A Flowing Economy

How Clean Water Infrastructure Investments Support Good Jobs in Chicago and in Illinois

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Executive Summary

Clean water infrastructure investment is a win-win-win for Illinois.

- Clean water infrastructure projects are a win for the blue-collar construction workers and the employees of water-related facilities, for whom middle-class employment opportunities are provided. Employment in the water infrastructure sector increases an average worker's hourly earnings by 10 percent in Illinois.
- Clean water infrastructure projects improve environmental quality and help households and businesses run more efficiently. Improvements in water infrastructure mean fewer disruptions in daily life and business activity from flooding, sewer breaks, leaks, and contaminated water supplies. While every family and business depends on clean water to survive and thrive, some businesses and livelihoods in the recreation and tourism industry see the benefits of clean water more clearly. This is especially true in Illinois where the Lake Michigan shoreline and abundance of lakes and rivers provide ample recreational and economic opportunities.
- The effects of a better environment with more jobs ripple into other sectors of the economy, which is a win for employers and for other workers who are not directly impacted by the investments. For every $1 billion invested in clean water infrastructure in the Chicago area, approximately 11,200 total jobs are saved or created on average. The average blue-collar construction worker in water infrastructure adds $162.92 per hour to Illinois' gross domestic product. Clearly, these jobs provide a positive return on investment for the state.

Nowhere are the economic and employment benefits of clean water more apparent than in the Chicago area. In 2014, investments by the Metropolitan Water Reclamation District of Greater Chicago and the City of Chicago Department of Water Management generated thousands of jobs. These expenditures improved the quality of Chicago area water, increased worker productivity by improving regional health, and prevented flood and other water damage.

- Operations and construction expenditures by the Metropolitan Water Reclamation District saved or created 13,200 total jobs– including 7,400 direct construction, water, and sewage jobs– and boosted the regional economy by $1.3 billion.
- Operations and construction expenditures by the Chicago Department of Water Management saved or created 6,300 total jobs– including 3,300 direct construction, water, and sewage jobs– and boosted the regional economy by $600 million.

Despite the major progress that has been made over the past few decades, Illinois is still under-investing in clean water projects. Much of the state's clean water infrastructure needs repairs and upgrades, and these required investments will only become more expensive the longer they are delayed. Each of the following opportunities for future investments in Illinois would improve water quality, create "high road" local jobs, and support the Illinois economy:

- **Nutrient removal**: The recently-released Illinois Nutrient Loss Reduction Strategy calls for a 45 percent overall reduction in the amount of phosphorous and nitrate-nitrogen leaving the state to reduce the occurrence of algae blooms in water bodies within the state and in the Gulf of Mexico. Implementation of the Strategy requires investments in wastewater treatment upgrades and best management practices for urban and agricultural runoff.
- **Green infrastructure projects**: Green infrastructure provides many environmental and community benefits while creating local construction jobs and reducing flooding. Examples include installing green roofs, disconnecting downspouts and replacing impermeable surfaces like streets, sidewalks and alleys with vegetation or permeable pavement. Initiatives like the Space to Grow program, which transforms Chicago schoolyards into green spaces with landscape features that capture rainfall, demonstrate the widespread benefits produced by green infrastructure investments.
- **Reducing combined sewer overflows (CSOs)**: Municipalities throughout Illinois need to implement plans to reduce CSOs from their sewer systems and improve water quality in their area. CSOs are a major water quality problem in the Chicago Area Waterway System, where large rainfall events regularly result in raw sewage discharges.
- **Dam removal**: Dams provide an ideal environment for harmful algae to grow, inhibit the movement of fish and other aquatic species and pose a safety hazard for water users. Rivers throughout the state would benefit from

removing dams that no longer serve their original purpose. The Army Corps of Engineers has identified the Fox River as one priority watershed for dam removal and habitat restoration projects.

- **Invasive species control**: The Chicago Area Waterways provide an artificial connection between the Great Lakes and the Mississippi River basin that has allowed aquatic invasive species (AIS) to move between the two watersheds. Solutions to reduce the risk of AIS entering Illinois' freshwaters require design and construction of infrastructure projects that will support local jobs and can be combined with efforts to reduce flooding and improve water quality.
- **Continuing the Great Lakes Restoration Initiative (GLRI)**: In the first five years of the federal program it has supported numerous on-the-ground restoration projects on Illinois' Lake Michigan shoreline.GLRI investments have remediated a Superfund site in Waukegan harbor, removing a toxic threat and creating new economic opportunities. GLRI funds have also benefitted Chicago parks, as well as job training and placement programs such as the city's Greencorps Chicago. The GLRI sets aside approximately $6 million for restoration projects by federal agencies with the key criterion that each project puts at least 20 unemployed people to work.

Continued clean water infrastructure investment promotes a healthy economy. A sustainable system of clean water distribution and treatment is necessary for long-term economic growth. By reducing pollution and stormwater runoff, preventing contamination, restoring natural waterways, reducing the potential for flood damage, and mitigating the potential impacts of climate change, clean water infrastructure ensures that the economy flows smoothly. Construction of clean water projects creates jobs and stimulates the economy in the short run. Completion of clean water projects fosters new jobs, augments productivity by maintaining a healthy workforce, and improves economic activity in the long run. Ultimately, clean water infrastructure investments enhance economic activity and support a "high road" economy with good, clean jobs.

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Section 1: The Importance of Clean Water Infrastructure

Introduction

Water is the basis of all life. Human beings drink water to survive, use water to cultivate food and feed livestock, and input water into the production of concrete, steel, and nearly all consumer products. Over 1,400 gallons of water are required to support the average American's lifestyle every single day– to drink, shower, and brush teeth but also to make food, power, goods, and services (Gordon et al., 2011). Additionally, water serves every ecosystem and allows plant and animal life to thrive.

Water quality is just as important as water quantity. In the United States today, there are nearly 170,000 public drinking water systems and almost 15,000 wastewater treatment facilities (ASCE, 2013). In Illinois alone, there are nearly 4,000 active certified drinking water operators, approximately 1,000 wastewater collection systems and more than 800 wastewater treatment facilities (IEPA, 2014; ISASCE, 2014). Water quality is threatened by the aging infrastructure of these systems and the 860 billion gallons of untreated sewage that annually overflows into U.S. waters (Gordon et al., 2011).

Clean water is a national priority. To keep pace with population growth over the next two decades, an estimated 740 million gallons of water per day, every day, will be needed (Lantsberg, 2005). Although the United States is rich in water resources, usable supplies are dwindling due to pollution, degradation, and depletion of the "easiest-to-obtain sources" (Lantsberg, 2005). Public opinion polls have consistently found that around 90 percent of Americans say the country should invest more in clean water. Approximately 70 percent of Americans also support the creation of a trust fund to help communities repair water infrastructure, similar to the Highway Trust Fund at the federal level to help communities repair roads and bridges (Cunningham & Cunningham, 2008).

A recent survey conducted by the Pew Research Center found that 72 percent of scientists do not believe that the best scientific information guides government policy on clean air and clean water (Funk & Rainie, 2015). In addition, fully 96 percent of scientists agree that climate change is occurring and 94 percent say that it is a "very serious problem" (77 percent) or a "somewhat serious problem" (17 percent). The intensifying impact of climate change on "extreme weather events, sea level rise, shifting precipitation patterns and temperature variability" requires scientifically-literate, data-driven public policies to mitigate its potentially catastrophic effects (EPA, 2015).

Building a sustainable system of clean water distribution and treatment is necessary for long-term economic growth. Restoring natural waterways and reservoirs, reducing pollution and stormwater runoff, and preventing contamination are all essential actions to improve public well-being, keeping workers healthy and productive. Repairing, replacing, upgrading, and expanding clean water infrastructure also prevents the high costs of flood damage and creates good jobs that stimulate economic activity throughout the economy. In addition, modernizing clean water infrastructure systems can mitigate negative impacts associated with global climate change, protecting the economy of the future from disruptions to water supply and water quality.

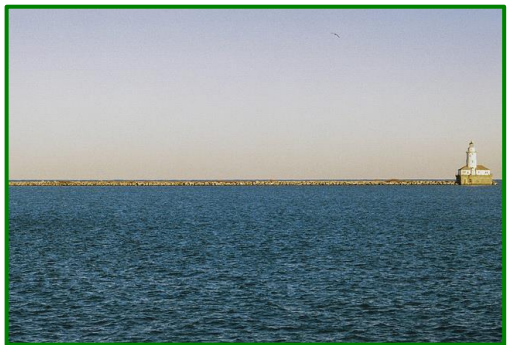
There are a sizeable number of academic publications that have examined the linkage between public infrastructure investment and economic growth (Costa et al., 1987; Aschauer, 1989; Munnell, 1990; Munnell, 1992; Lynde & Richmond, 1993; Glomm & Ravikumar, 1994; Cassou & Lansing, 1998; Auerbach & Gorodnichenko, 2012; Christiano et al., 2011). The vast majority of studies have found that public capital is positively related to private business output. Research has determined that impacts have ranged from significant to modest. The analysis presented here focuses on one area of public investment: water infrastructure.

This report, conducted by researchers at the Illinois Economic Policy Institute and the Project for Middle Class Renewal at the University of Illinois at Urbana-Champaign, is an evaluation of clean water infrastructure in Illinois, especially in the Chicago area. While the environmental and health benefits of clean water infrastructure are discussed, the primary focus of the report pertains to the economic and labor market impacts of previous and potential clean water infrastructure investments. The findings indicate that the net benefits of clean water infrastructure investments have been, and will continue to be, exceedingly positive for the Chicago region and the entire State of Illinois. Section 1 explores academic and policy research on the effects of clean water on the environment, human health, the labor market, and the economy. Section 2 subsequently investigates clean water infrastructure systems throughout Illinois, assessing current needs and threats before discussing how investments are funded. Then, the clean water labor market in Illinois is analyzed in Section 3 to understand how workers and the economy are already benefiting from water infrastructure investments. Section 4 assesses the impact of previous infrastructure investments– particularly in 2014– on job creation, labor income, and economic activity throughout the Chicago area. Finally, Section 5 presents opportunities for future investments in clean water infrastructure to address system needs in the coming years. Section 6 concludes by recapping key findings.

Clean Water, the Environment, and Human Health

Water use is increasing both in the United States and globally. Over the past half century, human water use has been increasing nearly twice as fast as population growth. The total amount of available renewable water supply in the United States is approximately 2.4 million gallons annually. About one-fifth of that amount is withdrawn for use per year. Agriculture and industry are the two primary users of water in the United States, followed by domestic households. For the typical resident of the United States, the largest single use of domestic water is toilet flushing (27 percent of all use), followed by laundry and dishwashing (23 percent), bathing and showering (17 percent), and facet usage (16 percent). (Mayer et al., 1999).

