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Water, Knowledge, and The Post-Industrial Landscape

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Water, Knowledge, and the Post-Industrial Landscape

by

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Dedication

To my mother, whose wisdom and love is endless and forever.

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Abstract

Water, Knowledge, and the Post-Industrial Landscape

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In this thesis I study the ways in which Milwaukee, Wisconsin has positioned itself for sustainable water-based economic development. More specifically, I examine the role of local knowledge in decision-making processes between WWII and 2014, and the degree to which past experience has allowed Milwaukee to engage a development strategy that is economically, environmentally, and socially sustainable. I argue that Milwaukee has positioned itself for sustainable water-based economic development by learning from past experience. Success and failure has informed decision-making across time, culminating in the city's ability to generate a sustainable economic strategy using local knowledge and water resources.

Historical and empirical methods were used to develop this hypothesis. Strategic research methods, including the content analysis of texts and interviews, allowed me to identify water-specific events and practices that have influenced the city's social systems and built environment within three distinct eras (1947 – 1967); (1967 – 2000); (2000 – 2014). Water-specific events, practices, and knowledge are framed as logics. Logics associated with each era describe how water is conceptualized at a specific point in time,

while revealing the values and reasoning behind water-related decision-making at the municipal level. Strategic analysis shows that Milwaukee's conceptualization of water is dynamic and malleable. Changes occur in tandem with, or in response to new conditions.

My research results in an understanding of how Milwaukee has positioned itself for sustainable water-based economic development and how successful those efforts have been. This understanding highlights two key findings: (1) Milwaukee's *water practices* as related to economic growth, and how those have changed across space and time; and (2) Milwaukee's *interpretation* of water resource abundance today. A primary conclusion is that the ways in which Milwaukee has positioned itself stem directly from incorporating local knowledge into decision-making. However, the city has not yet learned how social equity is a necessary dimension of sustainable development.

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Chapter 1: Introduction

Milwaukee, WI is one of several "Rust Belt" cities in America that continues to face the socio-economic and biophysical consequences of deindustrialization. In the early to mid-20th century, Milwaukee was considered the "Machine Shop of the World". Automobile, steel, and durable goods plants populated the landscape, promoting a cultural sense that semi-skilled laborers could join America's middle class through manufacturing work. However, Milwaukee's economic fortune reversed in the late 20th century. Industry declined as economic activity shifted to the Western and Southern United States and abroad.

Deindustrialization reduced sector employment significantly between 1970 and 2000. Forty percent of Milwaukee's workforce was employed in manufacturing in 1963. In 2007, only 17.7% remained (City of Milwaukee, nd). Plant closures such as Allis Chalmers in 1984, AF Gallun and Sons Tannery in 1993, American Motors Milwaukee Body Plant in 1977, Schlitz Brewery in 1981, and Pabst Brewery in 1993, left thousands without a pay check. Harley Davidson, Miller Brewery, Master Lock, Caterpillar, and Bucyrus Mining Equipment downsized significantly (Williamson, 2014). City officials attribute the economic downturn "…to the relocation of manufacturing firms to new facilities in suburban locations within metro Milwaukee; the movement of industrial production to lower-wage locations…and significant increases in productivity spurred by innovation technology" (City of Milwaukee, nd).

Today, Milwaukee is attempting to take a leadership role in an economic sector that draws need-based interest locally, nationally, and globally— water resource management and technology. In an era of increasing global scarcity and over-consumption, the water abundant city situated on the shore of Lake Michigan seeks to become the "Silicon Valley" of freshwater by utilizing the Great Lakes' resources, in collaboration with local knowledge as a resource, to catalyze economic development. The city's water-focused development strategy was codified by the creation of the Milwaukee Water Council in 2009, an organization designed to promote investment, research, and jobs within the water industry. The School of Freshwater Sciences at the

University of Wisconsin Milwaukee was also established, one of three freshwater schools that exist globally.

Milwaukee is repositioning its industrial base in response to a growing need for water technology and sustainable management across the globe. However, within this repositioning process, water is just one of many resources that the city can leverage as an asset. Its manufacturing legacy, cross-sector partnerships, and industrial traditions serve, among others, to support renewed economic development. From "Machine Shop of the World" in the 1940s, to "Rust Belt" in the 1980s, to "World Water Hub" today, the city's water resources that were once degraded to support mass industrialization are being reclaimed to secure a prosperous future.

RESEARCH QUESTION AND PROBLEM STATEMENT

In what ways has the City of Milwaukee, WI positioned itself for sustainable water-based economic development? How successful have their strategies been? These questions draw upon an emergent tension between economic development and water resource scarcity. Climate change and unsustainable water consumption reduce available freshwater supplies rapidly in the Western and Southwestern United States. The socio-economic and environmental landscapes of America's urbanized areas may be significantly affected as a result. "Sun Belt" cities have enjoyed high growth and economic prosperity in the post-WWII period. However, they now face increasing uncertainty. The Colorado River Basin has experienced a series of record low inflow levels since 2006, worsening the region's already drought-stressed environment (Posey, 2014). In April 2015, California Governor Jerry Brown ordered an unprecedented 25% cut in water consumption across the state— a measure which codifies concerns over regional water scarcity and implies that decades of unfettered growth are at an end (Nagourney et al., 2015). Diminishing water supplies can no longer support the region's unsustainable and consumptive development practices.

In contrast, the North American "Rust Belt" has suffered capital disinvestment and out-migration in the post-WWII period. Yet the region maintains jurisdiction over one of the largest

collections of freshwater on earth— the Great Lakes. The City of Milwaukee is attempting to utilize the Great Lakes' abundant water resources, and draw upon unique local knowledge to catalyze sustainable growth and recover from 20th century industrial loss. The city is acting in anticipation of future need and economic demand, transforming global scarcity into local economic opportunity. Their strategy engages water resources and local knowledge in support of sustainable economic development, providing an early example of how a "Rust Belt" city might utilize their natural and social assets to foster post-industrial growth.

An understanding of how Milwaukee has positioned itself for water-based economic development is relevant to the fields of planning and design. Climate change projections indicate a major shift in freshwater availability over the next several decades. While the effects of water scarcity are only beginning to appear on the utility bills of Americans across the "Sun Belt", southern-tier states will become increasingly dry (United States National Climate Assessment, 2014). Economic development practices will likely emphasize local water availability as a result. Post-industrial cities in the Great Lakes region have a unique opportunity to plan for and design a sustainable future based on their relative abundance of freshwater and local knowledge. Additionally, an in-depth understanding of the physical, social, economic, and political practices that engender post-industrial transformation expands the existing set of planning and design tools that municipalities can use to improve quality of life. Finally, this research contributes to an understanding of how past experience informs contemporary decision-making. By highlighting a case of boom, bust, and reemergence, Milwaukee's water-based strategy can be understood as a historical process, rather than an effort isolated in time. The expanded understanding demonstrates how cyclical processes of capital investment and disinvestment influence and inform sustainable action and economic decision-making in Milwaukee.

RESEARCH DESIGN

Within this research I ask two questions: (1) In what ways has the City of Milwaukee, WI positioned itself for sustainable water-based economic development? (2) How successful have their strategies been? Determining the ways that Milwaukee has positioned itself for sustainable water-based economic development requires a historic and contemporary understanding of the city's social systems and built environment. Taking a comparative historical approach informed by Harvey's (2006) Uneven Development theory, I generate this understanding within three distinct eras. Eras provide the organizational framework for my research. They follow three time periods established by Gurda (1999) in *The Making of Milwaukee,* a historical text published by the Milwaukee County Historical Society.

Eras adapted from Gurda (1999) provide a temporal structure for understanding Harvey's (2006) Uneven Development theory at the regional and metropolitan scale. Uneven Development can be broadly understood as the cyclical process of capital investment and disinvestment across space and time. The first era within this research, entitled Industrialization (1947 - 1967), includes a period of intense investment at the start of WWII. It marks the beginning of a robust capital accumulation cycle. Anticipation of war and subsequent war production rapidly increased the pace of economic recovery from the Great Depression. Wartime industry brought about a wave of prosperity driven by capital investment, employment growth, and population in-migration to the Milwaukee region. The second era, which I refer to as Deindustrialization (1967 - 2000), begins roughly twenty years after WWII, when capital disinvestment and flight triggered a slow yet dramatic decline in production. Practices, technologies, and social systems that once supported mass industry fragmented. Institutional arrangements shifted in response to resources that could be cheaply appropriated and consumed in the "Sun Belt" and abroad. The third era, entitled Post-Industrialization (2000 - 2014), begins when the Milwaukee Water Council and the Milwaukee7, a regional economic development organization, introduced the ambitious goal of transforming Milwaukee into a "World Water Hub" of research and technology.

Each era contains a discussion of water-specific practices relevant to the time period. Water practices are organized into what Hajer (1962) calls logics, "a specific ensemble of ideas, concepts, and categorizations that are produced, reproduced, and transformed in a particular set of practices through which meaning is given to social and physical realities". Logics provide an understanding of how water is conceptualized at a specific point in time. Water-logics differ throughout Milwaukee's history and my discussion within each era reflects those differences. My periodization of history uses water-logics to reveal the values and reasoning behind decision-making and action at the municipal level. Logics are presented in narrative form, a sort of storytelling which allows the dominant ideas, concepts, and values that inform Milwaukee's water practices to become apparent through historical context. I look closely at the social systems underlying each water-logic, transitions between eras, and patterns of development influenced by Milwaukee's water practices. The persistence or absence of a logic, and the practices informing it, frame how Milwaukee has positioned itself for sustainable water-based economic development today. A shift share and location quotient analysis highlights how Milwaukee's manufacturing sector specializations have shifted between 2004 and 2014. The city might use this information to continue, correct, or adjust resources allocated in support of the water-based initiative.

This research results in an understanding of how Milwaukee has positioned itself for sustainable water-based economic development and how successful those efforts have been. This understanding highlights two key findings: (1) Milwaukee's *water practices* as related to economic growth, and how those have changed across space and time; and (2) Milwaukee's *interpretation* of water resource abundance today. These findings inform two propositions: (1) Milwaukee has positioned itself for sustainable water-based economic development by incorporating local knowledge into decision-making; and (2) Milwaukee's conceptualization of water is dynamic and malleable. Changes and transformations occur in tandem with, or in response to new conditions.

As Hannigan (1995) suggests, a municipality's recognition and incorporation of resources into socio-political and economic processes depends upon how the claims or issues are presented by a limited number of agents, rather than the reality of the resources themselves. In reference to

Hannigan, I acknowledge that an absolute water-logic does not exist due to the complexity of variables that influence social and physical landscapes. Within this thesis, I choose to focus on the dominant water-logics held by the City of Milwaukee within each era. Any competing logic discussed informs what the dominant logic is. I approach, understand, and interpret each logic as a social construction, a piece of knowledge borne from and dependent upon social and cultural practices, which are neither stable nor stagnant.

METHODOLOGY AND METHODS

A constructivist viewpoint informs my research. Unlike the positivist approach which attempts to understand causal relationships using a limited set of tools, I seek to realize future causal relationships as a foundation for action. I engage Grounded Theory Method, a systematic methodology where codes, concepts, and categories provide a framework for analysis. Grounded Theory is an inductive approach to the systematic generation of theory from systematic research. By using a set of rigorous research procedures, which leads to the creation of concepts and categories, data-driven relationships emerge to create a theoretical explanation of the study question. Grounded Theory is highly qualitative and my strategic research methods reflect that. Core qualitative tools include content and historical analysis, interviews and secondary data, and logical interpretation. Logical interpretation provides an iterative and culminating feedback process from which I draw conclusions. Grounded Theory also embraces reliable quantitative data that can help explain the study question. I engage quantitative analysis to understand industrial structure and specialization in Milwaukee. Occupational and industrial data analysis highlights how the city's manufacturing landscape has shifted in relation to the water-based initiative.

Historical and Content Analysis: Historical and content analysis provides the foundation of this work. I began by surveying social, economic, environmental, and political literature that focuses on Milwaukee from WWII to 2014. A historical understanding of Milwaukee's socio-economic and environmental conditions was gained. Survey literature was earmarked for

additional research if it contained information relating to water resource policy, consumption, and use in Milwaukee. I followed bibliographic references and used the UT Austin Library database to investigate earmarked aspects of Milwaukee's water culture. The investigation resulted in a narrowing process. A collection of events, practices, and policies emerged as formative components of Milwaukee's water history. The collection was studied further using government and policy documents, organizational and institutional reports, academic literature, history books, newspaper articles, secondary interviews, and legislative documents.

Codes and categories were used to organize all information manually. For example, a frequency code marked the relevance and importance of an event or practice based on the number of times it appeared in the literature. Content codes, like "social" or "biophysical," allowed me to organize and categorize individual events, practices, policies, and connect seemingly disconnected information together. The coding and categorization process led to the selection of specific events, practices, or polices that demonstrated Milwaukee's relationship to water across space and time. Logical interpretation allowed me to weave categorized information together through narrative. Dominant and supporting water-logics are the direct result. It is important to note that no comprehensive water history exists for Milwaukee. While codes and categorizations provide a systematic research framework, the content created is very much my own interpretation and piecing together of information. Following Haraway (1988), I have constructed a partial perspective. Partial perspective refers to what Haraway (1988) calls situated knowledge—knowledge created and placed within the context of the person who generated it. I do not claim objectivity as a researcher. Rather, I acknowledge that my point of view is limited by personal factors including bias, social environment, and ideological values. As such, I expect that elements are missing and that the history presented can and will be disputed. While issue can be taken with the lack of positivist objectivity, I align with Haraway (1988) in promoting partial perspective as an inclusive opportunity for discussion. Situated knowledge results in a more complete discourse, and the creation of new objectivity that is diverse in perspective, accountable, and open to change.

Interviews: I conducted semi-structured telephone interviews with four key individuals involved in Milwaukee's water-based economic development strategy. Coding and content analysis was used to interpret the data. Codes were developed using themes that emerged within each interview. For example, a "legacy" code was applied to data describing historic systems and practices that influence or contribute to Milwaukee's current water-based development plans. Respondent data was individually coded and aggregated by code for analysis. Aggregated content was analyzed using a systematic process of identifying sub-codes and categories, like "perspective-change", across respondents. Disparities and agreements among respondents were highlighted. All interview data informed my partial perspective narrative and situated understanding (Haraway, 1988). Interview respondents represented an inclusive set of viewpoints, ranging from private and non-profit community development organizations to institutions of higher learning. Permission was obtained from each respondent to audio record the telephone interview. Privacy and confidentiality preferences were delineated prior to speaking. The interviews were conducted throughout the month of February, 2016. Interview protocol is listed in Appendix A.

Quantitative Analysis: A shift share and location quotient analysis was used to evaluate Milwaukee's economic landscape in relation to the water-based initiative. A shift share analysis measures the competitiveness of a region's industry as compared to the nation. A location quotient (LQ) analysis measures an industry's local concentration as compared to the nation. The quantitative tools highlight uniqueness and specialization within local industry. All data was retrieved from the United States Bureau of Labor Statistics (BLS). Obtaining consistent and reliable data at the municipal and county level, as opposed to the Milwaukee MSA, was difficult using the BLS database. The study scale is, therefore, imperfect. The analysis base year was set at 2004, one year before the initiative first emerged. The comparative year is 2014, the most contemporary twelve-month period that contains complete BLS data.

OUTLINE OF WORK

I begin with a literature review in Chapter 2. Guided by theories outlined in that review, Chapter 3 examines the relationship between urbanization, industrialization, and deindustrialization to contextualize a historic and contemporary understanding of Harvey's (2006) Uneven Development within the "Rust Belt" region. The first era, Industrialization (1947 – 1967), follows as Chapter 4. This chapter is subdivided into four sections, each presenting a particular water-logic held by city government within that time period. A content summary precedes the subdivided sections. Chapter 5 marks the second era, Deindustrialization (1967 – 2000). It follows an identical format to Chapter 4, only a note regarding equity is included at the end. The third era, Post-Industrialization (2000 – 2014), begins in Chapter 6. Content is subdivided into five sections, each demonstrating a contemporary logic embedded within Milwaukee's water-based economic development strategy. Chapter 7 includes a quantitative location quotient and shift share analysis used to evaluate Milwaukee's economic landscape between 2004 and 2014. Chapter 8 contains my conclusion.

Chapter 2: Literature Review

URBANIZATION: THE INDUSTRIAL AND POST-INDUSTRIAL SOCIETY

An industrial society can be broadly characterized as a rational and technical system where the mass production of physical goods is central to the economy. The nature of work is determined by physical and mechanical output capacity. Semi-skilled workers are broken down into components, each personifying a technical activity that transforms raw materials into finished goods for sale in the economy at large. Maximized efficiency, hierarchical organization, and practices that support the creation of more with less can be used to characterize the industrial setting. The pace and processes of daily life follow a factory rhythm of Fordist economics. Fordist economics refers to a system of high industrial productivity. Standardized low-cost goods are produced in mass using specialized machinery and semi-skilled labor. Rising factory output supports wage growth, which increases demand for the physical goods produced. Corporate profit gain and market expansion results (Thompson, 2005). The quantity and production of durable goods inform standards of living, as hourly wages enable laborers to purchase what they themselves manufacture (Melin, 2004).

Deindustrialization refers to the shift from a manual, goods producing society based on manufacturing, to that which is service-focused and centered upon the provision of personal and business services and associated production and distribution of information. Daniel Bell was among the first to identify the post-industrial (deindustrialized) society in his book, *The Coming of Post-Industrial Society*. Bell (1973) states that a post-industrial or information society is characterized by the shift from a goods to knowledge-based economy. The change is fueled by science-based industries that produce information, knowledge, and services. The transition is shown through mass change in sector distribution. The production of services and information drives occupation patterns, where people work, and the type of work they do.

Bell argues that the socio-economic transformation to a post-industrial society begins with increased efficiency in the movement of goods due to improved transportation and public utilities. As technology and energy use advances, efficiency and automation make the mass consumption

of goods widely affordable. Non-manufacturing employment rises and population growth occurs. Personal services and goods (real estate, legal, finance, insurance, retail, entertainment, etc.) become obtainable across social classes. Local markets expand, transport becomes increasingly feasible and cheap, and new occupations emerge in burgeoning service sectors. National income rises due to newly developed employment opportunities, further supporting the rapidly emerging sector of personal services. Society's pace and processes deviate from factory rhythms, as quality of life becomes increasingly "… measured by services and amenities … which are now deemed desirable and possible for everyone" (Melin, 2004).

In the post-industrial society, Fordist interests yield to a new regime, where human capital, defined as technological and scientific knowledge, generates a restructuring of the social and economic hierarchy. Heightened emphasis on knowledge production and educational attainment aims to remedy systems of social inequality, which had functioned to maximize profit in periods of industrialization. Issues of welfare, class, education, and health become central in political discourse. Using knowledge to transcend social strata and level the economic playing field, the theoretical aspiration of post-industrial (human) capital enables equal access to the financial benefits of information and technological development.

Table 1. The Post-Industrial Thesis: Transitional Steps from an Industrial to Post-Industrial Society

1	**Major Employment Shift**	"Primary and secondary production decreases labor needs because of technological change and innovation. This occurs primarily in manufacturing. Tertiary industry (services), are more labor intensive but cannot be mechanized through technological innovation."
2	**Increased Demand For Services**	"Costs associated with "need-based" goods (housing, clothing, food) rise slower than income, allowing for greater expenditures on service related goods."
3	**Knowledge-Based Labor**	"Production, distribution, and control of knowledge is a central characteristic of the post-industrial society. Heightened importance of educational, institutional, and information handling entities."
4	**Firm Regulation**	"Individual firms become increasingly subject to government regulation, society becomes more socially planned. Rather than economizing behavior, it becomes socialized to take into account values and purpose that is not otherwise reflected in the market."
5	**Power**	"Growing technocracy gains power in the planning and control of knowledge. Social and birth class becomes less important than skills and education."
6	**Social Class**	"Development of new social classes and groups, replacing those centered on ownership. Manufacturing no longer formalizes social class, rather they are formed based on the have and have not of knowledge types."

Urry, John. (1995). Is Britain the First Post-Industrialist Society? In F. Webster & et. al (Eds.), The Information Reader (2004, 121-132). New York: Routledge.

Bell's post-industrial theory issues a critical warning to the post-industrial society. With a focus on science-based information and knowledge producing industries, America's technology intensive products gain a primary market share. Tangible export goods remain globally competitive. Decreased transportation costs and growing wage differentials incentivize multi-national corporations to relocate abroad where lower operating and production costs can be found. Sectors that previously employed a critical mass of semi-skilled and unskilled workers decline, creating fertile ground for labor issues to arise. An ultimate result, Bell warns, is a "rentier" society, where an "…increasing proportion of [America's] trade balance consists of return on investments abroad, rather than exports" (1973).

John Urry (1995) agrees with Bell's institutional shifts, but states that post-industrial society has not emerged a-new. Rather, organized capitalism has become unorganized capitalism. Urry argues that Bell's post-industrial thesis is overly "economistic" in its account of social and political life. Organizational features of his thesis fail to address how people actually experience complex socio-economic transformations. The post-industrial society is not uniform across place or context. Urry argues that globalization of economic and social power, specialized product production, worker and employer mobility, and non-reflective political and social systems have emerged. These systems disorganize previous industrial processes rather than creating new ones. A primary result is that "economic and cultural globalization dramatically [changes] our understanding concerning society, space, and geography" (1995).

Urry's comment on the changing perception of space refers, in part, to how post-industrial economies are geographically distributed within and between cities. For Urry, spatial change reflects labor patterns, industry concentrations, and the emergence of "world cities". World cities have increased economic influence and power due to the establishment of corporate headquarters and financial centers. Yet their vitality is "substantially dependent upon the locational decisions of manufacturing firms" (1995). However, Urry notes that firm locational patterns are neither stable nor stagnant. Technological advances in transportation, communication, and manufacturing technologies allow companies to rapidly locate and relocate in accordance with an area's unique comparative advantage(s). As a result, society's perception and understanding of socio-political, economic, and cultural processes transform across space and time.

INDUSTRIAL LOCATION THEORY & ECONOMIC ADVANTAGE

Urry's brief discussion of industry's spatial characteristics within the post-industrial framework provides an ample bridge to theories of industrial location choice. Alfred Weber (1929) pioneered our understanding of industrial location choice using the neoclassical economic model, which assumes rational and profit maximizing actors populate the economic landscape. Weber

argues that three fundamental forces guide industrial location choice. These include: Transportation Cost Differentials, Labor Cost Differentials, and Agglomeration Economies and Diseconomies. Hoover (1937) building upon Weber and Ohlin (1933), reworked the third locational force, Agglomeration Economies and Diseconomies, into three distinct categories: Large-Scale Economies, Localization Economies, and Urbanization Economies. Hoover argues that large-scale economies profit when the scale of production is expanded within a given location. Localization economies profit when output increases for all firms within the given location. In urbanization economies, firms of all industries profit when economic size (population, income, exports, etc.) expands within the given location.

Alfred Marshall's (1919 & 1920) Industrial District Theory compliments the work of Weber (1929) and Hoover (1937). Marshall first examined the role of local economics of co-location in the 1980s. Early research on industrial districts informed the development of a formal Industrial District Theory. Within this theory, Marshall asserts that the localization of industry is the result of five considerations: Climate, Natural Resources, Decision Maker Production Preference, Chance, and the Occurrence of Particular Accidents (Marshall, 1919; Marshall, 1920; Chapman, 1904). These considerations are governed by two opposing forces: (1) Agglomeration: the efficient communication and exchange of knowledge; and (2) Dispersion: the geographic flow of people and skilled labor. For Marshall, productive economies emerge when a concentration of businesses in similar or related industries co-locate. Co-location increases productivity and output by increasing firm scale and concentration within the local economy. Market supporting characteristics include knowledge creation and interchange, specialization, integrated production, mutual trust, and "institutional thickness", a set of industry supporting institutions and organizations. Marshall's characteristics highlight a substantial departure from previous thought by recognizing the influence of decentralized social infrastructure and emphasizing the role of institutional and political support. Contemporary academics continue to support Marshall's characteristics, reiterating the importance of social networks in generating innovation and knowledge flows across firms (Saxenian, 1990; Basant, 2002; Asheim and Isaksen, 1997).

Nicolini (1998) adds that co-location forces stem in part from the prospect of utilizing or exploiting the benefits of shared cooperation and knowledge flows.

In 1956, Walter Isard developed the Industrial Complex Theory, the first comprehensive theory of industrial location. Isard's theory centers upon locational interdependence. He defines an industrial complex as a collection of firms operating within a specific location. Interconnected knowledge is produced through co-location. This knowledge can reduce the cost of technology and other forms of information acquisition for all co-located firms. Following Hoover's (1937) classifications, Isard asserts that localization economies profit when related firms collect within a given location. Resources, facilities, and infrastructure are shared and exploited. Urbanization economies profit when a variety of industries concentrate within an area, but are spatially juxtaposed.[1] Success is greatest when one's output becomes another's input. Czamanski and Czamanski (1977) and Czamanski et al. (1974) challenge Isard. They state that industrial complexes provide a core organizational pattern, while industrial clusters are defined on a geographic or functional basis.

