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## Green Infrastructure and the Sustainability Concept: A Case Study of the Greater New Orleans Urban Water Plan

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Green Infrastructure and the Sustainability Concept:  
A Case Study of the Greater New Orleans Urban Water Plan

A Thesis

Submitted to the Graduate Faculty of the  
University of New Orleans  
in partial fulfillment of the  
requirements for the degree of

Master of Urban and Regional Planning

by

Jessica Fisch

B.A., University of Florida, 2008

B.S., University of Florida, 2008

August 2, 2014

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For my family, Kevin, Dundee and Duke

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## **Abstract**

Sustainability has been touted as an ideal in city and environmental planning in recent decades, evolving to include environmental, economic, and equity-focused goals. While much has been written about these ideals, it remains unclear how their inherent tensions and challenges affect planning practice. This thesis analyzes these goals as they are perceived and prioritized in The Greater New Orleans Urban Water Plan, a regional water management plan released by Waggonner and Ball Architects in September 2013, utilizing interviews with architects involved in the plan's development, staff at agencies involved in green infrastructure implementation, and advocacy groups involved in and affected by the plan's implementation. I argue for the creation of a planning infrastructure that would promote a broader view of the array of green infrastructure's potential environmental, economic, and social benefits, as well as for an increased focus on equity in green infrastructure planning and implementation.

Green infrastructure, sustainability, sustainable development, water management, urban planning, New Orleans

# **Introduction**

Sustainability has been touted as an ideal in city and environmental planning in recent decades. The concept has generally been defined to include components of environmental protection, economic development, and social equity, commonly referred to as the ‘triple bottom line.’ Green infrastructure, a concept referring to managed networks of green space and their associated ecosystem services (Benedict & McMahon, 2006) as well as systems utilizing or mimicking natural processes in managing stormwater (EPA, n.d.), has been highlighted as important in achieving overall sustainability goals. The sustainability themes of environment, economy, and equity have been used to describe potential benefits of implementing green infrastructure principles in cities. While much has been written about these three ideals, it remains unclear how their inherent tensions and challenges play out in green infrastructure planning efforts. Using this ‘sustainability lens’, this thesis examines a green infrastructure plan and planning process--the Greater New Orleans Urban Water Plan, released in September 2013 by Waggoner and Ball Architects. In presenting a case study of the plan, planning process and implementation, I aim to understand how concepts of sustainability were perceived and prioritized by architects involved in the plan’s development, staff at agencies involved in green infrastructure implementation, and advocacy groups involved in and affected by the plan’s implementation.

## **Planning for Sustainability**

Sustainability in city planning has been the subject of a growing discourse, with implementation becoming increasingly pressing in recent decades. Rapid urbanization post-World War II and increased awareness of its environmental impacts--due to a growing body of

scientific knowledge--gave rise to the contemporary environmental movement as well as increased citizen involvement around environmental and social issues (Rouse, 2013). While a variety of definitions for sustainability exist, they generally share a focus on the ideals of environmental quality, economic development, and social equity (Campbell, 1996, Portney, 2003). These ideals have been referred to as the three “Es” of sustainability, or the triple bottom line (Elliott, 2006). Further emphasizing equity between generations, the most common definition of sustainable development, developed by the World Commission on Environment and Development, proposes that “development is sustainable when it meets the needs of the present without compromising the ability of future generations to meet theirs” (WCED, 1987, p. 8). When aiming to achieve sustainability in practice, tensions arise in relation to the conflicting nature of these ideals (Campbell, 1996).

Efforts toward sustainability have increasingly focused on urban areas (Beatley, 2000, Young, 2011). Responding to the environmental movement and sustainability concerns, state and local governments have implemented comprehensive planning and growth management initiatives (Rouse, 2013). State efforts include sustainability initiatives around land development practices in Florida, Minnesota, New Jersey, and Virginia (Berke & Conroy, 2000). Cities have embraced a multitude of strategies in working toward sustainability goals, including the implementation of government and nonprofit programs working toward sustainability goals (Portney, 2003). Today’s ‘green cities’ may support policies and programs as diverse as renewable energy, efficient public transit, innovative waste and water treatment, and less-polluting fuels (Karlzig, 2008). Still, some sustainability principles are implemented more than others, and the mere inclusion of the sustainability concept in plans does not affect how well plans actually promote sustainability principles (Berke & Conroy, 2000). Inherent tensions exist

among the goals of environmental protection, economic development, and social equity (Campbell, 1996), and plans focusing solely on environmental goals in achieving sustainability may be missing important components of social equity or economic development (Agyeman, 2013). This thesis focuses on these issues as they relate to the implementation of green infrastructure plans and projects, with the Greater New Orleans Urban Water Plan serving as a case study.

### **Green Infrastructure and Sustainability Goals**

Green infrastructure has been considered a vital area for investment as cities work toward achieving sustainability goals. Definitions of green infrastructure have included the concepts of the planning and management of interconnected natural and open space areas and the associated benefits for humans, wildlife, and ecosystems (Mell, 2013, Benedict & McMahon, 2006). The concept of green infrastructure may vary according to the scale being considered--Rouse (2013) describes its function at the city and regional scale as a “multifunctional open space network” and at the local and site scale as a “stormwater management approach that mimics natural hydrologic processes” (p. 1). Thus, green infrastructure may encompass features as diverse as large parks, greenways, and agricultural and forest lands, as well as smaller-scale green roofs, trees, rain gardens, planters, vegetated swales, and pocket wetlands that may be more appropriate for urban contexts (Rouse, 2013). In addition to being described as a concept, green infrastructure may also be viewed as a process in which diverse interests work together to encourage land use practices that benefit nature and people (Benedict & McMahon, 2006).

As sustainability became a national and international goal in the 1990s, planners increasingly recognized the need for connected landscapes in protecting ecosystem processes and services (Benedict & McMahon, 2006). Maryland and Florida developed the first greenway and

green infrastructure planning initiatives in the 1990s, and the President's Council on Sustainable Development (1999) highlighted green infrastructure as the first of five key areas in a comprehensive approach to sustainable development. From these initial efforts, a diverse array of green infrastructure planning initiatives has developed at various levels in regions and communities (Benedict & McMahon, 2006).

The sustainability concepts of environment, economy, and equity may be used in describing the potential benefits of green infrastructure (Rouse, 2013). Benedict and McMahon (2006) describe green infrastructure as “the ecological framework for environmental, social, and economic health—in short, our natural life support system” (p. 1). For Rouse (2013), one of the key principles for planning and design of green infrastructure lies in its multi-functionality, the ability to provide ecosystem services which create environmental, economic, and community benefits. Further, Brown (2007) states that communities are looking at infrastructure projects as “multi-purpose, multi-benefit” opportunities, focusing on increasing the social and economic benefits of green infrastructure (p. 3).

### **The Context of New Orleans**

Planning and implementation of sustainability and green infrastructure concepts are of particular urgency in New Orleans following decades of coastal erosion and soil subsidence, which have left the city vulnerable to extreme flooding from hurricanes and rain events. Geographer Richard Campanella (2010) describes how levees and municipal drainage, while significantly reducing flooding in the city, have contributed to soil decomposition and compaction, resulting in soil subsidence and a sinking city. Half of the city and metropolis south of Lake Pontchartrain had sunk below sea level by the end of the 20<sup>th</sup> century, with 62 percent of New Orleanians living below sea level (Campanella, 2010). As Campanella (2010) describes,

the combined issues of soil subsidence, coastal erosion, and rising sea levels constitute significant hazards for the city:

“Subsidence alone constitutes a tolerable urban problem. In the face of eroding coasts and rising seas, however, it can be deadly. A century of environmental manipulation brought those rising waters closer and closer to the subsided metropolis. Three major navigation canals—the Industrial Canal (1918-23), the Gulf Intracoastal Waterway (GIWW, 1930s-1940s), and the Mississippi River-Gulf Outlet Canal (MR-GO, 1958-68)—allowed saltwater to intrude into the ragged edges of the deltaic plain. Wave action eroded saline marshes, and salinity killed freshwater cypress swamps, allowing more saltwater to intrude and repeating the cycle of ecological destruction until it brushed against the levee-lined perimeter of the million-person conurbation” (p. 132-133).

With these issues in mind, local efforts to promote the city’s sustainability—from city rebuilding plans to grassroots planning efforts—have grown out of Hurricane Katrina and the economic and physical losses sustained during repeat flooding events. Urban sustainability principles have been core concepts in all of the city’s major post-Katrina planning efforts, and the role of green infrastructure has been key in sustainability dialogues (Fields, 2009). However, although flooding and hazard mitigation were primary concerns for residents (Nelson, Ehrenfeucht, & Laska, 2007), initial planning efforts were unable to build consensus around sustainability plans (Fields, 2009). As Fields (2009) describes,

“Creating politically acceptable solutions to long-standing problems in an intense, post-disaster environment is a monumental challenge that requires extensive reserves of patience, resourcefulness, and creative problem-solving (Wagner et al., 2008). Instead of creating a modicum of community consensus for risk-reduction strategies, initial planning efforts triggered a backlash to green space proposals that made future efforts to create sustainable solutions much harder” (p. 342).

He notes that in the post-Katrina environment, economic and social concerns were often of greater priority for residents than strictly environmental concerns. Further, for Nelson et al. (2007), contradictions “between residents’ desire to return to their neighborhoods regardless of the environmental and economic risks of rebuilding and their concern for reducing their flood vulnerability” reflect the issues of information scarcity, uncertainty, and complexity of the post-

disaster environment (p. 37). Finally, weighing the environmental, economic, and social benefits of implementing green infrastructure networks inside the levees versus the urgency of larger wetlands and coastal protection efforts creates issues for planners and agencies as they delegate limited resources.

Almost ten years after Hurricane Katrina, tensions regarding sustainability and rebuilding continue to shape planning efforts as the region recovers. In particular, this thesis focuses on the Greater New Orleans Urban Water Plan, a regionally-focused water management and green infrastructure plan released by Waggoner and Ball Architects in 2013. The planning effort was initiated in 2008, when the ‘Dutch Dialogues’ workshops brought together experts from Louisiana and the Netherlands--including engineers, urban planners and designers, landscape architects, and soil and hydrology experts--to discuss applicability of Dutch approaches to flooding and subsidence to the New Orleans area. In 2010, Greater New Orleans, Inc. (GNO, Inc.), a regional economic development organization, received funds through the State of Louisiana’s Office of Community Development- Disaster Recovery Unit to develop a “Comprehensive, Integrated, and Sustainable Water Management strategy for the east banks of Orleans and Jefferson Parishes and St. Bernard Parish” (Waggoner and Ball, 2013, p. 13).<sup>1</sup>

Over a two-year period, Waggoner and Ball Architects and a team of local, national, and international (especially Dutch) water management experts partnered in developing the Greater New Orleans Urban Water Plan. Designs were developed through collaboration among

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<sup>1</sup> Funds from the state office were received through the federal Community Development Block Grant program (Disaster Recovery) through the Department of Housing and Urban Development. The goals of Louisiana’s Community Development Block Grant Program are “to provide assistance to units of general local government in non-entitlement areas for the development of viable communities by providing decent housing and a suitable living environment and expanding economic opportunities, principally for persons of low and moderate income” (State of Louisiana Office of Community Development, n.d.).

architects, landscape architects, urban planners, hydraulic engineers, hydro-geologists, and policy-makers from the Netherlands and New Orleans. Notably, the process was unique in that plan development was managed by an architecture firm rather than traditional urban planners. The plan consists of a set of reports created for various constituencies, including *Vision*, a general overview of the plan; *Urban Design*, oriented toward planners and urban design professionals; and *Implementation*, for policy makers and other stakeholders.

### **Purpose of Research**

The purpose of this research is to examine how key concepts from the body of planning literature concerning sustainability were perceived and prioritized by plan developers, staff and leadership at city and regional agencies, and community and advocacy groups in a green infrastructure plan, its planning process, and early implementation of green infrastructure concepts. Focusing specifically on the Greater New Orleans Urban Water Plan and process, I aim to discover priorities and tensions within the ideals of environmental protection, economic development, and social equity as these actors begin to plan for green infrastructure policies and projects.

In order to accomplish these goals, I evaluate the Greater New Orleans Urban Water Plan and process, utilizing interviews with architects involved in developing the plan, staff and leadership at city and regional agencies involved in green infrastructure implementation, and community and advocacy groups working involved in and affected by implementation, in addition to examining the plan itself. Interviews provide increased depth in examining perceptions of various groups involved in the planning and implementation process and in understanding tensions between different goals and values held by these groups. They also



provide specific information on the planning process and perceived possibilities for implementation not found in the plan itself.

Specifically, I ask the questions:

*-How are tensions between the ideals of environmental quality, economic development, and social equity in planning efforts reflected in the Greater New Orleans Urban Water Plan and in conversations with architects involved in the plan's development, staff at city and regional agencies involved in green infrastructure planning and implementation, and advocacy groups involved in and affected by green infrastructure implementation? How do architects, agency staff members, and advocacy group members attempt to reconcile these tensions in the plan documents, the planning process, and implementation of the plan's concepts?*

Further, looking toward future planning efforts and opportunities, I ask:

*- What can be learned from successes and challenges for the plan and planning process? What future opportunities for improvement exist in promoting environmental quality, economic development, and social equity through green infrastructure planning in New Orleans?*

The following four chapters are devoted to these questions. Chapter 2 contains a review of the body of planning literature concerning concepts and definitions of sustainability; the ideals of environmental protection, economic development, and social equity; and inherent tensions between these concepts. I first discuss the concept of sustainability, including definitions and the components of environment, economy, and equity. I then provide an overview of the literature concerning each of the three components in the context of green infrastructure planning. This

review provides a background for analysis of the Greater New Orleans Urban Water Plan in relation to these key themes comprising the concept of sustainability in green infrastructure. Chapter 3 discusses the method employed in this analysis, specifically the use of qualitative research, case study, and thematic analysis. Chapter 4 is devoted to the results of the research. I discuss the analysis of the plan and planning process, using data from interviews and the plan itself to detail priorities, challenges, and tensions for each of the concepts. Chapter 5 includes a discussion of implications for future planning efforts.