Water pollution is any physical, biological, or chemical change that negatively impacts living organisms. A few decades ago, pollution brought the Great Lakes to the brink of ecological collapse from pollution. Elsewhere, the Cuyahoga River in Cleveland, Ohio burned regularly from the dumping of untreated chemicals, metals, oils, solvents, and sewage into the river. As a result of these and other issues, the Clean Water Act was passed in 1972.



Since enactment of the Clean Water Act, the United States has expended around $200 billion in public funds on water pollution control, and private companies have invested upwards of ten times this amount. The result has been significant improvements in surface-water quality. Aquatic species again thrive in waters that were almost barren and human activity is again permitted in rivers and lakes that were once closed due to pollution. The Clean Water Act has therefore been considered an "ambitious, bipartisan, and largely successful" public policy (Cunningham & Cunningham, 2008).

However, water pollution remains a problem in Illinois and across the country. The primary discharges of pollution today are municipal and industrial discharges, sediments from land erosion, plant nutrients from surface runoff of fertilizers, and pathogens and nutrients from human and animal waste (Cunningham & Cunningham, 2008). According to the Illinois Environmental Protection Agency (EPA), approximately 75 percent of the lakes and reservoirs and 83 percent of the stream miles used for drinking water showed some impairment. The sources of impairment in Illinois principally came from wastewater, agriculture, mining, and urban development.

Research demonstrates that clean water infrastructure investments positively impact both the environment and public health. Clean water infrastructure treats water for safe consumption and reduces major contributors of pollution by minimizing sewage overflow events and removing pollutants from wastewater effluent. In addition, investments in clean water systems have preserved and restored natural environments such as forests, floodplains, and wetlands, which provide natural flood protection and filtration of pollution (Gordon et al., 2011).

Furthermore, clean water infrastructure investments diminish the potential for disease outbreaks. An estimated 5 million people, mostly children, die across the world every year from diseases caused by poor-quality water (Fogden & Wood, 2009). In the United States, municipal investments in safe drinking water combined with Environmental Protection Agency drinking water standards protect the health of over 250 million people. Greater accessibility of safe drinking water, by preventing the spread of disease, improves the health and productivity of the population, increasing economic growth rates (Fogden & Wood, 2009). These impacts have led the United Nations to definitively conclude that sanitation and drinking-water investments have high rates of return in costs avoided, lives saved, reduced disease and health-care expenses, and increased productivity (UN-Water, 2011).

Economic and Labor Market Impacts of Clean Water

Economic research convincingly reports that clean water infrastructure investment boosts economic activity. In addition to the economic benefits of reducing pollution and preventing disease outbreaks, freshwater supports economic activity by serving as an essential input to many industries. The agricultural industry requires water to irrigate crops in many areas and feed livestock in an efficient manner. Similarly, the food and restaurant industries need clean water to ensure that there is no public health risk from consuming their products. The rapidly growing brewing industry relies on clean water to thrive, with Illinois breweries contributing more than $2.2 billion to the economy in 2014 and supporting over 17,000 jobs (Brewers Association, 2014). Clean water improves the travel and recreation industries as well, supporting an estimated $225 billion per year in coastal tourism and $50 billion per year in consumer spending on recreation (DeGood, 2013). A fully healthy Great Lakes would generate up to $50 billion in long-term economic benefits to businesses, beachgoers, boaters, homeowners, and visitors across the Midwest (Austin et al., 2007). Recreational activities supported by clean water include swimming, paddling, boating, fishing and other wildlife recreation. In 2011, $3.8 billion was spent on wildlife recreation in Illinois, including $973 million on fishing, and more than 3.8 million people participated in these recreational activities throughout the state (DOI, 2011). Steel mills, paper mills, and many other energy and manufacturing sectors use large volumes of water in production and cooling. Every industry, of course, also generates some level of wastewater that must be treated before it is returned to the hydrologic cycle.

In 2014, the Water Research Foundation and the Water Environment Research Foundation studied 30 participating public utilities, including the City of Chicago Department of Water Management and the Metropolitan Water Reclamation District of Greater Chicago. The participating public utilities performed a range of functions, including domestic and industrial water service, wastewater service, and stormwater service. The report concluded that the 30 public utilities– covering more than 83 million residents across the country– support $52.4 billion in economic activity per year. Extrapolated to the entire U.S. population, the water sector creates or saves over $200 billion in economic output annually, or approximately 1.2 percent of national gross domestic product (GDP) (Quinn et al., 2014). In the Chicago area, the City of Chicago Department of Water Management contributes $2.9 billion to the Chicago economy every year and the Metropolitan Water Reclamation District of Greater Chicago annually generates $1.3 billion in economic activity (WERF, 2014a; WERF, 2014b).

The water sector creates or saves over $200 billion in economic output annually, or 1.2 percent of national GDP.

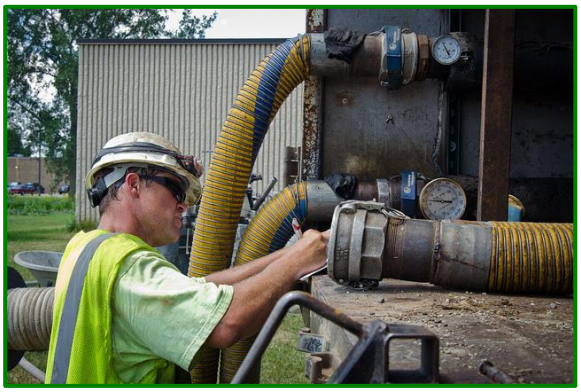
The demand for water and sewage infrastructure is stable and predictable, especially relative to other goods and services. From 1998 to 2008, annual volatility of the S&P 500 stock in the market was 16 percent. Consumption of groceries, clothing, and medical drugs also fluctuated by 3 to 5 percent over that time. Meanwhile, the service with the steadiest demand over the decade was water infrastructure, with a usage volatility of 1 percent. J.P. Morgan Chase has classified water systems and pipelines as “Core and Core Plus” infrastructure, indicating they are necessary, low-risk investments with a stable return (Kohn, 2009). The gains from investments in water and sewage infrastructure also regularly exceed the interest rates on 10-year and 30-year Treasury Bills, offering ample long-term financial returns for public bodies (Frank, 2012).

Economic impact studies find that a one-dollar investment in water infrastructure generates a positive return to the economy. The Water Research Foundation and the Water Environment Research Foundation report projects that $1.64 in economic

activity is generated for every dollar invested (Quinn et al., 2014). Gordon and her coauthors (2011) find that a $188 billion major investment in water infrastructure would stimulate $266 billion in economic activity, amounting to a return of $1.44 per dollar invested. The Congressional Research Service similarly reports that investments in water infrastructure could increase GDP by $1.30 to $1.50 for every dollar spent (Copeland et al., 2011). These investments range from upgrades for wastewater treatment plants and drinking water systems to green infrastructure such as the installation of green roofs and permeable payment. This economic benefit is *in addition to* the "high rates of return in costs avoided, lives saved, reduced disease and health-care expenses, … and increased productivity" (UN-Water, 2011).

The impact of clean water infrastructure investments on the labor market is substantial. DeGood calculates that every $1 billion invested in clean water infrastructure results in the creation of between 10,000 and 15,000 jobs nationwide. Another analysis finds even larger employment effects, with a $1 billion investment in water utilities translating into 16,000 total jobs, including 5,000 direct jobs and 11,000 indirect jobs (Quinn et al., 2014). Other researchers find that 9,900 jobs are created from a $1 billion investment in water infrastructure (Gordon et al., 2011). Estimates for the Chicago area have tended to be more conservative, with a $1 billion investment in water and sewage infrastructure producing about 4,900 to 5,700 jobs (WERF, 2014a; WERF, 2014b). Clean water investments are generally found to have greater effects on employment than comparable investments in military spending or similarly-sized cuts in personal income taxes (Pollin & Garrett-Peltier, 2011; Zandi, 2009).

The water sector workforce will offer significant opportunities for upcoming generations of workers. At present, one-third of water utilities (including drinking water and wastewater treatment) workers are eligible for regular or early retirement. Fully 37 percent of workers within this sector will need to be replaced in the next decade, compared to a replacement rate of 23 percent for the total workforce (Quinn et al., 2014). In addition, construction occupations– the workers who build and repair water facilities– are projected to be the third-fastest growing sector in the United States over the next decade, behind only healthcare support occupations and healthcare practitioners and technical occupations (BLS, 2013). Most of these available jobs will require completion of a three- to five-year certified apprenticeship program or some level of college education.



Section 2: Clean Water Infrastructure in Illinois

Needs Assessment and Environmental Threats

There is a great need for investments to improve the quality of Illinois' waters. Every two years, the state must report on the status of Illinois' waters to Congress. In the latest report by the Illinois Environmental Protection Agency (IEPA), about 9,500 miles of stream, over 144,000 acres of lakes, and 200 square miles of Lake Michigan were listed as being in need of a water cleanup plan. While the IEPA expects to initiate cleanup plans for these waterways over the next 13 years, they will require infrastructure investment at domestic and industrial wastewater plants, as well as on agricultural and urban lands through green infrastructure improvements. Green infrastructure projects "add capacity by reducing initial inflows into the sewer system" (Clisham, 2015). These types of projects improve stormwater management but also create sustainable local jobs across sectors, improve air quality, cool summer temperatures, revitalize business districts, and raise property values (CRC, 2015). Green infrastructure projects can also capture pollutants from farmland runoff as well as from urban areas.

Natural freshwater bodies, which hold high stakes for the region, are at risk in Illinois. Lake Michigan is the second largest of the Great Lakes by volume and provides drinking water for over 10 million people, including nearly 6.6 million Illinois residents. It serves as the state's largest public drinking water source and is one of its biggest economic assets. The Illinois

coastline extends 63 miles along the western shore of Lake Michigan, including 22 miles of City of Chicago shoreline (GLRI, 2015). The federal government recognizes the value of preserving this critical freshwater resource through programs such as the Great Lakes Restoration Initiative (GLRI). The GLRI was launched in 2010 to accelerate efforts to protect, restore, and strategically target ecological threats to the Great Lakes. For Lake Michigan, the current GLRI action plan for Fiscal Years 2015 through 2019 focuses on cleaning up areas of concern, reducing nutrient runoff, restoring habitat to protect native species, and preventing and controlling invasive species (GLRI, 2015).

Critical investments are needed in Illinois' drinking water and wastewater infrastructure systems. There are over 1,700 community water systems in Illinois that serve more than 11.9 million residents and are overseen by the Illinois Environmental Protection Agency. While 96.5 percent of these community drinking water systems are in full compliance with all health requirements, there are still more than 400,000 people in Illinois at health risk due to aging infrastructure (ISASCE, 2014). System vulnerabilities and the costs to repair, replace, and upgrade drinking water distribution infrastructure have led the Illinois Section of the American Society of Civil Engineers (ISASCE) to estimate that the State will need $19 billion over the next 20 years to serve the people of Illinois. Ultimately, ISASCE gives Illinois' drinking water infrastructure a C- grade (ISASCE, 2014).

