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Healthy Waters, Strong Economy:
The Benefits of Restoring the Great Lakes Ecosystem

"The Great Lakes and its waterways offer a tremendous opportunity for reinvigorating the economy of the region, and boosting the competitiveness of the nation as a whole."

By John C. Austin, Soren Anderson, Paul N. Courant, Robert E. Litan[1]

The Great Lakes are one of America's most important—and often-overlooked—natural features. Together, they account for 90 percent of the United States' and 20 percent of the world's surface fresh water. The Great Lakes also directly impact the lives of the roughly 35 million people who live in the cities, states, and Canadian provinces surrounding them, providing drinking water and recreation, commercial transportation, and both tangible and intangible quality of life benefits.

However, the Great Lakes and surrounding areas face numerous threats to their health and utility. This report summarizes the major findings of a more in-depth study—Developing America's North Coast: A Benefit Cost Analysis of a Great Lakes Infrastructure Program—of the benefits and costs of the federal-state Great Lakes Regional Collaboration (GLRC) Strategy by the same authors. It begins by outlining the major elements of the restoration strategy, and the costs of cleaning and preserving the Great Lakes ecosystem. It then describes the results of a rigorous analysis of the GLRC Strategy, highlighting the economic benefits of its implementation. The report concludes by discussing the policy implications of this analysis, arguing that, because the restoration plan outlined in the GLRC Strategy is likely to produce economic benefits well in excess of its costs, federal and state policy makers should act on its recommendations.

Introduction

The Midwestern states that surround the Great Lakes are in a time of economic transition—from an agricultural and industrial era that relied on the Great Lakes and its waterways for transportation and industrial production, to a global knowledge economy in which the lakes are both an increasingly valuable resource, and an important amenity. Outside the region, the United States and other nations around the world are increasingly looking for ways to move beyond economic growth patterns that diminish natural resources to those that support long-term sustainable development.

The Great Lakes and their abundant fresh water offer a doorway to this new economy.

In 2005, the Brookings Institution joined with academic, public policy, business, education, environmental, and civic organizations to launch the Great Lakes Economic Initiative—a multi-year research and policy development effort focused on supporting economic growth and change in the Great Lakes region.[2] A pillar of the initiative's agenda is to leverage the region's

unique natural assets, particularly the Great Lakes, to develop new technologies, improve the region's quality of life, and attract and retain talented workers. Much of this agenda has already been embodied in the Great Lakes Regional Collaboration Strategy (GLRC Strategy)—a $26 billion federal-state plan for cleaning and preserving the Great Lakes.[3]

Given the importance of the Great Lakes, and their current condition, the strategy is critical to the region's future prosperity, and suggests new opportunities for the nation as a whole. The Great Lakes are one of America's most important—and often-overlooked—natural features. Together, they account for 90 percent of the United States' and 20 percent of the world's surface fresh water—an astounding amount given rising global demand for this essential resource. The Great Lakes also directly impact the lives of the roughly 35 million people who live in the cities, states, and Canadian provinces that directly border them. They provide drinking water and recreation, serve as platforms for commercial transportation, and provide both tangible and intangible quality of life benefits to those that live nearby.

The Great Lakes and surrounding areas face numerous threats to their health and utility, however. In recent years, Great Lakes' beaches have been closed due to contamination, fish stocks have dwindled, and invasive species have become growing menaces. According to *Prescription for Great Lake Protection and Restoration: Avoiding the Tipping Point of Irreversible Change*—a 2005 report published by many of the region's leading scientists and now endorsed by 200 scientists nationally—the Great Lakes have experienced over 400 years of human induced stresses.[4] To reverse this damage, these scientists have called for the restoration of critical elements of the ecosystems' self-regulating mechanisms, particularly the wetlands, tributaries, and near-shore habitats that enable the lakes to heal themselves. The GLRC Strategy largely incorporates these recommendations.

This report summarizes the major findings of a more in-depth study of the benefits and costs of the strategy by the same authors: *America's North Coast: A Benefit-Cost Analysis of a Program to Protect and Restore the Great Lakes*.[5] It begins by outlining the major elements of the GLRC Strategy, and the costs of cleaning and preserving the Great Lakes ecosystem. It then describes the results of a rigorous analysis of the strategy, highlighting the economic benefits of its implementation. The report concludes by discussing the policy implications of this analysis, arguing that, because the restoration plan outlined in the GLRC Strategy is likely to produce economic benefits well in excess of its costs, federal and state policy makers should act on its recommendations.

