

## Beyond the Green:

Exploring how municipalities consider the  
planning and implementation of nature-  
based solutions

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**Lund 2023**

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Number of pages: 74

**Keywords:** Nature-based solutions; Co-benefits; Municipal planning; Piggyback projects; Multifunctionality; Inter-departmental collaboration; Social involvement; Climate change adaptation; Societal challenges; Conflicting interests; Malmö; Rotterdam

**Abstract:** Nature-based solutions (NbS) are gaining popularity as tools to address societal challenges while providing social, economic, and environmental benefits. Given that NbS is a relatively new concept, there is a lack of guidance on how NbS in urban areas can be adapted to fit their socio-spatial context and provide benefits. This research uses an exploratory comparative case study between Rotterdam, the Netherlands, and Malmö, Sweden, to generate insights into practitioners' considerations when planning for and implementing NbS and how these can differ. It triangulates qualitative interviews with policy document analysis to explore how NbS are considered in the everyday practicalities of municipal planning. This thesis finds that foundational and organisational factors include the lacking use of the term 'NbS' in practice and the importance of economic aspects in decision-making. Because of limited space in the urban fabric, multifunctionality is important and provides a platform to combine budgets. During planning and implementation, NbS are developed on a problem-solving basis, often piggybacking on other projects for cost efficiency. The social benefits of NbS are appreciated, and formal and informal involvement processes are used to adapt projects to their local context. The outcomes and goals show that the visibility of NbS has many benefits. This research finds that *prioritisation is key* throughout the planning- and implementation process of NbS in both cities. Additionally, *ways of social involvement are person-dependent*. Lastly, while academia has adopted the *term, 'NbS' has not translated to municipal practice* yet.

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Avdelningen för Riskhantering och samhällssäkerhet, Lunds tekniska högskola, Lunds universitet, Lund 2023.

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## Acknowledgements

Our biggest thank you,

To our supervisor, Per Becker, for his support and guidance throughout this process, from finding a starting point worthy to explore to this final product. To the participants of our interviews and key informants at Malmö municipality, Rotterdam municipality and beyond, who, despite their busy schedules, gave us the opportunity and time to answer our questions. To our fellow DRMCCA students that wrote their thesis in Lund, for the hangouts, study sessions, and support, and to all DRMCCA students for the great two years.

Victoria Johnson: I wish to thank my friends, near and far, for all of their endless support, and a special thanks to Catherine Jones for always being the best proof-reader and listener. To my friends and peers in Lund, thank you for being distractions when needed to allow for recharging. Thank you to Jade for writing this thesis with me and making it less lonely. And finally, to my parents for their support, both through this thesis process but also during my whole time at Lund University.

Jade Szegedi: I want to thank my friends in the Netherlands for all their support and love, even from far away. Thank you to my friends in Lund who made my time here so great, for the hikes, dinners, hangouts, and more. Victoria, thank you for being my thesis buddy and for making this process fun. To my parents, thank you for your endless support and the many trips to Sweden, and especially to my mom, for proofreading every single paper I've ever written.

## Summary

The effects of climate change and urbanisation trends lead to various social challenges, both separately and combined. Thus, when adapting to climate change in urban areas, a variety of problems must be addressed while fitting into specific circumstances and anticipating different possible future scenarios. Historically, many concepts have been developed about bringing more nature into urban planning. In recent decades, ideas relating specifically to ‘natural’ adaptation have gained traction. Concepts like ecosystem services, green infrastructure, and ecosystem-based adaptation have been grouped under the umbrella term ‘nature-based solutions’ (NbS), which has gained rapid popularity in the scientific community. At their core, NbS aim to use nature as an inspiration or resource to address societal challenges and provide social, economic and environmental benefits. In this regard, most definitions refer to co-benefits. This multifunctionality, and the aim to specifically provide social benefits rather than seeing these as a bonus that is not explicitly planned for, sets NbS apart from previous greening concepts.

NbS uniquely interact with their surroundings and are located in a specific socio-spatial context, meaning that there are no ‘one-size-fits-all’ solutions. It is, therefore, vital that those involved in the planning and implementation of NbS properly consider the effects it may have on the communities NbS are located in and take into account the physical and social context in which they are located. This thesis uses qualitative, inductive research to explore how various aspects and benefits of NbS are considered by those working with these in a specific, real-world context. A comparative case study of Malmö, Sweden and Rotterdam, the Netherlands, was done to gather various perspectives in different contexts. The primary data consists of semi-structured interviews with practitioners mainly from the municipal level of government, triangulated with secondary data analysis from policy- and other official documents from both cities.

The results of these interviews and analyses are divided into seven main sections. While the underlying ideas of NbS in terms of addressing societal challenges and multifunctional benefits are present in the municipalities, *the term itself is not used* by them. When working with limited space in the existing urban fabric, there is *a need to prioritise* the challenges to address, the factors that play a role in the decision-making process, and potentially conflicting interests. While projects *are problem-solving-oriented, the multifunctionality of NbS brings various benefits* and also some challenges. However, there mainly needs to be a separate trigger, such as a planned project that *NbS projects can piggyback* on. Social involvement is done formally and informally when planning a project, with the latter seemingly being person-dependent. The potential *social benefits of NbS are recognised* but also bring up issues related to quantification and measuring. Lastly, *the visibility of NbS projects is seen as a benefit* in various ways. While these themes are grouped based on the outcomes of both

municipalities, some are more central to one municipality. In others, the cases of Rotterdam and Malmö illuminate different aspects of the same theme.

From these results, three clusters of themes emerged. *Foundational and organisational factors* include the absence of NbS as a term in both municipalities and the importance of the economic aspect in decision-making. Limited space in the urban fabric leads to NbS' multifunctionality being necessary while also providing a platform to combine budgets. In the *planning and implementation phase*, NbS are developed on a problem-solving basis, often piggybacking on other projects for cost-efficiency. The social benefits of NbS are appreciated, and formal and informal involvement processes are used to adapt projects to their local context. The *outcomes and goals* of NbS show that the visibility of the projects has many benefits, including reputational aspects. However, difficulty in measuring benefits provides some challenges. The research finds that prioritisation between different factors is key throughout the planning- and implementation process of NbS in both municipalities. Additionally, informal ways of social involvement are person-dependent. Lastly, while academia has adopted the term NbS, this has not translated to municipal practice yet. With this, this thesis contributes to understanding how NbS are considered and used in practice. It examines the translation of NbS in academia and policy to the everyday practicalities of municipal work.

## **List of Abbreviations**

BGS	Blue-green Solutions
CCA	Climate change adaptation
DRM	Disaster risk management
EbA	Ecosystem-based adaptation
EC	European Commission
ES	Ecosystem services
GI	Green infrastructure
GYF	Grönytefaktor
IUCN	International Union for Conservation of Nature
NbS	Nature-based solutions
UNEP	United Nations Environment Programme

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# 1. Introduction

Climate change is having a global impact on society. While measures are being taken to limit global warming, the effects are already being felt (UNGA, 2019, p. 5). Simultaneously, urban populations are increasing. Currently, over half of the world's population lives in urban areas, with a trend of urbanisation leading to projections that 68% of the world's population will be urban in 2050 (UN, 2019, p. 1). These trends, separately and combined, lead to various societal challenges (Mearns & Norton, 2010, p. 24; Zhang, 2016, pp. 245-252). For instance, extreme weather is becoming more intense and frequent due to climate change, which can lead to flooding due to increased runoff and decreased permeable surfaces even in urban areas adapted to other types of floods (Hemmati et al., 2022, p.16). Vulnerable and disadvantaged communities are often significantly affected because of, for example, differences in housing, coping capacity, and protection by infrastructural measures (Hemmati et al., 2022; Mearns & Norton, 2010, p. 16).

Thus, climate change adaptation (CCA) must address various problems, fit into different circumstances, and adapt to different scenarios (Buurman & Babovic, 2016, p. 139). Adaptability is crucial when managing various societal challenges, as these interventions are often costly and time-consuming but placed in a fast-changing environment (Gersonius et al., 2013, p. 412). Grey infrastructural measures, including large-diameter pipes, pump stations (Chen et al., 2021, p. 1), and dikes and levees (Vojinovic et al., 2016, p. 97; Jones et al., 2012, p. 504) have been popular solutions to implement. However, in recent decades, ideas relating to 'natural' adaptation have gained traction, and measures have been proposed to introduce more vegetation into the urban environment. Examples include ecosystem-based adaptation (EbA), green infrastructure (GI), and, more recently, nature-based solutions (NbS) (Dorst et al., 2019, p. 1). NbS have rapidly gained popularity since entering the scientific community in the 2000s and can be seen as an umbrella concept for various greening efforts (Cohen-Schacham et al., 2016, p.3, 22).

At their core, NbS aim to use nature as an inspiration or resource to provide social, economic and environmental benefits to communities and help build resilience (Faivre, 2017, p. 510). What sets NbS apart from previous greening concepts is their multifunctionality and aim to address social benefits rather than seeing these as an added, but not explicitly planned for, benefit (Wijsman & Berbes-Blasquez, 2022, p. 378). This multifunctionality and aim are often referred to as co-benefits, which is present in most definitions of NbS. The social values NbS can address are diverse, ranging from educational benefits and better air quality to better mental health for inhabitants and spiritual connection (da Rocha et al., 2017, pp. 7-8; Wijsman & Berbes-Blasquez, 2022, p. 378). However, while most research on NbS focuses on their possible benefits, research on the potential downsides following their implementation is emerging. For instance, when NbS are used to create more attractive and climate-smart areas, this can, in turn, lead to property

values rising, and people living there may fall victim to social exclusion and segregation<sup>a</sup> (Omner et al., 2022, p. 2; Raymond et al., 2017, p.17).

NbS uniquely interact with their surroundings and are located in a specific socio-spatial context, meaning that there are no ‘one-size-fits-all’ solutions (Sari et al., 2023). It is, therefore, vital that those involved in the planning and implementation of NbS properly consider the effects it may have on the communities and take into account the physical and social context in which they are located. There is currently a lack of guidance and assessment in the planning and implementation process for NbS (Raymond et al., 2017, p. 16), meaning that a wide range of approaches may have developed over time. Therefore, these approaches and perspectives must be researched and compiled to understand how NbS are being implemented and planned for today.

## **1.1 Context and purpose**

This thesis is the result of exploratory research into the consideration of benefits that are said to be delivered by NbS, and how contextual factors are taken into account in the planning- and implementation process. Given the amount of research on the benefits of NbS and the provision of co-benefits as core aim in NbS definitions, it is essential to explore this relationship in practice. It becomes even more important given that there is a lack of research looking into the potential maladaptive outcomes of NbS (Omner et al., 2022, p. 2). There is an academic relevance for this research in identifying the relationship between ‘nature’ and human well-being *and* practical relevance for the field to implement efficient solutions to societal challenges.

This thesis uses a comparative case study of Malmö, Sweden, and Rotterdam, the Netherlands, to gain insight into how municipalities consider the planning- and implementation process of NbS. It is important to note that this comparative study aims to gain different perspectives and not to rank these cases. Since NbS is a relatively new, developing concept regarding scope and definition, it is important to clarify how this research defines NbS. In this thesis, NbS are understood as the use of vegetation, blue and green spaces, and greening principles with clear intentions of addressing societal challenges and gaining social, environmental, and economic benefits. The theoretical framework (see *chapter 3*) will further delve into the various definitions of NbS.

### ***1.1.1 Analytical boundaries***

Analytical boundaries were set to conduct this research. Firstly, in terms of space, this research focuses on the urban context of the two municipalities, as there might be a more explicit interaction between the three aspects of NbS (economic, social, and environmental) here. However, drawing a hard line for what areas to consider is challenging, as these divisions are

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<sup>a</sup> Also known as ‘green gentrification’ (Anguelovski et al., 2022).

often unclear in practice. Additionally, in the case of Rotterdam, different actors are at play, including the municipality and the district water boards<sup>b</sup> (further referred to as water boards). Secondly, not all data could be included in the results of this thesis. For example, in some cases, respondents brought up disadvantages of NbS. While interesting and important information, space constraints mean that only data that are relevant for the research question are included.

## **1.2 Research question**

This research departs from the aim of NbS to address societal challenges and gain co-benefits and explores how actors involved in planning and implementing NbS consider these. As implementing NbS projects and addressing social issues in the urban context are municipal functions in both Malmö and Rotterdam, this research focuses on how these aspects are considered in the municipal context. Therefore, this research is guided by the following question: How are those planning for and implementing NbS considering various aspects and benefits in this process and how can these differ in different contexts? Given the role that social aspects play in the concept of NbS, compared to other greening concepts, the study aims to pay extra attention to this.

## **1.3 Thesis structure**

This thesis is the outcome of research conducted between January and May 2023 by two students of the master's programme in Disaster Risk Management and Climate Change Adaptation at Lund University. The *Background* chapter introduces the contextual background of both Malmö and Rotterdam and provides information needed to situate the conducted research and its results. The *Theoretical framework* introduces the theory that underlies this thesis and describes the development of the concept of NbS and existing criticisms. The *Methodology and methods* chapter details the methods used to conduct the research and sampling and analysis methods. In *Results*, the main findings from interviews and policy document analysis are presented, ranging from findings relating to the definition, organisational issues and incentives, and public involvement. The *Discussion* section relates these findings to each other and to existing research to discuss the research implications. The research is summarised in the final chapter, *Conclusion*. The included appendices contain the used quotes in their original language, the interview guide, and consent forms.

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<sup>b</sup> In Dutch: 'Waterschappen'

## 2. Background

This chapter provides contextual background information for the cases of Malmö and Rotterdam. When exploring how the municipalities plan for and implement NbS and consider their different aspects and benefits, it is important to be aware of each city's spatial and social context, as well as some knowledge of their approaches to urban planning.

### 2.1 Malmö

With just over 350 000 people, Malmö is the third largest city in Sweden (SCB, 2023). The municipality is situated on the southwestern coast of Sweden and covers an area of around 155 square kilometres (SCB, 2011). With over 35% of the population being born abroad and 186 nationalities represented, Malmö is Sweden's most diverse and fastest growing municipality (SCB, 2023; Malmö Stad, 2023). Malmö was an industrial city before the closing of many big industries in the early 1990s. As a result, the city suffered from depopulation as workers moved away to find other jobs (Scarpa, 2014). The municipality has the highest unemployment rate in the country, 12,5% compared to the national average of 6,7% (Arbetsförmedlingen, 2022). Spatially, the municipality is polarised between the coastal areas, which have been regenerated and gentrified, and the inner parts of the city, with high-rise buildings and mainly low-income households (Scarpa, 2014).

According to the municipality's Risk and Vulnerability Analysis (in Swedish: 'Risk och sårbarhetsanalys'), some of the risks that Malmö is most vulnerable to include heatwaves, downpours and heavy rains, high sea levels after storms, and extreme cold and snowstorms (Malmö Stad, 2022, pp. 34-40). The combination of rainfall and coastal flooding risk means water management is a high priority. The heavy rainfall leads to overload in the stormwater system, resulting in excess water collecting above ground, causing disturbances for the municipality and its inhabitants (ibid., pp. 35-40). Flooding is projected to increase in frequency and severity due to climate change, which Malmö already had to face the consequences of in 2014, when severe flooding after storm Arvid significantly affected its infrastructure and societal functions (Malmö Stad, 2020, p. 35).

#### *2.1.1 Swedish framework for land-use planning*

In Sweden, the responsibility for physical planning lies with the municipalities (Granberg, 2018, p. 23). The Planning and Building Act (in Swedish: 'PBL') gives municipalities control over land use through a series of tools such as detailed development plans and building permits (Brokking et al., 2021, p. 7). For a municipality, the comprehensive plan (in Swedish: 'översiktsplan') outlines the municipality's ambition for land and water development, conservation and use (Boverket, 2021). The detailed development plan (in Swedish: 'detaljplan') is, in turn, a tool to help achieve those ambitions.