In addition, there are over 800 wastewater treatment facilities treating 3.1 billion gallons of sewage every day. Many of Illinois' community collection systems were built decades ago and cannot handle the current population, let alone future generations. In these areas, sewage often overflows into many of the state's river miles and inland lakes during wet weather. These "combined sewer overflows," or CSOs, carry microbial pathogens, suspended solids, and other pollutants that can contaminate drinking water, lead to beach closures, and cause negative environmental impacts (EPA, 2014). Currently, almost 40 of Illinois' community collection systems (5 percent) are in either "critical" or "restricted" status, meaning that they are at or approaching capacity. With an ISASCE grade of D+, the state would need to invest an additional $17.5 billion over the next 20 years to replace, repair, and upgrade Illinois' wastewater infrastructure. In total, $36.5 billion is needed over the next two decades to improve and expand the water systems of Illinois.

Furthermore, the state needs to take action to alleviate the adverse effects of nutrient pollution, which impair Illinois waterways and contributes to a "dead zone" in the Gulf of Mexico. The toxic algal blooms occurring in lakes across Illinois serve as an indication of the urgent need to address this problem (IEPA, 2015). In 2010, Illinois EPA assessed 14 percent of the state's 119,244 miles of rivers and streams and 47 percent of its 318,477 acres of lakes, reservoirs and ponds. The Agency found that 2,162 miles of the assessed rivers and streams (13 percent) and 105,580 acres of the assessed lakes, reservoirs, and ponds (71 percent) had a nutrient-related impairment (U.S. EPA, 2010). The recently released Illinois Nutrient Loss Reduction Strategy calls for reductions in phosphorous and nitrate-nitrogen from wastewater treatment plants, urban runoff, and farmland. The Strategy identifies priority watersheds where wastewater treatment upgrades and other implementation steps are most needed and will have the greatest impact.

In total, $36.5 billion is needed over the next two decades to improve and expand the water systems of Illinois.

As a result of the artificial connection made a century ago when the flow of the Chicago River was reversed, the Chicago Area Waterways provide a pathway for aquatic invasive species to move between the Great Lakes and Mississippi River basins. Invasive Asian carp receive significant attention as particularly voracious predators that have advanced towards the Great Lakes via the Mississippi and Illinois rivers, disrupting ecosystems and threatening a large fishing and recreation industry. The Great Lakes and Mississippi River Interbasin Study (GLMRIS) Report also identified 23 species posing a risk of transferring to the Mississippi River Basin from the Great Lakes, ten of which were identified as having either a medium or high risk of transfe (USACE, 2014). Controlling these invasive species requires short-term risk reduction measures and a long-term solution to prevent new invasions. Potential solutions will require infrastructure investment that can also serve to reduce flood risk and improve water quality in the Chicago region (USACE, 2014).

Furthermore, the State of Illinois has identified 15 run-of-river dams that no longer serve their original purpose (CDB, 2007). These dams pose significant hazard as the water drop at the crest and dangerous currents can trap river users, pedestrians, and

rescuers. Still waters created by dams also provide ideal habitats for algae to grow and prevent migration of fish and mussels upstream. The Army Corps of Engineers has also identified the Fox River as one priority for habitat restoration and fish passage and is conducting a feasibility study examining dam removal and fish passage alternatives for ten Fox River dams (FRSG, 2015). Removal of these and other dams would generate environmental, recreational, and safety benefits.

Finally, the effects of global climate change are likely to exacerbate current problems facing Illinois, as storms intensify, temperature becomes more variable and extreme, and increased warmth causes significant evaporation loss from reservoirs (Lantsberg, 2005). Municipal sewer systems may be unable to handle flows during intervals of extreme rainfall, diverting untreated sewage and waste into bodies of water that supply drinking water (Gordon et al., 2011). As temperatures rise, people, animals, and plants need more water to stay healthy and cool off. At the same time, the amount of available water may be reduced, limiting access to water supplies and increasing competition. Without adequate investment, the state's current water and sewage infrastructure is likely to be ill-prepared for the long-term effects of climate change.

State and Local Funding Mechanisms

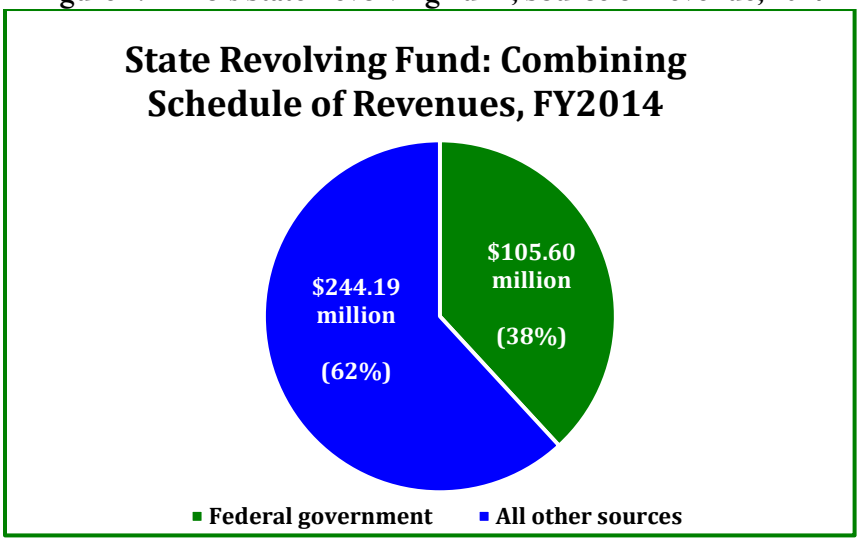
Clean water infrastructure investments are typically financed using municipal bonds that are repaid by fees levied on users of the service. Because demand for water and sewage infrastructure is stable and predictable over the long term, user fees are modest and easily anticipated. Compared to taxes, which must be approved by city councils or voters, fees are charges for specific city services that can be increased or decreased as needed by officials (Gordon et al., 2011). Though the municipal bond market remains a viable option for Illinois communities, credit rating downgrades across the state have increased borrowing rates and weak economies have strained local government budgets (Dornbirer, 2015).

Another common method of financing gray and green infrastructure projects is to borrow from the State Revolving Fund (SRF) of the Illinois Environmental Protection Agency. These loans are generally paid back over 20 years, and can have interest rates as low as zero percent (Gordon et al., 2011). The Illinois Clean Water Initiative (ICWI), which began in 2012, makes $2 billion in SRF funds available in low-cost loans to local governments to address critical infrastructure needs and promote economic development (IEPA, 2014).

SRF programs include the Water Pollution Control Loan Program (WPCLP) for wastewater projects and the Public Water Supply Loan Program (PWSLP) for drinking water projects. The two programs are funded using federal receipts, matching funds by the state, programs repayments, and bond and interest proceeds (IEPA, 2014). According to the State of Illinois' *Comprehensive Annual Financial Report* (CAFR) for Fiscal Year 2014, the State Revolving Fund received $151 million in funding from the federal government (38.1 percent) and $244 million from state funds, charges for services, and other sources (61.9 percent) (Figure 1). Fund expenditures amounted to $294.1 million, leading to a budget surplus of $100.7 million over the year. The SRF's net position, however, has fallen from $113.3 million in Fiscal Year 2010 to $37.4 million in Fiscal Year 2014 as projects in excess of $1 billion have been funded (CAFR, 2014a).

Without a significant commitment and contribution from the federal government, drinking water and wastewater investments will require new and innovative funding mechanisms. The Illinois Chapter of the American Society of Civil Engineers claims that "[p]ossible solutions include additional grants and loans, trust funds and incentives for private investment" (ISASCE, 2014). A relatively recent strategy in the developing world is to use private microfinancing to invest in the water sector (Fogden & Wood, 2009).

Figure 1: Illinois State Revolving Fund, Source of Revenue, 2014



Source(s): 2014 CAFR *for the State of Illinois.*

There are at least two other possible funding mechanisms. The first is "conservation pricing." Conservation pricing charges bulk users of drinking water, stormwater, and wastewater systems higher rates. Large institutions such as industrial factories, big box retailers, and hospitals pay a higher price per unit of water volume, allowing low-income residents to use water at a lower cost (Sebastian & Kumodzi, 2015). Historically, water pricing has been tied to the cost to provide current water service (a fixed rate) plus the cost of long-term planning (a variable rate). Conservation pricing adds a surcharge to bulk users in order to discourage peak usage and increase revenues for long-term capital investments. Utilities benefit from sustainable long-term budgets, customers benefit from an understandable and equitable system, and the economy benefits by conserving resources and investing in necessary clean water projects that spur economic activity. The Chicago Metropolitan Agency for Planning (CMAP) recommends that northeastern Illinois communities review their rates and consider including conservation pricing (Ahmed, 2008).

The second possible policy prescription is to institute "development impact fees" for water infrastructure systems (Sebastian & Kumodzi, 2015). Municipalities pay to expand water infrastructure systems out to new developments as their population grows. Most new developments, however, are built for richer residents. But the infrastructure investments are often paid for by the entire population. Development impact fees institute a one-time fee to the residential development for expanded facilities and services– a fee that is independent of property tax revenues. Thus, the costs of constructing new water infrastructure are shifted from existing residents and are instead incurred by the people, typically wealthier, who will actually live in a new area. Nationwide, the average water impact fee was $3,900 per single family home and the average wastewater impact fee was $3,700 per single family home in 2012 (Mullen, 2012). In Illinois, however, water and sewer facilities are not typically eligible for impact fees (Mullen, 2012). State law may need to be altered to pursue this method of financing. However, growing communities in Illinois can also use annexation agreements to get new development to cover the cost of its clean water infrastructure needs.

Section 3: The Benefits of Clean Water Investments on Illinois' Labor Market

Specific Trades Involved in Clean Water Infrastructure in Illinois

Figure 2 provides a breakdown of occupations in the water infrastructure sector in Illinois, as reported by the Bureau of Labor Statistics (BLS, 2015a). Data include information for workers employed by businesses engaged in "water, sewage, and other systems" and in "other heavy and civil engineering construction"– a classification which includes development of marine activities and the construction of water resources such as canal and waterway dredging or flood control projects (NAICS,

2015). As a result, Figure 2 reports water infrastructure jobs both during the construction phase and post-construction. Note that the average annual income and median annual income estimates reported by the Bureau of Labor Statistics are based on a full-time (2,080-hour) workload and *do not* include fringe benefits.

In general, water infrastructure jobs in Illinois can be categorized into three groups: administrative and professional services, construction occupations, and production and transportation workers. About three-in-ten workers perform an administrative or professional service. These include high-paying management jobs (10 percent) with salaries averaging $108,400 per year as well as business and financial operations workers (4 percent) earning $70,300 per year on average. Architecture, engineering, office, and administrative support workers make up the remaining 12 percent of employees in this group.