Within the past two decades, Cluster Theory has emerged as a central concept of industrial location. Porter (1990) developed Cluster Theory in an effort to identify how firms can become and remain competitive in international markets. Porter builds upon earlier theories of agglomeration economies, using basic theoretical precepts to rethink what drives industrial location within a globalized economy. He argues that while place-specific resource abundance or input costs drove historic location choice, today's knowledge-based economies are able to compensate for input and resource disadvantages due to innovative transportation and communication methods.[2] Competition centers upon the ability to use resources more productively, rather than increase the scale of production through resource proximity (Porter,

[1] Spatial juxtaposition refers to localization economies which typically exist within urbanization economies.

[2] Porter's understanding of location pairs well with the emergent field of New Economic Geography (NEG) which studies where and why economic activity takes place amidst imperfect competition and increasing returns (Fujita, 1998). NEG's Agglomeration Theory rests upon the idea that an economy's spatial characteristics result from the balance of two forces, one which pulls (agglomeration) and another which pushes (dispersion) consumer and firm behavior (Fujita and Thisse, 2002; Marshall, 1920). Uneven economic patterns across a geographic region is either the result of resource availability and abundance (first nature) or institutional actions aimed at balancing resource-based advantages or disadvantages (second nature) (Ottaviano and Thisse, 2003). Theorists argue that the latter provides a better explanation given technological abilities.

1998). For Porter, industry clusters are informally linked firms that operate within a formal and reinforcing spatial area. As firms exist within a concentration of rival suppliers and consumers, efficiency and specialization increases. The ripple-like benefits, such as knowledge production, are shared.

Industrial location theorists largely embrace a neoliberal view of the economy. The neoliberal's economic objective is a stable market equilibrium (Shah, 2010; Zera, 2008). Stable equilibrium means that the market can rebalance after an external force (e.g. policy, labor, and innovation) changes supply and demand trends. Capitalism is perceived as the market balancing agent. Capitalist systems generate and restore equilibrium through privatization, the unregulated movement of goods, and the competitive pricing of natural and social resources. The system results in maximized efficiency, increasing profit margins, and a socially optimal allocation of resources over time (Shah, 2010). In contrast, Marxist economists focus on the socio-economic processes underlying capitalist systems, and the societal effects of neoliberal practices (Zera, 2008). Traditionally, Marxist's are highly critical of capitalist systems, free-market economic processes, and neoliberal conceptions of resource balance. The forces underlying capitalism, transitions and change within the system, and resulting socio-economic consequences are brought into question (Prychitko, 2008; Zera, 2008).

UNEVEN ECONOMIC DEVELOPMENT

Harvey's (2006) Uneven Development, a Marxist oriented economic theory, studies the spatial and temporal effects of capitalist processes at regional, national, and international scales. The dominant theory of capitalist production, distribution, and exchange is neoclassical theory. There are three basic assumptions in the neoclassical model of market efficiency. The first assumption is that individuals in an economic society are autonomous and utility maximizing. The second assumption is that choices made by individuals, households, and businesses (firms) are rational, systematic, and consistent. The third assumption is that the size and composition of

individual endowments, such as labor and skill, are set. Within these parameters, efficiency is reached when the price of resources, at any given time, are unbiasedly valued based on all available market information. This occurs when supply meets demand at an equilibrium price and quantity. Neoclassical theory assumes that economic unevenness, both spatial and temporal, obtains evenness through a continued distribution of capital and investment within an open, free-market economy (Harvey, 2006).

Harvey's (2006) Uneven Development theory argues against the neoclassical framework. He asserts that the effects of capitalistic processes are felt deeply within the built environment through the disruption of social processes. The spatial and temporal qualities of capitalism cast the built environment in a state of turmoil in one era and prosperity in another. This occurs because market forces seek profit through low-cost consumption. Firms locate, and relocate, when cheaper resources can be used to generate a higher profit margin. The cyclical process of capital accumulation upsets and rearranges social, political, biophysical, and economic systems. Consequences are acutely felt at the local level.

Capital accumulation can be understood as the creation of profit for distribution to asset owners and for reinvestment to generate greater future profits. For Harvey, the dynamic of Western society, a capitalist society, is powered by profit— a constant push to continue accumulating capital. Gaining profit often means that the system must grow, seeking new resources as those in use become scarce from over consumption. Resources can be tangible or intangible, like labor and skills, raw materials, institutional support, or political and economic regulations. Within a capitalist system, growth is fueled by investment in and consumption of cheap resources. Growth is the primary measure of economic health. As a result, accumulation becomes a circular process where new and inexpensive resources are sought, consumed to the point of scarcity for profit, and sought again.

Capitalism cannot be divorced from the social, political, economic, or environmental landscape. It is neither an abstract or external force. Rather, capitalism is embedded within social systems and institutional arrangements, however concealed or apparent, that seek further

accumulation. Capitalism adapts to new conditions in the pursuit of profit, shaping and disturbing biophysical and social processes as it moves forward. Its strength lies in its flexibility and adaptability. Institutional arrangements and capitalist behavior are modified, negotiated, and renegotiated in response to cheap resources that can be "appropriated, used, bent and re-shaped to the purposes and paths of [profit]" (Harvey, 2006). The circulation of capital is equally important as the circulation of water and air in understanding the uneven effects of accumulation. Accumulation of all resources, tangible or intangible, creates landscapes that are constructed and reconstructed by "divisions of labor, the pursuit of product niches and the general evolution of discourse and ideologies that embody precepts of capitalism" (Harvey, 2006). The result is a perpetual and disruptive reordering socio-economic and environmental systems.

Similar to Harvey, Neil Smith (1990) connects Uneven Development with capitalistic functions. Smith argues that capitalism has transformed our social relationship to nature, and thus, transformed the natural world. For Smith, the production of nature and space is an inherent quality of capitalism. Nature and space have become commodities whose meaning can be produced and reproduced as context and price points change. Capitalistic systems are flexible and mobile, absorbing emergent markets and profits across geographic areas. Through this lens, the system itself can be seen as shaping and creating space as it moves unevenly in search of profit.

NATURAL RESOURCES AND ECONOMIC DEVELOPMENT

Contemporary economic literature recognizes that environmental resources, termed natural capital, are market assets similar to that of human and financial capital. Natural capital remains a neoclassical concept. Externalities, positive and negative consequences of economic activity that effect individuals outside of the transaction, are traditionally accounted for through pricing. Barbier (2002) summarizes recent debate over the role of natural capital in economic development in three questions. The first considers what role the environment has in supporting human well-being. Should compensation-based regulations exist to ensure that well-being is not diminished by

natural capital exploitation? The second question draws upon the Kuznets Curve (EKC), a U-Shaped empirical model that estimates the relationship between resource depletion and per capita income levels. Does the EKC model suggest that economic growth will decline in tandem with natural resource(s) depletion? The third, and perhaps most relevant to this research, considers:

> "…whether lower income economies that are endowed with abundant natural resources develop more rapidly than economies that are relatively resource poor. Is it possible that resource abundant economies are not reinvesting the rents generated from natural resource exploitation into productive assets, or that resource booms actually divert economic resources from more productive and innovative sectors?" (2003).

Barbier's third question stems from what Sachs and Warner identify as the "curse of natural resources" (2001). Sachs and Warner (2001) submit that resource rich economies maintain lower growth rates than their resource poor counterparts. Gylfason (2001) suggests that this occurs because resource abundance can lower investment in other forms of human, institutional, physical, and foreign capital which generate productive external markets. He notes, however, that the type of natural capital matters— "point resources", such as oils and minerals, show greater negative effects than resources that are "diffuse". Brunnschweiler (2010), counters Gylfason (2001), finding that oil production and reserves, a point resource, can positively affect an economy. This suggests that the management of natural capital, like Milwaukee's water resources, matters a great deal.

Gylfason (2001) describes four ways in which natural resources can overshadow other more productive forms of capital. The first is Dutch Disease. In this model, the discovery or price increase of a natural resource causes national currency to be overvalued. Non-natural resource exports decrease in competitiveness, which Matsuyama (1992) states is particularly true for industrial sectors that generate knowledge spillovers through production and manufacturing. Second, incentives for economies to save and invest are reduced. Gylfason states that natural capital creates a false sense of security, which lowers investment in wealth accumulating physical or industrial capital. The third cause is a reduced investment in public education. Resource-rich areas overconfidently view natural capital as their economy's primary asset. Investment is focused on low-skill labor and infrastructure development for resource extraction and sale. Education is

underrated and human capital becomes weak. Glyfason's fourth reason relates to institutional quality, which shifts the conversation from resource quantity to management. Here, he and other proponents argue that the resource itself is not a curse. Rather, institutional frameworks and poor policy decisions drive poor economic performance.

Water is a natural resource receiving increased attention due to growing scarcity. Unfortunately, the effects of water availability on economic growth is a relatively understudied topic. A recent study by Barbier and Chaudhry (2012) evaluates the effect of water availability on urban growth. They found that enhancements in public water supplies, in terms of quantity and infrastructure, increases population and economic growth rates. Increased limits on water availability, as measured by groundwater withdrawals, may not diminish economic growth. However, if groundwater is being withdrawn at unsustainable rates, income growth may be short lived.

Hanemann (2006) questions whether incremental water availability generates increments in economic activity. Citing precedent studies between 1964 and 1968, Hanemann finds that increment water availability does not affect location choice or economic growth when the production function[3] is used to model decision-making. For example, Howe (1968) argues that: "…water costs are a relatively small fraction of total production costs even in water-intensive industries, and there are many examples of firms in such industries choosing to locate plants in water deficient areas because of market or non-water input considerations" (2006). Howe's study followed Bower's (1964) hypothesis:

> "that the availability of water at the intake end and/or the effluent end is not a major factor in macro-location decisions of industry relating to location in major geographical areas or regions, such as river basins, but it can be a major determinant of micro-location decisions relating to location within the region or basin" (2006).

[3] A *production function* is an empirical tool used to evaluate the benefits associated with increment access to water. The function evaluates the level or amount of an input (Y) required to produce an output (X). The resulting output or outcome (Z) is then evaluated.

Hanemann challenges previous research. He states that while an investment in water supply does not guarantee growth, previous conclusions are faulty due to outdated concepts of causation within the production function. The relationship is more complicated. Hanemann suggests that adequate supply is necessary but not sufficient for economic growth. While availability may not result in growth, areas lacking sufficient water supply will not flourish:

> "For example, one can expect that people will eventually leave those areas and migrate to other areas that do have an adequate water supply. Thus, lack of water could be a sufficient condition for economic decline or, to put it another way, water may be necessary but not sufficient for economic growth. But, this is not a relationship that is captured in the existing formulations of production functions and regression equations. In fact, the relationship between water and growth might be even more complicated. It may be that there are multiple possible causal pathways, such that while there is some causal linkage between water and growth, the linkage is sufficiently imprecise and variable that water is neither a necessary nor a sufficient condition for growth. In effect, there is sometimes a causal linkage, but not always" (2006).

In light of Hanemann's findings, scholars can look towards an asset focused development framework to conceptualize how water might be one among several variables, or assets, that facilitate economic growth. Asset Based Economic Development Theory is an emergent framework guiding context-specific local and regional development. Economic development can be defined as "a process that influences growth and restructuring of an economy to enhance the economic well-being of a community" (International Economic Development Council, n.d.). Economic development differs from economic growth. Economic growth is traditionally seen as a rise in employment or income, which refers to an increase in economic activity within a given area over a shortened period of time (University of Wyoming, 2013). Economic development also includes job and income metrics within a given area, but draws distinction by incorporating measures of individual and firm productivity and quality of life over the long term. For example, a rise in employment may signal growth, but that growth may not qualify as economic development if those jobs pay sub-standard wages (University of Wyoming, 2013).

Asset based economic development often defines economic development by its context specific objectives because geographic, political, economic, and social assets vary across

communities. The framework generates long-term economic strategies through the identification and leveraging of resources. Environmental, social, cultural, economic, political, and raw resource advantages are considered in tandem with natural and working landscapes, local institutions and leadership, existing infrastructure, and human capital. Scholars suggest that a forward looking integration of these elements into comprehensive planning enables sustainable economic development to occur (ICMA, 2012).

SUSTAINABILITY

For a system to be sustainable, it has to be reproducible. To reproduce, the system must gain new knowledge for new conditions. Knowledge gain allows the system to adapt and endure in response to change. There are three generally accepted dimensions of sustainability: environment, economy, and equity. Sustainable systems engage practices that balance and maximize the benefits of environment, equity, and economy— frequently referred to as the three E's of sustainability— without exploiting any one value and causing harm (Wheeler et al., 2004).

Within this research, I define sustainability as knowledge— evidence of past experience informing equitable decision-making. I equate decision-making with action within this definition. Knowledge without action changes nothing. Decision-making attributes an increasing amount of municipal agency to action and outcome. Sustainability as knowledge does not have a standard metric. I account for this through comparative historical analysis, and look for evidence of knowledge gained or lost across time and its effects on system reproduction and decision-making. The equitable, environmental, and economic qualities of Milwaukee's past water-practices are used as context-specific weights against those currently in place. This use of knowledge as sustainability registers an understanding of equity within Uneven Development and the socio-economic effects of capital processes at the local scale. The definition refers to practical knowledge or metis, "a wide array of practical skills and acquired intelligence in responding to a constantly changing natural and human environment" (Scott, 1998).

The contemporary roots of sustainability lie in the social and environmental movements of the 1960s and 1970s, when the relationship between economy, environment, and equity was openly questioned. The question of economy, environment, and equity draws from the pursuit of economic growth at the expense of natural and human resources. For example, at what point does deforestation and industrial water pollution favor economic growth to the detriment of natural and physical health? Conversely, at what point does resource conservation inhibit the development of cities and hinder economic prosperity and quality of life? Equity is a vital piece of sustainability (Wheeler et al., 2004). Although often overlooked, it is a fundamental part of balancing economic growth and human and natural resource consumption. As capitalist systems seek low-cost, high-profit opportunities, racial disparities in income, educational attainment, health, and employment opportunity often emerge in tandem with environmental exhaustion (Harvey, 2006).

The 1987 Brundtland Commission report, *Our Common Future*, the 1992 Rio Summit, and the U.S. Millennium Goals are pivotal moments in the development of sustainability theory and practice across the world. However, no effort has been universally acknowledged as the benchmark of sustainability and sustainable development. This is not surprising, as sustainability and actions promoting it are best understood in context. The values embedded in environment, equity, and economy differ across political, social, environmental, and economic regimes. Engaging a place-specific analysis of sustainability within this research, my discussion of knowledge gain and equitable decision-making is unique to Milwaukee. However, the broader definition of sustainability as new knowledge can be adapted across contexts. Because sustainability hinges upon the ability to reproduce, new knowledge is required to adapt and endure across settings. Context determines knowledge type, but the need to gain knowledge for new conditions is universal.

Guided by theories outlined in the literature review above, the following chapter examines the relationship between urbanization, industrialization, and deindustrialization to contextualize a historic and contemporary understanding of Harvey's (2006) Uneven Development within the "Rust Belt" region. Uneven Development is the primary theoretical frame through which I

examine Milwaukee's water-based economic development strategy. The lens allows me to identify how cyclical processes of capital accumulation have shaped Milwaukee's water practices and effected socio-economic conditions within industrialized, deindustrialized, and post-industrialized time periods. The relationship between natural resources and economic growth is examined throughout my historic and evaluative casework. Drawing upon theories reviewed, I analyze qualities of natural and human resource management, rather than resource abundance alone, to determine how Milwaukee has positioned itself for growth without eclipsing fundamental dimensions of sustainability introduced above. Tying directly to Uneven Development, I look for even and uneven socio-economic consequences of Milwaukee's water-based development plan in regard to municipal practices and decision-making. Specific focus is placed on environmental protection, human capital development, and equity. Industrial location theory allows me to question how firm movement (location and relocation) during industrialization and deindustrialization informs Milwaukee's development of a water cluster today. As a spatially focused economic tool, I examine why firm agglomeration is perceived to generate water-based growth and advantage by municipal leadership. Throughout this casework, I utilize sustainability and asset based economic development theories to identify social, natural, and institutional resources and conceptualize them as local knowledge-based assets. Conceptualizations highlight the degree to which economic, environmental, and equitable knowledge gain has been incorporated into municipal water practices. This allows me analyze sustainability as knowledge— evidence of past experience informing equitable decision-making— and identify how the city has positioned itself for sustainable water-based economic development today.

Chapter 3: Regional Background

What we term the "Rust Belt" and "Sun Belt" today— the geographic codification of a shift in economic activity from the Northeast and Midwest to the Western and Southern United States— provides a historical-geographic case of Uneven Development. The "Rust Belt" prospered as the "Sun Belt" does today in the decades preceding WWII. The Great Lakes system, containing 20% of the world's surface freshwater (Annin, 2006), helped to catalyze the region's industrial development at the turn of the 19th century. Positioned between Northern Minnesota and Upper Michigan, a hot bed of Iron Ore, and the Appalachian Mountains, an area containing abundant coal, regional manufacturers harnessed water from the Great Lakes to mass produce and transport durable goods at an unprecedented rate (McClelland, 2013). The region's biophysical, material, and social resources were cheaply appropriated and consumed as industrialization took root and boomed. Political and economic structures unified in support of the Midwest's industrial expansion.

The Great Lakes' water resources were foundational in the region's rapid industrialization. Freshwater was a primary "input for the car industry in Detroit, for breweries in Milwaukee, [and] steelmakers in Gary…water lubricated the new activity—and helped transport raw materials and finished wares. The new industrialists could use water at scale—and they abused it, pouring toxic waste into the sea-like lakes" (The Economist, 2015). Industry leaders and their political counterparts ignored the environmental degradation of industrial progress. Rather, they pushed for social, political, economic, and technological systems that could unify the region's resources in support of rapid automobile, consumer goods, and raw material manufacturing. The "Rust Belt" became known for its manufacturing power, and through the 1950s, industrial and economic growth concentrated within the region.

In the mid-20th century, demand for the area's industrial output dropped as U.S. corporations entered a period of global competition and rapid technological change. Cultural practices that once supported mass industrial production began fragmenting as institutional arrangements shifted in response to natural and human resources that could be cheaply

appropriated and consumed in the "Sun Belt" and abroad. Labor disputes, union politics, and race and class-based tensions intensified with disinvestment, causing further damage to the region's urban centers. The economic investments and jobs from steel, automobiles, and other durable goods production in cities like Milwaukee, Flint, and Cleveland slowed dramatically as global competition and geographic shifts in production facilities became increasingly prominent. This left thousands of industry workers unemployed, stressed state and city budgets, and triggered an out-migration of people, especially young and educated residents who left in seek of superior job opportunities. Industrial damage to water and other biophysical resources remained largely ignored. Aged infrastructure, joblessness, abandonment, and capital flight were the primary urban concerns.

Biophysical and water resource damage was disregarded until the 1960s when toxin fueled fires in the Buffalo, Rouge, Detroit, and Chicago Rivers catalyzed change. In 1972, the Clean Water Act, the first federal law protecting fresh surface water was enacted by President Nixon. The following era saw the establishment of state pollution control and water resource management programs. In 2008, the Great Lakes Compact, an international agreement signed by President Bush, banned the diversion of water beyond the Great Lakes watershed. In 2010, the Great Lakes Restoration Initiative was enacted to restore water quality and shoreline habitat. As of 2015, 148,000 acres of wetland, inland, and coastal habitat have been restored. While more needs to be done to remediate the region's environmental systems today, focus has shifted "from conservation to the economic uses of abundant water" (The Economist, 2015).

The economic opportunity of water is the center point of Milwaukee's development strategy. In response to increasing scarcity and over-consumption, the city is attempting to catalyze local growth by taking a leadership role in an economic sector that draws need-based interest across the world— water resource management and technology. In what ways has the City of Milwaukee, WI positioned itself for sustainable water-based economic development? How successful have their strategies been?

The following three chapters trace select parts of Milwaukee's water history from WWII to 2014 in an attempt to answer these questions. The unfolding story explains how historic and contemporary practices have allowed Milwaukee to position itself for sustainable water-based economic development today. Within this narrative, the dominant ideas, concepts, and values that inform Milwaukee's water practices become apparent within historical context. Key events and practices are highlighted and discussed as water-logics. Logics provide a lens through which we might understand the values and reasoning behind water-specific action and decision-making. Individually, each water-logic describes the relationship between local water resources and economic development at a specific time. Together, they illustrate the changing relationship between water and economic development between WWII and 2014.

Similar to the narrative above, Chapters 4, 5, and 6 use Harvey's (2006) Uneven Development as a frame of analysis and understanding. Chapter 3 applied Harvey's theory to explain the regional shift in economic activity from the "Rust Belt" to the "Sun Belt". The following chapters apply his theory at the metropolitan scale. Harvey emphasizes the importance of Uneven Development processes in explaining metropolitan development patterns. A significant storyline emerges when using this lens to analyze investment, disinvestment, and redevelopment in post-WWII Milwaukee. Capital disinvests in Milwaukee's urban core and invests in suburban and exurban sites following the war. When inner-city land prices depreciate due to prior disinvestment, capital flows back to the urban core, which emerges as a renewed site for profitable reinvestment. Following Harvey (2006), the pattern of intraregional uneven investment cyclically restores the ability of capital to maximize profitability across Milwaukee's metropolitan landscape.

Chapter 4: Industrialization (1947 – 1967)

In the decades surrounding WWII, roughly 1947-1967, the City of Milwaukee perceived potable water as a commodity for production and exchange. Water was a raw material that the city could clean, sell, and use to facilitate economic and spatial wealth at a time of growing economic prosperity. In the early 1940s, the city viewed water, and related service provision, as a source of profit and revenue for municipal operations. Operating the only water utility in the region, the city positioned itself at the helm of control. They dictated the rates, terms, and conditions of any service contract, much of which was skewed to their financial benefit. Following WWII, provision for profit became entwined with annexation. While a link between water and jurisdictional growth had previously existed, the city redefined its water policy to acquire land— and associated property tax— which proved more valuable than rate-based revenue. As annexation efforts grew contentious with the surrounding municipalities, Milwaukee's provision to minority inner-city residents became a crutch for jurisdictional growth. Milwaukee's inner-city residents experienced the effects of Uneven Development as residential rates were used to subsidize profitable suburban expansion. A constant amidst relative change within this era was Milwaukee's use of water as an abundant input and output— a free good that could lubricate productivity while absorbing the negative externalities of urbanization and industry.

The following sections provide a narrative snapshot of Milwaukee's use of water as summarized above. Individually, each logic discussed highlights how central ideas surrounding water were translated into practice in this time period. Collectively, they represent the subcomponents that inform my understanding of the dominant logic— water as commodity— during this period. It is important to note that the narrative below is overlapping. While practices are subdivided to create clarity, cities are complex systems and ideas that begin at one point often inform, merge, and transform into subsequent ones.

WATER: A PROPRIETARY FUNCTION OF THE CITY

The City of Milwaukee viewed water as a source of non-tax revenue during and after WWII. While the selling of water to city residents at a profit existed before this time, the selling of water to suburban industrial and residential consumers to generate revenue for the city developed as a proprietary function under a socialist city government. In the broadest terms, socialist leadership in Milwaukee (1910 - 1960) was "…critical of capitalism and sought to create some kind of alternative to the inequality that capitalism engendered" (McGuiness, 79). Their alternative centered upon fiscal conservatism, which stemmed, in part, from practical class and political concerns of the party's voter base, working-class home-owners, who were increasingly burdened by rising property taxes. The party promoted austerity and prudence to increase municipal savings, which could then be used to increase spending ability for future projects. The elimination of municipal debt was key. Socialists favored pay-as-you-go schemes that aligned municipal expenses with available treasury funds (Buenker, 2009). Revenue from the municipal water utility was an ideal method for operational and capital financing with funds on-hand.

Milwaukee was the sole proprietor of the only central water facility in the region, the Linnwood Facility. As of 1939, the facility had a pumping capacity of 310 Million Gallons per Day (MGD), a filtration capacity of 290 MGD, and a storage capacity of 40 million gallons. Peak use stood at 142 MGD. Outlying communities did not have water works of their own. They relied upon wells and septic tanks for their water and sewer needs or contracted with the City of Milwaukee for water provision. Suburban provision rates were substantially higher than that of the city. Profit gained from extramural sales were transferred into the Milwaukee's general fund. This amounted to nearly three-quarter of a million dollars annually in the 1940s (Foss-Mollan, 2001).

Surplus revenue was used to reduce taxes levied on city residents and finance popular civic improvement projects. The proprietary operation of the city's water works, and its success under the socialist government, transformed political conceptions of provision from primarily governmental to a key source for surplus revenue. Water was a “cash cow” that political leadership could use as a financing mechanism and to keep tax rates low.

At its earliest, the propriety function of Milwaukee's water works was seen as distinct from any annexation effort. The extension of water service could facilitate annexation, but it was not required. The city assumed that annexation would occur naturally through the extension of infrastructure. Revenue generation would continue independently or until incorporation took place. Either way, the city profited in land acquisition or direct revenue. As a result, extramural rates were set just high enough to gain profit and city rates low enough to entice annexation.

Yet, the city's provision for surplus revenue generation operated in duality (Foss-Mollan, 2001). On one hand, the city had the authority to determine which areas would receive water. This allowed the government to use water service to facilitate annexation, but primarily for revenue. Higher rates associated with suburban contracts generated revenue that could be used to fund city operations. On the other hand, the city's existing policies reduced the cost of water provision to contracted areas once they incorporated. Equalizing suburban and city rates negated the tradition of extracting surplus revenue from water service.