# Literature Review

## Sustainability Concepts and Definitions

Sustainability has been widely touted as a goal and ideal in urban planning, and defining and implementing the concepts has become a global topic of concern. However, as Portney (2003) notes, “While the term obviously seems to convey great meaning to a wide array of people, the fact is, as a matter of practice, it has come to mean so many different things to so many different people that it probably does as much to promote confusion and cynicism as positive environmental change” (p. 3). The term sustainability and its variant sustainable development have roots in the concept of ecological carrying capacity (Beatley & Manning, 1997) and limits of growth debates of the 1970s (Agyeman, Bullard, and Evans, 2003). The concepts began to appear in literature in the early 1970s, becoming more widely discussed during the 1980s (Beatley & Manning, 1997). It has developed to encompass ideals of environmental protection, economic development, and both inter- and intra-generational social equity (Elliott, 2006, WCED, 1987).

The international community has formally explored sustainability in recent decades. The World Commission on Environment and Development (WCED, also known as the Brundtland Commission), was established in 1983 and constituted by the United Nations as an independent body in 1984 (United Nations, 2011). The concept of sustainability was explored and defined in its report, *Our Common Future*, first published in 1987 (WCED, 1987). The commission described necessary conditions for sustainable development, including reviving growth; changing the quality of growth; meeting employment, food, energy, water, and sanitation needs; maintaining sustainable population levels; conserving natural resources; managing technology

and risk; and including both environmental and economic factors in decision-making (Elliott, 2006). The push for consensus continued as sustainability was the central aim of the United Nations Conference on Environment and Development, held in Rio de Janeiro, Brazil, in 1992, to report on progress since the Brundtland Report (Elliott, 2006). The conference developed the Agenda 21 action plan for sustainable development and sparked tensions in attempting to define sustainable development (United Nations, 1992), while also emphasizing climate change as an important environmental concern (Elliott, 2006). Continued focus is visible in the President's Council on Sustainable Development (1999) and the World Summit on Sustainable Development, held in Johannesburg, South Africa in 2002 (United Nations, 2002). Elliott (2006) emphasizes that compared to Rio, the Johannesburg conference engaged a much broader array of interest groups including, for example, nonprofit groups focused on issues of human rights and social justice, reflecting an evolving view of the sustainability concept.

Many interpretations of sustainability exist, and these definitions help serve as a foundation for achieving sustainable development (Elliott, 2006). Holmberg and Sandbrook (1992) propose that more than seventy definitions of sustainable development exist. The most frequently cited definition of sustainable development and a foundation for future conceptions of sustainability comes from WCED's 1987 report, *Our Common Future*, which proposes that "development is sustainable when it meets the needs of the present without compromising the ability of future generations to meet theirs" (WCED, 1987, p. 8, Elliott, 2006, Agyeman, Bullard, and Evans, 2003). In addition to its environmental focus, the WCED definition includes concepts of economic development and social equity, signifying an important shift from traditional conservation-focused definitions, such as that of the 1980 World Conservation strategy (Agyeman, Bullard, and Evans, 2003). The commission focuses on giving "overriding priority"

to the needs of the world's poor as well as "the environment's ability to meet present and future needs" (WCED, 1987, p. 62). Further emphasizing the inclusion of equity, the report states that "[e]ven the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation" (WCED, 1987, p. 62). Elliot (2006) highlights the inherent tensions presented in this concept of sustainability, including the conflicting interests between present and future generations, between human well-being and environmental protection, and among socio-economic classes.

Other perspectives convey continued focus on linking the themes of environment, economy, and equity. Similarly to the WCED, Agyeman, Bullard, and Evans (2002) define sustainability as "the need to ensure a better quality of life for all, now and in the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems" (p. 2). Beatley and Manning (1997) also state the need for an integrative and holistic approach to sustainability in which programs, policies, and design are collaborative and "bring about multiple objectives" (p. 33). Thus, areas such as housing, transportation, and access to resources may be connected to sustainability efforts through policies and programs, addressing equity and economic development in concert with environmental protection and restoration. Further, for McLaren (2003), equity issues are "a driving force behind unsustainability," exacerbating environmental and economic problems for poor communities and nations (p. 21).

### **Tensions and Challenges**

Sustainability literature highlight the importance of focusing simultaneously on the goals of environmental protection, economic development, and social equity. However, these ideals include inherent conflicts and tensions, creating challenges for their implementation in practice. Several authors acknowledge the challenges in addressing the tensions among the ideals of

environment, economy, and equity and offer critiques of the sustainable development concept and its implementation.

Campbell's (1996) definition of sustainable development emphasizes the inherent tensions in the goal of supporting environment quality, social equity, and economic development, using a triangular model to describe these three priorities and their associated conflicts inherent in planning. Figure 1 details Campbell's descriptions of the tensions between each of the goals of sustainable development, which he names the property conflict, the resource conflict, and the development conflict (Campbell, 1996).

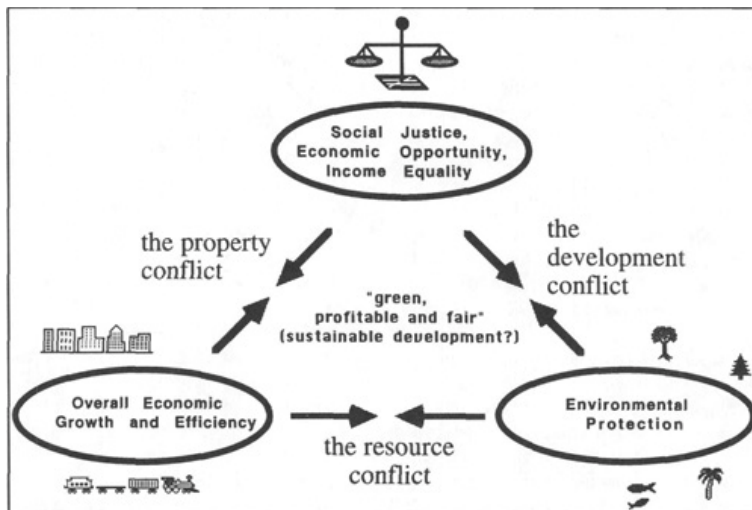


Figure 1: Conflicts in Sustainable Development (Campbell, 1996).

Campbell (1996) describes the conflicts between each ideal. First, he calls the conflict between economic growth and equity 'the property conflict,' which is the tension caused by a society that both defines property as a private commodity and also relies "on government intervention (e.g. zoning, or public housing for the working class) to ensure the beneficial social aspects of the same property," (Campbell, 1996, p. 416). According to Campbell (1996), this conflict between growth and equity "defines the boundary between private interest and public good" (p. 416). Second, the conflict between economic growth and environmental protection is

described as ‘the resource conflict’-- that businesses need to conserve resources for future use, but they resist regulation (Campbell, 1996, p. 417). Finally, Campbell names the conflict between social equity and environmental preservation, ‘the development conflict,’ and defines it as the difficulty of providing both economic subsistence and sustainable conditions for the natural environment simultaneously (Campbell, 1996, p.418).

The goal for planners, then, is to balance these three systems. Campbell’s interdisciplinary view of planning links social theory with environmental science and policy, as he suggests “that planners should do better in combining social and environmental models” (Campbell, 1996, p. 420). Stressing the significance of the development conflict, Campbell (1996) emphasizes planners’ role in helping to solve environmental and economic equity issues simultaneously through arranging procedures for stakeholder decision-making. He also emphasizes planners’ abilities to “put forth specific, far-sighted designs that promote the sustainable city” (Campbell, 1996, p. 430), and to understand conflicts at a regional scale and the potential for use of technology, strategies based around an outcomes approach. Thus, for Campbell, the planner’s task consists of a combination of procedural facilitating and guidance toward sustainable outcomes. Overall, he states, “In the battle of big public ideas, sustainability has won: the task in the coming years is simply to work out the details, and to narrow the gap between its theory and practice” (Campbell, 1996, p. 421).

Another critique of sustainable development theory is that it has focused more on environmental concerns than on equity, and more on intergenerational equity than intra-generational equity or social justice (Agyeman, Bullard, and Evans, 2003). Portney (2003) argues that most cities with sustainability indicators do not explicitly focus on social equity. However, Agyeman, Bullard, and Evans (2003) emphasize that environmental quality and

human equality are inseparable issues, and that environmental degradation is almost always tied to issues of social justice. Further, Agyeman (2009) proposes that this separation of the sustainability movement and the more equity-focused environmental justice movement can be attributed to their different origins, approaches, languages, and repertoires; a history of mistrust between the movements; class, social, and demographic issues; and the reluctance of the environmental justice community to engage in a ‘white, middle class discourse.’ These authors emphasize the challenges in achieving environmental and equity goals simultaneously, similarly to Campbell’s (1996) development conflict.

Responding to these challenges, Agyeman, Bullard, and Evans (2003) propose the concept of ‘just sustainabilities’, defined as “the need to ensure a better quality of life for all, now and into the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems” (p. 5). Agyeman (2013) argues that four conditions are equally necessary in achieving just sustainabilities of any scale, including “improving our quality of life and wellbeing; meeting the needs of both present and future generations (intra-generational and intergenerational equity); justice and equity in terms of recognition (Schlosberg 1999), process, procedure, and outcome; and living within ecosystem limits (also called ‘one planet living’) (Agyeman, 2005, 92)” (Agyeman, 2013, p. 7). Notably, while living within ecosystem limits is emphasized, almost all of these standards are equity-related, whether they focus on procedural equity or equity through outcomes.

### **Sustainability and Green Infrastructure**

The environmental, economic, and social components of sustainability, and inherent tensions, are being considered by cities as they plan and implement green infrastructure projects and policies. The following three sections detail these key components and how they have been



applied to green infrastructure planning. I describe key themes from the body of planning literature surrounding these areas, providing a foundation for analysis of the Greater New Orleans Urban Water Plan and planning process through a case study, to be presented and discussed in Chapters 4 and 5.

### **Green Infrastructure and Environmental Sustainability**

That cities have the potential to be greener, more natural, and healthier places is not a new concept. The development of the urban planning field has been linked to landscape architecture and public health by their common concerns with shaping the built and natural environments for improved living conditions. Early planners such as Frederick Law Olmsted and Ebenezer Howard emphasized the importance of green space as part of urban infrastructure (Eisenman, 2013, Howard, 1902), and early efforts in zoning were rooted in improving environmental quality in rapidly expanding cities. Years later, the environmental movement developed out of concern for the consequences of rapid urbanization (see Leopold, 1949; Carson, 1962). As an outgrowth of the movement, the federal government has implemented several major environmental laws affecting cities, beginning with the National Environmental Policy Act of 1970 (Daniels, 2008). Later works of literature began to detail concepts of city design in line with ecological principles, integrating the city with nature through urban design (McHarg, 1969; Spirn, 1984; Hough, 1995).

More recently, with increased concerns for issues such as climate change and urban sprawl, the environmental benefits of green infrastructure have been more specifically examined (Beatley, 2000; Benedict & McMahon, 2006; Birch & Wachter, 2008; Rouse, 2013). Green infrastructure's most obvious goals are focused on maintaining and restoring environmental

quality in urban environments. Benedict and McMahon (2006) describe the concept as both a connected physical landscape and as a process:

“Used as a noun, green infrastructure refers to an interconnected green space network (including natural areas and features, public and private conservation lands, working lands with conservation values, and other protected open spaces) that is planned and managed for the associated benefits it confers to human populations. Used as an adjective, green infrastructure describes a process that promotes a systematic and strategic approach to land conservation at the national, state, regional, and local scales, encouraging land-use planning and practices that are good for nature and for people” (p. 3).

Rouse (2013) describes the concept’s second definition, which evolved from the need to address water quality impacts resulting from stormwater runoff. According to the U.S. Environmental Protection Agency,

“Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water” (U.S. EPA, n.d.)

Rouse (2013) seeks to link the physical form of green infrastructure with its benefits, natural habitats with those managed by humans, and green infrastructure with gray infrastructure, utilizing a “holistic and interdisciplinary approach” (p. 11).

Green infrastructure has the potential to bring multiple environmental benefits to urban areas. Rouse (2013) states that specific benefits could include stormwater absorption, reduced runoff and flooding, improved environmental quality, climate moderation, preservation and restoration of natural ecosystems, and mitigation of climate change. Beatley (2000), in his description of the characteristics of cities exemplifying ‘green urbanism,’ also emphasizes several goals and benefits potentially applicable to green infrastructure, including functioning

with natural processes, living within ecological limits, facilitating healthy lifestyles, and creating livable neighborhoods, among others (Beatley, 2000).

However, as noted by Miller (2008), key impediments exist to the adoption of green infrastructure techniques. First, the benefits of implementation are generally seen over long periods of time, making them difficult to measure and reducing confidence. Also of concern is that revision of environmental regulations tends toward an ‘accretionary approach,’ which involves adding new regulations while leaving existing constraints in place (Miller, 2008). This approach leads to a disregard of smaller-scale blue-green practices while favoring a focus on ‘large-storm rate control’ (Miller, 2008).

### **Green Infrastructure and Sustainable Economic Development**

Sustainable economic development has been highlighted as important in achieving overall sustainability goals. The concept of sustainable economic development lies in contrast to traditional views of economic development, in which all growth is seen as positive and producing higher quality of life for residents--“the engine that drives the health of the city” (Portney, 2003). Fitzgerald and Leigh (2002) distinguish between the concepts of economic growth and development:

“Thus, economic development is concerned not only with creating growth or stabilization, but also with specific criteria for distributing the benefits of that growth (or distributing it within the stabilization). Whereas economic *growth* is defined as more development, more jobs, more taxes, and so on, we define economic *development* as raising standards of living and improving the quality of life through a process that specifically lessens inequalities in metropolitan development and the metropolitan population’s standard of living. Further, our distinction between growth and development is not oriented solely to the present because economic *development* is *sustainable*: it is growth and change that neither contributes to rising inequalities nor diminishes opportunities for future generations” (p. 27).

The authors describe principles for sustainable local economic development—development should increase standards of living, reduce inequality, and promote sustainable resource use and production (Fitzgerald & Leigh, 2002). Viewing the issue from another standpoint, authors have also criticized sustainability efforts which focus solely on environmental goals, emphasizing the importance of incorporating economic and equity concerns into the concept of sustainability. Agyeman, Bullard, and Evans (2002) propose that

“Sustainability cannot be simply a ‘green’ or ‘environmental’ concern, important though ‘environmental’ aspects of sustainability are. A truly sustainable society is one where wider questions of social needs and welfare, and economic opportunity are integrally related to environmental limits imposed by supporting ecosystems” (p. 78).

