

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
)
WATER QUALITY STANDARDS AND)
EFFLUENT LIMITATIONS FOR THE) R08-9
CHICAGO AREA WATERWAY SYSTEM) Subdocket C
AND THE LOWER DES PLAINES RIVER:) (Rulemaking – Water)
PROPOSED AMENDMENTS TO 35 Ill.)
Adm. Code Parts 301, 302, 303 and 304)

PRE-FILED TESTIMONY OF DARREN MELVIN

Good morning, my name is Darren Melvin. I am currently employed by Hanson Material Service as the Marine Operations Manager based in Romeoville, Illinois. I have been employed by Hanson Material Service since 1989 in various capacities. The positions I have held were all related to commercial navigation within the Chicago Area Waterway System (CAWS) including the Chicago River, the Chicago Sanitary and Ship Canal (CSSC), and the Lower Des Plaines River (LDPR). I have also been an active member of the Illinois River Carriers Association and the American Waterways Operators (AWO), both of which interact with the U.S. Coast Guard and the U.S. Army Corps of Engineers. My interactions with these two agencies have primarily involved issues regarding development and safety along the aforementioned waterways.

I am testifying today as a representative of AWO, the national trade association for the tugboat, towboat and barge industry. I am a member of the Board of Directors for AWO. I will be providing AWO's perspective on the proposal by the Illinois Environmental Protection Agency (IEPA) to amend water quality standards in the CAWS and the LDPR, as the amendments relate to aquatic life uses.

My testimony will focus on the following items: (1) the importance of preserving navigation in the CAWS to the regional economy, environment and road traffic; (2) the impact of potential strategies employed by federal and state agencies to limit the transfer of invasive species on companies engaged in waterborne commerce, and the relationship between this proposal and that effort; (3) the impact of increased recreational traffic in the waterways on safety; and, (4) the federal requirement to protect navigation. I believe that the arguments I will set forth in these areas will convince the Board that it should refrain from amending water quality standards in these waterways.

1. The Importance of Preserving Navigation in the CAWS to the Regional Economy, Environment and Road Traffic

AWO represents 350 member companies in an industry of nearly 4,000 towing vessels, more than 27,000 dry and liquid cargo barges and over 30,000 mariners. About twenty AWO members transit through or are based on the CAWS and at least six non-AWO towing companies also rely on this system.

These companies in our association, and more broadly, the companies that are part of our industry, rely on the free flow of commerce on the waterways. Additionally, the customers that these companies serve are dependent on waterborne commerce, as are the citizens of the greater Chicago region. The products imported and exported by barge through the CAWS include petroleum products, agricultural products, coal for regional power plants, road salt, steel, cement and countless raw materials for processing or manufacturing. The supply of products that are critically important to the Great Lakes-Midwest region during the winter months, such as road salt, home heating oil and

aircraft-deicing fluid, depend heavily on the towing industry and the use of the CAWS. Transport by barge and towing vessel is the most cost-effective and environmentally friendly way to move these materials.

The impact of the activity described above is substantial, as can be seen by the reality that in 2008, 12.4 million tons of cargo transited Lockport Lock, over 6 million tons of commodities moved through the Calumet-Sag Channel, 1.3 million tons of commodities traveled on the Chicago River and 1.1 million tons of materials transited Lake Calumet. Moreover, nearly 16 million tons of commodities moved through the CSSC during that year. The CSSC figure is significant because, although the canal would remain a non-recreational water under IEPA's proposal, interruptions in barge traffic through a significant part of the CAWS will impact all portions of the system. The transport of materials frequently move through different bodies of water within the system, making the CAWS an integrated network incompatible with the type of fragmentation that would result from adoption of this proposal. The other bodies of water referenced above would be directly impacted by the introduction of increased recreational traffic, as envisioned through IEPA's proposal.

The significance of continued barge transportation to the regional economy has been analyzed and quantified. For example, a recent study by the Ports of Indiana (Attachment 1) found 17,655 jobs and \$1.9 billion in economic activity in northwest Indiana attributable to barge movements through O'Brien Lock alone during 2008. Additionally, a study by DePaul University in April (Attachment 2) concluded that the conservative and preliminary economic value of the industry is \$4.7 billion.

While discussing the economic impact of the industry, it is also important to touch on some of the claims made by the U.S. Environmental Protection Agency (EPA) in its letter to the Board from April 15 regarding use attainability analysis (UAA) Factor 3. EPA states that, in order to allow for more recreation, “place, time and manner restrictions could be placed on barge and commercial boat traffic.” This statement does not take into account the logistics of arranging for the pickups and deliveries of essential commodities such as coal, iron ore, concrete and petroleum products to and from locations as far away as Pittsburgh, New Orleans, Milwaukee, Detroit, Montreal and all points in between. Consumers and businesses rely on the timely movement of these items, and placing arbitrary restrictions on their transport will have negative impacts upon the region as a whole. This was seen in August 2009 when the CSSC was closed for a week due to safety testing of the electric barriers, and stalled vessels cost the regional economy hundreds of thousands of dollars a day in increased transportation costs.

EPA’s other statement concerning navigation and UAA Factor 3 would lead to misinterpretations of the appropriate uses for the waterways if taken to be true. Specifically, the agency suggests that “there may be certain times when barge traffic is less intense, such as holidays or weekends.” There is no evidence to support this assertion and no reason to believe that it is accurate. Due to already building in time for travel through locks and events such as inclement weather, towing companies do not have the luxury to arrange for vessels not to be in transit on certain days of the week or periods of the year. EPA’s perspective on this matter, therefore, severely misstates underestimates waterborne commerce movement.

Beyond the commercial impact, limiting navigation would also do a great deal of harm to the Chicago region's air quality and its quality of life. This is due to the reality that if essential commodities are moved along the waterways in smaller amounts, they will likely travel by train or truck instead. The result of this would be a net negative for the regional environment. As reported in a study by the Texas Transportation Institute (TTI), sponsored by the Maritime Administration of the U.S. Department of Transportation and the National Waterways Foundation, if the annual amount of ton-miles of activity on the nation's inland waterways were transferred to rail or truck, the former mode would produce 2.1 million additional tons of carbon dioxide, while the latter mode would generate 14.2 million additional tons of the pollutant.

The TTI study also found that a cessation of waterborne commerce in the smaller metropolitan area of St. Louis would increase that region's traffic delays by almost 500%, and increase the injuries and fatalities on the region's highways by up to 45%. By way of comparison, the Chicago region has an estimated population of 9.7 million, while the St. Louis region has an estimated population of only 2.8 million. Barges also assist congestion relief by providing greater carrying capacity than their counterparts in other modes. For example, one barge on the inland river system is able to carry the same amount of dry cargo as 70 trucks, and the same amount of liquid cargo as 144 trucks.

As a result of these factors, if IEPA's recommendations on revisions to proposed recreational uses in the waterways are adopted, the economy, air quality and automobile traffic flow of the Chicago region would be significantly harmed. By encouraging a greater amount of recreational activity in the waterways, IEPA would increase air emissions and highway fatalities. A decreased amount of commercial navigation is likely

given the safety issues introduced by more recreational vessels, as described below in the section of the testimony on safety. This is important to consider when determining the appropriate use designations for the waterways.

2. The Impact of Potential Strategies Employed by Agencies to Limit the Transfer of Invasive Species on Companies Engaged in Waterborne Commerce, and the Relationship Between this Proposal and that Effort

Concern about the entry of invasive species into Lake Michigan via the CAWS has led to a number of actions and considerations of additional actions by various federal and state agencies over the last several years. An electric dispersal barrier designed to prevent the transfer of Asian carp was installed in 2002 in the CSSC by the U.S. Army Corps of Engineers. In the years since, an additional barrier has been added and a third barrier is scheduled for completion this fall. In order to ensure the safety of mariners and vessels traveling through this area, the U.S. Coast Guard has established Regulated Navigation Areas (RNA) with conditions for travel through the barriers over this period of time. The conditions of the RNAs have varied based on the voltage of the barriers and whether or not they are undergoing safety testing at a particular time. In August 2009, for example, the voltage of one of the barriers was increased, leading to a week-long closure of the CSSC.

Action to address the potential for Asian carp transfers have increased significantly since late 2009. In December of that year, the Illinois Department of Natural Resources (IL DNR) applied rotenone, a fish poison, to portions of the CSSC and the Cal-Sag Channel in an attempt to kill carp that were believed to be in those areas.

