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Parcel-Level Green Stormwater Management Policy: What New Orleans Can Learn from Philadelphia's Parcel-Based Utility Fee

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Abstract

The Greater New Orleans Urban Water Plan promotes the ideology of integrating green infrastructure into the City's water management strategy to cultivate resiliency. In order to develop enough green infrastructure to have a significant impact on the hydrological functioning of the area, New Orleans officials are investigating different options for encouraging property owners to manage their stormwater on-site. Philadelphia Water Department's parcel-based stormwater utility fee has been offered as a model for working within the constraints of the municipal government's regulatory authority to increase the water retention capacity of individual properties. This thesis provides an analysis of Philadelphia Water Department's stormwater utility policy and offers recommendations to other cities, like New Orleans, that are considering adopting a similar policy in their jurisdiction.

Key Words: Environmental Planning, Hazard Mitigation Planning, Land Use Planning, Greater New Orleans Urban Water Plan, Philadelphia Water Department, Parcel-Based Stormwater Utility Fee, Green Infrastructure, Decentralized Stormwater Management, Property Rights

Chapter 1

Introduction

New Orleans currently finds itself in the midst of a dangerous predicament. While residents of the Crescent City have been tempting fate for more than two hundred years, the consequences of living below sea level and developing hazard-prone areas with little regard for the surrounding natural environment are becoming increasingly apparent. This reality was highlighted as a result of devastation caused by Hurricane Katrina in 2005, which left hundreds dead, displaced hundreds of thousands, and flooded nearly all of the city, causing billions of dollars in damages. Yet, while many people would like to attribute the destruction caused by Katrina to the forces of nature, the reality of the matter is that human activities played a significant role (Laska, 2014). Regionally, the wetlands that have historically buffered New Orleans from the full force of hurricane storm surge have been disappearing at alarming rates due in large part to the impacts associated with human interventions such as the creation of the Mississippi River Gulf Outlet – or MRGO – and the exploratory drilling activities of oil and gas companies in vulnerable wetlands (Freudenburg, Gramling, Laska, and Erikson, 2009). Consequently, According to NOAA senior scientist Tim Osborne, New Orleans finds itself located in the middle of "the fastest disappearing delta in the world," losing between 25 and 30 square miles of land annually (2014). Within the city itself, the practice developing on hazard-prone land has left many homes and businesses susceptible to flooding and subsidence (Burby, 2006). On top of that, take the threat of global climate change and its promise of sea level rise and increasingly frequent and severe storm events, and the situation becomes increasingly bleak. These considerations have led many concerned observers to pose the logical question: How will New Orleanians be able to adapt to continue living in this environment?

If there is a silver lining to be found in this grim situation, it is that it has forced New Orleanians to wrestle with the question of creating a more resilient community capable of coping

with these types of shocks and continuing on relatively unaltered (Walker &Salt, 2012). As a result of this questioning, people have come to recognized the true and vast nature of the problem, one which is rooted in a tangled-web of interrelated problems (multi-problem), spanning numerous disciplines (multi-dimensional), and pertaining to activities at various levels (multi-scale) (Hommes, 2008). Therefore, if New Orleans is to become a truly resilient city that can withstand shocks, it must address the issues relative to all of these concerns. This way of thinking has gradually seeped into the consciousness of New Orleanians, inciting many individuals and organizations to action in an attempt to begin to address the various issues underlying this multifaceted problem.

In the midst of the gathering momentum centered around resiliency, Waggonner and Ball Architects in conjunction with Greater New Orleans, Inc. unveiled the New Orleans Urban Water Plan in the fall of 2013 promoting the ideology of Living With Water (2013a). This plan attempts to account for the characteristics of the region's natural geography, and proposes a multi-faceted approach to managing New Orleans' water resources through the creation of a vast green infrastructure network throughout the city to bolster the capacity of existing grey infrastructure. In order to accomplish this drastic reimagining of New Orleans' built environment, the plan proposes a series of multi-dimensional policy and action interventions ranging from the small scale (lot and block level) to the mid-scale (district and sub-basin level) to the large scale (basin and regional level).

One of the components of this plan recommends the extensive development of green stormwater management network at the parcel-level as a means of maximizing the water retention capacity throughout New Orleans' watershed. The plan details several different types of green infrastructure that property owners could feasibly implement on their parcels, while also offering a menu of policy and regulatory interventions local authorities might utilize in order to encourage or require private property owners to adopt such measures. By tapping into the

potential of many individual parcels of land, the city can hope to greatly expand its stormwater management capacity. However, the plan goes on to point out that it can be difficult to devise a strategic policy that works within the confines of the local context, as well as one that does not infringe on property owners' rights. To this end, the plan further recommends that the City engage the public in the process of devising a water management policy that will eventually govern private properties so as to avoid pitfalls associated with these limitations and create a functional policy that will work for New Orleans.

Fortunately for New Orleans, there are other cities in the United States that have already gone through the process of devising a water management policy geared toward implementing green infrastructure on private properties. One city in particular that has caught the attention of New Orleans officials is Philadelphia. In this city, the Philadelphia Water Department (PWD) is currently in the process of restructuring its stormwater management utility fee in such a way as to incentivize the creation of green stormwater management interventions on private properties throughout the city. As a result of the interest in Philadelphia, this thesis will look at the experience of the Philadelphia Water Department in the development and implementation of its parcel-based stormwater utility fee in order to determine how New Orleans might successfully replicate such a program locally.

Purpose of the Study

New Orleans officials are currently considering the prospect of adopting a stormwater utility fee similar to the one developed in Philadelphia. In particular, they are interested in the potential benefits this sort of utility fee might offer with regards to the creation of green stormwater infrastructure on private properties, thus augmenting the capacity of the City's current drainage infrastructure while also achieving a number of goals laid out in the proposed Urban Water Plan relating to subsidence, flood risk, and resilience. In light of such a prospect, it is important to examine the experience of PWD in order to see what they did well, as well as the

areas that their policy development and implementation could be improved upon. This thesis analyzes the case of Philadelphia Water Department's stormwater management utility fee, examining how the PWD went about creating an effective policy that was simultaneously functional and legal.

As the foundation of the analysis, this thesis draws upon concepts from the realms of sustainable stormwater management, legal precedent, and planning theory as the basis of its case. This thesis structures the analysis based on these criteria for the simple fact that the preponderance of existing literature related to policymaking appears to be centered around these concepts. In this way, this thesis will attempt to provide a holistic understanding of the multifaceted issues in question. The research questions guiding this thesis attempt to address the aspects of the policymaking equation related to legality and function, and are as follows: (1) How did the Philadelphia Water Department develop a policy that addressed the legal concerns related to property owner rights and municipal regulatory authority? (2) How does Philadelphia Water Department use the parcel-based stormwater utility fee and its ancillary programs to work property owners to adopt on-site green stormwater management practices?

Chapter 2 begins the thesis with a general overview of the literature related to the topic. This section includes: background information on development patterns in New Orleans and the Urban Water Plan, a discussion of green infrastructure and its role in sustainable stormwater management, and a brief history of contentious and evolving relationship between property rights and the government's authority to regulate in the United States. Chapter 3 presents the methodology justifying and structuring the investigation of the research questions. Chapter 4 provides an overview of the development and implementation processes of PWD's parcel-based stormwater utility fee. Chapter 5 breaks down the analysis of the case study into its various components, discussing each of the research questions individually. Chapter 6 provides recommendations to New Orleans officials as they continue to entertain the idea of developing a

similar stormwater utility fee locally. Finally, Chapter 7 offers some concluding remarks and suggestions for additional research.

Chapter 2

Introduction to the Literature Review

The objective of the literature review is to provide the theoretical and practical basis upon which Philadelphia Water Department's experience in developing and implementing the parcel-based stormwater utility fee can be analyzed in order to inform the formation of a similar policy in New Orleans. The ultimate goal of this exercise being that, in demonstrating the inherent links between the literature and what has unfolded in Philadelphia, the thesis can lend credence to its recommendations for New Orleans in order to help City officials devise a strategy for implementing this sort of stormwater policy that will meet the needs of the city while remaining within the confines of the law. Therefore, following the overview of the history of water management practices in New Orleans and an introduction to the Urban Water Plan, this thesis delves into the literature related to green stormwater management and land-use law. It should be noted from the outset that the information included in the literature review is intended to provide the basis of analysis to adequately answer the stated research questions. Thus, the information that follows highlights the facets of land-use law and green stormwater management as they pertain to stormwater management policy. It is hoped that the literature review in conjunction with the case study will illustrate the balance that must be struck between government intervention and private property interests in order to arrive at a successful stormwater management policy. The conclusion of the literature review provides a synthesis of the information to highlight this dualistic nature.

History of Water Management and Development Patterns in New Orleans

For as long as people have been living in New Orleans, they have been struggling to manage the water resources in and around the city. This is due primarily to the natural geography of the area (Figure 1). To the north, the city is bounded by the brackish waters of Lake Pontchartrain, while the Mississippi River makes up the city's southern boundary. Historically, the area between these two bodies of water was comprised of a mixture of wetlands and lowlands, broken intermittently by a series of natural ridges that resulted from centuries of sediment deposited along the river banks by seasonal flooding. These ridges, being the only areas of natural high ground, were also the only areas naturally dry enough to accommodate human settlement. As such, human development remained confined to these ridges for the first two hundred years of the city's existence.

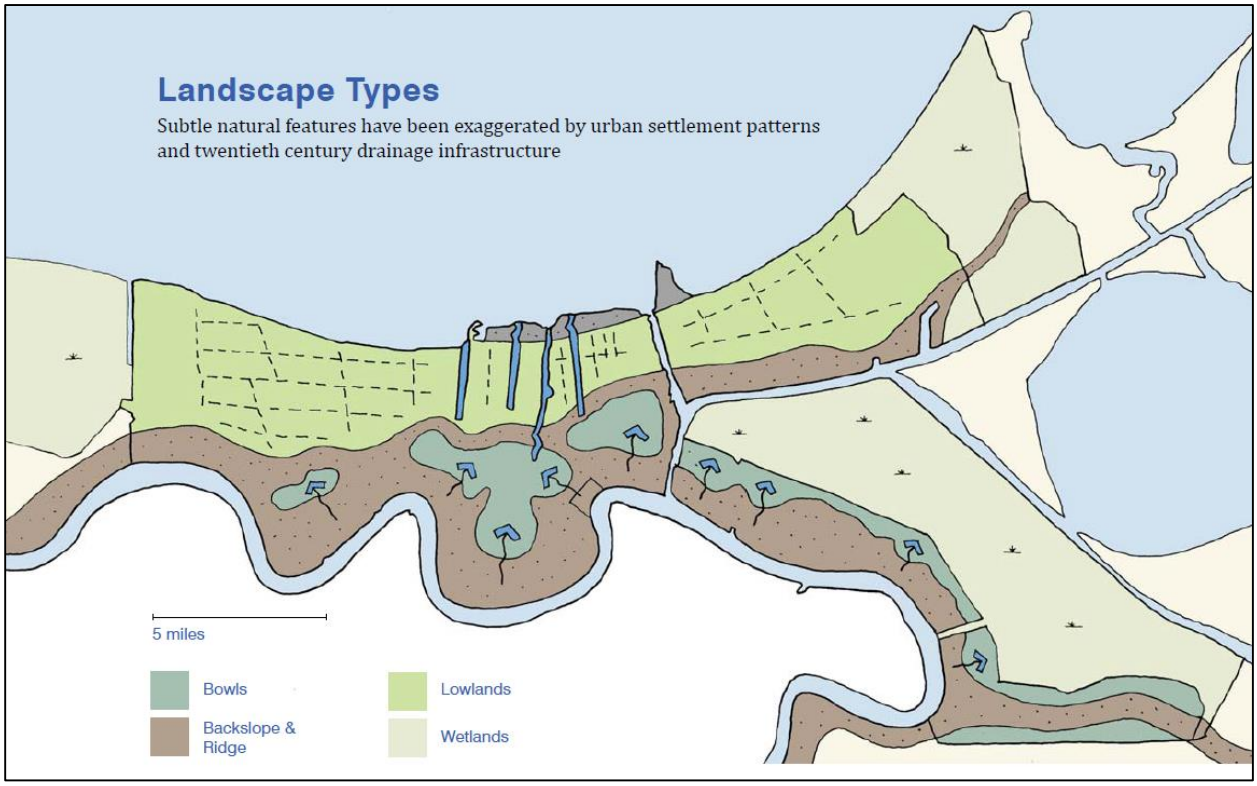

Figure 1: New Orleans Natural Geography (Source: New Orleans Urban Water Plan, 2013a)

Yet, even when confined to these locations of natural elevation, the surrounding waters still represented a source of constant conflict for the human element living in their midst. Despite being situated on high ground that was typically dry, these areas were not immune to the threat of flooding. Residents were still subjected to the seasonal springtime floods that overtopped the riverbanks as well as flooding brought about by heavy rainfall events, which are a common occurrence in the region during certain seasons. To mitigate the effects of these flood events, residents dug gutters, drainage ditches, and canals in an effort to store and remove the excess water (Campanella, 2008). Artificial levees were also constructed to keep out storm surge from neighboring bodies of water. Additionally, as constant flooding was an inevitable reality for certain areas, many people opted to build their homes on piers, lifting their structures further above the damaging threat of flood waters. In this way, the residents of New Orleans managed the threat of flooding for nearly two hundred years, acutely aware of the water surrounding them.