Both sets of authors emphasize the simultaneous pursuit of economic, environmental, and equity goals in working toward sustainability. However, as Fitzgerald and Leigh (2002) note, little of current practice qualifies as sustainable economic development under these criteria.

Green infrastructure presents an opportunity to create economic benefit while serving environmental and equity goals. As the industrial economy of the twentieth century has transformed into a “service-based knowledge economy,” city leaders are realizing the economic value in environmental quality (Daniels, 2008). Potential economic benefits of green infrastructure include providing job and business opportunities, stimulating economic activity, increasing property values, and providing cost savings from reduced energy, healthcare, and gray infrastructure expenses (Rouse, 2013). Green cities are showing that cities don’t necessarily have to trade jobs for environmental quality, and “increasingly footloose” skilled workers are drawn to these cities (Daniels, 2008, p.11). However, advocates of green infrastructure have rarely focused on the economic benefits that may be provided through ecosystem services, missing vital policy arguments for investment in the greening of cities (Hirsch, 2008). Hirsch

(2008) uses New York's upstate watershed and New Orleans' coastal wetlands as examples of ecosystems providing valuable services to their cities.

An important issue in the implementation of green infrastructure noted by Hirsch (2008) is that it constitutes a 'public good' which is challenging for the market to provide. Therefore, the public sector plays a vital role in supporting ecosystem services. Governments may choose to support ecosystem services by directly funding and implementing projects which enhance these services, charging fees for ecosystem destruction, subsidizing preservation, and establishing market-based programs which allow for ecosystem services trading (Hirsch, 2008). However, valuing ecosystem services often proves difficult, and public officials may have a hard time arguing for their funding (Wolf, 2008). Therefore, cities have the potential to play a "significant role" in the experimentation with various policy approaches, as they

"operate on a smaller scale than state or federal governments and are well-suited to policy experimentation and innovation. Moreover, they have many opportunities to make productive investments in ecosystem services, especially if they look outside their own jurisdictions to the natural environments on which they rely for clean water, flood control, and other such services" (Hirsch, 2008, p. 292).

Indeed, several cities serve as examples in their creation of economic development-oriented green infrastructure policies. These include Chicago's incentives for green roofs for new commercial construction (including expedited planning review and floor area ratio bonuses for developers), and Portland and Philadelphia's inducements for green roofs and courtyards included in new stormwater management ordinances (Miller, 2008).

The community economic development component may also prove important when considering the political viability of green infrastructure projects. Fields' (2009) case study of the Lafitte Greenway in central New Orleans helps to demonstrate the importance of this component of green infrastructure projects. The Lafitte Greenway, a "3-mile greenway/trail

system proposed for an abandoned rail corridor in the centre of New Orleans,” served as a multi-dimensional sustainability project which addressed community needs such as revitalization and connectivity, at the same time as encouraging the creation of public green space and green infrastructure (Fields, 2009, p. 331). By building grassroots-level enthusiasm and a balance between green space and revitalization concerns, the Lafitte Greenway became a politically viable project and is under construction at the time of this publication.

In contrast to the support generated by the greenway, Fields details green space proposals from the Bring New Orleans Back Commission plan, an early sustainability-focused planning effort following Hurricane Katrina that received significant community pushback. Specifically, plans to reduce the city’s urban footprint to create green space in low-lying neighborhoods “produced strongly negative public feedback that overwhelmed the more nuanced discussions about urban sustainability” (Fields, 2009, p. 333). Fields asserts that backlash to the proposals is rooted in community memory of land expropriation in mostly black residential areas, emphasizing the limitations of pursuing green infrastructure from a purely environmental standpoint:

“The public reaction to the BNOB proposals highlights the limits of emphasizing a purely ‘natural’, open-space preservation conception of green space in urban landscapes, especially where green space is perceived to be pitted against the economic needs of residents. The perception of trading neighbourhoods for nature proved to be a non-starter from a political perspective” (Fields, 2009, p. 335).

Similarly to issues described in Campbell’s (1996) ‘development conflict,’ residents’ concerns reflect illustrate tensions between environmental and equity goals.

## **Green Infrastructure and Social Equity**

In addition to environmental and economic emphases, several works highlight the potential for promoting social equity through green infrastructure projects and policies. Early planning for social equity began as a response to modernism, urban renewal, and the civil rights era, focusing on providing equitable processes and outcomes to support groups that have been disadvantaged through traditional planning processes. While some works focus on equity through participatory processes (see Davidoff, 1965; Forester, 2006), others emphasize creating equity through outcomes (see Krumholz, 1982; Fainstein, 2010). These ideals are seen in varying ways in literature relating green infrastructure with social equity goals.

Several works have highlighted the potential equity applications of green infrastructure. According to Rouse (2013), the social benefits of green infrastructure may include outcomes as diverse as providing outdoor recreation opportunities and the opportunity to connect with nature, improved public health resulting from improved environmental conditions, environmental justice, community building, improved aesthetic quality and opportunity for cultural expression, and production of local resources. Further, for Wolf (2008), urban greening provides psychological, physiological, and sociological benefits that are important for community health and wellbeing. These benefits are mainly outcomes- rather than process-focused. Alternatively, Rubin (2008) views green infrastructure through a community action lens, framing it within the areas of advocacy for environmental justice and community economic development in low-income areas, focusing on more of a participatory approach in green infrastructure planning and implementation.

While the implementation of green infrastructure can potentially address issues of equity, Beatley and Manning (1997) assert that the incorporation of a “strong social component” is also vital to the success of sustainability efforts (p. 30). As Fields (2009) notes in the case of post-

Katrina New Orleans, “the failure to build community consensus around redevelopment plans that intended to turn areas of the city into green space....resulted in a significant backlash that crippled large-scale sustainability planning” (p. 328). The incorporation of strong public participation and community development components proved to be vital for the success of green infrastructure projects that have gone forward in the city, such as the Lafitte Greenway (Fields, 2009). Agyeman (2013) also proposes that inclusive planning processes are vital to the success of community spaces, citing a “‘deep knowledge’ of the preferences of the actual communities who are likely to use those spaces” (p. 149). Further, the level and quality of community involvement can affect planning of future projects, with failed efforts potentially undermining future public engagement (Agyeman, 2013).

Further engaging with the issue of equity in environmental planning efforts, Agyeman (2013) argues that an increased focus on equity is vital in place-based sustainability efforts. Citing initiatives like complete streets, transit-oriented development, and livable streets, he argues that “additional caution is needed because some low-income communities and neighborhoods of color worry that changes...will foster gentrification, further diminishing their rights and roles in the community” (Agyeman, 2013, p. 97). Further, he notes, sustainability-focused placemaking initiatives are commonly criticized as based in middle-class narratives of place, creating a “struggle between residents’ different historical narratives” (Agyeman, 2013, p. 107). He emphasizes that “Decisions to construct or locate what might be considered by some as ‘beneficial amenities’ in traditionally disadvantaged neighborhoods can be seen as part of a privileged narrative” (Agyeman, 2013, p. 119). Additionally, policies to induce efficiency through green taxes may have “serious distributional impacts” when low-income or otherwise constrained people do not have capabilities to adopt efficiency measures (Agyeman, 2013, p.



164-165). However, supportive government intervention could support a more just application of such policies (Agyeman, 2013). To illustrate an increased focus on equity and the concept of just sustainabilities, Agyeman draws on the example of the Dudley Street Neighborhood Initiative (DSNI) in Boston. He highlights the DSNI's diverse 34-member board of directors, representing the four major cultures of the community; its works toward the implementation of resident-driven plans; and its creation a community land trust to combat gentrification and resident displacement as examples of equity-focused sustainable development (Agyeman, 2013).

### **Future Research**

Literature surrounding green infrastructure and sustainability points to the key themes of environmental protection, economic development, and social equity, as well as the tensions inherent in attempting to promote these competing ideals simultaneously. However, few works have detailed how these goals and tensions are prioritized and played out in the implementation of green infrastructure plans and projects specifically. The aim of this research is to begin to provide insight into green infrastructure planning and decision-making processes through an examination of the recently-released Greater New Orleans Urban Water Plan and through interviews with plan developers, staff at city and regional agencies, and community and advocacy groups about their experiences and perceptions of the plan, its development, and current and future implementation efforts. It is my hope that research on this plan and process will be of interest as planners and policy-makers consider environmental, economic, and social factors while working to develop and implement green infrastructure plans and projects.

# Methodology

## Research Design

**Overview of Approach.** This thesis examines the planning process and proposed outcomes of the Greater New Orleans Urban Water Plan with regard to key themes in existing literature concerning the sustainability concepts of environment, economy, and equity. In addressing these research questions, I utilize a qualitative research approach, building a case study of the plan and process and applying thematic analysis in examining the presence of key concepts from the body of planning literature. The approach assumes the existence of key themes and concepts of sustainability which are repeated in urban planning literature.

**Qualitative Research.** A qualitative approach was used for this research in order to fully explore participants' experiences in the plan's development and implementation of green infrastructure concepts. Using a qualitative method, information gathered through interviews could be examined through the lens of themes found in planning literature. The goal of this process was to produce a better understanding of priorities and tensions in the application of sustainability concepts in green infrastructure planning.

A qualitative approach was especially suited to this research because of the complex and emergent nature of the planning process. The qualitative researcher studies phenomena in their natural settings, using a wide variety of interpretive practices to understand them "in terms of the meanings people bring them" (Denzin & Lincoln, 2005, p. 3-4). Snape and Spencer (2003) describe qualitative research as well-suited to "analysis which is open to emergent concepts and ideas and which may produce detailed description and classification, identify patterns of association, or develop typologies and explanations" (p.5). Qualitative methods are also suited

to the exploration of complex issues or processes occurring over time (Snape & Spencer, 2003). In studying this complexity, data collection usually involves close contact and interaction between the researcher and participants, allowing for the exploration of developing issues (Snape & Spencer, 2003, p. 5). In this way, qualitative research was especially appropriate for researching the planning process as well as planners' perceptions on plan priorities and possibilities for implementation.

Specifically, this research employs an explanatory or conceptual research approach. The explanatory approach, described by Guest, MacQueen, and Namey (2012) as increasingly important within qualitative research, employs both deductive and inductive methods and is often used to facilitate decision-making (Guest et al., 2012). As such, there are increased concerns for research validity (Guest et al., 2012). As Morse and Mitcham (2002) describe, when beginning with focus on a concept of interest, qualitative inquiry may present the researcher with risks of misattribution, miscategorization, and/or tunnel vision. In addressing these concerns, the authors have presented a research process for maintaining validity while focusing on concepts of interest during analytic induction (Morse & Mitcham, 2002). First, the researcher conducts a concept analysis using literature on the concept of inquiry. The researcher should deconstruct the concept, identifying “the attributes or characteristics, assumptions, gaps, limitations, differing perspectives (including way the concept has been developed in different contexts or disciplines), and different forms of the concept for different functions” (Morse & Mitcham, 2002, p. 31). Next, depending on the maturity of the concept, either a ‘skeletal framework’ or a ‘scaffold’ may be used to further develop the research. As Morse and Mitcham (2002) describe,

“the systematic exploration of concepts, using interview or observational methods, progresses sequentially from deconstruction of concept analysis of the literature to the use of these data as a skeleton, or to using prior knowledge as a scaffold. All of these stages continue to use induction, but in different ways and in varying degrees. Awareness of the stage of development of the concept, and of how you are using previous inquiry, will expedite inquiry and enhance, rather than threaten, validity” (p. 33).

For this research, I employ this inductive-deductive approach in examining the concept of sustainability as it relates to green infrastructure. I use this prior knowledge regarding sustainability and green infrastructure planning as a scaffold for exploration of the plan documents and interview data.

**Case Study.** In this thesis, I conduct a case study in order to examine the Greater New Orleans Urban Water Plan with regard to the concept of sustainability in planning. A case study is a comprehensive research strategy that asks “how” or “why” about phenomena, focuses on contemporary events, and requires little control of behavioral events (Yin, 2009). The case study approach was chosen for this thesis because of its fit with the exploratory nature of the research. In examining perceptions of sustainability concepts, I focus my analysis on the plan itself as well as the planning process and current and future implementation efforts.

Yin (2009) describes a case study as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 13). Case studies rely on multiple sources of evidence, and theoretical propositions may guide collection and analysis of data (Yin, 2009). They may include quantitative and qualitative evidence. Yin (2009) points to case studies as important in explaining causality in interventions too complex for more quantitative strategies, such as the survey or experiment. Theoretical propositions guide the development of the case study by shaping research questions, the literature review, data collection, and the selection of

analytic strategies (Yin, 2009). This case study follows the proposition that tensions exist between key concepts of sustainability which exist in planning literature, and that these tensions are reflected in the practice of green infrastructure planning. This proposition guides the case study analysis in this thesis.

## **Applying Thematic Analysis**

**Overview of Thematic Analysis Approach.** I utilize thematic analysis in identifying, analyzing, and reporting themes within literature concerning sustainability (Braun and Clarke, 2006), and I apply these themes in an examination of the Greater New Orleans Urban Water Plan. The method is deductive as themes have been identified using the existing literature. Braun and Clarke (2013) describe thematic analysis as “a method for identifying themes and patterns of meaning across a dataset in relation to a research question” (p. 175). Thematic analysis is a flexible research method and can be applied across a variety of theoretical and epistemological approaches (Braun & Clarke, 2006). It has a broad scope and may be used in analyzing social and cultural phenomena in addition to subjective human experience (Guest, MacQueen, & Namey, 2012). Guest et al. (2012) find the greatest strength of the approach in its emphasis on “using whatever tools might be appropriate to get the analytic job done in a transparent, efficient, and ethical manner” (p. 18).

Themes may be identified in a ‘bottom-up’ manner, driven by examination of the data, or in a ‘top-down’ way, using data to explore theoretical ideas or using theoretical ideas in analyzing data (Braun & Clarke, 2013). Guest et al. (2012) describe two types of themes which may emerge as data is classified—structural themes imposed by the research design, and content or emerging themes which “describe what is observed or discussed in the context of the imposed research design” (p. 50). The authors describe a theme development as a process in which text is

read, reread, and sorted into categories through segmenting and coding, and categories, types and relationships are analyzed in an iterative fashion. Limitations of the approach include the possibility of missing “some of the more nuanced data” (Guest et al., 2012, p. 17).

