flood defence infrastructure

Maintenance and Functionality

- ☐ Evidence of maintenance of BGI elements (e.g. vegetation, drainage)
- ☐ Signs of neglect, debris, or poor functionality
- ☐ BGI elements functioning effectively or only partially

6. Public Interaction and Use of BGI Spaces

Accessibility and Use

- ☐ Public access to green-blue areas (paths, open space)
- ☐ Evidence of recreational or social use

Interaction with Infrastructure

- ☐ Clear separation between public space and operational infrastructure
- ☐ BGI contributes to amenity or remains purely functional

7. Analytical Field Notes (Researcher Reflection)

- ☐ Does BGI appear central or secondary to the scheme?
- ☐ What constraints (spatial, regulatory, financial) are most visible?
- ☐ How does the observed reality compare with planned or documented design?
- ☐ What tensions exist between engineered flood control and BGI integration?

APPENDIX B-5: DOCUMENT ANALYSIS MATRIX- CROSS CASE SYTHESIS

Case Study	Document Source	Core Evidence	Design Orientation	BGI Positioning	Nature of Constraint	Analytical Interpretation	Framework Dimension
Perry Barr and Witton	Scheme Overview	~1,400 properties protected	Engineering-led	Secondary	Structural	Flood protection drives design	Resources
Perry Barr and Witton	Planning Documents (Forge Mill)	Reservoir prioritised for storage	Infrastructure-first	Added later	Policy / Design	BGI introduced later	Legislation and Policy
Perry Barr and Witton	Environment Agency Reports	Focus on standards	Compliance-driven	Limited	Regulatory	Regulation shapes design	Legislation and Policy
Perry Barr and Witton	Consultation Materials	Information-led engagement	Delivery-focused	Minimal	Participation	Limited stakeholder influence	Stakeholder
Beales Corner	Scheme Plan	Flood wall defines layout	Engineering-constrained	Minimal	Spatial	Space limits BGI	Governance
Beales Corner	Planning Approval Documents	Heritage shapes design	Heritage-led	Constrained	Regulatory	Policy restricts options	Legislation and Policy
Beales Corner	Environment Agency Updates	Drainage added alongside works	Supplementary	Supporting	Design	BGI supports main design	Resources
Beales Corner	Consultation Materials	Engagement within fixed plans	Pre-defined	Low	Institutional	Input had little impact	Stakeholder

APPENDIX B-6: THEMATIC CODING MATRIX – CROSS-CASE ANALYSIS

Perry Barr and Witton Scheme

Data Source	Participant Category	Extract	Initial Code	Theme	Framework Dimension
Interview	Private Sector Representative	“BGI was not part of the conversation at that stage”	Late consideration of BGI	BGI secondary	Legislation and Policy
Interview	Private Sector Representative	“The legislation dictated the design...”	Policy-driven design	Regulatory dominance	Legislation and Policy
Interview	Local Authority Representative	“Everyone focused on their own bit...”	Fragmented roles	Institutional fragmentation	Governance
Interview	National Agency Representative	“We retained decision-making authority...”	Centralised control	Power concentration	Governance
Interview	Community Representative	“Virtual calls didn't suit everyone...”	Limited accessibility	Weak engagement	Stakeholder
Interview	Private Sector Representative	“Access was absolutely critical...”	Land dependency	Stakeholder reliance	Stakeholder
Interview	Public Sector Representative	“Core funding was FCERM...”	Central funding model	Funding dependency	Resources

Beales Corner Scheme

Data Source	Participant Category	Extract	Initial Code	Theme	Framework Dimension
Interview	Private Sector Representative	“Every design decision was scrutinised...”	Multi-agency approval	Regulatory pressure	Legislation and Policy
Interview	Private Sector Representative	“We had to fit biodiversity around the main works”	Post-design adjustment	BGI marginality	Legislation and Policy
Interview	Private Sector Representative	“Every step had to go through EA and planners”	Layered approvals	Complex governance	Governance
Interview	Local Authority Representative	“Heritage and planning constraints set the parameters”	Design restriction	Governance constraint	Governance
Interview	Community Representative	“People wanted certainty...”	Community concern	Limited influence	Stakeholder
Interview	National Agency Representative	“We listened... but requirements defined boundaries”	Controlled engagement	Constrained participation	Stakeholder
Interview	Private Sector Representative	“Everything was more expensive...”	Cost pressure	Resource limitation	Resources