With the passage of time, the residents of New Orleans devised more complex and technologically advanced methods of managing the surrounding waters. The beginning of the twentieth century saw New Orleans benefiting from innovations such as the formation of the Drainage Advisory Board in 1893, followed closely by the invention of the Wooden Screw Pump (Campanella, 2008). Both of these advances greatly increased the City's capacity to deal with the threats posed to its residents by the surrounding waters. The crux of the City's strategy for managing its water resources was to remove ground and stormwater from inside the city by any means possible. Since human development was threatened by excessive water surrounding the city, removing the water from the environs seemed like the ideal solution. Beyond that, this new technology was so powerful that it also made it possible to drain the wetlands that once surrounded the city, opening up a vast amount of new land for development that was previously uninhabitable (Campanella, 2008). Advances such as these set the tone for the ensuing

patterns of development in the New Orleans area. Over the course of the next century, the alteration of the natural landscape in the areas surrounding New Orleans continued in order to make room for additional human settlement. The city's footprint rapidly expanded beyond the ridges to which it had clung for centuries. Vast expanses of wetlands, bowls, and lowlands were drained and backfilled in order to make "new land" to build on (Seed, 2006).

Moreover, in the late 1960s Congress enacted the National Flood Protection Act, resulting in the creation of the National Flood Insurance Program (NFIP). In effect, this federal program provided additional support to individuals looking to develop hazard-prone tracks of land, offering financial assistance to help property owners recover in the wake of disasters when structural mitigation measures proved insufficient (Burby, Nelson, and Sanchez, 2006). Ultimately, these various structural and non-structural interventions encouraged a large number people in the New Orleans area to settle vast tracts of land that are located in areas of disproportionally high flood risk, believing that the City's water management strategy would provide sufficient protection from natural elements, and, when these defenses proved inadequate, at least their losses would be mitigated by fail-safes such as the NFIP.

Despite this confidence in the power of technology to overcome the limiting forces of nature, this approach to managing ground and stormwater in New Orleans has been ineffective. For one, the practice of constantly removing water from the ground serves to destabilize the local soils, especially in areas with fine-grain soil compositions such as those located in places that were once swamps or marshland (Dunbar & Britsch, 2008). This destabilization leads to subsidence, or sinking land, as the sediment deposited by the river dries and becomes increasingly compact. According to one study conducted post-Hurricane Katrina, the average rate of subsidence within the New Orleans levee system is 6.4 mm per year, with some rates as high as 33 mm annually (Figure 2) (Dixon, 2006). This is significant for two reasons. First,

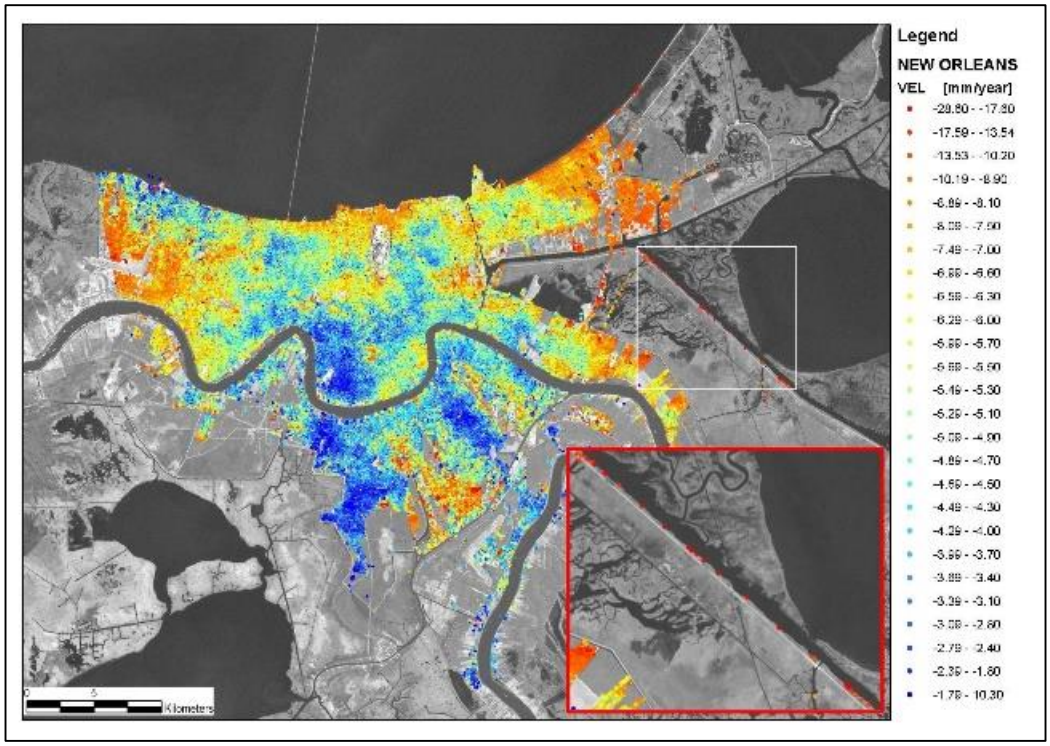

Figure 3: Annual Subsidence Rates in New Orleans, 2002-2005 (Source: NASA, 2006)

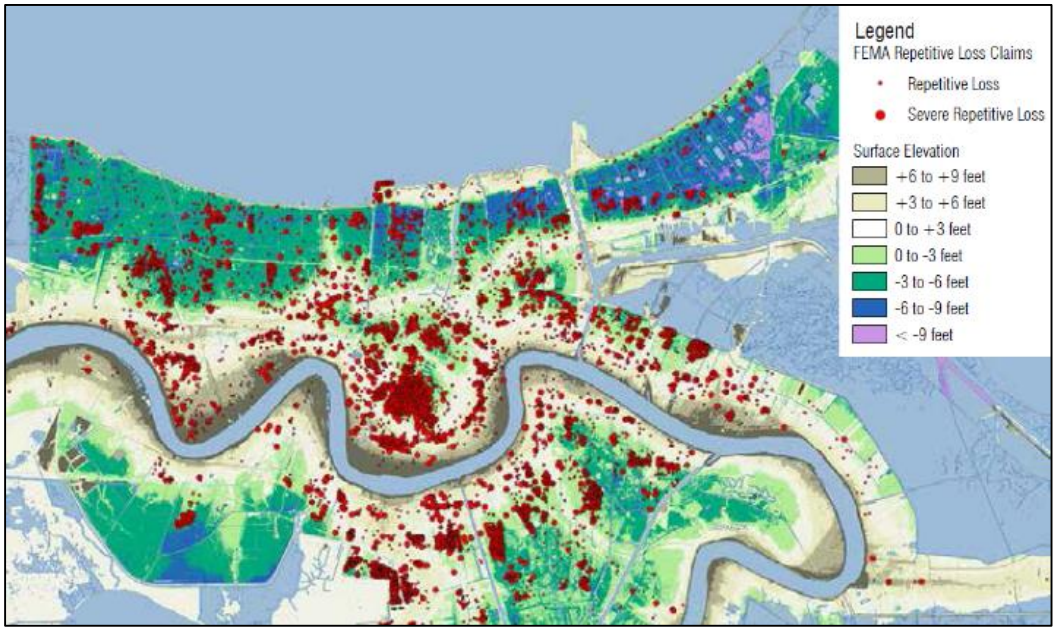

Figure 2: FEMA Repetitive Loss Claims – Greater New Orleans Area
(Source: Urban Water Plan, 2013b, p. 37)

unstable soils wreak havoc on infrastructure. Some of the negative and costly effects of subsidence include the formation of potholes and uneven roads, breakages of water and gas lines, and the deterioration of building foundations. If left unchecked, it is estimated that the New

Orleans area could experience in excess of $2 billion in subsidence-related damages over the course of the next 50 years (Waggonner & Ball, Architects, 2013b). Moreover, subsidence also increases the city's vulnerability to flooding, which is already high. Figure 3 shows the locations of Repetitive Loss and Severe Repetitive Loss properties throughout the city, illustrating just how severe the threat of flooding is in New Orleans. Flood risk in New Orleans has always been directly linked to the city's elevation relative to neighboring bodies of water. As the land continues to sink and the elevation drops closer to – and in many instances further below – sea level, the area will become increasingly vulnerable to flooding (Driessen & Van Ledden, 2012).

In addition, local and regional human activities have contributed to the significant loss of wetlands in the area. Within the city, this is due in large part to the fact that substantial portions of wetlands were drained and filled to make room for human settlement (Burby, Nelson, & Sanchez, 2006). In one respect, development of these areas increases vulnerability simply because it diminishes the natural buffer zone that wetlands provide New Orleans as protection against storm surge. On the other hand, not only does the development of wetlands reduce the amount of protection for existing communities, but it also increases the area of human development requiring protection, thus exacerbating the problem further.

At the regional level, there have been a number of manmade impacts that have contributed substantially to the loss of wetlands. For one, measures taken to control the flooding of the Mississippi River have prevented the occurrence of the natural processes that serve to replenish wetlands with sediment. Without this constant source of replenishment, wetlands and barrier islands have been eroding at an alarming rate (Penland & Ramsey, 1989). Furthermore, the entrepreneurial activities of economic and political "growth machines" have played a significant role in wetland deterioration across Southern Louisiana (Freudenburg, Gramling, Laska, & Erikson, 2009). Whether in the name of facilitating shipping access to the Mississippi River, as with MRGO, or searching for oil and gas reserves, the carving up of Louisiana's

coastal wetlands by industrial interests in the second half of the twentieth century allowed salt water to invade wetland areas, killing off salt-intolerant plants and destroying the natural ecosystem (Freudenburg, Gramling, Laska, & Erikson, 2009). These sorts of human activities have dramatically reduced the total area of wetlands in the region. This is of vital importance considering that wetlands serve as a natural buffer which protect the city from the destructive floods caused by hurricanes and storm surge. As this buffer has receded over the years, the city's vulnerability to flooding from storm surge has increased.

While these issues are currently a major threat to the safety and wellbeing of New Orleans residents, the additional impacts of global climate change will likely increase flood risk even further in the future. Since the late 1980s, organizations such as the Intergovernmental Panel on Climate Change have been warning the world about the implications of excessive greenhouse gas emissions and the necessity of mitigating these emissions to reduce the degree of human influence on global climate change (Intergovernmental Panel on Climate Change, 2014). However, many experts now agree that, regardless of our efforts to decrease greenhouse gas emissions and mitigate the effects of global climate change, some degree of climate change is inevitable (Bedsworth & Hanak, 2010; Quay, 2010). Among other things, this means that seasonal precipitation levels are going to increase and mean sea level is going to rise (NASA, 2014). As a low-lying coastal city with drainage issues, any change in precipitation or sea level has serious implications with respect to New Orleans' flood risk. Moreover, as Basolo (2010) points out, the city's traditional approach to managing stormwater and mitigating flood risk is just not working. She says,

> The future of New Orleans is uncertain at this point. Throughout its history, the city has flooded and the response has been higher levees and more sophisticated engineering. The engineering response has been no different post-Katrina. Of course, raising the levees and strengthening flood walls in the past have not eliminated disaster. In fact, the city has many conditions that suggest

> disaster cannot be averted in the long term; the city is subsiding, so increasing the height of the levees makes New Orleans a deeper bowl susceptible to filling with water; pumps are expected to remove water from the city, but can fail due to fatigue and storm effects; the erosion of wetlands between the Gulf of Mexico and the city makes New Orleans more vulnerable to hurricanes; and climate change due to global warming increases the threat of catastrophic hurricanes. (p. 110-111)

In effect, the current approach to managing the city's water resources has encouraged the development of hazard-prone areas without the ability to adequately account for the ensuing risk. Based on this understanding, the City needs to reevaluate its methods of managing ground and stormwater in order to address these concerns related to subsidence and flooding while also creating an urban environment that is capable of adapting to the threat posed by climate change.

The New Orleans Urban Water Plan

In the years following Hurricane Katrina, there were a number of attempts to establish a more sustainable and resilient approach to managing New Orleans' water resources. However, many of these initiatives were met with a great deal of community opposition, particularly from the residents of the most flood-prone areas of the city, who were generally distrustful of city officials and saw these efforts as a threat to the existence of their communities (Fields, 2009). Then in 2013, Greater New Orleans, Inc. in tandem with Waggonner and Ball Architects, along with the support of the Louisiana Office of Community Development-Disaster Recovery Unit and the US Department of Housing and Urban Development, published a promising proposal for the Greater New Orleans Urban Water Plan. This plan is centered around the idea of embracing the water resources that define the Greater New Orleans area, integrating water into the urban design of the city in a way that supports "stable soils and ecological health, as an important resource for industry and growth, and as a basic element of the region's culture and quality of

life” (2013a, p. 23). This plan proposes to integrate natural elements – especially water –into the fabric of the city throughout the entirety of the urban environment. By creating an extensive network of green water management amenities, ranging in scale from individual property retrofits to the construction of large circulating canals and integrated wetlands, the plan aims to increase retention capacity across the watershed in order to more effectively and efficiently manage ground and stormwater. The rationale behind this plan is derived from the Dutch model of water management (Figure 4) introduced to New Orleans official as a result of the Dutch Dialogues, a series of meetings between New Orleans and Dutch water management officials and politicians (Meyer, Morris, & Waggonner, 2009). In essence, the Dutch model of stormwater management works first to slow the progression of water down the watershed, allowing the water to be stored and used, and only drained when absolutely necessary (Waggonner & Ball Architects, 2013a). Advocates of this plan claim that intelligently integrating these elements into the urban design of the city will directly address the issues of subsidence and flooding while also creating a more resilient New Orleans that is increasingly capable of managing the threats posed by climate change.