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These actions were undertaken in response to positive eDNA tests conducted in the two bodies of water, even though eDNA does not have widespread support in the scientific community and has not been peer-reviewed. While the application took place, the waterways were closed to vessel traffic. These closures took place without warning, and caused disruptions to pickups and deliveries that had been scheduled for this time period. The rotenone application led to the discovery of only one carp, and that fish was found several miles south of the electric barriers. A second application of rotenone that took place in May 2010 in the Cal-Sag Channel also revealed no carp. As in the case of the first application, the waterway was closed with limited warning to industry. During the May application, the waterway was closed for one week. In addition to the fish poisoning, electro-fishing and netting have been occurring in parts of the CAWS since November 2009, and no Asian carp believed to have crossed the electric dispersal barriers has been identified.

In February 2010, a consortium of federal and state agencies known as the Asian Carp Regional Coordinating Committee (ACRCC) released a Framework with a number of actions and plans for actions designed to counteract the spread of Asian carp. A revised version of this Framework was released in May 2010. Included in the actions being considered and investigated in the Framework is hydrological separation of the Great Lakes and the Mississippi River basin. This action, which has also been supported by some states in the Great Lakes region and some members of the U.S. Congress, is currently being studied by the Corps, a member of the ACRCC. That study is scheduled to be released in 2012. Physical separation would be devastating for the towing industry, as well as to the customers, businesses and employees that rely on the timely, safe and

environmentally efficient transportation of essential commodities. AWO has worked to educate officials at the federal and state levels about the shortcomings of hydrological separation.

Other actions that were considered by the ACRCC for a period of time were closures of the Chicago and O'Brien locks. These are still being considered as part of proposals before Congress. Closing locks would also be an unfortunate step as it would severely limit the amount of barge transportation in the region. Furthermore, as has been acknowledged by various parties in this matter, locks were not designed as fish barriers and would not be able to interrupt carp movement. Officials have also acknowledged that locks would have to be opened periodically during flooding.

Through its work with federal and state agencies, AWO and its members have been supportive of a variety of methods to prevent carp migration into the Great Lakes, and have stated this to the appropriate agencies. These methods include: commercial fishing and targeted fish sampling; increased law enforcement options to prevent invasive species importation; expedited completion of the third electric barrier; the discovery of the response of the carp to pheromone products; the identification of selective toxicants to control the carp; and, the introduction of acoustic bubble barriers to the waterways. The goal of AWO is to protect the ecosystem of the Great Lakes while ensuring that waterborne commerce can continue in the region.

Given our interest in prevention of invasive species transfer, we are very concerned about the apparent contradiction between the IL DNR and other agencies seeking to continue engaging in efforts to eradicate carp throughout the waterway system, while the IEPA simultaneously seeks to alter the water quality of the CAWS to make the

northward movement of carp more likely through this proposal. This is particularly troubling to us as the rotenone applications that have taken place thus far have resulted in substantial numbers of fish killed. The May 2010 application, for example, killed more than 11,000 fish. As indicated above, none of these were Asian carp. If IEPA's proposal results in more carp movement, it would be unfortunate to have one of the results be a greater necessity to harm more fish and further disrupt the local ecosystem. In general, we respectfully suggest that there should be more coordination between state and federal agencies on what appropriate goals are with respect to the future of the fish population, including Asian carp, in the waterway system.

3. The Impact of Increased Recreational Traffic on Safety in the Waterways

An increase in the amount of recreational vessels on the CAWS and the LDPR will severely compromise the safety of all those who travel on the waterways, and will negatively affect the ability of commercial vessels to safely transport necessary commodities to businesses and consumers in the Chicago region. Due to requirements placed on them by federal and state agencies as well as by their trade association, in the form of the Responsible Carrier Program, towboat operators place safety as the highest priority when traveling through the nation's waters. This is not always the case with recreational vessels. In fact, operators of recreational vessels are not required to be licensed in most states, meaning that they have not gone through the safety training that their counterparts who operate commercial vessels have. This discrepancy in training levels often results in poor communication between vessels, as commercial operators have limited means to gain the attention of recreational operators, making accidents more

likely. Poor communication will have even greater consequences if great numbers of recreational vessels transit through locks, an action that demands pinpoint accuracy and an extended level of attention.

Limited exposure to the nature of towing vessels is another factor which lessens the ability of recreational boaters to navigate the same waterways as commercial vessels in large numbers. For example, it may often appear to a recreational boater, rower or kayaker that a towing vessel can come to a halt quickly. This frequently causes recreational boaters to perform actions aboard their boats in a manner that puts them closer to towing vessels than safety dictates. This danger, combined with the bending and curving nature of rivers and lakes within the waterway system as well as the limited visibility that occurs frequently due to weather, requires the spatial relationship between different vessels to always be very carefully managed. Adding an unlimited amount of recreational vessels to this environment will only heighten the level of unsafe conditions for recreational vessels, towboats and valuable cargo.

4. Federal Requirement to Protect Navigation in the Waterways

It is the responsibility of state officials to ensure that federal requirements are complied with. In the case of navigation in the CAWS and the LDPR, it is clear that federal law prohibits the changes that IEPA are urging to be undertaken. Specifically, the federal Clean Water Act prohibits states from removing or downgrading “those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards.” (40 CFR 131.3(e)). The use of these

waterways for navigational purposes qualifies for this protection because navigation in those locations existed as of that date and continues to exist today.

Clarity on what constitutes a protected use is provided by Section 2.1.5 of the EPA Water Quality Handbook where the agency states that navigation is a use classification designed “to protect ships and their crews and to maintain water quality so as not to restrict or prevent navigation.” Introducing a dramatic increase in recreational vessels to the waterways, as envisioned by IEPA, would negatively impact the ability of towing vessels to operate safely, as described earlier.

Conclusion

Based on these factors, it is my judgment, speaking on behalf of AWO, that IEPA’s proposed actions to amend water quality standards in the CAWS and the LDPR should not be allowed. The primary reasons for this are: the decrease in the economic, environmental and quality of life standards that would fall on the Chicago region and the nation as a result of a decrease in barge transportation; the contradiction among agencies in their strategies for managing the water quality and fish population of the waterways; the safety challenges that increased recreational traffic would introduce; and, the violation of federal law.



Darren Melvin

**ECONOMIC IMPACTS OF WATERBORNE SHIPPING
ON THE INDIANA LAKESHORE**

**August 2010
Calendar Year 2008**

**Prepared for:
PORTS OF INDIANA**

**Martin Associates
941 Wheatland Avenue
Suite 203
Lancaster, PA 17603**

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY.....	1
II. INTRODUCTION AND OVERVIEW	3
1. IMPACT DEFINITIONS	4
2. METHODOLOGY	6
3. ECONOMIC IMPACT MODEL.....	7
4. SUMMARY OF RESULTS	9
III. ECONOMIC IMPACTS OF INDIANA LAKESHORE WATERBORNE ACTIVITY	11
1. IMPACT STRUCTURE	13
1.1. <i>The Surface Transportation Sector</i>	13
1.2. <i>The Maritime Services Sector</i>	13
1.3. <i>Port Tenants, Lakeshore Terminals and Dependent Shipper/Consignees Sector</i>	15
1.4. <i>Ports of Indiana</i>	15
2. COMMODITIES INCLUDED IN THE ANALYSIS	16
3. MARITIME CARGO EMPLOYMENT IMPACTS.....	17
3.1. <i>Direct Maritime Cargo Jobs</i>	18
3.2. <i>Induced Jobs</i>	18
3.3. <i>Indirect Jobs</i>	18
3.4. <i>Related User (Shipper/Consignee) Jobs</i>	18
4. TOTAL ECONOMIC OUTPUT, BUSINESS REVENUE, INCOME AND TAX IMPACTS	19
5. PERSONAL EARNINGS IMPACT	20
6. TAX IMPACTS	21
APPENDIX A: PEER REVIEW LETTERS.....	22

ECONOMIC IMPACTS OF WATERBORNE SHIPPING ON THE INDIANA LAKESHORE

Study prepared by Martin Associates – August 2010

Peer Reviewed by Economics Professors from the Universities of Indiana, Notre Dame and Purdue

I. EXECUTIVE SUMMARY

Martin Associates was retained by the Ports of Indiana to measure the local, regional and state economic impacts generated by maritime activity of the Indiana Lakeshore terminals including the Port of Indiana-Burns Harbor tenant base. Economic impacts generated at the cargo and industrial facilities include the impacts generated by steel products, steel input commodities such as iron ore and coal/coke, cement, fertilizer, grain/soybean products, limestone, as well as other dry and liquid bulk cargoes. In 2008, according to the U.S. Army Corps of Engineers Waterborne Commerce Statistics, about 32 million tons of foreign and domestic cargo shipments were handled on the Indiana Lakeshore including facilities located at Burns Harbor, Indiana Harbor, Buffington Harbor and Gary (this includes 1.9 million tons that moved via the Inland Waterways System through O'Brien Lock). The majority, about 78% of this tonnage, was iron ore pellets discharged by laker vessels to the various steel mills along the Indiana Lakeshore. It should also be noted that 2008 was the most current year of data available for all shipping modes at the time of this study and that the 32 million tons of cargo handled that year were less than the previous 4-year average of 34.2 million tons. Similarly, the 1.9 million barge tons were less than the average of 3.0 million tons over the same 2004-2007 period.