Private landowners have the right to develop their land according to the stipulations of the detailed development plan (Brokking et al., 2021, p. 7). Therefore, the municipality can use the detailed development plan to protect, for instance, green space. However, it cannot stipulate exact solutions to do so. The detailed development plan also applies to municipal land, and the municipality has complete control over its development and inclusion of potential nature-based solutions (NbS) (ibid.). The municipality can also sell their land to, for example, private developers to build housing to cover housing needs. In these cases, the municipality can create requirements for private developers that demand social and ecological qualities that should be adhered to (ibid.). Therefore, the municipality has a key role in both private and public land to push for NbS involvement in development.

## **2.2 Rotterdam**

Rotterdam is a port city located in the west of the Netherlands. With a population of almost 664 000 people in the municipality, it is the second-largest city in the Netherlands after Amsterdam (Gemeente Rotterdam, 2023). The total size of the municipality is around 320 square kilometres, around one-third of that being water (Gemeente Rotterdam, 2012). About half of the population has a migration-background other than Dutch, with around 170 nationalities represented in the city (Gemeente Rotterdam, Onderzoek 010, n.d; IDEM Rotterdam, 2019). The city has the largest wealth inequality in the Netherlands (Dekker, 2019). Being a large transshipment port connecting the North Sea with Europe's inland, Rotterdam's economy is mainly based on shipping (Encyclopedia Britannica, 2023).

In 1940, during the Second World War, the inner city and other neighbourhoods of Rotterdam were bombed. In total, 258 hectares were destroyed in the city (Stadsarchief Rotterdam, n.d.). Therefore, Rotterdam is one of the few cities in the Netherlands where the city centre is newer than the surrounding neighbourhoods (Gemeente Rotterdam, 2021a, p. 25). Reconstruction was guided by CIAM's ideas on the functional city<sup>c</sup>. The pre-war neighbourhoods of Rotterdam are more compact, with narrower streets and less public (green) space (ibid, p. 30). In contrast, the post-war neighbourhoods are more spacious and have more green and blue public areas (ibid.). 60% of the city's land is privately owned, and its climate change adaptation (CCA) strategy, therefore, focuses both on public and private areas (Rotterdams Weerwoord, n.d.; Gemeente Rotterdam, 2013, p. 26). The spatial planning act (in Dutch: 'Wet Ruimtelijke Ordening') outlines that every municipality should create a spatial planning document called structural vision (in Dutch: 'structuurvisie') for their area (Rijkswaterstaat, n.d.).

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<sup>c</sup> In this vision, the city is divided into functions: living, working, recreation, transport (CIAM 6, n.d.).

Rotterdam derives its name from the Rotte, a river in the Rhine-Meuse delta. Being a Delta city located below sea level, Rotterdam is affected and threatened by both sea and rivers. It is one of the few cities in the Netherlands with a part outside dyked areas, i.e. part of the city is not protected by dykes. However, this part has protection from the Maeslantkering, a storm surge barrier that is closed when coastal floods threaten Rotterdam (Gemeente Rotterdam, 2013). As a result of climate change, Rotterdam faces various challenges, reflected in 6 climate themes. These are flooding, rainfall, heat, groundwater, land subsidence, and drought (Rotterdams WeerWoord, n.d.B., p. 12). Extreme rainfall events combined with insufficient draining systems, lack of infiltration due to impermeable surfaces, and lack of storage capacity are leading to problems already (ibid., p. 13). Furthermore, Rotterdam is threatened by floods from higher sea levels and less so by peaks in river water discharge (ibid, p. 46). Groundwater issues can be a result of either too much or too little water. The city's water system is influenced by its position below sea level: water does not flow towards rivers and sea but must be pumped to the groundwater and then pumped further to rivers to flow to the sea (ibid, p. 14). Due to the way that the Dutch water management system is organised, the water boards play a role in the implementation and planning of certain water management projects in municipalities. Therefore the following section will briefly introduce their role.

### ***2.2.1 The Dutch water management system***

The Dutch water management system is divided between different water managers, whose responsibility is to prevent flooding and manage ground- and surface water levels and quality (Government of the Netherlands, n.d.). Rijkswaterstaat, the executive department of the Ministry of Infrastructure and Water Management, manages major waters and the main flood prevention mechanisms (ibid.). The 21 water boards of the Netherlands each have their own responsible area and manage regional waters and flood defences. The provinces translate national water policy to actions on the regional level, and the municipalities are responsible for the management of groundwater in urban areas, as well as water drainage through sewers (ibid.). In the case of Rotterdam, the three involved water boards are Hollandse Delta, Delfland, and Schieland en de Krimpenerwaard.

### **2.3 Selection of case studies**

This research compares Malmö and Rotterdam to generate insights into NbS planning and implementation in an urban context. These cases were selected because they have similar risk profiles. For example, Rotterdam and Malmö are exposed to flood risk from the sea and from intense rainfall and also face urban heat risks. Additionally, these problems must be addressed in limited space in a densely populated urban context. Both cities are post-industrial, which has affected their existing infrastructure and urban fabric. This needs to be taken into account in their urban planning. They also face urbanisation as their populations are increasing fast, meaning that

social aspects are important to consider in their continuous development. Furthermore, while Malmö and Rotterdam are not similar in size when compared, they are both large cities for their respective countries<sup>d</sup>.

A comparison between Malmö, Sweden, and Rotterdam, the Netherlands, was made to gather different perspectives and explore how context may affect the planning- and implementation process of NbS. The aim is to induce some principles, factors and insights into how NbS are considered by practitioners and used in practice today.

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<sup>d</sup> Rotterdam is the second largest city in the Netherlands and Malmö is the third largest in Sweden.



### 3. Theoretical Framework

This chapter outlines the key information on the concept of nature-based solutions (NbS) and concepts related to its understanding and development. This chapter aims to help understand relevant terminologies and how these may differ between research and practice and between practitioners. This is especially important given the wide variety of definitions available for NbS. As this thesis aims to pay special attention to social aspects of NbS, this chapter will also outline important points to consider when developing interventions for various benefits.

#### 3.1 Development of urban greening concepts

To understand NbS and their aim, it is important to know how the concept evolved. Historically, many concepts have been developed around bringing more nature into urban planning (Dorst et al., 2019, p. 1). One concept is the ecosystem services (ES) approach which is “*the benefits human populations derive, directly or indirectly, from ecosystem functions*” (Costanza et al., 1997, p. 253). The underlying idea of ES is to create a space for ecological principles in economic decision-making (Dorst et al., 2019, p. 4). What ecosystem service is relevant, is context- and ecosystem dependent, and the borders of an ecosystem can often be hard to establish (Bolund & Hunhammar, 1999, p. 294). ES can be a part of the larger function of NbS, although one should not limit the design and planning of NbS to a single or few ES (Nesshöver et al., 2017, pp. 1218-1219).

As a result of ES and related concepts assigning an economic value to nature, green infrastructure (GI) was developed. GI is “*an interconnected network of greenspace that conserves natural ecosystem values and functions and provides associated benefits to human populations*” (Coutts & Hahn, 2015, p. 9770). GI does not have a CCA perspective, focusing instead on the physical aspects of connectivity in the landscape, creating green corridors between parks and other green spaces (Benedict & McMahon, 2002, p. 13). While this and other concepts were developed in the early 2000s, the ideas behind using green space to benefit people are not new (ibid.).

Ecosystem-based adaptation (EbA) builds on ES and GI concepts but relates more to CCA policy-making. The UNEP defines it as “[*using*] *biodiversity and ecosystem services as part of an overall adaptation strategy to help people and communities adapt to the negative effects of climate change at local, national, regional and global levels.*” (Lo, 2016, p. 10). EbA is critiqued for putting ES values above the human- and social components, as some definitions imply that societal vulnerability will be reduced or co-benefits will be considered or assumed, rather than promoted or ensured (Scarano, 2017, p. 67). Compared to the view of nature that NbS takes, EbA has more exclusionary ideas on what form of nature is included, entailing biodiversity and ecosystems but no artificial forms (Dorst et al., 2019, p. 3). However, Nesshöver et al. (2017, pp. 1218-1219) argue that NbS should include the EbA perspective to ensure their implementation is adapted to climate change.

### **3.1.1 Defining NbS**

The most recent addition to urban greening concepts is NbS, which aims to achieve co-benefits when introducing vegetation to address specific risks or challenges (Nesshöver et al., 2017, p. 1216). The application of NbS in an urban environment often creates confusion about whether an intervention is ES, GI, EbA or NbS (Dorst et al., 2019, p. 2), meaning it is essential to have clear definitions. An overarching aim of NbS is to be an umbrella term that includes various urban greening approaches. The definitions for NbS, however, are many and can vary in what they include or aim to do.

Two of the more popular definitions for NbS come from the European Commission (EC) and the International Union for Conservation of Nature (IUCN). The EC defines NbS as “*solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience*” (Faivre, 2017, p. 510). The IUCN, on the other hand, defines it as “*actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*” (Walters et al., 2016, p. 2). Balian et al. (2014, p. 5) add some specific examples, expanding the definition into “*the use of nature in tackling challenges such as climate change, food security, water resources, or disaster risk management*”. Here, they use a wider definition of the use of biodiversity, integrating “*societal factors such as poverty alleviation, socio-economic development and efficient governance principles*” (ibid.). Maes and Jacobs (2015, p. 123) in turn state that NbS are “*any transition to a use of ecosystem services with decreased input of non-renewable natural capital and increased investment in renewable natural processes*”, similarly to Laforteza and Chen (2016, p. 578) stating “*the incorporation of ecosystem services into applicable solutions*” and “*...maximizing an ecosystem’s net benefits to society*”. Given the myriad of definitions available, this thesis defines NbS to include elements of all these: *using nature with clear intentions of addressing societal challenges and to provide environmental, social and economic benefits to create a resilient society.*

While the section above summarised the core concepts that are important to consider in the development of NbS, Cohen-Shacham et al. (2019, p. 22) developed a more extensive list of the concepts that fit under the umbrella term NbS, organised into five categories: restorative (ecological restoration, forest landscape restoration, ecological engineering), issue-specific (EbA; ecosystem-based mitigation; ecosystem-based disaster risk reduction, climate adaptation services), infrastructure (natural infrastructure, GI), management (integrated coastal zone management, integrated water resources management), and protection (area-based conservation approaches, including protected area management and other effective area-based conservation measures).

### ***3.1.2 Forms of nature and typologies***

NbS can be implemented alone or in combination with technological- and engineering solutions. In that sense, they are not as exclusive as, for instance, EbA's view on what forms of nature are included (Dorst et al., 2019, p. 3). What can be seen as nature is a central question to the concept of NbS, as this significantly impacts whether a project is seen as NbS. It should be noted that similar to the wide range of definitions of NbS, the perceptions of what constitutes nature also differ, and some 'artificial' nature, such as biomimicry and hybrid solutions tying in engineered solutions, can still be included as NbS (Dorst et al., 2017, p. 3).

Related to forms of nature, Eggermont et al. (2015, p. 244) developed three typologies of NbS using two parameters: the amount of engineering involved and how many ecosystems and stakeholders are targeted. The typologies are: (1) no or minimal intervention in ecosystems, where the aim is to maintain or improve ES internally and externally for the ecosystems, (2) approaches that develop ecosystems and landscapes to be sustainable and multifunctional, improving the resulting ES in comparison to what would be developed using conventional practices, and (3) the more intrusive management or creation of new ecosystems, including artificial ecosystems such as green walls (ibid.). The concept of greening cities would then fall somewhere between typologies 2 and 3, depending on the circumstances of the specific intervention. Additionally, Castellar et al. (2021, p. 7) found from interviews with experts that nature is often defined as the 'green factor', which shows the existence of vegetation in a specific area. Given the connection between nature and NbS, it is important to consider how residents and practitioners view the 'nature' of NbS.

### **3.2 Multifunctional and social focus**

A central component of NbS is the aim to address societal challenges. According to the IUCN, these challenges include climate change, food security, water security, disaster risk, human health and economic and social development (Walters et al., 2016, p. viii). Variations of NbS can be used to target specific benefits, but their strength is their ability to apply a multifunctional approach, which contrasts with more rigid engineering solutions and grey infrastructure that cannot adapt to different functions (Dorst et al., 2019, p. 5).

#### ***3.2.1 Social benefits***

As this thesis includes attention for the potential benefits NbS can have on social aspects and values, it is important to consider the wide range of social and cultural values that can be affected. To illustrate, da Rocha et al. (2017, pp. 7-8) identify six social and six cultural values of nature: educational, well-being, life-sustaining, social inclusion, safety, intrinsic, aesthetic, cultural history and heritage, biological diversity, recreation, spiritual and religious, and place-based values. Following from this, they identify social and cultural benefits that can be derived from successful NbS (ibid., pp. 8-9):

1. Well-being enhancement; related to positive impacts on physical and mental health
2. Opportunities for social interaction; benefits relating to integration of local communities, and which can result in better sense of community
3. Enhancement of equality; related to benefits that are derived from a decrease of isolation, and empowering disadvantaged groups
4. Growth of employment; benefits of new job creation as a result of nature protection, recreation and nature tourism
5. Education development; related to informal and formal learning about nature, which can also raise awareness about nature conservation
6. Safety advancement; increasing the perception of safety in an area, as well as increasing climate change resilience
7. Aesthetic improvement; enhanced visual appearance of the environment
8. Spiritual connection; related to the benefits of the sense of calm and pleasure that can be derived from being in 'nature', as well as the impact it can have on developing religious mind-sets
9. Preservation of cultural heritage; benefits relating to impacts on restoration and conservation of cultural and historic heritage
10. Recreation opportunities; related to the benefits for well-being derived from outdoor activities, and the benefits of nature providing space for recreation

### ***3.2.2 Urban resilience***

Urban resilience is based on a city's ability to adapt to a changing environment and sudden or gradual stressors (Bush & Doyon, 2019, p. 2). NbS contribute to urban resilience through physical aspects, such as creating floodplains for high water levels (Turlboom et al., 2021, p. 1431) and intangible aspects, like increasing social cohesion (Mahmoud et al., 2021, p. 23). Furthermore, while social cohesion cannot be used by itself to measure resilience, it is a significant factor when evaluating a community's resilience (Townsend et al., 2015, p. 916). Various planning- and design approaches can feed into creating social cohesion (Schreiber & Carius, 2016, p. 318). However, social cohesion cannot be solely attained through physical interventions and needs to be combined with social measures (ibid., p. 324). Here, Nbs can be an option, addressing resilience's physical and social side. However, Mahmoud et al. (2021, p. 23) emphasise the importance of collaboration with the public when implementing NbS.

### **3.3 Critique on NbS**

While NbS are praised for their co-benefits, there are disadvantages that are mentioned less frequently, but important to be aware of. The definitions of NbS set a high bar of catering towards ecological, social and economic challenges, but sometimes addressing one of these categories can clash with another. For example, when NbS are used to create more attractive and

climate-smart areas, this, in turn, can cause property values to rise, leading to social exclusion and segregation (Omner et al., 2022, p. 2). NbS also threatens the ownership of resources or green spaces of vulnerable groups (Anguelovski & Corbera, 2023, p. 46). Within the context of social aspects of NbS, it is crucial to consider that perceptions of public spaces may differ between communities. Communities with a history of trauma relating to the use of public space, for example, may not have the same positive view of using such spaces to create social cohesion (Tozer et al., 2020, p. 2). Anguelovski and Corbera (2023, p. 46) emphasise the need for inclusive decision-making to avoid disbenefits such as gentrification or destructive investments.