In this research, the process of thematic analysis was made up of several steps. These included a review of planning literature related to the sustainability concepts of environmental, economy, and equity; pattern recognition and identification of key concepts in the data; and finding theoretical relationships among key concepts (Jabareen, 2006). This thesis uses these key concepts from the body of planning literature in an examination of the Greater New Orleans Urban Water Plan.

## **Data Collection**

**Participants.** In order to provide multiple perspectives on the plan, planning process and implementation, I conducted interviews with 12 individuals, including architects working at Waggonner and Ball Architects and involved in the plan’s development; staff at city and regional agencies involved in implementation of green infrastructure concepts; and members of advocacy organizations involved in and affected by the plan’s implementation. In addition to interviews with these groups, I also utilized information obtained directly from the plan documents in providing background information for examining the plan. Interviewees included two staff architects at Waggonner and Ball Architects; an environmental planner with the New Orleans City Planning Commission; the director of land stewardship at the New Orleans Redevelopment Authority; three New Orleans Sewerage and Water Board staff members working in the Environmental Affairs Department; the director of economic development, and transportation and sustainability planners with the New Orleans Regional Planning Commission; the co-chair of

the Horizon Initiative Water Committee; and the program director for Friends of Lafitte Corridor.

**Method.** In collecting qualitative data, I employed in-depth semi-structured individual interviews with the participants described above. In-depth or unstructured interviews are a primary method for data collection in qualitative research and are defined by structure and flexibility (Legard et. al, 2003). In-depth individual interviews were chosen for this thesis based on several factors. In-depth interviews allow the researcher to obtain a deeper understanding of responses through follow-up questions and the ability to explore reasons, opinions, and beliefs connected to individuals' responses (Legard et. al, 2003). Open-ended questions allow participants to express un-predetermined responses, which allows the researcher "to capture how those being interviewed view their world, to learn *their* terminology and judgments, and to capture the complexities of their individual perceptions and experiences" (Patton, 2002, p. 348).

**Procedure.** Interviews with architects, agency staff, and community and advocacy group members focused on the planning process, desired or perceived outcomes of green infrastructure projects and policies, and potential for implementation of the plan's concepts. Semi-structured interviews with open-ended questions allowed participants to convey complex responses and insights (Patton, 2002). The interview process was shaped by use of an interview guide in which I combined general questions with more specific follow-up questions in order to guide interview conversations (Legard et al., 2003). Follow-up questions could be asked in order to obtain more detailed information after general questions. General questions included prompts such as "Describe the planning process in creating the water plan," and "What are the major obstacles to implementing aspects of the plan?" Follow-up questions, including prompts such as "Describe the public participation element of the plan," and "Describe the plan's goals in relation to

economic development,” allowed for more detailed responses concerning specific themes. An interview guide included in the Appendix details specific questions used for interviews with different groups.

### **Data Analysis**

For this research, I recorded and transcribed audio data from each of the 12 interviewees (Legard et al, 2003). I used thematic analysis in analyzing data obtained from the interviews, and analysis of early interviews informed later interviews. As Guest et al. (2012) describe, “[i]n classic qualitative research, at least some of the data are analyzed as they are collected, and the results may be used in an iterative fashion to modify the data collection itself” (p. 22). The process of thematic analysis included coding, “The process by which a qualitative analyst links specific codes to specific data segments,” identification of potential themes and structures, and checking models with data in an iterative process (Guest et. al, 2012, p. 50).

I analyzed the interview transcriptions, codes, and coding notes for the recurrence of themes and concepts in interviewees’ perspectives of the plan and its goals, the planning process and plan development, and current and future implementation efforts. Taking into account the analytic objectives of the research, I utilized coding and note-taking in discovering themes, and these themes were then analyzed with regard to their relationship to one another and used to compare data across groups (Guest et al., 2012). These techniques were especially useful in comparing themes generated from interviews with architects involved in developing the plan with those generated from interviews with staff at agencies and advocacy groups involved in implementing the plan’s concepts.



# Analysis

## Introduction

Sustainability concerns are increasingly pressing in the New Orleans area following Hurricane Katrina and its devastating environmental, economic, and social consequences for the region. Plan developers seek to address many of these issues in the Greater New Orleans Urban Water Plan, which, in addition to its environmental focus, emphasizes issues of economic development and social equity. This section introduces the plan's overall goals and strategies and provides an analysis of priorities and perceived outcomes from the perspective of architects involved in its development, staff at city and regional agencies involved in implementing green infrastructure projects and policies, and community groups involved in and affected by the plan's implementation.

## Plan Goals and Strategies

The Greater New Orleans Urban Water Plan proposes goals and strategies in relation to economic development and social equity in addition to its overall environmental goals. Emphasizing economic development and social equity, the plan document states: "A fundamental premise of this new approach is to transform...costs into investment opportunities that produce lasting value, safety, economic growth, and that distribute the costs of implementation in the most sustainable and equitable manner possible" (Waggoner and Ball Architects, 2013b, p. 98). The plan structures its proposed benefits around a 'safety first' strategy, in which ecological, economic, and social factors combine to produce a safe and sustainable environment (Waggoner and Ball Architects, 2013b). Differing slightly from the

traditional ‘triple-bottom-line’ approach to sustainability, this approach stresses the importance of safety as an outcome of achieving environmental, economic, and social goals of sustainability.

The Greater New Orleans Urban Water Plan justifies green infrastructure investments in their ability to reduce flooding, combat subsidence, and create an urban identity around the region’s water assets. Specifically, Waggonner and Ball Architects (2013a) enumerate three issues the plan is designed to address in the plan documents, including drainage systems that are regularly overwhelmed by runoff; excessive pumping that lowers groundwater levels, causing land to sink; and wasted water assets that are hidden behind walls, buried, or pumped away. Environmental, economic, and social concerns are portrayed in the strategies for addressing these issues. Proposed strategies include increasing safety by reducing flooding and subsidence; creating opportunities for economic development through interaction with safe and attractive infrastructure and waterways; and improving quality of life for citizens through integrating clean water into public space and new development (Waggonner and Ball Architects, 2013a). In addition to an environmental focus on long-term safety and reduced subsidence, these strategies focus on issues of community wellbeing through promoting safety and quality of life, as well as economic development, through creating high-quality spaces which interact with water features and through promoting the region as a safe and attractive place to live and do business (Waggonner and Ball Architects, 2013b).

The plan focuses on several strategies for achieving its goals, including large-scale investment in green infrastructure projects, incentives and fees, zoning requirements, and voluntary retrofits to privately-owned property. Green infrastructure investments are detailed in the plan’s ‘Integrated Living Water System,’ a model for managing stormwater and groundwater together rather than separately. These strategies--including small-scale retrofits, circulating

canals, strategic parklands, integrated wetlands and waterworks, regional monitoring networks, and waterfront development zones—are intended to promote slowing, storing, and using of water to reduce dependence on pumping (Waggonner and Ball, 2013a).

- Small-scale retrofits can be implemented in individual properties, parks, and public spaces, and serve to allow water to infiltrate where it falls. These may include projects such as rain gardens, bioswales, permeable pavement, or landscaped curb extensions on streets.
- Canals would be widened and planted along the edges, with pumping stations at Lake Ponchartrain to maintain water levels at the height of surrounding neighborhoods. The Jefferson-Orleans Basin is divided into two sub-basins, the Orleans river side sub-basin and the Orleans lake side sub-basin, with the goal of diverting some water to the river side to reduce the load on the outfall canals. Circulating canals, with trees and walkways, would link together to replace large neutral ground areas.
- The plan uses parklands to serve as both recreation areas and stormwater storage areas.
- Wetlands are located in parks as well as throughout the region and help to filter stormwater.
- The plan details a system of integrated waterworks comprised of infrastructure that helps control flows in the water system.
- Regional monitoring networks provide data to system managers to address immediate and long-term needs relating to water levels and quality.
- Waterfront development zones use water as an asset for development, including dense, mixed-use districts (Waggonner and Ball Architects, 2013a).

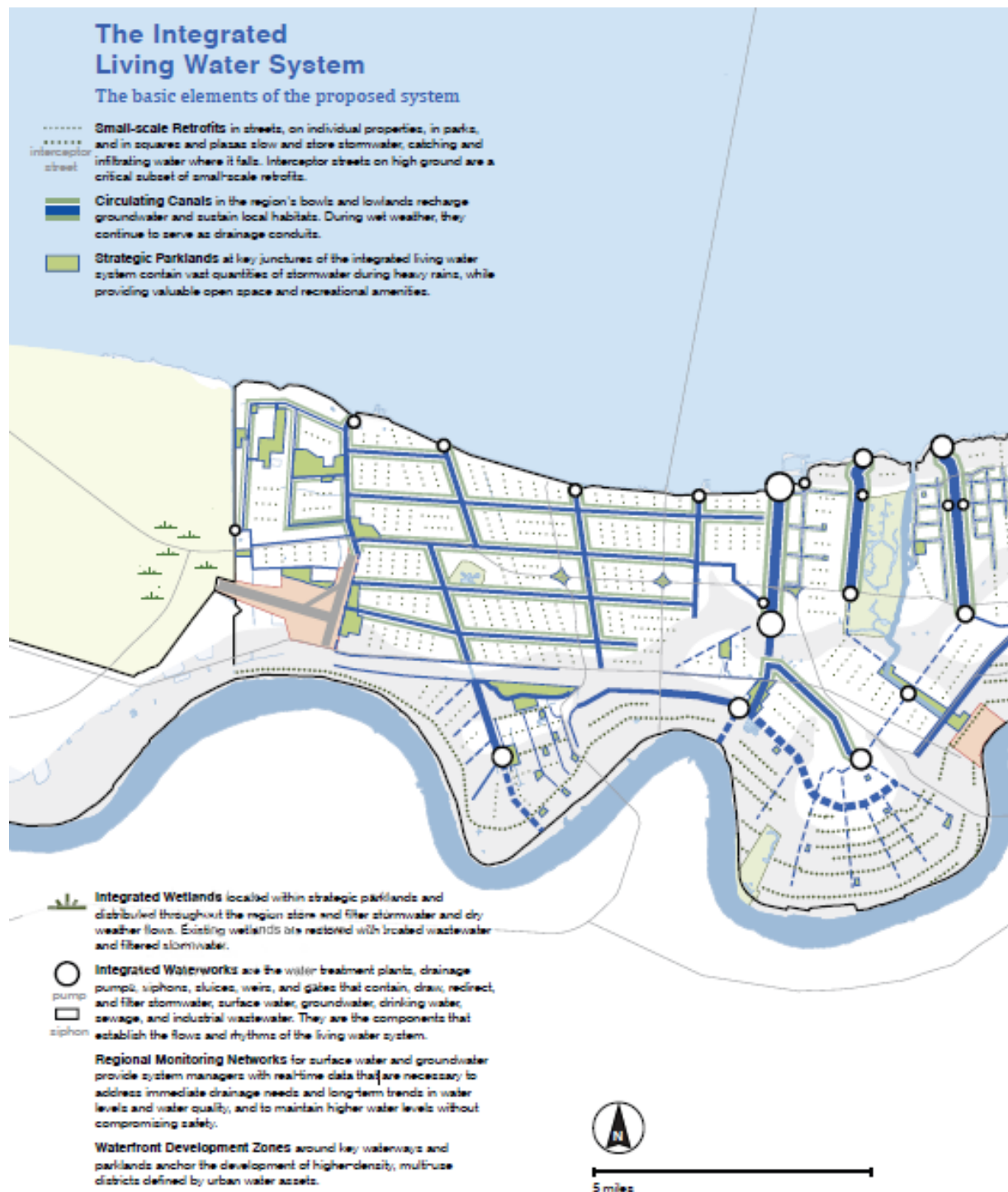


Figure 2: The Integrated Living Water System (Waggoner and Ball Architects, 2013a).

In implementing the 'Integrated Living Water System', the plan proposes several demonstration projects, which constitute its most detailed elements. Waggoner and Ball

Architects (2013b) specify the importance of the projects in addressing local water requirements and in maximizing economic development opportunities locally and for the region. Architects selected projects on the basis of several factors, including distribution throughout the region, potential to demonstrate the potential of water management goals, public visibility, accessibility, measurable benefits for surrounding residents, identification of committed stakeholders and funding, potential for innovative design and planning, and visibility for the collective water identity (Waggoner and Ball Architects, 2013a).

The plan also emphasizes zoning for stormwater management as critical in implementing the plan, as it would create uniform requirements for properties and new developments. The City of New Orleans' 2014 comprehensive zoning ordinance, now in draft form, contains requirements for landscape and stormwater management planning. The new ordinance signifies a significant shift in governance toward proactive stormwater management. Stormwater management plans are required for new developments or redevelopments with 10,000 square feet or more of impervious surface, or of one acre or more in size. The ordinance details stormwater best management practices and requires that sites' plans demonstrate how they will be implemented. The implementation of strict regulations in the zoning ordinance may also be effective in deterring concessions for new businesses, as alternatives to compliance require that certain standards are met.

The plan further suggests near term, medium term, and long term implementation of water management strategies. Near term retrofits (2013-2020) include implementing the plan's strategies into projects that have already been planned or are already underway, especially demonstration projects that have committed stakeholders. These include the Lafitte Blueway, the Mirabeau Water Garden, Lakeview Floating Streets, Eastern Water Walk, Canal Street

Canal, Elmwood Fields and Water Lanes, and the Forty Arpent Canal Zone. Medium term implementation (2020-2030) includes testing new standards and best practices for public and private projects and properties, as well as pilot funding, policy, and education programs. Long term implementation (2030-2065) includes new policies and regulations, increased public literacy around water management, public and private commitment, and the adaptation and spreading of the plan (Waggonner and Ball Architects, 2013b).