The study employs methodology and definitions that have been used by Martin Associates to measure economic impacts at more than 250 ports in the United States and Canada, and at the leading U.S. airports. It is to be emphasized that only measurable impacts are included in this study. In order to ensure defensibility, the Martin Associates' approach to economic impact analysis is based on data developed through an extensive interview and telephone survey program of port tenants, lakeshore shippers and firms providing cargo and logistics services on the Indiana Lakeshore. Specific re-sponding models have been developed for the Indiana area to reflect the unique economic and consumer profiles of the regional economy. To further underscore the defensibility of the study, standardized impact models, such as the MARAD Port Kit were not used. Instead, the resulting impacts reflect the uniqueness of the individual port operations, as well as the surrounding regional economy.

The Indiana Lakeshore is unique in the fact that three separate modes of waterborne commerce are currently used in the shipping and receipt of raw materials and finished product. These include: international ships moving cargo through the St. Lawrence Seaway ("salties"), lake ships moving international and domestic shipments throughout the Great Lakes ("lakers"), and barges of international and domestic cargoes moving along the Inland Waterways System. It is this unique convergence of water transportation modes that provides steel mills and other industries with the ability to use cost-effective methods for receiving raw materials such as iron ore, coal and limestone and for shipping finished products to domestic and international markets.

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Without water transportation, production costs would undoubtedly increase and therefore potentially hinder future contracts and levels of manufacturing.

While the balance of this report details the economic impact of the Indiana Lakeshore waterborne shipping activity, key findings from the CY2008 analysis include the following:

Annual Economic Impact of Waterborne Shipping on Indiana's Lakeshore:

- 104,567 direct, induced, indirect and related jobs;
- \$14.2 billion of economic activity to the state;
- \$567 million of state and local tax revenue; and
- 17,655 jobs and \$1.9 billion in economic activity attributed to Indiana barge movements through the O'Brien Lock

Economic Impacts of Waterborne Shipping Activity on Indiana's Lakeshore

*Based on economic data from CY2008**

CATEGORY	SHIP ACTIVITY (LAKER & SALTY)	BARGE ACTIVITY VIA O'BRIEN LOCK	TOTAL MARITIME SHIPMENTS
DIRECT JOBS	17,443	3,394	20,837
TOTAL JOBS	86,912	17,655	104,567
DIRECT PERSONAL INCOME	\$781,620,212	\$141,502,699	\$923,122,911
TOTAL PERSONAL INCOME	\$5,145,679,348	\$890,168,403	\$6,035,847,751
LOCAL PURCHASES	\$1,889,242,899	\$227,006,700	\$2,116,249,599
TOTAL STATE & LOCAL TAXES	\$483,693,859	\$83,675,830	\$567,369,689
TOTAL VALUE OF ECONOMIC ACTIVITY	\$12,287,459,456	\$1,909,005,610	\$14,196,465,066

*Totals may be rounded.

This study was conducted by Martin Associates, 941 Wheatland Ave., Ste. 203, Lancaster, PA 17603.

The following university professors provided input and peer reviews of the analysis:

- *Bruce Jaffee, Professor/Chairperson, Dept. of Economics & Public Policy, Indiana University*
- *Richard Jensen, Professor of Economics, Dept. of Economics, University of Notre Dame*
- *Amlan Mitra, Professor of Economics, Dept. of Finance and Economics, Purdue University Calumet; Member, Transportation Research Board, National Academy of Sciences*

II. INTRODUCTION AND OVERVIEW

Martin Associates was retained by the Ports of Indiana to measure the local, regional and state economic impacts generated by maritime activity of the Indiana Lakeshore terminals including the Port of Indiana-Burns Harbor tenant base. Economic impacts generated at the cargo and industrial facilities include the impacts generated by steel products, steel input commodities such as iron ore and coal/coke, cement, fertilizer, grain/soybean products, limestone, as well as other dry and liquid bulk cargoes. In 2008, according to the U.S. Army Corps of Engineers (USACE) Waterborne Commerce Statistics, about 32 million tons of foreign and domestic cargo shipments were handled on the Indiana Lakeshore including facilities located at Burns Harbor, Indiana Harbor, Buffington Harbor and Gary (this includes 1.9 million tons that moved via the Inland Waterways System through the O'Brien Lock). The majority, about 78% of this tonnage, was iron ore pellets discharged by laker vessels to the various steel mills along the Indiana Lakeshore. It should also be noted that 2008 was the most current year of data available for all shipping modes and that the 32 million tons of cargo handled in 2008 was less than the previous 4-year average of 34.2 million tons. Similarly, the 1.9 million barge tons were less than the average of 3.0 million tons over the same 2004-2007 period.

The study employs methodology and definitions that have been used by Martin Associates to measure the economic impacts of port activity at more than 250 ports in the United States and Canada, and at the leading airports in the United States. It is to be emphasized that only measurable impacts are included in this study. In order to ensure defensibility, the Martin Associates' approach to economic impact analysis is based on data developed through an extensive interview and telephone survey program of the port tenants and the firms providing cargo and logistics services on the Indiana Lakeshore. Specific re-spending models have been developed for the Indiana area to reflect the unique economic and consumer profiles of the regional economy. To further underscore the defensibility of the study, standardized impact models, such as the MARAD Port Kit were not used. Instead, the resulting impacts reflect the uniqueness of the individual port operations, as well as the surrounding regional economy.

The results of the economic impact studies are used not only to identify the importance and job generation aspects of the maritime community, but the cargo impact models are used to assess the impacts of alternative master plan development recommendation, the impact of changing tonnage levels, annual updates, the impact of new cargoes/services, and the justification of capital development projects.

The Indiana Lakeshore is unique in the fact that three separate modes of waterborne commerce are currently used in the shipping and receipt of raw materials and finished product. These include: international ships moving cargo through the St. Lawrence Seaway ("salties"), lake vessels carrying international cross-lake and domestic intra-lake shipments ("lakers"), and barges moving international and domestic cargoes along the Inland Waterways System. It is this unique convergence of water transportation modes that provides steel mills and other industries with the ability to use cost-effective methods for receiving raw materials such as iron ore, coal

and limestone and shipping finished products to domestic and international markets. Without water transportation, production costs would undoubtedly increase and therefore potentially hinder future contracts and levels of manufacturing.

While the balance of this report details the economic impact of the Indiana Lakeshore waterborne shipping activity, key figures from the CY2008 analysis include the following:

Annual Economic Impact of Waterborne Shipping on Indiana's Lakeshore:

- 104,567 direct, induced, indirect and related jobs;
- \$14.2 billion of economic activity to the state;
- \$567 million of state and local tax revenue; and
- 17,655 jobs and \$1.9 billion in economic activity attributed to barge movements through the O'Brien Lock.

1. IMPACT DEFINITIONS

The impacts are measured separately for the Indiana Lakeshore cargo activity and industrial activity. The impacts are measured in terms of:

- Jobs [direct, induced, indirect and related shipper/consignee (related users)];
- Personal income;
- Business revenue; and
- State and local taxes.

Each impact measurement is described below:

➤ **Direct, Induced, Indirect, Related Jobs**

Direct jobs are those that would not exist if activity at the port cargo and lakeshore terminals were to cease. Direct jobs created by cargo activity at the maritime terminals are those jobs with the firms directly providing cargo handling and vessel services, including trucking companies, terminal operators and stevedores, members of the International Longshoremen's Association (ILA), International Union of Operating Engineers, International Brotherhood of Teamsters and United Steelworkers, vessel agents, pilots and tug assist companies.

Induced jobs are jobs created in Indiana by the purchases of goods and services by those *individuals* directly employed by each of the terminals' lines of business. These jobs are based on the local purchase patterns of area residents. The induced jobs are jobs with grocery stores, restaurants, health care providers, retail stores, local housing/construction industry, and transportation services, as well as with wholesalers providing the goods to the retailers.