Additionally, as NbS is a fairly new concept, data on long-term outcomes is lacking and existing research is focused on finding co-benefits rather than potential drawbacks (Omner et al., 2022, p. 8). Moreover, assessing the effectiveness of NbS proves difficult, as projects often target complex issues (Seddon et al., 2020, p. 7). Therefore, Seddon et al. (ibid.) call for the development of context-specific metrics that can be used to measure the effectiveness of NbS. The research for this thesis adds a perspective on how NbS are currently considered in the practical context of municipalities, given the relative newness of NbS.

## 4. Methodological Approach

Nature-based solutions (NbS) are a relatively new concept in academia and practice. This research aimed to understand how various factors of NbS, including the social context and benefits, are considered in the decision-making and implementation process in municipalities. Here, NbS-projects are considered to be the outcome of socio-political processes in a specific spatial context (Bryman, 2016, p. 466). To gain an understanding of this, a qualitative research with a comparative case study approach was chosen. Qualitative research into case studies helps understand how different aspects and benefits are considered by those working with NbS in a specific, real-world context (Yin, 2014, p. 2). A comparison between Malmö, Sweden, and Rotterdam, the Netherlands, was made to gather different perspectives and see how context may affect the planning and implementation process. The aim was to gain some insights into how NbS are used in practice in two contexts. There is a possibility that these can be applied more widely to NbS planning and implementation in urban contexts.

This research has taken an exploratory approach to gain an understanding and develop new insights. As these emerge from the data, the logic of enquiry for this research is inductive (Georgia Tech, 2015). Since work on and with NbS is relatively new, inductive research can help generate new and possibly unexpected results. Additionally, it allows for more flexibility in the study. The methods used in this research are semi-structured interviews and document analysis of relevant policy documents. This mixed-methods approach was chosen to triangulate the interviews' findings with the specific policy that the municipalities have. This generates insights into the intention and planning process surrounding NbS in municipalities and how this relates to practitioners' work in practice. Additionally, the document analysis can provide a background for the interviews, situate their outcomes, and complement the interviews by filling in gaps. However, the primary method in this research, and the most significant part of the results, came from the semi-structured interviews.

### 4.1 Sampling

This research has used purposeful- and snowball sampling to include relevant participants for the research topic. Interviews were conducted with practitioners working for and with Malmö and Rotterdam municipality (and a water board in the case of the Netherlands). These practitioners worked with various topics such as CCA, urban green spaces and urban planning, and water management, and for various departments (for example, city planning) but were all in some related to the planning or implementation of NbS. Due to the different circumstances and organisations in both cities, people with different job descriptions were interviewed in both municipalities. This will be further expanded on in the limitations section (see *section 6.4*). However, due to the sampling method used, which purposefully included people working with

NbS in municipalities, this research still gives a good overview of how both municipalities approach different aspects and contexts of NbS projects. In the case of Rotterdam, an employee of a water board was also interviewed due to the board's role (see *section 2.2*).

Key informants for both municipalities were contacted to generate an initial list of contacts. From there on, new names were collected from the interviewed people, following a snowball method. The advantage of this way of sampling is that it leads to information-rich participants that are highly relevant to the research (Palinkas et al., 2015). While this method has the disadvantage of risking non-representative samples (Robinson, 2014, p. 5243), the aim of this research is to look at some factors and insights into how NbS are considered, and relevant participants were selected. The sampling- and interviewing process ended when no new insights were being produced and no new names were generated, i.e. when saturation was deemed to be achieved (Rowland et al., 2016).

#### **4.2 Semi-structured interviews**

The interview data was collected between January and March 2023. In total, 18 people were interviewed, 10 of which in Malmö and 8 in Rotterdam. 2 of the people in Malmö were interviewed together. The interviews lasted around 45 minutes and were either conducted in English with both researchers present, or in Dutch or Swedish with the researcher that spoke that respective language. While this brings up some questions of bias and translation of each interview, the participant's comfort and ease of speaking will probably have positively affected the data quality and amount (Alshenqeti, 2014, p. 42). Quotes in this thesis have been translated into English by the researchers, with the original quotes included in *Appendix A* for full transparency. Informed consent was obtained before the interviews, which were recorded and transcribed. The interviewees are kept anonymous.

The semi-structured interview format was chosen to allow some flexibility during the interviews (Kallio et al., 2016, p. 2955). This enabled the researcher(s) to follow up on points brought up during the interview and change the order of questions, which made the interview have a more natural flow (Cachia & Millward, 2011, p. 268). However, the interview guide (see *Appendix B*) ensured that all points were addressed in all interviews. This was especially important as both researchers were only present in the interviews conducted in English. For the others, where only one of the researchers was interviewing, the interview guide ensured that the content of the interviews had the same foundation. Thus, comparisons could be made. The interview guide consisted of four themes that related to NbS and the participants' work with these. The guide acted as a basis and was expanded with questions based on the participant's profile and was updated throughout the research process as themes emerged. However, as these were not mentioned in all interviews, the interview guide included in *Appendix B* is the original base

template. The themes were the interviewee’s general work with NbS, what they identified as the main functions and benefits, the planning- and implementation process of NbS-projects, and the local context of these projects.

The interview guide was developed by working backwards from the research question to identify what was needed to answer the main question (Bryman, 2016, p. 470). Additionally, the literature review for the theoretical framework helped develop the interview guide. The first theme was chosen to gain more insights into how the participants work with NbS in their daily lives and gain insights into the system of NbS in the municipality. By asking general, non-leading questions about the functions and advantages of NbS, the most important aspects, according to the participants, were generated. The researchers later asked about social benefits if the interviewees did not mention them. The questions about the planning- and implementation process aimed to produce insights into the reasoning for choosing NbS and who is involved in the processes. This would show whether a specific focus was on social context and advantages and whether there was cross-department collaboration. Lastly, the part on local context focused on adapting a project to the ones using it, and participation. The goal was to see whether processes were top-down or if the users of the space had an influence on how it was developed. It was kept in mind, however, that participation does not necessarily equal a well-adapted solution.

### 4.3 Policy documents

The data from the semi-structured interviews were supplemented and triangulated with an analysis of both municipalities’ policy documents (Yin 2014, p. 119). Moreover, comparing interview data and reviewing policy documents allowed for insights into planning versus practice. The policy documents were sampled through asking interviewees about relevant documents and searching the municipalities’ websites. Documents on climate change adaptation (CCA) strategies, urban greening, and water management were used. For Malmö, the documents were found on the main website, and for Rotterdam, this included, in addition, specific websites made by the municipality on CCA. The following documents were used:

Malmö	Rotterdam
Comprehensive plan (with relevant appendices) (in Swedish: ‘Översiktsplan’)	Programme Framework Rotterdam WeatherWise 2030 (in Dutch: ‘Programmakader Rotterdams Weerwoord 2030’)



Nature Conservation Plan (in Swedish: 'Naturvårdsplan')	Strategy on Spatial Planning and the Environment (in Dutch: 'Omgevingsvisie - De Veranderstad')
Storstadspaketet Malmö	Rotterdam Climate Change Adaptation Strategy (in Dutch: 'Rotterdamse Adaptatiestrategie')
Project instruction: Environment, ver 2.2 (in Swedish: 'Projektanvisningar Miljö ver 2.2')	The Greenblue Growth Diamond (in Dutch: 'De Groenblauwe Groeidiamant') <sup>c</sup>

#### 4.4 Data analysis

Both the transcripts of the interviews and the policy documents were coded. An inductive strategy was used, meaning that the codes emerged from the texts and were not externally generated and applied (Chandra & Shang, 2019, p. 91). Clusters of codes were identified and grouped into themes (Bryman, 2016, p. 583). This method allowed the data itself to determine the themes. For the policy document analysis, the documents were read in their entirety by the researcher speaking that language. Relevant sections, such as parts detailing how blue-green solutions (BGS) play a role in the municipalities' CCA strategy, were taken and coded following a structure and approach similar to the interviews. Specific attention was paid to keywords like 'nature', 'green', 'nature-based solutions' and 'ecosystem services'.

#### 4.5 On multi-language research

This research was conducted in a Dutch and Swedish context, with one researcher for each language. English was used where possible, but the majority of the interviews and documents were in Swedish and Dutch. This means that some parts of this research were conducted mainly by one of the researchers. English documents and interviews were coded by both researchers and were coded first to create a basis for the coding system. The Dutch and Swedish texts were coded by the person that speaks that respective language, though all codes were in English. When a researcher coded individually, they walked the other researcher through the coding process. While time-consuming, this facilitated some level of cross-checking between the researchers. While some information and data may have been lost in translation, the researchers feel that they have ensured that the results are as accurate as possible for multilingual research.

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<sup>c</sup> This document is a study on greenblue value creation in Rotterdam. As this is a study on possible future options, only the parts that described the current situation were used.

## 5. Results

This chapter is structured according to the main themes that emerged from this research: (1) unclear definitions, (2) need for prioritisation, (3) multifunctionality and holistic solutions, (4) piggyback projects, (5) social involvement and impact, (6) social benefits, (7) project visibility. Quotes presented in this section have been translated as carefully as possible while allowing for readability<sup>f</sup>.

### 5.1 Unclear definition

The first point to consider is the language the respondents use to talk about nature-based solutions (NbS) and climate change adaptation (CCA) projects. A finding is that many different terms are used to describe a similar concept: using green solutions for CCA and addressing societal challenges (social, economic and environmental).

The interviews show that there is some unclarity about what NbS are. For some respondents in Malmö and Rotterdam, it relates to every green intervention that includes vegetation in the urban environment, regardless of an intention to address societal challenges with these interventions. In the case of Rotterdam, a respondent explicitly mentions that the term NbS is not used in the municipality. Instead, ‘greening’ is used, but the intention is to implement this in such a way that it, for example, benefits water management. Several respondents in Malmö feel there is a change where NbS, and urban greening in general, are coming to the forefront of urban planning. In general, the term NbS is used sometimes, and there have been targeted projects to implement NbS but the term seems to not be mainstreamed into the whole organisation. One respondent showed a willingness to include more NbS but needed to see more examples of what that meant in practice for the projects implemented in Malmö: *“We really want to use nature-based solutions, but at the same time we don’t have - we need some good examples to understand what that actually could be and mean for us.”*<sup>1</sup>

In the Rotterdam WeatherWise<sup>g</sup> Programme Framework (in Dutch: ‘Programmakader’) (2022, p. 11), CCA is said to be connected to “other urban challenges” and it also adds that CCA measures in the city have a broader added value, such as increased living quality. The environmental vision of Rotterdam also mentions taking a holistic approach to future-proof neighbourhoods by addressing multiple societal challenges at once (Gemeente Rotterdam, 2021a). The concept of

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<sup>f</sup> The quotes in their original language can be found in *Appendix A*. If there is no endnote on the specific quote, this means that the original language of the quote is English.

<sup>g</sup> Rotterdams WeerWoord (in English: ‘Rotterdam WeatherWise’) is a climate change adaptation programme where Rotterdam municipality, the three district water boards relating to Rotterdam, and the watercompany collaborate together with citizens and citizen initiatives (Gemeente Rotterdam, n.d.A)

NbS is not used, though ‘bluegreen’ is mentioned. Similarly, in Rotterdam’s Climate Adaptation Strategy (Gemeente Rotterdam, 2013), NbS is not mentioned, but the role of ‘green’ in CCA is emphasised. It states that there will be more focus on nature and adaptation, ‘building with nature’, and not only relying on technical adaptation but also nature’s adaptation potential, while it can also make the city more attractive and liveable (Gemeente Rotterdam, 2013, pp. 6-8, 24). NbS are only mentioned in a research document published by the municipality (Gemeente Rotterdam 2021b, pp. 94-95) but does not seem to be implemented policy. For Malmö, the comprehensive plan and its appendices do not explicitly mention NbS or bluegreen solutions (BGS). However, the plan shows an ambition to create a more green urban environment for the benefit of its inhabitants. The following quote from one of the appendices of the comprehensive plan in Malmö illustrates this desire:

*“People need greenery, water and nature. The parks, green urban spaces and natural areas as well as the sea, coast and canals have great social value and are important for promoting health and quality of life. [...] Nature in the city contributes to sensual values and to improving air quality, reduce noise, delay stormwater and regulate the temperature in the urban environment. The green belt is an important part of the city’s identity and is of great importance for animal and plant life”<sup>2</sup>. (Stadsbyggnadskontoret, 2016, p. 22)*

Respondents in Rotterdam also mention that the general attitude from people and politicians is that green in public space is good and that everyone sees its value. When designing a public space, green is also an important way to adapt to climate change, and it is a function that has to be included in designs for funding. ‘Green’ is seen as an umbrella term encompassing many aspects and is promoted from a climate change- and biodiversity perspective. This is helpful because there are then substantial budgets to do work in the public space (see *section 5.3.1*).

While NbS do not play a key role in their policy documents, Malmö has implemented a wide variety of NbS in larger targeted projects such as the retrofitting of Augustenborg and smaller solutions like green walls throughout the city. According to some respondents, they also partake in networks promoting the implementation of NbS in cities and creating test areas<sup>h</sup>. In policy documents, they more often refer to ecosystem services (ES) rather than NbS. However, here it is defined similarly to NbS, as the overlap between social, economic and ecological benefits (Andersson, 2012, p. 3).

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<sup>h</sup> An example given in an interview is the Clever Cities initiative

## 5.2 Need for prioritisation

In both cities, budgetary- and other constraints lead to the need to prioritise the challenges that are meant to be addressed. There is an order of importance of different factors that play a role in the decision-making process, and usually, monetary values trump others. Additionally, different societal actors can want different things, creating a further need for prioritisation.

### 5.2.1 Order of importance

With limited space in the city, there are many different claims to this space. A Rotterdam respondent mentions that NbS can take up more space than conventional grey solutions. Here, there is a need to think about what you want to prioritise.

*“Mainly again in the old city neighbourhoods, because the streets there are narrow, so in those streets everything has to go underground. So the places that are most affected by heat and precipitation, also have the least amount of space to solve it”*<sup>3</sup>

Several respondents in Malmö point out that often there is an order of importance for all the functions that need to fit into the urban context. In both Rotterdam and Malmö, trees are often mentioned as leading to issues further down the line, for example, roots interfering with different pipes underground, and growing into cellars, causing flood risks. “ [...] so it's not just about finding a nature solution but for example a tree in an urban environment also creates new challenges.”<sup>4</sup> To solve this issue, trees can be moved away from cables and pipes, which brings up issues with the width of sidewalks, or pipes and cables have to go deeper underground, which is an expensive and therefore unwanted option. A Rotterdam respondent describes how the energy transition towards green energy means that there is a need to put even more pipes for heat systems into the ground. Respondents in both Malmö and Rotterdam mention that the options for greening become limited in this way, which makes it harder to find natural solutions in the city. A Malmö respondent mentions this:

*“And then it's not completely easy to work with the question either in the existing [environment], that is something one should be clear on sometimes. It is hard to get this green [right] and the strains and it can also be hard to work in the underground solutions and also so that it - yeah, there's a lot that has to fit together in one area.”*<sup>5</sup>

### 5.2.2 Conflicting interests

The interviews bring up conflicting interests in three ways. Firstly, there are issues surrounding budgets within the municipality. Secondly, there are various pushes towards choosing NbS. Lastly, city residents sometimes have wants and needs that conflict with CCA projects.