The onset of WWII in 1941 saw an increase in water consumption and utility revenue. The City of Milwaukee, dubbed the Arsenal of Democracy, was a national center of war manufacturing (Foss-Mollan, 2001). Water consumption rose due to increased inner-city industrial use and a new service contract with the Town of Milwaukee, a previously unserved suburban area. The Town of Milwaukee was designed as a Milwaukee Ordinance Area in service of the Allied war efforts. The War Assets Administration sought a water provision contract with the City of Milwaukee in support of the area's armament manufacturers who required a large supply of water for production.

The contract was executed between the City of Milwaukee and the federal government. The town itself was excluded from the formal agreement. Provision was intended to be temporary, providing service only for the duration of the war: "The City of Milwaukee reserves the right to discontinue service should the property served be sold or leased to a private enterprise for a private purpose, or upon the termination of the existing war emergency if the property has not be annexed to the City of Milwaukee." (Foss-Mollan, 149). Utility and contract rates were set at a favorable price for Milwaukee.

In 1946, one year after WWII ended, an editorial attacking the city's water provision policy was published in the Milwaukee Journal. It publically exposed the duality of the city's water provision policy: "If outside areas could receive water without previously agreeing to become part of Milwaukee, why should they join the city?...Extending water service to unincorporated areas as a lure for annexation was a negation of the tradition of using extramural sales to generate revenue, because once these areas were annexed the profit would decrease" (Foss-Mollan, 133).

The 1946 editorial marked a turning point in Milwaukee's water provision intentions. Was water a commodity best produced and sold for profit? Or could water have a higher value as a tool for annexation? The city responded by amending its water expansion policy in 1946 to state: (1) provision without annexation would not occur in the future; and (2) annexation would be insisted upon in outlying areas with existing service contracts. The city began shutting off service to outlying areas that refused to incorporate. Although fiscal surplus generation had transitioned to annexation efforts, water service remained a proprietary function of the municipal government. Milwaukee owned and controlled the resource, at least for the time being.

WATER: A TOOL FOR JURISDICTIONAL GROWTH

Following WWII, an emergent housing and land shortage was amplified by an influx of war-time manufacturing labor and firms to the city. Additional land was needed to support rapid growth, changing the city's motivation to pursue territory rather than revenue. Milwaukee's control over water provision provided a tool for annexation.

While Milwaukee's industrial sector boomed in wartime, continued expansion was limited by lack of space. In 1939, the city had 5 million square feet of available industrial space. By 1946, there was practically none left. Milwaukee's manufacturing economy required raw material and market access to grow (Teaford, 1994). The city was able to provide raw material, like water, but no longer able to provide land in close proximity to transport hubs. Lack of space threatened industrial capacity and expansion. It became increasingly difficult for Milwaukee to attract new

business. Firms began to relocate or expand in towns outside city limits. Space for single-story low-density factories was readily available, less competition existed, lower wages could be paid, and well-water or existing provision contracts with Milwaukee fulfilled their water needs (McCarthy, 2009).

In 1947, the Wisconsin Legislature reiterated its commitment to no income tax, establishing property tax as the most reliable municipal revenue source. Industrial property taxes were disproportionately high and retaining industry was vital to government operations. Corporate tax assessments and returns could offset residential service costs and be used to finance capital projects and municipal operations (McCarthy, 2009). Fiscal viability depended on providing for industrial expansion and retention.

Under Socialist Mayor Frank Ziedler, the city engaged an aggressive annexation program to ensure that industry remained within their borders. Milwaukee's largest incentive for annexation was water and sewer provision. The city controlled water from Lake Michigan and maintained infrastructure that could safely pump, clean, carry, and dispose of the resource. The post-war building boom had placed pressure on landlocked towns and suburbs who drew water from wells. Growing populations stressed well supplies, causing water tables to drop and wells to dry up in various communities. As a result, suburban growth became limited by water availability.

Several communities sought to purchase Lake Michigan water from the city but were denied in accordance with the 1946 water policy amendment. Milwaukee was most able to manage water installations throughout the region, yet they refused to provide it anywhere outside its borders without annexation: "without the ability to offer efficient and affordable public improvements the city's physical growth would come to a halt. They guarded the commodity (McCarthy, 185). For Arthur Werba, Head of the Milwaukee Department of Annexation and Abstraction, "water is one city facility that we are able to promise that really persuades people to annex. The average individual does not like to spend over $1,000 for an inadequate well water supply" (Rast, 70). Werba's confidence in the persuasive power of water was demonstrated in 1952

when the Town of Lake announced plans to build a school. Milwaukee's Water Works superintendent wrote the board:

> "...may I remind your body that the City of Milwaukee had gone on record as opposing the granting of a water supply to any property located outside the City of Milwaukee...Kindly inform me whether I am correct in my understanding that you are contemplating the building of this school outside the City of Milwaukee as I am interested in knowing where you expect to get your water supply?" (Rast, 70).

In 1953, the Town of Lake approved annexation, adding 13 square miles to the city and 13,000 residents. This cemented water as Milwaukee's most valuable tool in gaining territory. Water provision ultimately forced many outlying areas to annex. Increases in the cost of digging private wells, growing populations, and uncertainty about sufficiency of groundwater supplies was, in many cases, enough for outlying areas to give up local control in return for Lake Michigan water and related city services (Gurda, 1999).

However, annexation driven service provision was an expensive endeavor. It drained the city budget for no less than a decade after incorporation. Between 1950 and 1955, annexation-related development consumed 33.6% of municipal expenditures but only brought in 27.56% of its revenue (Gurda, 1999). Further, not all suburban communities were willing to trade independence for water provision. Like Milwaukee, they were interested in supporting residential and industrial growth in service of an expanded tax base. Suburban populations had grown substantially in the post-war years. They had become autonomous communities with local control.

Suburban hostility over annexation efforts mounted in the late 1940s when Milwaukee attempted to annex the Town of Butler. Butler was 10 square mile strip of undeveloped industrial land with access to the Chicago and Northwestern rail lines. Butler bordered Milwaukee to the north west and Waukesha County to the east. Milwaukee has plans to annex Waukesha County as a satellite community. Getting to Waukesha required annexing the Town of Butler. Yet more immediately, the town provided valuable space for industrial development. The city generated a Butler redevelopment plan that included 4.7 square miles for public and private housing, 1,000 acres for industry, 120 acres for retail, and 2,000 acres for green belts and parks.

Butler residents were in need of infrastructure improvements, and most poignantly an adequate water supply. Developing water systems independently would cost Butler residents $300,000. The entire valuation of the town was $500,000, meaning that any construction would result in large tax increases. The town agreed to annexation in return for water and service provision. Part of Butler, however, was in the Town of Wauwatosa which had long opposed Milwaukee's annexation efforts.

The Town of Wauwatosa unsuccessfully challenged Milwaukee's annexation of Butler in the state Circuit Court in 1948. When the Town of Wauwatosa appealed to the state Supreme Court in the early 1950s, Butler withdrew its interest in annexation. The City of Milwaukee had a vested interest in Butler's withdrawal. Butler's choice to withdraw or incorporate depended on a re-vote to develop independent water and sewer systems. The town voted to incur the debt necessary to build the system: "…a vote for public improvements, was then a vote against Milwaukee" (McCarthy, 160). The city feared that suburban power was forming. Communities were increasingly willing to align against the city's annexation program that used water as a lure. Many moved to incorporate as cities themselves.

Tension over water supply and provision reached its height in 1954. The newly incorporated City of Wauwatosa (previously the Town of Wauwatosa) annexed 8.5 square miles for residential growth and industrial development of their own. The city's water existing system relied on eight wells and was quickly overwhelmed with new demand. Their request to purchase water from Milwaukee Water Works was denied. Wauwatosa appealed the denied request to the Wisconsin Public Service Commission (PSC), the state utility authority. In 1958, the PSC ruled in Wauwatosa's favor, a precedent decision that determined Milwaukee's provision practices were proprietary rather than governmental. Milwaukee must supply water to any suburb in the county that requested it (Rast, 2007). One year later, Governor Kohler, with support from the Wisconsin Legislature, signed the Oak Creek Law. The law reversed the rule that areas wishing to incorporate must meet a common-sense definition of 'urban' in terms of population and density levels. It was

now legal for any area bordering Milwaukee with at least 5,000 people and property valued at $20 million to become a city themselves (Gurda, 1999).

The PSC's 1958 ruling and the Oak Creek Law marked the end of water being used as a proprietary mechanism for jurisdictional growth or large-scale revenue support for Milwaukee. Not only was the city now required to provide water service to any suburb, but virtually any outlying area now had the freedom to incorporate— and many did— creating what is popularly known as the "iron ring" of suburbs and sealing off any hopes of municipal expansion. Water had begun to lose its value as a key source of revenue to finance city services. While provision rates could still be set to generate surplus revenue, its wholesale value and jurisdictional leveraging power decreased substantially. Water rate increases would now be levied on all utility users. Charging inflated differential rates to outlying areas became impossible without state approval.

City leadership attempted to preserve the political influence and profitability of water. Although Milwaukee could no longer barter service for annexation, leadership could use inner-city water rates to subsidize infrastructure expansion in outlying areas. Subsidies served two objectives. First, low-cost provision extended a tension-easing olive branch to angry suburban neighbors while incentivizing continued consumption. Although surplus revenue would decline in the immediate future, long-term contracts with Milwaukee Water Works ensured the city's monopoly over regional residential and industrial consumption. Rates could be raised after infrastructure was complete and political tensions eased. Second, existing provision commitments to newly annexed areas required infrastructure that the city could not currently afford. Inner-city rates provided a financing mechanism for immediate jurisdictional growth. While water remained a profitable tool, Milwaukee's political and profit seeking water policy resulted in what Harvey (2006) calls Uneven Development. Low-cost inner-city resources were consumed in service of tax-base expansion. Milwaukee's downtown was neglected as outlying development saw more profitable returns.

WATER: A GOVERNMENTAL FUNCTION WITH UNEVEN PROVISION

A link between public health and city planning catalyzed early clean water and waste water treatment and management efforts in Milwaukee. As early as 1871, the Milwaukee Board of Water Commissioners was charged with extending water and sewer lines across the city. However, the provision of water service to city residents was uneven. Affluent neighborhoods received water and sewerage extensions quickly. Poorer immigrant neighborhoods, like the Polish South side, received extensions slowly. They opted out of higher assessments that accompanied service provision, preferring instead to pay off mortgages with discretional income. In the early 1900s, local government realized that water provision could generate surplus revenue. City officials began extending water lines to newer suburban communities who were willing to pay inflated water costs (McCarthy, 2009). Support from the real estate community hardened lines of uneven provision. Outward development was more profitable than inner-city provision for private interests and city officials. As a result, water service transformed into a proprietary function. The City of Milwaukee acted as a corporation that could produce municipal revenue and generate networks of patronage (McCarthy, 2009). With little political influence and higher profits found outside the city center, inner-city provision remained sub-standard.

Socialist leadership emerged in the early and mid-1900s. They advocated equality in service distribution, as their voter-base developed from disenfranchised blue-collar and minority residents. Leadership extended water service across the city, and by 1940, all residents were connected to the local utility and sewerage systems. At the onset of WWII, demand for machinery, housing, and labor outpaced local supplies. Milwaukee compensated for raw material shortages by converting failed or unused infrastructure into production material. Social boundaries subsided to fill labor needs. African Americans, women, and other minority groups were rapidly employed (Gurda, 1999; Fure-Slocum, 2009). However, the influx of labor stressed Milwaukee's infrastructure. Local payroll supported a robust construction market, but materials and labor were not available until the end of WWII. Development nearly halted, a result of rationing and material diversion. The city's singular focus on war production generated economic growth in tandem with

neglect. Milwaukee's inner-city infrastructure was not maintained. Streets, bridges, buildings, and water infrastructure showed signs of severe deterioration by the war's end in 1945. This was a nationwide phenomenon.

Decentralization through land expansion was seen as the remedy for post-war deterioration in Milwaukee. It also provided a means to retain and expand the city's industrial tax base. Ziedler's annexation campaign favored urban development through a balance of annexation and inner-city redevelopment. He advocated public housing for low-income, working class, and veteran families, but was committed to debt-free financing methods. Thus, he focused on increasing the city's tax base through jurisdictional expansion. This would allow him to pay for infrastructure needs downtown. Milwaukee's biggest lure for annexation was water. They owned and operated the only utility in the region. The city maintained high water quality and quantity standards for suburban and affluent communities to bait incorporation. As further incentive, Milwaukee did not assess its new suburban residents the full cost of infrastructure improvements as it had previously.

While Ziedler intended to support outward and inner-city development in tandem, his expanding jurisdiction did not curb tax-base loss. Middle and upper class families were fleeing city life. Industry was seeking newer and cheaper areas to locate. Class lines hardened as suburban communities catering to white-flight transitioned from bedroom communities to vibrant commercial and industrial property markets with the technological conveniences of inner-city living (Gurda, 1999). The city's revenue stream was not enough to meet the cost of city improvements and infrastructure provision to newly acquired territory. As a result, even less focus was placed on supply and filtration services in poor and minority areas downtown (Hubka and Kenny, 2009). As fiscal conditions worsened, Milwaukee began relying on "inner wards of the city… to subsidize development of the periphery through their property taxes" (McCarthy, 181).

Jurisdictional growth occurred at the expense of the downtown Milwaukee, which stagnated and declined. Socialist leadership had not intended to deepen minority and low income inequity. However, the city was unable to delegate financial resources to inner-city communities. Rather, they used inner-city resources to subsidize profitable sprawl. As municipal finances

became increasingly vulnerable to industrial relocation and white-flight, the distribution of resources and governmental decision-making was relatively unchecked. Uneven Development ensued as market forces favored territorial gain and race and income exclusion.

WATER: A SOURCE OF INDUSTRIAL INPUT AND OUTPUT

So far, we have seen water being used for revenue generation—both budgetary and jurisdictional—at the economic gain of some and the expense of others. A relative constant among this, however, was the practice of using water as an input and output. Water was a raw material that could absorb municipal and industrial pollution while fueling production.

Before WWII, industrial waste concerns were secondary to human sanitation. Leadership believed that human waste, rather than industrial, contained germs and bacteria that harmed health. This belief was embedded within Anticontagionist, or Miasma Theory of Disease, paradigms of the 20th century sanitation movement. Anticontagionists argued that epidemics such as cholera, yellow-fever, or typhoid, evolved from decomposing organic waste, rather than foreign bacteria transmission between people. Creating a clean and healthy city required the removal of organic waste before it putrefied. Sanitarians advocated the construction of water carrying technologies, like sewerage systems, to remove human waste from the city. Polluted water was disposed of in local streams, rivers, or lakes, where running water was believed to be a purifying agent itself.

Disposing raw sewage into local water bodies generated severe bacterial problems for downstream users. Health benefits upstream often resulted in increased morbidity, mortality, and infectious disease rates downstream. Public health official solved this problem by developing filtration and chlorination technologies, which allowed withdrawn water to be cleansed prior to consumption. By 1940, "almost all urbanites were drinking treated water, and morbidity and mortality from waterborne disease had ceased to be a serious public health problem" (Tarr, 344).

However, treating sewage before disposal did not develop in tandem with filtration and chlorination technologies. Tarr (1996) offers four explanations for this disparity. First, engineers,

health officials, and policy makers were unclear about how disease developed. Many believed water dilution and movement were sufficient purifying agents. Second, cities did not want to finance operations that were perceived as primarily beneficial to downstream users. Third, costly improvements did not ensure a material return. Forth, municipalities were concerned that water disposal regulations would slow economic development, disrupt industrial operations, and test the political power of firms.

Milwaukee operated a centralized water system and attempted to protect its supply from bacterial contamination through filtration and chlorination technologies. Yet, municipal concern over water quality was met by greater concerns over prosperous economic development centered on manufacturing. Any action taken to abate industrial pollution was slow and cautious. In general, a perception prevailed that "no existing satisfactory and economically feasible means of treatment existed for wastes of many important industries and that legal action could drive industry out of the state, rather than produce environmental improvement" (Tarr, 399).

For Milwaukee, water was a seemingly abundant input and output— a free good that could lubricate productivity while absorbing negative externalities of urbanization, industry, and profitable growth. The free-market economy of industrial cities affirmed this paradigm, encouraging prosperity driven by natural resource exploitation. The cheapest and least regulated sources of water withdrawal and disposal were sought (Tarr, 1996). Industrial waste disposal, treatment, and analysis remained relatively ignored. From the standpoint of public health officials and sanitary engineers:

> "…the main problems caused by industrial wastes [were]: interference with water- and sewage-treatment technologies, consumption of oxygen that reduced dilution power of streams, the creation of taste and odor problems in drinking water (especially phenols), and devastating effects on fish life" (Tarr, 344-45).

Milwaukee maintained and operated one facility in the years surrounding WWII to process and treat water for industrial, commercial, and residential use. The Linnwood Water Treatment Facility, a northern plant located two miles from the city harbor, used coagulation, sedimentation, filtration, and disinfection to treat Lake Michigan water. Economic progress brought about the

invention and use of new toxic pollutants in domestic and industrial settings. Traditional metal, coal, food, and petroleum industries had expanded. New substances with large pollutant capacities, like DDT, Chlordane, Benzene, Hexachloride, Endrin, Dieldrin, Aldrin, and synthetic materials became increasingly common. Milwaukee's wet-industry, including refineries, gas and by-product coke works, distillation plants, metallurgical processes and mining firms, and tanneries operated "without concomitant attention to pollution control because of wartime restrictions and a lack of legislation and enforcement" (Tarr, 374).

Industrial pollution remained a secondary concern after the war. Challenges associated with population growth and service capacity took precedence. In the late 1950s, Milwaukee authorized a study of their Water Works to determine the state of the system and best practices for expansion that would not interfere with economic development. Black and Veatch, the firm commissioned to review Milwaukee's system, was directed to consider regional and city growth (Foss-Mollan, 2001). The firm recommended construction of a new pumping station, filtration plant, and booster stations— to be paid for through bonds— to better supply central and outlying areas. A 25% rate increase for city residents was recommended.

Black and Veatch advised that the new Howard Facility be located on the south side of Milwaukee. Concerns over water quality in south Milwaukee were raised, but project engineers countered that chemical treatment and filtration would alleviate any public health issues. The location was chosen for three reasons: (1) decentralized water infrastructure would minimize any chance of system destruction should cold war concerns come to fruition; (2) a south side placement diminished the need for additional booster stations to ensure adequate water pressure for southern residents; and (3) the city owned a plot of land on the south side of Milwaukee. The second and third measures center upon cost-saving.

Howard's intake pipe was extended 7,600 feet into Lake Michigan and placed at a depth of 30 feet. The intake coincides with disposal plume from a northern sewerage plant, resulting in increased pathogenic levels and turbidity due to the shallowness of water. Leadership recognized that the plant would process low quality water due to its placement close to a sewerage outflow.

However, it was presumed that chemical treatment would remediate any and all health hazards while providing significant capacity for industrial, commercial, and residential consumers. Water demand was projected to increase from 148 Million Gallons per Day (MGD) in 1959 to 230 MGD by 1980 (Foss-Mollan, 2001).

Milwaukee's 1959 assumption and projection was made in response to economic conditions that supported continued residential and industrial growth, unfettered consumption, and lax environmental protection in service of economic expansion. Drinking water concerns were remedied using industry-produced chemical treatments. Municipal decision-making focused on cost savings and jurisdictional gain. Provision and service standards for minority inner-city residents was secondary to the generation of surplus revenue. Through the lens of Uneven Development, this period highlights a patterned component of uneven investment in the metropolitan area. Capital disinvested in Milwaukee's urban core and invested in suburban and exurban sites where the ability to maximize profitability was greater. However, conditions changed as deindustrialization took root. Around 1967, demand for Milwaukee's industrial output dropped as U.S. corporations entered a period of global competition and rapid technological change. Milwaukee faced economic decline as mass industrial production began to fragment. Illustrating the cyclical rearranging of Uneven Development, economic and institutional arrangements shifted in response to physical, material, ecological, and social resources that could be cheaply appropriated and consumed in the "Sun Belt" and abroad. Capital flight left thousands of factory workers unemployed. Racial tension and the post-war yearning for space and nature, individuality and automotive freedom, and technological convenience within the nuclear household intensified white-flight. Declining economic opportunity resulted in significant population loss. Deindustrialization deeply disrupted socio-economic conditions in Milwaukee, and municipal perceptions of water shifted in response.

Chapter 5: Deindustrialization (1967 – 2000)

The logic of water as a commodity had characterized Milwaukee's industrialized practices because economic conditions supported the production and exchange of raw material—be it water, iron ore, or grain—to generate wealth at an unprecedented scale. This was no longer the case as deindustrialization took place. However, a new logic of water emerged in its place within this time period (1967 - 2000). Water shifted from being a commodity itself, to being a valuable amenity around which commodity could be created. Water became infrastructure. The concept of infrastructure can be used to discuss how water might be viewed as a resource around which commodity is created. Pipes, pumps, and other physical connections often come to mind when infrastructure is mentioned. However, if you look past its physical components, infrastructure can be viewed as a series of network or relationships (Star, 1999; Star and Ruhleder, 1996). In Milwaukee's case, water connected land, investment, private-public interests, and city leadership to create an intended result.

Within this era, water became infrastructure around which commodity was created. It served as a catalyst from which efforts and relationships attempting to remediate economic loss could occur. Four interweaving logics within this time period demonstrate water's role as infrastructure. The first highlights a shift in economic focus. Industrial development outside the city became secondary to inner-city redevelopment. Milwaukee's water resources, Lake Michigan, the Milwaukee Harbor, and the Menomonee, Kinnickinnic, and Milwaukee Rivers, converge in the urban core. The spatial change highlights a transformed relationship between land value, water, and capital investment. The second and third logics speak to water quality— sewerage and service provision projects that remediated water resources— so that water might function as an amenity around which investment could occur. The fourth deals specifically with the commodity created around water resources, which includes the formal establishment of private-public partnerships. A note regarding equity is included at the end.

Similar to the previous section, the following narrative provides a snapshot of Milwaukee's relationship to water as summarized above. Individually, each logic discussed highlights how

central ideas surrounding water were translated into practice within this time period. Together, they represent a collection of practices that inform my understanding of water as infrastructure. Again, it is important to note that the logics below overlap. While they are subdivided to create clarity, Milwaukee is a complex system and ideas that begin at one point often inform, merge, and transform into subsequent practices.

WATER: THE HIGHEST AND BEST USE OF LAND

Large-scale redevelopment programs were initiated across U.S. cities after WWII. While many cities emphasized downtown redevelopment, focusing resources and policies towards inner-city renewal, Milwaukee emphasized industrial retention and manufacturing. Attention was not placed on inner-city redevelopment until the 1980s. Milwaukee's downtown business leaders and city officials envisioned different redevelopment trajectories in the mid-20th century. Downtown business leaders advocated urban core redevelopment. Political leadership advocated the maintenance and extension of industry. While visions differed, urban challenges were shared. A 1948 study commissioned by the Milwaukee Common Council found that 15% of the city's land was blighted, the worst of which surrounded the city's central business district. Further, the "suburbanization of white, middle-class city residents, fueled in part by an acute housing shortage in central city, was undermining the city's property tax base and eroding the customer base of downtown retail establishments" (Rast, 406). Property values in the central business district had fallen by 50% since the 1930s.

Milwaukee's business community took action against inner-city degradation by forming the 1948 Corporation, a downtown redevelopment advocacy organization. The Corporation generated a downtown redevelopment plan which included highway construction, local transportation infrastructure, middle-class housing, a renewed civic center, and new entertainment, sports, and cultural facilities. The Corporation proposed a reversal of the city's debt-free and pay-as-you-go policies to finance redevelopment. However, their efforts failed. The Socialist

administration operated as a budgetary caretaker. Pay-as-you-go financing systems were established to reduce the payment of interest to financial institutions, and ultimately, achieve a debt and bond free obligation status. City leadership viewed the Corporation's plans as “glamour projects” and paid little attention to downtown redevelopment as business interests saw it. Rather, they saw industrial development as the best method for remediating inner-city degradation. Slum clearance would occur on the back of industrial development, being paid for with revenue from an expanded tax base.

In 1949, Milwaukee’s political leadership received federal and state resources that allowed them to move semi-autonomously towards their industry focused redevelopment plan. The Housing Act of 1949 provided funding for land purchases under Title I. Development was focused on the periphery. While several downtown projects were constructed in the 1950s— including a lake front war memorial and an indoor sports arena— the acquisition of peripheral land through annexation was "…a key component for an economic development strategy emphasizing manufacturing over development and job creation over real estate development" (Rast, 408).

Milwaukee’s acquisition of large parcels catered to industrial preference. Manufacturers preferred large-scale single-story plants and additional acres for expansion. The City of Milwaukee did not have comparable plots within their borders. A 1948 Economic Study of Milwaukee found that the city’s lack of industrial land was a primary factor in a corporation’s choice to locate outside of Milwaukee. The city spent a substantial amount of tax dollars on roads, water mains, sewer lines, and other infrastructure to attract industry to newly annexed land. Capital costs were projected to be recovered through industrial property tax paid over time, which encouraged a long-term commitment to industry focused economic development.