Indirect jobs are created throughout the area as the result of purchases for goods and services by the **firms** directly impacted by Indiana Lakeshore activity, including the tenants, terminal operators and the firms providing services to cargo – which includes steel, general cargo, dry bulks and liquid bulks. The indirect jobs are measured based on actual local purchase patterns of the directly dependent firms, and occur with such industries as utilities, office supplies, contract service providers, maintenance and repair, and construction.

Related shipper/consignee (related user) jobs are jobs with shippers and consignees (exporters and importers) including the state's manufacturing, farming, retail, wholesale, distribution industries, and the in-state industries supporting the movement and distribution of cargo imports and exports using the port terminals for shipment and receipt of cargo. While these impacts occur for all commodities, the majority of Indiana Lakeshore shippers and consignees impacts involve the import and export of steel, coal, grain, fertilizers, salt, limestone and miscellaneous dry and liquid bulk commodities. A large number of dependent steel users are already accounted for in the port tenant/dependent user category due to the fact that the Indiana Lakeshore's facilities, including the Port of Indiana-Burns Harbor, maintain a large steel manufacturing and processing presence.

Related jobs are not dependent upon the port marine terminals to the same extent as are the direct, induced and indirect jobs since it is the demand for the final products, which creates the demand for the employment with these shippers/consignees - not the use of a particular port or maritime terminal - and therefore these firms can and do use other ports. For example, when hurricane devastation renders a port's container and breakbulk terminals inoperable, essentially suspending operations at the port, the direct, induced and indirect jobholders are immediately affected with similar consequence. However, the jobs held with related users such as manufacturing as well as wholesale and retail distribution throughout the unaffected areas of state will continue to operate. These firms are required to find alternative ports to ship and receive cargo in order to maintain given levels of operation. Therefore, viable port operations are essential to long-term retention of import and export related jobs throughout the state.

- **Personal income impact** consists of wages and salaries received by those directly employed by port and lakeshore activity, and includes a respending impact which measures the personal consumption activity in Indiana of those directly employed as the result of Indiana Lakeshore cargo and industrial activity. Indirect personal income measures the wages and salaries received by those indirectly employed.
- **Business revenue** consists of total business receipts by firms providing services in support of the cargo activity. **Local purchases for goods and services** made by the directly impacted firms are also measured. These local purchases by the dependent firms

create the indirect impacts. Revenues from port tenants, dependent shippers and consignees and lakeshore terminals are included.

- **State and local taxes** include taxes paid by individuals as well as firms dependent upon Indiana Lakeshore cargo and industrial tenant activity.

2. METHODOLOGY

The methodological approach to this study is designed to provide highly defensible, as well as accurate results. This same methodology has been used by Martin Associates in the last 25 years to assess the economic impacts of cargo and passenger activity at more than 250 seaports including:

*Los Angeles, CA
Long Beach, CA
Oakland, CA
Portland, OR
Seattle, WA
Sacramento, CA
San Francisco, CA
Vancouver, BC
Vancouver, WA
Houston, TX
Corpus Christi, TX*

*Freeport, TX
New Orleans, LA
Texas City, TX
Baton Rouge, LA
Port Everglades, FL
Palm Beach, FL
Miami, FL
Jacksonville, FL
Wilmington/Morehead City, NC
Virginia/Hampton Roads, VA
Baltimore, MD*

*Philadelphia, PA
Wilmington, DE
Brunswick, GA
Richmond, VA
Providence, RI
Montreal, QC
Quebec City, QC
Prince Rupert, BC
Halifax, NS
Saint John, NB
18 U.S. Great Lakes Ports*

The impacts of the Indiana Lakeshore presented in this 2008 report were estimated based on telephone and personal interviews with 94 firms in the respective region. This represents the universe of cargo and related industrial businesses (with the exception of trucking firms) on the Indiana Lakeshore including Burns Harbor, Indiana Harbor, Buffington Harbor and Gary. It is to be emphasized that a 99% response rate was achieved from these firms located in the port as well as those on the Indiana Lakeshore reporting significant maritime cargo volumes.

In order to estimate the share of impacts in terms of lake activity (laker traffic and international cargo through the St. Lawrence Seaway) and O'Brien Lock (cargo moving by barge via the Inland Waterway System), Martin Associates estimated the percentage of waterborne tonnage throughputs by commodity as identified by the USACE for the CY2008 period. This share of lake versus O'Brien Lock tonnage was then appropriated to each commodity group and resulting lakeshore shipper/consignee, as well as commodity-specific job sectors such as terminal employees, dockworkers and maritime service providers. The results of this analysis provide an estimation of the economic impacts for lake shipments versus O'Brien Lock shipments.

The direct impacts are measured at the firm level of detail, and aggregated to develop the impacts for each of the terminals' lines of business. Each firm surveyed provided Martin Associates with detailed employment levels (both full time and part time), annual payroll, local

purchases and the residence of the employees. Additional data collected from the Indiana lakeshore terminals includes: employment, vessel and barge tonnage, vessel and barge calls, revenues and expenditures.

The induced impacts are based on the current expenditure profile of residents of Indiana as estimated by the U.S. Bureau of Labor Statistics, "Consumer Expenditure Survey." This survey indicates the distribution of consumer expenditures over key consumption categories for Indiana residents. The consumption categories are:

- Housing;
- Food at Restaurants;
- Food at Home;
- Entertainment;
- Health Care;
- Home Furnishings; and
- Transportation Equipment and Services.

The estimated consumption expenditure generated as a result of the respending impact is distributed across these consumption categories. Associated with each consumption category is the relevant retail and wholesale industry. Jobs to sales ratios in each industry are then computed for Indiana, and induced jobs are estimated for the relevant consumption categories. It is to be emphasized that induced jobs are only estimated at the retail and wholesale level, since these jobs are most likely generated in each terminal area. Further levels of induced jobs are not estimated since it is not possible to defensibly identify geographically where the subsequent rounds of purchasing occur.

The "Consumer Expenditure Survey" does not include information to estimate the job impact with supporting business services, legal, social services, state and local governments, and educational services. To estimate this induced impact, a ratio of State of Indiana employment in these key service industries to total State of Indiana employment is developed. This ratio is then used with the direct and induced consumption jobs to estimate induced jobs with business/financial services, legal, educational, governmental and other social services.

The indirect impacts are estimated based on the local purchases by the directly dependent firms, combined with indirect job, income and revenue coefficients for the supplying industries in the State of Indiana as developed for Martin Associates by the U.S. Bureau of Economic Analysis, Regional Input/Output Modeling System (RIMS II).

3. ECONOMIC IMPACT MODEL

The impacts are measured for CY2008 – based on the latest USACE data available, computer models for cargo and industrial operations have been developed to test the sensitivity of the impacts to changes in economic conditions and facility utilization. It is to be emphasized

that this study is designed to provide a framework which Ports of Indiana can use in formulating and guiding future development of shipping facilities and policies for the state of Indiana.

The cargo impact model is designed to test the sensitivity of impacts to changes in such factors as maritime tonnage levels, port productivity and work rules, new port facilities development, inland distribution patterns of cargo, number of vessel/barge calls and the introduction of new carrier service. The cargo impact model can also be used to assess the impact of developing a parcel of land as a maritime terminal versus other non-cargo land uses. Finally, the maritime cargo impact model can be used to assess the economic benefits of increased maritime activity due to infrastructure development and the opportunity cost of not undertaking specific maritime investments such as dredging, new terminal development or warehouse development.

4. SUMMARY OF RESULTS

Exhibit I-1 provides a breakdown by shipping on the lake and through the O'Brien Lock for the economic impact analysis of the maritime activity at Indiana Lakeshore facilities.