Production and transportation workers carrying out many of the day-to-day functions at water facilities make up another three-in-ten workers in the sector in Illinois. Production workers and their supervisors account for 19 percent of the industry's workforce. These individuals perform quality control inspections, run equipment, and ensure facilities are working properly. Water treatment plant and system operators manage the system of machines that transfer or treat water, often through the use of control boards. These workers comprise another 6 percent of the labor force and earn $43,700 per year on average. The roughly 5 percent of workers performing transportation and material moving tasks in the industry are mainly hand laborers or operate vessels that take cargo and people over water.

Figure 2: Occupations Involved in Illinois' Water Infrastructure Sector, May 2014

Water Infrastructure Sector	Percent of Occupations	Average Income	Median Income
Management Occupations	10%	$103,400	$100,500
Business & Financial Operations Occupations	4%	$70,300	$69,000
Architecture & Engineering Occupations	1%	$47,300	$49,200
Office & Administrative Support Occupations	11%	$37,200	$35,700
First-Line Supervisors of Construction Workers	4%	$68,700	$61,500
Carpenters	1%	$64,100	$63,900
Construction Laborers, Plumbers, Pipefitters, and Painters	23%	$49,000	$43,200
Operating Engineers & Other Equipment Operators	10%	$67,600	$76,700
Installation, Maintenance, & Repair Occupations	5%	$50,900	$48,100
Other Construction Workers	2%	$38,400	$31,400
Production Occupations	18%	$38,700	$35,700
First-Line Supervisors of Production Workers	1%	$69,400	$62,100
Water & Wastewater Treatment Plant & System Operators	6%	$43,700	$41,600
Transportation & Material Moving Occupations	5%	$51,300	$49,100
All Occupations within the Sector	**100%**	**$55,900**	**$48,900**
All Occupations in Illinois	--	*$48,800*	*$36,600*

Source(s): BLS (2015a), "May 2014 Occupational Employment and Wage Estimates." Note that percentages may sum up to more than 100 percent due to rounding.

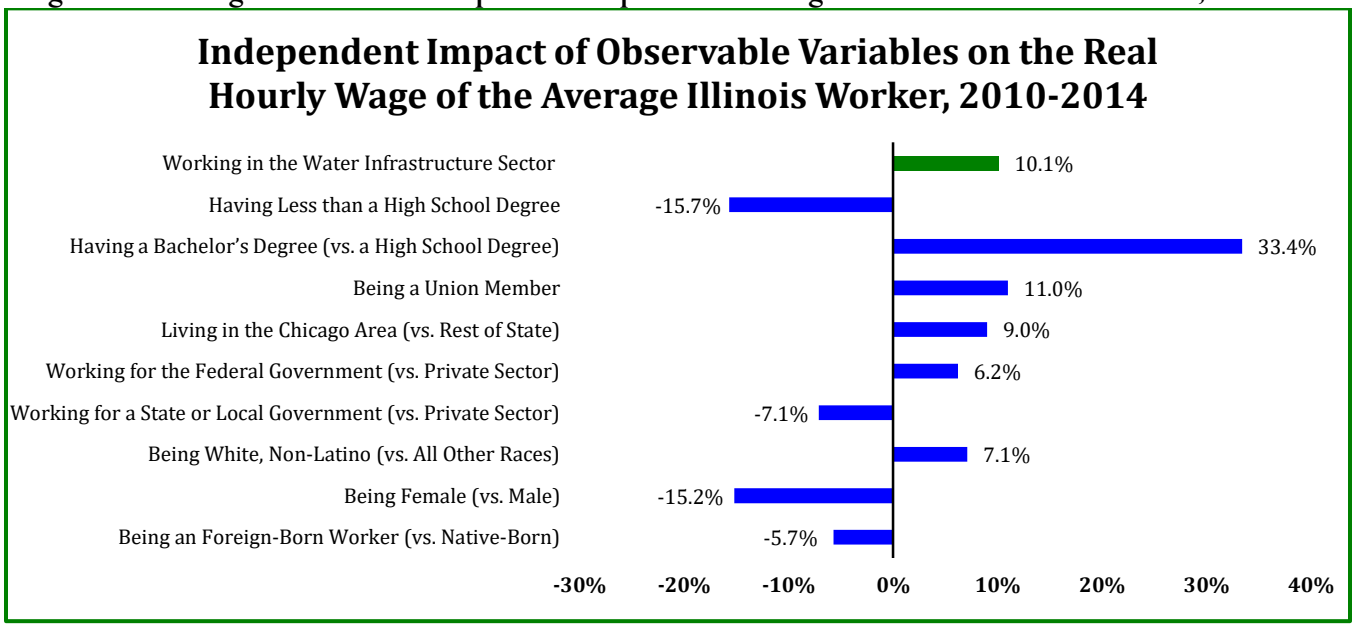
Over four-in-ten (45 percent) of jobs related to water infrastructure are in construction. These include first-line supervisors (4 percent) who annually take home $68,700 on average. According to the Bureau of Labor Statistics, the trade with the highest employment in Illinois' water infrastructure sector is the laborers. Construction laborers, plumbers, pipefitters, and painters account for 23 percent of the entire workforce and earn approximately the same amount ($49,000 per year) as the statewide average for all occupations ($48,800 per year). The operating engineers represent the second-largest trade in the industry in terms of employment, with just over 10 percent of the workforce classified as operating engineers and other equipment operators. Among the trades involved in Illinois' water infrastructure sector, operating engineers earn the highest income from wages both on average ($67,600 per year) and on median ($76,700 per year). Installation, maintenance, and repair workers account for about 5 percent of the workers and earn an estimated $50,900 per year. At 1 percent of the workforce, carpenters make up the last major trade involved in the construction of water systems. Carpenters in the state's water

infrastructure sector annually make $64,100 on average. Other construction workers such as helpers and electricians make up the remaining 2 percent of the workforce. For every major trade involved, both the average income and the median income exceed the comparable statewide estimate. Construction of clean water infrastructure can therefore be considered a pathway into the middle class for blue-collar workers in Illinois.

The Personal Benefit of Working in the Clean Water Industry

To understand the actual and unique impact of working in Illinois' water infrastructure industry, an "ordinary least squares" (OLS) regression model is used. Put plainly, this technique describes "how much" a specific factor is responsible for increasing or decreasing a worker's wage. The analysis controls for all observable factors and allows researchers to estimate how the same exact worker would be impacted if only one variable changes. For example, if an African-American female worker in Illinois with a bachelor's degree were to move from Decatur to Chicago and perform identical work, how much would her hourly earnings be expected to increase or decrease? The answer, according to the regression model, is by 9.0 percent. Figure 3 reports the main findings from the analysis.

Figure 3: OLS Regression of the Independent Impact of Working in the Water Sector in Illinois, 2010-2014



Source(s): CEPR (2015), Current Population Survey Outgoing Rotation Groups. *The analysis also includes variables for age, veteran status, marital status, citizenship status, hours worked, having multiple jobs, involuntarily part-time workers, other educational attainment levels, yearly trends, and occupational group. The water infrastructure sector includes all workers in construction, water and irrigation systems, and sewage treatment facilities. The total number of Illinois workers surveyed from 2010 through 2014 was 28,695 and the total number of water infrastructure sector workers was 865. Observations are adjusted to match the actual Illinois population using analytic weights provided by the Bureau of Labor Statistics. For a .txt file with the complete results, email author Frank Manzo IV at fmanzo@illinoisepi.org.*

Construction of clean water infrastructure is a pathway into the middle class for blue-collar workers in Illinois.

Employment in the water infrastructure sector increases an Illinois worker's hourly earnings by 10.1 percent on average. The benefit to working in the water infrastructure sector is comparable to the union wage premium (11.0 percent) and the effect of moving into the Chicago metropolitan area from downstate (9.0 percent). It is also larger than the racial income divide between Caucasian workers and nonwhite employees (7.1 percent). This means that water sector jobs offer African Americans, Latinos and Latinas, and other minority residents the possibility of earning the same amount as the average white worker, or more, helping to close the wage gap. All else equal, workers with a high school degree or equivalent earn 15.7 percent more than those without a degree, and a bachelor's degree improves hourly wages by 33.4 percent on average– or about 8.3 percentage points for each year in college. At 10.1 percent, working in water infrastructure provides a personal

benefit that roughly equates to an additional year of schooling. Increasing employment in the water infrastructure sector would therefore foster good, middle-class jobs for Illinois workers.

The High Productivity of Illinois' Construction Workers on Water Projects

To this point, this section has focused on water infrastructure workers both in the construction phase and after construction using May 2014 data from the Bureau of Labor Statistics (BLS). However, there are limitations to BLS data. Notably, no information is provided on worker productivity and the income estimates do not include fringe benefits. The 2012 *Economic Census of Construction*, conducted by the U.S. Census Bureau, on the other hand, does provide this information and helps to partially complete the picture. The *Economic Census of Construction* only considers the construction phase of water projects, but includes the industry's overall contribution to the economy.

According to the *Economic Census of Construction*, white-collar employees in Illinois' "other heavy and construction engineering construction" sector (which includes the construction of water resource projects) earned $108,908 per person in total compensation in 2012 (Figure 4). White-collar jobs include such occupations as managers, supervisors, lawyers, and accountants. On an hourly basis, white-collar employees took home approximately $52.36 per hour in total compensation. Conversely, blue-collar construction workers earned $86,964 in annual wages, fringe benefits, and other forms of compensation in 2012. Given that blue-collar construction workers averaged 1,959.7 annual hours worked, hourly compensation amounted to $44.38 per hour for construction workers. These comparatively high wages, however, are rewards for high levels of worker productivity.

The average blue-collar construction worker in water infrastructure contributes $162.92 per hour to the Illinois economy.

The U.S. Census Bureau quantifies an industry's unique impact on the economy by the "value added" metric. Value added is total business revenues minus the costs for materials, components, supplies, fuels, and subcontracted work. Dividing total value added in the industry by the total number of hours worked by the blue-collar construction workers who actually build and repair the infrastructure yields a measure of worker productivity over one year. By definition, value added per worker is how much the average individual contributes to the economy per year.

Worker productivity is extremely high in Illinois' water systems construction industry. Census data reveal that the average blue-collar construction worker in water infrastructure contributes $162.92 per hour to the Illinois economy (Figure 4). This is, in part, due to high union density of construction workers in Illinois. By investing in worker skills development through joint labor-management apprenticeship programs, labor unions positively increase worker productivity. Across the country, a one percentage-point increase in a state's construction unionization rate is highly correlated with a $0.81 per hour boost to value added per worker (Manzo, 2015a). Another economist has found that union productivity is between 17 and 22 percent higher than nonunion output in the construction sector (Allen, 1984).