The city's program continued through the 1960s when Henry Maier was elected Mayor. Business elites hoped that non-socialist leadership would support private-public partnerships focused on downtown redevelopment. Maier claimed that downtown redevelopment was a keystone in his agenda. Yet, conflict surrounding downtown redevelopment remained. The 1948 Corporation, now the Greater Milwaukee Committee (GMC), had not made significant progress

in the past decades. Downtown business leadership was fragmented and private developers had little interest in building new projects in the central business district without assurances of future development.

In contrast, the city's industry focused economic strategy outside city limits had gained ground. Large areas for industrial expansion were now available. Significant investments through Milwaukee's capital improvement program had extended utility and service infrastructure into newly acquired territory. Labor and industrial real estate developers supported the program due to job creation and market expansion. Momentum favored the existing industry focused approach and Maier decided to make industrial development a keystone of his economic development strategy.

Mayor Maier established the Division of Economic Development to oversee and direct economic development policy. Formally, the division was charged with "assist[ing] business firms seeking to locate in Milwaukee, conduct[ing] economic research and promot[ing] the city as an industrial location" (Rast, 411). The principle initiative created with the division was the Industrial Land Banking program. Initiated in 1963, the Industrial Land Banking Program purchased large parcels of industrial land which were held in reserve for industrial buyers. The city financed the purchases through bonds, a departure from previous debt-free practices. The program's objective was "…to maintain a large supply of vacant industrial land so that marketable sites for development would always be available to industries seeking to relocate or expand in Milwaukee" (Rast, 411).

By 1966, the city had acquired 563 acres of previously annexed property on the northwest side of Milwaukee. By 1980, the city had acquired 900 acres, 400 acres of which was sold to large-scale manufactures. Private investment in the Land Bank stood at $100 million. More than 3,000 jobs were created. Despite modest successes, the program's weakness became apparent by the early 1970s. A study by the Division of Economic Development found that few large-scale high employment manufactures, the target demographic, had purchased land held in reserve. The report concluded that "with advances in transportation and communications making capital increasingly

mobile, such firms now sought lower-cost locations in the Sunbelt and, increasingly, in Third World Countries" (Rast, 411).

The Maier administration shifted focus following the report. Rather than marketing industrial reserves to large-scale companies, they began targeting small to midsize industries. The city proposed the development of a municipality-owned industrial park that would contain sites immediately available for occupation. The proposal grew from the Division of Economic Development's finding that smaller firms maintained relatively shorter relocation timeframes, and thus, would be attracted to built-out sites. Pushback was immediate. Developers who previously supported the Land Banking program argued that city ownership competed with private industry. A 49 acre industrial park was built amidst private-public controversy.

As the city struggled to adapt its existing program to new economic conditions, downtown business leaders renewed their push for inner-city redevelopment. In 1973, the GMC called for a downtown focused redevelopment approach that would target a 20 acre span in the city's central business district. The GMC commissioned a formal study of downtown redevelopment as tangible support. It concluded that "…downtown redevelopment had become particularly important due to secular trends away from manufacturing employment toward service sector employment" (Rast, 412). The Maier administration received the study positively and supported the creation of a business-led private development corporation, The Milwaukee Economic Development Corporation, to provide leadership and financing for downtown projects. With $3 Million in private seed money, Maier and prominent business leaders in Milwaukee announced a "partnership for progress" that was dedicated to downtown revitalization.

Cooperation between private and public partners was tenuous at first. While a public announcement had been made, private developers were hesitant to engage projects without assurances of additional development in targeted areas. The city did not provide such assurances and, as a result, a substantial number of project proposals fell through. Historic distrust between the GMC and political administration was also an impediment. The Socialist administration had largely refuted downtown projects in favor of industrial expansion. Maier's administration had

followed a similar path, redirecting only when the Land Banking program showed modest results and manufacturing was found to be moving to lower-cost locations. Private and public cooperation was fragile and clashes were frequent. For example, a developed canceled plans for a $10 million office building because "…obstructionist city officials had strangled the project" (Rast, 412).

In 1974, the Maier administration released its own downtown redevelopment master plan. Its publication signified that the city wanted an increasing amount of agency in its renewed economic approach. Further, the plan constituted a major transition from an industrial manufacturing-based development strategy to one that was markedly post-industrial. Economic emphasis was placed on service and amenity industries in the downtown area. Inner-city land was increasingly affordable due to disinvestment and depreciation following WWII. In line with Harvey's (2006) Uneven Development, capital began flowing back to the urban core where reinvestment promised increasingly profitable returns. However, despite the release of a formal master plan and economic opportunity, public and private sector clashes continued through 1978. An April editorial in the Milwaukee Sentinel stated that "the necessary partnership between the private and public sectors has still not materialized into a strong alliance for the salvation of downtown" (Milwaukee Sentinel, 1978). Business leaders believed that a large-scale project with multiple components was needed to jumpstart development and alleviate investor concerns. A 1977 project proposal fit the bill and in 1978 an estimate of $90 million in project costs was reached. The redevelopment project included a retail center, hotel, federal building, and shopping mall, which would be built and operated by the Rouse Company, a nationally prominent firm. The 65,000 sq. ft. shopping mall was scheduled for the first phase of development, providing an anchor from which subsequent phases could unfold. The large price tag and complicated financing scheme made it necessary for private developers and city officials to cooperate. Both parties considered the project risky, making effective working relationships vital as the project moved forward.

By 1980, Milwaukee's redevelopment strategy was increasingly focused on downtown and the central business district. Although Milwaukee's:

> "…industrial policy was not abandoned, it was no longer at the center of the city's development agenda. A deeper, more sustained partnership was emerging around real estate development and the "highest and best use" of land, particularly downtown. Although this strategy would create certain benefits for Milwaukee, the employment opportunities it produced would not offset the massive job losses in manufacturing that would occur in the subsequent decades" (Rast, 413).

In 1985, the first trace of Milwaukee's water-focused redevelopment plans emerged under Maier. A financial collaboration between the GMC and the City of Milwaukee, a river frontage was constructed adjacent to the Ivory Tusk Building (then the Gimbels Department Store). The property was owned by the GMC. As the frontage took shape, the city's new Riverwalk Civics Committee was developing plans for a public park and private boat landing on East Mason Street, which would link the Milwaukee Center, the Performing Arts Center, and Marquette Park.

The concept of walkways along Milwaukee's downtown riverfront signified that proximity to water itself, rather than the use of water in production, could emerge as a piece of what made land a valuable commodity and real estate development a profitable endeavor. Water became an amenity which could generate economic value through the appreciation of real estate prices and attraction of service and retail businesses. Financial collaboration in constructing the river frontage— which draws upon the meeting of the Menomonee, Kinnickinnic, and Milwaukee Rivers in the urban core— highlights the emergence of private-public partnerships in realizing a highest and best use of land in the downtown area. This stands in contrast to the city's past development efforts, which were largely autonomous and heavily focused on outlying areas.

1985 marks the first sign of water-focused redevelopment in the downtown area, but the value of water in redevelopment, in terms of increasing property value and catalyzing real estate development, was not fully realized until sewerage and provision infrastructure could ensure quality. Remediation measures had to be taken to transform water from an industrial agent to one that facilitated land value in service of commercial and business activity within the city. As you

will read in the next two logics, the Water Pollution Abatement Program (WPAP) and the C. Parvum Crisis set a new infrastructural foundation for sewerage and service provision. This generated value in water as a reliable asset, one which could be used to help foster economic activity through environmental health and consumer confidence.

WASTE WATER: A REGIONAL RESPONSIBILITY

Milwaukee had developed successful systems to treat sewage and purify water by 1940. At the onset of WWII, however, water quality decreased due to population gain and industrial expansion. Milwaukee's water utility, Milwaukee Water Works, was a city-owned and operated enterprise that served both the city and the metropolitan area. Although the city was required to serve outlying areas following the PSC's 1958 ruling, Milwaukee remained the sole authority in water provision. Sewerage was a shared enterprise. Two sewerage authorities existed at this time. The Metropolitan Sewerage Commission of the City of Milwaukee, which served the city only, and the Metropolitan Sewerage Commission of the County of Milwaukee which served outlying areas. Together, these two organizations ran the Metropolitan Sewerage District of the County of Milwaukee (MMSD, 2015).

The 1960s and 1970s highlight a time when increased federal attention was placed on environmental issues. The city's sewerage system was most vulnerable to scrutiny due to combined sanitary and storm systems in the oldest neighborhoods of Milwaukee and Shorewood. Combined sewer overflows released untreated human waste into the local waterways roughly 53 times per year (Hein, 2015). Additionally, regional sewerage was piped from outlying areas into Milwaukee for processing. So while the city shared authority over the sewerage, inner-city facilities were responsible for treating urban and suburban waste. Unlike the city's water utility, Milwaukee's treatment plants and sewerage conveyance systems had been designed for a lower capacity than needed. In a 1952 response to sewerage overflows and insufficient capacity, the Jones Treatment plant, Milwaukee's first treatment facility, was expanded. In 1968, a South Shore

facility was constructed to mediate the amount of waste water processed at the Jones Treatment Plant. Additional expansions occurred in 1968 and 1974.

Waste water emerged as a regional issue due to mounting pollution and sewerage concerns. In 1957, representatives from Illinois, Indiana, Michigan, and Wisconsin met to discuss water quality improvements at the Lake Michigan Pollution Control Conference. The conference concluded in new state sewerage standards. All treatment plants located on the bank of Lake Michigan would disinfect waste water before release. Milwaukee's sewerage commissions set their deadline for 1971.

In 1972, the federal Clean Water Act was amended, lowering the quantity of sewage that states could legally dump into national waterways. In the same year, the state of Illinois and the Wisconsin's Department of Natural Resources (DNR) sued both the Metropolitan Sewerage Commission of Milwaukee County and the City of Milwaukee Commission. Reaching back to the Lake Michigan Pollution Control Conference, they claimed that the sewerage authorities did not disinfect effluent before it was released into Lake Michigan. At that time, the Jones Treatment facility did not disinfect effluent after treatment. Rather, plant officials claimed that 98% of the bacteria was gone before discharge occurred. The lawsuit went to trial in January 1977 and was heard before the Supreme Court in 1982.

Throughout the trial, Milwaukee negotiated with the DNR to delay the enactment of new federal sewage discharge standards. In May 1977, they reached a settlement that required the city and county sewerage commissions to spend $670 million over the next 25 years on a Water Pollution Abatement Program (WPAP). The program included an expansion of treatment plant capacity through solid waste management programs by 1982 and the construction of relief sewers by 1983. In 1981, however, the Environmental Protection Agency (EPA) released federal compliance measures for the district. The EPA's compliance measures added significant costs to the WPAP program, which had been steadily increasing since the settlement was first developed four years earlier.

Illinois's 1977 case was settled by the Supreme Court in 1982. The Court's review included Illinois's claims, WPAP, and the 1981 EPA compliance measures. Their ruling extended WPAP's completion date to the mid-1990s, allowing the city to avoid the need to borrow money immediately. The Court relieved the requirement to construct separate sanitary and storm sewers in the combined-system neighborhoods of Milwaukee and Shorewood. Sewer extensions were allowable. WPAP's expansion and management plans were upheld. The City of Milwaukee and sewerage authorities viewed the ruling as a success. Concern over property tax increases was alleviated due to decreased project costs and an expanded timeline. Fear that a large-scale sewer reconstruction program would result in bankruptcy was also reduced. Federal and state grant funding was available and pending (Cutler, 2001).

Milwaukee's sewerage commissions moved forward with a WPAP master plan that would improve Lake Michigan water quality by decreasing the amount of untreated water dumped into the lake: "by increasing the capacity of the system, sewage overflows would be eliminated and water quality would improve" (Hein, 1). The city and county authorities considered three large-scale options for reducing sewage overflows. The first was to prevent water from:

> "…infiltrating the system; this might involve, for example, eliminating sewer leaks on private property or reducing leaks of water…in the public system. The second possibility was to enhance the sewerage system so that it could be able to handle increased volume during wet weather. This could be done by increasing the capacity of the treatment plants and/or by adding large storage tunnels for untreated sewage and storm water, holding it for processing. The third possibility was to separate the combine sanitary and storm sewers in Shorewood and Milwaukee" (Hein, 7).

The first option was declared too expansive. It would have added an additional $1 billion to project costs. The third option, separating combined systems, was disregarded due to physical and economic disruption. Property owners in Shorewood and Milwaukee would have been forced to pay for new sewer connections ($2,000 – $4,000 per household) while businesses suffered from large-scale construction downtown. This option added $469 million to project costs. The second option, increasing sewerage system capacity, was selected. Its lower overall cost was a primary consideration.

Increasing sewerage system capacity included treatment plant upgrades, which would increase processing capability, and the construction of underground tunnels to retain waste water before treatment. The tunnel system would run 300 feet underground, spanning approximately 15 miles under the Milwaukee and Menomonee River valleys. Lake Michigan water quality was expected to increase as a direct result. WPAP set a goal of no more than two combined sewer overflows per year. Sanitary sewer overflows would be eliminated entirely.

The Deep Tunnel system was the best alternative to separating combined sewerage systems in Milwaukee and Shorewood. Mayor Maier was opposed to separation, and critics "…contend that money was the driving force behind this decision, because the cost of separating the systems would have fallen primarily on the city, while the cost of the alternative— the Deep Tunnel, was spread across the region (Gunn, 7). The decision was both social and political. For Maier, saving Milwaukee meant not tearing up downtown Milwaukee and accruing the associated costs.

What is termed the "Sewer Wars" follows the approval of the WPAP plan and deep tunnel construction. The Sewer Wars centered upon project costs, which amounted to nearly $3 billion. How much should sewer service users be required to pay for WPAP's construction program? Milwaukee's sewerage authorities held independent contracts with cities outside county lines. Contract communities paid capital costs using a preset formula based on volume (flow). County communities paid capital costs based on a property value calculation within the territory. WPAP's initial funding scheme was based on the district's existing rate framework. However, WPAP's high capital costs triggered an analysis of alternate charging methods in 1977. Contracts with outlying communities were permitted for termination in 1984, providing an opportunity to change the rate structure if it might serve their financial interest. The analysis concluded that all users should be charged on a property value basis:

> "all communities inside and outside the district should be charged on the same basis. If the contract formula were applied equally to all communities, revenues would be inadequate to pay the debt service on the bonds. That is because the formula recaptured costs over fifty-years while the bonds had to be repaid within twenty years" (Cutler, 183).

Contract communities had anticipated the possibility that WPAP costs would greatly increase their sewerage provision rates, but they did not receive formal word until 1980. The report was kept quiet due to concern over political backlash. Disclosing rate changes prematurely could jeopardize final approval of construction plans and state and federal grants. It was also speculated that an early disclosure would prompt contract communities to terminate service and petition to construct their own treatment facilities (Cutler, 2001). In 1982, the Sewerage District and Milwaukee County received legislative authority to expand its boundaries to include all contract communities currently served, so long as the community agreed. They also received legislative approval to merge into the Milwaukee Metropolitan Sewerage District, a single commission rather than two, in response to financing disputes. The district acted immediately to draft procedures for boundary expansion.

Contract communities were deeply opposed when the new rate scheme and district expansion was announced. Sewerage rates would rise substantially if service costs were to be based on property value. The average Milwaukee home was valued at $40,000, resulting in an annual rate of $140. In contrast, the average Fox Point home was valued at $127,000. Their annual rate would amount to $420. Contract communities organized into the Fair Liquidation of Wastes (FLOW), arguing that rates should be set based on flow generated by each community. The newly joined district was allied with the Joint Organization for Better Sewers (JOBS), a collection of wet-industries such as tanners, brewers, food processors, printers, hospitals, and electroplaters. Together, they countered that:

> "77% of the construction costs was needed to cope with invasive storm water rather than-- as FLOW suggested-- customers' use, like taking a shower. Further, protecting the public health from sewage overflows was a public good, logically chargeable to property, like police and fire, all of which enhanced property values" (Cutler, 185).

A volume-based rate system would have been multiplied costs ten-fold. Controversy and court battles ensued from the mid-1980s to 1996. The sewerage district, which suburban groups claim was stacked with city bias, ultimately won. A settlement of $140.7 million was reached and contract communities were forced to join the district. Their sewerage would be assessed in line

with property tax. The sewer wars ended in a victory for Milwaukee and the newly joined district. The cost of infrastructure improvements would be shared throughout the region, rather than by the city alone, who could not afford to finance the project.

An understanding of water as regional infrastructure might be drawn in two ways. First, sewerage was shown to transcended political boundaries. The management and mismanagement of water resources had cross-jurisdictional consequences that were not fiscally attributable to a singular political entity. The physical infrastructure— the Deep Tunnel construction project— established a built system for managing regional waste and sewerage. The WPAP program, soft infrastructure, generated the social and institutional capacity under which operational and managerial aspects of the pollution abatement program could occur successfully across communities. In combination, the project set a foundation for the remediation of water resources at a regional scale.

Second, regional relationships formalized through cost sharing marked a shift from water being city-owned to water being a shared resource. The Sewer Wars highlight a transformative moment in power relationships. With rate structures uniformly assigned throughout an expanded district, waste water was shown to be a responsibility that city and regional leadership needed to manage and maintain in collaboration. This was, of course, a contentious change. The court-backed shared funding scheme came at a high cost. Political infighting led to substantial fragmentation throughout the region. Milwaukee's provision of potable water was a decisive and fragmenting issue between city and suburbs during Ziedler's annexation campaign. Waste water infrastructure, and decisions surrounding who should pay, worsened an already stressed relationship. The irony embedded within this is that while water became a unifying agent through cost and operation, sharing the resource placed neighboring communities at a greater distance.

Politics aside, WPAP and the Deep Tunnel system significantly impacted Milwaukee's water landscape by cleaning it up. It created an infrastructural foundation, in terms of physical and institutional systems, that allowed Milwaukee's rivers and lakes to emerge as an asset around which economic activity can take place. This has been particularly true for "… areas that have

been the focus for downtown revitalization during recent decades and the development of amenities such as the Milwaukee Riverwalk" (Holmes, 2015).

DRINKING WATER: HEALTH FOR THE PEOPLE

A framework for regional sewerage and pollution remediation was in place by the 1990s. Rivers flowing through the City of Milwaukee and Lake Michigan itself were gradually cleaned, renewing a platform from which economic opportunity could emerge. However, WPAP and the Deep Tunnel dealt with sewerage, not potable drinking water. Milwaukee Water Works would face crisis before cleaning up its operations. Drinking water quality had not been a large point of discussion in Milwaukee before 1993. Ensuring sufficient quantity for industrial and residential provision was the primary focus. Water quality had been praised since the opening of the Linnwood treatment facility in 1939. Although the Howard Plant's intake pipe remained questionable, Milwaukee's water received national praise for purity and taste. The utility consistently surpassed federal Environmental Protection Agency and Wisconsin Department of Natural Resources standards by setting its bacterial tolerances below requirement.

In 1992, the Wisconsin Department of Natural Resources passed new standards for lead levels in potable water. Milwaukee's water contained no measurable amounts of lead when tested at the filtration plant. Rather, high pH in the water caused aging pipes to leach lead as water was transferred across the city. The utility was charged with altering the chemical composition of potable water to meet the newly established lead standards. A new coagulant agent, poly-aluminum chloride (PAC), was selected to lower the water's pH to "a level where sediment was deposited in the tainted pipes, forming a protective barrier over the lead solder" (Foss-Mollan, 164). PAC was purchased in October 1992 from the General Chemical Company in New Jersey. It was more expensive than alum, Milwaukee's previous coagulant agent, but the company assured the city that the product's superiority would decrease the amount needed, and thus, reduce long-term costs.

Savings were estimated at $500,000 annually, which would increase the amount of surplus revenue available for general fund transfers.

Coagulants are commonly used to clean particles from water. The appropriate dosage, however, is subject to water conditions. The incorrect dosage can harm health. While cities already using PAC had instituted training programs to ensure against possible health problems, Milwaukee began its use in winter. Cold temperatures prohibited bacterial growth which minimized the need for chemical agents. Water conditions also remained relatively constant, so the outcome of PAC-related quality tests appeared stable. The city had not instituted a training program when spring conditions emerged in March. Standard testing and treatment processes were assumed to be the proper mechanism for ensuring quality. Chlorine kills bacteria, coagulation aggregates dead particles, and filtration removes particle groups— the treatment had worked flawlessly over the past fifty years.

However, PAC's coagulation rate was not well suited to Milwaukee's spring conditions and in March 1993, prolonged winter conditions gave way to sudden temperature rise. Three resulting environmental conditions increased turbidity: (1) Large snowbanks melted rapidly, releasing runoff that contained animal waste, air pollution residue, and other human-related contaminants. Milwaukee's sewer system could not handle the flow. Streets and gutters flooded as excess water flowed towards the Milwaukee, Menominee, and Kinnickinnic drainage basin and into the Milwaukee Harbor; (2) Milwaukee's sewage treatment plant reached capacity, causing untreated water to flow directly into Lake Michigan (the WPAP Deep Tunnel Project was completed in 1996); (3) River ice in the Milwaukee, Menominee, and Kinnickinnic melted and flowed rapidly towards Lake Michigan. Significant agricultural waste had accumulated during the winter months. Howard Plant operators performed water quality tests as turbidity levels increased. However, they were inexperienced at performing tests when both PAC and high turbidity was present. As a result, the bacterial treatment selected was incorrect. Turbidity continued as operators sought new chemical solutions. The use of PAC was discontinued after several days. Reverting back to an

alum additive, turbidity normalized and "bacterial testing indicated that complete disinfection had occurred and that no bacteria were present in the finished water" (Foss-Mollan, 170).

On March 29th, the facility received forty-five service calls. People noticed a yellow-tint in their water and increased cloudiness. Many wondered whether it was safe to drink. Plant officials assured them it was. Unusually high levels of diarrheal illness were reported a week later. City and state officials suspected a rotavirus, rather than a bacterial infection, yet fecal samples taken by health officials confirmed the presence of cryptosporidium parvum (C. Parvum), a water borne bacteria. A boil order was instituted until leadership remedied the problem on April 15th. C. Parvum was found at both the Linnwood and Howard plants. Mayor Norquist (1988-2004) temporarily closed the Howard Plant. Bacterial levels had shown the highest concentration there. Public concern over drinking water quality amplified as local and national media covered the crisis. Many perceived Water Works employees, who were largely silent on the issue, to be at fault.

The Water Crisis hearings were held on April 26th. Water department officials admitted that their lack of knowledge surrounding the use of PAC may have negatively affected water quality. Others who testified produced a series of operational recommendations and physical upgrades to the Linnwood and Howard Plants. Physical recommendations included a revised practice of sending waste water to sewers rather than recycling it; the installation of ozonization technology and large-scale infrastructure upgrades; and the extension of the Howard Facility intake an additional three quarters of a mile into Lake Michigan (beyond the nearby sewage outflow point). Operational recommendations included the creation of water quality improvement division and water quality management supervisor to oversee communications and training; increased turbidity monitoring; improved chemical dosing technology; and what is broadly referred to as "updated systems of plant operations monitoring" (Foss-Mollan, 184). All recommendations were adopted simultaneously at a cost of $90 million. Improvements would be funded through bonds, which would be repaid by higher water rates over a period of twenty years.

The C. Parvum crisis occurred at a time when the city was struggling to retain its residential population and economic base. Leadership feared that an image of Milwaukee:

> "…as a city with unclean water [would] seriously affect the decision of existing and potential manufacturers to locate in the Milwaukee area … [and] since the mayor and the common council wanted to improve the city's commercial and industrial base, any negative images had to be addressed as rapidly as possible" (Foss-Mollan, 187).

Water could no longer be viewed as an industrial input and output— a sink that could absorb contaminants— and later be purified for consumption with standard chemicals and processes (Tarr, 1996). Water was shown to be a vital ingredient in public health by directly harming it. While customers had no alternative non-potable water source due to Milwaukee's monopoly on city and suburban supply, moving forward with "business as usual" was not possible. Failing to act quickly was perceived as ruinous to the city's economic future and the mayor's reputation.

The 1993 outbreak was a transformative moment in the city's conceptualization of water. The relationship between treatment, quality, consumption, and health had been exposed through crisis. Milwaukee's large fiscal expenditure demonstrated action. Physical and operational changes to Milwaukee's water infrastructure were used to establish a new meaning of health. Provision of high-quality potable water meant municipal investment, rather than cost cutting, and improved management, training, and hiring practices, to serve residential and industrial consumers. Like WPAP, the health crisis impacted Milwaukee's water landscape. Large-scale infrastructural investment ensured that potable water would be delivered in the highest quality form. Technologies installed were cutting-edge and operational practices went above legal requirements. Unlike WPAP, however, the water remediated was not flowing visibly through the city's urban core. It flowed through pipes and into the homes and businesses of residential and industrial consumers. This produced a different value, the value of consumer confidence. Without consumer confidence in water, any economic activity derived from proximity or use— whether goods production, amenity, or recreational— would cease to exist. People would leave the city.

WATER: PRIVATE-PUBLIC COMMODITY MAKING

So far, I have discussed the transition from suburban and exurban industrial development to inner-city redevelopment, and the resulting relationship between land value, water, and capital investment. I have also discussed two large-scale infrastructural projects, WPAP and the C. Parvum Crisis, which remediated water resources in service of their economic potential. I now return to where we began, Mayor Maier's catalyzing 1985 water project, to demonstrate how water was used to generate economic value, as an amenity and commodity-creating agent, through the appreciation of real estate and attraction of commercial and retail services.