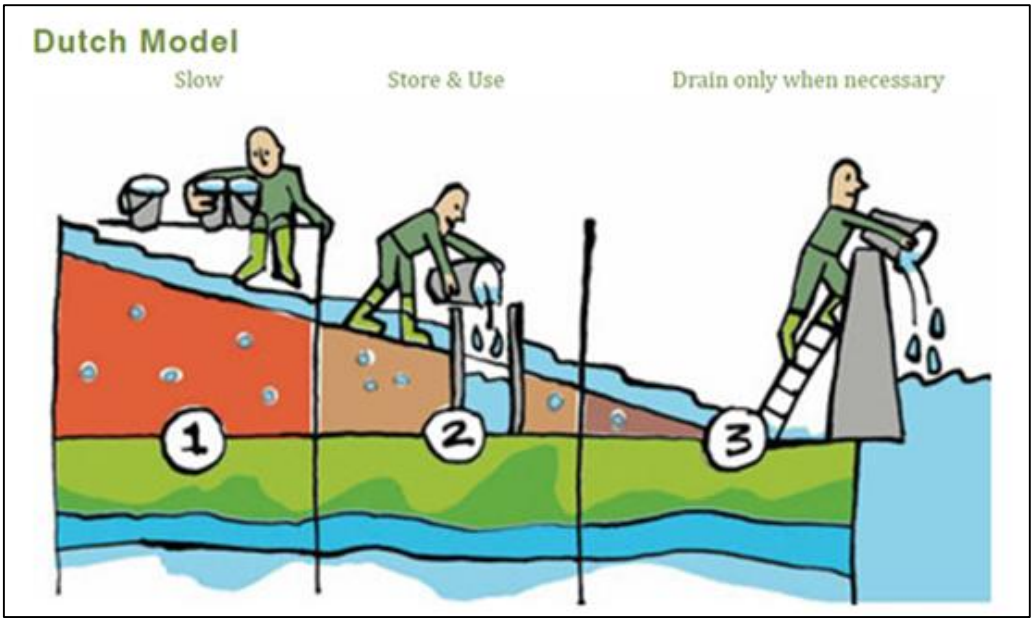

Figure 4. Dutch Model of Water Management
(Source: Waggonner & Ball Architects, 2013a)

One of the major components of this plan is its proposition to engage private property owners as partners in the development of an extensive green infrastructure network to assist in water management activities. According to this plan, the City should employ regulation and/or incentive programs to encourage or require all private property owners to increase the water retention capacity on their property (Waggonner & Ball Architects, 2013b). Among other goals, these programs should seek to decrease the amount of impermeable surfaces across the watershed, increase the amount greenery, and get residents and business owners to install different amenities that serve to store stormwater, like rain gardens. Broadening the scope of actors involved in the stormwater management program beyond the public sector dramatically increases the ability to develop retention capacity in the watershed. This is essential given the nature of the proposed strategy, which depends heavily upon utilizing large amounts of property from all parts of the city. By bringing private property owners into the fold, New Orleans greatly increases the amount of land that is potentially at its disposal.

However, while the Urban Water Plan recommends that New Orleans adopt some sort of policy framework to develop green stormwater infrastructure on private property, it does not specify what such a program should look like. Instead, it offers a list of tools that city officials could consider utilizing, including stormwater utility fees, grants, public/private collaborations, awards and certificates, rebates, and a number of other regulatory options, to encourage the implementation of green interventions such as planting new trees, constructing bioswales and rain gardens, installing rain barrels, and replacing impervious pavement with pervious groundcovers to name a few (Waggonner & Ball Architects, 2013b).

The overview of New Orleans' historic approach to managing its water resources and subsequent development patterns illustrates the necessity of revising the City's water management policies. This thesis focuses on this issue as it relates to parcel-level interventions.

The remainder if this thesis is dedicated to examining the scientific and legal considerations that must be accounted for in the development of a policy governing stormwater management on individual parcels.

Green Infrastructure and Decentralized Stormwater Management

In the interest of devising a green stormwater management policy that is functional, it is important to have a basic understanding of the science behind green infrastructure. Broadly speaking, green infrastructure refers to the strategic approach of utilizing elements of the natural environment so as to tap into the benefits of ecological processes and functions to the benefit of human populations as well as the natural environment (Nickel et al., 2014; Mayer et al., 2012). At a basic level, these elements are comprised of things like trees, shrubs, soils, and other types of vegetation as well as water features which occur naturally in the environment (Nickel et al., 2014; Environmental Protection Agency, *What is Green Infrastructure?*, 2014). However, these individual elements can also be manipulated by humans to create more complex constructions such as green roofs, green facades, rain gardens, bioswales, permeable pavements, and a number of other green creations that are specifically designed to take advantage of the many benefits these natural elements offer (Keely, 2011; Nickel et al., 2014). Further, some experts emphasize the importance of defining green infrastructure as a large-scale, interconnected network comprised of these various green elements (Llausàs & Roe, 2012; Mayer et al., 2012). This is based on the understanding that the various components of green infrastructure are only able to have a significant ecological impact on the surrounding environment when used in concert throughout a given area.

For a long time, green infrastructure was viewed through a one-dimensional lens. Young (2011) states that, in the past, urban greening projects were typically seen as beautification efforts and were considered primarily of aesthetic value to the community. This assumption has played a significant role in fostering the general belief that greenery in the urban environment is

a luxury and not a necessary amenity. This belief is perpetuated by the fact that open spaces and greenery are typically located proximal to communities of higher socio-economic status (Brueste, 2008). Moreover, Wolf (2005) points out that many people often overlook the value of the natural environment and its contributions to issues of livability and quality of life in their community. As a result of this undervaluation of the utility of green infrastructure in the urban environment, the size and quality of green amenities have steadily decreased in US cities in the latter half of the 20th century (Husqvarna, 2012).

However, over the course of the past two decades, increased attention has been given to green infrastructure and the numerous additional benefits it can provide in an urban context. Recent research points to green infrastructure as "an important strategy for providing public goods and increasing resiliency while reducing ecological footprints and social inequity in metropolitan areas" (Young, 2011, p. 368). Similarly, Deak & Bucht (2011) argues that the percentage of green space, and especially trees, in an urban area is directly linked to its ecological performance. He goes on to say that developing networks of green infrastructure that are informed by natural landscapes and hydrology can be used to successfully manage the negative effects of urbanization and achieve sustainable land use. The research of Fratini, Elle, Jensen, & Mikkelsen (2012) supports these claims, pointing to scientific evidence that suggests green infrastructure's capacity to mitigate the effects of urbanization, such as urban heat islands, increased runoff volumes, and loss of biodiversity, more efficiently than strategies that focus on grey infrastructure alone. Young (2011) argues that the development of green infrastructure at the metropolitan level "should be considered part of a city's fundamental infrastructure" (p. 377).

Pertaining specifically to stormwater management, green infrastructure and decentralized stormwater management go hand in hand. This is due to the ability of natural elements to absorb and use rainwater, slowing its progress through the watershed.

Concentrations of greenery, whether in nature or developed settings, have been shown to significantly reduce runoff volumes (Whitford, 2001). In turn, reduced runoff leads to a reduction in flooding, combined sewer overflows, and surface water pollution. Urbanization, the expansion of impervious surfaces, and the reduction of vegetative land cover in an area have significant implications for the hydrological and ecological functioning of that area. According to Fletcher et al. (2011), these factors diminish the ability of the landscape to retain water and slow its progress through the watershed as runoff. Whereas in pre-development scenarios it would require an excessive amount of rainfall to generate a substantial amount of runoff, in the urban context where impervious surfaces expedite the conveyance of runoff to receiving water bodies, even small rainfall events (>1mm) are enough to generate runoff. This creates an environment that is more susceptible to flooding, especially during heavy rainfall events.

Traditionally, cities rely on combined sewer systems to manage urban stormwater. These complex networks are typically designed to collect stormwater along with sewage and wastewater and transport it to water treatment plants, which treat the water before discharging it into a nearby water body or sending it back to residents' faucets. However, this presents a number of issues. For one, during particularly heavy rainfall events, runoff volumes can exceed the capacity of these systems to manage all of the water coming in. Thus many combined sewer systems are designed with release valves which allow excessive untreated water to be discharged from the system, resulting in a combined sewer overflow (CSO). When this happens, stormwater along with human and industrial waste, toxic materials, and debris are released into neighboring bodies of water. This is a major contributor to water pollution in municipalities that rely on combined sewer systems (Environmental Protection Agency, "Tapping Green Infrastructure to Curb Sewer Overflows," 2013). Additionally, this manner of dealing with stormwater can be expensive because all of the water collected in combined sewer systems must be treated. According to Anderson, Gatton, and Shaehan (2013), the amount

Figure 5: Alexandria, VA Decentralized Green Stormwater Network
(Source: City of Alexandria, 2009)

local governments in the United States have been spending on water treatment has been steadily increasing since the 1950s, capping out at more than $111 billion nationally in 2010. The report concluded that this method of dealing with our water resources is unsustainable in the long run and that alternative methods of water treatment are needed.

Decentralized stormwater management is an alternative or supplementary approach to managing stormwater which aims to increase the water retention capacity throughout a watershed, utilizing many small-scale interventions to capture rainwater where it falls (Water Environment Research Foundation, 2007). The central idea is that, if rainwater is captured where it falls and its progress through the watershed is impeded, allowing natural processes such as evaporation, infiltration, and transpiration to occur, there will be less runoff as a result. Figure 5 demonstrates how an interconnected network of green infrastructure capable of

retaining a significant amount of stormwater can be created across a watershed in order to reduce the volume of runoff generated. When used in tandem with traditional grey stormwater management infrastructure, this reduction in runoff translates to lower flood risk, less water entering the sewer system, and fewer CSO events.

Concepts for decentralized stormwater management strategies are often informed by predevelopment landscapes and natural hydrological functions of an area, taking advantage of natural processes to manage water. Consequently, in the realm of stormwater management, green infrastructure can be used to enhance the capacity of urban landscapes to promote the storage, infiltration, evapotranspiration, and reuse of water (Fratini et al., 2012). In effect, the development of a network of small-scale, decentralized green interventions throughout a watershed helps to reverse the large-scale negative effects of urbanization and impervious surfaces and restore the natural hydrological functioning of an area (Burns, Fletcher, Walsh, Ladson, & Hatt, 2012; Deak & Bucht, 2011). The promotion of these processes and functions across the urban watershed serves to reduce stormwater runoff, ultimately reducing the frequency and volume of direct stormwater discharges, instances of combined sewer overflow, the volume of water that requires treatment, and pollution of receiving water bodies (Spatari, Yu, and Montalto, 2011; Green, Schuster, Garmestani, and Thurston, 2012). Additionally, it should be noted that using decentralized green infrastructure to manage stormwater is a more cost-effective approach than using grey infrastructure alone (Spatari et al., 2011; Green et al., 2012). Due to the nature of these small-scale intervention strategies, they represent an ideal strategy to managing stormwater that could feasibly be implemented on private parcels.

The information presented in this section represents an overview of the scientific principles at the heart of the New Orleans Urban Water Plan. Based on this understanding, any policy which aims to promote the integration of green infrastructure into the stormwater management activities of a municipality must emphasize the importance of widespread

participation on properties throughout the watershed if it hopes to have a significant impact on an area's ecological performance. Moreover, the literature highlights the need to educate the community about the utility of urban greenery beyond its aesthetic value. By increasing awareness of the multifaceted benefits of green infrastructure, residents and city officials will come to see green infrastructure not as a luxury item, but as necessary amenities that are vital to the wellbeing of their communities. Moving forward, this thesis examines how Philadelphia Water Department accounted for these consideration in the development of its parcel-based stormwater utility fee and how these lessons might be applied in the New Orleans context.

Property Owner Rights and Municipal Authority to Control Land-Use

Generally speaking, regulations are put in place to mitigate negative externalities that result from market failures. These regulations seek to identify the causal root of the externality and change individual and/or organizational behaviors so as to create positive outcomes for society as a whole (Coglianese, 2012). Initial regulatory efforts with respect to land-use were primarily oriented toward societal problems presented by public housing, overcrowding, and sanitation. However, over the course of the past century, municipal authorities have expanded the application of private land-use controls to account for other issues facing urban populations, including environmental concerns, infrastructure development, and stormwater management (Fishman, 2012).