Figure 4: Cost and Productivity of Workers in "Other Heavy and Civil Engineering Construction," 2012

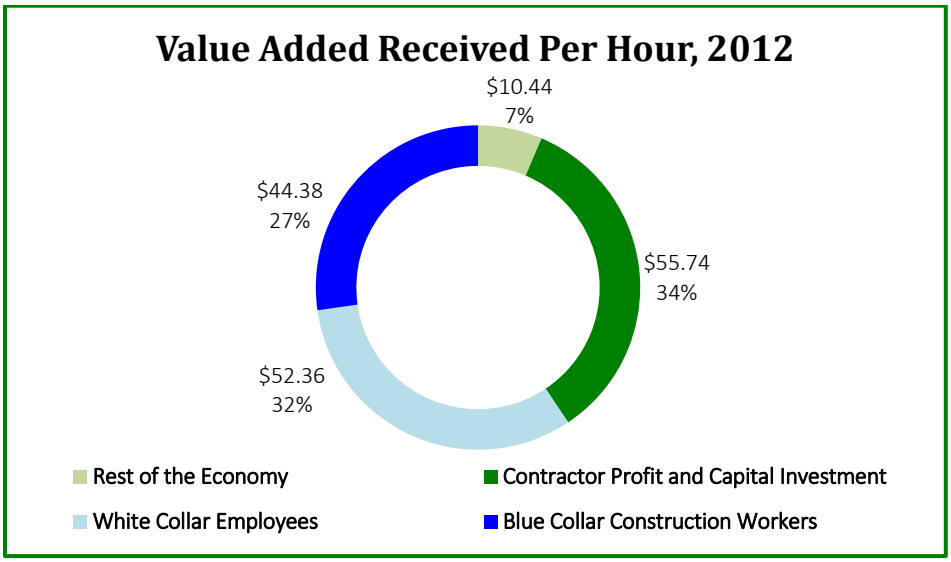
Labor Cost and Labor Benefit	Annual Estimate	Hourly Estimate*
White-Collar Employee Payroll Plus Benefits	$108,908	$52.36
Blue-Collar Construction Worker Payroll Plus Benefits	$86,964	$44.38
Value Added Per Blue-Collar Construction Worker	$319,278	$162.92

Source(s): Census (2015), 2012 Economic Census of Construction. **Annual labor hours are only available for blue-collar construction workers, with an average of 1,959.67 hours per worker in 2012. For white-collar employees, the analysis assumes 2,080 hours.*

With compensation averaging $44.38 per hour, a blue-collar construction worker "captures" 27 percent of his or her contribution to the state's economy (Figure 5). At $52.36 per hour, white-collar employees account for about 32 percent of a given hour of economic activity. Labor's share of the total economic "pie" is thus 59 percent. Conversely, capital– including

contractor profits and investments in machinery and equipment– captures $55.74 an hour, or 34 percent of the gains. The remaining $10.44 per hour, or 7 percent of GDP, is a positive spillover into the rest of the economy. This external benefit from water infrastructure investment is due to reducing pollution and bolstering economic activity. It can also be interpreted as the annual social return on investment to the state.

Figure 5: Share of Hourly GDP from "Other Heavy and Civil Engineering Construction" Received by Group, 2012



Source(s): Census (2015), 2012 Economic Census of Construction. *Results are for any given hour of output.*

Section 4: The Impact of 2014 Clean Water Investments in the Chicago Area

Economic Impact Analysis Methodology and Assumptions

Economic impact analyses are commonly used by policymakers and consultants to evaluate the impact of a policy or proposed investment on the entire economy. The approach helps researchers understand the impacts to individuals who either benefit or lose as a result of the change, beyond those who are just *directly* affected. Economic impact analyses inform policymakers about predicted impacts compared to what would otherwise occur in the absence of the policy or project.

The primary method to perform an economic impact analysis is to use an "input-output model," which accounts for the interrelationship between industry spending and consumer spending. Input-output models quantify inter-industry spending in the form of "multipliers" (or "ripple effects") based on observable economic data. Through multipliers, input-output models provide estimated effects on economic value added, employment, labor income, and tax revenues.

The economic impact analyses in this report are based on the IMPLAN (IMpact analysis for PLANning) software and data for the State of Illinois. IMPLAN was originally developed by the U.S. Department of Agriculture to assist the Forest Service with land and resource management planning. The model was developed at the University of Minnesota in the mid-1980s. By 1993, the software was privatized and made available for use by the public.

IMPLAN adheres to traditional economic impact analyses and itemizes effects by direct, indirect, and induced impacts. *Direct impacts* measure outcomes for the affected industry that implements the actual work as a result of the policy change or project investment. In this study, direct impacts occur in the clean water infrastructure sector, which provides immediate jobs for construction workers and water treatment operators as well as revenues for contracted firms. On the one hand, increased investment means that public funds cannot be used for other services or projects, which could reduce direct impacts; on the

other, the positive investments may produce economic benefits that exceed the costs, which would enhance direct impacts. *Indirect impacts* measure the effects of inter-industry purchases by firms which receive direct expenditures from the clean water infrastructure sector, such as businesses which supply construction firms with the machinery and materials used to update facilities and pipelines. Finally, *induced impacts* measure the additional consumer spending by those who gain economically as a result of both the direct and indirect impacts. As a consequence of the methods used in this report, these dynamic market simulations are straightforward, objective, data-driven, and reproducible.

Metropolitan Water Reclamation District of Greater Chicago

The Metropolitan Water Reclamation District (MWRD) of Greater Chicago is a special-purpose district that recovers and treats wastewater and flood water for 883 square miles of Cook County, Illinois. MWRD's mission is to protect the health and safety of the public, protect the water quality of Lake Michigan, and protect businesses and homes from flood damage. In 2014, MWRD's major initiatives included constructing sewers and force mains to intercept wastewater, conducting master planning studies for major treatment plans in the region, collecting biosolids, providing stormwater retention at elementary schools, completing Detailed Watershed Plans for flood control projects, maintaining facilities, and continuing the Tunnel and Reservoir Plan. The District had $606 million in annual expenditures, including interest payments, and a $64 million (9.5 percent) budget surplus in 2014 (CAFR, 2014b).

To estimate MWRD's impact on the regional economy in 2014, expenditures related to day-to-day operations and actual construction must be ascertained. In 2014, MWRD's "construction in progress" (or projects financed using funding from 2014 and from previous years) amounted to $830 million. MWRD funds for operations, administrative services, and other professional services totaled $348 million in 2014. These expenses are independent of pension and other trust fund costs, depreciation, and interest payments. Totaling nearly $1.18 billion, the construction in progress and operational expenses represent the true value of public funds spent by the District to directly employ workers and to directly improve infrastructure (CAFR, 2014b).

MWRD is an economic engine for Cook County (Figure 6). As a result of this $1.18 million investment in 2014, approximately 7,400 jobs were directly created, including an estimated 6,000 construction jobs (Figure 7). These directly-provided construction jobs all require materials, fuel, and supplies. Contracted firms also spend money on legal, financial, human resources, and other services. This resultant economic activity saves or creates about 2,200 indirect jobs over the year and supports $229 million in business revenues. Lastly, the increase in consumer demand from MWRD's direct and indirect effects on employment stimulates an additional 3,600 jobs over the year.

The overall economic benefit of MWRD to Cook County is significant (Figure 6). In 2014, MWRD functions and investments boosted the regional economy by $1.27 billion and created 13,200 jobs in total. Compared to total expenditures, the net gain in economic value added effectively represents a 7.8 percent "return on investment" over the year. In addition, MWRD spending is responsible for a 0.5 percentage-point reduction in the Cook County unemployment rate: Without MWRD, Cook County's unemployment rate in January 2015 would have been 7.6 percent instead of 7.1 percent.

Metropolitan Water Reclamation District functions and investments boost the regional economy by $1.27 billion and create 13,200 jobs in total.

MWRD activities support middle-class jobs in Cook County (Figure 6). In 2014, the total estimated impact of the District on aggregate labor income in the region was $951 million. This equates to more than $72,000 in annual compensation per job created, including benefits and social insurance payments. Labor "captures" 75 percent of the total economic gain to Cook County, with individuals who are directly employed by MWRD procuring a 46 percent share.

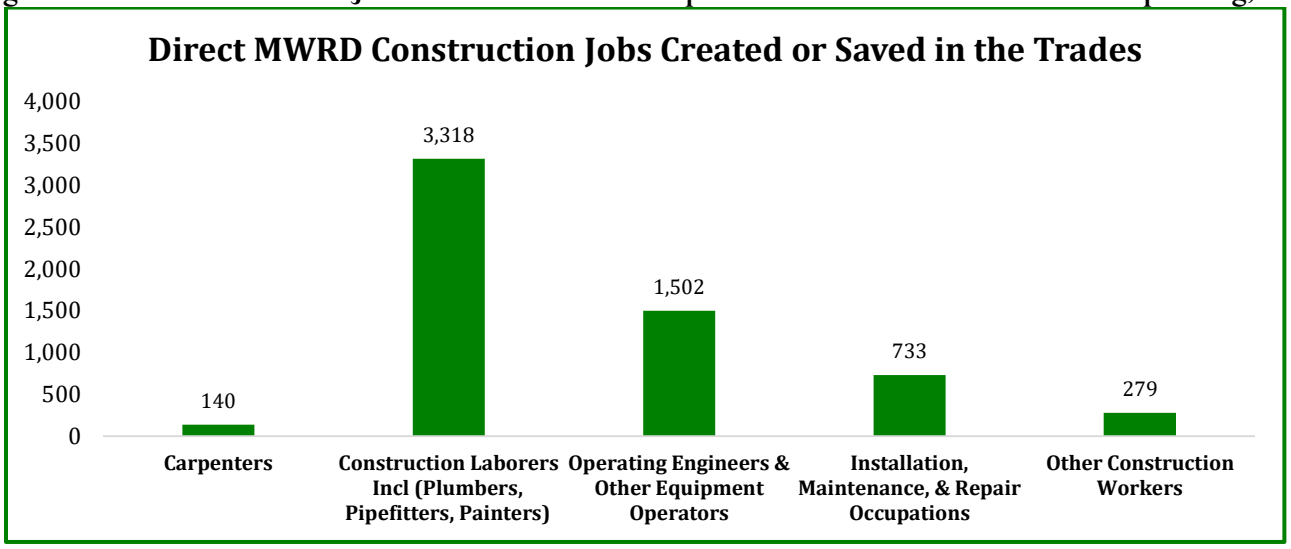
Figure 6: Analysis of the Economic Impact of $1.18 Billion in MWRD Applicable Spending in 2014, IMPLAN

Economic Impact Analysis	Employment	Labor Income	Economic Value Added
Direct Effect	7,372 jobs	$579.8 million	$657.5 million
Indirect Effect	2,183 jobs	$174.0 million	$229.4 million
Induced Effect	3,631 jobs	$196.6 million	$332.4 million
Total Effect	**+13,187 jobs**	**+$950.5 million**	**+$1,269.4 million**
Decrease in the Cook County Unemployment Rate	-0.497 percentage-point decrease		

Source(s): 2014 CAFR for the Metropolitan Water Reclamation District; BLS, 2015b; IMPLAN (2013). Results are reported in 2015 dollars.