Many respondents in Malmö bring up the conflicting interests of different departments. It mainly relates to the fact that the municipality has a limited amount of money allocated to the different

departments through the annual budget. A Malmö respondent states that if one department argues to receive a larger budget, that money must come from another municipal function:

*“There’s no endless pot of money, so arguments that I could give for climate change adaptation, then that’s at the expense of maybe preschool, or leisure centres or social investment or something. You’re always taking the money from somewhere.”<sup>6</sup>*

Similarly, budget constraints and economic implications are the main factors in deciding whether or not to pursue NbS projects. In Malmö, several respondents brought up this topic: *“Everything can be done, but it costs a lot and then it’s like, yeah where does the money have the best impact.”<sup>7</sup>*

*“And then economy comes in. As a rule in these projects I would say that the social aspects - of course when it’s being implemented you consider like the local social questions such as security, equality, our public spaces always have these ambitions to implement - but it’s not the primary aspect we look at.”<sup>8</sup>*

Interestingly, respondents in both municipalities give differing views on whether NbS are cost-effective or more expensive than other measures. Additionally, there are economic incentives to choose green over grey solutions. This is partly because when creating green space anyway, it can be cheaper to incorporate NbS, for example by lowering green spaces for water storage. A Rotterdam respondent mentions that the cost of NbS in this case is often preferred, given that it can benefit CCA. One reason this added cost is said to be acceptable by Malmö and Rotterdam respondents, is that tax money is then used more efficiently to create a more sustainable solution. Additionally, a Malmö respondent shows there is the economic incentive of green and sustainable solutions being ‘trending’ right now. Therefore, external funding can be easier to acquire if using NbS:

*“[...] in addition to the fact that green environments can create several different benefits in the form of e.g. ecosystem services, there is a greater general interest in green environments, so it is much easier if you want to seek external money and similar if it has some kind of green element than if it’s just a grey one”<sup>9</sup>*

Lastly, respondents in Malmö and Rotterdam reflect that it is hard to meet everyone’s wants and needs at once and that expectations need to be managed. While they try to consider people’s wishes, sometimes decisions must be made by the municipality. A Rotterdam respondent cautions that possible negative consequences, such as increased rental prices when requiring housing corporations to include projects, must be considered carefully to avoid maladaptive outcomes. The following two quotes from Malmö and one from Rotterdam illustrate some aspects:

*“But then the ambition has been for a long time to have [the public space] be like a living room kind of where you have the same level of the street outside as the building floor inside almost. That’s amazing from an accessibility perspective. But really bad from a flood risk perspective.”*<sup>10</sup>

*“What we looked at in Söderkulla park were the lines of sight and such when we redid it, from the start it was kind of fun for the children because you could run and hide and such, but for residents it felt a bit unsafe [...] because the bushes were so high and dense.”*<sup>11</sup>

*“And if we identify such a project, then we involve the residents immediately. like [...] what do you want? And a lot of people want more parking spaces. Yeah, that is conflicting with those bluegreen solutions. But sometimes it’s the other way around, where people say yeah, we don’t need the parking, just turn it into a park.”*<sup>12</sup>

### **5.3 Multifunctionality and holistic solutions**

One of the most frequently mentioned aspects regarding the benefits of NbS is multifunctionality. Topics that the interviewees bring up include combining different budgets for a project and some challenges that this brings, being able to (and needing to) do more in a limited space, and the benefits that NbS have compared to grey solutions. Lastly, the problem-solving orientation of projects is mentioned.

#### **5.3.1 Challenges of combining budgets**

When working with NbS, multifunctionality is a core aspect. Interviews show that in a municipal setting, multifunctionality can have specific implications. Projects may cover several departments’ responsibilities, leading to a need to determine where the money comes from. Combining the budgets of different departments can be beneficial and is brought up in different ways by respondents in Malmö and Rotterdam. When public spaces are designed, different departments are involved in creating a set of requirements in both cities. In Malmö, while inter-departmental collaboration takes place depending on the scope of a project, collaboration can pose an issue as it needs to be decided which department’s budget you are using:

*“We are several departments and all departments have their own budget to keep to and sometimes it’s not so easy that you can just adjust your property against vulnerabilities toward extreme rainfall, it could be that - well water runs downstream - so you need to implement measures upstream to help the ones downstream. And how you finance that, cause then it could be somebody who does not benefit from the measure who has to carry out the measure.”*<sup>13</sup>

A Rotterdam respondent mentions that working across departments to create more multifunctionality is more time-consuming and costly. While examples of successful projects can help, the first step is hard because they will see that it is more expensive. “[...] the extra euro that you spend can save 100 euros somewhere else. But yeah, that is a different department”<sup>14</sup>. Another respondent in

Rotterdam similarly mentions that the multifunctionality of NbS and their multiple benefits also means that there are multiple beneficiaries. It would be valuable if these different departments and beneficiaries communicated amongst themselves, but time constraints are a factor here. This can lead to limits in communication and collaboration between different departments, as well as either some departments profiting without investment or projects are not implemented.

On the other hand, by creating a multifunctional space, budgets of different departments can be combined for a project. Rotterdam respondents mention that working in silos is still present within the municipality, but that collaboration is increasing and that the municipality takes action to integrate different departments. One Rotterdam respondent explains that a few people working for the municipality are not bound to a specific task or role description. They have free reign to do projects, which helps with cross-departmental work. Some respondents mention the goal is to have CCA automatically integrated into all projects that are carried out in Rotterdam, both by the municipality itself and by individuals:

*“And I want it for the present, but also the future, knowing that there is a variety of changes coming our way, and then it’s not just about climate change adaptation but there are of course many other transitions. So that is why I want it to be incorporated into all projects, because yeah, then it contributes to the more attractive, healthy green city”<sup>15</sup>*

However, having a CCA programme in a large municipality like Rotterdam can pose problems:

*“And that is always the disadvantage of a programme like this, there are 10.000 people working for Rotterdam municipality and when people hear something about climate change adaptation, they think, oh, but we have a programme for that.”<sup>16</sup>*

### **5.3.2 Measuring benefits**

Multiple respondents in Malmö and Rotterdam mention that it is hard to express social and environmental effects or benefits in a monetary value. CCA effects<sup>i</sup> can be expressed in numbers, while others, such as health benefits, are harder to quantify. Other factors, such as shorter life expectancy in ‘grey’ neighbourhoods, probably depend on various factors, not just the absence of green. A Rotterdam respondent mentions that politicians like targets, such as X amount of green space added. Then, the landscape architects connect other benefits, such as biodiversity, to that. However, research shows the benefits of green space, and the municipalities recognise these. This

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<sup>i</sup> Such as the carbon sequestration of a tree or water storage capacity.

is echoed by a Malmö respondent who works more with numbers, who points out that the currently ‘softer’ aspects of green need some level of calculation:

*“I can describe that there is a 14,3% chance annually that you get a water level leading to this [scenario]. [...] So I can count in such detail in this that ‘if you take away this and this and there [and it will lead to the following].’ Try to come with that same thing for the green. For the social.”<sup>17</sup>*

### **5.3.3 Multifunctionality in the Dutch water management system**

In Rotterdam, the municipality collaborates with water boards on water management (see section 2.2.1). The three water boards with Rotterdam in their area of responsibility are involved in water management projects. While the water boards can identify areas that need to be addressed in the municipality, they cannot implement projects as that area is the municipality’s responsibility and ownership. One respondent working for a water board states that they can have an advisory role and financially contribute to projects if these meet the water board’s requirements but that the municipality is mostly the driver of a project:

*“So effectively it is really the municipality in 99% of the cases that says, we want to do something here and that we together think about what would be fitting, with what conditions, what solution, whether we can solve the problem at all. We can think about that together, but it is actually always the municipality’s initiative that something happens”<sup>18</sup>*

The respondent emphasised that while NbS/BGS are gaining popularity in the water boards, the municipality has more interest in taking those approaches because of social- and biodiversity interests. The water board’s main interest is the amount of water that a project can store or drain. Their financial contribution to a project is also only for the water management part: *“When push comes to shove, we really only pay for the blue aspect.”<sup>19</sup>* The other aspects and benefits are the municipality’s responsibility: *“Our board [...] they see that as a task for the municipality. Which also makes sense.”<sup>20</sup>* Project maintenance also lies with the municipality or other parties. If a BGS is more expensive than other solutions, this might be a decision-factor for the responsible party. According to a Rotterdam municipality respondent, this also relates to departments in Rotterdam municipality. If the maintenance department has a fixed budget, implementing a multifunctional but more expensive solution without increasing maintenance budget might become a problem. Here, more money might have to be allocated.

### **5.3.4 Limited space requiring multifunctionality**

In a city, projects often occur within the existing environment rather than in new developments. Therefore, space can become an issue and multifunctionality of space becomes important, as illustrated by the following two quotes from Rotterdam and one from Malmö:



*“We cannot solve everything with just money [...] and the Netherlands is quite crowded, so we have limited space. We need to use the space we have as efficiently as possible, preferably multifunctional. [...]”*

*“[...] because you have the issue of the water challenge, and the heat stress, and inclusivity. [...], there has to be space for festivals, [...]. There are a lot of challenges. And you can use that to justify that you are investing that much money in the public space.”<sup>21</sup>*

*“We also have quite a lot of overcrowding, which means that we need good public spaces that mean that you can use the public space as a living room kind of.”<sup>22</sup>*

A Rotterdam respondent has a similar view, adding that when designing or reconfiguring a public space, one also needs to consider parking, play areas, accessibilities of the sidewalks, and safety. Additionally, with a changing climate, a Rotterdam respondent points out that one must ensure that the streets are adapted to future scenarios, as projects are not carried out frequently: *“If you now do work on a street, you will not go there again for the next 30 years.”<sup>23</sup>*

### **5.3.5 The advantages of NbS over grey solutions**

Many changes and transitions, such as circularity or biodiversity, are considered or collaborated with in NbS projects. One Rotterdam respondent said that doing this automatically leads to a different kind of solution:

*“But then if you look at what the added value is of that concrete buffer for the ecosystem, for the health of people, for the attractiveness of the city, then that is zero. But maybe it was for the short term, for the sectoral goal, the cheapest solution. And I think that we in Rotterdam for 10, 15 years have been learning that the cheapest solutions are often very sectoral solutions. And if you manage to connect other challenges to it, that you maybe have to choose more expensive solutions sometimes, but that those serve many other goals.”<sup>24</sup>*

The multifunctionality of NbS is also seen as a benefit in Rotterdam because the CCA aspect might not be needed year-round:

*“Look, if you build a water buffer underground, yeah maybe it rains 5% of the time, a few percent of which extreme. You only need that buffer for those times of the year, while if you work with a bluegreen solution, it fulfils a function the entire year [...]. So yeah, if you then invest your euro, it’s better to do that in a multifunctional solution.”<sup>25</sup>*

Malmö's technical requirements<sup>j</sup> for their projects specify that green spaces should be planned so that they can, for example, accommodate multifunctionality and double as floodable surfaces (Serviceförvaltningen, 2022, p. 12).

### ***5.3.6 Problem-solving oriented***

While Malmö previously targeted projects for increasing NbS, this is no longer the case.

Respondents explain that the focus lies on identifying and solving a problem instead of the specific means used. A Malmö respondent talks about this: when there were targeted projects for implementing NbS (or similar solutions), the focus was more on the solution. Now they have realised the need to first identify the problem. Another Malmö respondent further echoes this:

*“In general, in running the city, it's not really that you start with the idea ‘let's do a nature-based solution’. You start with a context, an area, a detailed plan, a problem, and then you might end up saying oh yeah, nature-based solution, that's a good intervention for us to design.”*

One way of identifying a problem in Malmö is using the urban greening factor (GYF<sup>k</sup>) to measure the amount and quality of green space in an area. The city has established a specific goal value. In general, the GYF is presented as a way to ensure that the urban environment incorporates ES and multifunctional areas that benefit both people, animals and the environment (Boverket, 2020). Before incorporating GYF into the urban planning model, sometimes issues arose where an area looked very green on a map or plan since it was zoned as a park. However, when looking at it, the area was very concrete-heavy.

*“So we had examples of parks where when you just look at the plan it looks very green, but when you went there you saw that it is really built and it's just one big stormwater facility. And then the question is, how much of a park is that, in other words how much green is that then?”<sup>26</sup>*

However, while GYF can be used as an indicator of where more green solutions should be incorporated, there is still inequality in access to green space in Malmö. The focus is still more on fixing a problem than the social implication of differences in green space access. This means that for example when reducing flood risk, the interventions will be primarily located in the areas with the most impact on risk reduction instead of where there is the least green space. While it would

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<sup>j</sup> Different areas can be covered by technical requirements, i.e. things to consider across all the municipalities projects. Project managers can use project instructions and other strategic plans to achieve the ambitions set out in strategic documents for the city on different factors, for instance flood risk management.

<sup>k</sup> GYF is the Swedish abbreviation for urban greening factor (from 'grönytefaktor'). The GYF of an area is calculated by assigning higher values to 'soft' landscape and lower values to 'hard' landscape, and non-permeable surfaces get a value of zero.

be beneficial if that would take place in an area where it could also have a positive impact on societal challenges, it is not the main focus when choosing a site.

The focus on problem-solving processes is also reflected in Rotterdam. They created maps showing main challenges that have to be addressed on different scales. Using these maps, one can identify the neighbourhoods that need the most attention, generally the centre and the old (pre-war) neighbourhoods in the north and south of the city. Issues in these neighbourhoods include heat stress, precipitation and its implications, and the ‘action perspective’<sup>1</sup> of the people is lower. According to one Rotterdam respondent, the social context is a direct factor. However, another respondent and a document mention that a cost- and risk view is the basis for deciding what projects to do. The projects take place where it is most urgently needed, while value creation and where it has the highest impact on people is not (yet) considered (Gemeente Rotterdam, 2021b).

Respondents in both cities mention that attention is paid to the amount and the dispersion of green spaces throughout the city. Rotterdam has a goal of each resident having access to green space within 300 metres<sup>m</sup>, which is connected to the implementation of projects. However, a Rotterdam respondent also critiques that sometimes, differentiation is needed for equality:

*“And like a cool area every 300 metres is very good. But we also know that there are neighbourhoods in Rotterdam where 30% of the population has a mobility limitation. And maybe then 300 metres is very far”*<sup>27</sup>

Additionally, two other Rotterdam respondents encourage intentionality with projects. Firstly, while small-scale projects contribute some, *“if there is a park next to it, is it not better to invest money in that park to take large-scale climate change adaptation measures?”*<sup>28</sup>.

*“But I feel that we have to think about it, okay we can add green, but what kind of green do we create? Because you can add a plot of grass, yes, that is green, but what kind of value does it have then? So you shouldn’t just add green for the green. I think that you should really ascribe a value to it.”*<sup>29</sup>

#### **5.4 Piggyback projects**

While projects are implemented on a problem-solving basis, respondents in both cities also mention that there often has to be another trigger. Some projects are not carried out as standalone projects but incorporated into an already planned project.