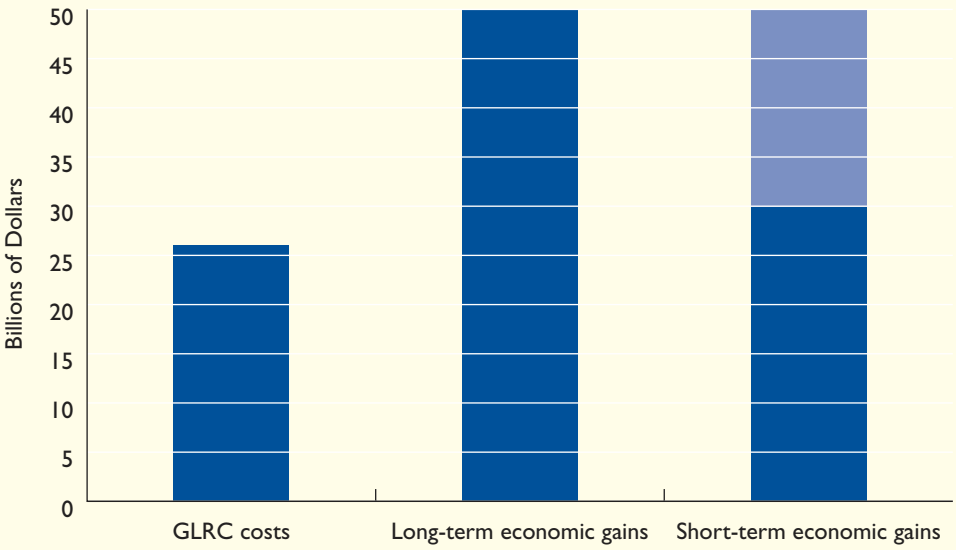
II. The Great Lakes Regional Collaboration Strategy

In December 2004, a collaboration of federal, state, local, and tribal government officials and private sector stakeholders was formed to develop a comprehensive strategy for restoring the vitality of the Great Lakes, and to better ensure their long-term ability to contribute to sustainable development in the region and nation. This effort, the Great Lakes Regional Collaboration (GLRC), ultimately involved over 1,500 individuals, and eight strategy teams focusing on particular subject areas. The teams solicited public input, developed recommendations, and worked together to produce a strategy to address the threats to and damage already suffered by the lakes. That plan, since referred to as the Great Lakes Regional Collaboration Strategy, and the analysis supporting it can be found in the *Great Lakes Regional Collaboration Strategy To Restore and Protect the Great Lakes*, published in December 2005.

The GLRS has a number of major elements, which involve various combinations of federal, state, local, and, in some cases, tribal and private resources:

Enhancing Coastal Health

The GLRC Strategy report emphasized the importance of assuring that contacts with near-shore waters do not pose a risk to human health. Near shore waters are sources of drinking water, and are places for recreational activities such as swimming and fishing. Several recent disturbing trends—continued stormwater sewer overflow discharges, waterborne disease outbreaks, and beach closing and advisories—therefore must be reversed.



Source: Authors' analysis

The GLRC Strategy proposes to eliminate by 2020 discharges of untreated or inadequately treated human and industrial wastes to Great Lakes basin waters from municipal wastewater treatment and on-site disposal systems through efforts that:

- improve municipal wastewater treatment facilities along the Great Lakes (five year total of $13.7 billion);
- improve drinking water quality through protection of drinking water sources ($1.61 billion); and
- develop more rapid and more accurate tests for determining when beach water is safe for swimming ($7.2 million).

Treating Areas of Concern (AOCs)

In 1987, a joint U.S.-Canadian Commission designated 43 Areas of Concern (AOCs) for high priority cleanup efforts. The AOCs were designated on the basis of 14 different types of impairment relating to the eating of fish, ability to drink water and swim, and ecological impacts (such as the loss of diversity in aquatic life and destruction of fish and wildlife habitat). The strategy report proposes as a goal to restore all of the Great Lakes AOCs by 2020 (with interim targets in the meantime). Toward this end, the GLRC Strategy recommends:

- that Congress appropriate $750 million over 5 years, under the Great Lakes Legacy Act, to remediate contaminated sediment sites in the AOCs (along with various amendments to the Act itself);
- that Congress provide funding of $50 million over 5 years to support state and community-based coordinating councils in the AOCs and $8.5 million over 5 years to the EPA Great Lakes National Program Office for regional coordination and program implementation; and
- that Congress fully fund, at $3 million annually, the research and development program authorized in the Great Lakes Legacy Act.