Figure 7 depicts the breakdown of blue-collar construction workers directly employed as a result of MWRD activities by trade. MWRD functions and investments support nearly 6,000 direct construction jobs. The two occupations accounting for the majority of construction work are laborers and operating engineers. The District supports the livelihoods of more than 3,300 construction laborers– which include plumbers, pipefitters, and other labor-intensive jobs– and more than 1,500 operating engineers and other equipment-intensive jobs. Blue-collar construction jobs supported by MWRD also include over 700 installation, maintenance, and repair workers and over 100 carpenters (Figure 7).

Figure 7: Direct Construction Jobs Attributable to Metropolitan Water Reclamation District Spending, 2014



Source(s): BLS, 2015a; BLS, 2015b; IMPLAN (2013).

Example of MWRD Expenditures: Phase II of the Tunnel and Reservoir Plan

Constructed on a marsh where the Chicago River meets Lake Michigan, Chicago has had to combat stormwater overflows since its inception (Gordon et al., 2011). In 1972, the Metropolitan Water Reclamation District (MWRD) of Greater Chicago adopted the Tunnel and Reservoir Plan (TARP) to solve combined sewer overflow problems, becoming the first city to undertake a "deep tunnel" upgrade. A two-phase project, TARP consists of nearly 110 miles of tunnels excavated as deep as 350 feet below the surface with a capacity to hold 2.3 billion gallons of sewage and stormwater. Phase I was completed in its entirety by 2006, with all TARP tunnels constructed at a cost of $2.3 billion to the region. Completion of Phase I is estimated to have supported nearly 25,000 construction jobs and have improved business revenues by $4.1 billion (FCR, 2013).

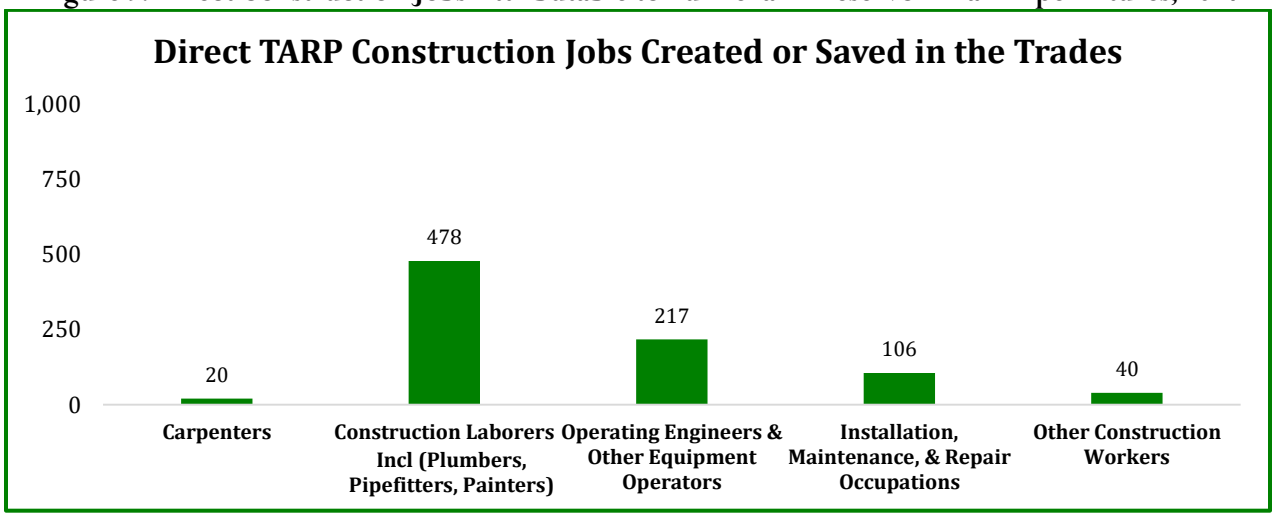
Phase II of the Tunnel and Reservoir Plan "consists of reservoirs intended primarily for flood control, but it will also considerably enhance pollution control benefits being provided under Phase I" (MWRD, 2015). Since completion in 1998, the $45 million construction of the Majewski Reservoir near O'Hare International Airport has already saved $250 million in flood damage that otherwise would have occurred. Two additional reservoirs in Thornton and McCook will be completed in 2015 and by 2029, respectively. The total cost to complete the Thornton Reservoir has been estimated at $428 million while the cost to construct the McCook Reservoir will sum up to an expected $1.0 billion (MWRD, 2015). On a per-year basis starting in 2014, the average annual cost of constructing both reservoirs is $170 million.

Figure 8: Analysis of the Economic Impact of $170 Million in TARP Applicable Spending in 2014, IMPLAN

Economic Impact Analysis	Employment	Labor Income	Economic Value Added
Direct Effect	1,065 jobs	$83.7 million	$102.2 million
Indirect Effect	315 jobs	$25.1 million	$33.1 million
Induced Effect	524 jobs	$28.4 million	$48.0 million
Total Effect	**+1,903 jobs**	**+$137.2 million**	**+$183.3 million**
Decrease in the Cook County Unemployment Rate	-0.072 percentage-point decrease		

Source(s): 2014 CAFR for the Metropolitan Water Reclamation District; BLS, 2015b; IMPLAN (2013). Results are reported in 2015 dollars.

Figure 9: Direct Construction Jobs Attributable to Tunnel and Reservoir Plan Expenditures, 2014



Source(s): BLS, 2015a; BLS, 2015b; IMPLAN (2013).

Estimated TARP expenditures– included in the previous analysis of the MWRD– are used to demonstrate the impact of a specific policy action on the region (Figure 8). The successful Tunnel and Reservoir Plan alone supports approximately 1,900 jobs, including over 1,000 direct jobs in construction and operations occupations. In addition to averting flood costs over the long run, the construction of TARP projects increases annual labor income by $137 million and boosts economic activity by $183 million per year in Cook County. Without the independent effect of the Tunnel and Reservoir Plan, Cook County's unemployment rate would have been marginally higher (7.2 percent instead of 7.1 percent). Almost 500 construction laborers

(including plumbers, pipefitters, and painters), 200 operating engineers, and 200 other blue-collar construction workers would be unemployed in the absence of the TARP program (Figure 9).

Another recent investment to improve water quality in the CAWS by the MWRD is creating hundreds of jobs while making Chicago rivers safer for paddlers who are increasingly exploring these urban waterways. In September 2013, the MWRD began the construction of disinfection facilities at its O'Brien Water Reclamation Plant on the northside of Chicago and at the Calumet Water Reclamation Plant on the southside. The work received $10 million in funding from the Illinois Jobs Now! capital program in addition to $21 million in engineering and design costs. Disinfected wastewater began flowing at Calumet plant in July 2015, and the O'Brien facility is set to come online before the 2016 recreational season. The two disinfection projects have created 750 construction, operations and support jobs (MWRD, 2013).

City of Chicago Department of Water Management

The American Society of Civil Engineers considers the City of Chicago Department of Water Management a "success story" (ASCE, 2013). The Department of Water Management delivers nearly 1 billion gallons of freshwater to 5.4 million residents of Chicago and 125 surrounding suburban communities. The Department's mission is to protect public health by delivering sufficient supply of exceptional quality water and efficiently managing wastewater and stormwater. While the City of Chicago's credit rating in 2014 was a "Baa1" by Moody's and an "A+" by Standard & Poors, both water and wastewater revenue bonds were assessed as better financial investments: "A2" by Moody's and "AA" by Standard & Poors (CAFR, 2014c).

In 2012, Chicago embarked on a 10-year plan to replace 90 miles of aging drinking water pipes every year. Many of the drinking water pipes being replaced are over 100 years old. By planning ahead, and keeping operating expenditures stable, the City has already been able to invest an additional $225 million in new water infrastructure improvements per year (ASCE, 2013).

Expenditures related to day-to-day operations and actual construction must be determined in order to evaluate the economic impact of the Department of Water Management. Major funds dedicated to the Department of Water Management include the Water Fund and the Sewer Fund. In 2014, the two funds accounted for $493 million of construction in progress. Total water and sewer expenses on personnel services, repairs and maintenance, and commodities and materials by the City of Chicago amounted to $65 million in 2014. These expenses are independent of pension and other trust fund costs, depreciation, General Fund reimbursements, materials costs, and interest payments. Thus, they represent the true value of public funds spent by the Department to directly employ workers and to directly improve infrastructure (CAFR, 2014c).

The City of Chicago Department of Water Management (DWM) helps to sustain the Cook County economy (Figure 10). The $558 million expended by the Department on construction in progress and personnel services and maintenance in 2014 directly created approximately 3,500 jobs, including 2,800 construction jobs (Figure 11). Over 1,800 of these positions are within the Department and have publicly-available salary records, while the rest are created in contracted construction firms (City of Chicago, 2015). The direct jobs all require materials, fuels, and supplies. As a result, the indirect economic activity associated with Department of Water Management expenditures supports more than 1,000 jobs in the Chicago area. Finally, the overall increase in consumer demand stimulates an additional 1,700 jobs over the year.

Department of Water Management functions and investments improve regional output by $602 million and create 6,300 jobs in total.

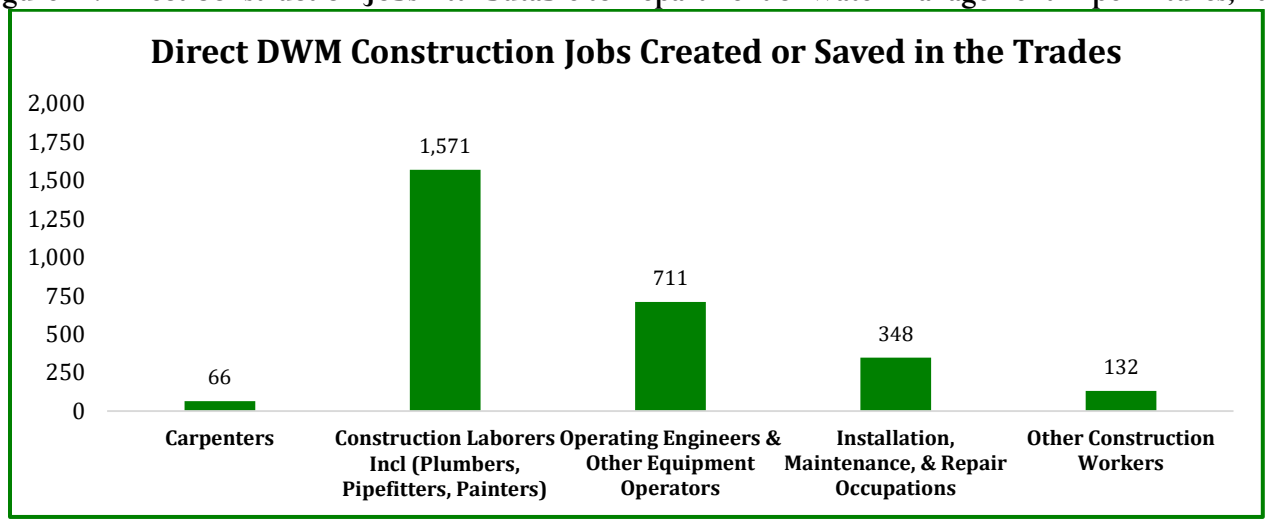
The Department of Water Management has a net-positive impact on the Cook County economy (Figure 10). In 2014, Department functions and investments improved regional output by $602 million and boosted employment by about 6,300 jobs in total. The ratio of economic value added to total cost effectively represents an 8.0 percent "return on investment" over the year from Department activities. In addition, without this local government spending in 2014, Cook County's unemployment rate in January 2015 would have been 7.4 percent instead of 7.1 percent.