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<sup>1</sup> The ability to recognise and comprehend the various courses of action that can be taken in order to accomplish a desired goal

<sup>m</sup> Malmö has a similar goal, although it was not brought up in the interviews. The ambition is that each resident should be able to see three trees from their residence, every city district should have a tree coverage of 30%, and everyone should have access to green space within 300 metres (Region Skåne, 2023)

In Malmö, these are called ‘passa på projekt’, i.e. ‘piggyback projects’. They are mentioned as a way of creating more multifunctional areas, as any explicitly targeted project, whether for NbS or extreme rainfall drainage, was very costly. Using existing projects and widening their scope maximises their effectiveness, as exemplified in the following quote from a Malmö respondent:

*“But in this mess, we’re talking about 1000 projects a year, [...] then it’s appealing to get in even more functions. Can we include for example the social? Can we strengthen security? Can we strengthen resilience towards different weather events and so on when anyways doing something, and then you must - because to go in and do these that I mentioned earlier these targeted projects, they often have quite high costs - whilst when you are anyways digging, well then maybe we can dig slightly differently.”<sup>30</sup>*

Similarly, landscape architects in Rotterdam have multiple information channels to work with. From the CCA perspective, they know which neighbourhoods have a water surplus, which ones need to store more water, where heat stress is, biodiversity and green issues, and mobility needs. Based on this information, street work is done, and they always work to make a street attractive with greenery. However, too many places need something addressed, so they have to prioritise where to do a project. One criterion for whether a project is implemented is if there is an intervention or maintenance planned anyway, which means that they can piggyback on the already available budget for the work. The city’s policy documents (Gemeente Rotterdam, 2013, p. 26; Rotterdams Weerwoord, 2022, p. 64) also explicitly mention the intent to link greening- and CCA measures to sewage replacements and other urban programmes and projects:

*“A different channel is really when we do a project in neighbourhoods of which we think, there’s really not enough green, there has to be more green here. [...]. But then there has to be a reason for us to do it from sewage systems or because there is a special project”<sup>31</sup>*

In Rotterdam, those projects mainly relate to sewage pipe replacements. As the city is sinking<sup>n</sup>, the sewage system must be replaced every 40 to 60 years. These replacements are usually the budget channels that greening projects piggyback on, which provide a possibility to redo the streets and connect greening with CCA completely: *“because often if the sewer needs to be replaced, a lot of money is freed up for a project. And then you can start stacking budgets, [...] and in the end you have a lot of different pots of money together.”<sup>32</sup>*

One Rotterdam respondent mentions that while silo thinking still exists, this situation shows collaboration across departments. Another respondent in Rotterdam emphasises that if risk maps

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<sup>n</sup> The land Rotterdam is built on consists of peat and clay. Natural land subsidence is here exacerbated by human actions, and in some places, subsidence is over 1 centimeter a year (Gemeente Rotterdam, n.d.B)

show areas where the situation is severe enough that action should be taken in the short term, it is possible to do projects from just a CCA perspective without piggybacking on other projects or trying to achieve multiple benefits. They also have their own budget and subsidies for local initiatives and minor projects. Similarly, there is a separate project for ‘small greenery’ running.

Piggyback projects raise the question of what the additional cost of NbS can be. A Malmö respondent states that as there is an original project with a budget, the add-on of including NbS cannot go beyond a certain cost compared to the original budget: “*Where does the pain limit go for added value when we are anyway doing something?*”<sup>33</sup> Similarly, in Rotterdam the water board can help finance projects, but their interest is only in blue solutions. In contrast, a Rotterdam respondent mentions that the city’s adaptation strategy for water is now combined with the green plan, which means combined budgets and multiple finance streams. Additionally, the Netherlands has a good finance and governance structure for water management, like rain and floods. Together with the water boards and the sewage taxes, this finances everything ‘below ground’. Extra money is needed for green additions to the public space, which is a political decision. While CCA has become more accepted on the entire political spectrum, the story is still framed differently by those working with CCA depending on the political parties in the city council.

## **5.5 Social involvement and impact**

When a project is carried out in the public space, both Malmö and Rotterdam gather input from the residents. There are both formal and informal processes through which this can take place. There is awareness in both municipalities that inequality exists in the (mainly formal) processes of social involvement. Therefore, some actors try to find ways of moving beyond the traditional ways of involving the public.

### ***5.5.1 Formal processes and informal ways of involvement***

Several respondents in both cities point out that there are formal and mandatory processes for gaining public input, such as referrals. However, any public involvement beyond that is up to each project manager. Several respondents said that communication was an essential aspect of projects, in general to ensure that inhabitants are informed on what is taking place. The following quote from a Malmö respondent illustrates the formal process:

*“Yeab, but on the formal side you have a right to referral. If you’re resident in an area that’s being intervened in, or if you have a business there and we almost always host meetings where you can come and voice your concerns so there are those avenues and I mean I think you can appeal as well if you have kind of legal reasons for why this should not happen.”*

At this stage, plans in Malmö are usually not very detailed and more rough ideas of what a space will be used for rather than how the design will look. “*I feel that perhaps there is more focus on how*

*many buildings are going to be raised, that the public space may not be as detailed at that stage.*”<sup>34</sup> One Malmö respondent noted that sometimes inhabitants are not interested in the project details but more in the overall function of protecting them from risk, as was the case in a park connected to dealing with flood risk:

*“My impression was that there wasn’t much interest in the exact design of the park. They wanted something that would lower their risk. Really they wanted a guarantee it [flooding] wouldn’t happen again. It was that and nothing else that was their focus.”*<sup>35</sup>

In both Malmö and Rotterdam, one way of gaining public insight is through ‘input nights’, where municipal actors and the public gather for information-sharing on projects. In Rotterdam, respondents criticise this form of involvement, as only specific people attend these nights, and much nuance is lost by not having a dialogue. One Malmö respondent noted that there is a difference in how different people know the process and have the means to affect its outputs and drive changes they see fit: *“There’s a clear difference [during the involvement process] between existing areas from socio-economic background, or, yeah that it’s a bit harder in well off areas with literate people, who can afford to drive a process possibly.”*<sup>36</sup> In Rotterdam, when input meetings were held online during COVID-19 instead of in-person, one respondent was surprised at how many people showed interest. Several respondents in both meetings also mention doing a variety of other things to get input from a wider public, such as meeting with groups separately. However, while mentioning positive examples, another Rotterdam respondent notes the following:

*“There are still dozens of projects where we do it as cheaply as possible, so it’s not yet that it is happening everywhere. And that also has to do with the available capacity of workers, the limited amount of landscape architects that can look at it thoroughly, budgets that have to be spent in a certain year which makes you say, okay, then we’ll do a shorter participation process, then just a bit less complicated.”*<sup>37</sup>

In Malmö, an example is engaging the public by standing on designated sites to talk to people who spend time in that area. One respondent points out that giving this type of detailed input to municipalities is not something that Swedish people are used to:

*“Then we want as many opinions as possible, then it’s relatively rare - it’s a matter of culture, we are not that used to it in Sweden I would say if we compare with both Holland and Denmark and a few others where you’re a bit more used to having more of a larger dialogue - it’s a little bit how you view the municipality. So here the view is that the state and municipality should fix it for you in some way.”*<sup>38</sup>

### **5.5.2 Local knowledge**

Several Rotterdam respondents mention that the scale on which the projects take place affects the involvement level. The more local the level of work is, the greater the participation will be,

while on a city-wide level, the scale is too large for people to contribute much. There are participation projects, but it is less intensive. However, people have ideas and visions to contribute on the neighbourhood level and are often more involved in the design process.

According to a respondent in Rotterdam, residents have specific knowledge of their space, which is valuable to consider before projects start: *“So, inhabitants of Rotterdam maybe know less about water or climate change adaptation. But they are also experts, but then mainly on what happens in their area.”*<sup>39</sup>

Another Rotterdam respondent emphasises a similar view: *“So participation is an important component as well, because then you learn what is happening, and also get the local knowledge. And both help to improve the design.”* However, one Rotterdam respondent mentions that a full bottom-up approach can lead to too much fragmentation and insufficient power for action. The WeatherWise programme in Rotterdam is meant as a middle ground.

In Rotterdam, the Bentheplein water square<sup>o</sup> is an interesting example of social involvement. The square was first meant to be placed elsewhere but was designed by the municipality without much input from the people in the neighbourhood. In the end, the plans did not meet the residents’ wishes. It was moved then to the current location, where people had an existing wish to change their square. In that process, there was a lot more involvement of stakeholders and the people living in the surrounding area, even in the design process:

*“[...] with the Bentheplein they went to the other end of the extreme and involved everyone they could involve, even including a kind of game form, so that you really can take all influence into account, so they have learned a lot from the neighbourhood process [...]”*<sup>40</sup>

Malmö has projects integrating school children in the implementation and planning processes of projects to gain social involvement in areas they spend time in. Methods included interviews with children to determine their wants for these spaces or involving them in sowing meadow flowers. This type of project is seen as a way to educate children on nature conservation and the benefits of increasing biodiversity in the urban environment. That knowledge is also meant to spread as children share with their families what they have learned. Furthermore, it is mentioned that these projects also help children and their families to connect to that space as they walk past and feel pride of being a part of its creation. One respondent talked about a more extensive project involving older school children. Here, they received an actual budget and had to consider what they wanted their park to look like both in terms of design and function, and later present it to the municipality for feedback. Then, a proposal would be implemented. This was seen as a win-

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<sup>o</sup> This water square is more a blue solution, with many grey infrastructural elements leading us to not view it as a NbS, but it is included for the example it provides.

win project, benefiting the involved children and the municipality by gathering input on their inhabitants' wants. Since schools are municipal functions, they can be easier to reach and coordinate with. However, not only children were targeted, as the intention was that the information would be spread to their parents:

*“So they were involved, and the thought there was that - sure also the educational that they were with us and understood the whole purpose behind it. But also the thought was that they would tell their parents and their neighbours, and that it would spread in the area that yeah, our kids have been involved with this and you can also feel some pride and a connection to the place.”<sup>41</sup>*

Some Rotterdam respondents also explain the importance of a feeling of ownership. This feeling can be fostered through involvement and co-creation and provide benefits for the space:

*“Because a pleasant environment also contributes to the feelings of ownership of the residents and identity, and pride, pride in your street, pride in your neighbourhood. And if you manage to create that, then that means that a lot happens by itself.”<sup>42</sup>*

Multiple participants in Rotterdam mention that one needs to find a dialogue and common ground with the residents. One respondent emphasises the need to identify what the residents consider a problem, solve that, and include CCA. Another respondent mentions that one can ‘sell’ CCA projects differently by for example focusing the language on increased attractiveness on streets<sup>P</sup>. Similarly, a respondent mentions that a single approach for all of Rotterdam does not work, but that there instead is a ‘neighbourhood dialogue’ in every neighbourhood. The type of people living in the neighbourhoods is taken into account, as well as the ownership situation of the buildings, the social context, and what works to motivate people. That way, they say, “[...] so our city-wide challenges are being translated to what works in these neighbourhoods, to what connects to the social context of the people that live there”.<sup>43</sup> In the WeatherWise programme, they use intermediaries that live and are active in the neighbourhood they want to do a project in:

*“But the advantage if you have intermediaries, so people that are right in between, yeah then the distrust is way less and you can find that collaboration way easier. And it can be anyone, but coincidentally we often collaborate with designers or landscape architects that are already very active in the city, especially with nature-like things. So they also automatically steer the municipality in the direction of working on nature development and biodiversity and the like. They also keep us on edge, which I really appreciate. And they*

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<sup>P</sup> The respondent mentions that this also applies to politics



*also generate extra enthusiasm with the residents, especially in the beginning phase, and then when we've started up, everyone is enthusiastic”<sup>44</sup>*

## **5.6 Social benefits**

Over time, the importance of green public space became more valued. Simultaneously, the social benefits that this can bring are realised more. In Rotterdam specifically, CCA projects are used as a means to increase social cohesion.

Respondents in both cities mention that green spaces have become more valued. Over time, people started using the public space more, for example for sports and festivals. During COVID, that use exponentially increased and has kept up. People are now more aware of the importance of parks. Simultaneously, it is realised that CCA can be used to create a nicer, more attractive, more social, and healthier city. This shift is highlighted by a Malmö respondent:

*“I think historically, it's previously been that social was seen as an added benefit or an added thing to think about [...], they're now starting to plan and think about it because they didn't realise that that was going to be one of the benefits. But now they do realise that so now they are consciously thinking about it.”*

In Rotterdam, results from some interviews show that CCA projects are used to increase social cohesion in neighbourhoods. This is also mentioned in the CCA strategy (Gemeente Rotterdam, 2013, p. 28). Citizen initiatives are promoted next to projects carried out in the public space. An example is the facade gardens people create in front of their houses by removing sidewalk tiles. The city has projects running for this, and subsidies are available. The municipality's webpage promotes these gardens for aesthetics, CCA, and biodiversity. Though not explicitly mentioned, these are used as instruments to increase social cohesion:

*“Look, a facade garden doesn't contribute that much to climate change adaptation, but it does make for a very attractive living environment, and raises awareness, and is a communication instrument. [...] But what it mainly led to, is that people afterwards said that their street had improved. [...]. But yeah, that is not at all because of the facade garden, but because of the fact that they did it together. Or because of that they got to know each other and say hi to each other on the street again. Yeah, those are very valuable things.”<sup>45</sup>*

Another Rotterdam respondent expresses a similar view: “[...] where the impact of the greening was sometimes very limited in the physical sense. But more in the social sense, that you have brought people together and taught them skills, which is also very valuable”.<sup>46</sup> At first, the goal of the municipality and the corporation was to target water issues, but they identified that that was not the people's need. So, while it did not contribute greatly to CCA, and the municipality could have done the project quicker and cheaper, they still chose to involve citizens in the building process to target social

benefits purposefully. However, the respondent also mentions that subsidies can have accessibility issues that lead to them not targeting those who could use them the most.

### 5.7 Project visibility

Finally, respondents from both municipalities mention that a benefit of NbS is that it is a visible intervention in the urban fabric, as opposed to often hidden engineered solutions. This brings different advantages, such as inspiration for more CCA initiatives and ‘legitimation of land use’. In the case of Rotterdam, it is also related to international recognition.

A Rotterdam respondent mentions that NbS as a visible solution, instead of for example an underground water buffer, can be connected to behavioural change. Similarly, while the water board’s primary focus is water management, “[...] *it can look fun and beautiful, also because that can work towards inspiring residents, that they also take those kind of measures*”<sup>47</sup> Another respondent in Rotterdam also mentions that even though small projects like the facade gardens (see section 5.6) are not extensive enough to address the whole problem, that too can be inspiring:

*“But for many people it is mainly a starting point to start concerning themselves with climate change adaptation, because in a fun way, you make your street greener and nicer with your neighbours, and sometimes people will think, oh, but then I can maybe also do something about my roof, or my garden. So on one hand, it is also about having people be playfully or in a fun way involved in climate change adaptation as a sort of first step.”*<sup>48</sup>

Apart from behavioural change, there are other benefits of the visibility of projects. Aesthetics are mentioned by a respondent in Rotterdam: “[...] *in general, say greener solutions are much more appreciated, because it is very visual and also immediately gives a more attractive living environment. So that is of course a very welcome way of communicating.*”<sup>49</sup> A Malmö respondent mentions that visible projects mean that the workers and the public can see what they have implemented. Additionally, it is a means of showing a clearer purpose with the space use regarding why it is there and why the municipality is ‘spending’ space on it, thus ‘legitimising’ the use of space. This can communicate to the public that certain risks or problems are being managed and that the municipality views them as important to address.