Reducing Non-Point Contamination Sources

Water pollution from non-point sources contributes significantly to the impairment of waters in the Great Lakes basin and has particularly damaging effects on wetlands and tributaries. The GLRC Strategy aims to protect and restore existing wetlands in both urban and rural areas so that all water bodies across the Great Lakes region function as healthy ecosystems. To achieve these objectives, the strategy report recommends that funds be provided to:

- restore up to 550,000 acres of wetlands over 5 years, recognizing that 50 percent to 70 percent of the historic area wetlands already have been lost (between $375 million and $944 million);
- restore 35,000 acres of buffer areas in urban and suburban areas ($335 million);
- implement measures to reduce by 40 percent the soil loss in 10 selected watersheds ($120 million);
- support the development and implementation of comprehensive nutrient and manure management on livestock farms ($106 million); and
- achieve hydrological improvements in ten urban watersheds ($90 million).[6]

Toxic Pollutant Strategy

Although certain toxic substances have been reduced significantly in the Great Lakes region, they continue to be present at levels that pose threats to human and wildlife health. Accordingly, the strategy calls for the virtual elimination of future discharges of any and all "persistent toxic substances" (PTS) to the Great Lakes ecosystem, a significant reduction to exposure to PTS from historically contaminated sources, a reduction of toxic chemicals to the point where all restrictions on the consumption of fish from the lakes can be eliminated, and protection of the health and integrity of wildlife populations and habitat from the adverse effects associated with the release of PTS. To achieve these objectives, the strategy report recommends that funds be provided to:

- reduce and virtually eliminate principle sources of mercury, PCBs, dioxins, and other toxic substances in the Great Lakes Basin ($60 million);
- prevent new toxic chemicals from entering the Great Lakes Basin ($80 million in spending, $250 million in tax incentives);
- institute a comprehensive research, surveillance, and forecasting plan for identifying, managing, and regulating chemical threats to the Great Lakes Basin ($25 to 50 million, in addition to the $1.5 billion likely to be spent already over the next five years);
- launch a public education and messaging campaign relating to threats of toxins to fish consumption ($68 million in new spending); and
- support efforts to reduce continental and global sources of PTS to the Great Lakes Basin ($30 million in new spending).

Preserve Habitats and Enhance Conservation

Development in the Great Lakes Basin has resulted in the loss of more than half of the region's wetlands, and has degraded habitats, threatened numerous plant and animal species, and damaged the lakes' ability to resist stresses such as pollution. These habitats play a critical role in maintaining local ecosystems, as well as the social and economic vitality of the region, thus repairing and protecting them is a vital component of the overall strategy.

The GLRC Strategy aims to restore and preserve habitats and native species in the lakes themselves; maintain the full range of ecosystem services in area wetlands; ensure sustainability of Basin streams, rivers, and tributaries; and restore coastal shore habitats and the processes that sustain them. To accomplish these goals, the GLRC report proposes an increase in habitat conservation and special management funding by $289 million/year, for a five-year total of $1.45 billion.

Addressing Aquatic Invasive Species

Aquatic Invasive Species (AIS) have posed a continued threat to the Great Lakes ecosystem for at least several decades. The GLRC Strategy has two goals: to prevent all new introductions of

AIS into the Great Lakes, and to halt the spread of existing AIS within the Basin (or, if impossible, to control AIS levels to ensure that ecosystems and the social, economic, and cultural uses they support are sustainable). To achieve these goals, the strategy report recommends that (five-year cost estimates are provided in parentheses):

- efforts be made to eliminate and/or control AIS spread by ships and barges ($66 million);
- federal, state, and local governments enact measures—including full federal funding of the Chicago Sanitary and Ship Canal barrier—to ensure that AIS are not introduced through the Basin's canals and waterways, ($225 million);
- federal and state governments implement measures preventing the introduction and spread of AIS through the trade and potential release of live organisms ($85 million);
- that an AIS management program be established to implement rapid response and control ($220 million); and
- outreach and education programs be designed and aimed at recreational and other users of the Great Lakes ($98 million).

Develop a System of Indicators and Information

A successful restoration strategy for the Great Lakes Basin will require consistent monitoring and measuring of key indicators of the functioning of the lakes' ecosystem. Current efforts are under-funded. To ensure adequate tracking of the lakes' health, the strategy recommends a series of measures aimed at collecting, analyzing and disseminating key information, including doubling the current Great Lakes research budget and increasing the involvement of universities. The total estimated cost for these measures is $350 million over five years.

