



STRATUS CONSULTING

Phase 1 Study of the Triple Bottom Line Values of Clean Water in Northeast Ohio: Executive Summary

Prepared for:

Cleveland Water Alliance
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and

Northeast Ohio Regional Sewer District
3900 Euclid Avenue
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1. Introduction

Northeast Ohio is blessed with abundant, high-quality water resources – most notably Lake Erie and its tributaries. The lake and its associated rivers and streams are “natural capital” assets that provide considerable value to those who live, work, and visit Northeast Ohio.

To ensure that Ohio’s Lake Erie communities are able to realize the full potential of the lake, federal, state, and local agencies and organizations have made substantial investments in restoring and maintaining the quality of water in Lake Erie and its watersheds. To better understand and communicate the importance of these continued investments, the Northeast Ohio Regional Sewer District (NEORS) and the Cleveland Water Alliance (CWA) retained Stratus Consulting to explore the different values associated with clean water in Northeast Ohio.

This study is the first phase of an envisioned two-phase effort to provide useful information regarding the value of clean water in the Northeast Ohio region. In this initial phase, we identified the benefits and values associated with clean water, provided a general reconnaissance of available data and studies, and developed some preliminary estimates to help demonstrate the range of values for clean water in Northeast Ohio.

2. Northeast Ohio Study Region

The study area consists of seven counties in the Northeast Ohio region, including Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit. These counties fall within Lake Erie’s Central Basin, which roughly extends from Sandusky, Ohio, eastward to the Ohio-Pennsylvania border. Cuyahoga, Lake, and Lorain counties border Lake Erie on the north end; while Geauga, Medina, Portage, and Summit counties make up the inland portion of the study area. Key watersheds in the region include the Cuyahoga, Black, Chagrin, Grand, and Rocky River watersheds (Exhibit 1).

3. Clean Water Values in Northeast Ohio

To estimate the values associated with natural capital assets, it is important to understand the different services they provide and how changes in the level or quality of these services would affect human welfare. Based on our research and understanding of the Northeast Ohio region, we have identified a number of water quality-dependent goods and services associated with Lake Erie and its tributaries. These include services related to the direct use of water, such as for



Exhibit 1. Northeast Ohio study region.

recreation or as a source of water supply, as well as “nonuse” services, such as related to ecosystem functions or the inspiration that residents take from wildlife and the natural environment.

Exhibit 2 summarizes the different clean water values that we explored in this Phase 1 effort, and provides order-of-magnitude estimates for some of these values. These values are not additive, but help to provide insight into the different ways that people value clean water.

Exhibit 2. Summary of key findings and examples of clean water values

Triple bottom line category	Service category	Key findings/examples of value
Economic/ financial	Economic development/activity	<ul style="list-style-type: none"> ▶ Key water-dependent sectors in Northeast Ohio region include manufacturing, agriculture, tourism, and commercial fisheries. Many target sector industries also depend on clean water, including advanced manufacturing, food and beverage manufacturing, and biohealth. ▶ There is a belief that the region’s water resources have the potential to provide a competitive advantage in attracting businesses and employees.
	Reduced water treatment costs	<ul style="list-style-type: none"> ▶ Capital, operation, and maintenance costs for water treatment can vary by more than 200% depending on source water quality. ▶ Ohio communities have spent \$125,000 to \$3 million per investment to protect drinking water from harmful algal blooms (HABs; sometimes these expenditures are necessary each year). ▶ Municipal water suppliers in Northeast Ohio region avoid significant costs associated with water treatment because they have access to a reliable, high-quality source of supply.
Social	Public health	<ul style="list-style-type: none"> ▶ In 2012, Ohio Lake Erie beaches were closed 20% of the time during the swimming season due to bacterial contamination. ▶ Drinking water contamination and contact with HABs or bacteria at local beaches can result in severe illness. ▶ Individuals that contract waterborne illnesses, or experience long-term health effects, incur real and often significant costs associated with medical bills, pain and suffering, restricted activity days, and lost work days. ▶ Fish contamination can adversely affect “at-risk” populations.
	Recreation and tourism	<ul style="list-style-type: none"> ▶ Residents and visitors to Northeast Ohio are willing to pay \$14.13 to \$62.72 per day to participate in various water-based recreation activities. ▶ Closures at just one popular beach due to bacterial contamination may have resulted in close to \$1 million in lost recreational value during the 2012 swimming season. ▶ In the Great Lakes region as a whole, a decrease of 25% in fish abundance would result in \$87 to \$170 million in lost recreational value. ▶ Tourism is an important, water-quality dependent sector. In 2012, the total economic impact of tourism in Ohio counties adjacent to Lake Erie included \$11.8 billion in sales, \$3.2 billion in wages, and 117,513 jobs.