In 1988, newly elected Mayor John Norquist announced the Riverwalk Initiative, a continuation of Maier's 1985 water project. The Riverwalk Initiative, a formal water-based improvement project, would use the Milwaukee River as a means to catalyze and connect downtown development with business and leisure activities. Norquist wanted to change negative perceptions of Milwaukee's waterways and rediscover their monetary and recreational value. He believed that cities, like businesses, could foster wealth production. They benefitted from the free movement of goods, people, and capital demand. Norquist applied his neoliberal economic beliefs to Milwaukee's waterways. Engaging a market-based approach to environmental protection, he sought to increase downtown property value and real estate development by transforming the Milwaukee River into an amenity (Norquist, 1998).

Between 1988 and 1992, the city developed a Riverfront Master Plan in compliance with Wisconsin's Public Trust Doctrine. The plan established construction and use guidelines for the Riverwalk and delineated its physical location within the city. The master plan was formally approved by the Wisconsin Department of Natural Resources and adopted by the Common Council in 1992 (City of Milwaukee, 2015). In 1993, the Riverwalk Initiative was expanded to include design specifications. Twenty-two segments were planned along both sides of the Milwaukee River, providing a unified link among downtown attractions. A Riverwalk Development Fund was approved and adopted that fall, signifying political support for continued investment.

In March 1994, property owners and city leadership formed a Business Improvement District (BID) in the downtown area: “for the purpose of constructing and maintaining downtown Riverwalks … The objective [was to] complete improvements along the river that will increase public access and promote, attract, stimulate and revitalize commerce and industry within the City” (City of Milwaukee, 2015). Although the funding scheme was not formalized until 1996, BIDs allowed the city, property owners, and developers to split building costs (Local Government Center, 2015). The cost sharing formula set the city's contribution at 70%. A permanent public access easement was guaranteed in return for municipal investment.

The Riverwalk's first segment using BID financing was completed in 1994. Plans for a second segment, the Historic Third Ward, were initiated in 1999. Project costs were estimated at $11 million. The segment would expand beyond the Milwaukee River to include the Menomonee River. This time, a Tax Increment Financing (TIF) district was established to pay for the city’s 70% contribution. TIF allowed the city to finance upfront construction costs within the BID, while reimbursing 22% of the Riverwalk costs using annual assessments over twenty years (City of Milwaukee, 2015). Segment construction coincided with rapid residential development in the neighborhood. Over $80 million in new private investment was focused on vacant industrial lots bordering the river and Riverwalk (Holmes, 2015). For Harvey (2006), Riverwalk investment highlights the cyclical process of uneven metropolitan redevelopment. Capital flowed back to the urban core following the depreciation of central city land values. Land values had fallen due to investment in suburban and exurban areas in the late 1940s and 1950s. Downtown redevelopment was now increasingly profitable. Land could be cheaply consumed, while remediated water resources incentivized amenity-focused investment.

While the Riverwalk's initial development plans focused solely on the Milwaukee River, the project has expanded across the city. Expansion is largely the result of strong private-public partnerships between the City of Milwaukee, developers, and riverfront property owners. All parties recognize that water itself, and proximity to the resource, can be used to increase land value and catalyze real estate development. Ensuring water quality was and continues to be a key

component in generating value. Using waterways as a means to catalyze downtown development and connect commercial, recreational, and leisure activities requires market demand. The aesthetic and environmental qualities of resource management are large components that drive this demand. Commodity created from water, land and property value, is contingent upon the quality (and quantity) of the amenity itself. Developers and property owners will not invest if economic activity and profit is not a direct outcome. Recognizing this, city leadership and private entities have engaged Milwaukee's waterways as economic infrastructure. Successful partnerships have allowed water to emerge as a significant factor in what might facilitate land value, real estate development, and economic activity in the city. Norquist's acknowledgement of the relationship between environment and economy suggests that the Riverwalk provided a starting point for not only water-based development, but economic and environmental sustainability efforts as well. He took a market-based approach to environmental protection that has fostered long-term water resource health through amenity focused investment. However, environment and economy are just two of three traditionally accepted dimensions of sustainability (Wheeler et al., 2004). The equity value-set remained missing. This is a historic trend in the City of Milwaukee.

A NOTE REGARDING EQUITY

The word Gemutlich, meaning hearth and home, represented a shared status quo among Milwaukee's earliest German, Polish, and Irish immigrants. Gemutlich accounted for similarities within the culturally divergent, but all together white, European population (Gurda, 1999). When African Americans integrated and filled WWII labor needs, their expanding population came to represent change and cultural unfamiliarity— a threat to Milwaukee's Gemutlich nature. While ethnic boundaries are rooted in Milwaukee's spatial history (Rast, 2007; Gurda, 1999), social unfamiliarity fostered severe race and income-based exclusion. Milwaukee's African American population was segregated and concentrated in the downtown area during and after WWII. Living conditions in the inner-core, which were blighted due to long-standing housing shortages, wage

gaps, and wartime diversions of municipal resources, disenfranchised the minority community. With little political power, post-war annexation, slum clearance, and low-income housing became negatively associated with the community (Gurda, 1999). Mayor Ziedler's attempts to develop low-income housing from 1948 to 1960 faced strict political limits as a result.

In the summer of 1959, riots over inner-city living conditions intensified racial sentiments. The Civil Rights Movement had gained momentum in the United States and Milwaukee's minority communities pushed for equality. However, newly elected Mayor Henry Maier (1960 - 1988) believed that inner-city problems were best handled by state or federal government. He took action after President Johnson's 1963 War on Poverty provided financial support for inner-city renewal. Public housing projects were pushed to completion, yet inner-city development was heavy handed. Maier insisted on demolishing and rebuilding from scratch. Little community input was obtained.

Socio-economic divisions intensified as capital disinvestment took hold around 1967. While minorities already worked undesirable hours, made lower wages, and lacked union protections that their white counterparts enjoyed, competition for employment, concern over individual prosperity amidst economic hardship, and inner-city decay and poverty fueled intense prejudice. Ethnically similar social groups unified in opposition to one another. This proved particularly stark along racial lines. White communities perceived African Americans as a threat to economic and job security. Milwaukee's 1967 riot was the peak of racial tension. The riot occurred on the heels of an open-housing ordinance demonstration in Milwaukee's inner-city due to "…conditions perceived as oppressive" (Gurda, 1999). Mayor Maier reacted by instituting martial law, believing that the riots were a "moral threat" to the city. He attempted to gain control by closing off neighborhoods, instituting curfews, and stopping utility and city services.

While the concept of environmentalism emerged in the 1960s and 1970s with Civil Rights, Mayor Norquist's 1988 Riverwalk Initiative appears to be Milwaukee's first formal effort to merge any of the three dimensions traditionally associated with sustainability (environment, economy, equity) with city life. Norquist spoke to the environmental and economic value-sets of sustainability, believing in the free market's potential to facilitate environmental protection.

However, the equity value-set was missing. His belief in free-market enterprise extended to social programs and workforce development. Taking an activist government role negated the power of capitalist systems to generate economic balance and resource equity (Levine, 2007). For Harvey (2006), Norquist's free-market city management demonstrates social vulnerabilities embedded within neoliberal systems. Market-based growth revitalized Milwaukee unevenly. Water resources were developed as a profitable amenity while Milwaukee's minority labor force was largely neglected. Economic conditions did not support the profitable consumption of their labor. Poverty, joblessness, and educational gaps within the local population deepened. As we turn towards Chapter 6, Post-Industrialization, the equity value-set of sustainability remains dormant. While efforts are made to improve human capital through workforce development and job training programs, an emphasis on water-based profit generation through amenity focused downtown redevelopment appears to support environmental and economic sustainability at the expense of low-income and minority residents. As a form of Uneven Development in Milwaukee, stark disparities in income, educational attainment, health, and employment opportunity persist. Challenges are discussed most relevantly in the Chapter 6 sub-section entitled, The Need for Human Capital.

Chapter 6: Post-Industrialization (2000 – 2014)

Norquist's 1988 Riverwalk marked a catalyzing moment for Milwaukee's water-based strategy. Past patterns of intraregional uneven investment had refreshed the ability of capital to maximize profitability in downtown Milwaukee (Harvey, 2006). Capital disinvestment following WWII led to the depreciation and fall of central city land prices. When suburban and exurban development was no longer profitable in the 1970s and 1980s, capital began flowing back to the urban core. Cheap land promised highly lucrative reinvestment opportunities. However, despite renewed capital interest, Milwaukee's cumulative economic development efforts were fragmented in the early 2000s. A comprehensive economic development plan was not in existence. This made unifying private, community, and public sector leadership through action challenging. A summary of economic conditions in 2006 completed by the Public Policy Forum concluded that:

> "unlike the vast majority of its peer cities, the City of Milwaukee has neglected to sit down with stakeholders and map out an economic development plan. Absent a plan or guiding vision, one is left to conclude that the City has and will continue to engage in economic investments, no matter how worthy, in an ad-hoc fashion" (Helpap et al., 7).

The City of Milwaukee has mobilized since the Forum's report, recognizing that economic development is not a singular governmental effort. Private, public, and regional partnerships are needed to catalyze sustainable economic change. New partnerships illustrate shared objectives within the private and public sectors. Unity has been found in the economic potential of water. Across stakeholder groups, water has been identified as an asset— one that can generate economic opportunity and growth.

The city's water-based economic efforts mark the emergence of a new opportunity, one that builds upon the area's water resources and local knowledge. Using water as an amenity-based downtown redevelopment focus, Milwaukee is leveraging its water resources to build a set of advanced manufacturing and technical service industries around resource management and technology. However, an implicit contradiction exists within this. Although the city is aligning its industry towards conservation, they offer significant water rate reductions to large industrial users.

The following sections provide the final piece in understanding how Milwaukee has positioned itself for sustainable water-based economic development. As with the previous sections, I organize relevant information into water-logics. Each logic highlights how central ideas surrounding water are translated into practice within the time period.

I begin by discussing why water and industrial legacy are perceived as economic assets in Milwaukee. Next, I provide an understanding of how the area's water-based economic plans emerged and developed throughout the 2000s. Cross-organizational relationships highlight that water-based efforts were largely spurred by private sector and regional interests. The city was a relative latecomer. The third section speaks directly to the City of Milwaukee's role within the water-based economic development efforts. It delineates specific tools and processes that the city has used in positioning itself for growth. The fourth section discusses water-based plans in terms of human capital, or workforce development, to highlight critical socio-economic challenges associated with Milwaukee's initiative. An emphasis on the development of and job creation within a knowledge-intensive water industry reveals burning equity issues around whom this initiative serves. The fifth section discusses the city's use of water as place making, including the construction of a "World Water Hub" brand that aims to resolve local skill gaps by attracting out-of-state human capital for industry needs.

WATER: MILWAUKEE'S INDUSTRIAL LEGACY

Milwaukee has identified water as an asset in economic development for several reasons. The first is location. Milwaukee sits on the shore of Lake Michigan. Lake Michigan is the fourth largest lake by area within the Great Lakes system, which contains 20% of the world's surface freshwater (Annin, 2006). The city perceives advantage in attracting and growing water-related or intense industries due to Great Lakes access, proximity, and service capacity (Milwaukee Water Works, 2014). The second is existing firms and expertise. Between 130 and 150 water technology related firms exist within the Milwaukee region. As a diverse industry, they produce a broad

variety of goods and services, including pumps, meters, boilers, valves, and water movement, treatment, and assessment technologies (Marcoux, nd; White, 2008). Existing firms provide a foundation of expertise and economic activity from which the initiative can grow. The third is institutional support. Milwaukee is home to educational and research institutions, like the Great Lakes Water Institute and the University of Wisconsin Milwaukee (UWM) School of Freshwater Sciences, which provide a base for water technology research, development, and innovation. Additionally, community and civic organizations, such as the Milwaukee Water Council, are dedicated to developing cross-sector partnerships that spur water-related economic development through business attraction, formation, and technology development (Growing Prosperity, 2014; Milwaukee7, 2014). The fourth, and perhaps foundational component of Milwaukee's water asset is relative resource scarcity. Milwaukee's abundance contrasts available water resources in the Western and Southern United States and across the globe. Growing scarcity is said to play a large role in local industry's economic potential (Milwaukee7, 2014; Marcoux, nd).

The ability to transform water as an asset into economic growth stems from industrial legacy. Scott Mosely, Director of Investment Strategies at the Water Council, believes that the depth of Milwaukee's history —its industrial timeline— serves as a critical component of what makes water such a germane component of the city's economic development efforts (2016). While the timeframe of my analysis begins at WWII, Mosely (2016) remarks that the city's water traditions began long before industrialization. Milwaukee grew from the geographic area's water resources. Located at the juncture of three rivers, the Milwaukee, Kinnickinnic, and Menomonee, and Lake Michigan, Native Americans were first to settle and name the land "Millioke", meaning gathering place by the water. In 1785, Milwaukee was resettled as a French trading post. Beaver fur was a prized and lucrative possession. In the 1840's, European settlers, primarily German and Polish, developed industries that relied upon the city's water resources and nutrient rich soil. Farming, tanning, meat-packing, and brewing grew productive as immigrants created goods using local resources.

Early immigrants urbanized the area and developed the foundational industry that many associate with Milwaukee's legacy as the "Machine Shop of the World" (Flisram, 2014). Brewing, in particular, made Milwaukee an economic powerhouse. When Northern European immigrants arrived in the mid-1800s they brought with them a rich tradition of brewing and brewing technology. According to Mosley (2016), this included not only brewing recipes and process knowledge, but operational technologies such as pumps, pipes, meters, valves, and filters needed to run an efficient operation. The industry used a large amount of water in production, and as a result, water-related technologies developed in tandem with new expertise and knowledge. By the mid-19th century, Milwaukee was home to the world's four largest commercial breweries—Schlitz, Pabst, Blatz, and Miller.

A critical component of the "Big 4's" success was the ability to catalyze knowledge in response to changing conditions. During Prohibition, institutional know-how or knowledge enabled brewers to shift their product lines to non-alcoholic beverages, candy, and other food products (Milwaukee7, 2014). When the 21st amendment ended prohibition in 1933, historic brewers resumed operation alongside new businessmen sensing opportunity. However, newer operations had little to no brewing experience. Many did not survive the Great Depression. Established brewers stayed afloat (Shears, 2014). During WWII, firms developed container technology in response to GI initiatives and demand for mobile consumption. Tavern-oriented keg sales dropped in favor of packaged and bottled beer. Milwaukee's brewing industry saw unprecedented growth as "…shops adapted their production processes to deliver war material" (Milwaukee7, 1).

Economic prosperity and industrial might defined the city through the 1950s. Milwaukee exported beer and durable goods across the nation. As technology advanced and demand increased, commercial activities moved towards manufacturing. Milwaukee became home to firms like A.O. Smith Corporation, Allis Chalmers, Cutler-Hammer, and Johnson Controls. They propelled the city forward as a center of industrial application. Suppliers "…specializing in all aspects of the water cycle emerged to serve core industries…" (Bird and Kanter, 2). Advanced research and

development (R&D) departments drove patent activity. Engineering and technical schools supported knowledge production within the manufacturing focused economy (Flisram, 2014).

In the late 1960s, multi-decade deindustrialization occurred and the city's powerful manufacturing and brewing industry collapsed. Factories closed, suburbs developed, white-flight took place, and "Sun Belt" migration generated demographic and economic shifts to the west and south. The municipal tax base decreased and inner-city neighborhoods became blighted. Milwaukee's population fell dramatically. However, Milwaukee's decline was not as drastic as its neighboring cities (Bird and Kanter, 2013). Its manufacturing was not rooted in sector specific activities. The city produced intermediate goods for a variety of industries, many of which developed out of the early brewing industry to serve a diversity of water-related needs. According to Miller[4] (2016) several grew into large companies all their own. Some industry remained as well, including power and control makers, Johnson Controls and Briggs & Stratton, and equipment and device manufacturers A.O. Smith and Badger Meter. Julia Taylor, President of the Greater Milwaukee Committee, explains that these water-related companies found stability and success by entering global markets over time (2016). Further, their headquarters remained in Milwaukee, providing a base for corporate R&D activities during industrial shifts. Mosely (2016) sites the rootedness of academic and research institutions, such as the Great Lakes Institute, as a R&D legacy that serves current economic efforts.

The City of Milwaukee invested in its land to maintain existing firms and attract new ones during deindustrialization. Roughly 30% of the city's land that once supported heavy industry was vacant or contaminated. The city focused on these sites, "redeveloping them to attract, for example, European manufacturers in the solar panel and wind turbine industries" (Bird and Kanter, 2). Smaller companies that supplied large manufacturing and brewing industry operated on redeveloped land and maintained production infrastructure within the region. These firms continued to grow, change, and develop, adjusting to changing economic conditions as the city's early brewing industry did. Today, companies that once located or developed in Milwaukee to

[4] Miller serves as a pseudonym for an anonymous interview respondent.

serve large-scale wet industry, those that make "…pumps and valves and meters and pipes— have grown up into over 150 companies that represent the greatest concentration of water technology companies in the world" (Weissmann, 2011). They have built, and continuing building upon, expertise developed over the decades.

Water-related growth is engrained in local tradition and knowledge. Yet until 2005, private and public leadership did not see connections between new and long standing water-related companies. They were thought of as separate industries and separate firms. Knowledge and expertise that developed over time was not linked (Miller, 2016). Economic opportunity emerged by connecting local expertise, and placing a renewed focus on what the city knows rather than catch-all growth policies. The strategy has enabled the city to return "…in a sense, to some of their original driver industries" (Flisram, 34). The identification of wet-legacy, and the ability to harness it in service of economic growth, is the foundation of Milwaukee's positioning process. However, the city does not act alone in its water-based efforts. In fact, the city was not even the entity that catalyzed water-based economic efforts. The idea emerged from private sector interests. A key component of the water-based economic strategy has been, and continues to be, the inclusion of non-governmental organizations— private, public, and non-profit— to provide institutional support.

WATER: A COLLABORATIVE OPPORTUNITY

A formal economic strategy— one that identified and connected Milwaukee's water assets— was not developed until the mid-2000s. The identification and transformation of the region's water assets into shared economic opportunity emerged from the private sector, not the City of Milwaukee. The city's role arose in response to land development needs, which occurred after private sector leadership had created the initiative's foundation.

In September 2005, leaders in regional government and chambers of commerce created the Milwaukee7 (M7), a civic organization including government, private sector, and non-profit

leaders from the seven county area of metropolitan Milwaukee (Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha). M7's objective was to coordinate regional economic development efforts. After reviewing and identifying potential assets, focus was placed on Next Generation Manufacturing (NGM). NGM would develop emerging energy, water, and bioscience technologies in the region. The M7 formed a council of local CEOs to investigate the identified opportunities (Conover, 2013). Emphasis was placed on water.

The Milwaukee Water Council emerged from M7's NGM initiative and formally separated in 2009. The Council gained momentum by spearheading efforts that linked local water resources to economic development. Their ultimate goal was to transform Milwaukee into a "World Water Hub". Finding overlap within and between existing wet-companies and local institutions was key in catalyzing the initiative. Local businesses that focused on finding, cleaning, and delivering water were disconnected. Educational institutions maintained environmental expertise but rarely collaborated with the private sector. Environmental organizations and other non-profits were familiar with educational partnerships, but unfamiliar with corporate collaboration. Firm interests were seen as conflicting with conservation (Bird and Kanter, 2013).

Limited overlap and cross-sector understanding led to conflicting visions over the Water Council's purpose. While water was largely considered an asset, some viewed the Council as an employment agency focusing on job creation and placement. Others viewed it as a water industry trade and lobby group. Several saw it as an advocacy group aimed at obtaining corporate money for environmental cleanup. Ultimately, Council leadership defined the organization around economic development, talent creation, and technology. Talent and technology efforts would transform Milwaukee into a "World Water Hub" for research and application. Economic development would be achieved by harnessing talent and technology to remedy local, national, and international water problems.

Organizational and operational challenges were furthered by lack of space and recognition. Without a brick-and-mortar facility and little acknowledgment outside the local community, the Water Council remained associated with the NGM initiative. However, in mid-2008, the Water

Council received a federal Department of Labor WIRED grant which provided funding, status, and credibility. The Council moved to incorporate as a 501 (c) (3). Soon after, the Council applied for a designation as a member of the United Nations Global Compact Cities Programme specializing in water. The Council worked with the University of Wisconsin Milwaukee (UWM) to develop the proposal. That April, Milwaukee received its designation. The Mayor of Milwaukee, Tom Barrett, perceived it as an affirmation of expertise and global authority. However, Barrett's comments remained the primary connection between the City of Milwaukee and private water-based efforts.

Fostering industry university partnerships was vital to talent and technology development, two components deemed necessary in catalyzing economic growth (Conover, 2013). Industry growth and employment opportunities would emerge if human and institutional capital could support water-focused economic activity. UWM became the largest and primary partner in human capital development. In collaboration with the Water Council, they envisioned creating a graduate School of Freshwater Sciences. The school's novel status as first in the nation and third in the world stimulated political interest. UWM has the second largest undergraduate enrollment, but received much less state funding than its counterpart in Madison, the capital of Wisconsin. Collaboration with the Water Council provided an opportunity to increase state funding, public visibility, and political profile for both parties. Together, they requested $240 million to build the graduate School of Freshwater Sciences to develop regional water talent and technology. Additional funding was secured from private sector groups. Milwaukee Mayor Tom Barrett lobbied in support as well. The state allocated funding in 2010.

To this point, the City of Milwaukee was not actively involved in the Water Council's efforts. Although Mayor Barrett had supported the UN Global Compact City application and the graduate School of Freshwater Sciences, Council leadership maintained intentional distance from local government. Accepting financial support from the city was seen as a threat to private sector flexibility. This was a historic perception. Friction emerged from Socialist economic development practices in the 1940s and 1950s. Critical of capitalism and committed to debt-free financing,

Mayor Ziedler's post-WWII government engaged autonomous development efforts which sidelined private interests. Distrust continued throughout the 1960s when Mayor Maier's public support for downtown redevelopment masked his administration's focus on industrial expansion. Long standing concerns also existed over unwanted strings attached to city aid. Competition for limited resources and tax revenue between the city and suburbs generated adversarial relationships in the 1940s and 1950s. Difficulties were further reinforced by the Sewer Wars in the 1980s and 1990s. So while "some in the Water Council cared about regional economic development…all were aware that…cities cared about boundaries…" (Bird and Kanter, 8). The politically and physically fragmented region had not resolved past tension over strained resources. (Milwaukee7, 2014).

However, private leadership needed municipal support to convert talent, research, and technology into a workable economic strategy. Specifically, city buy-in and backing was needed to attract firms that could commercialize local water research and technology. Private real estate development, which the city controlled through zoning and could incentivize through public financing, was seen as the foundation for industry attraction. Leadership envisioned a clustered business district, containing the School of Freshwater Sciences, related laboratories, and the Great Lakes Water Institute, as the initial platform to incubate and develop emergent business. The proposed location was Milwaukee's downtown lakefront. City officials supported the planned physical redevelopment. The at-large initiative and envisioned district represented job creation, tax base expansion, a foundation and direction for capital investment, and an opportunity to energize the local economy.

Development required a series of municipal approvals and permits, including one from the Milwaukee Harbor Commission, to move forward. In May 2009, the Water Council and UWM leadership were denied approval from the Commission. Lakefront land is governed by the Wisconsin Public Trust Doctrine, which reserves areas along Wisconsin's waterways for public purposes. The Water Council was found to be a private organization which pursues commercial interests. So while the City of Milwaukee owned and controlled the land, industry specific

development was found at odds with Wisconsin's definition of public use (Kaiser, 2009). The City of Milwaukee took their first major action in response. Mayor Tom Barrett and City Development Commissioner, Rocky Marcoux, were concerned that potential "… research, patents, technologies, companies, and jobs created in Milwaukee could leave the city" (Bird and Kanter, 8). With the support of Mayor Barrett, Marcoux suggested Reed Street Yards as an alternative site. The Water Council's buildings and the School of Freshwater Sciences could be developed adjacent to Reed Street Yards. Reed Street Yards, a former tannery near the Milwaukee River, would be developed as a Water Technology Park, the proposed business district where new or relocated firms could operate. Flexing its regulatory muscle and demonstrating political commitment to the initiative, the city changed zoning and tax incremental financing (TIF) regulations to accommodate the development. By approving the use of public funds to construct the necessary streets, sewers, and utility infrastructure, the City of Milwaukee committed to building out Reed Street Yards in anticipation of private investment. Reed Street Yards marks the formal incorporation of the City of Milwaukee into the water-based initiative. Although Mayor Barrett had lobbied on behalf of water-focused economic plans, city departments were not directed to action until 2010.

The recognition of water-based development as a shared effort, and the strategy as a shared endeavor, serves as a keystone within Milwaukee's economic plans. The strategy's long-term potential stems from stakeholder diversity. Cross-sector and private-public partnerships allow the initiative to find niche and commonality among a broad range of individuals and activities. Marking a departure from historic economic development practices characterized by autonomous government control and siloed economic activity, Milwaukee's water-based plans engage a variety of people, directions, and activities in support of a common goal. As an organizational asset, diversity decreases reliance on any one actor or economic activity. Vulnerability within the strategy is reduced because success is not singularly dependent. This increases its potential to reproduce and sustain over time. It must be noted, however, that diversity differs from equity. The initiative's diversity includes a broad range of private and public leadership whose political power enables voice and agency. For Harvey (2006), this class of voices, however diverse, represents the

social tier that will profit most from the initiative as city resources are consumed in support. Milwaukee's minority majority population are not present or equal in the discussion. Any reference to equity is alluded to as job creation. This community is in most need of local employment, yet they are largely underqualified for the water industry jobs sought. I return to critical equity issues in the sub-section entitled, The Need for Human Capital. Interview respondents did not speak to burning equity issues, perhaps because I did not directly or specifically ask. Rather, they echo the role of diversity in facilitating a long-term economic initiative.