Assuring Sustainable Development

Finally, the GLRC Strategy contains a series of measures aimed at assuring that further development in the Great Lakes Basin is environmentally sustainable. Toward this end, the strategy report recommends that:

- state and local governments in the region encourage sustainable development;
- state and regional planning and governance be aligned to enhance sustainable planning and management of resources ($115 million);
- marketing and outreach programs be launched to educate consumers and users on sustainable alternatives ($10 to 20 million);
- adequate resources be provided to implement this overall strategy ($30 million).

Total Cost of Great Lakes Restoration Initiative

All told, the total cost of the GLRS, taking into account both the initial capital costs and the continuing operating costs, is an estimated $26 billion in present value.

At this writing, the governors of the U.S. Great Lakes states have agreed to use the GLRC Strategy to guide future restoration efforts, and legislation to implement the strategy has been introduced in both houses of Congress. In fact, several major elements of the strategy are already moving through Congress. A habitat restoration measure, the Great Lakes Fish and Wildlife Restoration Act, passed last year. So did partial funding for the highest priority of the strategy: an electric barrier to keep Asian and silver carp out of Lake Michigan. This year, the House passed a multi-billion dollar bill to pay for sewage treatment upgrades; the House and Senate have both passed legislation to complete work on the electric fish barrier; and both chambers are marking up bills to address invasive species in a comprehensive way.

Given these developments, it is thus both timely and highly relevant to examine both the benefits and costs of the strategy—topics that will be discussed in the following section.

III. The Economic Benefits of Great Lakes Restoration: Key Findings

Developing America's North Coast presents the results of two approaches to estimating the benefits of the GLRC Strategy:

(1) ***Economic Benefits of Specific Improvements***: The study first identified the specific improvements in the environment that were expected from restoration, valued them, and then added up the individual estimates to arrive at a total.

(2) ***Aggregated Economic Benefits:*** The study also estimated the increase in property values in all the areas likely to be affected by the restoration initiative and then summed them to arrive at a total. The property value increase reflects how individuals value all of the various disaggregated benefits associated with restoration of any given area.

The findings of these analyses are summarized here. Some of the benefits are presented in ranges, reflecting the significant uncertainties involved, and extend considerably further into future (appropriately discounted) than the five year period of the initial investment. As noted below, the present value of the initial investment and the operating costs required to implement the GLRC Strategy total $26 billion. This figure should be subtracted from estimates of the gross economic benefits to arrive at the *net* economic benefits to be expected from implementation of the strategy.

Direct Economic Benefits of Specific Improvements

The team's analysis revealed that the restoration of the Great Lakes would yield numerous direct, specific economic benefits:

Restoring the lakes will lead to direct economic benefits of $6.5–11.8 billion dollars from tourism, fishing, and recreation alone

Water-based recreation. During 2005, Great Lakes beaches were plagued by nearly 3000 days of beach closings and advisories, with the total number of closings and advisories up 5 percent from 2004 to 2005. A major feature of the GLRC Strategy would eliminate untreated or undertreated human and industrial waste flowing into the Great Lakes from municipal wastewater treatment systems, ultimately leading to a reduction in beach closings and advisories. Research suggests beachgoers would value a 20 percent reduction in beach closures at about $23 per visitor per year, or about $1.50 per visit. With 8 million swimmers and 80 million swimming days annually in the Great Lakes, the economic benefit from a 20 percent reduction in beach closings and advisories would be $130 to $190 million per year, which translates into a present value of about $2 to $3 billion dollars.[7]

Recreational and commercial fishing. In the absence of any further actions to bolster the Great Lakes fishery, which in some locations is in decline, game fish abundance is likely to further decline by 25 percent to 50 percent relative to current levels over the course of the next two decades. A number of studies reliably estimate the benefits to recreational anglers and commercial fisheries from increased fish health and abundance in the Great Lakes. Studies also estimate the benefits to Great Lakes anglers and elsewhere of lower fish contamination levels. The benefits related to fish abundance alone are conservatively estimated at $1.1 to $5.8 billion dollars.