Exhibit 2. Summary of key findings and examples of clean water values (cont.)

Triple bottom line category	Service category	Key findings/examples of value
Social (cont.)	Aesthetics/quality of life	▶ People are willing to pay 1% to 10% more for their homes in areas with better water quality. Water-quality improvements associated with the 2005 Great Lakes Regional Collaboration (GLRC) Restoration Strategy would result in property values benefits in coastal counties in the study region ranging from \$2.28 to \$3.32 billion.
	Water supply reliability	▶ Household willingness-to-pay (WTP) to avoid multiple-day, water quality-related supply disruptions may range between \$13.4 and \$52.8 million per year in the three coastal counties that rely on Lake Erie for drinking water.
Environmental	Nonuse values	▶ Households in the study region might be willing to pay \$291 million per year to maintain important “nonuse” ecosystem services that Lake Erie and its tributaries provide.

3.1 Economic Development

Many of Northeast Ohio's important sectors are dependent on having an abundant, high-quality supply of water. Cleveland State University (CSU) identified agriculture, power-generation, and several manufacturing subsectors, including textiles and garments, meat production, beverages, and automobile manufacturing, as the most water-intensive industries in the region (Alexander et al., 2014). Other important water-dependent subsectors include chemical and petrochemical manufacturing and biohealth. These represent two of the fastest-growing industries in the Northeast Ohio region.

In addition to abundant supplies, high-quality water is also necessary to sustain and promote thriving water-dependent industries and their diverse water needs. For example, in many manufacturing sectors, cooling water is often used for contact cooling; intake water quality must therefore meet specific standards. This is important for iron and steel manufacturing, which is a large part of the state and region's manufacturing core, and which in turn affects other key manufacturing-related sectors such as automotive and aviation (Alexander et al., 2014). Many advanced manufacturing firms are also affected by water-quality considerations, such as those associated with producing specialized metal components and technological chemicals (Alexander et al., 2014). The food and beverage industry relies on high-quality water for food and beverage production processes, and is a growing contributor to the Northeast Ohio economy.

In terms of economic development, the Northeast Ohio region has the potential to provide a strong competitive advantage for many industries relative to more drought-prone regions, or regions affected by adverse water-quality events. Evidence indicates that water supply and quality are increasingly important factors in business location decisions. Quality-of-life benefits associated with Lake Erie can also help to attract high-quality employees to the region.

3.2 Avoided Water Treatment Costs

Water quality directly affects the level of treatment required for drinking water and water used for industrial purposes. Thus, high levels of water quality can result in reduced or avoided costs for water treatment processes and associated infrastructure.

In terms of water treatment, municipal water suppliers are typically most concerned with salinity and total suspended solids (TSS; Koteen et al., 2002). Based on data from the literature, Austin et al. (2007) estimated that a 40% reduction in sedimentation in the Great Lakes – the target reduction identified in the 2005 *Great Lakes Regional Collaboration Strategy to Restore and Protect the Great Lakes* (GLRC, 2005) – would reduce drinking water treatment costs by \$12 million per year. In addition, water suppliers would also likely benefit from reduced capital costs associated with water treatment infrastructure (Austin et al., 2007).

In the Northeast Ohio study region, salinity and TSS do not present a significant issue for municipal water suppliers. Municipal suppliers and their customers have therefore benefited from lower costs associated with water treatment in relation to these constituents. However, water-quality treatment issues associated with HABs remain a pressing concern, and many Ohio communities have made significant HAB-related investments. Although HABs are not yet widespread within the Central Basin, conversations with water utility representatives in the study region indicate that they do continually monitor for HAB-related constituents, as well as other water-quality parameters. The region's water suppliers have benefited from not having to expend large amounts of money to treat water that has been contaminated by HABs.