Exhibit I-1 Economic Impact of Indiana Lakeshore Waterborne Shipping Activity CY2008*

CATEGORY	LAKE ACTIVITY	THROUGH O'BRIEN LOCK	TOTAL LAKESHORE
JOBS			
DIRECT	17,443	3,394	20,837
INDUCED	23,845	4,351	28,197
INDIRECT	23,896	2,871	26,768
RELATED USER	21,728	7,038	28,766
TOTAL JOBS	86,912	17,655	104,567
PERSONAL INCOME			
DIRECT	\$781,620,212	\$141,502,699	\$923,122,911
INDUCED	\$2,657,039,750	\$481,024,275	\$3,138,064,025
INDIRECT	\$994,721,789	\$119,523,281	\$1,114,245,071
RELATED USER INCOME	\$712,297,597	\$148,118,147	\$860,415,744
TOTAL PERSONAL INCOME	\$5,145,679,348	\$890,168,403	\$6,035,847,751
VALUE OF ECONOMIC ACTIVITY			
BUSINESS SERVICES REVENUE	\$431,756,656	\$371,520,213	\$803,276,869
TENANT/DEPENDENT USER REVENUE	\$9,761,986,933	\$853,334,510	\$10,615,321,443
RELATED USER OUTPUT	\$2,093,715,867	\$684,150,887	\$2,777,866,754
TOTAL VALUE OF ECONOMIC ACTIVITY	\$12,287,459,456	\$1,909,005,610	\$14,196,465,066
LOCAL PURCHASES	\$1,889,242,899	\$227,006,700	\$2,116,249,599
STATE & LOCAL TAXES			
DIRECT, INDUCED AND INDIRECT	\$416,737,885	\$69,752,724	\$486,490,609
RELATED USER TAXES	\$66,955,974	\$13,923,106	\$80,879,080
TOTAL STATE AND LOCAL TAXES	\$483,693,859	\$83,675,830	\$567,369,689

*Totals may be rounded.

In 2008, waterborne shipping at Indiana Lakeshore facilities supported 104,567 jobs in the region. Of these jobs, 20,837 jobs were directly created by cargo shipping and related industrial activities, while another 28,197 induced jobs were generated in the state as a result of local purchases made by those directly employed by Indiana Lakeshore terminals and Ports of Indiana cargo and tenant activity. In addition, there were 26,768 indirect jobs supported in Indiana as the result of \$2.1 billion of local purchases. The waterborne cargo moving via the Indiana Lakeshore facilities supported 28,766 jobs throughout the State of Indiana. The majority

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of these jobs were associated with the processing and movement of steel products, fertilizer, grain and dry bulk cargoes at the individual terminals.

The 20,837 direct jobs received \$923.1 million of direct wage and salary income, for average earnings of \$44,300 per direct employee. As a result of local purchases with this \$923.1 million of direct wages and salaries, an additional \$3.1 billion of income and local consumption expenditures were created in the respective regions. It is this re-spending impact that supported the 28,197 induced jobs.¹ The indirect jobs holders received \$1.1 billion in personal income. Related users in the state received another \$860.4 million of personal income. In total, \$6.0 billion of personal income was created as the result of the Indiana Lakeshore waterborne shipping operations.

Local businesses received \$803.3 million of revenue from providing services to the cargo activity. Also, the terminal operators and port tenants generated nearly \$10.6 billion of revenue from processing and manufacturing activities at their facilities. In addition, \$2.8 billion of output was generated throughout the state by related users using the marine terminal facilities for shipment and receipt of cargo.

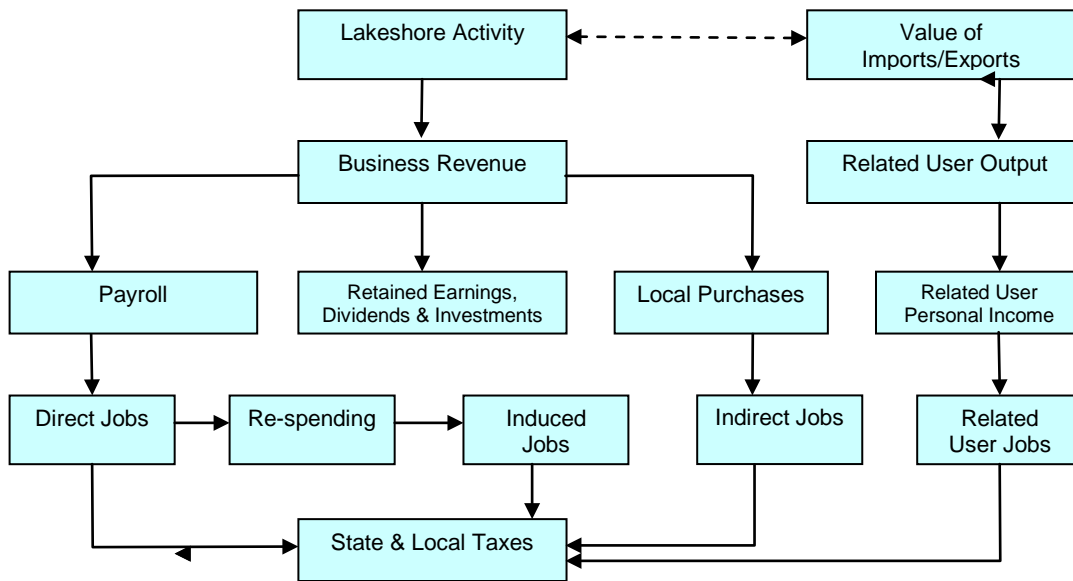
As a result of the cargo and industrial activity at the Indiana Lakeshore waterborne terminal facilities, a total of \$567.4 million of state and local tax revenue was generated.

¹The induced income impact also includes local consumption expenditures and should not be divided by induced jobs to estimate the average salary per induced job. This re-spending throughout the region is estimated using a regional personal earnings multiplier, which reflects the percentage of purchases by individuals that are made within the area. Hence, the average salary would be overestimated.

III. ECONOMIC IMPACTS OF INDIANA LAKESHORE WATERBORNE ACTIVITY

Waterborne cargo activity at a port or cargo terminal contributes to the local and regional economy by generating business revenue to local and national firms providing vessel and cargo handling services at the terminals. These firms, in turn, provide employment and income to individuals, and pay taxes to state and local governments. Exhibit II-1 shows how activity at maritime terminals generates impacts throughout the local, state and national economies. As this exhibit indicates, the impact of waterborne shipping on a local, state or national economy cannot be reduced to a single number, but instead creates several impacts. These are the revenue impact, employment impact, personal income impact, and tax impact. These impacts are non-additive. For example, the income impact is a part of the revenue impact, and adding these impacts together would result in double counting. Exhibit II-1 shows graphically how activity at the Indiana Lakeshore facilities generates the four impacts.

Exhibit II-1 Flow of Economic Impacts Generated by Maritime Activity



At the outset, activity at the maritime terminals generates business revenue for firms which provide services. This business revenue impact is dispersed throughout the economy in several ways. It is used to hire people to provide the services, to purchase goods and services, and to make federal, state and local tax payments. The remainder is used to pay stockholders, retire debt, make investments, or is held as retained earnings. It is to be emphasized that the only portions of the revenue impact that can be definitely identified as remaining in the local/regional economy are those portions paid out in salaries to local employees, for local purchases by individuals and businesses directly dependent on the port, in contributions to state and local taxes, in lease payments by tenants, and wharfage and dockage fees paid to a port.

The employment impact of port activity consists of four levels of job impacts:

- **Direct employment impact** -- jobs directly generated by lakeshore activity. Direct jobs generated by cargo include jobs with railroads and trucking companies moving cargo between inland origins and destinations and the terminals, longshoremen and dockworkers, steamship agents, freight forwarders, stevedores, etc. It is to be emphasized that these are classified as directly generated in the sense that these jobs would experience near term dislocation if the activity at Indiana Lakeshore maritime terminals were to be discontinued.
- **Induced employment impact** -- jobs created throughout the local economy because individuals directly employed due to maritime activity spend their wages locally on goods and services such as food, housing and clothing. These jobs are held by residents located throughout the region, since they are estimated based on local and regional purchases.
- **Indirect Jobs** -- are jobs created locally due to purchases of goods and services by firms, not individuals. These jobs are estimated directly from local purchases data supplied to Martin Associates by the companies interviewed as part of this study, and include jobs with local office supply firms, maintenance and repair firms, parts and equipment suppliers, etc.
- **Related shipper/consignee (related user) jobs** -- jobs with shippers and consignees (exporters and importers) supported in the state's manufacturing, agriculture, construction, energy, retail and wholesale distribution industries, and the in-state industries supporting the movement and distribution of all commodities, primarily steel, coal, grain, fertilizer, limestone and salt imports and exports using the cargo terminals. ***Related jobs are not dependent upon the marine terminals to the same extent as are the direct, induced and indirect jobs. It is the demand for the final products, which creates the demand for the employment with these shippers/consignees - not the use of a particular port or maritime terminal - and therefore these firms can and do use other ports.***

The personal earnings impact is the measure of employee wages and salaries (excluding benefits) received by individuals directly employed due to port activity. Re-spending of these earnings throughout the regional economy for purchases of goods and services is also estimated. This, in turn, generates additional jobs -- the induced employment impact. This re-spending throughout the region is estimated using a regional personal earnings multiplier, which reflects the percentage of purchases by individuals that are made within the area. The re-spending effect varies by region -- a larger re-spending effect occurs in regions that produce a relatively large proportion of the goods and services consumed by residents, while lower re-spending effects are associated with regions that import a relatively large share of consumer goods and services (since

personal earnings “leak out” of the region for these out-of-regional purchases). The direct earnings are a measure of the local impact since they are received by those directly employed by local maritime activity.