Multiple respondents mentioned that Rotterdam is putting itself on the map as a frontrunner city regarding resilience and CCA. This is born out of necessity, as Rotterdam is a low-lying Delta city, but the city also wanted to gain (and has gained) international recognition. By profiling themselves this way, Rotterdam has fostered a culture of always taking the next step:

*“Look, that is also the unique position of Rotterdam again, because we are for a large part located below sea level, we are surrounded by water, we basically have the lowest elevation point in the Netherlands located within the municipal limits, that means that we have been for years working to make and keep the*

*city safe. Especially because we have the harbour here, so also regarding economic position you need to be a safe city. So that means that we have been working with climate change adaptation for years. And that because of that the world looks at us like, what kind of things do you do? [...] so this started out of necessity and now it is also something that we put in the market. [...] So yeah, we focus on making Rotterdam climate-proof of course, but we also like to expand the front runner position that we got out of necessity”<sup>50</sup>*

However, a different Rotterdam respondent mentions that Rotterdam has this position for a reason, with some iconic works on CCA, however:

*“[...] internationally, people know to find Rotterdam because of the good examples, but Rotterdam residents often don’t know what these examples contribute to. Additionally, there is the question which Rotterdam residents profit off of these icons, that are mainly found in the immediate vicinity of the centre.”<sup>51</sup>*

## 6. Discussion

This discussion is structured around three clusters of themes that emerged from the results of this research. The first cluster is organisational and foundational factors, which relate to the structures and underlying conditions within the organisations that provide the foundation for decisions surrounding nature-based solutions (NbS). These decisions and their considerations are grouped into the second cluster, planning and implementation. This relates to how the projects are located in a specific space, the points that must be considered when projects are planned and implemented, and the social aspect of NbS. The third cluster relates to the outcomes and goals that are connected to NbS projects. On the one hand, these include the specific benefits that NbS projects deliver and bring up questions of measuring. On the other hand, different aspects surrounding the visibility of the projects are presented. The need to prioritise between different deciding factors, and the conflicting interests of different departments and people are two sides of the same coin. Considerations relating to these topics are reflected in almost every one of the themes that are identified in the results. Therefore, prioritisation and conflicting interests are connected to each section and serve as a red thread throughout this chapter.

### 6.1 Organisational and foundational factors

This thesis departed from the assumption that ‘nature-based solutions’ was a term that is used in both Rotterdam and Malmö municipality. However, the interviews and document analysis results show that this is not always the case in practice. Instead, words or concepts like ecosystem services (ES) or ‘greening’ are used. Nonetheless, the language that the respondents and policy documents use implies the want to use vegetation to some degree to address multiple challenges and often with a goal of multifunctionality. Given this intent, the researchers chose to include these as NbS and look into the process, and the aspects and benefits surrounding them.

The interviews show that respondents interpret NbS differently, and some mention that they do not explicitly know what the term means. Generally, for both Malmö and Rotterdam, any green measure is brought up by respondents when prompted about NbS. It seems to not matter greatly whether this green intervention is used to additionally address a societal challenge like climate change adaptation (CCA) or achieving social- or other benefits from green space access. Confusion surrounding the concept of NbS and its meaning is also a common finding in literature. Castellar et al. (2021, p.2) point out confusion originating from the many definitions of NbS. Others point out that since NbS shares a lot of key elements with other concepts that came before it, such as ES and green-blue infrastructure, both academics and practitioners can get confused about what the concept entails (Almenar et al., 2021, p. 2; Sarabi et al., 2019, p. 3). Here it may be important to note that previous concepts have gone through similar loops of integrating into the everyday language of implementers and the public. For instance, ‘biodiversity’

and ‘sustainable development’ are keywords that are often used in- and outside policy, despite only recently being introduced (Nature Editorial, 2017, p. 134).

The language used in interviews, and policy- and official documents in Malmö and Rotterdam implies that NbS are suitable tools to achieve their goals. However, they do not explicitly state that is what they will use. In the case of Rotterdam, a respondent mentions that while the term is not used within the municipality, the intentions of greening the city are the same. In Malmö, explicit NbS-projects have been implemented, and they are working with various networks that aim to implement more NbS. However, Malmö has moved away from implementing targeted projects, i.e. starting from a basis that they are going to implement a certain amount of NbS, and instead focuses on issues and the most appropriate solution, where NbS may come into play. Similar to the reflection that NbS are not explicitly mentioned but the intention is the same, Kotsila et al. (2021, p. 260) find that in Barcelona, many implemented projects fit the description of NbS without the term being used explicitly in city policy.

An aspect that is brought up frequently in interviews, in both Rotterdam and Malmö, is multifunctionality. Multifunctionality is also described as a key element of NbS in literature. Dorst et al. (2019, p. 5) and Nesshöver et al. (2017, p. 1220) argue that with this multifunctionality, NbS advocates for not having a hierarchy between ecological, social, and economic values. However, in a literature review Dorst et al. (2019, p. 4) show that in practice, such hierarchies exist, with social and economic values often trumping environmental objectives. Such hierarchies imply that practitioners need to find ways of prioritisation. Similar to the literature, results from the interviews in both Malmö and Rotterdam indicate that economic constraints are the most influential factor when making project decisions. Despite NbS being presented in its definitions as a ‘catch-all’ option, and while respondents appreciate this multifunctionality, the role of economics seems to be quite substantial in the decision-making process.

Respondents further emphasised the role of economics, stating that the cost-effectiveness benefit of NbS is a reason to choose this over technical solutions. Factors feeding into the cost-effectiveness include the range of ES that a specific NbS can provide and the co-benefits it may lead to (Seddon et al., 2020, pp. 4-7). However, other respondents mention the increased costs of NbS, especially in terms of maintenance, as a caution with NbS projects. Research shows the same, with some stating cost-effectiveness (Kabisch et al., 2016, p. 2; Bush & Doyon, 2019, p. 3; Price, 2021, p. 2) and some mentioning that it is case-dependent (Albert et al., 2019, p.14). Seddon et al. (2020, p. 7) highlight this issue of differing views and refer to the need to assess the benefits that can be derived from a project on a context-specific basis. They argue that measuring and comparing results is difficult due to the complexity of the systems NbS are in, and the lack of

long-term perspective in the measurement tools (*ibid.*). In Malmö, the difficulty of measuring benefits made it harder to argue for NbS in terms of their cost-effectiveness, and in turn, argue for a larger budget. From the findings of this research, defining NbS' cost-effectiveness can be important in several ways. Firstly, following Seddon et al.'s (2020, p. 7) critique, a long-term perspective could be absent. This makes targeted NbS projects seem more expensive. Secondly, when NbS are add-ons to a project, the added cost has to be limited. Defining cost-effectiveness makes clearer how much this added cost can be. However, it should be noted that both municipalities seem to recognise the benefits of NbS and its added value without being able to express it in concrete terms.

Using NbS as cost-effective add-ons is partly due to their multifunctional nature, where they can simultaneously impact social, economic, and ecological challenges (Dorst et al., 2019, p. 4). In general, multifunctionality is a frequently-mentioned benefit of NbS, both in literature and this research. In this research, three factors related to multifunctionality come forward. The first is the flexibility of NbS, second is the limited space that cities have to work with, and third is the possibilities this provides for combining budgets and collaboration between departments. In terms of flexibility and multifunctionality, the benefit of NbS is that the intervention provides benefits year-round, compared to an infrastructural solution that only serves its specific purpose when necessary. However, this means that interests of different parties should be navigated and possibly prioritised; when co-financing a project in Rotterdam, for example, the water board would only support the water-solution part of the project, while the municipality might want to aim for multiple benefits. In Malmö, it is encouraged that green space projects are designed to accommodate multifunctionality. According to respondents in Rotterdam, the added benefit that NbS provide is a factor to consider, even though the price might be higher.

In addition, there are many different claims to public space in the city. Respondents mention that working within the existing urban fabric in the city means limited available space for any project, and many functions need to be addressed. Here, multifunctional projects can be preferable. Lack of space in urban areas providing a barrier to NbS is also an outcome of a literature review conducted by Ershad Sarabi et al. (2019). In this context, the need for prioritisation relates to what occurs in the space. The biggest challenge respondents in both cities mention concerning this, is trees and their root systems that can interfere with underground pipes and cables and provide above-ground issues when there is no space on the sidewalk. Additionally, more cables must be placed underground with a transition to green energy, allowing even less space for tree roots. Here, a choice must be made on what to prioritise in the urban environment. However, it is not necessarily an either/or decision, as respondents in mainly Rotterdam bring up that there are options to work around the tree root system. In Malmö, the same problems are brought up,

but without the added discussion on how these could be solved. This might be a case of a non-representative sample in both cities, and maybe with prompting Malmö respondents would have said the same. However, it might also exemplify a difference in knowledge levels on how to adapt practices for NbS. This is somewhat reflected in one Malmö interview, where the respondent shows willingness to use more NbS but needs guidance on how.

Moreover, a solution providing co-benefits can be both a facilitator and a point of contention for collaboration and combining budgets. One way budgets can become an issue is the limited amount of money a city has available. In both cities, collaborating across departments can become an issue when there is unclarity regarding whose budget is used. Due to the multifunctionality of NbS, there can be multiple beneficiaries, and the money spent by one department can lead to savings for another, as the project also addresses their responsibility. This issue is further emphasised in literature, with multiple beneficiaries of NbS, also outside of the governmental system, leading to questions of ownership (Seddon et al., 2020, p. 8). Additionally, collaboration can be more time-consuming and costly, as mentioned by several respondents.

Lastly, specific to the case of Rotterdam, projects can have multiple financing streams that need to be navigated when the district water board(s) are involved since these actors can have different requirements. However, different finance streams can also be helpful, as combining budgets means more money is available. Silo-thinking needs to be addressed and overcome to collaborate. In Rotterdam, respondents mention that silo-thinking is still present, but being overcome and that interdepartmental work is increasing. This is reflected in the fact that different departments are involved in the pre-designing phase of public space. In Malmö, it is project dependent which departments are involved and if there is inter-departmental collaboration. Given their multifunctionality and aim to address multiple issues in the city, inter-departmental collaboration is identified as a larger need for NbS (Beyer & Andersson, 2020). While budgets can be stacked in inter-departmental projects, in both Malmö and Rotterdam, there is often a need to have a trigger that is the *reason* for the project which goes beyond an identified need, such as more green space.

## **6.2 Planning and implementation**

An interesting finding from this research is that NbS are most often a part of so-called piggyback projects. For Malmö, this seems true in general, whereas in Rotterdam it is often explicitly related to sewage replacements. In Malmö, this is partly due to targeted projects being more expensive than adding multiple functions to a pre-established project. While this can promote the creation of multifunctional spaces and benefits, it raises questions on prioritisation. It could be seen as an expression of values associated with the societal issues stand-alone NbS projects aim to address. However, it could also relate to the practicalities of municipal work, where time- and budget constraints are part of practice. This can be contextualised with respondents in both

municipalities stating that they value the social benefits that can be derived from implementing NbS.

Initially, piggyback projects seem to need a physical problem to address in a space, to which consideration of other aspects is added later. However, absence of a physical problem is not the only factor stopping either municipality from doing targeted projects. For example, respondents in Rotterdam state that creating an intervention in an area would be a waste of funds if the street needs to be opened up for sewage repairs in the next few years. In Malmö it is mentioned that using NbS as a project add-on uses taxpayers' money more efficiently, referring to the municipality's responsibility towards their citizens when creating budgets. This relates to Frantzeskaki et al. (2019, p. 457), who point out that NbS can be an entry point for addressing a multitude of societal issues. They state that while a project may start with a goal of addressing a specific issue, in the development of that project and through dialogue with citizens, NbS offers flexibility to address multiple issues at once (*ibid.*).

In addition to implementing NbS through piggyback projects, both municipalities mention that their work is predominantly problem-solving-oriented, meaning that an issue is first identified, and then a solution is chosen. Wickenberg et al. (2021, p. 46) likewise state that problem identification should be the first step for NbS implementation to ensure that the chosen intervention targets the societal challenges it aims to address. Given that there is a myriad of NbS to choose from (Croeser et al., 2021, p. 3), being aware of what challenges the project first and foremost needs to address can make it more impactful. In turn, this can be a way of ensuring that NbS are being implemented in a cost-effective way (Wickenberg et al., 2021, p.46). This perspective shows that if there is no social aspect that poses a more significant problem than a physical one, it may not be at the forefront of municipalities' interventions. However, when implementing a project somewhere, it will then be taken into account how to improve it.

All projects are situated in their specific context, including physical and social aspects (Sari et al., 2023, p. 2). Regarding (mainly) physical aspects and access to green space and -solutions, both municipalities have tools to evaluate areas to identify what issues need to be addressed, combining a problem-solving perspective with potential social issues. In Malmö, this is the urban greening factor (GYF) to assess the quality of green spaces to feed into multiple qualities of the city, such as human well-being and environment. Rotterdam incorporates physical stressors and social aspects on maps. This helps to evaluate the existing environment and can more easily identify where they can and need to create interventions for resilience. As NbS need to be adapted to their socio-ecological context to be effective (Chausson et al., 2020, p. 6149), having tools to analyse contexts is good practice. Further research might be needed to see the full scope and effectiveness of these, however. Additionally, there is a growing body of literature on



maladaptive outcomes of NbS (Omner et al., 2022; Anguelovski & Corbera, 2023; Tozer et al., 2020). When implementing NbS projects, this should be considered, as mentioned by a Rotterdam respondent regarding the potential negative impact that imposing CCA requirements on housing corporations can have.

Regarding the social aspects of a project's context, this research found that multiple benefits are considered when implementing NbS, several connecting to their social context. For example, in Rotterdam, it is mentioned that several projects aimed to improve social cohesion, not only as a result of more green space but also through implementing it through participation with the public. This is also mentioned in literature; as mentioned in *section 3.2.1*, social cohesion and resilience in communities can be an outcome of NbS if the public is involved in its implementation (Mahmoud et al., 2021, p. 23).

A way to include the public and situate a project in its context, is through social involvement. This research shows two types of involvement: formal and informal. Regarding the formal, the referrals and 'input nights' processes were critiqued in both municipalities for only reaching a certain audience and being one-sided. This relates to Arnstein's (2011, p. 241) ladder of participation, where degrees of participation are categorised and explained in relation to the power that the participants hold. The formal process of input nights could be placed somewhere in the realm of 'degrees of tokenism', as it provides the opportunity of making oneself heard without the guarantee that one's opinion will have an effect (*ibid.*). Silverman et al. (2020, p. 414) echo that generally, there is a critique towards urban planning and planners that public participation is, for various reasons, not highly valued and used to 'tick a box' rather than done for the actual process.

It is worth noting that respondents in Malmö pointed out that when presented for public input, the proposals are more general. Furthermore, in Malmö and Rotterdam it is mentioned that there is inequality in the formal process as some citizen groups are more aware of the system than others. Conflicting interests within the public and between public- and municipal interests may also arise in the stage of social involvement. The inequality of the process can come into play here, when some actors are more equipped than others to push an agenda. Decision-makers will then need to decide which interests to prioritise in a project, or how these can compromise with each other, as not all needs and wants can be met. This is emphasised in literature in a general urban planning setting, with calls for urban planners to use the tool of public participation means to redistribute power in the communities and advocate for the disadvantaged (*ibid.*, pp. 415-416).

Beyond the formal processes of social involvement, respondents mention several informal ways. In Malmö, it is seemingly easier to connect this to municipal functions, such as schools, as in the

case of involving school children in planning and implementing different meadow projects. This can be linked to da Rocha et al.'s (2017, pp. 8-9) categories of social benefits that can be derived from NbS. The projects approached these from different angles. For instance, the projects were seen as a learning opportunities for the children, and a way of raising general awareness in the community as children shared what they learned with their family and friends. Additionally, the municipality believed that there would be an opportunity for place connection, as the children and families walked past and could feel involved in the making of this green space. From Rotterdam there are examples of public involvement beyond the formal process given by different respondents. Here, respondents emphasise the importance of incorporating local knowledge in projects, and using (informal) participation when designing interventions. Both this example of Malmö and the goal of Rotterdam to create more social cohesion can be linked to da Rocha et al. (2017, pp. 8-9) and the opportunity to social involvement that they mention as a benefit of NbS.