3.3 Public Health

Water quality-related health effects are difficult to quantify. However, individuals that contract waterborne illnesses, or experience long-term health effects from water-quality contamination, incur real and often significant costs associated with medical bills, pain and suffering, restricted activity days, and lost work days. Residents of Northeast Ohio avoid many of these effects because of the relatively high quality of water in Lake Erie's Central Basin. However, many public health concerns persist.

Discharges of polluted urban runoff, untreated sewage spills, and combined sewer overflows (CSOs) result in elevated levels of bacteria and other pathogens at Lake Erie beaches. This in turn can cause a number of water-borne illnesses, including stomach flu, respiratory infection, and ear and skin infections. During the 2012 swimming season, Ohio's Lake Erie beaches were closed and deemed unsafe for swimming approximately 20% of the time. In addition to public health concerns, beach closures can have significant economic effects. Over the past several decades, NEORSD invested nearly \$900 million in reducing CSO events, and plans to spend an additional \$3 billion over the next 25 years to achieve 98% capture of CSOs. This program will continue to significantly reduce public health issues associated with bacterial contamination.

In addition, the toxins that develop as a result of algal blooms in the Lake Erie region can make people ill if they are exposed to contaminated water or if they eat contaminated fish or shellfish. Approximately 10% of all foodborne disease outbreaks in the United States are caused by eating seafood contaminated by algal toxins. Toxins produced by harmful algae can also cause respiratory distress in beach visitors who do not even go into the water (NRDC, 2010). According to the Ohio Department of Health, there were 48 probable and suspected human illnesses related to recreational algal toxin exposure in 2010.¹

1. This is considered a low estimate because seafood-related illnesses are likely underreported, misdiagnosed, and possibly increasing.

Another public health concern in Northeast Ohio is related to legacy industrial pollution and discharges. Consumption of fish is the primary route of human exposure to these chemicals in Lake Erie. To limit adverse health effects associated with fish consumption, the Ohio Environmental Protection Agency issues fish consumption advisories for Lake Erie and its tributaries. Although exposure to contaminants from Great Lakes fish is dependent upon the amount eaten and species consumed, research has shown that some populations have a higher risk of experiencing adverse health effects associated with exposure to contaminants from fish consumption. These populations include Native Americans, minorities, sport anglers, the elderly, pregnant women, and fetuses and infants of mothers consuming contaminated Great Lakes fish (Lake Erie LaMP Work Group, 2006).

3.4 Water-Based Recreation and Tourism

Lake Erie and inland water bodies provide a popular tourist attraction for Ohio residents, as well as visitors from other states. Lake Erie and its beaches serve as the primary recreational attraction within the region, supporting countless beach recreation activities, including swimming, fishing, and boating. In addition to Lake Erie, the region's extensive network of rivers, streams, and inland lakes also serve as important recreational assets.

The value of recreation includes values that individuals derive from participating in recreational activities (i.e., recreational-use values, measured based on individual WTP). For example, Sohngen et al. (1999) estimated that there were approximately 224,000 beach user days at Headlands State Park during the summer of 1998, and that each day provided users with \$21.03² in recreational-use value. Recent studies indicate that recreational-use values associated with Lake Erie beaches may be much higher, ranging from \$40.24 to \$62.72 (Song et al., 2010).

Boating and fishing are also popular recreational activities in Northeast Ohio, especially on Lake Erie.³ In a survey conducted by the Ohio Sea Grant, the average respondent took 15.6 trips to Ohio boating sites, of which 4.3 were to Lake Erie sites, 8.7 to inland lakes and reservoirs, and 1.3 to inland rivers and streams (Hushak, Undated). Rosenberger (2011) reports that the value of these trips averages \$16.53 per day.

Tourism-related expenditures associated with water-based recreation also result in economic benefits for the local region. Tourism Economics (2012) estimated that in 2012, the total economic impact associated with tourism in Ohio's lake region included \$11.8 billion in sales, \$3.2 billion in wages, and 117,513 jobs. Sohngen et al. (1999) reported that visitors to Headlands

2. All values reported in 2014 USD.

3. According to the Great Lakes Commission (2007), approximately 50% of angling in Ohio is boat-based. For this study, we did not disaggregate the economic values between boating and fishing.