Tax impacts are payments to the state and local governments by firms and by individuals whose jobs are directly dependent upon and supported (induced jobs) by activity at the marine terminals.

1. IMPACT STRUCTURE

Economic impacts are created throughout various business sectors of the state and local economies. Specifically, four distinct economic sectors are impacted as a result of activity at the marine terminals. These are the:

- Surface Transportation Sector;
- Maritime Services Sector;
- Port Tenants, Lakeshore Terminals and Dependent Shippers/Consignees Sector; and
- Ports of Indiana (Central Office/Administration).

Within each sector, various participants are involved. Separate impacts are estimated for each of the participants. A discussion of each of the economic impact sectors is provided below, including a description of the major participants in each sector.

1.1. The Surface Transportation Sector

The surface transportation sector consists of both the railroad and trucking industries. The trucking firms and railroads are responsible for moving the various cargoes between the marine terminals and the inland origins and destinations.

1.2. The Maritime Services Sector

This sector consists of numerous firms and participants performing functions related to the following maritime services:

- Maritime Cargo Transportation;
- Vessel Operations;
- Cargo Handling; and
- Federal, State and Local Government Agencies.

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A brief description of major participants in these four categories is provided below:

- Maritime Cargo Transportation: Participants in this category are involved in providing and arranging for inland and water transportation for inbound and outbound freight. For example, a freight forwarder/customhouse broker arranges for the freight to be delivered between the terminals and inland destinations, as well as the freight transportation, while the line haul barge operator provides transportation on the river system to port facilities.
- Vessel/Barge Maritime Service Operations: This category consists of several participants. The steamship agents provide a number of services for the vessel as soon as it enters a port. The agents arrange for medical and dental care of the crew, for ship supplies as well as payment of various expenses including port charges. The agents are also responsible for vessel documentation. In addition to the steamship agents arranging for vessel services, those providing the services include:
 - Chandlers - supply the vessels with ship supplies (food, clothing, nautical equipment, etc.);
 - Towing firms - provide the tug service to guide the vessel to and from port;
 - Pilots - assist in navigating the vessels to and from the maritime terminals;
 - Bunkering firms - provide fuel to the vessels;
 - Barge Fleeting/Cleaning – provide fleeting services for barges at the terminals;
 - Marine surveyors - inspect the vessels/barges and the cargo; and
 - Shipyards/marine construction firms - provide repairs (either emergency or scheduled) as well as marine pier construction and dredging.
- Cargo Handling: This category involves the physical handling of the cargo at the terminals between the land and the vessel/barge. Included in this category are the following participants:
 - Longshoremen & dockworkers - include members of the International Longshoremen's Association (ILA), International Union of Operating Engineers, International Brotherhood of Teamsters and United Steelworkers as well as those dockworkers with no union affiliation that are involved in the loading and unloading of cargo from the vessels/barges, as well as handling the cargo prior to loading and after unloading;

- Stevedoring firms - manage the longshoremen and cargo-handling activities;
 - Cargo terminal operators - provide services to operate the maritime terminals, track cargo movement and provide security where cargo is loaded and off-loaded;
 - Warehouse operators - store cargo after discharge or prior to loading and consolidate cargo units into shipment lots. In many cases, the freight forwarders and consolidators are also involved in warehousing activity.
 - Foreign Trade Zone (FTZ) tenants - operate facilities in the Ports of Indiana Foreign Trade Zone.
- Government Agencies: This service sector involves federal, state and local government agencies that perform services related to cargo handling and vessel/barge operations at the port. Department of Homeland Security (DHS), which includes Customs and Border Protection (CBP), U.S. Immigration and Customs Enforcement (ICE) and U.S. Coast Guard, U.S. Department of Agriculture (grain inspection) and the U.S. Army Corps of Engineers (USACE), are involved. These services are provided by the government offices located in the Great Lakes region.

1.3. Port Tenants, Lakeshore Terminals and Dependent Shipper/Consignees Sector

Port tenant and lakeshore terminals jobs consist of jobs with dependent shippers/consignees that operate cargo terminals on the Indiana Lakeshore including steel mills and petroleum refineries as well as port tenants shipping and receiving cargo through the cargo terminals at the Port of Indiana-Burns Harbor facilities. The Ports of Indiana is unique in the fact that many of the tenants of each facility, specifically at Burns Harbor, are users of the waterborne cargo handled at the ports docks. Furthermore, many of the operations performed by these tenants, specifically in the steel manufacturing and steel processing are inter-dependent of each other. It is to be noted that only a portion of the raw materials and finished products used and produced by the port's tenants is received/shipped via vessel or barge. There is also a large portion of this cargo that enters/leaves the port via rail and truck. However, the advantage of having access to the Great Lakes and Inland River System with the low-cost option of vessel and barge shipments, as well as the presence of other complementary tenants, is a key attribute in attracting and maintaining such a strong tenant base at Ports of Indiana facilities. The Ports of Indiana has, over the years, been successful in creating a steel processing campus at Burns Harbor, and therefore, for the purpose of this analysis, all of the port tenant jobs are included.

1.4. Ports of Indiana

The Ports of Indiana includes those individuals employed by the port whose purpose is to oversee port activity at the port's cargo and industrial terminals.

2. COMMODITIES INCLUDED IN THE ANALYSIS

A major use of an economic impact analysis is to provide a tool for terminal development planning. As a port or terminal grows, available land and other resources for facilities become scarce, and decisions must be made as to how to develop the land and utilize the resources in the most efficient manner. Various types of facility configurations are associated with different commodities. For example, containers, automobiles and RO/RO require a large amount of paved, open storage space, while certain types of breakbulk cargoes such as steel coils, lumber and plywood may require covered storage. Perishable commodities require temperature controlled warehouses and some dry bulk cargo requires covered storage and special dust removing equipment, while tank farms are needed to store liquid bulk cargo.

An understanding of the commodity's relative economic value in terms of employment and income to the local community, the cost of providing the facilities, and the relative demand for the different commodities is essential in making future development plans. Because of this need for understanding relative commodity impacts, economic impacts are estimated for the following commodities handled at the public and private cargo terminals:

- STEEL COILS;
- IRON ORE;
- WIRE/STRUCTURAL STEEL;
- STEEL SLABS;
- COAL/COKE;
- PROJECT CARGO/MISCELLANEOUS BREAKBULK;
- GRAIN/SOYBEANS;
- BULK METALS/SCRAP;
- FERTILIZER;
- PETROLEUM PRODUCTS;
- CEMENT;
- LIMESTONE/OTHER DRY BULK;
- SALT; AND
- OTHER LIQUID BULKS.

It should be emphasized that commodity-specific impacts are not estimated for each of the economic sectors described in the last section. Specific impacts could not be allocated by individual commodities with any degree of accuracy for maritime construction, ship repair, or the state and federal government due to the fact that it is difficult to estimate the percentage of resources that are dedicated to one commodity over another. For example, maritime construction may occur at a terminal that is multi-use and cannot be attributed to a specific commodity. Similarly, law enforcement and security operations cannot be attributed to a single commodity.

3. MARITIME CARGO EMPLOYMENT IMPACTS

Employment generated by maritime cargo activity at the Indiana Lakeshore is estimated.

- First, the total employment that is in some way related to the activities at the individual ports is estimated from the interview process of 94 Indiana Lakeshore terminals, Port of Indiana tenants and service providers as well as data provided by the Ports of Indiana as described in the methodology;
- Second, the subset of total employment that is judged to be totally dependent (i.e., direct jobs) on port activity is analyzed as follows:
 - The direct job impact is estimated by detailed job category, i.e., trucking, dockworkers, barge operators, steamship agents, chandlers, surveyors, etc;
 - The direct job impact is estimated for each of the key commodities/commodity groups;
 - The direct job impact is estimated based on the residency of those directly employed;
- Induced and indirect jobs are estimated;
- Finally, jobs related to the maritime activity at the cargo terminals are described.