Figure 10: Analysis of the Economic Impact of $558 Million in DWM Applicable Spending in 2014, IMPLAN

Economic Impact Analysis	Employment	Labor Income	Economic Value Added
Direct Effect	3,498 jobs	$275.1 million	$335.7 million
Indirect Effect	1,035 jobs	$82.5 million	$108.9 million
Induced Effect	1,723 jobs	$93.2 million	$157.7 million
Total Effect	**+6,256 jobs**	**+$450.9 million**	**+$602.2 million**
Decrease in the Cook County Unemployment Rate	-0.236 percentage-point decrease		

Source(s): 2014 CAFR for the Department of Water Management; BLS, 2015b; IMPLAN (2013). Results are reported in 2015 dollars.

Figure 11: Direct Construction Jobs Attributable to Department of Water Management Expenditures, 2014



Source(s): BLS, 2015a; BLS, 2015b; IMPLAN (2013).

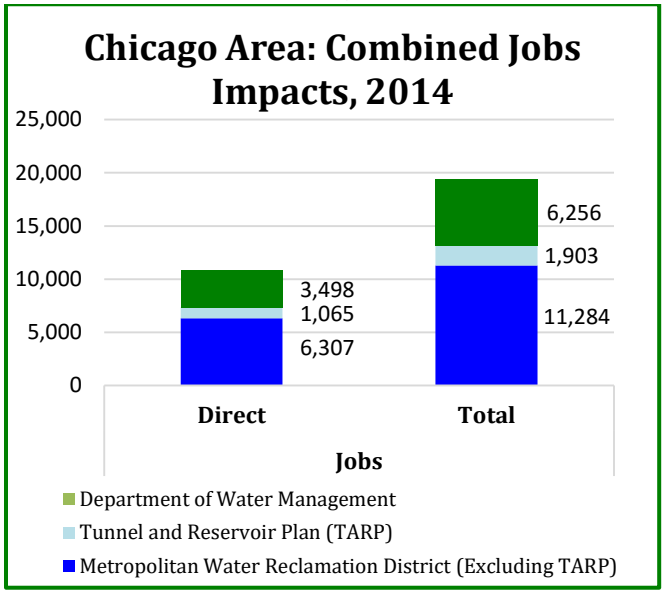
Department of Water Management expenditures support good middle-class jobs in Cook County (Figure 10). In 2014, the total estimated impact on aggregate labor income in the region was $451 million. Again, this equates to over $72,000 in annual compensation per job created, including benefits and social insurance payments. As is the case for Metropolitan Water Reclamation District expenditures in Cook County, labor "captures" 75 percent of the total gain in GDP.

Trades involved as a result of direct Department of Water Management expenditures are shown in Figure 11. Department functions and investments support over 2,800 direct construction jobs. Of these blue-collar construction jobs supported, about 1,600 are for construction laborers, plumbers, pipefitters, and other labor-intensive jobs and just over 700 are for operating engineers and other equipment-intensive jobs. Blue-collar construction jobs supported by the Department also include over 300 installation, maintenance, and repair workers (Figure 11). Replacing nearly 90 miles of subterranean water mains alone accounts for 2,500 of these jobs throughout the city: 1,400 direct construction jobs, 400 indirect jobs, and 700 induced jobs.

Summary of Clean Water Infrastructure Investment Impacts in the Chicago Area

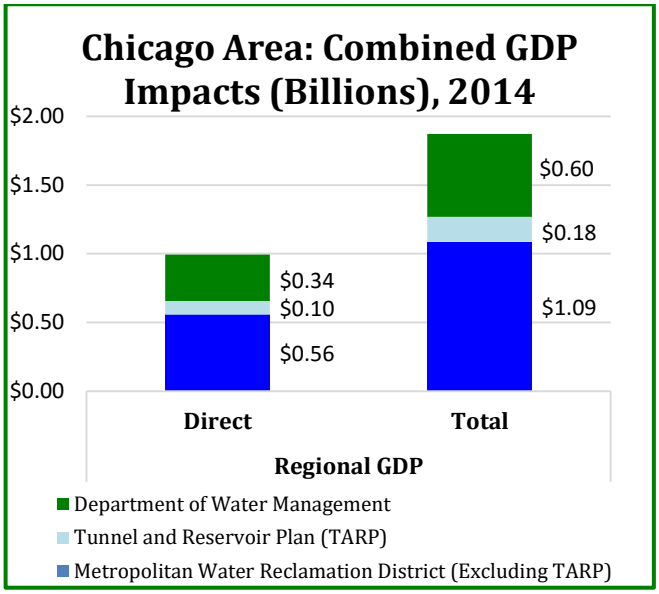
Combined investments by the Metropolitan Water Reclamation District (including the Tunnel and Reservoir Plan) and the City of Chicago Department of Water Management generate considerable economic impacts for the Chicago area. Ultimately, the two local government enterprises generate over 19,400 total jobs, including about 10,900 direct construction, water, and sewage jobs (Figure 13). Together, MWRD and the Department of Water Management increase Cook County's gross domestic product by $1.87 billion (Figure 14). These expenditures improve the quality of Chicago area water, save hundreds of thousands of dollars in forgone health expenditures by minimizing the spread of disease, increase worker productivity by millions of dollars by improving regional health, and prevent hundreds of millions of dollars in flood and other water damage.

Figure 13: Combined Jobs Impacts of Water Infrastructure Spending by City of Chicago and MWRD, 2014



Source(s): IMPLAN (2013). Results are reported in 2015 dollars.

Figure 14: Combined GDP Impacts of Water Infrastructure Spending by City of Chicago and MWRD, 2014



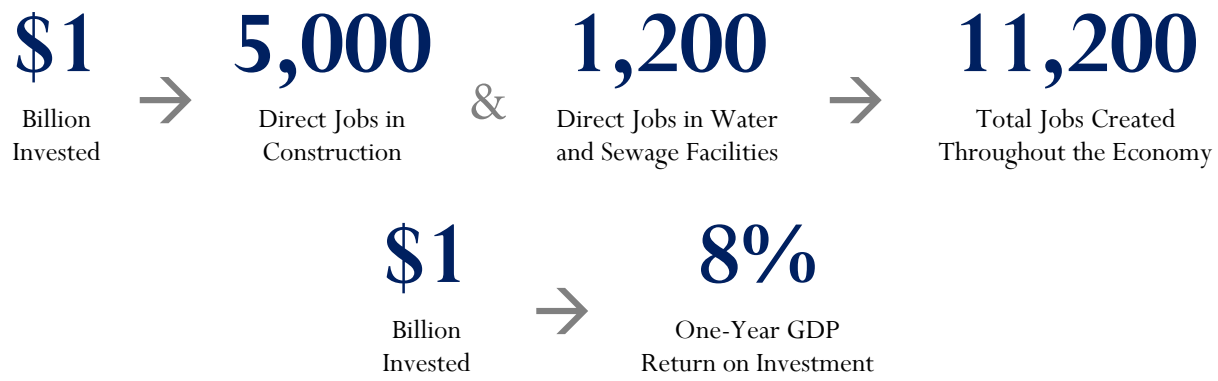
Source(s): IMPLAN (2013). Results are reported in 2015 dollars.

These impacts align with, but are slightly more conservative than, estimates by the Water Research Foundation and the Water Environment Research Foundation. In 2014, a joint project by these organizations assessed that the MWRD and the Department of Water Management together create 21,800 total jobs (including 7,400 direct jobs) and generate $4.18 billion in economic activity (WERF, 2014a; WERF, 2014b).

These reported effects differ from the estimates in this study in two ways. First, the Water Research Foundation and Water Environment Research Foundation project used all "operations" and "capital" expenditures in their evaluation, which include items that are not directly tied to *current* infrastructure investments such as interest payments. This analysis, on the other hand, focuses on current expenditures to improve water quality and supply. Second, the former project uses "gross economic output" to measure economic activity, while this analysis utilizes "value added." Gross output counts goods and services multiple times if they are used in the production process, while value added measures the final demand expenditures exclusive of intermediate inputs (Bess & Ambargis, 2011). In other words, value added is a more conservative number that is equivalent to GDP. Both evaluations lead to the same conclusion, however: these two water agencies support about 20,000 jobs and generate billions of dollars in short-term economic activity. The benefits exceed the costs.

Figure 15 recaps and simplifies the effects of clean water infrastructure investments for Cook County. For every $1 billion invested in clean water infrastructure projects, about 5,000 construction jobs and 1,200 water and sewage facilities jobs are created or saved. In turn, this direct increase in regional employment stimulates additional employment, summing up to approximately 11,200 annual total jobs created per $1 billion invested in one year. The quantified employment "multiplier," or ripple effect, is estimated at 1.79, meaning that every direct job in clean water infrastructure supports 0.79 additional jobs throughout the Cook County economy. This multiplier is larger than the equivalent for many other potential public policies, including extending unemployment insurance benefits, cutting personal income taxes, cutting corporate income taxes, and increasing general aid to state governments (Zandi, 2009). Furthermore, clean water infrastructure investments are catalysts for economic activity, offering an 8 percent annual return to the economy. By increasing environmental quality, reducing pollution, and improving health outcomes, clean water infrastructure investments also correct "negative externalities" (or market imperfections) and improve gross domestic product.

Figure 15: Economic Benefits of Investing $1 Billion in Clean Water Infrastructure, Chicago Area



Average Environmental and Social Impacts Per $1 Billion Invested

While clean water infrastructure investments create over 11,200 total jobs in the Chicago area per $1 billion invested on average, the investments have other environmental and social impacts that are more difficult to quantify. In 2004, researchers at the World Health Organization (WHO) evaluated the costs and benefits of water and sanitation improvements across the world. Water quality improvements provide much larger impacts for developing countries due to the poor state of their current systems, but investments in the United States and Canada were still assessed to have considerable benefits. This is especially true when action is taken on WHO's "Intervention 5," which is the provision of universal access to a regulated piped water supply and a sewage connection into every home and business (Hutton & Haller, 2004).