Strategies for financing the Urban Water Plan include utilizing new and existing funding sources and implementing new policy and regulation mechanisms. The plan assumes that federal and state sources will make up a majority of funding, with existing compatible funds including the Federal Emergency Management Agency (FEMA)'s Hazard Mitigation Grant Program, FEMA's Recovery Roads Program, and RESTORE Act Funds, which dedicate penalties paid by BP following the Gulf Oil Spill to Gulf Coast restoration. Further, grants and disbursements are likely to come from federal entities, including FEMA, the Environmental Protection Agency (EPA), the Department of Housing and Urban Development (HUD), the U.S. Army Corps of Engineers (USACE), and state entities, including the Louisiana Department of Environmental Quality and the Louisiana Department of Transportation and Development. The plan emphasizes collaboration with local public sources and private foundations (Waggonner and Ball Architects, 2013b).

Funding mechanisms include real estate investment tools, policy changes, and incentives, with a diversity of funding sources. Methods include:

- sales tax increases with portions devoted to green stormwater infrastructure
- issuing bonds for stormwater management infrastructure

- stormwater utility fees based on each property's amount of impervious surface
- special assessment districts for properties benefiting from specific stormwater management projects
- development fees on new construction to fund green infrastructure
- impact fees on new developments for creation of green space
- permit or inspection fees related to developments' ability to manage stormwater
- bonds to help property owners pay for improvements
- on-bill financing, in which a utility company provides initial capital for improvements and allows for low-interest or no-interest payments through the monthly utility bill
- off-balance sheet financing, in which a third-party firm acts as a developer and profits from savings resulting from the implementation of best practices
- credit enhancements providing lenders greater assurance that a borrower will repay a loan
- environmental tax shifts on undesirable activities
- reverse auction to find reduced prices on stormwater infrastructure
- public-public and public-private collaborations
- private grants and loans
- tax credits for private installation of green infrastructure
- fee reductions for individuals reducing the amount of stormwater entering a system
- tax-based fees, including tax increment financing
- rebates and installation financing
- awards, certification, and recognition programs
- trading ecosystem services
- land trusts for conservation

- fee-based funding
- and other tactics, including volunteering (Waggoner and Ball Architects, 2013b).

The following sections provide an analysis of the priorities and perceived outcomes, costs, and benefits of green infrastructure implementation from the perspectives of architects involved in developing the plan, staff members at city and regional agencies, and community groups involved in and affected by the plan's implementation. The analysis is based on interviews conducted with members of these groups as well as information obtained from the Greater New Orleans Urban Water Plan documents. In each of three sections—focusing on the areas of environment, economy, and equity—I detail the costs and benefits of implementation as proposed by architects and the plan documents, after which I describe costs and benefits as perceived by agencies and community groups involved in implementing green infrastructure.

## **Planning for the Environment**

**Introduction.** Environmental concerns are at the forefront of the Greater New Orleans Urban Water Plan, with two of its three primary goals addressing the region's issues of flooding and subsidence. However, the plan promotes economic and social goals and concerns alongside its environmental focus. Architects and agency staff members stressed that these areas may take precedence for citizens and elected officials over environmental concerns. Further, while staff members emphasized an environmental imperative for the implementation of green infrastructure regulations geared toward the private sector and individuals, tensions between environmental, social, and economic goals often complicated the implementation of publicly-funded green infrastructure projects. Finally, agency staff members proposed that engaging with the public on social and economic concerns in relation to green infrastructure would be important in gaining support for projects and policies.



**Benefits as Proposed by the Greater New Orleans Urban Water Plan.** The plan argues for environmental quality through green infrastructure in key areas and includes strategies for implementation and achievement of environmental goals. Similar to many of the works of literature on green infrastructure highlighted in this thesis, the plan defines green infrastructure as a connected natural system providing ecosystem services. One architect emphasized that “there are smaller interventions that have a small impact in isolation but when distributed throughout the land through the networks of streets and canals, it can have a big impact.” Impacts emphasized in the plan documents include stormwater absorption, reduced runoff and flooding, reduced subsidence, and aesthetic benefits (Waggoner and Ball Architects, 2013b). Small-scale retrofits to individual properties, parks, and open spaces, and the use of parks and wetlands for stormwater storage and filtering in the plan’s ‘Integrated Living Water System’ strategies focus on green infrastructure as a provider of these services. Interaction with nature is also emphasized as a benefit of green infrastructure, through helping to create more livable neighborhoods. The plan highlights opportunities for public space around waterways and stormwater features, including tree-covered walkways and recreation areas. While reducing flooding and subsidence, the features also serve to increase community interaction with water and natural areas (Waggoner and Ball Architects, 2013b). In the plan, these environmental benefits are proposed alongside economic and social benefits of green infrastructure, to be discussed in future sections.

Architects interviewed for this case study also noted that social and economic priorities exist for citizens and elected officials in addition to environmental priorities. Therefore, green infrastructure was viewed as potentially taking a back seat to issues seen by officials and citizens as more pressing. As such, while architects proposed that pressure from citizens for these

projects could serve as a primary means toward implementation, they perceived citizen priorities related to green infrastructure to be more closely tied to flood protection, quality of life, and economic development issues over strictly environmental concerns. As one architect involved in the plan's development emphasized,

“At the same time, it's not that the elected officials are not motivated, it's just that they may not think that this is the priority, because there are so many other issues that need to be addressed, especially here in New Orleans—crime, public education, all that. But when they hear from more and more of their constituents that this is a priority and this has to do with our safety, above all, and our quality of life, and economic vitality, then they might make it more of a priority and move faster.”

Notably, the interviewee stresses economic and social issues as potential benefits from green infrastructure, framing social concerns around quality of life issues as well as safety from flooding and subsidence. The public is expected to push for green infrastructure in relation to these concerns over its proposed environmental benefits. Similarly, the plan documents also focus on “creating economic value and enhancing quality of life,” in addition to addressing flooding and subsidence issues (Waggoner and Ball Architects, 2013b, p. 7).

**Benefits and Concerns as Perceived by Implementing Agencies.** Similarly to architects and the plan documents, agencies interviewed for this case study specifically noted an environmental imperative in implementing green infrastructure; however other concerns were often considered equally or more pressing. Environmental, economic, and equity concerns were prioritized in different ways as agencies considered implementation of green infrastructure through regulatory measures--which would pass a majority of costs on to developers and individuals--versus public green infrastructure projects, which would be funded by individual agencies or attached to existing projects. While environmental concerns could more often take precedence over economic or social concerns in the implementation of regulatory measures, agencies often found it difficult to prioritize green infrastructure over these concerns when

considering the addition of green infrastructure to public projects or creating a budget for green infrastructure.

In the implementation of regulatory measures, agencies emphasized the environmental urgency of implementing green infrastructure in the region. As one agency staff member noted concerning the implementation of the City's stormwater ordinance with its new Comprehensive Zoning Ordinance,

“Our point of view is that the city, it has no choice. We need to do it...We're not trying to bring a hardship or undue burden on development, but these are real situations in the city, and we have to change our paradigm on dealing with it, and it starts here. It starts with the Urban Water Plan and the comprehensive study and it starts with the city which enacted a master plan which called for all of this.”

In this way, staff members tended to view regulatory measures which would pass a majority of costs on to developers and individuals as necessary for the environmental benefit they would provide, even if some hardship on the private sector would result. Similarly, several agency staff and advocacy group members promoted a potential stormwater fee to be implemented by the New Orleans Sewerage and Water Board--which would charge property owners based on the amount of impervious surface on a property--as a simple and necessary way for the city to reduce stormwater runoff and flooding at the individual household level. As one water management advocacy group member argued concerning the potential to affect change at the individual level through the new stormwater fees,

“I think that people don't understand the true cost of water and what it is that, so yes that's part of it. That's just one of the tools is that you have to put a price on it, and then people will value it. Until then, and you also have to put a price on the pavement that they're putting there because they want another driveway. That that's a luxury that we cannot afford, and you're going to pay for it. So it's like pay to pave. That's what it is, and it's going to be very effective, I'll tell you that much.”

Another agency staff member emphasized the potential for funding projects through the regulatory measures focusing on individual households, stating that

“[the city] keep[s] trying to say where’s the money going to come from for the projects? And we look to traditional sources like the Federal Highway Administration which can only do roads, and it gets really fragmented when you start looking at different funding sources which have their own kind of parameters. And [a leader at one agency stated] it’s not until the people that are experiencing these, the people of New Orleans or the people of the Greater New Orleans area say I will pay myself out of my pocket, and higher dues or fees to the Sewerage and Water Board to accomplish these things. And I think he’s right.”

Overall, agency staff and advocacy group members viewed implementation at the private sector and individual level through regulatory measures as a necessary and feasible way to increase environmental quality and safety through green infrastructure, whether through fees or zoning regulations.

Alternatively, agency staff often viewed the implementation of public, government-funded green infrastructure projects as more challenging than the implementation of regulatory measures based on the up-front funding and inter-agency coordination involved. With these public projects, staff members often viewed economic or equity concerns as more pressing than the implementation of green infrastructure projects or the consideration of other environmental concerns. These tensions often played out at the individual project level for individual agencies.

As one staff member noted,

“The fact that it’s nobody’s job to make it happen, and the fact that it can only be a subset of other projects that are going on typically. And when you’re looking at a project, getting it done, and you can say well I can repave three miles of road, or I could do one mile and culverts underneath to collect stormwater. Those are serious challenges. What is the greater good? Is it to do three miles, or is it to do one mile with all these extra features? And I think that’s something that I see as a challenge to implementation is how much do these things cost, and how much are they taking away from something else important?”

As agencies struggled with limited resources to accomplish a wide array of economic, social, and environmental goals, staff members viewed green infrastructure as one of many aspects of a project which could convey benefits to surrounding communities.

In addition, like architects interviewed for this case study and the plan itself, agency staff members also emphasized a need to engage with the public around economic and social concerns in the implementation of green infrastructure projects rather than focus solely on environmental concerns. As one agency staff member noted,

“I think you have to look at whatever neighborhood you’re going to, when you look at... a number of community meetings and you start talking rain gardens or downspout disconnect or rail barrels, then [the community is] more in tuned to safety, economic development, survival, than they are about having a rain garden on their block. And so, you know, when people aren’t meeting their minimum needs of shelter, food, and employment...”

However, the potential social aspects of green infrastructure and saliency of reducing flooding as an issue were also noted. Another staff member described the importance of flooding as a social issue:

“I’m not talking about it really getting in a lot of houses, but just maybe your car gets stalled, or you just can’t get to pick up your kid or can’t get home. You know, it’s really an aggravation and sometimes it does get into houses and boy, when that kind of thing happens then that’s the number one priority for a long time and then it fades. But anybody who’s been here over a period of years has experienced some of that at some point and it gets to be a very emotional issue. So my point is that because people do recognize it it’s a big, big, big issue.”

These competing environmental, economic, and social goals were important as agency staff members considered whether to spend funding on adding green infrastructure to a project, expanding it in other ways, or using the funding to begin a new project altogether. Green infrastructure was considered to be one goal of many, with other needs often times taking precedence as citizens and agencies developed priorities.

Overall, while the plan emphasizes the importance of both public projects and regulatory measures in implementing green infrastructure concepts, agencies tended to prioritize environmental goals differently as they considered implementation through these strategies, an issue which could have important consequences regarding equity. Specifically, the prioritization of environmental goals for regulatory measures, which would pass a majority of costs onto individuals and businesses, has the potential to create injustice regarding who bears the costs of green infrastructure implementation. As Agyeman (2013) emphasizes, “where people do not have the capabilities to adopt efficiency measures, because of lack of income or constraints..., efficiency measures can have implications for justice” (p. 165). This point is especially applicable when considering proposed increased stormwater fees based on properties’ impervious surface, which could disproportionately affect low-income residents unable to afford to property retrofits required to reduce stormwater fees. However, Agyeman (2013) also notes that “supportive government intervention can enable the just application of efficiency policies” (p. 165). Policies and programs which would support low-income people in retrofitting properties to reduce stormwater fees have the potential to promote just and equitable implementation of green infrastructure concepts.

On the other side of this issue lies agencies’ uncertainty of how to prioritize the environmental benefits of green infrastructure in public projects, as economic or social issues were also being considered and as agency and project budgets were limited. Agencies’ project-level perspective and the view of green infrastructure as primarily an environmental project led to its lower priority in public projects relative to its higher prioritization for incorporation in regulatory measures. The following section argues for the creation of a green infrastructure planning body in order to coordinate agencies for the implementation of green infrastructure

projects and policies, while maintaining a focus on broader sustainability goals and ensuring just and equitable implementation. This planning body would also assist in creating a broader view of the potential benefits of green infrastructure, which when viewed above the agency or project level can be demonstrated to create a broad array of environmental, economic, and social benefits, as described by Rouse (2013) and Benedict and McMahon (2006). While agencies noted these potential benefits and stressed their importance in gaining citizen support for projects, the perspective and interests of individual agencies and their tendency to view green infrastructure at the individual project level created limitations for broader implementation.

### **Planning for Economic Development**

**Introduction.** As noted in the previous section, economic development concerns are prominent as the plan details potential benefits of implementing green infrastructure projects and policies. The plan focuses on specific monetary benefits and costs of green infrastructure which would accrue to the region as a whole, as well as broader economic benefits related to increasing the region's marketability. On the other hand, interviews with agency staff members revealed tensions which occur at the individual agency or project level, creating real challenges as agencies consider the costs and benefits of implementing green infrastructure projects.

**Benefits as Proposed by the Greater New Orleans Urban Water Plan.** The Greater New Orleans Urban Water Plan envisions economic benefit from the implementation of green infrastructure projects and policies through a combination of increased development, reduced costs associated with damages, and overall marketability of the region. Much of the argument for green infrastructure implementation is based on these increased revenues and costs savings benefitting the region and local businesses. In aiming to create economic value, plan developers assert that the use of federal funding for implementing stormwater best management practices is

more cost effective for local governments than continued investment in traditional infrastructure, such as in enlarging existing pumping systems. Thus, the plan's new green infrastructure-based approach requires "alternative and not additional investment...that not only addresses the urgent issues of subsidence and flooding, but returns high value" (Waggonner and Ball Architects, 2013b, p. 98).