What stands out from both municipalities is that outside of the formal process, it seems quite person-dependent how much the project leadership decides to involve the public in the planning and implementation of NbS, and projects in general. It seem that these ways of involvement, which go beyond the formal processes, have the ability to lead to more involvement and possible social benefits, as these are the projects that were often highlighted by respondents. Therefore, it could be beneficial to find a way to mainstream these now person-dependent practices into municipal-wide practices when implementing projects.

### **6.3 Outcomes and goal**

The person-dependency of the project leaders means that the level of involvement across city projects, and their subsequent results, are not necessarily consistent. Not only is the level of involvement dependent on the person in charge of a project, but their expertise also plays a vital role as they need to know who to include in what way for optimal outcomes. This applies to urban planning projects in general in the two municipalities, not just when NbS are involved. Lastly, the visibility of NbS plays a role.

The visibility of NbS is seen as a benefit in both municipalities. According to a Malmö respondent, it communicates to the public that the municipality is addressing an issue and taking action. While this is an interesting point, literature on this is seemingly limited and discusses for example the benefits of visibility in terms of aesthetics (da Rocha, 2017, p. 8). However, when NbS are used to communicate that action is being taken, there is a delay in benefits for NbS given the time it takes for them to establish and mature into a full-scale solution (Sari et al., 2023, p. 1). Thus, as research participants point out, clear communication to the public of what is taking place and what the process and timescale of implementation will be, is important. They

also express that social (and in some cases, overall) outcomes of NbS are seen as harder to measure than their grey counterparts. Literature describes this as one of the current disadvantages to NbS (Raymond et al., 2017, p. 16).

This difficulty relates partly to the multifunctionality of NbS, as many aspects are included and can be impacted, adding an additional barrier to gaining a complete overview of the benefits (Seddon et al., 2020, p. 7). However, some frameworks are being developed in an attempt to better understand and measure the co-benefits of NbS, and in turn better plan for them (Raymond et al., 2017, p. 17). Regarding multifunctionality, a Rotterdam respondent pointed out the benefit that NbS provide in that they are year-round assets instead of only performing one specific function. Visible NbS also serve as a way to legitimise the use of space in Malmö. Additionally, a greener and more climate-adaptive environment is said to inspire more sustainability-focused behaviour by residents in Rotterdam. In literature, however, it is pointed out that there is a lack of correlation between a person's neighbourhood being green and their level of sustainable actions (Alcock et al., 2020, p. 2). However, Alcock et al. (2020, p. 2) mention that this lack of correlation is due to small-scale studies that cannot be generalised.

Linked to the visibility aspect, in Rotterdam NbS play a role in the city's reputation as a frontrunner and is an integral part of its identity in this way. Similarly, Malmö mentions in their comprehensive plan that the green belt plays an important role in their identity (see 5.1 *Unclear definition*). While this does not relate directly to only NbS, but greening in general, having these elements be visible to the public and visitors alike can enhance that image and idea. Furthermore, in regards to implementing NbS for the benefit of a municipalities' citizens, one Rotterdam respondent reflects on the fact that while Rotterdam having this prestige is nice, it in itself does not benefit all of its residents, since most projects are located in the city centre. This should be taken into account when planning for and implementing NbS.

#### **6.4 Method and limitations**

There are some considerations and limitations related to the methodology of this research. The most important ones are mentioned, as they likely have influenced outcomes. The authors want to emphasise that qualitative research itself brings up some limitations, such as interviewer effect. This applies to both this research, where the researchers conducted interviews separately, and the replication of the research. While this, and other qualitative research limitations, are important to be aware of, this section highlights the limitations that are thought to have played a significant role in this research.

Firstly, the sequence of interviews meant that most of the interviews in Malmö were completed before those in Rotterdam. As the interview guide was expanded with emerging themes throughout the interview process, there was a clearer idea of established themes and interesting

finds before the Rotterdam interviews were conducted. This can have impacted the depth of results found, with the expectation that more expanded insights were prompted in Rotterdam than in Malmö.

Secondly, the employed sampling method means that the outcomes of this research are likely not representative of the approach to NbS of both municipalities. Limitations relate to sample size and method but also to the size of the municipality system and the specific people that were interviewed. People with different job descriptions were interviewed in both municipalities, since the sampling was done using a purposeful snowball method. Some job titles might overlap in both municipalities, but many do not. This might make direct comparison harder, but this thesis focuses on the municipality as a whole, and not individuals. There are many different departments within a municipality, each with different responsibilities, goals and budgets. Additionally, they are comprised of individuals who bring their own views and backgrounds. Therefore, it is hard to generalise any finding and speak for 'the municipality' as a whole. However, this research did not intend to find a generalisable, absolute truth. Instead, it aimed to explore how practitioners in two different municipalities work with the planning for and implementation of NbS in practice, and how they consider various aspects and potential benefits of NbS in this process. It has generated these insights.

## 7. Conclusion

The concept of nature-based solutions (NbS) evolved from a need to address a multitude of societal challenges with natural resources and move away from reliance on grey infrastructure. Planning for and implementing NbS projects in an urban setting is a complex process. It involves location-specific and contextual factors and relates to stakeholders within and outside the municipal governing system. This research explored how practitioners working for and with Malmö, Sweden, and Rotterdam, the Netherlands, consider the planning for, and implementation of, various aspects and benefits of NbS. A comparative case study was done to explore these two different contexts and see what similarities and differences exist. By interviewing practitioners involved in the NbS process in the municipality, this research gained insights into how the practicalities of everyday municipal work influence NbS projects. NbS have been extensively researched regarding what they can be in theory, so this research adds the perspective of how it is applied in practice today. This research is academically relevant in identifying the relationship between ‘nature’ and human well-being, as well as socially relevant to the field to implement efficient solutions to societal challenges. This thesis does not claim to speak for either Malmö or Rotterdam municipality as a whole but rather presents the outcomes of the research as how NbS are considered by the respondents working for and with the municipality at this point in time.

This research found that various factors dispersed throughout the process influenced the considerations of NbS. Organisational and foundational factors form the foundation on which the planning- and implementation process is built. The goals and outcomes of NbS projects then, are a result of both of these. The results in these sections are contrasted with or complemented by existing literature. From this overall information, three main conclusions can be distilled.

The need for prioritisation is a recurring theme throughout the NbS process in Malmö and Rotterdam. Social aspects and benefits of NbS seem to be appreciated, but do not play a main role and are most often not the focal point of the projects. However, the social benefits of green space are recognised by many respondents, and municipalities want to, and often do, address these with projects. The multifunctionality of NbS makes them a suitable option to address a variety of factors, including social benefits, in a limited amount of space. Addressing a specific issue may sometimes be the primary target for a project. In Malmö, a problem-solving perspective uses, for example, the GYF to find possible issues, such as areas where green interventions need to take place or where flooding issues are most prevalent. However, this research found that most often in both Rotterdam and Malmö, there is a different trigger to kickstart a project. This tends to be already existing projects, that NbS and their co-benefits often piggyback on. However, on some occasions, Rotterdam uses climate change adaptation (CCA) projects themselves as tools to create social cohesion. Still, the economic aspect seems to be the

deciding factor for both municipalities. NbS are said to be either cheaper or more expensive than grey infrastructural solutions, depending on the respondent. This is seemingly traced back to the root issue of difficulty in measuring NbS benefits. While multifunctional benefits can help combine budgets to fund projects, this is not always an easy task, as it requires an integrated and holistic way of working, with cross-departmental collaboration. It is not always a clear-cut issue of being able to address the economic, social and environmental aspects equally and simultaneously. Therefore, *prioritisation is key*.

NbS projects in an urban setting are always situated in a specific socio-spatial context and have to be adapted to ensure the intended benefits are achieved. Respondents in both Malmö and Rotterdam mention that projects are done on a problem-oriented basis. If a social aspect is not the main reason for a project, it is often included as an added benefit, as it is recognised that social cohesion or human well-being can be improved with NbS. There is social involvement in the planning process to situate these projects in their context. This takes place formally and informally, where the latter seems to be (more) person-dependent. Regarding the formal participation process, it is recognised that there can be inequality in the process, and it does not always nurture a productive dialogue. People working with NbS projects in Rotterdam and Malmö municipalities mention that informal ways of participation are often used to ensure that the projects fit the wants and needs of people. It seems that these *informal ways of social involvement are person-dependent*. Additionally, there can be conflicting interests between different parties both amongst residents themselves, and between residents and the municipality. Here again, there is a need to prioritise.

In academia, NbS is an established concept which has gained popularity. In contrast, NbS was an unfamiliar or unused term for many respondents of the research and the policy documents that were analysed. Some emphasised that it was not used in their respective municipality, while others did not question the concept and continued to talk about their field, such as urban greening. However, the language used to talk about these things, and the goals and issues that were aimed to be addressed, imply that NbS are what they are looking for. There seems to be unclarity surrounding the concept and what counts and what does not count as NbS. So, *academia has adopted the term NbS, but this has not fully translated to municipal practice yet*. Whilst municipalities have not mainstreamed the use of NbS as such (yet), it seems to appeal to them due to its benefits, for example, NbS being visible solutions in the urban fabric. In this regard, NbS can be used by the municipality as a tool to communicate that they are addressing an issue and that they value creating a greener and healthier environment for their citizens. Similarly, in Rotterdam, some projects are used for prestige and its international reputation as a front-runner in CCA.

Following from the findings and conclusions of this research, several points of further research can be suggested. First, in regards to the finding that the use of NbS as a term is not mainstreamed into the municipal language, does incorrect use of a term actually matter if the end result is the same? In both municipalities, there seems to be an intent to use more natural solutions to address the various issues they face, to create more attractive but also resilient environments. The question arises if it is enough to plan natural solutions with the intent of providing societal benefits or if a particular process or framework needs to be followed in order to be able to call it NbS. If so, future research could collaborate with practice to develop such guidelines. Additionally, further research might need to be done with a more strict lens of what NbS are and how they are being implemented by municipalities.

In conclusion, planning for and implementing NbS in an urban setting is a complex process that involves many different aspects, actors, and departments in the municipal context. In academia and theory, NbS is a young but established concept that aims to address a multitude of societal challenges. In municipal practice, while intent might be there, this is limited and affected by factors including conflicting interests, physical factors and elements in the context of NbS, economic realities and not fully developed collaboration systems. Throughout the process, social benefits are recognised and appreciated but not always prioritised. Social involvement to situate a project in its specific place, however, has been given attention. The more informal processes of social involvement, and the extent to which many of the other factors above are addressed and solved, are person-dependent. Moving forward, the question is when and how NbS can be more mainstreamed in municipal projects.

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## Appendix A – Quotes in original language

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1 “Vi vill gärna använda liksom naturbaserade lösningar, men samtidigt så har vi liksom inte – vi behöver bra goda exempel för att förstå vad det faktiskt skulle kunna vara och innebära för oss.”

2 “Människor behöver grönska, vatten och natur. Parkerna, de gröna stadsrummen och naturområdena samt havet, kusten och kanalerna har stora sociala värden och är viktiga för att främja hälsa och livskvalitet. [...] Naturen i staden bidrar med sinnliga värden och till att förbättra luftkvaliteten, minska buller, fördröja dagvatten och reglera temperaturen i stadsmiljön. Grönskan är en viktig del av stadens identitet och har stor betydelse för djur- och växtliv.”

3 “Voornamelijk dan weer in die oude stadswijken, want daar zijn de straatjes ook smal, dus in die straat moet alles in de ondergrond zitten. Dus de plek die het meest getroffen wordt door hitte en neerslag, heeft ook de minste ruimte om het op te lossen.”

4 “[...] så det är inte bara att hitta en naturlig lösning utan till exempel ett träd i en stadsmiljö skapar också nya utmaningar.”

5 “Sen är det ju inte helt lätt att jobba med frågan heller i det befintliga, det ska man ju vara tydlig med ibland. Det är det ju svårt att få till det här gröna och belastningarna och det kan också vara svårt att få in underjordiska lösningar och också så att det - ja, det är mycket som ska samsas liksom på en yta.”

6 “Det finns ingen oändlig pott pengar, så med argument drar jag över pengarna till klimatanpassning ja, då är det ju på bekostnad från kanske förskolan, eller fritidsgårdar eller sociala satsningar eller någonting. Det är ju alltid någonstans ifrån som man tar de där pengarna.”

7 “Allting går att göra, men det kostar väldigt mycket och då är det liksom, ja, var gör sig pengarna bäst”

8 “Och sen så då kommer ekonomi. Men så i regel i de projekten skulle jag säga att den de sociala aspekterna – sen så klart att när det här genomförs tar man ju hänsyn till liksom lokal sociala frågor som trygghetsfråga, alltså jämlikhets- alltså våra allmänna platser har vi ju alltid de ambitionerna att genomföra, men inte primärt att vi tittar på.”

9 “[...] utöver att gröna miljöer kan skapa flera olika nyttor i form av tex ekosystemtjänster är det ett större allmänt intresse för gröna miljöer, så att det är ju betydligt lättare om man vill söka externa pengar och sånt där om det har någon form av grönt inslag än om det bara är ett grått”

10 “Men då är det ju att ambitionen har ju länge varit att man ska ha det, liksom som ett vardagsrum ungefär liksom där du har samma nivå på utomliggande gata och fastighetsgolvet innanför liksom. Det är ju fantastiskt ur ett tillgänglighetsperspektiv. Men ur dåligt ur ett liksom översvämningsrisk perspektiv.”

11 “Det vi tittade på i Söderkullaparken det var ju med siktlinjer och sånt där att när man gjorde om, från början det var ju liksom lite kul för barnen för man kunde springa och gömma sig och sånt där, men för närboende så kändes den lite otrygg [...] för det var sånt högt buskage och tätt.”

12 “En als we zo’n project identificeren, dan worden ook gelijk de bewoners erbij betrokken, van [...] wat willen jullie? En heel veel mensen willen meer parkeerplaatsen. Ja, dat staat dan haaks op

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die groenblauwe oplossing. Maar soms is het ook andersom, dan weer zeggen mensen ja, dat parkeren hebben we niet nodig, maar er maar gewoon een park van.”

13 “Vi är ju flera förvaltningar och alla förvaltningar har ju sin egen budget att förhålla sig till och ibland är det inte så enkelt att man liksom bara som med skyfallsanpassa sin egna fastighet, utan det kan ju vara så att- ja vattnet, det rinner ju neråt - så att man kan ju behöva göra åtgärder uppströms liksom för att hjälpa dem nedströms. Och hur man finansierar det, för då kan det ju vara någon som inte drar nytta själva åtgärden som får göra åtgärden.”

14 “[...] die extra euro die jij besteedt kan ergens anders € 100 opleveren hè. Maar ja, dat is wel een andere afdeling.”

15 “En ik wil het voor nu, maar ook voor later, wetende dat er allerlei veranderingen op ons afkomen, en dan gaat het niet meer puur om klimaatadaptatie maar er zijn natuurlijk veel meer transitie. Dus vandaar dat ik wil dat het in alle projecten meegenomen moet worden, want ja, dan draagt het bij aan de aantrekkelijke en gezonde groene stad.”

16 “En dat is altijd het nadeel van zo’n programma dan, bij Rotterdam werken 10.000 mensen bij de gemeente en als mensen iets horen over klimaatadaptatie dan denken ze, oh, maar daar hebben we een programma voor.”

17 “Jag kan beskriva liksom att det är 14,3 % chans årligen att du får en vattennivå som leder till detta [...] Alltså jag kan ju räkna så detaljerat i detta så liksom tar ni bort den och det och där. Försök att komma med det med samma grej för det gröna. För det sociala.”

18 “Dus effectief is het eigenlijk ook zo dat in 99% van de gevallen de gemeente zegt van we willen hier iets en dat we samen dan gaan nadenken over wat er passend zou zijn, [...] met welke voorwaarden, welke oplossing, of we het probleem überhaupt kunnen oplossen. Daar kunnen we samen over nadenken, maar het is eigenlijk altijd op initiatief van de gemeente dat er iets gebeurt.”