Birds, birding, and wildlife tourism and recreation. There are about 17 million bird watchers in the Great Lakes states, including an estimated 5 million bird watchers in the Great Lakes basin.[8] In the absence of any restoration efforts, meadow marsh habitat would decline 5 percent annually and eventually to zero over the next two decades. The authors project that a 100 percent loss of such habitat would lead conservatively to a 5 percent to 10 percent decline in waterfowl hunting and birding opportunities. How much economic activity is involved in birding? One estimate suggests that wildlife viewing trips within a viewer's state of residence generate a surplus value of about $40 per trip in 2006 dollars, while trips to locations outside a

viewer's state of residence generate a surplus value of about $153 per trip.

Assuming that reductions in habitat occur gradually over 20 years, and that potential improvements resulting from the GLRC Strategy occur gradually over 10 years, the total present value of the benefits of the plan for Great Lakes birders is about $100 to $200 million. Present value benefits related to waterfowl hunting would conservatively add an additional $7 to $100 million.

Ancillary benefits. The benefits of sport fishing, bird watching, swimming, and beachcombing principally accrue to individuals. But there are secondary benefits felt by others in the Great Lakes economies as these individuals purchase equipment, transportation, lodging, and other goods and services. These economic impacts are not quantified in this analysis.

Direct Economic Effects from Recreation and Tourism

Improvement	GLRC effect (relative to baseline)	Affected value	Present value benefit (relative to baseline)
Increased fish abundance	30%–75% increase	Improved catch rates for anglers	$1.1–$5.8 billion or higher
Avoided dislocation of sport-fishery workers and assets	20% reduction or higher	Maintenance of sport-fishery wages and profits	$100–$200 million or higher
Reduced bacterial and other contamination leading to fewer beach closings and advisories	20% reduction		
More swimming activity	$2–$3 billion		
Improved water clarity at beaches	5% improvement or higher	More swimming and improved enjoyment of swimming activity	$2.5 billion or higher
Improved wildlife habitat leading to more birds	10%–20% improvement	Improved opportunities for birding	$100–$200 million or higher
Improved wildlife habitat leading to more waterfowl	10%–20% improvement	Improved opportunities for waterfowl hunting	$7–$100 million

Restoring the Great Lakes will directly raise coastal property values $12 billion to $19 billion by remediating Areas of Concern (AOCs)

The GLRC Strategy also recommends the clean up of contaminated sediments in (AOCs), which, in addition to benefiting aquatic ecosystems, may reduce the real or perceived health risk associated with living near these contaminated areas. Remediation of contaminated sediment may also allow nearby residents and visitors to use these areas for recreational purposes without fear of adverse health effects.

There are over 11 million housing units in the Great Lakes drainage basin.[9] Based on a study by Stoll and colleagues, which finds that each of these households is willing to pay $150 per year to clean up contaminated sediment completely in Areas of Concern over the next one to two decades, the total value of cleaning up AOCs should total at least $1.7 billion annually for 10 to 20 years, or $12 to $19 billion in present discounted value (the range reflects the 10 to 20 year time period).[10] This estimate reflects both the benefits to households living near AOCs, as well as the benefits to households in more distant areas of the basin, who travel to AOCs or benefit from the knowledge that the AOC locations are being improved for current and future generations. The $12 to $19 billion in benefits associated with legacy toxic sediments in AOCs is not likely to overlap with the other benefits quantified in this study, which are generally associated with species, resources, and/or geographic locations unrelated to AOCs.

Even this range is conservative, however, because it does not account for the "existence" or non-use value that individuals living outside the Great Lakes basin would derive from knowing

that the Great Lakes are cleaner for future generations. Such values could be substantial and also help explain why the federal government has contributed to the cleanup of contaminated areas throughout the country, as discussed in the next section.

Direct Benefits of Remediating Areas of Concern

Improvement	GLRC effect (relative to baseline)	Affected value	Present value benefit (relative to baseline)
Remove contaminated sediment in Areas of Concern (AOC)	All toxic sediment contamination remediated	Basin residents benefit directly or indirectly from knowledge that AOCs are being restored	$12–$19 billion
Use values (e.g., health-related and recreational) and non-use values (e.g., "existence" and "bequest") for unquantified resources	Unquantified	Multiple	Potentially single digit billions or higher

Restoring the Great Lakes will reduce costs to municipalities by $50 to $125 million dollars

Sediment management actions in the GLRC Strategy are designed to reduce sedimentation by as much as 40 percent in selected watersheds. Given that the operating costs for water supply facilities that draw on water from the Great Lakes total an estimated $600 million in 2006 dollars, the strategy's goal of achieving a 40 percent reduction in sedimentation might be expected to reduce drinking water treatment costs by $12 million per year.[11] A more conservative 10–25 percent reduction in sedimentation would reduce costs by $3 to $7 million annually.