The plan proposes that the total economic benefit created from this alternative investment would be more than \$22.3 billion (Waggonner and Ball Architects, 2013b). It proposes that this value and growth will be created through a combination of economic impact and job creation, reduced flooding costs, reduced subsidence costs, lower flood insurance premiums, increased property values, retained business investment, reduced energy consumption, and transformation of blight and vacant land. Ninety seven percent of economic benefit is predicted to come from the combined impacts of economic impact and job creation (51 percent), reduced costs of flood damage (36 percent), and reduced costs of subsidence damage (10 percent) (Waggonner and Ball Architects, 2013b, p. 51). In contrast, the cost of inaction over the next 50 years is predicted to reach nearly \$8 billion in flood damages, more than \$2.2 billion in subsidence damages, and \$600 million in avoidable insurance costs (Waggonner and Ball Architects, 2013b).

In addition to value created through green infrastructure projects, jobs, and new development, the plan proposes that green infrastructure will create new value by enhancing the region's marketability and by creating new industries around water management (Waggonner and Ball Architects, 2013b). It emphasizes the importance of promoting the region as "a place where business can safely thrive, where flood-induced interruption is not a constant worry, and where property values are unfettered by the threat of flooding or subsidence" (Waggonner and



Ball Architects, 2013b, p. 55). The region could also serve as an area of expertise, with local firms becoming specialized in water management and green infrastructure.

**Costs as Proposed by the Greater New Orleans Urban Water Plan.** While the plan proposes a high value in economic benefit, costs are also high, creating challenges and trade-offs for implementing agencies. Cost estimates for the Jefferson-Orleans, New Orleans East, and St. Bernard basins include the plan's "slow, store, and drain" elements, modeled around interventions for streets and vacant lots, large-scale storage interventions, and system-scale water conveyance and discharge (Waggoner and Ball Architects, 2013b). The plan estimates the total cost of implementation at the 'basic' level, which assumes basic street and lot interventions, lower volumes of large-scale storage, and basic drainage system upgrades, at \$2.9 billion. It estimates the cost of implementation at the 'intensive' level, which assumes intensive street and lot interventions and drainage system upgrades, and maximum large-scale storage, at \$6.2 billion (Waggoner and Ball Architects, 2013b). As the plan's budget does not include land acquisition, plan developers view promoting its principles to city agencies and property owners as important for implementation. The plan suggests a variety of funding sources for its implementation, as described in the overview at the beginning of this chapter. As a majority of funding is expected to come from federal sources, including RESTORE Act funds among other sources, issues arise with regard to the devoting of these funds to green infrastructure networks inside the levees versus their proposed delegation to broader coastal and wetlands restoration efforts.

**Benefits as Perceived by Implementing Agencies.** Agencies and advocacy groups interviewed for this case study viewed economic benefits from green infrastructure similarly to the plan's proposed economic benefits. Neighborhood-level benefits mentioned by agency staff members included avoided flood claims, improved aesthetics and amenities (resulting in

improved property values), green jobs, real estate development and neighborhood revitalization, and improved perception of vacant property. Broader economic benefits included promoting the region as a safe, thriving place to live, work and do business, and the creation of a local expertise in resiliency planning. As one agency staff member noted,

“...everyone in the world knows that New Orleans had a hurricane. And some people think we’re still under water. And when we’re trying to attract businesses here, people don’t understand all the complexities of what went into that flood. I mean some people still think it came from the Mississippi River or that we’re on the coast, literally and it was like waves lapping up into the city. Like there’s a lot of complexities about what happened with Katrina that I think a lot of people don’t understand. And in order to attract companies here, which are full of employees, which they have to also convince to move here, someone from DuBuque, Iowa, or from Silicon Valley in San Francisco is concerned about moving here. And I think doing proactive things to say, we do not have our head in the sand. We are not hiding from the issues of being in the place we are in. We are proactively confronting it and we are living with water. And we are making this place a safe place for people and a thriving place for businesses. So I think there’s a story that we need to be able to tell and some of these projects can help us tell that story, that we’re confronting our issues and that you can come here and do business here.”

In addition to promoting economic development at the local level, agency staff members viewed green infrastructure as a way for the region to show that it is a safe place to invest.

**Costs as Perceived by Implementing Agencies.** Agencies also viewed green infrastructure as having significant economic costs, many of which create tradeoffs not visible in the plan documents. These tradeoffs often create challenges for the implementation of green infrastructure which occur at the agency or project level. In the case of regulations and fees, costs are passed on to the private sector or individuals, while for the public sector, agencies cited the additional up-front costs associated with green infrastructure, with much of existing funding seen as inflexible. Agencies were often unable to factor in all of the potential benefits of green infrastructure at the project level, with several staff members proposing that a broader view of

the benefits of green infrastructure would be necessary in order for broader implementation to occur.

Costs passed on to the private sector included additional resources and time for developers to follow the City Planning Commission's stormwater ordinance for larger developments, and the up-front expense for individuals to retrofit properties to retain stormwater in order to reduce stormwater fees. In this way, agencies viewed green infrastructure regulations as potentially having negative economic impacts, as costs passed on to the private sector through regulations could discourage development. However, as noted in the previous section, the environmental imperative of implementation outweighed any perceived economic risk. The impacts of regulation would remain unknown until implementation begins in full. As one City Planning Commission staff member described,

“If we have the rules in the ordinance and they're fair and they're clear...and not much room for interpretation, and it's all a level playing field, then as long as it puts it in the construction schedule because most of the time a development will put that cost to whoever the buyer is—this is the cost of doing business in New Orleans, that they've had a hard time with flooding; we know that their infrastructure is not sound, so we understand what's going on, so we have to anticipate putting X amount of dollars forward and 2 extra months to do stormwater management. We hope that's how it's going to work.”

City Planning Commission staff expressed hope that any potentially negative economic outcomes could be mitigated through developers viewing stormwater planning as an asset to be promoted. As one staff member noted,

“We're really hoping that the development community will embrace [stormwater management] and want to outdo each other, to have the most progressive in their building...that we have done this, look at this, come see our facility that does this. That's what we're hoping for—rather than resistance, self-promotion. And again if that's what we have to do, to give out awards, ceremonies...I would certainly promote the City rewarding good stewards.”

In the public sector, agencies cited the additional up-front resources required for project development, monitoring, enforcing regulations, staffing, and agency collaboration. With high costs associated with developing and maintaining green infrastructure projects, agencies cited the need to see clear benefits from projects. As one agency staff member with the New Orleans Redevelopment Authority (NORA) explained,

“The investment, and again, from NORA’s perspective, we’re trying to use property that we own and that we’re paying to maintain, so I can tell you, and we’ve had several landscape architects tell us the same thing—the cheapest way to maintain your property is just to cut the grass. We have a good deal for grass. It’s \$25 per cut. We can do that for 30 years and be okay. That’s the easiest and cheapest thing to do with our property. Green infrastructure does involve investment on the front end, which will far exceed what we would have otherwise paid for cutting grass. The maintenance of it will far exceed what we would ever pay for just cutting the grass...So just to put it in perspective, we cut each of our properties 18 times per year, \$25 a pop. It’s approximately \$500 per year. To do one rain garden lot costs us about 25 or 30 thousand dollars, and in addition to the 25 or 30 thousand dollars that we spend on the rain garden lot, we now have a maintenance regime for that lot that exceeds the regular cut. So, not only are we still on the hook for the \$25 maintenance, actually we’re on the hook for maintenance that costs like 100 bucks a month. And we’ve made more of a long-term commitment to maintaining the property, so in other words, as long as we’re cutting the grass, someone asks for the lot, we’ll include it in an auction, which we now do twice per year... So once we’ve installed green infrastructure... it’s a long term commitment to maintaining it at a higher cost than we otherwise would have. So in order for NORA to continue to make those types of decisions, it’s important that we’re able to quantify the benefit.”

Further, much of existing funding is viewed as inflexible, purposed for maintaining and expanding current programs and projects. For funding designated for new projects, the inclusion of green infrastructure is often seen as an extra expense that takes away from expanding the projects in other ways. For example, the inclusion of a ‘green’ street design in a transportation project could be viewed as utilizing a large portion of the project’s budget, which could otherwise be used to extend the project or in starting a new project all together.

In addressing some of these concerns, agency staff expressed that a clear vision of green infrastructure’s costs and benefits would be vital if agencies are to devote scarce resources to

green infrastructure projects over other pressing community needs. However, while projects may provide a wide array of economic, environmental, and social benefits, most implementing agencies are interested in one or a select few of them and thus may not be motivated to invest in green infrastructure--the costs of implementation are perceived to outweigh the one or two benefits of importance to a particular agency.

This issue is made apparent through an examination of a specific agency involved in water management and green infrastructure, the New Orleans Sewerage and Water Board. The board is tasked with managing the city's sewer, water, and drainage systems. Its primary goal in funding green infrastructure projects is to improve water quality, which the agency is required to do under an Environmental Protection Agency (EPA) consent decree that has been in place since 1998. By implementing green infrastructure projects through its Request for Proposals (RFP), the agency hopes to achieve its goal of improving water quality but will also create additional benefits such as reducing flooding and providing neighborhood amenities. However, since these economic and social benefits do not accrue to the Sewerage and Water Board specifically, the agency does not view them as motivators for investing more in green infrastructure projects than it is required to under the consent decree. The agency continues to view its consent decree as its primary motivation for implementing green infrastructure projects.

Similarly, a staff member at NORA noted that the agency used reduced flood claims as the sole measure for the viability for one of its recent green infrastructure projects in the Pontilly area of New Orleans. However, the staff member also expressed interest in expanding the agency's future benefit-cost analyses to include additional measures. Even if calculated, not all of the benefits of future projects would result in cost savings for NORA in particular--many benefits, such as water quality, would accrue to other agencies, and some, like social value, may

be challenging to calculate. Still, the agency is interested in factoring in as many of the potential benefits of green infrastructure as possible into its future cost-benefit analyses. According to the staff member at NORA,

“The benefit cost analysis [for implementing green infrastructure projects in the Pontilly area] was favorable, meaning it came out at more than one. So it’s actually worth the investment of doing the intervention, just based on flood mitigation. Factors relative to water quality are not even considered in that benefit cost analysis for the Pontilly project. Factors relative to quality of life considerations, basically all social and environmental considerations or the impact that these interventions may have on other properties that NORA and private owners have in the area. None of that was taken into consideration. This was purely based on the interventions are going to mitigate X number of water, which we believe will prevent X number of claims. So, we made that argument pretty easily. But that was a hazard mitigation project that already kind of has a BCA model in place to work off of. I think in the bigger picture, the benefit cost analysis has to be based on like a triple bottom line type analysis where everything is considered—mitigation value, social value, water quality value, all these things have to be considered.”

Thus, green infrastructure tends to be undervalued by individual agencies, and the broad nature of green infrastructure’s benefits may be lost as agencies consider only individual projects and costs. As another agency staff member noted concerning the implementation of permeable pavement into individual agency projects,

“Everybody says, oh but in the long run [permeable pavement] is relieving you of having to build as much infrastructure for the drainage, you know, you’re not seeing that in your project. So that’s a challenge where everybody has to kind of, somebody’s got to be able to help define, say if it gets into the parish’s hands—the parish has all those departments that are affected, you know, the water department, the drainage department, the construction part so maybe at the parish level they could be taught to see the big picture. I don’t know but project specific it’s hard to see the whole thing.”

In addressing the issue of this narrow, project-specific view of benefits, many agency staff members argued for a broader view of the benefits of green infrastructure, overseen at the parish or city level. In this way, agencies would collaborate, and green infrastructure projects would be overseen in a way that more of the wide range of benefits would become visible. As one staff

member argued regarding agencies' complementary goals in implementing green infrastructure projects,

“And I don't think anyone's interests are necessarily competing, but they're just slightly different in some ways and you know, Sewerage and Water Board might be more interested in the water quality aspect of it. You know, the Office of Emergency Preparedness is going to be interested in more of the flood mitigation aspect of it. Public Works might be interested in this more of as a means of mitigating subsidence and protecting their infrastructure that's in the ground. The Office of Environmental Quality will have a perspective that's similar to Sewerage and Water Board. Sewerage and Water Board will also have a similar perspective to Public Works because they also have infrastructure in the ground. So, some of the stuff is overlapping, not necessarily conflicting. They complement one another. And I think taken as a whole it all equates to what you and I both know are the full range of benefits.”

These complementary interests would incentivize collaboration among agencies, assisting agencies in calculating the full range of potential benefits from green infrastructure and inducing increased investment than would be seen if agencies viewed projects from their own silos.

Thus, though individual agencies may have narrow goals in implementing green infrastructure, the potential exists for wider collaboration under a planning body focused solely on the implementation of green infrastructure projects and maintaining a focus on broader sustainability goals. As Campbell (1996) notes, planners tend to represent one particular goal of the sustainability triad--whether related to environmental, economic, or equity concerns--with the other two often being neglected. This points to important tradeoffs as agencies consider implementing green infrastructure into projects or budgets, as well as to the need for a broader perspective on green infrastructure and its potential environmental, social, and economic benefits. The plan and agency staff members noted a need for a parish-level or regional agency devoted to coordinating green infrastructure efforts among the broad array of agencies it involves. However, this green infrastructure planning body should also maintain a larger focus on the goals of sustainable development, as Campbell (1996) argues, contributing to promoting

its goals both procedurally and substantively. This structure would allow for, as Campbell (1996) promotes, “planners to identify their specific loyalties and roles in these conflicts accurately; that is, to orient themselves in the [sustainable development] triangle” (p. 434), as well as his call for some planners to act as mediators. In this way, in addition to the increased capacity for coordination among agencies and a broader view of green infrastructure planning in general, by identifying the roles of individual agencies and projects, the planning body could help to support increased balance in achieving the goals of a “green, profitable and fair” sustainable development (Campbell, 1996, p. 415). As the following section describes, this balance is especially important when considering social equity, which is often the least considered of the three priorities.

### **Planning for Social Equity**

**Introduction.** As Fitzgerald and Leigh (2002) and Agyeman (2013) emphasize, equity constitutes an important, though often overlooked, goal of sustainable development. In the development and implementation of the Greater New Orleans Urban Water Plan, architects and agency staff perceive and prioritize equity concerns in a variety of ways. While the plan and architects interviewed for this case study frame equity primarily as protection from flooding and subsidence and provision of amenities, increased development and property values are also promoted as increasing quality of life. Further, architects, agency staff, and advocacy group members expressed support for regulatory measures as a simple and fair way to generate revenue for green infrastructure projects. Finally, architects and agency staff members framed public participation, talked about mainly as occurring most extensively following the plan’s release, as occurring mainly through public education efforts and citizen advocacy for the plan’s implementation.