The battle over land-use regulation in the urban environment in the United States is largely defined by the legal cases centered around the practice of zoning. In 1916, New York became the first US city to adopt a comprehensive zoning ordinance (Stenning, 2008). Modeled after a similar practice developed by the Germans, this system regulated the height and bulk of built structures while also restricting the use of a given tract of land. The primary aim of this regulatory framework was to keep incompatible uses, such as houses and factories, separate while also protecting for residents' health and wellbeing. The constitutionality of this regulatory

practice was challenged in the 1926 Supreme Court case Village of Euclid, Ohio v. Ambler Realty Co., in which the Court upheld the municipal authority to regulate land-use in order to ensure the public health, safety, morals and welfare of the community (272 US 365, 1926). Subsequently, the federal government published the Standard Enabling Acts in order to promote this sort of land-use regulation throughout the United States (United States Department of Commerce, 1926). Zoning remains the primary method of land-use control in the United States. A municipality's authority to regulate land use stems in large part from this initial legal precedent.

Yet, there is a delicate balance that must be struck so as to uphold the rights of property owners while simultaneously promoting for the common good. In the American experience, land-use law has primarily been shaped by three amendments to the United States Constitution. The first of these is the Fifth Amendment, which states, "nor shall private property be taken for public use without just compensation" (US Constitution. Amend. V). This amendment protects landowners from both physical and regulatory takings without being reimbursed for the value of the lost property. With respect to the types of takings, physical takings refers to the actual seizure of land while regulatory takings refers to the lost ability to enjoy land as a result of regulation. However, the Fifth Amendment is tempered by the Tenth Amendment, which delegates police power to the states in order to protect the health, safety, welfare and morals of the public (Daniels, 2014). Subsequently, states turn a certain degree of power over to local governments, which forms the foundation of municipalities' claim to authority under this delegated police power. Local governments are able to exercise this police power to restrict the use of private property through the adoption of laws such as zoning ordinances and subdivision regulations. The intrinsic conflict that exists between the Fifth and Tenth Amendments has been the subject of much legal debate. This fact is evident in the central arguments of Euclid v. Ambler and are discussed further in the following paragraph. Finally, the Fourteenth

Amendment has also been applied to the issue of property rights consistently, guaranteeing all citizens due process and equal protection under the law (US Constitution. Amend. XIV). In the realm of land-use law, due process entails that government authorities must follow certain procedures, such as informing the public about hearings and meetings, which allow citizens to participate in the dialogue around the formation of land-use policy (Daniels, 2014). Additionally, equal protection prohibits discriminatory practices and "ensures that governments treat all citizens and like-situated properties similarly" (p. 44).

Over the past century, US courts have continuously returned to these legal precepts in order to discern the appropriate boundary between property rights and governmental authority. Private property owners often claim that the government oversteps its bounds, adversely impacting the ability to enjoy their land. The term regulatory taking was coined as a result of the Pennsylvania Coal Company v. Mahon US Supreme Court case, which ruled that, when government regulation "goes too far" and thus significantly diminishes the value of a property owner's land, the action is deemed a taking and must be compensated (260 US 393, 1922). Subsequent Supreme Court cases have gone on to further articulate the limitations of government regulation, stating that regulation: cannot deny economically viable use of a property (Lucas v. South Carolina Coastal Council*,* 505 US 1003, 1992), cannot force a property owner to accommodate a non-governmental use (Loretto v. Teleprompter Manhattan CATV Corps., 458 US 419, 1982), cannot be arbitrary nor capricious (5 U.S. Code § 706), and must demonstrate an essential nexus and rough proportionality to the associated negative externalities (Nollan v. California Coastal Commission, 483 US 825, 1987; Dolan v. City of Tigard, 512 US 374, 1992). More recently, the US Supreme Court case of Koontz v. St. Johns River Water Management District further articulated the dynamic of this relationship, placing the burden of proof on regulating authorities to scientifically and measurably demonstrate the essential nexus and rough proportionality (568 US, 2013*)*. However, despite this constant

redefinition and re-articulation of the limited ability of the government to intervene on private property, the courts have continually upheld the governmental right to regulate private property, validating practices such as open space requirements and development impact fees (Cosner, 2001). One thing that is apparent from all of this, as Eagle points out, is that "neither property rights nor government powers have been fully defined" (2009). Consequently, local authorities must exercise precaution when attempting to regulate land-use so as to avoid infringing on property owner rights.

Despite the fact that the line between property rights and governmental authority has not been firmly established, there are a number of steps that local authorities can take to gain support for their policies and legitimize their claim to authority. First and foremost, it is of the utmost importance that municipalities link their policies and ordinances to the community master plan and other planning documents that have been adopted with the force of law. According to the State Enabling Acts, the municipal authority to enact legislation is tied to the existence of a master or comprehensive plan. According to Section 3 of the Standard State Zoning Enabling Act, "regulations shall be made in accordance with a comprehensive plan" (United States Department of Commerce, 1926). Haar (1955) states that any regulation that is not made in accordance with the master plan is beyond the authority granted to municipal governments by the enabling acts. Thus, the first step any municipal authority should take when attempting to enact a new policy is to associate the policy objective with the goals delineated in the community master plan. If the policy can be linked to the master plan, this fact alone goes a long way in supporting the authority of the municipality. If the policy cannot be tied directly to the master plan, the authorities need to amend the master plan first and foremost before they attempt to enact the policy in question.

Similarly, municipal authorities can legitimize their authority by connecting their policies to federal and state laws and mandates. Burby & Dalton (1994) points out that federal and state

mandates have been effective tools for mobilizing municipal authorities to take planning and regulatory action at the local level. The reason for this efficacy being that these mandates legally require municipalities to address certain issues. While local authorities typically exercise a great deal of discretion in determining how they will comply, they are able to point to these mandates handed down by the federal and state governments as justification for their actions. Pedersen (2004) supports this rationale, demonstrating that many federal laws, such as the Clean Water Act, are designed to require action at lower levels of government to meet federal standards. However, it is important to note that these pieces of legislation do not dictate the manner by which localities must comply. Consequently, they do not ensure the legality of local compliance measures. Nevertheless, laws and mandates enacted at higher levels of government can be used to validate the adoption of local policies.

Thus, in addition to analyzing the functional aspects of Philadelphia Water Department's stormwater utility fee, this thesis investigates how PWD went about addressing the legal concerns associated with controlling land use presented in this section. This analysis is based on a legal litmus test which addresses the concepts of health, safety and welfare, essential nexus, rough proportionality, and scientific and measurable conditions. Moreover, this thesis looks at how PWD linked the restructuring of the stormwater utility fee to the comprehensive plan and other pieces of legislation as a means of justifying the policy action.

Conclusion of the Literature Review

This chapter demonstrates the multifaceted nature of the developing and implementing an effective stormwater management policy. In addition to achieving the obvious goal of developing a functional policy that is feasibly implementable, policymakers must also be cognizant of the legal ramifications of the policy. This reality if reflected by the research questions this thesis is attempting to answer regarding the Philadelphia Water Department's parcel-based stormwater utility fee. With respect to the question of legality, this thesis uses the

legal precedents described previously in this chapter as a means of illustrating how the parcel-based stormwater rate satisfies the criteria mandated by US constitutional law and legal precedent. Moreover, this thesis examines how PWD linked this policy reform to preexisting legislation in order to provide additional justification for the policy action. Finally, this thesis draws upon all of the existing literature presented in this chapter to provide recommendations that can help facilitate and improve upon the implementation process of a stormwater policy similar to PWD's in other municipalities, such as New Orleans.

Chapter 3

Methodology

The goal of this thesis is to perform a case study of Philadelphia Water Department's parcel-based stormwater utility fee, particularly focusing on the legal and functional aspects of developing and implementing this sort of policy. It is hoped that the examination of this case study may provide other cities that are interested in replicating this program with a certain degree of insight as to how they can implement and use this tool to engage private property owners in the development of green stormwater management in their municipalities. In particular, this thesis is interested in applying the lessons from this case study to New Orleans, Louisiana, a particularly hazard-prone city which is currently investigating its own stormwater management options in light of issues related to flood risk, subsidence, and climate change. This is a critical question for investigation because, while the proposed New Orleans Urban Water Plan recommends the development of policies that encourage or require private property owners to adopt green stormwater management practices on their properties, there is still a great deal of uncertainty as to the best way to go about making this happen. Thus, this thesis examines Philadelphia Water Department's effort in developing and implementing a parcel-based stormwater utility fee in the hopes of providing some sort of guidance for policy makers as they attempt to plan for the precarious future of New Orleans.

Case Study Design

The following sections will investigate the single-case study of the parcel-based stormwater utility fee administered by the Philadelphia Water Department (PWD), which aims to encourage the development of green stormwater management infrastructure on private properties in Philadelphia. This thesis is using the single-case study as a means of researching this topic for a number of reasons. First, Yin (2003) points out that "the case study is preferred in

examining contemporary events […] when relevant behaviors cannot be manipulated" (p. 7). Since this case study is examining a phenomenon that is fairly recent, and with the variables in question being beyond the ability of researchers to manipulate, the only practical way to go about conducting an investigation of the topic is via the case study. Moreover, the case study allows the researcher to cast a net more broadly, accounting for a wide variety of variables, such as contextual conditions, that may have significant implications with respect to the phenomenon in question, though not apparent on the surface (Yin, 2003). This being an exploratory study which attempts to explain *how* authorities in Philadelphia went about implementing the parcel-based initiative, it is necessary to account for a wide variety of variables which may have played a role in arriving at this policy decision. The case study is an appropriate means for administering this type of study. Finally, the single-case study presents the best option for analysis due to the unique nature of the case in question, taken together with the limited availability of data. Yin (2003) states that one of the circumstances under which it is justifiable to conduct a single-case study is when that case represents a unique phenomenon that is worth documenting and analyzing. Philadelphia is not the only city which has implemented a stormwater utility fee geared toward encouraging property owners to implement green stormwater management practices on their parcels. However, Philadelphia is unique in that it has extensively documented the development and implementation process of this parcel-based stormwater utility fee. Given that this case represents an uncommon phenomenon worth investigating, and that other municipalities lack sufficient information upon which comparisons might be drawn, this thesis is constrained to the single-case study. However, in order to legitimize the findings of this case study, this analysis will draw connections between the information presented in the literature review and Philadelphia Water Department's parcel-based stormwater utility so as to make reasonable conclusions and recommendations.

Case Study Selection

Beyond the fact that there is limited data available on the topic, Philadelphia's parcel-based stormwater utility fee is the focus of this case study because New Orleans has demonstrated a great deal of interest in this program. Waggonner and Ball (2013b) refer to this utility fee in the Urban Water Plan as a policy of particular interest that New Orleans should consider replicating. Since the publication of the Urban Water Plan, New Orleans water management officials have started a dialogue with the Philadelphia Water Department and plan to visit Philadelphia later this year to observe the impacts of the parcel-based stormwater fee on the urban environment (Dahme, 2014). Moreover, the Sewage and Water Board has publically stated it is investigating the possibility of adopting a similar policy locally (Kaplan-Levenson, 2014). This strong interest led to the selection of Philadelphia's parcel-based stormwater utility fee as the central focus of this case study.

This case study offers the opportunity to examine how Philadelphia went about working with property owners to devise and implement its parcel-based stormwater utility fee in order to tap into the benefits of urban greenery via the creation of a green stormwater management infrastructure network on private properties. This thesis attempts to systematically lay out the experience of the Philadelphia Water Department throughout this process in order to demonstrate how it was able to balance functionality and legality throughout the development and implementation process.

Research Questions

1) How did the Philadelphia Water Department develop a policy that addressed the legal concerns related to property owner rights and municipal regulatory authority?

2) How does Philadelphia Water Department use the parcel-based stormwater utility fee and its ancillary programs to work property owners to adopt on-site green stormwater management practices?

Data Collection

The information used to perform this analysis came primarily from two sources. First, the thesis is primarily based on reports and policy documents made publically available through the web sites of the Philadelphia Water Department and the City of Philadelphia. This forms the foundation for the analysis. In addition, in order to supplement the information made available through these sources, two phone interviews with staff members from the Philadelphia Water Department, one with the General Manager of Public Affairs, Joanne Dahme, and the other with the Manager of Public Education Programs, Drew Brown will be used to supplement the information provided in the reports and policy documents. Interviews lasted roughly an hour and were recorded. This thesis applies the various concepts presented in the literature review to the information gathered from these sources in order to answer the stated research questions and help understand how the Philadelphia Water Department went about developing and implementing its parcel-based stormwater utility fee so as to promote both functionality and legality.