For Miller (2016), the strategy leverages a multi-sector group of companies, businesses, environmental organizations, government groups, legal groups, and educational groups— all of whom are looking at water issues. The robust and diverse group allows the initiative to grow in a variety of positive directions that the city could not foster alone: "this is one example— one of very few examples— of everyone working together towards the same effort. Economic development is a benefit to everybody" (Miller, 2016). For Mosley (2016), the recognition of Milwaukee's industrial water concentration spans the state, regional, and city scales to engage efforts promoting water technology development. Political figures, elected leaders, social leaders, business leaders, and civic leaders understand the importance that water plays in the city's and region's economy. But most importantly, they understand the future role that water will play (Mosley, 2016). Decisions are made around that, and the differing roles of all groups involved have allowed the economic strategy to gain strength.

Mosley (2016) explains that the university and technical colleges work to commercialize research and provide career training for water technology. The State of Wisconsin Economic Development Organization supports a water industry working group, which attracts domestic and international water-related businesses for local job growth. The Water Council provides institutional and operational support. It acts as a catalyst for water technology, research, commercialization, and development. As a driver of entrepreneurship within the water industry, this includes a six month accelerator program, programming under contract from the Small

Business Administration for water company growth, and a program funded by JP Morgan Chase around increasing access to capital for water-related companies (Mosley, 2016).

The City of Milwaukee provides incentives, including TIF and other enticements that can facilitate the location of companies into the water technology district (Miller, 2016; Taylor, 2016). The city itself doesn't have a specific program around water or water-related economic development (Mosley, 2016). Their role lies primarily in land redevelopment and infrastructure improvements through tax incentives and real estate financing.

WATER: A TOOL FOR ECONOMIC DEVELOPMENT

Milwaukee positions itself for water-based growth by creating a regulatory and financial framework within which private development can occur. Tax incentives and real estate financing are the primary financial tools used by the city. Zoning is the city's main regulatory tool. In Milwaukee, property tax provides the greatest opportunity to generate an independent and stable revenue stream (Taylor, 2016). The city is barred by state legislation to levy a sales or income tax at the local level (Safir, 2011). Growing the municipal property tax base by increasing land value is a priority. Doing so provides revenue for public operations and services. In the past, Milwaukee focused on increasing its property tax base by expanding its jurisdiction, or the quantity of land it could tax. Jurisdictional growth became impossible in the late 1950s. Suburban areas incorporated in response to aggressive annexation efforts. Focus was placed on raising property values within city limits as a result. In recent years, land vacancy has presented Milwaukee with added fiscal challenge. Foreclosures stemming from the 2008 banking crisis has placed ownership of roughly 1,300 structures and more than 2,200 vacant lots in the hands of city government (Growing Prosperity, 2014). Vacant and foreclosed property has a negative effect on the city's tax base. It requires municipal expenditure, but does not produce revenue.

Land development is a longstanding feature of Milwaukee's economic development efforts. However, doing so today provides a two-tiered approach to economic growth. First, it reduces the

city's expansive inventory of vacant and foreclosed property. Second, it revitalizes land for productive, tax generating uses. Within this, the City of Milwaukee is positioning itself for water-focused growth by partnering the development of land with the development of the water industry. In a sense, land development is synonymous with the development of the "World Water Hub" itself. This is problematic through Harvey's (2006) lens of Uneven Development. Land and water-based economic development presents a contemporary cycle of profit seeking systems that consume low-cost resources. Land acquired via foreclosure from Milwaukee's low-income residents is transformed by property-tax seeking policy into opportunity for the affluent.

Actors

Milwaukee uses TIF, zoning, and several small-scale financial incentives to create a physical foundation in which private water-focused investment can occur in service of tax base expansion and job creation. The city's economic development efforts are led by three agencies, the Department of City Development (DCD), the Redevelopment Authority of the City of Milwaukee (RACM), and the Milwaukee Economic Development Corporation (MEDC). RACM and MEDC are not technically part of city government, but work in close partnership with the DCD. The RACM and MEDC were created to fill gaps within the city's economic development toolbox. Their interplay is central to understanding the city's collective role in generating economic development (Helpap et. al, 2011).

The DCD plays a targeted and supportive role within the city's economic landscape by creating a framework within which development efforts supported by city leadership can materialize. Rather than working to attract firms, or developing plans and financing schemes for commercial or residential development, the DCD's most "critical function is to lay the groundwork for job creation and tax base growth by planning for where and how such creation and growth should occur; preparing priority sites for development; and conducting necessary permitting and plan review for job-creating and growth-generating activities" (Helpap et al., 27). RACM, an

independent corporation created by Wisconsin statute in 1958, compliments the DCD's efforts through a targeted focus on real estate redevelopment and financing. In a sense, the DCD creates the regulatory framework in which RACM can use the tools of eminent domain, money borrowing, bond issuance, and loan making to acquire and redevelop property. RACM's efforts are largely focused on brownfield remediation and land redevelopment. Brownfield remediation revives sites with hazardous or contaminated land for active use. The MEDC is the third-prong of Milwaukee's economic development team. Established in 1971, the non-profit corporation is charged with providing low-interest loans to local businesses. Building upon the DCD and the RACM, MEDC's work helps local businesses locate in redeveloped sites, and thus, generate economic activity. MEDC grants and loans work in tandem with local lending institutions to support municipal projects as well.

As a unit, the DCD, RACM, and MEDC leverage each other's tools and functions in support of economic development. They play a targeted role towards "… real estate development and redevelopment, financing assistance to existing small, medium and large businesses, comprehensive planning, and logistical support and permitting for private sector economic development activities" (Helpap et al., 27). These organizations support water-based growth by creating the regulatory and financial framework for private investment. A preliminary component of this is the identification of sites and projects which are deemed "priority" for development. A priority site has market value because of, and in addition to, its potential to support the water cluster, private interests, and increase the municipal tax base. Dr. Val Klump, Senior Director and Associate Dean of Research at the University of Wisconsin Milwaukee School Of Freshwater Sciences and Director of the Great Lakes Water Institute, articulates that investment sites, some of which contain scrap and coal remnants of a past industrial life, have enormous potential for redevelopment and sustainable redesign. The city's ability to set aside and remediate land in response to and in preparation for private development has been very successful. He notes that the economic potential is huge, and that the city recognizes it (2016).

Positioning

Public funds are used to facilitate private water-focused investment, but only so much as to leverage the city's tools—TIFs, zoning, and limited incentives— in service of private sector growth. In doing so, the city draws heavily from Porter's (1990 & 1998) work on Industrial Innovation Clusters (Mosley, 2016). Porter's theory, as understood by Milwaukee, says that "…economic growth typically occurs in particular clusters—groups of businesses that thrive together because of their geographic concentration with its associated competitive advantages like specialized suppliers, skilled workforce, good physical infrastructure, and interlocking networks of buyers and sellers who mutually support each other's businesses" (Growing Prosperity, Xii). Porter's theory of Industrial Innovation Clusters comes into play in relation to Reed Street Yards, the 2010 Water Technology District, which marks the city's catalyzing action in support of water-based economic development efforts.

Milwaukee seeks to transform itself into a city where a water-technology cluster can flourish. As their role lies primarily within land and real estate development, the city is attempting to create a physical landscape that supports Porter's spatial qualities of what a cluster is. Bridging theory and practice at the local level, the city is creating a district where water-technology and water-related companies can become concentrated. The intended outcome of spatial concentration is an accumulation of knowledge, innovation, and productivity which produces comparative advantage around water. This means that Milwaukee's firms are able to produce water-related goods and/or services at a lower cost than competitors (Library of Economics and Liberty, 2007). As firms profit and expand due to comparative advantage, a culture of expertise and productivity attracts new business and jobs to the area. The growth and establishment of firms benefits the City of Milwaukee by increasing its tax base. Revenue can be used to keep residential property taxes low, finance public projects and infrastructure, and fund community programs. As a reproducing system, clusters encourage long-term growth by establishing economic networks (Knauseder, 2001) that adapt to change by gaining and sharing knowledge. Concentrated social and economic infrastructure decreases the chance of capital flight and firm relocation. While resources needed

for production may be cheaper in other areas, industry serving systems and cross-firm relationships generate a rootedness to place. Conversely, rapid growth associated with cluster investment highlights vulnerabilities surrounding Uneven Development. Capital influx can deepen existing socio-economic inequities by increasing costs of living and wage disparities. Pressing equity issues associated with Milwaukee's water-based plans will be discussed in the following sub-section.

Reed Street Yards is Milwaukee's envisioned water cluster. The development leveraged private and public funds in the establishment of a local Water Technology District. According to Miller, a primary charge of the City of Milwaukee was "…the real estate side of everything. Where should…offices be located and where is there enough room for a research park that could be associated with this new water cluster?" (2016). The city reviewed a number of sites and ultimately decided on Reed Street Yards which is south of downtown: "it was a former rail yard and then it was a truck terminal...but it's about 17 acres of vacant land and [the city] had been talking to the property owner for a number of years about potential development proposals, but he wasn't motivated to do too much. He was going to wait until the market came to him. And when [the city] brought this water research park idea to him, he was pretty excited about it" (Miller, 2016).

The city moved forward and established project goals which included: (1) the creation or retention of "…jobs by creating development opportunities near downtown Milwaukee and attracting water-related companies to relocate or expand in the District; and (2) [increasing] … the tax base of the City by reinvigorating the District and neighborhood property to maximizing their full potential" (Amendment No. 2). Preliminary action was taken by establishing a tax increment financing district (TID 75) in support of the 20 acre redevelopment project. No funding was authorized at that time. Rather, the TID was created to incentivize private investment. Establishing the TID would "demonstrate the City's commitment to redeveloping the area; allow time for a specific project development to materialize; and further asses the infrastructure needs and placement within the district" (Office of the Comptroller, 2011). Miller (2016) notes that TIF, Milwaukee's core funding mechanism within water-focused redevelopment, allows the city to spend the money needed to make Reed Street Yards developable. This included the installation of

utilities needed to transform the former rail and truck yard into a viable site, as well as environmental remediation (2016).

In 2011, TID 75 was amended in support of confirmed private investment. A public expenditure of $6.2 million for infrastructure and related improvements was authorized in conjunction with an approved Development Agreement between Milwaukee and Building 41, LLC., the private developer. Infrastructure and public improvement expenditures were deemed essential to the development, not expected to be financed by the private party itself, and necessary in allowing private investment to proceed. Redevelopment took place in two phases. The first phase coincided with the Water Council's renovation of a seven story (88,000 sq. ft.) building into the Milwaukee Water Council office building. Valued at $21 million, the privately funded renovation provided office and retail space for water-specific firms, including A.O. Smith, Gannett Flemming, Pave Drain, and Veoila, who had previously signed letters of intent to lease. Additional private development included office space, known as 234 Florida. First phase city funding, amounting to $3.58 million, covered infrastructure improvements and installation, environmental remediation, administration costs, and a 10% contingency. Per the Development Agreement, Building 41, LLC. provided public easements for the placement of infrastructure, such as streets, lighting, landscape, sanitary and stormwater sewers, and Riverwalk placement. The DCD established a BID, which allowed the RACM to facilitate a $345,000 loan that covered the developer's portion of Riverwalk costs. RACM’s loan made it possible for the "developer to distribute Riverwalk and dockwall costs to new business locating within the district as the site attracts new development" (Office of the Comptroller, 2011).

Phase one TID 75 costs were anticipated to be recovered in 2029: "We believe the feasibility analysis is reasonable, including the assumptions on existing and new value in the district, projected growth in property values…and declining property tax rates” (Office of the Comptroller, 2011). Phase two funding was estimated at $2.28 million for additional infrastructure and environmental remediation. Projected recovery of phase two funding was project year 24,

when property values had increased by $5.2 million. Funding was released after sufficient tax increment revenue was generated to recover additional project costs.

In 2012, a Development Incentive Zone (DIZ) overlay was adopted by the Milwaukee Common Council. The DIZ is an example of zoning, the city's primary regulatory tool. DIZs use performance standards to tighten existing zoning regulations such as lot coverage requirements, height limitations, and permitted uses. Reed Street Yards was zoned as Industrial Mixed (IM), which allowed for a broader number of uses than the city preferred. DIZ standards established more stringent aesthetics, relating to facade and fenestration treatment, signage, landscaping, open space, pedestrian and vehicular access, building height and placement, and construction materials. Establishing this overlay created a tailored framework in which the city could guide water-based redevelopment. It allowed the city to restrict and plan what was built, while setting an aesthetic tone for the site itself and firms looking to invest (Miller, 2016). While property owners were said to "not always agree" because of increased restrictions, the city used zoning and DIZs to "let people know what is going to be happening next" (Miller, 2016).

Between 2009 and 2014, the Water Council's building achieved a lease occupancy of 85%. Assessed value grew significantly, rising from $984,000 in 2009 to $9.7 million in 2014. Commercial office space, 234 Florida, achieved 59% occupancy and is projected to reach a stabilizing property value of $8.4 million by 2017. The property was valued at $2.9 million in 2009. Overall, TID 75 (Reed Street Yards), has increased in assessed value from $19.8 million in 2009 to $39.5 million just five years later (Amendment No. 2, 2014).

In anticipation of increased private investment, including the confirmation of new residential development and Water Technology Buildings, TID 75 was amended again. The 2014 amendment authorized an additional $7.12 million in public expenditures. This included $1.36 million for infrastructure improvements; $660,000 for public parking, a public plaza, and streetscaping associated with Florida Lofts, a new residential development; $5 million for a Public/Private Venture Fund; and $100,000 in administration expenses (Amendment No. 2, 2014). The $5 million was "set aside from the TIF to create a public/private venture fund to assist in

recruiting business and creating jobs" (Reid, 2015). Public infrastructure improvements included the extension of the Hank Arron State Trail, Riverwalk construction and dockwall repairs, sewer connections, and a new road named "Freshwater Way". The new road features a bioswale, signage, and a bike-sharing station. Freshwater signage serves to illustrate the relationship between land development and the water cluster. By 2036, total TID value is anticipated to reach $113.8 million, all of which is taxable by the City of Milwaukee.

Incentives

Tax increment financing (TIF) and zoning are foundational mechanisms that have allowed the city to engage water-based economic development. Milwaukee uses TIF to pay for infrastructural upgrades, utility installations, and environmental remediation. Zoning permits the city to delineate specific uses within the property that are conducive to Porter's (1990 & 1998) Industrial Innovation theory and targeted water industry (Miller, 2016; Klump, 2016). City specific incentives are limited. Miller (2016) notes that Milwaukee's basic enticement is to "level the playing field". This means, in part, using public funds (TIF) for environmental remediation and infrastructural installation at no cost to the developer or property owner. Miller (2016) explains the Private/Public Venture Fund as a new incentive at Milwaukee's disposal. A mechanism similar in nature has not been done in the past. The fund functions as a pre-approved $5 million reserve that the city, owners of Reed Street Yards, and the Water Council can use to entice business to locate within the Water Technology District: "…There's no set formula, but it is used to provide basically what [can be called] a forgivable loan to a company that is moving to the site, and it is forgiven if they meet their job projections— their employment projections. [Then it] basically becomes a grant" (Miller, 2016). To date, the fund has only been used for the relocation of ZURN, a plumbing fixtures company that moved its headquarters from Pennsylvania to Milwaukee. However, it has been written into several proposals for other water-related companies who are considering relocation. The fund is unique in that allocations do not need to be re-approved by the

Common Council. As approval is often political, the upfront allocation removes interference and greatly shortens the development timeframe. It also demonstrates the strength of political support and commitment of city leadership.

A related and highly relevant incentive that emerged within the interview process are water rates. Miller (2016) notes that Milwaukee's water rates are the lowest in the county, which can have a significant impact if there is a particularly large water user. Low rates can also generate surplus revenue. Water service is a long-standing source of revenue for the city. Since WWII, water rate revenue has been used to generate economic activity, cut taxes, attract or retain business, and to a lesser degree, preserve the environment. Maintaining infrastructure that can efficiently process and transfer water from source to user is key within this. The ability to supply high quality water at a low cost is perceived as attractive to firms, particularly as states like California and Arizona suffer from prolonged drought conditions. Reliable water supply and attractive pricing then provides a valuable economic tool. Offering low cost water through a declining block rate, water-heavy job creating companies are incentivized to establish or relocate in the city (Milwaukee Water Works, 2014). As a continued avenue for general fund transfers, this echoes past efforts of using water to entice annexation in the decades following WWII. Only now, water is used to entice urban development rather than jurisdictional growth. It has become a currency to subsidize business and associated job creation (Holahan, 2010).

The section above discusses Milwaukee's use of water for economic development in terms of land redevelopment, tax base growth, and tangentially, job creation. What I have not discussed is workforce development. Workforce development and training is a vital component of sustainable economic development. This is particularly true in the case of Milwaukee. Unemployment rates are exceptionally and historically high along minority lines. Mayor Barrett "…has emphasized that job creation has been, and continues to be, a primary goal of his administration" (Helpap et al., 7). Yet creating jobs is just one half of the equation. The city's workforce must be able to obtain the economic opportunity. Without the ability to do so, Harvey's

(2006) Uneven Development reveals the harshly unequal socio-economic impact of capitalist processes that favor profit seeking growth over sustainable economic development.

WATER: THE NEED FOR HUMAN CAPITAL

The City of Milwaukee strongly supports a water-centric economic vision as an avenue for job creation. For Mayor Tom Barrett, the initiative brings "… together government, industry and academia to promote our economic agenda which is [to] create more jobs" (Weissman, 2011). Kevin Shafer, Milwaukee's Metropolitan Sewerage District Director, embraces its potential as well: "Jobs, jobs, jobs, jobs, jobs," (2011) he said when discussing the initiative with Weissmann from Chicago Public Media. Even Rocky Marcoux, Commissioner of the Department of City Development, anticipates substantial job growth to come from water-related initiatives, including Reed Street Yards: "It's going to have thousands of jobs associated with it" (Weissman, 2011).

However, Water Council and city leadership are weary of releasing formal projections about how many jobs might be created. When speaking with Chicago Public Media in 2011, Water Council co-founder Richard Meeusen said, "Well, we don't play that game …I don't want to get into a numbers game, I'm not trying to compete in that" (2011). However, that game matters a great deal. Not only are job opportunities cited by city leadership as a primary driver, but as the fourth poorest city in the United States, Milwaukee needs them. African American unemployment stands at 29% overall, and at 50% among African America men (Weissman, 2011). High-skill water-technology jobs are not likely to fill that need.

Low-skill manufacturing jobs have grown increasingly rare in Great Lakes cities. Milwaukee is no exception. Dr. Marc Levine, Director of UWM's Center for Economic Development, criticizes the initiative on the basis of employment. Emphasizing knowledge-intensive job creation within the water industry discounts existing inequity:" …city and business leaders' focus on water to the exclusion of other urgent issues…The harm is obviously that this initiative is sucking up an incredible amount of public energy…resources and energy will be

monopolized by an initiative that will not deliver the kinds of economic development results that we need" (Weissman, 2011).

In 2000, Milwaukee became a minority majority city, with white residents constituting less than 50% of the population (Growing Prosperity, 2014). Milwaukee has a long history of racial inequity, and contemporary demographics show that little progress had been made to enfranchise low-income minority groups. The city's unemployment rate peaked at 15.8% in 2010. While it dropped to 13.1% in 2012, it remained much higher than the regional rate of 8%. Unemployment has:

> "…disproportionately affected minorities and lower skilled workers… trends are exacerbated by the concentration of poverty within the city limits. According to the Brookings Institution, 71% of those living in poverty in the Milwaukee area were in the City of Milwaukee. In fact, the city is the 9th most impoverished big city in the U.S., with nearly 30% of all residents living below the poverty line" (Growing Prosperity, 11).

The average poverty rate between 2008 and 2012 in Milwaukee stood at 28.3%. Among minority populations poverty rates are even higher. The Latino population maintains a poverty rate of 28.8%, while African Americans maintain a rate of 37.8%. Household income is equally stark. Affluent suburban communities such as Waukesha and Ozaukee show a median household income of more than $70,000, while the city's median household income is $34,042. Even so, "the breakdown is even more pronounced within the city: Latino and African American households have median incomes that are 30% and 45% lower than white households, respectively" (Growing Prosperity, 11).

Deep disparities in employment opportunity and educational attainment exist in the Milwaukee area. A 2009 survey of job openings across the region showed that more than 50% required training beyond high school, such as an associate's degree from a technical college. Less than one in six jobs were available for individuals with only a high school diploma. 89% of full-time job openings and 83% of half-time job openings required related professional experience, licensure, or post-high school training. Roughly 30% of Milwaukee's residents have only received a high school diploma, 18% haven't completed high school. One in five residents has a bachelor's

degree or higher. White Milwaukeeans maintain a disproportionate percentage of higher education degrees. White residents constitute 30% of the population, yet hold 71% of the bachelor's degrees. African Americans, 40% of the population, hold 17% of the bachelor's degrees. Latinos, 17% of the population, hold only 5% (Growing Prosperity, 2014). Employment is increasingly difficult for residents with limited education. Both technical training and high school education is required to advance in the workforce: "Thirty years ago, a high school degree would have been a “terminal” degree for factory and clerical workers in Milwaukee. Now it is just one stop on the path to job readiness" (Growing Prosperity, 41). Labor disparities are further reflected in the unemployment rate as related to educational attainment. As of January 2014, individuals without a high school diploma maintained an unemployment rate of 9.6%. This stands in stark contrast to individuals with some college experience at 6%, and individuals with a bachelor's degree or higher at 3.2%. Annual incomes reflect educational gaps as well. The average median income for full-time employees with a bachelor's degree is $17,500 higher than those with only a high school diploma (Growing Prosperity, 2014).

Milwaukee is positioning itself for growth in knowledge-based jobs— jobs that require higher education or a specialized degree to obtain. However, a significant number of jobs in the region already require post-secondary education and training. The requirement is only projected to increase. Global and national employment trends reflect a growing demand for higher education skill sets. This is particularly true in the water technology sector, where substantial emphasis is placed on knowledge-intensive advanced manufacturing. Milwaukee’s current workforce does not have the skills needed to meet the human capital needs of emergent water industry, yet a skilled workforce is critical to the success of Milwaukee's water-focused initiative.

Occupational groups critical to the water industry’s development are expected to experience shortages within the next ten years if supply trends continue: "The number of in-state graduates in relevant fields is projected to fall slightly between 2012 and 2021, in-migration is projected to be modest, and many workers are expected to retire, resulting in projections of insufficient labor pool growth to meet industry needs" (Milwaukee7, 33). Mechanical

manufacturing and metal manufacturing, those being actively advanced within the water cluster, face alarming labor deficits. For example, employment demand within the field of mechanical engineering is projected to rise 43% within the next decade. However, workforce within the field is aging and expected to decline 44% within the next ten years. Increasing demand for skilled labor and decreasing supply may result in available labor meeting only half of the mechanical engineering profession's needs. Adding to the potential mismatch, the "… state's colleges and universities have not historically graduated engineers at a pace sufficient to fill the gap" (Milwaukee7, 33). Projections are equally stark within the metal manufacturing industry, another vital component of the emergent water cluster. Demand for skilled labor is anticipated to grow 50%, while supply is projected to decrease by the same amount: "By 2021, Wisconsin may have less than half the metal manufacturing professionals required by industry employers. As of 2012, supply lags demand by more than 2,000 workers, a shortage projected to grow to more than 13,000 workers by 2021" (Milwaukee7, 33-34).

Milwaukee's manufacturing economy is transitioning from one that supported unskilled and semi-skilled workers with on the job training, to one that requires science, technology, engineering, and math (STEM) skills to be competitive and succeed (Milwaukee7, 2014; Growing Prosperity, 2014). This restructuring appears to be creating a mismatch (Levine, 2007 & 2009). Political leadership is focusing on job creation, yet Milwaukee's workforce is not qualified for the opportunities that the city and region are investing in. A plausible consequence is not positive—industry is unable to obtain the labor needed to fuel Milwaukee's new post-industrial economy, and Milwaukee's residents are unable to obtain emergent and much needed jobs because they lack the necessary training. For the city's new economy to thrive, there must be people that firms can hire. And, in turn, workforce development and technical curriculum must equip local labor for knowledge-based jobs.

The City of Milwaukee is attempting to address this tension using a small amount of public funds. Organizations that receive public funding include the Milwaukee Area Workforce Investment Board (MAWIB) and the Milwaukee Area Technical College (MATC). Additional

funding is allocated in the 2015 City of Milwaukee budget to the Compete Milwaukee program and KIVA, a micro-lending program. The State of Wisconsin Department of Workforce Development and smaller training programs sponsored by non-profit agencies contribute to local workforce training and job-readiness as well. The importance of these organizations cannot be understated. However, since the core of this work is the City of Milwaukee's efforts, our focus will remain on programs that receive public and budgetary funding.