State Park spend about \$28 per single-day trip, generating approximately \$4.5 million in local economic impacts. Boating and visits to local parks for water-based recreational activities also contribute substantially to recreation-related economic activity.

Water-quality issues can significantly affect recreational use and tourism-related spending. For example, the Lake Improvement Association (Undated) estimated that in Grand Lake St. Mary's State Park, local businesses have lost 35–40% annually in revenue since the algal bloom occurred. HABs and decreased fish abundance in the Lake Erie dead zone may also affect sales in the Lake Erie charter boat fishing industry: Austin et al. (2007) estimated that avoiding an immediate 25% decrease in fish abundance would be worth roughly \$87–\$170 million annually in the Great Lakes region (2007 USD).

3.5 Property Values

Several studies have examined the relationship between water quality and residential property values. Results of these studies indicate that water quality can affect the value of both waterfront properties and properties located near, but not directly adjacent to the shore.

Based on existing literature, Austin et al. (2007) developed order-of-magnitude estimates of the benefits and costs of the *Great Lakes Regional Collaboration Strategy to Restore and Protect the Great Lakes* (GLRC, 2005). Specifically, the authors assumed that the program would result in a 10% increase in value at properties located in Census tracts adjacent to the Great Lakes. For properties located in Census tracts within Metropolitan Statistical Areas (MSAs) beyond the coastal Census tracts, but within the “zone of possible impacts,” the authors assumed a 1% to 2% increase in value.

We followed this basic method to develop order-of-magnitude estimates for how property values might increase if water-quality improvements similar to those described in the GLRC Strategy restoration plan were implemented in the seven-county region. Our results indicate that residential property value benefits would amount to \$1.24 billion and \$1.04 to 2.08 billion in coastal and non-coastal Census tracts, respectively. Combining the two estimates yields an estimated range of \$2.28 billion to \$3.32 billion in increased property value, and thus economic benefit, associated with the water-quality improvements described in the GLRC Strategy restoration plan.

3.6 Water Supply Reliability

Water utilities in Northeast Ohio provide reliable supplies of high-quality water to households and businesses within the seven-county region. Water utilities in the three counties (Cuyahoga,

Lake, and Lorain counties) that rely primarily on Lake Erie as a primary source of water supply provide water to 1.8 million residents.

Water quality can affect the reliable delivery of these supplies. For example, in 2014, a toxic algal bloom in Lake Erie interrupted water delivery by the City of Toledo for three days. The effects of the 2014 algal bloom were substantial. Toledo's mayor estimated total the economic impact at \$2.2 million to \$2.5 million, and other estimates were higher, at \$3 million to \$4 million. Effects from the event also lingered, as residents had to conserve water for the rest of the summer to reduce stress on the treatment plant.

The effects of water quality-related supply disruptions can also be measured by the amount that residents are willing to pay to avoid these types of events. Based on estimates from existing literature, we estimated that households in the lakeside counties of Lake, Lorain, and Cuyahoga (where households receive drinking water from public water systems that rely on Lake Erie as their source of water supply) would be willing to pay between \$13.4 and \$52.8 million per year to avoid water quality-related supply disruptions.

3.7 Environmental Values

In addition to the values that individuals derive from direct and indirect uses and activities, clean water also provides some level of "nonuse" benefits. These benefits stem from the inherent value that individuals place on environmental goods and services, even if they do not use them for recreational or other purposes. Nonuse values can only be estimated using stated-preference methods that elicit individual or household WTP to maintain or improve an environmental asset or amenity.

Studies have shown that residents located relatively close to large water bodies, such as Lake Erie and its tributaries, are willing to pay relatively significant amounts to maintain water quality and associated ecosystem functions. Based on estimates from the literature, we estimate that household nonuse values within the seven-county region are about \$275 per year per household. Thus, total annual nonuse values amount to more than \$291 million.

4. Summary

Residents and visitors benefit in a number of ways from the high-quality, abundant water resources within the Northeast Ohio region. Lake Erie, its associated rivers and streams, and other inland water bodies support economic development within the region and will underpin economic growth in future years. In addition, Lake Erie and its tributaries serve as a reliable source of water supply for residents and businesses, and provide important benefits in terms of

public health, recreation and tourism, quality of life, and ecosystem services. In Phase 2 of this research, we will conduct a more in-depth assessment of many of these values.

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