Direct Benefits from Reducing Water Treatment Costs

Improvement	GLRC effect (relative to baseline)	Affected value	Present value benefit (relative to baseline)
Reduced sedimentation	10%–25% reduction	Lower water treatment costs for municipalities	$50–$125 million

Restoring the Great Lakes will produce additional unquantifiable but significant economic activity by making the region more attractive to business and workers

By restoring the Great Lakes ecosystems and the many environmental and aesthetic benefits that these ecosystems provide, the GLRC Strategy clearly will improve the general quality of life in the Great Lakes basin. This, in turn, will assist the region in attracting and retaining a talented workforce.

There is substantial evidence in the economics literature documenting that people are willing to pay more to locate in areas with high environmental quality.[12] Home values differ within and across metropolitan areas, with residents paying more to live in areas with parks and open spaces, lakes, rivers, wetlands, good air quality, and other environmental amenities.[13] At the same time, residents of environmentally attractive areas actually enjoy higher real wages (current wages adjusted for inflation). For example, one recent study found that living 100 miles closer to a national park is equivalent to a wage increase of 4 percent, holding housing prices fixed.[14] Other studies find similarly large wage-equivalent effects of environmental quality, as

measured by local air and water pollution, landfill waste, and the number of Superfund and hazardous waste sites nearby.

While none of these studies, nor this one, attempt to estimate the wage-equivalent benefits of improving the environmental quality of the Great Lakes, they do provide evidence that such improvements would increase the attractiveness of Great Lakes basin cities to mobile workers. There is already evidence around the Great Lakes of this dynamic at work: Along Chicago's waterfront and the Chicago River, for example, old factories and warehouses are being converted to gleaming new offices and residences, and the waterfronts of both Milwaukee and Detroit are now serving as fulcrums for massive urban renewal efforts. Meanwhile, Traverse City and Marquette, Michigan, Wisconsin's Door Peninsula, and Duluth on Lake Superior are already communities of choice for many well-educated professionals seeking proximity to the Great Lakes.

Overall, then, the rejuvenation of the Great Lakes and its waterways has the potential to pay important dividends for the region: If more of the region's homegrown talent stays in the Great Lakes region, and others are attracted to it, the lakes become a resource for economic growth, and thus contribute directly and indirectly to the region's health and prosperity.

All told, the direct economic benefits of restoring the Great Lakes total at least $50 billion

As the charts above indicate, the quantifiable economic benefits that can be expected from restoring the health of the Great Lakes range from $18 to $31 billion, or higher. Additional benefits that cannot be quantified are likely to add at least several billion dollars. And finally, new technology development and growth of local economies would add additional billions. In total, then, the economic impacts that can be expected from cleaning up the lakes are at least $50 billion.

Aggregate Economic Benefits

Another way to value the economic impact of Great Lakes restoration implementation is to estimate the increase in property values that is likely to result from these activities. This second approach yields a similar result to the first method described above.

A number of studies provide estimates for increases in property values following cleanup activities in various Great Lakes cities. To be conservative, the study team used the lower bounds of those estimates for the region: a 10 percent increase in property values for those living in census tracks adjacent to the Great Lakes, and an average 1 percent to 2 percent increase for properties within major metropolitan areas that abut them. Applying these data together, the restoration of the lakes would increase residential property values by an estimated $29 to $41 billion. When improvements in commercial property values are taken into account, the benefits of the restoration would exceed $50 billion.

Short-term Multiplier Effects

Aside from these long-term economic benefits, the team estimates increases in short-term economic activity of between $30 billion and $50 billion, primarily for the Great Lakes region. These so-called "multiplier effects" are well-documented: The spending of $1 by a fiscal authority typically results in additional spending in a region of between 1.5 and 2.5 times the original spending, as contractors and their employees spend what they receive from government on other purchases, whose suppliers and their employees also spend what they receive, and so on.

However, these short-term multiplier effects do not themselves justify spending on Great Lakes restoration. Spending $20 billion of public funds on other types of initiatives would lead to similar benefits, thereby justifying *any* expenditure in the region. However, because the $20 billion in spending is justified for other reasons—including the $50 billion in long-term economic benefits estimated for both the region and the nation— the multiplier effect is real and must be taken into account as one of the significant economic impacts of Great Lakes restoration.

Overall Economic Impact of Great Lakes Restoration

In sum, the study estimates the following present-value economic benefits from implementing the GLRC Strategy:

- Over $50 billion in long-term benefits; and
- Between $30 and $50 billion in short term multiplier benefits.