The Milwaukee Area Workforce Investment Board provides training and readiness resources to Milwaukee's minority and low-income population. Federal and state government are the primary funding agents. In 2014, state funding accounted for 72% of the MAWIB's operating budget, while federal funding accounted for 20%. Funding from the City of Milwaukee, a line item titled City of Milwaukee & Other, accounted for just 3% of the budget (MAWIB Funding, 2014). Funding is used for basic skills training, industry and sector specific skill development, customized training programs as requested by individual employers, and youth, individual, and displaced worker training programs. However, activities are limited by federal and state funding restrictions, which comprise the majority of the MAWIB's budget. Restrictions relate to income thresholds and "specific life situations" that must be met before training and resources can be dispensed.

Of the three primary educational institutions in Milwaukee — The University of Wisconsin Milwaukee, Marquette University, and the Milwaukee Area Technical College (MATC) — MATC is the only institution that receives city funding. MATC is the largest technical school in Wisconsin, enrolling more than 50,000 students per year at four campuses in metro-Milwaukee. The school is vital to workforce development because it offers a direct avenue to specialized training. MATC's Office of Workforce and Economic Development works closely with industry and water cluster organizations, such as the Water Council, to develop relevant and customized training certification programs. Local property tax is the primary source of funding for the MATC. Within the 2013 - 2014 budget, property tax provided 33% of the school's total revenue. However, this 33% represents a drop of nearly 39% ($56 million) from the previous year. This was a result of Act 145, a legislative action that shifted technical school funding from property tax levied within

the district, to a state aid payment (MATC, 2015). Concerns over the robustness of future funding following Act 145 have emerged.

Workforce development programs included in the City of Milwaukee's 2015 budget reflect their newly released Economic Development Plan, entitled Growing Prosperity. The 2014 plan includes specific metrics for measuring economic progress: (1) Population change, with particular focus on central city areas; (2) Acres of developable industrial land available and redeveloped; non-residential vacancy rates; (3) Workforce participation rate, by race/ethnicity; (4) Percent of workforce employed in manufacturing or family-supporting jobs; (5) Percent of workforce employed in key asset industry clusters; (6) Total population poverty rate; poverty level as a share of MSA; (7) Number of business start-ups and closures; (8) Median household income; (9) Neighborhood market conditions; and (10) Percent of residents 25+ with bachelor's degrees or higher; income migration (Growing Prosperity, XVII). Unfortunately, baseline and 2015 metrics relating to all but population count categories have not been calculated or released. Further, Milwaukee's economic plan was published without a formal timeline. Action items are marked as short-term, intermediate, or long-term. Those reflected in the 2015 budget can be assumed as short-term, or perhaps priority. These include a workforce development program and a micro-lending program.

Compete Milwaukee is the city's workforce development program. The program "…aims to address the city's high unemployment rate by improving connections between workforce development programs and key growth industries, and by expanding the City's transitional jobs program" (Gavin et al., 2014). Milwaukee's Compete program is allocated $880,000, the majority of which supports the expansion of an existing Transitional Jobs Program— a state initiative which the MAWIB directs. City funding, a majority of which comes from a federal Community Development Block Grant, will be used to increase 100 available positions as of 2014, to 130 positions in 2015. The program connects Milwaukee's hardest to employ residents to skill development and wage earning opportunities with the City Department of Public Works, the Police Department, and the Department of Neighborhood Services. $75,000 will be used to analyze the

area's existing and future labor market and workforce needs. Another short-term action accounted for in Milwaukee's budget is a micro-lending program to small businesses. $25,000 is allocated for these purposes through a partnership between the Wisconsin Women's Business Initiative Corporation and KIVA, a national non-profit organization. In contrast to workforce development, the 2015 budget includes a line item for remediating 500 acres of brownfield land for active industrial use within the next ten years. The initiative calls for $500,000 in city funding, the same amount dedicated to similar efforts in past budget cycles. Brownfield remediation often incorporates additional TIF and state and federal funding, so the amount spent will likely be larger than Milwaukee's line item provision and include additional sources (Gavin et al., 2014). For example, the City of Milwaukee spent $774,000 between 2012 and 2013 for 17 acres of brownfield remediation within Reed Street Yards (TID 75). In 2015, the city spent roughly $2.8 million to remediate seven acres for a Freshwater Plaza development. The Wisconsin Economic Development Corporation contributed an additional $700,000 (The Water Council, 2015).

Recent funding suggests that the city's investment in land development is a larger priority than its workforce. Unfortunately, this is a longstanding trend in Milwaukee. In the early 2000s, economic development funding was primarily directed towards real estate and community development. Expenditures for business and workforce development— invested to strengthen income, create jobs, and develop a community of skilled labor— were largely neglected (Horton, 2006). A budgetary analysis between 2002 and 2005 showed that only 8% of economic development funds came out of the city's general fund. Of this, 70% was funneled into neighborhood and real estate investment, including expanding and retaining manufacturing jobs and infrastructure. One percent of expenditures went towards workforce development (Horton, 2006). At a time when Milwaukee's job base was continually eroding, almost no funding was used to create, retain, and expand job opportunities in the city. While responsibility was and continues to be shared with other governments and educational institutions, the city neglected to play a vital role in human capital development.

Discounting joblessness in minority communities stems back to Mayor Maier (1960-1988) who did little to make workforce development a political priority. He believed racial inequality was best resolved at the state and federal level. Little changed when Mayor John Norquist took office in 1988. Viewing Milwaukee as a neoliberal marketplace, he thought that taking an activist governmental role in workforce development would create "…more problems that he solved" (Levine, 43). A perception that industry should train its own workers, or worse, that some citizens are expendable appears to have guided city priorities. Municipal efforts were project specific or merely public statements, highlighting the city's abdication of responsibility through temporary problem solving (Peterangelo et al., 2012). A shrinking labor force paired with an emergent skills gap ensued between quality of life sustaining wages and an unskilled workforce (Horton, 2006). Today, Milwaukee's efforts demonstrate a larger degree of workforce investment. What funding is allocated is meant to prepare local labor for growing job opportunities in key industries. Unlike economic development efforts between 2002 and 2005, the city now has an economic development plan and small-scale workforce training organizations are leveraged to help align local labor with the city's water-based aspirations.

The City of Milwaukee cites employer concerns over local skill gaps as a primary challenge to economic success (Growing Prosperity, 2014). However, limited funding for workforce development programs highlights a heavy reliance on outside organizations and a continued focus on bringing jobs in, rather than training the city's vulnerable labor pool. Milwaukee anticipates meeting their human capital needs through in-migration— a perception that "if you build it they will come". Given the local skills gap, attracting a talented workforce that can fill industry needs is required for successful economic growth. However, successful economic growth deviates from sustainable economic development along equity and labor lines. Milwaukee has engaged a branding effort to support human capital import, rather than local human capital development. Associating water-related economic opportunity with place, Milwaukee's branding serves to attract a knowledgeable workforce that can fill the needs of an attracted industry.

WATER: THE RE-CREATION OF PLACE

The geography of Milwaukee's wet-industry is historically aligned with the location of natural water resources. Developing at a time when preservation and packaging technologies did not exist, wet-industry served a local market which created a direct connection between place and product (Gatrell et. al, 2014). The real and perceived quality of a product, and its inputs, were inherently tied to the environment in which it was consumed and produced. Beer is central to Milwaukee's history and identity. Pabst, Miller, Blatz and other multi-national breweries are strongly associated with the city. Their brands have come to represent Milwaukee, and their products are inextricability linked to place. The narrative of brewing, or brew-lore, focuses on the pristine nature of water resources used in the creation of beer (Gatrell et. al, 2014). Water quality was critical for early brewers and sites were chosen based on abundance and quality within the spring, stream, river, or ground water well. Treatment, however, was always necessary in some degree or another to ensure safety and taste. This means that pure water never really existed. Rather, it was a narrative tool used to create a relationship between product and place in service of branding. The lore of pristine waters was and continues to be a strategy used "… to add value [to their product within] the market place. [It is the] story surrounding water that sells beer and defines quality, not necessarily the water" (Gatrell et al., 97).

A parallel can be drawn between Milwaukee's water-based economic development efforts— a large part of which is branding and associating the city with water-centricity. Milwaukee is attempting to promote itself as "America's Water-Centric City". The product being sold, so to speak, is Milwaukee. Consumers, whether individuals, families, or large firms, buy this product by moving to Milwaukee, choosing to build a home, life, and business within the city. Drawing upon its history of wet-industry, Milwaukee is marketing itself in a similar way to its historic brewers. This is not to say that they are branding themselves as a place of pristine and untouched water resources. That would be a clear fallacy to any consumer given the city's industrial past. Rather, they are attempting to associate the city and local life with water expertise, sustainability, and economic opportunity. All of which is readily available for consumption at a

time of, and in contrast to, growing scarcity in the Western and Southern United States and across the globe.

Milwaukee's branding draws upon national and international designations to validate its perception of expertise. In 2009, the city received a United Nations Global Compact Cities designation. This is one of thirteen designations worldwide. Admission marked the recognition of Milwaukee's "…expertise and global leadership in fresh water technology and science" (Murphy, 2015). In 2014, the United States Small Business Association designated Milwaukee a federal water technology cluster, one of four designations in the nation. Grants from JP Morgan and the National Science Foundation have helped as well. Milwaukee's branding scheme uses high profile designations and grants to establish water-centricity. As Miller describes, "every branding effort now is about water, all the colors have switched to blue, all our symbols are blue—some people are calling it the Fresh Coast and things like that. It has completely taken over the image and branding of the city" (2016). This includes the city's sports teams. Mosley (2016) remarks that the Milwaukee Bucks recently announced a plan to build a new arena. It will be the "bluest" arena in the NBA. Klump (2016) echoes both Miller and Mosley. He describes the city as wanting to establish and style itself as a place of water knowledge. The phrase "Fresh-Coast", another popular branding term, allows city leadership to distinguish Milwaukee from the east, west, and gulf coast (Klump, 2016). It provides an opportunity to transform Milwaukee's "Rust Belt" past into a "Blue Belt" future at a time when water solutions are needed. Klump (2016) remarks that the city recognizes opportunity within this. Yet even more so, Klump and Miller (2016) note that Milwaukee recognizes their responsibility in planning for water-based economic development.

A key responsibility recognized by water-centric Milwaukee is sustainable water management. In relation to water consumption, low residential and commercial water rates do not reflect sustainability. Heavy consumption is not moderated by price. Low water rates are touted as an economic tool for industry attraction and job creation. The city appears to support an unsustainable trade-off between employment opportunity and unfettered consumption. This creates an implicit contradiction within Milwaukee's water-based strategy. The city is using water

as an amenity-based downtown redevelopment focus. They are leveraging their water resources to build a set of advanced manufacturing and technical service industries around water resource management and technology. However, while aligning their water industry towards conservation, they also offer significant rate reductions for large industrial users of any kind. As Miller (2016) notes, Milwaukee's declining block water rates can incentivize heavy users to locate within city limits. In line with Harvey's (2006) criticism of capitalist systems, cheap consumption is engaged as a profit generating tool.

Weak consumption measures are contrasted by sustainability efforts surrounding stormwater management. All respondents (2016) remarked that the city's sustainability efforts around water are most prominent in relation to green infrastructure (GI). Further, all noted innovation within the sewerage district. Miller, Mosely, and Taylor (2016) commented that Kevin Shafer, the Sewerage District's executive director, is known internationally for GI work. GI sustainability efforts provide a two-pronged tool for the city. First, it is highly effective in managing polluted runoff. Action taken to preserve riparian buffers, create green space in densely populated areas, and install bioswales and raingardens in vulnerable areas across Milwaukee has reduced sewerage overflows and decreased polluted runoff entering Lake Michigan. The creation of a Green Streets Stormwater Management Program and an inaugural 2013 Sustainability Plan highlights the city's growing understanding of the relationship between land use and water quality. Taylor (2016) notes the historical significance of this. While the Water Pollution Abatement Program (WPAP) and the Deep Tunnel construction of the 1980s and 1990s substantially decreased sewerage overflows, more stormwater management was needed. The city faced a transformational decision— should they engage another large infrastructure project? Or should they manage runoff using GI that could be installed across the city, including residential and commercial settings? A "very conscious decision" (Taylor, 2016) was made to invest in GI. That decision, Taylor (2016) says, has allowed Milwaukee to become not only a national leader in GI but to successfully demonstrate sustainable management at the local level.

As the second-prong, public demonstrations of GI provide visual evidence of water sustainability to residents, visitors, and firms. Taylor (2016) remarks that green roofs, swales, and raingardens have reached residential and public school settings, including K – 12 buildings. Miller (2016) notes that public demonstrations at Reed Street Yards showcase emergent sustainable management technology, and that forward thinking infrastructure is being planned throughout the city. In terms of policy, Milwaukee now incorporates green stormwater technology into the planning and design of new and renovated streets. For example, a purple pipe sits below the main road at Reed Street Yards to manage onsite graywater (Miller, 2016). Building by building, it will unify the system in service of sustainable waste water reuse and management.

The public nature of GI has helped create a water-centric identity in Milwaukee. Miller explains that "… before, when you would bring up stormwater, people's eyes would roll or glaze over and they weren't very interested in it. But now it's … in the vocabulary of people around the city" (2016). Taylor (2016) speaks to a perception change as well. She explains that living on the Great Lakes has changed people's view on the importance of Lake Michigan. It has created a sense of necessity in protecting local water resources. Although Milwaukee has water abundance, community members are starting to understand stewardship as more "… than an economic driver" (Taylor, 2016). Demonstrating sustainability, in service of branding and environmental health, has facilitated this change.

Water resource stewardship expands beyond an economic driver to become economic opportunity in Milwaukee. Given the apparent skills gap between Milwaukee's residents and the targeted water industry, a marketing strategy that associates place with individual and firm growth may serve in attracting human capital. Milwaukee's logic in attracting a knowledge-intense workforce draws upon the need to develop sustainable solutions for local and global water challenges. Sustainable solutions include the development of new technology, policy and regulatory frameworks, and business incentives that can be adapted across contexts (Klump, 2016). Innovation is linked to human capital, both of which are needed to test, re-test, and develop successful and sustainable solutions. Challenges are posed as actionable (and profitable) research,

innovation, business development, and employment opportunity. Future oriented language allows Milwaukee's branding scheme to imply community, individual, and firm agency in the creation of local and global solutions. Milwaukee is attempting to position itself as a water-leader within the global economy. To generate a reputation of expertise and opportunity, a place-based image of high-skilled workers, academics, and entrepreneurs working at the cutting edge of water technology is intentionally constructed. This image operates as a call to opportunity. Depicting Milwaukee as a place to grow with and contribute to water technology development, positioning yourself, family, or firm in Milwaukee is positioning yourself at the core of water-based economic opportunity.

Chapters 4, 5, and 6 traced select parts of Milwaukee's water history from WWII to 2014. The unfolding story explained how historic and contemporary practices have allowed Milwaukee to position itself for sustainable water-based economic development today. The analysis showed Milwaukee's conceptualization of water to be dynamic and malleable. Changes occurred in tandem with, or in response to new conditions. For example, the need to maintain and attract industry after WWII transformed water from being a tool for municipal revenue, to a tool for jurisdictional growth. Another applicable example can be drawn from the C. Parvum outbreak in 1993. Water was shown to be a vital factor in human health by directly harming it. The perception of water as an industrial and municipal disposal source was eliminated. Subsequent practices at Milwaukee Water Works reflected a new meaning of health. A full discussion delineating and drawing conclusions from cross-era changes and transformations is featured in the conclusion. However, before reaching that point, we must evaluate the second research question: How successful have Milwaukee's water-based strategies been?

Chapter 7: Evaluating Success

Milwaukee's water-based economic development plans are relatively new. The strategy was only introduced in 2005, leaving less than ten years from inception to evaluate industrial change. That being said, it's important to discuss the degree to which the economic landscape has shifted within this timeframe. A quantitative determination of Milwaukee's industrial state provides an opportunity for the city to continue, correct, or adjust resources allocated in support of advanced manufacturing. Location quotient (LQ) and shift share analyses provide the framework of evaluation. Data was obtained from the United States Bureau of Labor Statistics (BLS) for the Milwaukee MSA in 2004 and 2014. MSA, rather than county, was selected due to the reliability and relative consistency of data. Data was obtained at the Super Sector, Sub-Sector, and 4-digit NAICS code level. Super Sector analysis contains information relevant to all United States industries. Focus is then placed on manufacturing at the Sub-Sector level. 4-digit NAICS codes are used to narrow Sub-Sector classifications, identifying industrial categories at the intersection of manufacturing and water industry. Sub-Sector and 4-digit NAICS codes were adapted from a United States Department of Commerce Report entitled, *Water Technologies: A Global Opportunity Scan for U.S. Companies* (2011). It is important to note that the analysis does not measure the success of the initiative itself. Some water or environmental industry activity is likely in a classification outside manufacturing. At most, this analysis provides a snapshot of the MSA's economic landscape, specific to manufacturing and water-related industry, as compared to national averages and trends. The LQ analysis precedes the shift share analysis below.

A location quotient (LQ) measures an industry's local concentration as compared to that of the nation. The analysis is valuable as a specialization measure, revealing what makes a particular area unique relative to national averages. A LQ greater than one indicates economic strength or concentration, meaning that local industry employs a greater share of industry-specific workforce as compared to the nation. Industry with LQs greater than one are often export-oriented. This means that the industry produces more goods and/or services than are consumed locally.

Export oriented industry is growth producing. It brings new money into the local economy, rather than circulating what already exists (Indiana Business Research Center, 2006).

Table 2. Super Sector Location Quotients for Milwaukee MSA, 2004 - 2014

Industry (SuperSector)	US Total Employment (2004)	US Total Employment (2014)	Milwaukee-Waukesha-West Allis, WI MSA: Total Employment (2004)	Milwaukee-Waukesha-West Allis, WI MSA: Total Employment (2014)	Milwaukee-Waukesha-West Allis, WI MSA: Location Quotients (2004)	Milwaukee-Waukesha-West Allis, WI MSA: Location Quotients (2014)
Base Industry: Total, all industries	108,490,066	115,568,686	720,855	720,973	1.00	1.00
Natural resources and mining	1,675,038	2,073,041	1,183	1,252	0.11	0.1
Construction	6,916,398	6,108,673	33,271	26,708	0.72	0.7
Manufacturing	14,257,380	12,156,537	136,022	119,212	1.44	1.57
Trade, transportation, and utilities	25,276,319	26,099,969	152,185	140,117	0.91	0.86
Information	3,099,633	2,732,191	18,380	14,308	0.89	0.84
Financial activities	7,890,786	7,674,037	57,178	50,626	1.09	1.06
Professional and business services	16,294,776	19,074,275	106,149	119,682	0.98	1.01
Education and health services	16,084,963	20,573,137	124,190	147,243	1.16	1.15
Leisure and hospitality	12,467,597	14,626,556	66,068	73,630	0.8	0.81
Other services	4,287,999	4,235,390	26,199	28,172	0.92	1.07
Unclassified	239,179	214,881	31	23	0.02	0.02

Data obtained from the Bureau of Labor Statistics: Census of Labor Employment and Wages.

Milwaukee's water-based economic plans emphasize water technology and related manufacturing. As no standard industrial classification code exists for the water industry, initiative leadership define it as advanced manufacturing, including mechanical manufacturing and metal manufacturing (Milwaukee7, 2014; White, 2008). Local LQ analyses are relatively vague, showing pumps at an LQ of 3.3, meters (LQ 5.2), boilers (LQ 5.6), and values (LQ 1.6) (Marcoux, nd; Milwaukee7, 2014). A formal NAICS code and date of analysis is not associated with this information. While I have not been successful in tracing these numbers, the Milwaukee MSA's manufacturing LQ's are strong.

In Table 2, total employment in the Milwaukee MSA shows a marginal increase between 2004 and 2014. However, total local employment within the manufacturing industry has declined.

This mirrors national manufacturing employment trends. Decreasing employment numbers at the MSA and national scale suggests a weakening of the manufacturing industry or increased efficiency, as less workers may be needed for production. Similarity in trend is not necessarily negative. National economic trends often affect those at the local level. However, this does serve as a warning that industry employment is shrinking in the United States.

Despite declining national and MSA manufacturing employment, Milwaukee maintains a relatively strong industry LQ. Since 2004, Milwaukee's manufacturing LQ has increased from 1.44 to 1.57, a positive change of .13. This can be interpreted as a specialization strength— local industry employs a greater share of the manufacturing industry workforce as compared to the nation. Milwaukee MSA's manufacturing concentration suggests a uniqueness or advantage within the local industry. As high LQs are often export related, it's possible that Milwaukee's manufacturing sector produces more goods and/or services than are consumed locally. New money may be entering the local economy as a result.

Turning towards Sub-Sector manufacturing in Table 3, NAICS codes classifying Plastics and Rubber Products Manufacturing (326), Primary Metal Manufacturing (331), Fabricated Metal Product Manufacturing (332), Machinery Manufacturing (333), and Computer and Electronic Product Manufacturing (334) have, by and large, increased in share concentration and specialization. All MSA manufacturing Sub-Sectors maintain LQs greater than one. Printing and Related Support Activities (323) is included in the BLS's manufacturing categorization, but was omitted from the data table due to relevance.

Table 3 Sub-Sectors also represent overlap between the manufacturing and water industries. For example, Fabricated Metal Product Manufacturing (332) includes metal containment tanks, fluid power values and hose fittings, and plastic tubing. Machinery Manufacturing (333) includes water purification equipment and pumping equipment. Table 3 shows specific categories of water-related manufacturing within the MSA by 4-digit NAICS code. These are nested within the Sub-Sector. Unfortunately, codes with greater specificity often lack

full data sets. However, all LQs present have a value greater than one and demonstrate positive change between 2004 and 2014.

Table 3. Select Sub-Sector and 4-Digit NAICS Code Location Quotients for Milwaukee MSA, 2004 - 2014

Industry	Milwaukee-Waukesha-West Allis, WI MSA: Location Quotients (2004)	Milwaukee-Waukesha-West Allis, WI MSA: Location Quotients (2014)
NAICS 326 Plastics and rubber products manufacturings	1.17	1.38
NAICS 3261 Plastics product manufacturing	ND	1.58
NAICS 331 Primary metal manufacturing	2.10	2.09
NAICS 3312 Steel and Product Manufacturing from Purchased Steel	ND	1.82
NAICS 332 Fabricated metal product manufacturing	2.34	2.48
NAICS 3324 Boiler, tank, and shipping container mfg.	ND	ND
NAICS 3329 Other fabricated metal product manufacturing	2.07	2.29
NAICS 333 Machinery manufacturing	2.93	2.94
NAICS 3332 Industrial machinery manufacturing	ND	2.19
NAICS 3333 Commercial and service industry machinery	ND	ND
NAICS 3336 Turbine and power transmission equipment mfg.	ND	6.55
NAICS 3339 Other general purpose machinery manufacturing	2.7	3.03
NAICS 334 Computer and electronic product manufacturing	1.32	1.44
NAICS 3345 Electronic Instrument Manufacturing	ND	2.76

Data obtained from the Bureau of Labor Statistics: Census of Labor Employment and Wages.

Strong LQs suggest that water-related manufacturing may have contributed to concentration and specialization within the last ten years. With a high concentration and relative degree of uniqueness within the region, these industries may produce more water-related

manufactured goods than consumed within the MSA. Excess goods are likely exported, bringing new money into Milwaukee's local economy, and thus, generating economic growth.

The second step of this analysis is a shift share. A shift share analysis measures the competitiveness of a region's industry. It evaluates the performance of specific industries within an area, as well as its industrial mix. A shift share determines economic competitiveness within three categories: national growth, industry mix, and competiveness (regional shift). While shift shares can be used to understand additional measures such as income and earnings, I use it to analyze employment. Doing so demonstrates the portion of total employment growth within the region based on national economic growth, a combination of slower or faster than average growth rates among industries, and the competitiveness of industries in the region (Sentz, 2011).

The national growth component indicates how many jobs within the local industry can be attributed to the growth or decline of the U.S. economy. It assumes that if the national economy grew at 2%, the local economy would too. Industry mix calculates how much growth or decline in local industry employment can be attributed to industry performance at the national scale. Regional shift (competitiveness) shows the amount of employment gain or loss within an industry that can be solely attributed to local advantage or disadvantage. A positive number denotes that the region gained additional jobs, more than can be attributed to national growth or industry mix factors. A negative number means that the regional industry was less competitive than the national average (Sentz, 2011).