**Plan Perceptions of Equity.** The Greater New Orleans Urban Water Plan proposes several social benefits from green infrastructure implementation, most of which are intertwined with its proposed environmental and economic benefits. The plan defines “socially just outcomes” as occurring through “equal protection and amenities for all and avoidance of undesired demographic shifts and extreme changes in culture and character” stating that these goals present “a great opportunity in a city and region where the most disadvantaged often live in the areas most prone to flooding” (Waggonner and Ball Architects, 2013b, p.32). Several of the federal grants listed as potential funding sources focus on affordable housing, and a case study included as an example of social benefits of integrated water management details the establishment of a community land trust to ensure residents benefitted from improvements; however, overall the documents focus on equity through the other two measures—protection and amenities. These goals for social equity include a reduction in neighborhood flooding and subsidence, and increased quality of life through the provision of public space from canal improvements, and increased park and recreation space (Waggonner and Ball Architects, 2013a).

This view of equity as occurring through protection and amenities was also emphasized by architects interviewed for this case study. While safety was important “above all,” access to public space and amenities was also noted as highly beneficial to communities in which green infrastructure projects would be implemented. As one architect involved with the plan’s development noted regarding recreational access to canals,

“[the canals are] not currently being enjoyed by the community, the houses basically have their backs turned towards those canals. In other places like the Netherlands, they use those canals for recreation, for parks, you know people can run up and down them, they can swim in them, they can boat in them. In our drainage canals, there’s specific rules that say ‘you shall not swim, you shall not boat, you shall not fish, nothing that has to do with recreation. So they are basically single-purpose drainage canals that don’t offer any

other amenity to the community. However, they can become beautiful places to use and enjoy and at the same time store more water and minimize or control subsidence so that in the end it's a win-win situation for everybody.”

Waterfront development and increased property values are also proposed as social benefits of plan implementation both in plan documents and in interviews. Canal improvements and creation of waterfront property and amenities, especially, are expected to raise property values in currently lower-market areas, improving neighborhood conditions, access to resources and public space, and increasing safety. The plan emphasizes these benefits in a section focused on quality of life concerns, stating:

“A comprehensive approach to water management draws on the beauty and appeal of highly valued and appreciated spaces like Bayou St. John, Old Metairie, the Garden District, and St. Bernard’s bayous to create new waterfronts and public spaces accessible to a broader, more diverse public...[Newly accessible green spaces] provide visual stimulation and enhance natural beauty, taking a waterway that once resembled a trash-strewn ditch and turning it into a canal worthy of Amsterdam. Studies have shown that providing access to open space, water, and nature increases the value of nearby vacant land, spurring new housing and commercial development” (Waggoner and Ball Architects, 2013b, p. 67).

During interviews, architects also emphasized increased quality of life for citizens resulting from new waterfront parks and development. As one architect proposed,

“Whenever you have a park or a waterway, there is evidence that more development is desirable and the property values go up. So, in that way, we hate to use the word beautify, but when you improve a street, a lot, a district, a region, it's not just in New Orleans East, but everywhere, it's the same opportunity. We're creating more waterfront property, basically, with this plan. And we're creating more green spaces that people can use and enjoy, not just single purpose drainage ditch that is there and everybody has their backs turned on.”

In New Orleans East, for example, the proposed Citrus Redevelopment Zone and Eastern Water Walk are proposed to support economic development and connectivity in the area, which includes many large vacant parcels. The plan proposes that “businesses and residences will draw

value from their proximity to redeveloped canal frontage. Walking paths, parks, and plazas serve as places where public life can flourish” (Waggoner and Ball, 2013a, p. 139). Figure 3 displays the plan’s predicted locations of more than \$183 million in property value increases over the next 50 years resulting from water management interventions in the region.

**Potential Corridors of Economic Activity**

Proposed interventions that will have a positive impact on adjacent property and investment

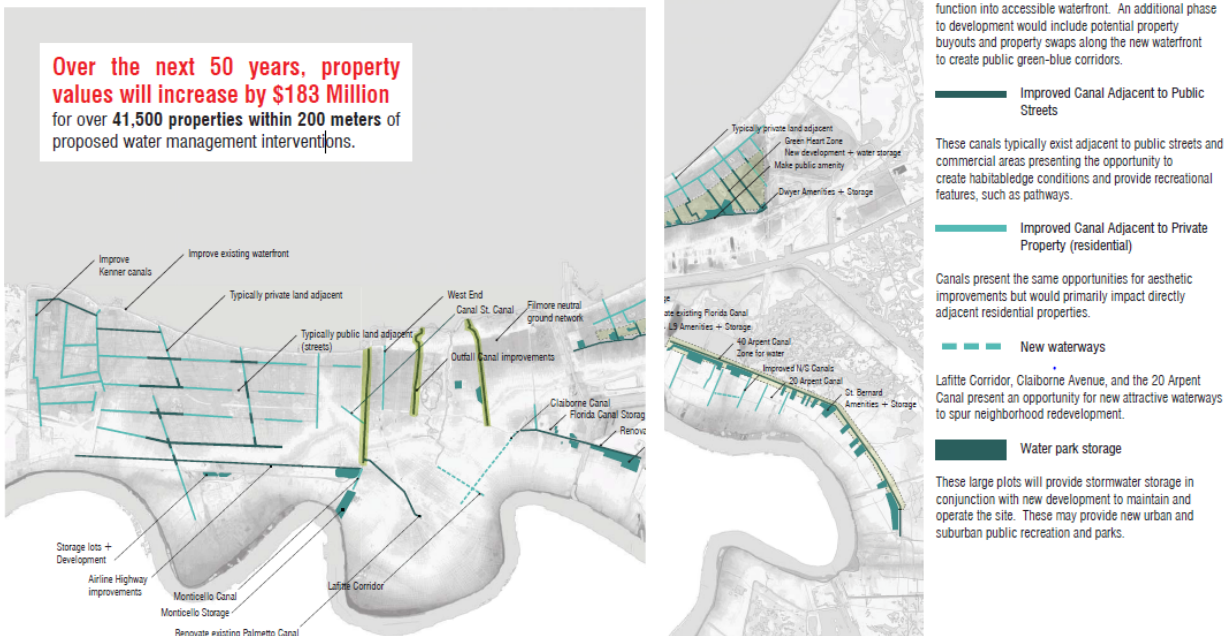


Figure 3: Predicted property value increases resulting from water management interventions (Waggoner and Ball Architects, 2013b).

Additional social benefits promoted by the plan include reduced risk of disruptions for life and work caused by flooding, preservation of local traditions and culture, public education around water management for a more informed and confident public, improved air and water quality, reduced heat island effect, and enriched ecosystems (Waggoner and Ball Architects, 2013b).

**Agency Perceptions of Equity.** Agencies proposed similar social benefits during interviews completed for this case study, noting the benefits and value created by increased parks, open space, and interaction with waterways. Agency staff members further emphasized

that improvements to canals and reduced flooding from the development of stormwater lots would benefit a wide range of neighborhoods, including people of all socio-economic levels. The location of green infrastructure projects was also noted as agencies considered equity in green infrastructure projects; however, staff members emphasized the vast amount of available space still vacant in many neighborhoods. One agency staff member noted that

“...space is always a factor with green infrastructure, so I think there’s always a risk of, there’s always going to be a risk of exploiting neighborhoods where there’s more space, simply because they have more space. If you look at other parts of the country and the world, not having enough space for green infrastructure is a really big challenge. So the real advantage that New Orleans has is that we have a ton of available space. I mean [the New Orleans Redevelopment Authority] alone owns 2600 vacant lots. So there’s a ton of space to do this here, but I could easily see in a city where space is limited and they’re really trying to use green infrastructure to address specific problems, weaker market areas are probably going to be more likely to be targeted for green infrastructure projects, simply because they’re going to be more likely to have the space. And to some degree you can see that in New Orleans because the weaker markets are where we have the most space. But I think the difference is we still have a lot of space everywhere, so even though we have an overabundance of space in the Lower Ninth Ward for example, we still have a ton of space in Gentilly too, and we still have a ton of space in Broadmoor, too. Space is not scarce enough here to where we’re trying to push everything into one area like the Lower Ninth Ward.”

However, the issue of utilizing lower market areas for green infrastructure was countered by the proposal that the projects would bring value to these areas through the creation of aesthetically pleasing parks and open space.

Agency staff, plan architects, and advocacy group members also expressed support for regulatory measures as a necessary and fair way to address the issue of stormwater on individual residential and commercial properties. An architect of the plan and an advocacy group member, respectively, described the proposal of a stormwater fee through the New Orleans Sewerage and Water Board-- designed to encourage property owners to retain water on-site by taxing impervious surfaces—as “a fair way to handle our water problems,” which would “really help

change the public’s opinion on green infrastructure and these types of plans.” A few agency staff members further noted the importance of ensuring that revenues generated from the fees would be spent on green infrastructure projects, that an opportunity exists with the increased capital from the fees and “there should be a vision” around how these revenues will be spent. However, agency staff at the New Orleans Sewerage and Water Board noted that the fees would probably be used to support the existing drainage system rather than to invest further in green infrastructure. Agency staff also reported that the stormwater ordinance in the City’s new Comprehensive Zoning Ordinance was a necessary solution in promoting the retaining of water on larger commercial properties, with costs of additional time and planning for stormwater management passed on to developers and buyers.

Overall, architects’ and agencies’ focus on achieving equity through protection and amenities, as well as the actors’ emphasis on regulatory measures as an inherently equitable strategy for the implementation of green infrastructure concepts, could obscure focus on other vital components of social equity and necessary interventions as planning and implementation processes continue. Specifically, as the plan notes in an introduction but fails to substantively return to, the goal of avoiding extreme demographic shifts and changes in culture and character of neighborhoods experiencing green infrastructure interventions should be a primary concern, as the plan emphasizes the potential for increased property values resulting from the creation of high-quality public spaces, increased development, and recreation opportunities provided by green infrastructure. As Agyeman (2013) notes, “a common and not unwarranted criticism of place-making, especially in the developed world, is that it is based on middle-class visions, values, and narratives of place, and leads to gentrification” and “can be seen as a struggle between residents’ different historical narratives” (p. 107). Issues of affordability and avoiding

these extreme shifts should be returned to as planning and implementation continue, with area residents playing a leading role in both green infrastructure planning and the preservation of affordability, similar to what Agyeman (2013) describes in the Dudley Street Neighborhood Initiative, with its diverse board of directors, resident-driven plans, and creation of a community land trust to preserve affordability and avoid gentrification.

Further, architects' and agencies' emphasis on regulatory measures, especially stormwater fees leveled on individual properties, may also raise issues regarding the equitable implementation of green infrastructure. As discussed in previous sections, the prioritization of environmental goals for regulatory measures which pass costs on to individuals and businesses raise important issues of who pays for green infrastructure. Supportive government intervention for these policies, as described Agyeman (2013), could look like Seattle Public Utilities' RainWise program, which supports residents in implementing green infrastructure projects (Seattle Public Utilities, 2013).

**Perspectives on Equity and Public Participation.** In addition to the outcomes of planning efforts, public participation in planning efforts also constitutes an important component of equity, as authors noted in the literature review for this thesis. While authors emphasize equity in terms of outcomes (e.g. Fainstein, 2010), it is also understood in terms of recognition, process, and procedure (see Agyeman, 2013). Architects interviewed for this case study and the plan itself discussed roles for the public both during the planning process and following the plan's release. Architects described a planning process in which the general public had limited opportunities for involvement; however, both architects and agency staff members called upon citizens to act as advocates for green infrastructure investment and to become more educated on water management issues following the plan's release.

The public outreach component of the plan consisted of three phases, beginning in 2011. The first phase was in conducting eight meetings that focused on educating community leaders. The firm determined the number and locations of meetings by the location of the area's water basins. Two meetings were held in New Orleans East, directed to the Vietnamese and African-American communities, and in each of four other neighborhoods, including the Lower Ninth Ward, Gentilly, Lakeview, and Uptown. Another meeting was held for Jefferson Parish, as well as one for St. Bernard Parish. The meetings aimed to create a strong support base in neighborhood leaders, a group who would share a common language and an understanding of the region's water issues. The architects described the meeting process as a 'grass-tops' approach in its focus on community leaders, as opposed to the more commonly-referred to 'grassroots' approach, referring to community-driven movements. At the meetings, the firm shared the basic principles that would form the basis of the water plan, including the concept of slowing, storing, and draining water, as well as the importance of planning for subsidence and flooding. No design proposals were shared in these meetings.

The second phase consisted of presentations of plans and demonstration project concepts to stakeholder groups, including professional organizations, government officials, community leaders, and foundations. Waggonner and Ball Architects showed the plan at its latest stage, including design drawings of water management strategies the city could implement. The firm received generally positive feedback from these groups on the plan, although parts of the plan received a high degree of pushback. Plans presented in the Hollygrove neighborhood were met with particularly high opposition, as initial plans called for using a high percentage of the neighborhood for water storage, according to one architect interviewed for this case study. The pushback from neighborhood leaders in Hollygrove led to a change in proposals for the final

plans, which attempt to shift water storage areas to vacant land. The final plan proposes the use of land around highway interchanges for water storage, but continues to propose the use of privately-owned lots, including vacant land, post-industrial areas, and some lots with inhabited homes and buildings.

One architect described the tension between the Dutch team members, who were used to a more centralized planning approach in the Netherlands, and the local team members, who had experienced the citizen pushback to top-down planning efforts following Hurricane Katrina. The groups differed in their perspectives of the relationship between government and citizens and the possibilities for changes in land use, with the Dutch members arguing for proposals that required the taking of more privately-owned land. The locals on the team were considered the voice for citizen concerns, such as those regarding the taking of privately-owned land. The firm aimed to create a defensible set of recommendations and considered themselves to be highly conscious of local concerns. Phase three, completed in July and August of 2013, included four meetings by basin. The final plan was released to the public on September 26, 2013.