In addition to these quantifiable benefits, implementation of the strategy is likely to encourage the development of new technologies and industries that will be built around an environmentally improved Great Lakes region. Although sufficient information is not available at this point to quantify and put a dollar value on these benefits, they are nonetheless likely to occur. Moreover, the benefits accruing from any technological developments would accrue to the nation as a whole, and not just the Great Lakes region. The same is true of the reduced congestion and disaster costs elsewhere in the country that would follow in the wake of enhancing the attractiveness of the Great Lakes region as a place to work and live. Taking all the projected benefits into account, the GLRC Strategy clearly passes a cost-benefit test.

IV. Policy Implications and Conclusion

The 12-state Great Lakes economic region is a vital part of the U.S. economy. Over the past 150 years, many of the economic and social innovations that have driven U.S. prosperity were created here—from the auto to the airplane to the Internet. It is a huge domestic marketplace, home to nearly one-third of the country's population and producing one-third of its Gross State Product.[15] And its innovation infrastructure is unrivaled: 300 of the nation's Fortune 1000 firms are located here, and it has the world's leading network of universities, which together produce 38 percent of the nation's bachelor's degree holders, and 37 percent of the its advanced science and engineering graduates.[16]

But the region's industrial dominance has also left many challenges, including a lack of entrepreneurialism, lagging education attainment levels, and a drain of talent to more dynamic communities elsewhere in the country.

That needs to change.

The Great Lakes and its waterways offer a tremendous opportunity for reinvigorating the economy of the region, and boosting the competitiveness of the nation as a whole. While other regions face long-term sustainability challenges from lack of water, congestion, costs of infrastructure, sprawl, and natural disasters, the country's "North Coast" offers the prospect of environmentally and financially sustainable commercial and population growth. But in order to capitalize on this asset, policy makers need recognize its value, and invest accordingly. This can happen in two major ways.

First, federal policy makers should understand the economic significance of Great Lakes restoration, and realize that by enacting the legislation currently before Congress to implement the GLRC Strategy they can deliver important economic benefits to both the regional and national economies. And they need to act soon: If the full $26 billion of funding is not provided over the next five years as recommended in the strategy, the health of the lakes will continue to deteriorate, and the costs associated with their restoration will continue to rise.

Second, federal, state, local, and tribal policy makers should work together to support the lakes potential as a major resource in developing freshwater protection, treatment, and energy conservation technologies. The nation and the world face mounting challenges concerning access to, and efficient use of limited freshwater resources. At the same time, concern over global climate change is driving attention to energy conservation—and the use of water for heating, cooling, sanitation, and growing food in more sustainable ways.

The Great Lakes region could be at the center of water-based innovation. Not only is it the world's largest single repository of freshwater, it is already home to the nation's leading freshwater research centers, and the largest number of private firms engaged in various ways in fresh water technology. Stewardship of the lakes—through follow-through on GLRC Strategy as well as federal, state, and local freshwater technology research and development activity as the ini-

tiative is implemented—is key to expanding upon the region's emerging prowess, and spurring advances in technologies that could prove vital to the region and beyond.

For the past half century, the Great Lakes region has struggled to find its niche in a changing global economy. The Great Lakes themselves can be a key asset in this process—serving as a platform for sustainable economic growth, a crucible for freshwater protection and technology development, and the foundation for this region to thrive anew as a magnet for skilled workers. The potential is there to be tapped, provided that federal, state, local, and tribal leaders work together to commit the resources needed to ensure that the health and beauty of the lakes is restored and maintained in the 21st century and beyond.

Endnotes

1. John Austin is a non-resident senior fellow at The Brookings Institution and vice president of the Michigan State Board of Education. Soren Anderson is a doctoral candidate in economics at the University of Michigan. Paul Courant is Harold T. Shapiro Collegiate Professor of Public Policy, professor of economics, and director of the Center for State, Local and Urban Policy at the University of Michigan. Robert Litan is a senior fellow at the Brookings Institution and vice president for research and policy at the Kauffman Foundation.

2. The first major product of this initiative, published in 2006, was *The Vital Center: A Federal-State Compact to Renew the Great Lakes Region*. This report identified areas of regional economic opportunity and comparative advantage that can nurture robust and sustainable economic growth for the benefit of the region and the nation. Prominent among its recommendations was investing in the Great Lakes themselves.