Chapter 4

History of Stormwater Management Fee

The City of Philadelphia has a long history in the field of public stormwater management. Dating as far back as the 1880s, the Philadelphia Water Department (PWD) has been charging the residents of Philadelphia for the provision of stormwater management services (Philadelphia Water Department, "Handout 2: Historical Background," 2011). Up until 1968, this fee was embedded in a blanket water and sewer charge that covered everything from the provision of water to wastewater and stormwater management. At this point, technological advances allowed PWD to transition away from this rudimentary method of administering the water utility, and the Water Department began to base the fee on a parcel's water meter size. However, while the water meter is an effective tool for measuring the amount of water a property uses, there is little correlation between meter size and the amount of stormwater runoff generated by the parcel. Consequently, a small portion of Philadelphia's property owners that used large or multiple water meters ended up paying stormwater fees disproportionate to the amount of runoff their properties generated (Dahme, 2014). In particular, this affected properties such as hospitals, apartment complexes, and condominiums, which require numerous large water meters to serve their clients. At the same time, another segment of the property owning population whose properties contained small water meters, or no water meter at all, yet possessed a great deal of impervious surface and generated significant amounts of runoff, paid relatively little, if at all. Warehouses, industrial buildings, and parking lots best exemplify these types of properties.

As a result, in the min-1990s, a contingency of property owners who believed they were paying more than their fair share for stormwater management approached PWD about the possibility of restructuring the stormwater management fee in a way that accurately reflected the runoff-generating characteristics of a parcel (Dahme, 2014). While these property owners

acknowledge the rationale and necessity of the stormwater management fee, they argued that parcel features such as impervious surface, gross area, and groundcover types are more accurate indicators of runoff volumes than the meter-based determination. They simply sought a more equitable method of determining a parcels stormwater management fee.

In response to this request, PWD assembled a group of Philadelphia property owners to form a Community Advisory Committee (CAC) in 1994 (Philadelphia Water Department, "Handout 2: Historical Background," 2011). This committee, composed of stakeholders representing the various residential and non-residential interests affected by the stormwater management fee, was charged with devising an alternative method of determining a parcel's stormwater management rate that is fair and equitable, as well as feasible, for all parties involved. In the end, the CAC formally recommended the PWD transition away from the meter-based charge to a parcel-based charge which would be determined based primarily on two parameters: 1) gross area and 2) impervious area. At the same time, the CAC acknowledge the potential impacts such a shift might have on certain properties – particularly warehouses, industrial buildings and parking lots that previously paid very little. This restructuring of the stormwater rate would likely increase these properties stormwater rates significantly. To account for this concern, the CAC also recommended PWD implement a system of credits, financial and technical assistance, and an appeals process so as to work with these negatively impacted property owners to ease the transition between the meter-based and parcel-based rates, while also providing an avenue for these property owners to reduce their fees in the long term.

Despite these recommendations, PWD was unable to make the transition to the parcel-based billing structure immediately. While the CAC's conclusions were logically sound and equitable, PWD simply lacked the data and technological resources to administer such a fee in the late 1990s (Philadelphia Water Department, "Handout 2: Historical Background," 2011). In light of this, at the close of the initial CAC planning process PWD pledged to work towards the

implementation of this rate structure as soon as the technology and data were in place, setting the tentative goal for implementation between 1999 and 2002. However, in 2002 neither the data nor technology was sufficiently in place to administer the parcel-based fee for all properties in the Philadelphia sewer service area. However, in an effort to begin the transition to the new rate structure, PWD moved all residential properties to the parcel-based billing system. Since there is little variability between residential parcel characteristics, at least with respect to the parcel-based rate, PWD applied a flat rate to all residential properties based on the median gross area and median impervious area of all residential properties. Again, PWD renewed its commitment to non-residential and condominium property owners that it would make the full transition to the parcel-based rate as soon as possible.

Implementation and Structure of the Parcel-Based Fee

Finally, in 2008 PWD announced that all of the pieces were in place, and that it would begin the transition to parcel-based fees for all properties in Philadelphia (Philadelphia Water Department, "Handout 2: Historical Background," 2011). As a precursor to the actual implementation of this revised stormwater management fee, PWD dedicated two years to public outreach and education to inform property owners of the transition to the parcel-based rate and the rationale underlying the new fee structure. Over this two-year period, PWD educated residents about the link between impervious surfaces and runoff, and how high runoff volumes lead to elevated levels of pollution, erosion, habitat destruction, and flood risk in the city. They explained that PWD is responsible for managing stormwater and mitigating the negative impacts of runoff, and that the stormwater utility fee is administered for all properties in exchange for the provision of stormwater management services (Dahme, 2014). Finally, PWD informed property owners that the new stormwater rate was being implemented to more accurately reflect the amount of runoff generated by a parcel. In this way, they explained, each property would contribute its fair share to stormwater management activities. The primary source of opposition

to the revised stormwater rate was the general perception that PWD was leveeing a new tax against property owners, which is beyond its authority. This perception was largely due to the fact that the newly structured stormwater fee was separated from the general sewer utility and presented as an additional line on the water bill. During this outreach period, PWD had to reiterate time and again that the stormwater management charge is a user fee like any other utility, and not a tax. Moreover, they informed property owners that the fee was not new, and that Philadelphians have been paying the stormwater fee for more than 100 years.

According to Dahme, the General Manager of Public Affairs at PWD, this two-year outreach and education period was vitally important in generating support for the parcel-based rate structure (Dahme, 2014). While some property owners might not have liked the way their property stood to be impacted as a result of the parcel-based rate, the majority of citizens accepted the legitimacy of the science behind the restructuring. In addition, the outreach activities opened up a dialogue between property owners and PWD, and ultimately played a role in shaping the financial and technical assistance programs that PWD offered to adversely impacted property owners. Despite the fact that these negatively impacted property owners acknowledged the justification for this rate restructuring, that did not change the fact that their rates would increase substantially once the new fee structure went into effect. This period allowed property owners and PWD the opportunity to discuss how the Water Department could provide relief to those that stood to be most impacted by the new parcel-based fee, easing the transition and allowing property owners to take steps to lower their rates. By allowing sufficient time to engage and educate the public about the upcoming transition and entertain property owners' concerns, PWD was able to further legitimize the new rate structure and create a policy uniquely suited to the needs of Philadelphia's property owners.

In order to provide additional legitimacy to the new rate structure, PWD linked the rate restructuring to a number of pieces of legislation at the federal, state, and local levels. At the

federal level, PWD associated the parcel-based billing initiative with the Clean Water Act of 1972 as well as the numerous pieces of legislation stemming from it, including the National Pollution Discharge Elimination System (which regulates point sources that discharge pollution into US waters), the Safe Drinking Water Act of 1974 (which sets standards for the quality of drinking water), and the National Combined Sewer Overflow Policy (which works with state and municipal entities to reduce combined sewer overflow occurrences contributing to water contamination). At the state level, the parcel-based billing initiative has been linked to Pennsylvania Act 167, which mandates that localities across the state prepare and adopt a stormwater management plan for each watershed under their jurisdiction (Philadelphia Water Department, “Mandates”, 2014). Finally, at the local level, the parcel-based rate has been linked to items such as the 2006 stormwater management standard requiring properties larger than 15,000 ft^2 to manage the first inch of rainwater, Greenworks Philadelphia (a six-year plan to transform Philadelphia into the “Greenest City in America”), and Green City, Clean Waters (the city’s 25-year plan to implement an extensive green stormwater management infrastructure network). In some way or another, all of these laws, regulations, or planning documents address developing the stormwater retention capacity within Philadelphia’s watersheds. By linking the objectives of these other pieces of legislation with the aims of the parcel-based utility fee, PWD has been able to further validate the transition to the parcel-based billing policy.

In July of 2010, after completing the public outreach and engagement portion of the implementation strategy, PWD began with the actual transition from the meter- to parcel-based billing (Philadelphia Water Department, "Handout 2: Historical Background," 2011). In accordance with the recommendations of the CAC in the mid-1990s, the parcel-area based fee is calculated based on two parameters: 1) the gross area (GA) and 2) the impervious area (IA) of a given parcel (Philadelphia Water Department, "Handout 3," 2011). However, to account for the additional runoff generated as a result of excessive impervious surfaces on a parcel, each

parameter is weighted differently. Based on the 2010 rate structure, 20% of stormwater management costs are recovered from the gross area charge and 80% from the impervious area charge. Thus, every non-residential and condominium parcel is charged \$0.52 per 500 ft^2 of the parcels gross area, and \$4.14 per 500 ft^2 of impervious cover. In addition, because the rate is structured in a way to recover the costs of performing stormwater management activities alone and does not include administrative fees, an additional fixed administrative fee of \$2.53 has been added to the bill. So the stormwater management rate for a given non-residential parcel is calculated as follows:

($0.52 x GA/500 ft^2) + ($4.14 x IA/500 ft^2) + $2.53 = Stormwater Fee

Here it should be noted that all parcels, residential and non-residential, are calculated based on these parameters. Yet, as before, since there is little variability between the rates paid by residential property owners, residential parcels continue to be charged a flat rate based on the median gross and impervious area figures. The current residential rate is \$13.48 per month.

Further, it is important to note that the shift from meter- to parcel-based rates allowed PWD to begin billing vacant properties as well as properties without a water meter (Dahme, 2014). Under the previous billing system, the owners of these parcels did not have to contribute to the provision of stormwater management, despite the fact their parcels were contributing runoff into the sewer system and adjacent water bodies. In some cases, such as parking lots, these properties were generating a significant amount of runoff. By bringing these property owners into the fold and forcing them to pay their fair share, the distribution of stormwater costs hopes to become increasingly equitable. However, Dahme (2014) remarked that PWD has not been successful to this point in collecting stormwater fees from some of these properties, particularly vacant properties. While the process for handling delinquent utilities is fairly straight forward for inhabited properties (i.e., shutting off the water), it is tricky to take action against the owners of vacant parcels. She stated that PWD did expect to run into this difficulty initially, and

that they have a strategy for encouraging these property owners to pay. Basically, unpaid utility charges are liened against the property and must be settled before the property can be sold. This is a fairly common practice for utility companies.

In tandem with this rate restructuring, PWD has taken a number of steps to reduce the negative impacts felt by certain property owners who experienced significant rate increases as a result of the switch to parcel-based rate. One of the most significant aspects of this transition from the meter- to parcel-based rate has been the gradual phasing-in of the new rates over a four year period, from 2010 to 2014 (Philadelphia Water Department, "Handout 3," 2011). As proposed, the portion of the stormwater charge attributed to the parcel-based fee structure will increase 25% each year, gradually reducing the meter-based portion of the fee. At the end of the four-year period, the fee will be totally comprised of the parcel-based fee. Figure 6 demonstrates the proposed transition. In this way, stormwater management rates will increase gradually, giving property owners a grace period during which they can take steps to implement stormwater retention measures on their property and reduce impervious surfaces, which will ultimately reduce their stormwater fees in the long run (Philadelphia Water Department, Green Guide for Property Management, 2009).

Year	*Existing Meter-based Charge*	*New Parcel-based Charge*
7/1/10 to 6/30/11	75%	25%
7/1/11 to 6/30/12	50%	50%
7/1/12 to 6/30/13	25%	75%
7/1/13 to 6/30/14	0%	100%

Figure 6: PWD's Parcel-Based Rate Phase-In Plan

In addition to this four-year transition period, the Water Department has implemented a variety of assistance programs geared towards helping non-residential property owners implement stormwater infrastructure on their properties and reduce their monthly bills. One of

the most basic services offered by PWD is free technical assistance (Dahme, 2014). This program allows property owners the chance to sit down with a landscape architect who can provide guidance as to the most affordable way they can retrofit their parcels to increase its stormwater retention capacity and lower their bills. In this way, property owners are able to weigh out the long-term financial benefits of performing stormwater retrofits on their property in order to determine the net benefit of taking such measures.

In addition, PWD offered a number of financial assistance programs to non-residential and condominium property owners in the form of credits and incentives. The goal of these programs are twofold. First, these financial assistance measure were put in place to encourage "private property owners to implement and maintain stormwater management practices … to help the City meet its stormwater management goals" (Philadelphia Water Department, "Handout 3," 2011). Additionally, they present property owners the opportunity to reduce their monthly stormwater fees. The difference between credits and incentives is that credits are recurring and can be applied for on an ongoing basis. Incentives are a one-time assistance measure. PWD offered three types of credit: Gross Area Stormwater Credit (GA Credit), Impervious Area Stormwater Credit (IA Credit), and National Pollution Discharge Elimination System Industrial Permit Stormwater Credit (NPDES Credit). IA Credit is awarded to property owners who work with their impervious surfaces to reduce runoff volumes and pollution discharges, either by directing runoff from impervious surfaces to pervious areas for infiltration or taking steps to reduce the runoff volume generated by these surfaces. On the other hand, property owners can receive GA Credit either by demonstrating their parcels' inherent characteristics – such as soil type or groundcover – naturally result in lower runoff volumes (based on Natural Resources Conservation Service Curve Number) or by taking steps to attenuate peak flow runoff levels. Property owners are able to receive up to 100% credit toward both their GA and IA charges. In addition, PWD offers NPDES Credit to industries that

demonstrate they are subject to and in compliance with NPDES permit standards. The NPDES Credit reduces the property owners' stormwater management fee by 7%.