It is estimated that 104,567 jobs are directly or indirectly generated by activities at the cargo terminals on the Indiana Lakeshore. Of the 104,567 jobs:

- 20,837 jobs are directly generated by activities at the cargo terminals and if such activities should cease, these jobs would be discontinued over the short term.
- 28,197 jobs (induced jobs) are supported by the local purchases of the 20,837 individuals directly generated by port activity at the cargo terminals. An additional 26,768 indirect jobs were supported by \$2.1 billion of purchases in the local and regional economy by firms providing direct cargo handling and vessel/barge services.
- 28,766 jobs are related to inbound and outbound cargoes through Indiana Lakeshore facilities. These jobs are supported in the state's steel processing, manufacturing, farming, construction, retail, wholesale and distribution industries, and the in-state industries supporting the movement and distribution of all commodities, primarily concentrated with steel, coal, grain, limestone, salt and fertilizer cargo imports and exports using the Indiana Lakeshore terminals.

3.1. Direct Maritime Cargo Jobs

In CY2008, about 32 million tons of domestic and foreign waterborne cargo moved via the Indiana Lakeshore terminals in Burns Harbor, Indiana Harbor, Buffington Harbor and Gary. As a result of this activity, 20,837 full-time jobs were directly created². These jobs would vanish immediately if shipping operations on the Indiana Lakeshore were to cease. About 16 percent of the direct jobs are attributed to cargo activity moving into the Inland Waterway System through the O'Brien Lock.

3.2. Induced Jobs

The 20,837 directly employed individuals due to activity at the cargo terminals received wages and salaries, a part of which was used to purchase local goods and services such as food, housing, clothing, transportation services, etc. As a result of these local purchases, 28,197 jobs in the regional economy were supported. The majority of the induced jobs are with local and regional private sector social services, business services, educational services and state and local government agencies, followed by jobs in the food and restaurant sector, and then jobs in the construction and home furnishings sector.

3.3. Indirect Jobs

In addition to the induced jobs generated via purchases by directly employed individuals, the firms providing the direct services and employing the 20,837 direct jobs make local purchases for goods and services. These local purchases by the firms dependent upon the cargo facilities generated additional local jobs – indirect jobs. Based on interviews, these firms made \$2.1 billion of local and in-state purchases. These direct local purchases created an additional 26,768 indirect jobs in the local economy.

3.4. Related User (Shipper/Consignee) Jobs

It is estimated that 28,766 jobs are supported in Indiana with shippers/consignees that use the Indiana Lakeshore facilities. To estimate the related user impact for cargo, the average value per ton of imports and exports was estimated using U.S. Maritime Administration, Foreign Trade Statistics and Ports of Indiana. The employment to value of output coefficient for the retail sector related to the exported and imported cargoes was then computed from Bureau of Economic Analysis, Regional Input-Output Model for the State of Indiana.

For breakbulk cargoes, the associated consuming and producing industries were identified with each commodity. For example, for imported iron and steel products, relationships were developed to convert the dollar value of these imported materials into a dollar value of

² Jobs are measured in terms of full-time worker equivalents. If a worker is employed only 50 percent of the time by activity at a cargo terminal, then this worker is counted as .5 jobs.

output in the key consuming industries, which include construction and metal fabrication. Relationships between the values of inputs to the value of outputs in these industries were estimated using data from the U.S. Bureau of Census, Census of Manufacturing and Census of Construction. These ratios were then used to convert the dollar value of the imported breakbulk and bulk cargoes into a dollar value of output in the consuming industries in the state. Using the respective jobs to value of output multipliers for these industries from the Bureau of Economic Analysis, Regional Input-Output Modeling System (RIMSII) model, the value of the breakbulk and bulk cargoes moving via the maritime terminals and remaining in (or produced in) the State of Indiana was converted into related shipper/consignee jobs with these users and associated supporting industries within the state. A similar methodology was used in estimating related user jobs for agricultural products.

Finally, the direct, induced and indirect maritime sector job impacts (lakeshore shippers, port companies and dependent shippers) associated with each of the cargoes for which related shipper/consignee jobs were estimated were subtracted from the total related jobs (by commodity and cargo type) to avoid double counting. The related shipper/consignee jobs include job impacts at each stage of handling the imported and exported cargo, such as the port activity, the trucking activity and the rail activity used to move the cargo to and from the lakeshore terminals and the induced and indirect jobs associated with the direct terminal activity.

4. TOTAL ECONOMIC OUTPUT, BUSINESS REVENUE, INCOME AND TAX IMPACTS

The 32 million tons of steel, general cargo and bulk (dry and liquid) cargo handled at the Indiana Lakeshore cargo terminals included in the study generated revenue for firms in each of the economic sectors. For example, revenue is received by the railroads and the trucking companies within the surface transportation sector as a result of moving export cargo to the lakeshore terminals and distributing the imported commodities inland after receipt at the cargo terminals. The firms in the maritime services sector receive revenue from arranging for transportation services, cargo handling, providing services to vessels/barges and repairs to vessels/barges calling on the terminals. The Ports of Indiana receives revenue from terminal leases and port charges such as wharfage and dockage assessed on cargo and vessels. In addition, revenue is received by dependent shippers/consignees from the sales of cargo shipped or received via the cargo terminals and from the sales of products made with raw materials received through the terminals. Since this chapter is concerned with the revenue generated from providing maritime services, the shipper/consignee revenue (i.e., the value of the cargo shipped or received through the lakeshore terminals, as well as the value of the products produced by the port-dependent shippers/consignees) will be excluded from the remaining discussion.

The revenue generated by port and lakeshore terminal activity consists of many components. For example, gross revenue is used to pay employee salaries and taxes. It is also distributed to stockholders of the companies providing the vessel and cargo handling services, and it is used for the purchases of equipment and maintenance services. Of these components,

only three can be isolated geographically with any degree of accuracy. These are the personal income component of revenue, which can be traced to geographic locations based on the residence of those receiving the income, the payment of state and local taxes, and the local purchases made by firms dependent upon the maritime activity. The balance of the revenue is distributed in the form of payments to firms located outside the State of Indiana providing goods and services to the economic sectors and for the distribution of company profits to shareholders. Many of these firms and owners are located outside of the State of Indiana and, thus, it is difficult to trace the ultimate location of the distributed revenue (other than personal income, taxes and local purchases). The value of output created by in-state related shippers/consignees of the port is attributed to the State of Indiana, and the local purchases from other firms within the state are also included in this user output measure, as defined by the in-state output coefficients (for the user industries) developed from the U.S. Bureau of Economic Analysis, Regional Input-Output Modeling System (RIMSII).

The revenue impact is a measure of the *total economic activity* in the state that is generated by the cargo moving via the Indiana Lakeshore. In 2008, maritime cargo and port industrial activity on the Indiana Lakeshore generated a total of \$14.2 billion of total economic activity in the state. Of the \$14.2 billion, \$803.3 million is the direct business revenue received by the firms directly dependent upon the terminals and providing maritime services and inland transportation services to the cargo handled at the maritime terminals and the vessels calling on the terminals, while another \$10.6 billion of revenue is generated by the lakeshore shippers, port tenants and on-site dependent shippers/consignees. The remaining \$2.8 billion represents the value of the output to the State of Indiana that is created due to the cargo moving via the port and lakeshore terminals. This includes the value added at each stage of producing an export cargo, as well as the value added at each stage of production for the firms using imported raw materials and intermediate products that flow via the marine terminals and are consumed by industries within the State of Indiana.

5. PERSONAL EARNINGS IMPACT

The income impact is estimated by multiplying the average annual earnings (excluding benefits) of each port participant, i.e., truckers, steamship agents, pilots, towing firm employees, longshoremen, warehousemen, etc., by the corresponding number of direct jobs in each category. The individual annual earnings in each category multiplied by the corresponding job impact resulted in \$923.1 million in personal wage and salary earnings. It is important to emphasize that the average annual earnings of a marine terminal-dependent job is about \$44,300. By comparison, based on data supplied by the Bureau of Labor Statistics (BLS), the average wage earner in Indiana in Q1 2009 was \$739/week or annual 52-week average of \$38,428. Therefore, these relatively high paying jobs will have a much greater economic impact in the local economy through stimulating induced jobs than will a job paying lower wages.

The impact of re-spending this direct income for local purchases is estimated using a personal earnings multiplier. The personal earnings multiplier is based on data supplied by the

Bureau of Economic Analysis (BEA), Regional Input-Output Modeling System (RIMS II). The BEA estimates that for every one dollar earned by direct employees generated by activity at the cargo terminals, an additional \$3.39 of personal income and consumption expenditures would be created as a result of re-spending the direct income for purchases of goods and services produced locally. Hence, a personal earnings multiplier of \$4.39 was used to estimate the total income and consumption impact of \$3.1 billion, inclusive of the re-spending effect. This additional re-spending of the direct income generates the 28,197 induced jobs.