3. "Great Lakes" means Lake Ontario, Lake Erie, Lake Huron (including Lake Saint Clair), Lake Michigan, and Lake Superior, and the connecting channels (Saint Marys River, Saint Clair River, Detroit River, Niagara River, and Saint Lawrence River to the Canadian Border).

4. This document is available on the Web, see **www.restorethelakes.org/PrescriptionforGreatLakes.pdf**.

5. See John C. Austin, Soren Anderson, Paul N. Courant, and Robert E. Litan, *America's North Coast: A Benefit-Cost Analysis of a Program to Protect and Restore the Great Lakes*, available at **www.healthylakes.org** and **www.cgli.org**

6. The GLRC Strategy identifies these cities as likely candidates: Duluth, Milwaukee, Green Bay, Gary, Detroit, Cleveland, Toledo, and Buffalo.

7. Figures are estimates based on the numbers of swimmers and swimming days in Atlantic and Pacific ocean coastal states that have similar climates as the Great Lakes states.

8. This estimate is based on the fact that approximately 28 percent of people living in Great Lakes states live in the Great Lakes Basin.

9. This total is for housing units in Great Lakes basin counties in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin, as well as housing units in coastal counties in New York and Pennsylvania. We have not attempted to identify New York and Pennsylvania counties that are in the Great Lakes basin other than those adjacent to the coast. Figures are based on 2000 U.S. Census Data, available at: **marineeconomics.noaa.gov/socioeconomics/czcounties/cw_pop_housing/cw_mainpage.html**.

10. John R. Stoll, Richard C. Bishop, and J. Philip Keillor, *Estimating Economic Benefits of Cleaning Up Contaminated Sediments in Great Lakes Areas of Concern* (Madison: University of Wisconsin Sea Grant Institute, 2002).

11. According to the U.S. Census, municipalities in Great Lakes states spent $4.5 billion on operation and maintenance of water supply systems in 2002 in 2006 dollars. These costs include acquisition and distribution of water to the general public or to other local governments for domestic or industrial use. About 28 percent of the people in these states live in the Great Lakes drainage basin. (We obtained the total number of state residents in 2000 from U.S. Census and the number of basin residents in 2000 from **www.great-lakes.net/envt/flora-fauna/people.html**.) About 47 percent of basin residents depend on the Great Lakes for their drinking water, according to the EPA. (See **www.epa.gov/glnpo/p2/bns.html**.) This implies that about 13 percent of Great Lakes states residents depend on the Great Lakes for their drinking water. Assuming that municipal water utility costs per capita are roughly uniform within these states, 13 percent of $4.5 billion implies total water utility operating costs of about $600 million for municipalities that rely on Great Lakes water.

12. See, e.g. Jennifer Roback, "Wages, Rents, and Quality of Life," *Journal of Political Economy* (90) (1982): 1257–1278; Jennifer Roback, "Wages, Rents and Amenities: Differences among Workers and Regions," *Economic Inquiry* (26) (1988): 23–41; and Glenn C. Blomquist, Mark C. Berger, John P. Hoehn, "New Estimates of Life in Urban Areas," *American Economic Review,* (78) (1988): 89-107.

13. See Soren T. Anderson and Sarah E. West, "Open Space, Residential Property Values, and Spatial Context," Regional Science and Urban Economics (36) (6) (2006): 773–789, and Kenneth Y. Chay and Michael Greenstone, "Does Air Quality Matter? Evidence from the Housing Market," *Journal of Political Economy* (113) (2005): 376–424.

14. Paul Courant and Lucille G. Schmidt, "Sometimes Close is Good Enough," *Journal of Regional Science*, (46) (5) (2004): 931–951.

15. U.S. Bureau of Labor Statistics, 2005.

16. Science and Engineering Indicators, 2006. Advanced degrees include only master's and doctoral degrees. Science and engineering degrees include physical, computer, agricultural, biological, earth, atmospheric, ocean, and social sciences; psychology; mathematics; and engineering.

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About the Great Lakes Economic Initiative

The Great Lakes Economic Initiative is a multi-year research and policy development initiative to improve the economic vitality of the 12-state Great Lakes region. The initiative, launched in 2005, culminated in the development and dissemination of a framing report, The Vital Center: A Federal-State Compact to Renew the Great Lakes Region, released in October 2006.

The Great Lakes Economic Initiative is also a critical part of the Brookings Blueprint for American Prosperity, which advances federal policies central to U.S. competitiveness and provides independent and powerful ideas to shape the 2008 campaign debate and the work of the next administration.

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