PDW also offered a variety of incentives to property owners to encourage the implementation of additional stormwater management interventions on private parcels. These incentives included green roof tax credits, reduced stormwater plan review standards, fast-track development project review, and the Stormwater Management Incentive Program (SMIP), which is a low-interest loan program to assist property owners with the implementation of stormwater management best practices on their properties (Philadelphia Water Department, "Handout 3," 2011). In addition to these incentive programs, PWD was considering adopting two additional programs at that time: the Stormwater Retrofits Grant Program (which would offer grants to non-residential property owners to assist with the design, construction and implementation of stormwater best management practices on their parcels) and the "Stormwater Pioneers" Recognition Program (which would acknowledge the proactive efforts of property owners that install stormwater management infrastructure on their property) (Philadelphia Water Department, "Handout 14," 2011).

Revision of the Parcel-Based Rate

During the first year of its implementation, it became apparent that there were a number of issues with the parcel-based billing structure that would need to be addressed. This was primarily due to the dramatic stormwater rate increases that numerous non-residential and condominium property owners were experiencing (Philadelphia Water Department, "Meeting #7 Summary," 2011). Despite the 4-year phase-in period, many property owners were having trouble keeping up after just the first year. On the average, stormwater management fees increased $976 annually from 2010 to 2011 (approximately $81.33/month). Roughly 5% of these property owners experienced an annual increase in excess of $3,000 in the first year ($250/month), and 120 saw their rates rise more than $25,000 ($2,000+/month). As a result,

PWD formed a new CAC to address issues related to rate relief, improving credits and incentives, and special ratepayer cases.

The new Customer Advisory Committee was convened in April 2011, and met ten times of the course of the following seven months (Philadelphia Water Department, “Stormwater Fee Customer Advisory Committee Meeting Summary,” 2011). The committee was composed of 21 members representing the interests of educational, governmental, and religious institutions, environmental and business law, industry and manufacturing, real estate and developers, non-profits, and residents in Philadelphia. The mission of this CAC, similar to the first CAC in 1994, was “to provide advisory opinions to PWD on topics related to rate structure, stormwater credits and incentives, and special ratepayer situations to be considered as a part of the Department’s 2012 rate case” (p. 1).

From the outset of the process, PWD did three things to provide a framework for the ensuing productive CAC discussion. First they provided a set of givens that the CAC could not alter (Philadelphia Water Department, “Handout 1,” 2011). These givens acknowledged certain programmatic constraints, such as the fact that PWD would continue to bill for stormwater management services, the rate would continue to be based on parcel characteristics, and that the stormwater utility must continue to be revenue neutral – meaning that the utility would cover all stormwater management costs incurred by PWD. In addition, PWD emphasized that the administration of stormwater rates must stay within the bounds of the law. In an effort to keep discussion within the legal realm, PWD provided a list of guiding principles that the CAC could use as a sort of legal litmus test. This list of principles required that the stormwater fee must be fair and reasonable, be based on demand, not be discriminatory, and demonstrate costs linked to the provision of stormwater services. PWD also stressed the importance of including mechanisms for allowing property owners to take steps to reduce their stormwater fees. In this way, PWD hoped to orient the CAC in a direction that would lead to solutions that were within

their legal limits to implement. Finally, PWD asked the CAC to come up with a list of criteria to which they would like the revised stormwater policy to conform. This exercise helped members of the CAC to identify common goals despite any differences of opinion they may possess. The resulting CAC Criteria list demonstrated that committee members generally wanted to promote the well-being of Philadelphia's residents and businesses. Members also supported policy that encourages the adoption of good stormwater management practices as well as good stewardship of the city's financial and environmental resources. The CAC also emphasized the importance of recognizing property owner investments aimed at reducing their parcel's runoff. In this way, PWD set the tone for the discussion that would take place over the course of the rest of the advisory process.

Once this framework was in place, the CAC began its investigation of the issues in question. Over the course of next seven months, PWD worked with the CAC to devise a strategy for revising the stormwater fee policy to reduce the burden the parcel-based fee structure had placed on certain property owners while simultaneously accounting for the consideration specified by PWD and the CAC mention in the previous paragraph. In order to accomplish this, PWD structured the meeting series so as to tackle each issue (rate structure and relief options, special ratepayer cases, credits, and incentives) individually. The analysis of each issue began with PWD providing members of the CAC with the background information necessary to understand the nuances of the problem. Typically, PWD distributed handouts with information relevant to the topic in question a week prior to the meeting date. In this way, committee members had sufficient time to read over the materials and familiarize themselves with the issue. In addition, PWD often used this as a way to generate feedback from CAC members outside of meetings. Feedback forms, or "Homework," were often included in the packet of informational materials distributed to committee members. By asking members to complete these sheets prior meetings, PWD was able to obtain input from all participants

regardless of meeting time constraints or a participant's willingness to offer their ideas in a group setting.

Within the meetings themselves, PWD dedicated the first portion of the meeting to review the informational materials distributed to committee members. In this way, PWD was able to clarify any questions that members of the CAC might have regarding certain facets of the issue while also getting other members who neglected to review the materials up to speed. Once the committee was sufficiently informed on the topic in question, PWD proceeded to present various possible solutions as well as their potential implications. PWD would then lead the CAC in a discussion of the topic, allowing members to voice their opinions and concerns, ask questions, and propose alternative solutions for consideration. Statements, questions, and ideas voiced by committee members over the course of discussion were extensively documented for the final report. At the end of each meeting, depending on the discussion, PWD would either ask the CAC to formally weigh in on the topic in question, or ask the committee what additional information they required before offering their opinion. In the event that the CAC required additional information, PWD would attempt to provide the necessary information for the next meeting. In this way, PWD worked with the CAC to come up with the best, most-informed solutions possible.

Following the planning process, PWD produced a final document summarizing the input provided by the members of the CAC. In addition to documenting the discussion that took place at every meeting, the final report emphasized the points of general consensus at which the CAC arrived. These areas of agreement were translated into two general categories: themes and recommendations (Philadelphia Water Department, Stormwater Customer Advisory Committee, 2014). The themes address concepts that often times transcended individual issues and could be used to guide future alterations to the structure or administration of the stormwater fee. The first theme that the report mentions is gradualism. The CAC concluded that any changes made

to the stormwater rate structure or credit programs must be implemented gradually so as to avoid burdening property owners unnecessarily. Additionally, the report mentioned the theme of predictability, which recognizes that property owners need to have confidence that rates and credit structures will remain relatively constant. In the absence of predictability, PWD cannot hope to encourage property owners to invest in their property. The CAC further agreed that PWD's obligations must be met, meaning that future policy should be formulated to "further, not hamper, its ability to meet its regulatory and service provision obligations" (p. 1). Finally, the CAC stressed that policy decisions must display strong nexus among rates, rate structure and cost causation are desirable, and decisions must be based upon good science and be technically rigorous. These provisions were included largely to ensure the legality and constitutionality of future policy implemented by PWD.

In addition to these themes, the CAC Final Report offered five concrete recommendations. The recommendations include:

- Reallocation of costs from stormwater to sanitary sewer utility fee of approximately $17 million of FY 2012 costs, in accordance with program, data and engineering drivers.
- Changes to direct dischargers crediting policy, so that direct dischargers on the Delaware and Schuylkill Rivers that have not installed specific on-site stormwater management practices only retain a credit for peak flow control as these sites are not subject to flood protection requirements in accordance with the City's stormwater management regulations.
- Capping of stormwater service charge increases (on a monthly basis) to no more than 10% and $100 from one fiscal year to the next resulting from the parcel area-based transition or because of other policy changes to the credit structure (not related to an annual rate increase).

- Implementation of the proposed incentives described during the incentives meeting. The impacts were not modeled, as costs are included in the current year budget already.
- Restructuring of the credit criteria to address volume control, peak discharge reduction, and water quality factors. The impacts of these changes would be balanced by decreases in credits under the direct dischargers credit program change.

The report further acknowledged the fact that, in addition to these areas of general consensus, there were also many issues on which the committee could not reach a consensus. It explains that, while these disagreements were not included in the summary of the CAC report, they were extensively documented in the individual meeting minutes that were provided as an appendix to the final report (Philadelphia Water Department, Stormwater Customer Advisory Committee, 2014). As such, they could be taken into consideration in the future. Additionally, the report recognized the limitations of the planning process, most notably that the CAC examined each aspect (i.e., rate structure, special ratepayers, and credits/incentives) individually instead of cumulatively. PWD explained that it worked with consultants to translate the discussion on individual topics to account for cumulative impacts.

As a result of the formal recommendations offered by the CAC, PWD made a number of revisions to its stormwater policy. One of the greatest steps taken by PWD to reduce the burden of the parcel-based fee on substantially impacted property owners is the implementation of the Customer Assistance Program (CAP) (Dahme, 2014). The CAP program limits stormwater fee increases for substantially impacted property owners to 10% and $100 on their monthly bill. For property owners who experienced rate increases in excess of this amount, the CAP program allows an extended phase-in period to the full amount determined by the parcel-based rate. For the most negatively impacted property owners, this program extends the phase-in period by as much as 20 to 30 years, allowing ample time for the property owner to take steps toward runoff

reduction and lowering their stormwater fees. However, the vast majority of property owners will make the transition to the parcel-based rate over a much shorter period. Currently, roughly 1,700 customers are eligible for the CAP program.

In response to the CAC's recommendation of offering more incentive programs, PWD has developed three additional incentive programs for property owners to tap into. First, PWD built off of the existing SMIP Loan program and now offers SMIP Grants, which offers significant financial assistance to grantees (up to $100,000 per impervious acre managed) to implement stormwater management interventions, such as green roofs, rain gardens, and porous pavement, on their property (Philadelphia Water Department, Stormwater Management Incentive Program Grants, 2014) Unlike the SMIP Loan program, grantees are not required to pay grants back. In addition, PWD added the Greened Acres Retrofit Program (GARP) to its arsenal of financial assistance programs. GARP provides financial assistance grants to companies and project aggregators for large-scale retrofit projects, usually across multiple properties. This grant provides up to $90,000 per impervious acres managed and has a minimum project size of 10 acres (Philadelphia Water Department, Greened Area Retrofit Program, 2014). Finally, PWD is in the process of implementing the "Stormwater Pioneers" Recognition Program for the fall of 2014 (Dahme, 2014). This program will provide special recognition to property owners who are leading the charge in implementing stormwater management infrastructure on their properties. Recipients' properties can then serve as an example to other property owners attempting to reduce their parcel's runoff and lower their bill. In addition, PWD stated that it is in the preliminary stages of investigating the feasibility of a stormwater credit banking and trading system.

The Water Department has made a number of minor revisions to its credit policy as well (Dahme, 2014). At the suggestion of the CAC, PWD now allows property owners to receive up to 100% credit toward both the IA and GA charges, encouraging property owners to maximize

the stormwater retention capacity of their parcels. In addition, PWD revised the GA Credit to account for the various types of groundcover on a property. Whereas prior to 2012, a parcel's GA Credit potential was significantly impacted by its soil type and did not factor in the retention capacity of various types of open space, the revised GA Credit places increased importance on the type of groundcover. The revised method for determining a parcel's GA Credit break ground cover types into 10 categories (Meadow, Athletic Fields, Porous Turf, Brush, Woods-Grass Combination, Woods, Gravel, Dirt, and Lawns, Parks, Golf Courses, Etc.), awarding more credit for ground cover types with more retention capacity (City of Philadelphia, 2013).

Finally, PWD altered the way it handles properties that discharge runoff directly into adjacent water bodies (Dahme, 2014). Previously, properties that could prove their status as a direct discharger could receive up to a 100% IA Credit for impervious surfaces that drained into neighboring water bodies. The CAC recommended that direct dischargers be granted some form of special consideration as a result of their unique situation. However, they specified that this consideration should not be solely based on their status as a direct discharger, but rather on the measures taken by the property owner to reduce runoff. Consequently, PWD revised their policy to award 10% additional credit with respect to both IA and GA Credits for the measures direct dischargers take to reduce their property's runoff.

Chapter 5

Discussion

The case study of Philadelphia Water Department's parcel-based stormwater utility fee provides a number of lessons that can be extracted and used to assist other municipalities in the development and implementation of a similar policy. This section begins with a legal analysis of the parcel-based stormwater rate based on the constitutional precedents that were offered in the literature review. In this way, this thesis will help to understand how this policy meets the various criteria required by US law, while also identifying any areas that might be potentially problematic. Following this, the thesis will take a holistic look at the implementation process of the parcel-based stormwater utility fee to examine what lessons can be extracted from PWD's experience in order facilitate the implementation of a similar policy in other municipalities.