APPENDIX C-1: ABSTRACTS OF CHAPTERS OF BOOK, CONFERENCE PRESENTATION DURING THE RESEARCH PROGRAMME

BOOK CHAPTER

Title: Stakeholder Collaboration in Delivering Blue-Green Infrastructure: Urban and Rural Flood Management Lessons from England

Authors: Ruth Awara (Birmingham City University), Claudia Carter (Birmingham City University), Hong Xiao (Birmingham City University), David Proverbs (De Montfort University)

Book Title: New Insights in Flood Risk Management: Learning from Global Case Studies of Stakeholder Partnerships

Publisher: Taylor & Francis

ABSTRACT

This chapter explores how stakeholder collaboration influences the implementation of BGI in flood risk management in various urban and rural contexts in England. Using case studies from urban Perry Barr and Witton and rural Beales Corner, the chapter shows how spatial, institutional and community characteristics influence governance arrangements and project outcomes. The analysis examines the roles, relationships and negotiation processes between public agencies, local authorities, landowners, land managers, private developers and communities in two case study locations. While cities have a strong institutional presence, in flood risk considerations and management they can suffer from bureaucratic inertia and fragmentation. In contrast, local authorities in rural areas tend to take on more responsibility,

with informal networks of co-operation playing a greater role. However, in this case study they faced challenges in planning and regulating cultural heritage. This chapter argues that the successful implementation of BGI depends not only on legal frameworks, but also on adaptive, trust-based partnerships that reflect local realities. The findings of this study contribute to the global debate on co-designing climate-resilient infrastructure and highlight pathways towards more inclusive flood governance.

CONFERENCE PRESENTATION

Title of Poster: An Evaluation of Legislative and Policy Effectiveness in Implementing Blue-Green Infrastructure for Flood Risk Management in England

Presenter: Ruth Awara

Event: International PhD Week – Sustainable Research and Leadership

Host Institution: Hochschule Trier (University of Applied Sciences), Germany

Format: Poster Presentation

Date: September 22–27, 2024

Abstract:

This poster presented the preliminary findings of an ongoing doctoral research project that examines the barriers to realising national policy and legal frameworks for BGI in England. It focused on evaluating the effectiveness of legislative and governance structures in enabling the delivery of multifunctional BGI for flood resilience. Using two case studies Perry Barr & Witton (urban) and Beales Corner (rural) the presentation explored how BGI is interpreted and implemented within diverse institutional contexts. Themes included stakeholder engagement, governance fragmentation, policy coherence, and resource limitations. The poster also introduced a conceptual framework guiding the research and outlined the methodological approach involving document analysis, semi-structured interviews, and site observations. The presentation fostered valuable international discussion around governance models and the practical challenges of embedding BGI within flood risk management strategies.

An Evaluation of Legislative and Policy Effectiveness in Implementing Blue-Green Infrastructure for Flood Risk Management in England