19 “Alleen als puntje bij paaltje komt, dan betalen wij eigenlijk alleen maar voor het blauwe aspect.”

20 “Ons bestuur[...]die zien dat als taak voor de gemeente. En op zich is dat ook wel logisch.”

21 “[...] want je hebt het probleem van de wateropgave, en de hittestress en inclusiviteit. [...] er moet ruimte voor festivals zijn [...] Er zijn een heleboel opgaves. En daarmee kan je ook verantwoorden dat je zoveel geld in die openbare ruimte investeert.”

22 “Vi har också en ganska stor trångboddhet, vilket innebär att vi behöver ha bra offentliga miljöer som gör att man kan använda det offentliga rummet som vardagsrum och liksom”

23 “Als je nu in de straat aan de slag gaat, de komende 30 jaar kom je daar niet meer.”

24 “Maar als je dan kijkt naar wat is dan de toegevoegde waarde van die betonnen bak voor het ecosysteem, voor de gezondheid van mensen, voor de aantrekkelijkheid van de stad, dan is die nul. Maar het was misschien wel op korte termijn, voor het sectorale doel, de meest goedkope oplossing. En ik denk dat we in Rotterdam al een jaar of 10, 15 aan het leren zijn dat de goedkoopste oplossing vaak hele sectorale oplossingen zijn. En als je het voor elkaar krijgt om

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daar andere opgaven aan te koppelen, dat je misschien wel eens voor wat duurere oplossingen moet kiezen, maar die daarmee ook vele doelen meer dienen.”

25 “Want kijk, als jij een waterberging onder de grond bouwt, ja misschien regent het 5% van de tijd, waarvan een paar procent extreem. Alleen voor die tijd van jaar heb je die berging nodig, terwijl als je het met een groenblauwe oplossing werkt, het hele jaar vervult die een functie. [...]. Dus ja, als je dan je euro investeert kan je dat beter in een multifunctionele oplossing doen”

26 “Så vi hade exempel på parker som när man tittar bara på planen så såg det ju väldigt grönt ut, men när man sen såg det verkligen bli byggd så var det ju en enda stor dagvattenanläggning. Och då är det ju frågan, hur mycket park är det, alltså mycket grönt är det då?”

27 “En net zoals, op elke 300 meter een koele plek is heel mooi. Maar we weten ook dat er wijken zijn in Rotterdam waar 30% van de bevolking een mobiliteitsbeperking heeft. En dan is misschien 300 meter al heel ver.”

28 “Maar als er een park naast ligt, kan ik dan niet beter dat geld investeren in dat park om daar grootschalige klimaatadaptieve maatregelen te nemen?”

29 “Maar zelf vind ik wel dat we erbij moeten nadenken, oké, je kan vergroenen, maar wat voor groen leg je aan? Want je kan wel een grasveldje neerleggen, ja, dat is groen, maar wat voor waarde heeft dat dan? [...]. Dus alleen maar groen aanleggen om het groen, dat moet je niet doen. Ik vind wel dat je er echt de waarde aan moet toekennen.”

30 “Men i det där gyttret, det handlar ju om 1000 projekt per år eller kanske ännu fler projekt per år? Där är det ju lockande, då kan vi få in fler funktioner. Kan vi få in till exempel social? Liksom kan vi stärka de sociala frågorna här? Kan vi stärka trygghet? Kan vi stärka resiliens mot olika väderhändelser och så vidare när vi ändå gör någonting, då får man – för att gå in och göra de här som jag då sa innan de här riktade projekten, det är ofta en ganska hög prislapp – medans när man ändå gräver, ja, men då kanske vi kan gräva lite annorlunda liksom.”

31 “En een andere stroom is echt als we een project doen in buurten waarvan we denken, nou, hier is echt te weinig groen, hier moet groen bijkomen. [...]. Maar het moet dan wel een aanleiding zijn vanuit de riolering of omdat er een speciaal project loopt. ”

32 “[...] want vaak als het riool vervangen moet worden, komt heel veel geld vrij voor een project. En dan kan je budgetten gaan stapelen, [...] dus uiteindelijk heb je dan heel veel potjes geld samen.”

33 “Var går smärtgränsen liksom för mervärde där vi ändå skall göra?”

34 “Jag upplever det kanske mer fokus på hur mycket byggnader som ändå ska fås upp att den allmänna platsen kanske inte är som sagt så detaljerad projekterat i det skedet.”

35 “Min bild var att det var inte särskilt stort intresse av den exakta utformningen av parken. De ville ha någonting som minskade deras risk. Egentligen ville de ha en garanti att det här aldrig skulle kunna ske igen. Det var det och ingenting mer som var i deras fokus.”

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36 “Det där har där, där finns en tydlig skillnad mellan befintliga områden utifrån socioekonomisk bakgrund, eller. Att ja det är lite tuffare i välbeställda områden med skrivkunniga människor, och som har råd att driva en process eventuellt.”

37 “Er zijn ook nog tientallen projecten waarin we het toch zo goedkoop mogelijk doen, dus het is nog niet dat het overal gebeurt. En dat heeft ook met beschikbare capaciteit van medewerkers te maken, het beperkte aantal landschapsarchitecten dat er goed naar kan kijken, budgetten die in een bepaald jaar uitgegeven moeten worden waardoor je zegt, ja, dan maar even een wat korter participatieproces, dan maar even wat minder ingewikkeld.”

38 “Då vill vi ha så mycket synpunkter som möjligt sen är det väl relativt sällan det – det är ju en kulturfråga, vi är inte så vana vid det i Sverige skulle jag säga om vi jämför med både Holland och Danmark och lite andra där man är lite vana med att ha en lite mer en större dialog – det är ju lite hur man ser på kommun alltså här är ju synen på att staten och kommunen den ska fixa biffen på något sätt.”

39 “Dus bewoners van Rotterdam weten misschien minder over water of over klimaatadaptatie. Maar ze zijn ook expert, maar dan met name wat er gebeurt in hun gebied.”

40 “[...] bij Bentemplein hebben ze dat in het andere uiterste gegooid en hebben ze echt iedereen die ze maar konden betrekken, betrokken tot aan een soort spelvorm toe, dat je echt eigenlijk alle invloed kan meenemen, dus daar hebben ze heel erg veel van geleerd van dat wijkproces zeg maar [...]”

41 “Så de var med och tanken där var visst också det pedagogiska att de är med och förstår hela syftet bakom det. Men sen var tanken att dom berättade för sina föräldrar och sina grannar, och det liksom sprids i området att ja, men våra barn har varit med här och man kan också känna lite stolthet och en koppling till platsen.”

42 “Want een fijne omgeving draagt ook bij aan het gevoel van eigenaarschap van die bewoners en identiteit, en trots, trots op je straat, trots op je wijk. En als je dat voor elkaar weet te krijgen, dat betekent ook dat er heel veel zelf gebeurt.”

43 “Dus dan worden onze stadsbrede opgaven vertaald naar wat werkt nou in deze wijken, naar wat aansluit bij de sociale context van de mensen die daar wonen.”

44 “Maar het voordeel als je intermediairs hebt, dus mensen die ertussen staan, ja dan is dat wantrouwen veel minder en kun je veel makkelijker die samenwerking vinden. En dat kan dus iedereen zijn, hè, maar toevallig werken wij heel veel samen met ontwerpers of landschapsarchitecten die zelf al heel erg actief zijn in de stad en dan met name juist weer op de natuur-achtige dingen. Dus zij sturen ook een beetje mee dat de gemeente automatisch veel meer aan natuurontwikkeling en biodiversiteit en dat soort dingen doet. Ze zouden ons ook scherp, wat ik heel fijn vindt. En weten ook een extra enthousiasme bij de bewoners, zeker in de beginfase op te roepen en daarna als we eenmaal aan de gang zijn is iedereen enthousiast.”

45 “Kijk, een geveltuin draagt niet heel veel bij aan klimaatadaptatie, maar het zorgt wel voor een hele aantrekkelijke woonomgeving en bewustwording en als communicatie instrument blablabla. [...]. Maar wat het vooral heeft opgeleverd, is dat mensen achteraf zeiden van ja, onze straat is opgeknapt. [...]. Maar ja, dat is helemaal niet door dat geveltuintje, het is door het feit dat ze met

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elkaar hebben gedaan. Of via dat hebben ze ook elkaar hebben leren kennen en elkaar weer groeten op straat. Ja, dat zijn de superwaardevolle dingen.”

46 “[...] waarbij de impact van het vergroenen soms heel beperkt was in fysieke zin. Maar meer in sociale zin dat je zegt, je hebt mensen bij elkaar gebracht en vaardigheden bijgeleerd, wat ook heel waardevol is.”

47 “[...] mag het er ook leuk en mooi uitzien, ook omdat dat dus richting de inwoners weer inspirerend kan werken, dat zij dus ook dat soort maatregelen nemen.”

48 “[...]. Maar het is voor veel mensen wel een soort startpunt om zich bezig te gaan houden met klimaatadaptatie, want op een leuke manier, je maakt met je burens de straat wat groener, wat fleuriger, en als soms denken mensen van, oh, maar dan kan ik misschien ook wat aan mijn dak doen, of aan mijn tuin doen. Dus het is ook een beetje aan de ene kant, mensen spelenderwijs of op een leuke manier betrokken laten raken bij klimaatadaptatie als een soort eerste stap.”

49 “[...] in het algemeen wordt, zeg maar groenere oplossingen veel meer geapprecieerd, omdat dat heel visueel is en ook meteen aantrekkelijker leefomgeving geeft. Dus dat is natuurlijk een heel welkome manier om te communiceren.”

50 “Kijk, dit is ook weer de unieke ligging van Rotterdam, want doordat we voor een groot deel onder zeeniveau liggen, dat we omringd zijn door water, dat we het diepste punt van Nederland zo'n beetje binnen de gemeentegrenzen hebben, dat betekent dat we al jaren bezig zijn om die stad veilig te maken en te houden. Zeker ook omdat hier de haven hebben, dus ook qua economische positie moet je gewoon een veilige stad zijn. Dus dat betekent dat we al jaren bezig zijn met het klimaatadaptatie. En dat daardoor ook de wereld naar ons kijkt van hé wat doen jullie allemaal? [...] dus dit is ontstaan vanuit noodzaak en nu is het ook gewoon iets wat we in de markt zetten. [...]. Dus ja, we focussen ons natuurlijk op het klimaatbestendig maken van Rotterdam, maar die koploperspositie die we uit noodzaak hebben gekregen die bouwen we ook graag uit.”

51 “[...] internationaal weten mensen Rotterdam te vinden vanwege de goede voorbeelden, maar de Rotterdammers weten veelal zelf niet waar deze voorbeelden aan bijdragen. Daarnaast is het de vraag welke Rotterdammers er profiteren van deze iconen, die toch voornamelijk in de directe omgeving van het centrum te vinden zijn.”

## Appendix B – Interview Guide

Interview protocol project: Municipal planning for co-benefits with NbS

Time of interview:

Date:

Place:

Interviewer:

Interviewee:

Information about the project: Me and my thesis partner are conducting research for our master's degree at LTH. Through this project, we wish to identify how potential social benefits are considered in the planning and implementation process of NbS by municipalities. The project will use a comparative case study between Malmö, Sweden and Rotterdam, the Netherlands. However, the point of the comparative study is not to highlight one as better than the other but to gain a broader perspective of potential ways to approach planning for co-benefits.

What we mean by social aspects is anything directly or indirectly related to people using and interacting with these spaces. With social benefits, we mean anything that relates to people's well-being and meeting their needs and wants, beyond the physical problem that NBS solves. It can be both related to an individual or community level. I.e. improved mental and physical health from having more plants in your neighbourhood. Or increased opportunities for recreation and outdoor activities.

RQ: How are social aspects and benefits considered by those implementing NbS and how can these differ in different contexts?

- introduce yourself and the research project information
- hand information sheet and consent form, go through
- asks for consent to record

### The interviewee's general work and relation to nature-based solutions

- Can you tell us a bit about your work?
- How do you work with implementing or planning for nature-based solutions?
- Are there any policy- or law frameworks that you need to work with relating to nature-based solutions?

### Benefits of nature-based solutions

- What are the benefits of nature based solutions?
- What is the highest priority/main function for NbS in a specific space?
- Most important benefits
- Probe social benefits according to the interviewee

### The implementing and planning process

- Enabling factors and incentives for NbS
- What does the structure of a project group for nature-based solutions look like?
  - Is there anyone that is specifically looking at social benefits?
  - Do these collaborate with other related departments (for example those that focus on public health)
- What are the administrative levels involved?

### Local context

- How do you situate these projects in their social context, *place specificity*
- Is the public involved as participants in the process?
- In what ways can they participate?
- How do you decide where the projects are implemented?



## **Appendix C – Interview consent forms**

### **1. Information about participation in thesis project “Municipal planning for co-benefits with Nature-based Solutions”**

### **2. Information about the project and how research subjects are selected**

We are two master’s students at the Faculty of Engineering at Lund University. We want to ask you if you would be willing to participate in a study within a research project called “Municipal planning for co-benefits with NbS”. Through this project, we wish to identify how potential social benefits are considered in the planning and implementation process of NbS by municipalities. The project will use a comparative case study between Malmö, Sweden and the Rotterdam, the Netherlands. However, the point of the comparative study is not to highlight one as better than the other, but rather to gain a broader perspective of potential ways to approach planning for co-benefits. The reason we ask you to participate is because you are in some way involved in planning or implementing NbS on a municipal level and can give insight to considerations taken in a project.

### **3. What participation in the study would involve for you**

If you agree to participate, this will mean that you partake in an interview concerning your experience and expertise on the topic of inquiry. The interview is predicted to take ½-1 hour, either taking place in-person or digitally. During the interview, we will take notes and also record digitally. The recording will later be transcribed.

### **4. How to learn about study results**

You will be able to partake in the results of the study by downloading the finished thesis from <https://lup.lub.lu.se/student-papers/search/publication?sort=year.desc&q=studentpapertype%20exact%20H2&q=department%20exact%20v1000170&q=department%20exact%20v1000224&q=course%20exact%20VBRM15> once approved by examiner and published later in 2023. If you wish to be notified we can email you when it is available.

### **5. Participation is voluntary**

Your participation is voluntary, and you can decline to answer any question you do not want to answer. You are free to cancel your participation or withdraw from the project at any time and this will not result in any penalties. All information will then be deleted if you do not want it to be used. You also have the option of withdrawing parts of the interview, or other types of information that have come to the study’s attention, at any time. If you no longer wish to participate, please notify the person in charge of the project, see contact details below.

### **6. How your personal data will be processed**

We ensure that any information you share with us will be treated with utmost care. The information you provide will be used for research purposes and will be presented and published in accordance with an approved master’s thesis at Lund University. All data will be analyzed on an aggregated level and presented in a format that ensures confidentiality. You will not be personally identified in any results, either directly or indirectly. After the end of the project, all recordings and audio recordings of the interviews will be deleted. The data you provide will be used in the master’s thesis and possible future publications. You can request that any data you

provide be deleted at any time during or after the project, without any penalties whatsoever. To do this, contact us (see contact details below).

**Consent to participating in the thesis project “Municipal planning for co-benefits with NbS”**

I have read and understood the information about the study in the above text. I have been given the opportunity to ask questions and I have had them answered. I may keep the written information.

- I consent to participating in the study described in this document
- I consent to the processing of my personal data as described in this document

Place and date

Signature and clarification of signature

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If you have any questions, please don't hesitate to contact us:

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