Legal Litmus Test

Regarding the issue of legality, there are a number of steps that PWD took in order to ensure that the parcel-based stormwater rate stay within the confines of the law. First and foremost, the question that must ultimately be raised is: does the problem of excessive stormwater runoff volumes constitute justifiable grounds for government intervention? This question can be traced back to Euclid v. Ambler and the roots of land-use control as a means of protecting the health, safety, morals and welfare of the community. Based on the understanding that excessive runoff leads to community problems such as elevated flood risk, water pollution, and erosion, the simple answer is yes. However, as Haar (1955) points out in the literature review, this claim must be validated by the comprehensive plan, the document that has been adopted with the force of law, in order to be legitimate. As the case study indicates, Philadelphia Water Department is able to connect the parcel-based stormwater utility rates to a number of

goals laid out in Philadelphia's Master Plan, Philadelphia 2035. In fact, Philadelphia was in the process of developing an updated comprehensive plan at the same time as PWD was developing the parcel-based utility fee. Consequently, PWD was able to work with the City in order to provide the legal basis necessary to support this policy. In numerous sections, Philadelphia 2035 (2011) lists community goals that justify the parcel-based stormwater utility fee, such as section 3.2.1.c, which identifies the importance of creating "policies for development already existing on sensitive lands to lessen impacts on the environment and public safety" (p. 96). Similarly, section 5.1.1.b states the goal to "continue innovative ways to reduce and control stormwater runoff to reduce burden on [the] existing sewer system" (p. 124). Finally, the comprehensive plan explicitly endorses the activities of PWD in section 7.2.3, supporting "stormwater regulations set by Philadelphia Water Department to capture stormwater on site and reduce flooding damage" (p. 150). Establishing these connections to the comprehensive plan provide a solid legal foundation justifying the parcel-based stormwater utility fee.

In addition, the parcel-based rate is founded upon clearly defined and scientifically based parameters. The literature review discusses the legal precedents which have come to shape the dynamic between property owner rights and municipal authority. This discussion reveals that the rules which govern land-use law must not be arbitrary nor capricious, while also demonstrating a rough proportionality and essential nexus to the externality. The rate-determining equation devised by PWD accounts for all of these factors. First, with respect to the question of essential nexus, PWD takes great care to explain the relationship between a parcel's pervious and impervious characteristics and the subsequent runoff generated by that parcel. The doctrine of essential nexus requires that the regulatory agency demonstrate the link between legitimate state interests and the terms of regulation. By identifying stormwater runoff as a major contributor to water pollution, flood risk, and habitat destruction, PWD successfully

validates the claim that stormwater management and runoff reduction are legitimate interests. Further, the equation reflects the reality that all parcels generate runoff, yet impervious surfaces generate significantly more runoff than pervious surfaces (which is evidenced by the Impervious Area coefficient being four times greater than the Gross Area coefficient). As a result, the parcel-based rate legitimizes the practice of charging parcels with greater impervious cover for the additional burden they place on the stormwater management system.

Moreover, the restructured stormwater rate is designed to be revenue neutral and charges every parcel based on the calculated costs for managing its stormwater relative to the cost of providing the service. This understanding supports the claim that the parcel-based rate is linked and roughly proportional to the service being provided. Furthermore, since the parameters upon which the rate is determined are more or less the same with regard to all properties, this protects against any claim of PWD being arbitrary and capricious. Even the justification for special ratepayer cases, which receive slightly different treatment under the restructured rate, are based on scientific fact and far from arbitrary. Finally, while the implications of the recently decided Koontz v. St. Johns River Water Management District remain to be seen, the requirement espoused by this decision that essential nexus and rough proportionality must be both scientific and measurable are satisfied in this rate structure. Thus, by developing a clear rate structure that is based on sound scientific principles, PWD ensured that the revised utility rates would remain within the confines of the law.

The parcel-based stormwater utility rate further validates its legality in that it does not require property owners to implement stormwater management interventions of their parcels. As a result of Loretto v. Teleprompter Manhattan CATV Corps. the Court decided that government regulation cannot force a property owner to accommodate a permanent physical occupation on their land, and that any government action that does so constitutes a regulatory taking and requires compensation (458 US 419, 1982). Instead, the parcel-base rate offers property

owners a choice. On the one hand, they can opt to pay the stormwater utility fee at the rate that is initially set for their property without taking any action to reduce the runoff generated by their property. Conversely, they also have the option of taking steps to manage their stormwater on-site in order to reduce their stormwater bill. While the policy is structured so as to encourage property owners to adopt on-site stormwater management measures, the choice is ultimately up to the property owner.

One area in which the parcel-based stormwater fee becomes less clear is as it relates to the economically viable use of the land. There is no denying that this rate restructuring has placed a significant financial burden on certain property owners which could feasibly threaten the profitability of their business. This is especially true for businesses such as parking facilities and warehouses. These property owners could justifiably argue that the restructuring of the stormwater utility fee and the resulting rate increases denies them the economically viable use of their land. However, being that the parcel-base rate offers property owners a variety of mechanisms for reducing their rates, through both Gross Area Credits and Impervious Area Credits, it is just as valid an argument to contest that there are measures these property owners can take to reduce the runoff-generating characteristics of their parcels and reduce their stormwater fees. Moreover, PWD offers property owners a number of financial and technical assistance programs to ease the transition to the parcel-based rate and is working with significantly impacted property owners to help them reduce their stormwater fees. Given that the parcel-based stormwater policy provides the possibility of reducing rates to manageable levels and offers property owner assistance to achieve this, this policy does not deny all economically viable use of the property and seems to remain within the limits of the law.

The parcel-based stormwater fee also experienced a significant amount of criticism from property owners regarding some of the credit and incentive programs that rewarded property owners for characteristics inherent to a parcel that were beyond the ability of the owner to

control. The most notable example of this is the Gross Area Credit, which used soil type as a significant metric for determining how much credit a property owner could receive. Based on this method of determining how much GA Credit a property qualified for, properties that possessed soils with greater absorption capacity were able to receive more credit regardless of any measures the property owner took to manage runoff (Philadelphia Water Department, "Handout 13," 2011). Property owners complained that credit programs should focus on the measures taken to manage stormwater runoff on their parcel instead of the inherent characteristics of the property that are largely out of their control. PWD responded to this criticism by revising the methodology for calculating a parcel's GA Credit, shifting the emphasis from soil types to groundcover types. In doing so, PWD has encouraged property owners to take proactive steps to modify their properties' groundcover characteristics so as to improve its hydrological functioning in order to receive GA Credit toward their stormwater fee. While a number of credit and incentive programs still offer rate reductions for a property's inherent characteristics, PWD is moving in the direction of programs that emphasize property owner actions that improve the hydrological functioning of their parcel.

Lastly, it is important to note how PWD related the goals of the parcel-based stormwater policy to various pieces of legislation at the federal, state and local levels. As indicated by Pederson (2004) and Burby & Dalton (1994) in the literature review, while this does not guarantee the legality of a locally-developed policy, it does provide a certain degree of validation of the goals the policy is trying to achieve. Thus, by connecting the parcel-based stormwater utility fee to the goals laid out in other policies such as the Clean Water Act, the Safe Drinking Water Act, NPDES, and the National Combined Sewer Overflow Policy at the federal level, Pennsylvania Act 167 at the state level, and Green City, Clean Waters and Greenworks Philadelphia at the local level, Philadelphia Water Department further increased the legitimacy of the parcel-based utility rate.

Observation for Implementing a Functional Policy

Philadelphia Water Department's experience in developing and implementing the parcel-based stormwater utility fee offers a great deal of insight to other municipalities that are looking to adopt a similar policy locally. In a general sense, the lesson of this case study is that a stormwater management policy that aims to engage property owners in the creation of a decentralized green stormwater management network must simultaneously work toward the widespread adoption of green infrastructure while also working within the means of property owners. On the one hand, if the point of the policy is to facilitate the broad adoption of green infrastructure throughout the watershed, it is pointless to implement a stormwater utility policy that does not effectively motivate property owners to develop green stormwater management infrastructure on their parcels. On the other hand, a strict policy requiring the adoption of on-site green stormwater infrastructure that is beyond the ability of property owners to implement and local authorities to administer also misses the point. Thus, as PWD's experience demonstrates, the ideal structure of the stormwater utility fee is one which effectively encourages the mass adoption of green stormwater infrastructure throughout the watershed with the agency administering the program working with property owners to achieve this goal.

One aspect of PWD's approach to stormwater management that is important to recognize is that it forces all properties to contribute to stormwater management activities. Under the former utility rate structure, properties without a water meter, such as parking structures and vacant lots, did not contribute in any way to the provision of stormwater management services. However, the parcel-based utility rate corrected this shortcoming, and now all properties are paying their fair share to support stormwater management activities in Philadelphia. At the very least, this means that there are 25,000 additional properties contributing financially to the provision of these services. However, due to the nature of the parcel-based stormwater utility rate and the incentive mechanisms that have been put in place

to encourage property owners to implement on-site stormwater management interventions, this also creates 25,000 additional potential locations for green stormwater infrastructure to be implemented. This is significant in light of the information presented in the literature review, which emphasizes that green infrastructure must be broadly adopted if it is to have a substantial effect on the ecological performance of an area. By including all property owners in stormwater management activities, PWD increased the potential effectiveness of the parcel-based stormwater utility fee.

Moreover, due to the general increase in many property owners stormwater rates coupled with the opportunity to receive rate reductions via on-site stormwater management measures, this policy will likely encourage many property owners to implement green stormwater infrastructure on their properties in order to receive reductions on their utility fee. This is especially true for large properties with a high degree of impervious groundcover, which experienced the greatest rate increases as a result of the transition to the parcel-based utility fee. Previously, the owners of these properties had no incentive to reduce the amount impermeable surface on their land. However, since property owners are now charged based on site-specific characteristics, properties with a significant amount of impervious coverage have a strong incentive to adopt on-site stormwater management measures in order to make their stormwater utility bill more manageable. In this way, the parcel-based stormwater utility fee targets properties that generate the greatest volumes of runoff and provides a strong incentive for them to retrofit their properties. Yet, as the case study illustrates, the burden placed on property owners must be accompanied by various financial and technical assistance programs on behalf of the regulatory agency if the policy is to be feasible. Otherwise, many property owners simply will not be able to cope with substantial rate increases.

Consequently, it is equally important to the success of such a policy that the regulatory authorities charged with implementing a similar stormwater utility fee in their jurisdictions work

with property owners on an ongoing basis. In Philadelphia, while the vast majority of property owners recognized the legitimacy of the logic underlying the transition to the parcel-based stormwater rate and generally agreed upon its fairness, they likewise acknowledged the potential hardships that this transition could place on certain property owners whose rates would increase substantially as a result. Thus, in order to protect property owners from substantial rate increases and allow sufficient time to retrofit their properties, the first CAC recommended PWD phase in the restructured stormwater utility rate over the course of four years. In addition, the CAC emphasized the necessity of offering various financial and technical assistance programs to property owners to assist them through this transition period. However, once PWD began the transition to the parcel-based rate, it became clear that certain property owners were still significantly impacted by the new rate structure and that adjustments to the implementation strategy were necessary. Subsequently, PWD reconvened the CAC to determine how best to revise the parcel-based stormwater utility and the ancillary programs to adequately assist property owners through the transition period. This second series of CAC meetings resulted in the creation of several assistance programs which capped rate increases for significantly impacted properties and expanded financial assistance and rate reduction opportunities to further ease the burden of transitioning to the parcel-based rate. In this way, PWD's experience demonstrates the difficulty of developing a perfect transition strategy from the start, and that it is necessary to maintain open lines of communication with property owners to understand how they are being impacted by the restructured utility fee as well as the ways in which the regulating agency can adjust their strategy to assist property owners in making the transition successfully.

In addition, this case demonstrates that assistance programs are a critical component of the transition strategy moving toward the implementation of the parcel-based stormwater fee. Arguable the most important of these programs is the Customer Assistance Program, which

offers extended phase-in periods for significantly impacted properties experiencing rate increases of greater than 10% and $100 on their monthly fee. This program caps annual rate increases for qualifying property owners at 10% and $100 on their monthly fee, allowing them additional time to transition to the new rate, in certain instances over the course of 30 years or more. These property owners can then use this extended phase-in period to make and implement plans for managing stormwater on-site. Roughly 1,700 – or 2% – of Philadelphia's 76,000 non-residential properties qualify for this program (Dahme, 2014). Additionally, property owners have been taking advantage of PWD's Stormwater Management Incentive Program (SMIP) grants and low-interest loans to assist in making the transition. To date, PWD has approved 36 SMIP grants and loans totaling $3.5 million. The projects funded by the SMIP program will result in 205.5 greened acres to help manage stormwater within the Philadelphia sewer system (Dahme, 2014). These sorts of programs which provide assistance to significantly impacted property owners are essential to counteract the financial burden incurred as a result of the restructured parcel-based stormwater utility fee. Without the assistance of these programs, the transition would be much more difficult for property owners and would likely drive many out of business.