Waggonner and Ball Architects saw gaps in the public engagement and education component of the planning process; however, according to one architect, the firm did not consider extensive public involvement and education across the three parishes to be within the scope of the project. Architects stated that funds were not available for public engagement processes, and that the firm had already gone over budget in time spent creating the plan. Instead, public engagement outside of the firm's informational presentations was viewed as the combined role of many nonprofit and institutional groups. These groups would perform a wide range of tasks in engaging the public, including developing public education campaigns in partnership with the city's schools, creating rain gardens, promoting best management practices



in street design, shaping water management policy, and forming groundwater monitoring programs.

Architects pointed to several groups that have taken on the task of engaging the public on stormwater management concerns, best practices, and retrofitting properties to slow and store water. In one example, the Greater New Orleans Foundation put on a series of free workshops aimed at starting a public discussion about the city's stormwater management, with speakers from cities employing best practices, before the release of the water plan. Architects also mentioned the Horizon Initiative, an economic development-oriented group of business and civic leaders that has developed a water management subcommittee; the Neighborhood Partnership Network, which has conducted educational campaigns around stormwater management best practices and implementation at the individual level; and the Urban Conservancy, which has started conducting swimming classes to promote a more positive relationship with water for citizens. Further, new nonprofits would arise in relation to diverse issues, relating water to public health, social justice, and to different areas on a geographic basis.

Notably, much of the public engagement effort was expected to occur following the plan's release, with the plan itself guiding citizen action. Citizen engagement following the plan's release is seen as a primary pathway to implementation of green infrastructure projects, as the plan states that "Perhaps the Urban Water Plan's greatest opportunity is to influence the people who can make it a reality: the citizens of Greater New Orleans" (Waggoner and Ball Architects, 2013b, p. 33). Marketing and education are especially important in catalyzing citizen action, and the plan is promoted as a framework for citizen engagement. As the plan further states,

"Though awareness of integrated water management and its benefits is spreading thanks to many affiliated and unaffiliated outreach events, conferences, and organizations,

catalyzing action in the public realm will depend heavily on ongoing coordinated outreach, education, and marketing. Moving from awareness to action is a critical next step. By providing the tools and framework for progressive, results-oriented public engagement, the Plan can translate ideas into citizen action” (Waggonner and Ball Architects, 2013b, p. 33).

Architects also expressed that the plan and broader awareness efforts would drive citizen action, ultimately influencing elected officials and policy. As one architect stated,

“So, mainly, the financing and the policy change needs to happen as well as a broader public education, public awareness, and water literacy so that more people than those that show up at these meetings, because it’s still a small group compared to the region. More people need to be aware so they can push this policy changes and get the elected officials more motivated to move forward.”

Agency staff members also noted that “there is definitely a grassroots education that needs to happen,” but emphasized additional concern for public perception of green infrastructure projects and water in general. Demonstration projects were promoted as a potential way to alleviate fears and educate citizens on the value of green infrastructure projects. As one agency staff member stated,

“I also hear there’s a real challenge with educating the public that they want to see those canals empty. If they’re full, that means danger. So they freak out and they call the parish and say why is there water standing in the canal, make it go away. So they’re fighting against this public perception of if I see water it’s a threat to me, and I think that’s a real communication challenge that I think a well-planned demonstration project could really help address.”

Overall, the plan is expected to serve as a catalyst for citizen action, shaping public education efforts and citizen perceptions, while inspiring and guiding citizen action to influence the implementation of green infrastructure projects and policies. However, as architects and agencies mainly argued for public participation in terms of education and advocacy, equity issues arise in relation to recognition, process, and procedure (Agyeman, 2013). Citing Schlosberg (2014; 2007), Agyeman (2013) notes that “just treatment involves recognizing people’s membership of the moral and political community, as well as providing for the capabilities

needed for their functioning and flourishing, and ensuring their inclusion in political decision-making” (p. 39). As some low-income communities and neighborhoods of color worry that place-making initiatives will “foster gentrification, further diminishing their rights and roles in the community” (Agyeman, 2013, p. 97), equity in terms of recognition and process become interdependent with promoting equitable outcomes. Agyeman’s (2013) case studies, including the Dudley Street Neighborhood Initiative, highlight place-making efforts “focused *explicitly* on shared narratives of equity, justice, and, ultimately, just sustainabilities” (p. 163). These values should be explicitly practiced as architects, agencies, and advocacy groups continue to consider the region’s green infrastructure projects and policies. Recognition will require an expansion of the general public’s involvement from simply receiving education and advocating for the plan’s implementation, to actively working to ensure just and equitable implementation of green infrastructure concepts, however this takes shape in individual communities and neighborhoods.

## **Toward a Sustainable Future for Green Infrastructure Development: Issues and Recommendations**

**Introduction.** Tensions and challenges in the implementation of green infrastructure projects and policies revealed in interviews reflect several concerns highlighted by authors in the literature review chapter of this thesis. Similarly to the inherent tensions and challenges in sustainability goals of environmental protection, economic development, and social equity noted by Campbell (1996), agency staff members emphasized competing goals as they considered green infrastructure at the individual project or agency levels. As Campbell (1996) argues, planners usually represent one particular goal of sustainable development, while neglecting the other two goals. Agency staff members provided similar stories in interviews, describing the limited goals of their agencies in implementing green infrastructure projects. As promoted by

many staff members, a broader perspective of the array of potential benefits of green infrastructure would be necessary in order for agencies to increasingly collaborate and invest further in green infrastructure projects, as all benefits are generally not visible at the agency or project level or do not accrue specifically to the implementing agency. Similar to what Campbell (1996) describes in his model for “Merging the substantive and procedural,” with planners employing a combination of substantive visioning and negotiating skills to create win-win situations for meeting sustainability goals (p. 432), a broad-visioning green infrastructure planning body would have the capacity to maintain a focus on larger goals of sustainability while coordinating the actions of individual agencies. This model would also support planning for issues of justice and equity which may be more likely to be overlooked as individual agencies consider green infrastructure projects and policies.

Related to this issue, an increased focus on equity in green infrastructure planning—both through outcomes and process-- will be vital in meeting sustainability goals as various actors continue to coordinate projects and policies. As environmental and economic goals are being considered, planners and agencies should not neglect equity concerns, whether surrounding quality jobs, affordability, or public participation. Architects’ and agencies’ framing of equity through protection and amenities; framing of public participation through citizen education and advocacy; and prioritization of environmental goals when considering the implementation of regulatory measures, have the potential for obscuring equitable outcomes and processes. Regarding equity, not all residents will see their quality of life as being enhanced by place-based sustainability initiatives, as efforts may be seen as portraying a privileged viewpoint, may follow a history of non-consultation in communities, or be perceived to portend gentrification (Agyeman, 2013). Additional measures will be necessary to ensure equitable outcomes and

processes in green infrastructure planning, with explicit focus on preserving affordability and involving residents as leaders in the development of projects and policies. Further, equity through recognition, process, and procedure are also vital and should be seen as interdependent with creating just outcomes (Agyeman, 2013). As residents have thus far had limited opportunity for involvement in green infrastructure planning, architects, agencies and advocacy groups should actively involve residents as leaders in planning and implementation in the future as processes continue. Finally, regulatory measures implemented without supportive government intervention also have the potential to promote unjust outcomes (Agyeman, 2013). As the plan emphasizes the avoidance of demographic shifts and changes in culture and character in the region, an increased focus on equity in these areas will be vital to ensuring the just development and implementation of green infrastructure projects and policies.

**Recommendations.** The plan analysis, agency and advocacy group interviews, and review of planning literature conducted for this case study suggest several planning and policy recommendations to increase the overall sustainability of green infrastructure planning and implementation. These include the implementation of a planning structure for making visible the array of green infrastructure's potential benefits for a variety of agencies at the parish and regional levels, as well as an increased focus on equity in green infrastructure planning and implementation. In taking these needs into account, the region, individual parish and city governments, agencies, and advocacy groups would come closer to reaching goals of environmental protection, economic development, and social equity described in the concept of sustainable development.

First, almost all interviewees noted that the creation of a planning and administrative infrastructure for green infrastructure would be vital in the region's continuing efforts to

implement green infrastructure and its concepts promoted in the Greater New Orleans Urban Water Plan. Agencies emphasized the importance of the creation of planning and administrative bodies at both the parish and regional levels to organize the multiple actors and agencies required to collaborate on green infrastructure projects. The creation of an administrative infrastructure would support city and parish governments in seeing the variety of environmental, economic, and social benefits of green infrastructure implementation, many of which are not visible or not practical at a project scale. This green infrastructure planning body would be an overall facilitator to the implementation of green infrastructure, able to maintain focus on larger goals of environmental sustainability, social equity, and economic development. In playing this role, the agency should draw on a diverse array of leadership, including community and advocacy groups, residents, and agencies involved in green infrastructure implementation. There is a strong potential for these groups to play an important role in green infrastructure leadership going forward, serving to increase equity as well as community confidence in planning processes.

Further, in the overseeing of green infrastructure implementation, an increased focus on equity is vital to achieving the goal that all citizens to benefit from green infrastructure and the plan's proposals. First, as the plan proposes that a majority of economic benefit will be seen through jobs and development, it is important to examine the quality and permanence of jobs that will be created. Jobs which pay a living wage, provide health coverage, and are long-term are preferable to those which pay low wages and are temporary in duration. Implementation of wage and quality standards for all green infrastructure jobs and contracts would support the equity component of sustainable economic development.

Another important aspect when considering equity is maintaining affordability in areas experiencing green infrastructure development. Although agencies argued that extensive vacant

land exists in the city, and that therefore people would not be pushed out of areas experiencing increased development due to green infrastructure, they did perceive green infrastructure development as providing neighborhood amenities that would potentially raise property values. Plan architects in particular emphasized that the canal retrofits proposed in the plan would increase the amount of waterfront property in the region, making areas ripe for increased development. In neighborhoods where large projects such as canal retrofits are proposed, affordability measures should be put in place which allow current residents, renters, and business owners to stay in place and benefit from the proposed projects. These measures could include partnerships with community land trusts and the development of affordability measures for rental housing and existing small businesses in affected neighborhoods.

An additional concern with affordability surrounds the issue of how costs for green infrastructure implementation are passed to citizens. In the application of regulatory measures such as stormwater fees and zoning ordinances, low-income residents and small business owners may face financial hurdles preventing them from implementing green infrastructure projects that would provide long-term cost savings. In this way, the implementation of regulatory measures could actually serve to increase inequality, as low-income residents unable to afford to retrofit their properties in order to reduce their stormwater fees would end up paying more, and small business owners who are unable to pay the additional costs of stormwater planning may face difficulties in growing their businesses. Additional programming and incentives supporting low-income residents and small business owners in the implementation of green infrastructure projects would increase the fairness of cost distribution. Programs could include assistance for low-income residents in retrofitting their properties to alleviate the burden of new stormwater fees and assistance in stormwater planning for businesses under a certain size. Some of these

programs could be implemented by community-based organizations, but local governments also has a significant role to play, as they will be responsible for the regulations and should have a stake in increasing equity.

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Although green infrastructure plans and policies are often well-intentioned, the goals of environmental protection, economic development, and social equity they promote can be challenging to bring to fruition. Difficulties in achieving these broad goals can be further exacerbated if the full range of costs and benefits of projects and policies, and to whom they incur, are not fully perceived. The above recommendations represent examples of actions that could be taken at the parish, city, agency, and community levels to ensure that the complete array of costs and benefits are perceived by actors at a broad level, and to increase equity in the implementation of projects and regulations. The suggested measures could work together to reinforce each other. For example, the green infrastructure planning body's role of bringing together agencies, while supporting a collaborative process around economic costs and benefits, could also support the implementation of measures to increase equity, affordability, and access to the benefits of green infrastructure for all residents. It is the hope that this research will serve as a call for further examination of these issues as the region, government agencies, community groups, and individuals work to implement green infrastructure projects and policies promoted by the Greater New Orleans Urban Water Plan. Further research could serve to detail how policies and programs would be structured as well as demonstrate the costs and benefits of implementation and non-implementation of specific policies and programs to increase sustainability in green infrastructure implementation.



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# Appendix

## Interview Guide:

### Interview Questions for Waggoner and Ball Architects:

- Can you talk about the plan's major impacts?
- What are the major obstacles to implementing aspects of the plan?
- How has the plan's process informed its content?
- Describe the planning process in creating the water plan.
- Describe the public participation element of the plan.
- Describe the plan's environmental goals.
- Describe the plan's goals in relation to economic development.
- Describe the plan's goals in relation to social equity.
- Are there any conflicts between these varied goals? What has worked well in addressing these conflicts?
- How do you see the plan being implemented?
- What was the role/ freedom of the firm in creating the plan? How much freedom did the firm have in determining the planning process?

### Interview Questions for Agency Staff members:

- How does the agency plan to implement green infrastructure concepts promoted by the water plan?
- What are the agency's goals in implementing these projects?
- Describe the agency's environmental goals in relation to green infrastructure.
- Describe the agency's economic development goals in relation to green infrastructure.
- Describe the agency's goals for social equity in relation to green infrastructure.
- What are the economic benefits and challenges to implementation?
- What are the benefits and challenges for social equity for implementation?
- What are the environmental benefits and challenges for implementation?
- What has the role of the agency been in plan development?
- What is the agency's current role and timeline for implementation?
- How do you view major challenges to implementation for the agency?
- How do you see the purpose of the plan?
- How do you see the plan's economic development goals? What are the challenges to achieving them?
- How do you see the plan's goals for social equity? What are the challenges to achieving them?
- What are some current and future plans for collaboration with other agencies/ groups for implementation? Are there any resulting challenges?

**Interview Questions for Community/ Advocacy Groups:**

- What is your perception of how the plan/ green infrastructure planning will affect your group or neighborhood?
- How do you see the planning process and public involvement?
- How were you involved in the planning process? How did the group's involvement affect the plan?
- What is the importance of the plan/ green infrastructure for the group/ neighborhoods?

## VITA

Jessica Fisch was born in Tallahassee, Florida, where she grew up interested in the complex relationships between cities, people, and the natural environment. She obtained Bachelor's degrees in geography and journalism from the University of Florida in 2008. After graduation, Jessica worked in Seattle and New Orleans in positions with City Year and Habitat for Humanity. She began the Master's program in Urban and Regional Planning at the University of New Orleans in the fall of 2012 and has continued to work in neighborhood revitalization and planning through positions at Broad Community Connections and Burk-Kleinpeter, Inc., during her time at the University of New Orleans.