Figure 16 utilizes these "Intervention 5" findings to provide general parameters on additional social and environmental benefits from Chicago area infrastructure investments. Ultimately, a $1 billion investment in clean water infrastructure systems improves the health of Chicago residents, averting 405 diarrheal cases per year and reducing the annual number of days that a child misses school by a total of 90 days. The annual time gain associated with the policy change is 487,000 hours saved in water collection, improving infrastructure efficiency. Furthermore, the calculated financial benefit from preventing deaths due to contaminated water has also been estimated at $184 per resident.

Finally, water has an ascetic appeal. "The view of a clean lake, river, or seashore makes people happy," write Professors Cunningham and Cunningham. "[A]nd water provides for recreation, so many people feel their quality of life has improved as water quality has been restored." The Chicago Riverwalk, for example, can attract nearly 2.8 million visitors per year, generating around $1 million in additional city tax revenue (FCR, 2013). Lake Michigan attracts visitors, swimmers, recreational sports leagues, and wildlife. Water flows, ripples, falls, washes, and refreshes. It is the defining factor of existence. As "a most beautiful and precious resource," clean water provides benefits that many would consider priceless (Cunningham & Cunningham, 2008).

Figure 16: Annual (Quantifiable) Environmental and Social Impacts of $1 Billion Invested in Clean Water Infrastructure in the Chicago Area

Environmental or Social Impact	Estimated Value
Diarrheal cases averted	405 cases
School days gained due to less diarrheal illness	90 days
Annual time gain (water collection hours saved)	487,000 hours
Value of averted deaths per capita (in 2015 dollars)	$184 per capita

Source(s): Authors' application of estimates by Hutton & Haller, 2004.

Section 5: Opportunities for Future Investments in Illinois

While the Metropolitan Water Reclamation District (MWRD) of Greater Chicago, the City of Chicago Department of Water Management, and other local agencies and enterprises have made major progress over the past few decades, Illinois is still under-resourcing and under-investing in water infrastructure systems. Much of the state's clean water infrastructure needs will only become more expensive the longer they are delayed, and additional costs will be accrued from failures in these systems. Each of the following opportunities for future investments in Illinois would improve water quality, create high-road local jobs, and support the Illinois economy:

- **Nutrient removal**: The recently-released Illinois Nutrient Loss Reduction Strategy calls for a 45 percent overall reduction in the amount of phosphorous and nitrate-nitrogen leaving the state, which have contributed to an aquatic life "dead zone" that stretches for thousands of miles in the Gulf of Mexico. The plan also calls for further reductions to improve water quality within Illinois where nutrients spur algae blooms that deplete oxygen levels, hinder recreation, and threaten public health. Nutrient pollution also degrades drinking water quality and results in expensive back-end treatment costs that can be avoided through preventative measures. Improvements at MWRD plants, some of the largest wastewater dischargers in the world, can reduce urban pollution in the Chicago area. Priority watersheds for nutrient reductions from both the agricultural and urban sectors throughout the state include the Des Plaines River, the Fox River, the Rock River, the Illinois River, the Sangamon River, Lake Decatur, Lake Bloomington, Lake Vermillion, Lake Springfield, Evergreen Lake, the Big Muddy River, the Little Wabash River, and many others (IEPA, 2015). Investments in nutrient reductions from wastewater discharges, farmland, and urban runoff are needed to help restore the health of these watersheds and resolve the costly problems that result from excess nutrient pollution.

- **Reducing combined sewer overflows (CSOs)**: While green infrastructure is an effective way to reduce the frequency and volume of CSOs, traditional "gray" infrastructure is still required. Gray infrastructure includes pipes, sewers, and other concrete and steel structures used for stormwater management. Off-line storage facilities, for example, collect wet weather overflows in tanks, basins, or deep tunnels. The MWRD's Tunnel and Reservoir Plan (TARP) is an example of this type of project aimed at reducing CSOs in the Chicago area, while also saving or creating approximately 1,900 jobs. Other municipalities throughout Illinois will need to implement similar, albeit much smaller, projects to reduce CSOs from their sewer systems and improve water quality in their area. These gray infrastructure projects create hundreds of local jobs both for construction and for operation and maintenance after construction is complete.

- **Dam removal**: Dams provide an ideal environment for harmful algae to grow, inhibit the movement of fish and other aquatic species, and pose safety concerns for river users including anglers, boaters, and paddlers. Rivers throughout the state would benefit from removing dams that no longer serve their original purpose. An Army Corps of Engineers' feasibility study to be completed by July 2017 will examine dam removal and fish passage alternatives for ten Fox River dams, in cooperation with the Illinois Department of Natural Resources, local communities and the Fox River Study Group. This opportunity allows stakeholders to coordinate with state agencies to improve the Fox River using the best identified methods and sound information (FRSG, 2015). Similar studies must be conducted on other rivers to identify dams that no longer serve their original purpose and should be removed. Recent dam removal successes in the Chicago area demonstrate the benefits that additional dam removals could generate if funded and approved. In 2014, two dams owned by the Forest Preserves of Cook County (FPCC) were removed from the Des Plaines River because they no longer served their original purposes (American Rivers, 2014). The dam removals were part of a broader restoration effort to remove seven total dams between the Wisconsin border and Joliet, Illinois. Removal of the two dams created between 3,000 and 4,000 labor hours for construction workers and reconnected nine miles for recreational users and fish, eliminating species displacement.

- **Invasive species control**: Aquatic invasive species (AIS) entering new waters– including Lake Michigan, the Illinois River, and the Mississippi River– wreak havoc on ecosystems and the economy. The main pathway of concern in Illinois is through the Chicago Area Waterways System (CAWS), an artificial connection between the Great Lakes and Mississippi River basins established by the reversal of the Chicago River a century ago. For many years, the CAWS has been used to flush Chicago's wastewater downstream to the Illinois River and for transportation of goods and materials. The river has recently seen increasing popularity as a desirable location for storefronts, offices, and restaurants, as well as for recreational and tourism uses like rowing, kayaking and boat tours. This new appreciation of the river for a variety of uses presents an important opportunity to address the challenges that prevent the river from reaching its full potential as an asset to the city and its visitors. To reduce the risk of AIS moving through the CAWS, new infrastructure projects must be designed and constructed, providing an opportunity to solve flooding and water quality problems while supporting local jobs. A long-term solution can be combined with ongoing efforts to re-envision the CAWS in order to promote new economic investment and reduce back-end costs associated with aquatic invasive species.

- **Continuing the Great Lakes Restoration Initiative (GLRI)**: The GLRI is a federal program launched in 2010 that supports efforts to restore Lake Michigan and the other Great Lakes. In the first five years of the program numerous on-the-ground restoration efforts have been supported, including removal of invasive species from Lake Michigan's shoreline and many Chicago parks. Restoration work on over 20 acres of sand dunes and aquatic habitat at Chicago's 63rd Street Beach has attracted new beachgoers and migratory birds. A $48 million cleanup at Waukegan Harbor has removed 175,000 cubic yards of contaminated sediment (HOW-GLC, 2015). The GLRI fund also supports job-training programs such as the city's Greencorps Chicago and the Friends of the Forest Preserves' Conservation Corps. Greencorps Chicago is the City of Chicago's green industry job-training program for individuals with barriers to employment. Conservation Corps teaches high school students, young adults, and adults about conservation while providing them leadership skills that can be used to pursue future careers. In another effort to create new jobs, the GLRI set aside approximately $6 million for restoration projects by federal agencies with the key criterion that each project puts at least 20 unemployed people to work. Continued investments through this program will ensure that Lake Michigan remains an attractive destination for families and wildlife– supporting local jobs as well as revenue for the recreation, hospitality, and food and beverage industries.

- **Green infrastructure projects**: Investments in green infrastructure have proven successful in the Chicago area, and additional investments in these types of projects are needed to efficiently manage stormwater and reduce local flooding problems. The Space to Grow program, led by the Healthy Schools Campaign and Openlands, demonstrates how green infrastructure projects can benefit students, community members, and the environment while providing local construction jobs. The program transforms schoolyards into green spaces with landscape features that capture rainfall, helping to keep Chicago's water resources clean while facilitating outdoor activity and learning. Space to Grow uses capital funds from Chicago Public Schools, the Chicago Department of Water Management, and the Metropolitan Water Reclamation District and selects schools based on eligibility criteria, targeting schools in impoverished areas. Similar initiatives throughout the state can help Illinois address stormwater challenges while providing widespread benefits to communities. Building green roofs is another possible method to manage stormwater, save energy, and reduce air pollution. Covering just 5 percent of Chicago's suitable rooftop area could save or create as many as 8,000 jobs (American Rivers, 2014). Incorporating vegetated areas or permeable pavement into streets, sidewalks and alleys would allow water to percolate into the ground rather than pooling on pavement or flooding the sewer system. According to the City of Chicago's 2014 Green Stormwater Infrastructure Strategy, "Chicago's public right-of-way represents 23 percent of the city's land area and an even higher percentage of the city's impervious surfaces. The city's over 4,000 miles of streets and approximately 2,000 miles of alleys represent a critical opportunity to keep stormwater out of our overtaxed sewer system" (City of Chicago, 2014).

Section 6: Implications and Conclusions

Clean water infrastructure investment is a win-win-win for Illinois. Publicly-assisted projects in clean water infrastructure improve environmental quality for households and businesses, which is a win for the state. The projects are also a win for construction workers and the employees of water-related facilities, for whom middle-class employment opportunities are provided. The effects of a better environment with more jobs ripple into other sectors of the economy, a win for employers and workers who are not directly impacted by the investments.

Nowhere is this more apparent than in the Chicago area. In 2014, investments by the Metropolitan Water Reclamation District and the City of Chicago Department of Water Management generated nearly 20,000 total jobs, including more than 10,000 direct construction, water, and sewage jobs. Together, both local government enterprises increased regional economic output by almost $2 billion over the year. These expenditures improved the quality of Chicago area water, increased worker productivity by improving regional health, and prevented flood and other water damage.

The remaining and emerging threats to our water supply reveal a need for continued investment. Addressing these threats presents ongoing opportunities to keep these economic and societal benefits flowing for workers and communities.

Clean water infrastructure investment promotes a healthy economy. A sustainable system of clean water distribution and treatment is necessary for long-term economic growth. By reducing pollution and stormwater runoff, preventing contamination, restoring natural waterways, eliminating flood damage, and mitigating the potential impacts of climate change, clean water infrastructure ensures that the economy flows smoothly. Construction of clean water projects creates jobs and stimulates the economy in the short run. Completion of clean water projects fosters new jobs, augments productivity by maintaining a healthy workforce, and improves economic activity in the long run. Ultimately, clean water infrastructure investments enhance economic activity and support a "high road" economy with good, clean jobs.

Clean water infrastructure investments enhance economic activity and support a "high road" economy with good, clean jobs.

Appendix

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