Table 4. Super-Sector Shift Share Analysis for Milwaukee MSA, 2004 -2014

Industry Sector	Total Employment By Sector: United States					Total Employment By Sector: Milwaukee-Waukesha-West Allis, WI MSA					National Share	Industry Mix	Regional Shift	Total Change in Employment 2004-2014	Check
	2004	% of Total	2014	% of Total	% Change	2004	% of Total	2014	% of Total	% Change					
Base Industry: Total, all industries	108,490,066	100.00%	115,568,686	100%	0	720,855	100.00%	720,973	100.00%	0.00%					
Natural resources and mining	1,675,038	1.54%	2,073,041	1.79%	-0.25%	1,183	0.16%	1,252	0.17%	-0.01%	77	204	(212)	69	69
Construction	6,916,398	6.38%	6,108,673	5.29%	1.09%	33,271	4.62%	26,708	3.70%	0.92%	2171	(6,056)	(2,677)	(6,563)	(6,563)
Manufacturing	14,257,380	13.14%	12,156,537	10.52%	2.62%	136,022	18.87%	119,212	16.53%	2.34%	8875	(28,918)	3,233	(16,810)	(16,810)
Trade, transportation, and utilities	25,276,319	23.30%	26,099,969	22.58%	0.72%	152,185	21.11%	140,117	19.43%	1.68%	9930	(4,970)	(17,027)	(12,068)	(12,068)
Information	3,099,633	2.86%	2,732,191	2.36%	0.50%	18,380	2.55%	14,308	1.98%	0.57%	1199	(3,378)	(1,893)	(4,072)	(4,072)
Financial activities	7,890,786	7.27%	7,674,037	6.64%	0.63%	57,178	7.93%	50,626	7.02%	0.91%	3731	(5,301)	(4,981)	(6,552)	(6,552)
Professional and business services	16,294,776	15.02%	19,074,275	16.50%	-1.48%	106,149	14.73%	119,682	16.60%	-1.87%	6926	11,181	(4,573)	13,533	13,533
Education and health services	16,084,963	14.83%	20,573,137	17.80%	-2.97%	124,190	17.23%	147,243	20.42%	-3.19%	8103	26,550	(11,600)	23,053	23,053
Leisure and hospitality	12,467,597	11.49%	14,626,556	12.66%	-1.17%	66,068	9.17%	73,630	10.21%	-1.04%	4311	7,130	(3,879)	7,562	7,562
Other services	4,287,999	3.95%	4,235,390	3.66%	0.29%	26,199	3.63%	28,172	3.91%	-0.28%	1709	(2,031)	2,294	1,973	1,973
Unclassified	239,179	0.22%	214,881	0.19%	0.03%	31	0.00%	23	0.00%	0.00%	2	(5)	(5)	(8)	(8)

Data obtained from the Bureau of Labor Statistics: Census of Labor Employment and Wages.

Table 5. Select Sub-Sector Shift Share Analysis for Milwaukee MSA, 2004 -2014

Industry Sector	Total Employment By Sector: United States					Total Employment By Sector: Milwaukee-Waukesha-West Allis, WI MSA					National Share	Industry Mix	Regional Shift	Total Change in Employment 2004-2014	Check
	2004	% of Total	2014	% of Total	% Change	2004	% of Total	2014	% of Total	% Change					
Base Industry: Total, all industries	108,490,066	100.00%	115,568,686	100%	0	720,855	100.00%	720,973	100.00%	0.00%					
NAICS 326 Plastics and rubber products manufacturings	803,718	0.73%	673,098	0.58%	0.15%	6,273	0.87%	5,807	0.81%	0.06%	409	(1,429)	553	(466)	(466)
NAICS 331 Primary metal manufacturing	465,993	0.43%	397,520	0.34%	0.09%	6,510	0.90%	5,188	0.72%	0.18%	425	(1,381)	(365)	(1,322)	(1,322)
NAICS 332 Fabricated metal product manufacturing	1,488,713	1.37%	1,449,371	1.25%	0.12%	23,100	3.20%	22,436	3.11%	0.09%	1507	(2,118)	(54)	(664)	(664)
NAICS 333 Machinery manufacturing	1,136,771	1.05%	1,120,463	0.97%	0.08%	22,112	3.07%	20,522	2.85%	0.22%	1443	(1,760)	(1,273)	(1,590)	(1,590)
NAICS 334 Computer and electronic product manufacturing	1,047,449	1.21%	2,732,191	0.91%	0.30%	11,563	1.60%	9,396	1.30%	0.30%	754	17,844	(20,765)	(2,167)	(2,167)

Data obtained from the Bureau of Labor Statistics: Census of Labor Employment and Wages.

Table 6. 4-Digit NAICS Industrial Code Shift Share Analysis for Milwuakee MSA, 2004 -2014

Industry Sector	Total Employment By Sector: United States					Total Employment By Sector: Milwaukee-Waukesha-West Allis, WI MSA					National Share	Industry Mix	Regional Shift	Total Change in Employment 2004-2014	Check
	2004	% of Total	2014	% of Total	% Change	2004	% of Total	2014	% of Total	% Change					
Base Industry: Total, all industries	108,490,066	100.00%	115,568,686	100%	0	720,855	100.00%	720,973	100.00%	0.00%					
Four Digit Code															
NAICS 3261 Plastics product manufacturing	631,764	0.58%	540,826	0.47%	0.11%	ND	ND%	5,347	0.74%	ND%	ND	ND	ND	ND	ND
NAICS 3324 Boiler, tank, and shipping container mfg.	90,620	0.08%	98,129	0.08%	0.00%	ND	ND%	ND	ND%	ND%	ND	ND	ND	ND	ND
NAICS 3329 Other fabricated metal product manufacturing	276,026	0.25%	277,420	0.24%	0.01%	3,799	0.53%	3,962	0.55%	-0.02%	248	(229)	144	163	163
NAICS 3332 Industrial machinery manufacturing	119,930	0.11%	109,133	0.09%	0.02%	ND	ND%	1,490	0.21%	ND%	ND	ND	ND	ND	ND
NAICS 3333 Commercial and service industry machinery	114,537	0.11%	86,794	0.08%	0.03%	ND	ND%	ND	ND%	ND%	ND	ND	ND	ND	ND
NAICS 3336 Turbine and power transmission equipment mfg.	93,147	0.09%	99,375	0.09%	0.00%	ND	ND%	4,061	0.56%	ND%	ND	ND	ND	ND	ND
NAICS 3339 Other general purpose machinery manufacturing	263,778	0.24%	263,327	0.23%	0.01%	4,738	0.66%	4,977	0.69%	-0.03%	309	(317)	247	239	239
NAICS 3345 Electronic Instrument Manufacturing	429,568	0.40%	390,014	0.34%	ND	ND	ND%	6,713	0.09%	ND%	ND	ND	ND	ND	ND
NAICS 3312 Steel and Product Manufacturing from Purchased Steel	60,141	0.06%	59,683	0.05%	ND	ND	ND%	676	0.93%	ND%	ND	ND	ND	ND	ND

Data obtained from the Bureau of Labor Statistics: Census of Labor Employment and Wages.

Beginning with Super Sector classifications in Table 4, it appears that 8,875 of Milwaukee MSA's manufacturing jobs between 2004 and 2014 can be attributed to national economic growth. However, industry mix, representing the share of local industry growth or decline due to manufacturing performance at the national level, shows a decline of 28,918 jobs. This supports national and local manufacturing employment trends seen in the LQ analysis above. The negative effect that national manufacturing trends have had on local industry employment is quantified. In contrast, regional shift or competiveness shows a positive employment figure of 3,233. This represents employment change at the MSA level which national manufacturing trends cannot account for. A positive local share indicates competitive strength. National industry is shown to be declining, yet the MSA's local industry has stemmed a portion (3,233 jobs) of that employment loss. In a sense, Milwaukee is outperforming the nation in manufacturing. This suggests that a unique economic attribute within the MSA exists, and that this attribute has resulted in a quantifiable degree of local economic advantage.

Sub-Sector classifications in Table 5 show a positive regional shift within the Plastics and Rubber Products Manufacturing Sector (326). As before, the positive number denotes that the MSA gained additional jobs, more than can be attributed to national growth or industry mix factors. All remaining Sub-Sector industry in Table 5 show a negative regional shift. This suggests that local sectors were less competitive than the national average. However, a negative regional shift at the Sub-Sector level does not mean that all industries within the Sub-Sector are uncompetitive. NAICS-code digits increase as industry specifies. Unfortunately, this also means the amount of data available narrows.

Table 6 includes 4-digit NAICS codes specific to water-related manufacturing across Sub-Sectors (326; 331; 332; 333; and 334). The 4-digit codes were adapted from a United States Department of Commerce Report entitled, *Water Technologies: A Global Opportunity Scan for U.S. Companies*. While the report lists 6-digit codes, I did not increase past four. Data was largely inconsistent at the 4-digit level to begin with. Only two 4-digit codes contain a full dataset: Other Fabricated Metal Product Manufacturing (3329) and Other General Purpose Heavy Machinery

Manufacturing (3339). These industries are components of two non-competitive Sub-Sectors (332 and 333) listed in Table 5. However, they show a positive regional shift at the 4-digit level. Industry types listed in Other Fabricated Metal Product Manufacturing and Other General Purpose Heavy Machinery Manufacturing are largely water-related, including pumps, valves, pipe fittings, compressors, and fluid power cylinders among others. A full list can be found in Table 7.

Table 7. NAICS Code 3329 and 3339 Industry Listings, 2014

NAICS 3329 Other fabricated metal product manufacturing		**NAICS 3339 Other general purpose machinery manufacturing**	
NAICS 3329 Other fabricated metal product manufacturing	NAICS 332992 Small arms ammunition manufacturing	NAICS 3339 Other general purpose machinery manufacturing	NAICS 333996 Fluid power pump and motor manufacturing
NAICS 33291 Metal valve manufacturing	NAICS 332993 Ammunition, except small arms, manufacturing	NAICS 33391 Pump and compressor manufacturing	NAICS 333997 Scale and balance manufacturing
NAICS 332911 Industrial valve manufacturing	NAICS 332994 Small arms and ordnance manufacturing	NAICS 333911 Pump and pumping equipment manufacturing	NAICS 333999 Miscellaneous general purpose machinery mfg.
NAICS 332912 Fluid power valve and hose fitting mfg.	NAICS07 332995 Other ordnance and accessories manufacturing	NAICS 333912 Air and gas compressor manufacturing	NAICS 333924 Industrial truck, trailer, and stacker mfg.
NAICS 332913 Plumbing fixture fitting and trim mfg.	NAICS 332996 Fabricated pipe and pipe fitting mfg.	NAICS 333913 Measuring and dispensing pump manufacturing	NAICS 33399 All other general purpose machinery mfg.
NAICS 332919 Other metal valve and pipe fitting mfg.	NAICS07 332997 Industrial pattern manufacturing	NAICS 33392 Material handling equipment manufacturing	NAICS 333991 Power-driven handtool manufacturing
NAICS 33299 All other fabricated metal product mfg.	NAICS07 332998 Enameled iron and metal sanitary ware mfg.	NAICS 333921 Elevator and moving stairway manufacturing	NAICS 333992 Welding and soldering equipment manufacturing
NAICS 332991 Ball and roller bearing manufacturing	NAICS 332999 Miscellaneous fabricated metal product mfg	NAICS 333922 Conveyor and conveying equipment mfg.	NAICS 333993 Packaging machinery manufacturing
NA	NA	NAICS 333923 Overhead cranes, hoists, and monorail systems	NAICS 333994 Industrial process furnace and oven mfg.
NA	NA	NA	NAICS 333995 Fluid power cylinder and actuator mfg.

Data obtained from the Bureau of Labor Statistics: Census of Labor Employment and Wages.

It is particularly difficult to draw a reliable conclusion given the lack industry-specific data. However, it appears that manufacturing remains a strong component of the MSA's economy despite declining national employment trends. Regional shift at the Sub-Sector level shows MSA advantage in Plastics and Rubber Products Manufacturing (326). Only two industries contained complete datasets at the 4-digit level: Other Fabricated Metal Product Manufacturing (3329) and

Other General Purpose Heavy Machinery Manufacturing (3339). While parent Sub-Sector classifications were shown as uncompetitive, regional shift at the 4-digit level was positive. This suggests that a unique economic attribute exists within these industries, and that this attribute has resulted in a quantifiable degree of local economic advantage. High LQs across the manufacturing sector support this notion.

Manufacturing strength in specific water-related industry may likely exist. However, more data, time, and statistical analysis is needed to draw a meaningful conclusion that accounts for long-term industry trends at the local and national level. Further, the City of Milwaukee and partner organizations, like the Water Council, have not released specific metrics for water-related employment growth. This data is key in understanding employment success across demographic groups within the City of Milwaukee, as a critical goal of their initiative is local job creation.

Chapter 8: Conclusion

I asked two questions at the onset of this research: (1) In what ways has Milwaukee positioned itself for sustainable water-based economic development? (2) How successful has their strategy been? I draw upon Harvey's (2006) Uneven Development theory to examine these questions and construct a partial perspective answer through narrative (Haraway, 1988). The three-era storyline highlights historic and contemporary practices that have allowed Milwaukee to position itself for water-based growth. A shift share and location quotient analysis has shown water-related manufacturing to be strong, although a longer timeline and larger dataset would produce a stronger conclusion.

My definition of sustainability allows me to draw a distinction between a sustainable positioning process, and a positioning process isolated in time. A positioning process isolated in time does not require historical understanding. While sustainability may very well exist, the temporal relationship between knowledge gain and decision-making is a lesser focus. A sustainable positioning, as I have defined it, requires historical understanding— evidence of past experience informing equitable decision-making. This understanding demonstrates the degree to which economic, environmental, and equitable knowledge gain have been incorporated into municipal water practices. Within this research, I have found that Milwaukee has positioned itself for sustainable water-based economic development by learning from past experience. Success and failure have informed decision-making across eras, culminating in the city's ability to generate a sustainable strategy centered upon its water resources and local knowledge. However, the city falls short in regard to the equity value-set of sustainability. Evidence to support this hypothesis is found by tracing individual and cumulative change across time.

My analysis begins at the onset of WWII when industrial strength characterized the region and city. During industrialization (1947 – 1967), water was perceived as a commodity— a raw resource produced and exchanged to create profit. The City of Milwaukee operated their water works in a proprietary manner, using provision and sales to generate excess municipal revenue. This occurred at the expense of low-income and minority groups, for whom service was neither a

governmental priority nor profitable endeavor. In the years following WWII, race and income-based provision gaps worsened as the city engaged in an aggressive annexation campaign. Expansion was seen as vital to economic prosperity, and the city acted autonomously in its development efforts. Territorial gain, in service of industrial attraction, retention, and tax base expansion, was the goal. Milwaukee owned and operated the only water utility in the region. Outlying areas were reliant upon wells. Milwaukee used water provision to lure annexation, and ultimately, expand its municipal boundary. Inner-city water rates subsidized these expansion efforts. Unprecedented economic and spatial growth occurred during this time period. City leadership and wet-industry alike perceived water as an input for growth and production, and an output for municipal and industrial waste. Consumption practices reflected water as an unlimited resource for both profit and disposal. Environmental and human health were secondary. Significant environmental problems resulted.

During deindustrialization (1967 – 2000), economic, environmental, and social failures forced Milwaukee to change its water practices. Environmental failure can be traced to the late 1960s and 1970s when increased federal attention was placed on water pollution. Milwaukee's sewerage and treatment plants were built to accommodate a lower volume than needed. This resulted in sewerage overflows and waste water dumping when the systems reached capacity. Mounting pollution in Lake Michigan led to legal action against Milwaukee. State and federal court rulings prompted the creation of a Water Pollution Abatement Program (WPAP) and the Deep Tunnel construction project. The results were twofold. First, the city's water resources and treatment practices were substantially improved, generating increased water quality and setting a new foundation for environmental health. Second, the project's extremely large price tag was split between jurisdictions. This created the perception that water was a shared resource— a cross-jurisdictional responsibility— rather than a resource under the sole authority of Milwaukee. Social changes can be pinpointed to 1993, when the C. Parvum outbreak in Milwaukee's water supply harmed 400,000 people. The crisis helped redefine the relationship between health and water in Milwaukee. Utility practices were linked to well-being by demonstrating a direct ability to harm

it. Taylor (2016) notes that this raised community consciousness about the importance of safe drinking water. The outbreak shaped the approach the sewerage district and city took in water provision, and it continues to shape management today. Economic transformation can be pinpointed to 1970. With a failed Industrial Land Banking program, the Maier administration redirected its efforts towards mid-sized industry and became increasingly focused on downtown redevelopment. The city engaged a tenuous new practice— working with private sector leadership to facilitate inner-city growth. Success was not immediate, yet two vital (and altogether new) perceptions emerged. First, economic development could be a shared effort rather than the sole charge of city government. This marked the beginning of cooperative private-public partnerships. Second, water could be used to create economic growth without actually consuming it. Proximity to local water resources, like the Milwaukee River or Lake Michigan, could increase land value and facilitate commercial activity. Paring environmental restoration and economic opportunity, the Riverwalk emerged as the predecessor to Milwaukee's water-based economic strategy seen today.

The final era, Post-Industrialization (2000 – 2014), marks the emergence of Milwaukee's water-based economic development strategy. Although not formalized until the mid-2000s, the city's water-based strategy is deeply informed by past experience. Evidence of this is found in the city's current actions. First, Milwaukee does not seek to be the sole driver of economic development. The initiative was first developed by private sector leadership, and since its inception, has remained a joint endeavor. This contrasts development practices in the decades surrounding WWII, and demonstrates knowledge gained by engaging new practices— private-public partnerships— in the late 1970s and onward. All respondents (2016) site cooperation across stakeholder and interest groups as a key element of success within today's initiative. Miller (2016) further notes that the diversity and robustness in leadership allows the strategy to develop in multiple directions. Historic difficulties in developing private-public partnerships have lessened significantly. For Mosley (2016), the very fact that the initiative is not top-down, that it came from industrial and academic experience, allows city government and all actors to play catalyzing roles.

Second, industrial legacy, a return to Milwaukee's driver industries, is the foundation from which the water-based strategy is built. Industrial legacy maintains roots beyond WWII. It can be traced to historic brewing, tannery, and meat processing plants established when early immigrants settled the area. Economic conditions have ebbed and flowed in Milwaukee. Yet wet-industry has continually adapted by creating new products, technologies, and processes that serve local, national, and global markets. By returning to key industries that the city knows, they are, in a sense, reviving a knowledge-base and expertise in water and manufacturing built over decades of past experience.

Third, a focus on inner-city land and real estate development demonstrates knowledge gained from failed investment. Milwaukee's industrialized economy supported a spatially expansive industry. Large plots of land served the mass production of goods and generated substantial property tax revenue for the city. As the city deindustrialized, economic conditions shifted towards knowledge and service-based industry. Jurisdictional growth no longer supported economic prosperity. Recognizing this, this city invested in its land and turned its attention downtown. It began a processes of remediating contaminated sites in service of future development. This trend continues today. However, specific focus is placed on the siting of water-related firms in service of future planned growth. In practice, this has become a mutually reinforcing process, as a formal water-based purpose has been applied to priority land development projects. Using tax increment financing, zoning, and a newly approved Private/Public Venture Fund, water has become a tool to catalyze land development, and land development a tool to catalyze water-based growth.

Fourth, water is now increasingly tied to health, sustainability, and quality of life. This is a stark departure from production and disposal practices in the decades surrounding WWII. Change was catalyzed by the court-mandated WPAP program, Deep Tunnel construction, and C. Parvum outbreak. It was supported by the realization that proximity to water, rather than direct consumption, could generate growth through commercial activity and land value. As Milwaukee engages water-based plans, the relationship between land use and local water resources has

strengthened. Sustainability measures, such as green infrastructure, have reinforced such knowledge by demonstrating the impact that human behavior (and decision-making) can have on environmental quality and health. As Kump (2016) suggests, sustainability implies a willingness to invest, and while it's been difficult to generate that perspective across Wisconsin, the City of Milwaukee is moving ahead in that direction.

Milwaukee's strategy draws upon an advantage of water abundance at a time when scarcity has become increasingly common throughout the world. Their positioning process aims to transform Milwaukee into a water-centric city, a "World Water Hub" of industry, technology, research, and expertise. The initiative is less than ten years old, yet preliminary quantitative analysis suggests a supporting economic landscape. As national and global communities begin to understand the value of water, and its necessity, from a risk management and financial standpoint, communities, firms, and individuals with water needs may turn to areas with resource abundance. The City of Milwaukee is one of those areas. Mosely (2016) believes that Milwaukee's ability to meet emergent supply needs will foster local innovation and knowledge, making the city an attractive community for future investment in water and water technology. Miller and Klump (2016) suggest the possibility that abundance is a disadvantage. Living on 20% of the world's surface freshwater creates a tendency to take water for granted. Scarcity and need often breed innovation, which Miller (2016) notes, Milwaukee does not have. As a result, less focus is placed on conservation than needed in the long-run. In fact, water is touted as low-cost and readily available for any large user or interested industry.

Yet, what if we connect scarcity and need to socio-economic equity? If we look through that lens, scarcity and need certainly exist. The dramatic and continuing decline of Milwaukee's manufacturing industry in the late 1960s hit middle-class, low-income, and minority workers particularly hard. Factory closings left thousands unemployed. Labor disputes, union politics, and race and class-based tensions intensified in tandem with disinvestment. This caused significant damage to Milwaukee's urban center. The individuals most hurt by deindustrialization were those upon which it was built. Semi-skilled blue-collar and minority labor followed an uneven path to

America's middle class through manufacturing work. Today, those most injured by capital flight struggle to recover. Unemployment in the City of Milwaukee stood at 8.4% in 2014. 29.5% of Milwaukee's residents were found to be living in poverty (U.S. Census Bureau, 2014; Wisconsin WorkNet, 2014). As Milwaukee struggles to recover from mid-century industrial loss, perhaps the water-based strategy itself is a form of innovation driven by socio-economic need. Yet, this innovation does not account for or produce equitable benefits at the local level. The strategy's focus on knowledge-intensive industry will produce jobs that Milwaukee's low-income population— those most vulnerable and in need— are underqualified for. The city is choosing a route that seeks profit over human resource development. Catalyzing local knowledge in service of water-based growth benefits highly educated natives and newcomers, not Milwaukee's minority majority population.

Harvey's (2006) Uneven Development theory accounts for the effects of capital processes within the built environment. He argues that capital accumulation— a circular pursuit of profit through resource consumption— creates spatial and temporal inequalities that are deeply disruptive to social processes. Milwaukee experienced Uneven Development at the national and international scale when economic power shifted from the Northeast and Midwest to Western and Southern "Sun Belt" states and abroad. At the metropolitan scale, Milwaukee experienced Uneven Development when capital investment shifted from the urban core to suburban and exurban sites following WWII. After depreciation and fall in central city land value, capital began flowing back to the city's inner-core in the late 1970s and 1980s. Today, downtown Milwaukee is a renewed frontier for profitable water-based reinvestment. Uneven cycles of investment and disinvestment have refreshed the ability of capital to maximize profitability across Milwaukee's urban landscape. Although the city is experiencing an influx of capital, the socio-economic consequences of Uneven Development across space and time are acute at the local scale. Equity remains a significant issue for the city. Historic race and income-based exclusion, driven and deepened by past practices that used water to facilitate surplus revenue and growth, are perpetuated by the city's current initiative. Maximizing water-based profit over socio-economic equality demonstrates a lack of equitable

knowledge gain at the municipal level today. It appears Milwaukee has not yet learned how social equity is a necessary dimension of sustainable development.

Water has been a profitable resource since the city's inception, and its use is historically aligned with the creation of inequality. Reaching back to the decades surrounding WWII, water provision was unequal in service of monetary gain. Minority residents experienced below standard service provision and slow utility connections because they opted out of higher tax assessments. Suburban areas seeking water contracts in the 1940s and 1950s faced inflated rates due to the city's want for surplus revenue. When Ziedler's post-war annexation campaign intensified, inner-city water rates were used to subsidize jurisdictional growth. Profit gained was invested in suburban utility infrastructure so that the city might expand its tax base. Minority communities suffered as a result. In the early 1960s, the Howard Facility, servicing Milwaukee's south side minority population, was located in an area with questionable water quality. In large part because the city already owned that plot of land, and the location reduced construction costs, pollution concerns were assuaged through the application of chlorine. Howard Facility users were most negatively affected by the C. Parvum crisis in 1993.

Today, water is no longer uneven in terms of distribution and service. Rather, water has been transformed into a new resource for a different type of profit— knowledge-based capital. The city is allocating a substantial amount of resources and energy to a water-based economic development strategy focused on knowledge-intensive production. Their goal is job creation, yet the strategy attracts firms whose employment qualifications exceed the educational attainment of the city's minority majority population. While the city has engaged efforts to fill this skills gap, and workforce development programs (educational and non-profit) have emerged to support paths to employment, the pursuit of jobs that many residents are not qualitied for is fundamentally inequitable and, therefore, unsustainable. An economic strategy that serves those with high educational attainment is a continuation of historic trends that sought profit using water. These trends have contributed to racial inequality throughout Milwaukee's history. Given that the city and the Water Council have not released water industry employment metrics, one will have to wait

and see if and how a skills and employment gap might be closed rather than widened. It's possible that related manufacturing jobs could provide a foothold for lower-skilled and less educated workers. More targeted investment in workforce training would better position local workers for the water-related manufacturing and service jobs sought. However, if Milwaukee's use of water for profit throughout history is any indication, social equity will remain secondary to fiscal growth. This will continue until the equity value-set is understood as a necessary dimension of sustainable economic development.

Appendix

A: Interview Protocol

1. In a few words, how would you describe Milwaukee's water-based economic development plans?

2. How would you define your role within these plans?

3. Do you think Milwaukee's water-based development plans are sustainable, and if so, why?

4. How might you improve these sustainability efforts?

5. Do particular aspects of Milwaukee's history provide advantage in developing a water-based economic development strategy, and if so, how?

6. Do these aspects inform current decision-making in the city, and if so, how?

7. What contemporary tools and/or processes allow the city to catalyze water-based economic development?

8. How might you improve the city's efforts?

9. Is there anything that you consider important that I haven't asked you yet?

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