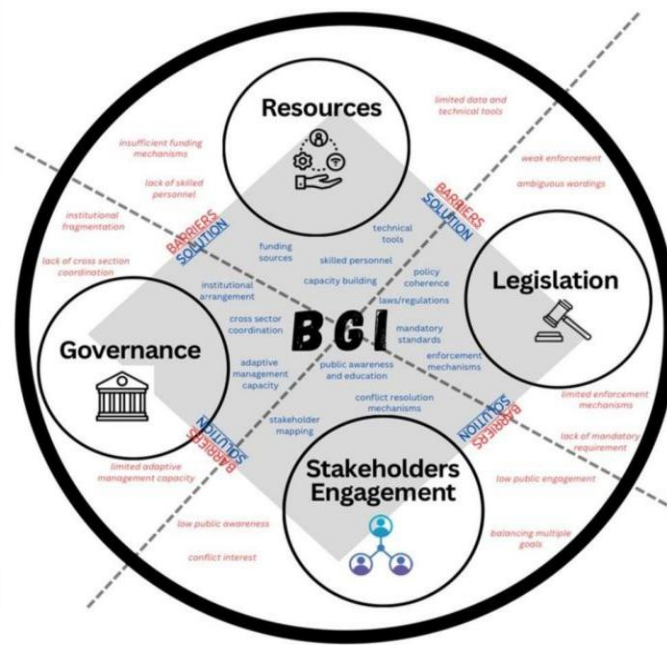
Introduction & Problem Formulation

Flooding is a significant issue in England, exacerbated by climate change and urbanization. Traditional flood defences are no longer sufficient, making Blue-Green Infrastructure (BGI) crucial for sustainable flood risk management. BGI not only mitigates flood risks but also provides ecological benefits like biodiversity enhancement and improved air quality. However, fragmented policies and poor governance prevent its widespread adoption. This research aims to address these challenges by analysing how current laws, policies, and governance structures either facilitate or hinder BGI integration. It will offer actionable recommendations for policymakers and urban planners to enhance the deployment of BGI in flood-prone urban areas.



Conceptual Framework

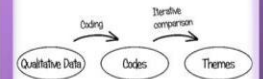
The conceptual framework highlights the interactions between legislation, resources, governance, and stakeholder engagement as key barriers to BGI implementation. It serves as an analytical tool to identify opportunities for improving policy coherence and governance in BGI projects.



Methodology

The research involves data collection through case studies in both urban (Perry Barr & Witton Project) and rural (Beles Corner Scheme) settings. The data flow includes document analysis of legislative texts and policies, interviews with key stakeholders such as policymakers and urban planners, and field observations. Thematic analysis will be employed to analyse the collected data, aiming to identify key themes and patterns related to governance, legislative, and policy barriers that impact the implementation of Blue-Green Infrastructure (BGI).

Thematic Analysis



Expected Results

This research will contribute theoretically by providing a conceptual framework that integrates legislative, policy, and governance challenges in Blue-Green Infrastructure (BGI) implementation. It will enhance the understanding of how these frameworks impact flood risk management in urban settings. Practically, the study will offer recommendations for policymakers and urban planners to improve BGI deployment through better policy alignment, resource management, and stakeholder collaboration.

NAME OF PHD STUDENT: Ruth Awara

SUPERVISORY TEAM: Prof Claudia Carter, Prof David Proverbs, Dr Hong Xiao

DURATION: 02/2020-08/2025

CONFERENCE ABSTRACT

Title: From Statues to Systems: Evaluating Legal and Policy Coherence for Blue Green Infrastructure in England and Canada

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Conference: International Conference on Flood Management (ICFM)

Location: Ontario, Canada

Date: May 2026

ABSTRACT:

Flood risk management is increasingly challenged by climate change and continued development in flood-prone areas, exposing the limitations of traditional grey infrastructure such as levees, dikes and flood walls. Blue green infrastructure (BGI) has emerged as a nature-based approach that can support flood mitigation while delivering wider ecological and social benefits. Despite growing policy support, the adoption of BGI remains uneven across jurisdictions. This paper examines how legal and policy frameworks shape the conditions under which BGI is implemented in flood risk management. It compares two common law jurisdictions facing rising flood risk England and Canada each operating under different governance arrangements: a more centralized system in England and a polycentric, multi-level governance structure in Canada. The study analyses legislation and policy across flood risk management, planning and environmental governance using four analytical dimensions: legal and policy mandates, governance allocation, resources, and enforcement and monitoring. The findings highlight how institutional design influences the implementation of BGI and provide insights into strengthening governance frameworks supporting nature-based flood management.

‘The Lord sits enthroned over the flood; the lord is enthroned as King forever.’