Finally, in order to ease the administrative burden of assessing a unique utility fee for every parcel, PWD chose to assess the nearly 275,000 residential properties across Philadelphia differently from non-residential and condominium properties. The rationale behind this is that it is unfeasible for the Water Department to assess a unique fee for all of the more than 350,000 properties across the city. Such a task is impractical due to the personnel and time constraints of the department. Moreover, PWD points out that, when it comes to size and impervious coverage, the vast majority of residential properties are similar, and would pay more or less the same utility fee as a result. In light of this fact, PWD charges residential property owners a flat rate based on the average gross and impervious surface areas of residential

properties. Yet, since residential properties' utility fee is assessed in this way, there is no financial incentive for these property owners to take steps to manage their stormwater on-site. PWD justifies this in two ways. First, they claim that most residential properties are small, and typically have a limited capacity to retrofit their parcel to increase its stormwater management capacity. Dahme (2014) argues that rural residential properties usually have a significant amount of greenery and permeable surface coverage which serves to manage runoff from these properties, while urban residential properties do not have enough space to retrofit their properties in a way that would have a significant hydrological impact on the watershed. Consequently, offering these property owners financial incentives to manage stormwater on their parcels would yield marginal benefits at best. Second, PWD does attempt to work with residential property owners to manage their properties' runoff in other ways. The main vehicle for engaging residential property owners is PWD's Rain Check program, which provides rain barrels free of charge while also providing cost-sharing tools to assist with the installation of other green stormwater infrastructure, such as rain gardens and downspout planters. This program has been well received despite the fact that residential property owners cannot obtain reductions to their utility fee by adopting these stormwater management interventions on their property. To date, PWD has installed approximately 2,877 rain barrels on residential properties, managing nearly 10 million gallons of stormwater annually (Philadelphia Water Department, "Rain Barrel Map", 2013). Thus, PWD is able to tap into the ecological benefits residential properties have to offer while focusing limited financial and administrative resources on larger non-residential and condominium properties, where they are needed most.

Chapter 6

Bringing the Parcel-Based Stormwater Utility Fee to New Orleans

While Philadelphia Water Department's parcel-based stormwater utility fee has been touted as a successful policy for promoting green stormwater management practices on private properties, there are a number of considerations that need to be made in order to allow for the adoption of a similar policy in New Orleans. The following section makes recommendations based on the information presented in the literature review as well as the case study which would help to facilitate the implementation of a parcel-based stormwater utility policy in New Orleans.

Link to the Master Plan. First and foremost, the preliminary step that New Orleans officials absolutely must take in order to adopt a similar stormwater utility policy locally is to link the policy to the New Orleans Master Plan, *Plan for the 21st Century*. In the literature review, Haar (1955) claims that this first step is of the utmost importance in establishing the legality of a new policy because it officially relates the goals and objectives of the policy action with legally recognized community goals pursuant of the common good, or in Euclid v. Ambler terms, the health, safety, morals, and welfare of the community (272 US 365, 1926). Without establishing this legal basis for government intervention, Haar claims, any action taken by the local government is beyond the authority granted by the enabling acts. This point is clearly illustrated by the case study of Philadelphia, where the master plan, *Philadelphia 2035*, explicitly expresses support for the efforts of Philadelphia Water Department to increase the stormwater retention capacity of individual properties and manage stormwater on-site (2011). Moreover, the objectives of the parcel-based stormwater utility policy can be linked to other goals mentioned in *Philadelphia 2035*, such as reducing environmental impacts of development on sensitive lands and controlling stormwater runoff to reduce the burden placed on the existing sewer system. By

creating these connections to the master plan, Philadelphia laid the legal foundation for their parcel-based stormwater utility fee.

In the current master plan for the City of New Orleans, there are a number of goals that can be used to support the adoption of a parcel-based stormwater utility policy. For example, in the section entitled *Resilience*, the first goal listed is “a holistic community standard of resilience from flooding and other hazards” (p. 12.1). In order to achieve this, the plan recommends the development of “a Stormwater Management Plan that will provide technical expertise, identify best management practices, and establish minimum requirements to control the adverse effects of stormwater runoff for all new development and capital improvements” (p. 12.1). Similarly, one of the strategies mentioned in the *Land Use Plan* recommends the adoption of “sustainable land use and zoning practices” (p. 14.6). As a means of achieving this goal, the plan suggests the City “promote the use of water conservation and innovative stormwater management techniques in site planning and new construction” (p. 14.6). However, it must be acknowledged that, while many of the goals and strategies outlined in the current master plan may provide implicit support for a policy like the parcel-based stormwater utility fee, there are some discrepancies that exist between the two. The most obvious disconnect is that the master plan recommends that these new policies be applied to new construction or new development, whereas a stormwater utility would be applied to all properties. In this respect, Philadelphia had the good fortune of being in the process of updating their master plan while the Water Department was developing their parcel-based stormwater utility fee. As a result, the City was able to specifically address the activities of PWD and give express consent for the restructuring of the stormwater utility fee. While New Orleans could feasibly link the parcel-based stormwater utility fee to various sections of the existing master plan, the ideal course of action would be go through the process of formally revising the master plan in order to provide express consent for the adoption of a parcel-based stormwater fee.

Relate Goals and Objectives to Existing Legislation. In addition to making the connection between the parcel-based stormwater utility fee and the New Orleans master plan, it is also important to associate the objectives of the stormwater utility fee with other pieces of legislation at the federal, state, and local levels. Again, while this does not ensure the legality of a policy, both Burby & Dalton (1994) and Pederson (2004) demonstrate that creating these links lends a certain degree of validity to the policy action and can be used to justify the measures taken by local authorities. The case study illustrates how Philadelphia Water Department established numerous connections between the restructuring of their stormwater utility policy and federal policies (i.e., Clean Water Act, National Pollution Discharge Elimination System, Combined Sewer Overflow Policy), state mandates (i.e., Pennsylvania 167), and local plans (i.e., Greenworks Philadelphia and Green City, Clean Waters).

The City of New Orleans should follow the example set by Philadelphia, and seek to create additional links between the stormwater utility policy and other pieces of legislation at various levels of government. For instance, at the federal level, in addition to the EPA policies identified in the Philadelphia case study, New Orleans officials should consider establishing connections with the policies of other agencies, particularly FEMA, which already has a strong presence in the New Orleans area. One FEMA policy that seems ideal for connecting to the parcel-based stormwater utility fee is the NFIP Community Rating System (CRS), a "voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements" (2014). By establishing this connection and working with FEMA, in addition to garnering support for the adoption of a stormwater utility policy, it may also be possible to create flood insurance rate reduction opportunities for taking steps to reduce flood risk throughout the city. In this way, New Orleans officials can attempt to reap multiple benefits from the implementation of this sort of stormwater management policy. Additionally, the parcel-based stormwater utility fee could be linked to policies such as the Louisiana Coastal

Master Plan and the Louisiana Pollution Discharge Elimination System at the state level as well as the New Orleans Hazard Mitigation Plan and the Greater New Orleans Urban Water Plan (if adopted) at the local level.

Adopt PWD's model to the Local Context. Philadelphia Water Department's parcel-based stormwater utility rate provides an excellent model for New Orleans to replicate locally. In particular, the City should seek to employ a rate-determining equation similar to that developed by PWD. This is because, as the legal analysis performed earlier in this thesis demonstrates, the structure of this equation goes a long way in building the legality of this utility fee. It is simultaneously clearly defined, scientifically-based, measureable, and applied equally to all properties, thus accounting for a number of the constitutional considerations necessary when municipal authorities attempt to control land use.

Yet, the case study also demonstrates the necessity of working with local stakeholders to devise a stormwater utility policy and implementation strategy based on the unique set of needs and capacities of property owners and administering agents, while also accounting for local environmental, political, social, and economic conditions. Wildcat (2009) points out the error in the assumption that strategies for managing the natural world around us can be universally applied across locales, and argues that solutions for these problems must be formulated taking into account local circumstances and knowledge. New Orleans must resist the temptation to rely too heavily on the policies devised by PWD simply because they have been successful in Philadelphia. New Orleans is not Philadelphia. In light of this, New Orleans officials need to engage local stakeholders to devise a stormwater utility policy and assistance programs that are appropriate for the local context.

In order to achieve this locale-specific policy design, New Orleans can again look to Philadelphia for guidance. In particular, PWD did two things to inform the formulation of the parcel-based stormwater utility fee and its ancillary programs. For one, the Water Department

dedicated a two year period, from 2008 to 2010, specifically to performing community outreach and education activities. The benefits of this were two-fold. First, this outreach and education period offered PWD the opportunity to inform stakeholders about the rationale of restructuring the stormwater utility fee based on parcel runoff-generating characteristics. This process allowed them the opportunity to establish transparency in the policymaking process and clarify some of the misconceptions about the utility that could have caused problems down the line had they not been addressed during this period. In addition, these activities opened a dialogue between the Water Department and stakeholders, allowing each side to voice their opinions and concerns about the restructured stormwater utility rate. Consequently, the outreach and education period served as a sounding board, allowing PWD to gauge how the community felt about the revised utility policy and make considerations accordingly. Secondly, PWD formally convened a group of stakeholders – the CAC – multiple times over the course of the policy design and implementation period to serve an advisory role guiding the design, implementation, and revision of the parcel-based stormwater utility fee. Similar to the outreach and education activities, this helped to establish lines of communication between PWD and Philadelphia property owners, ultimately helping PWD respond to the needs of customers and revise the utility policy as necessary to work with property owners to make a successful transition to the parcel-based utility rate.

In order to appropriately adapt the model of Philadelphia Water Department's parcel-based stormwater utility fee to New Orleans's unique context, New Orleans officials should include 1) community outreach and education activities and 2) a formal advisory committee in their policymaking process.

Allow for flexibility and alterations in the implementation process. If there is one aspect of PWD's experience that this case study makes abundantly clear, it is that the agency in charge of administering the parcel-based stormwater utility fee should expect to constantly monitor the

impacts the utility rate is having on different groups of property owners and make adjustments to the policy and assistance programs as necessary. After nearly twenty years of planning and preparation for the transition to the parcel-based rate, it became obvious within the first year of the transition period that PWD needed to take steps to revise certain aspects of their implementation strategy, including offering extended phase-in periods for significantly impacted property owners, modifying the method of determining Gross Area Credits, and offering additional assistance programs to work with property owners to help make the transition to the restructured utility rate.

While New Orleans can certainly learn from the missteps committed by PWD, the fact that the parcel-based stormwater utility fee is a fairly recent concept and has yet to be tested in other municipalities means that there is a good chance there are still kinks to be worked out. Consequently, New Orleans policymakers should not expect to devise a perfect design and implementation policy on the first try. Instead, in addition to performing adequate outreach and education activities geared toward making the most informed decision possible from the outset, they should also anticipate the need for making adjustments on the fly and build this expectation into the monitoring and evaluation process. Moreover, New Orleans officials should make property owners aware of this expectation, while also notifying them of how they can inform the City of any issues they have so the City can determine if strategic adjustments are necessary.

Focus credit and incentive programs on encouraging property owners to implement green stormwater management infrastructure on their on their properties. Throughout the process of designing and implementing an effective stormwater utility policy, New Orleans needs to remain mindful of the initial impetus for adopting this sort of policy in the first place, namely, encouraging property owners to implement green stormwater management infrastructure on their parcels. In Philadelphia, one of the areas that PWD experienced the greatest amount of community resistance was regarding specific credit and incentive programs

that offered property owners rate reductions based on characteristics that were inherent to their properties, such as soil types. This is problematic in two ways. First, it draws negative attention from disgruntled property owners who are upset because their property does not qualify for the rate reduction that other property owners are able to tap into despite the fact that they did nothing in particular to create this advantageous situation. Second, these types of programs do nothing to encourage property owners to take proactive steps to manage stormwater on their parcel. Therefore, PWD responded by revising its credit and incentive programs to award benefits and rate reductions for actions taken on behalf of the property owner to increase the capacity of their property to manage stormwater on site. By structuring the credit and incentive programs in this way, PWD was able to further empower property owners to reduce their stormwater utility fees while simultaneously creating a stronger motivation for property owners to adopt green stormwater management practices on their property, which is ultimately one of the main points of this policy. Accordingly, New Orleans officials should keep this in mind when designing credit and incentive policies, structuring them so as to entice property owners to implement green stormwater management interventions on their parcels to the maximum degree possible.

Conclusion

New Orleans has had to learn a number of hard lessons as a result of its past approach to drainage and development. However, this hardship has also sparked an important debate that is critical to the future existence of the city: How will New Orleanians be able to adapt to continue living in this precarious environment? Over the past few years, concepts promoting sustainable and resilient development have ascended to a prominent position in this debate. The Greater New Orleans Urban Water Plan is one of the most recent and acclaimed proposals of this kind, advocating a shift away from managing New Orleans' water resources with pumps and grey drainage infrastructure, integrating water back into the fabric of the city's urban

environment and tapping into the capacity of green infrastructure to assist in sustainable water management activities at various scales and in different capacities. One of the ways in which this plan proposes to accomplish this goal is through the engagement of property owners in the development of a decentralized network of green infrastructure that will serve to increase the water retention capacity throughout the area.

This thesis examines the case of Philadelphia Water Department's parcel-based stormwater utility fee, which was showcased in the Urban Water Plan as a model policy for encouraging property owners to adopt green stormwater management practices on their parcels. Subsequently, this policy has drawn a great deal of attention from New Orleans officials, who are entertaining the idea of adopting a similar utility fee locally. The analysis performed in this thesis demonstrates that New Orleans officials need to account for both the legal considerations of balancing property rights and municipal regulatory authority on the one hand, while also working with property owners and administering agencies in order to devise a policy and implementation strategy that is feasible for all stakeholders. Thus, while the process of designing and implementing a similar stormwater policy in New Orleans will likely not be an easy task, the parcel-based stormwater utility policy appears to have the potential to play a vital role in the creation of an increasingly resilient community.

Chapter 7

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Vita

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