The 26,768 indirect job holders earned \$1.1 billion in indirect wages and salaries. The 28,766 related shipper/consignee jobs tied to cargo moving via marine terminals received about \$860.4 million of personal income.

Therefore, the total personal income impact and consumption impact created by Indiana Lakeshore cargo shipments and related industrial activity is estimated at \$6.0 billion.

6. TAX IMPACTS

State and local tax impacts are based on per employee tax burdens which are developed at the county, local and state jurisdictional levels. These tax per employee burdens are essentially tax indices that are used to allocate total taxes at each level of government to economic activity generated by the cargo terminals. To estimate the per employee tax indices, total taxes received at each governmental level in Indiana was developed from the Tax Foundation, which reports total state and local taxes from all sources as a percent of total personal income.

Cargo and marine terminal activity generated \$486.5 million of state, county and local taxes. As a result of the economic activity created by the related shipper/consignees, an additional \$80.9 million of state and local taxes were generated for a total cargo tax impact of \$567.4 million.

APPENDIX A: PEER REVIEW LETTERS

INDIANA UNIVERSITY



July 9, 2010

KELLEY
School of Business

Mr. Jody W. Peacock
Director of Corporate Affairs
150 W. Market Street, Suite 100
Indianapolis, IN 46202

RE: Economic Impacts of the Ports of Indiana
Economic Impacts of Waterborne Shipping on the Indiana Lakeshore

Dear Mr. Peacock,

I would like to thank you and the Ports of Indiana for the opportunity to review these studies. Overall, I think they are carefully designed studies following standard economic impact approaches. I found the studies to be well written and organized. I am very impressed that Martin Associates was able to get such a high response rate from the firms that they interviewed. The location specific data provided by phone interviews coupled with Martin Associates' knowledge of the maritime industry enhance the accuracy of these results.

During my review of these studies, I provided comments and suggestions for a few specific areas including the explanations of economic models used in the analysis, types of data collected for the study, RIMS II modeling considerations, evaluation of related user jobs, and historical comparisons with 2009 data, especially because that was a recession year.

I personally have conducted economic impact studies of various individual events (e.g., the Indianapolis 500 and the Final Four basketball tournament) and industries. As a result, I feel qualified to recognize methodologically appropriate studies such as these.

Sincerely,

A handwritten signature in black ink, appearing to read "Bruce L. Jaffee".

Bruce L. Jaffee
Professor and Chairperson

BLJ:rg

DEPARTMENT OF
BUSINESS ECONOMICS
AND PUBLIC POLICY

1309 East Tenth Street
Bloomington, Indiana
47405-1701

812-855-9219
Fax: 812-855-3354



Richard A. Jensen
Department of Economics
434 Flanner Hall
Notre Dame, IN 46556
phone: 574 631 7698
email: rjensen1@nd.edu

Peer Review Letter of Endorsement

To Whom It May Concern:

I reviewed and provided comments on the following studies:

“Economic Impacts of the Ports of Indiana,” and
“Economic Impacts of Waterborne Shipping on the Indiana Lakeshore.”

I provided suggestions for improvement during the process, including adding more explanations for various complex issues and terms which are well-known to economists, but might seem mysterious to the non-specialist. These suggested changes were incorporated into the final versions of these studies, which I also have thoroughly reviewed.

These studies use standard, well-accepted techniques to measure the economic benefits that result from the operations of the ports of Indiana. There is nothing controversial about the methodology used. The studies also use only data that is readily available, so their results can be easily replicated by anyone who wants to verify them.

My expertise in this area of economics arises from 30 years of conducting and publishing original research and teaching in the area of industrial economics. For the last 17 years I have served on the editorial board of the *International Journal of Industrial Organization*, an academic journal that publishes peer-reviewed studies on industrial economics. For the last six years I have served as a co-editor, making final decisions about which articles this journal publishes.

In summary, Martin Associates appears to have extensive experience in conducting studies of the economic benefits of maritime activities, and uses best-practice empirical methods and data in these studies. The results are presented clearly and should provide valuable information for future discussions of the economic benefits of maritime shipping for the State of Indiana.

A handwritten signature in cursive script that reads "Richard A. Jensen".

Richard A. Jensen
Professor of Economics
Department of Economics
University of Notre Dame

Electronic Filing - Received, Clerk's Office, October 8, 2010



SCHOOL OF MANAGEMENT

July 12, 2010

Peer Review Letter of Endorsement

Ladies and Gentlemen,

I am very pleased to review the economic impact studies conducted by Martin Associates for the Ports of Indiana titled:

- Economic Impacts of the Ports of Indiana
- Economic Impacts of Waterborne Shipping on the Indiana Lakeshore

The studies focused on the local, regional, and state economic impacts generated by maritime and industrial activities for two different areas: 1) The state's three public ports located at Burns Harbor, Jeffersonville, and Mount Vernon; and 2) Indiana's Lake Michigan shoreline. Direct, indirect, and induced impacts of jobs, personal income, business revenue, and tax revenue were measured. The various exhibits demonstrate the flow of economic impacts generated by maritime activities at the various terminals of the Ports of Indiana and the Indiana Lakeshore. The overall reports show the significant economic impacts these activities have on Indiana's economy.

My background and expertise are in the fields of transportation and economic development. My past research experience includes economic impact studies of the transportation, distribution and logistics industry in Northwest Indiana. Currently, I am working on projects focusing on the estimation of economic impacts of improved freight reliability and security and of natural and man-made disruptions to inter-modal freight systems. The economic impacts of the Ports of Indiana are an integral component of the total economic impacts in the Indiana freight network system.

Based on my review of this material, I made several observations and suggestions that were included in the study related to the sections on direct and induced impacts. I have reviewed both final reports and can endorse these studies as sound measurements for the economic impacts of the Ports of Indiana and the Indiana Lakeshore shipping activities.

Please do not hesitate to contact me if you have any questions. Thank you.

Respectfully submitted by:

A handwritten signature in black ink, appearing to read "Amlan Mitra".

Amlan Mitra, Ph.D.
Professor of Economics
Department of Finance and Economics
Member, Transportation Research Board, National Academy of Sciences

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AN ANALYSIS OF THE ECONOMIC EFFECTS OF TERMINATING OPERATIONS
AT THE CHICAGO RIVER CONTROLLING WORKS AND O'BRIEN LOCKS ON
THE CHICAGO AREA WATERWAY SYSTEM

April 7, 2010



DEPAUL UNIVERSITY

Joseph P. Schwieterman, Ph.D.*
Professor, School of Public Service, and Director,
Chaddick Institute for Metropolitan Development
DePaul University
Chicago, IL 60604
jschwiet@depaul.edu
312.362/5732

*The author would like to acknowledge the assistance of Alice Bieszczat,
Steve Field, Lauren Fischer, and Andrew Pizzano

Executive Summary

Concern about the migration of Asian Carp into the Great Lakes system has been the impetus for discussion about terminating operations at three facilities in the Chicago Area Waterway System: the Chicago Controlling Works, the Thomas J. O'Brien Lock and the Wilmette Pumping Station. To foster understanding about the implications of this method of partial ecological separation, this study explores the extent of the economic activity that would be affected by these actions and their potential influence on the region's economic wellbeing.

The findings show that spending by consumers and commercial shippers on the barge and boat operations that would be affected by closure of the locks has an annual financial impact of \$1.3 billion. This figure is inclusive of multiplier effects related to waterway use but not inclusive of certain employment-related effects, which can only be measured with further study. The economic value lost from permanent closure is estimated to be \$582 million the first year, \$531 annually over the subsequent seven years, and \$155 million annually thereafter. The net present value of these costs, over a 20-year planning horizon at a four percent discount rate, is \$4.7 billion.

For the first year after closures, the lost value consists of added transportation costs (\$125 million; inclusive of social costs), losses to recreational boaters (\$5 million), consumers of river cruises and tours (\$20 million), municipal departments providing public protection (\$6 million), property owners (\$51 million), and regional agencies needing additional funds for flood-abatement systems (\$375 million). A portion of these losses would be shouldered by industries outside the Chicago metropolitan area, particularly certain ports in the Mississippi River basin that serve the barge transportation industry.

Additional research is needed to develop more accurate estimates in a variety of areas, including the effects of closure on assets and activities that derive their value from the aesthetic qualities of the river system, such as riverfront property, boat tours and cruises. This study also does not consider the employment-related effects, which will require separate study. Nonetheless, it offers a framework to illustrate how closure would affect various sectors of the economy, and offers suggestions for a more detailed study that could be conducted in the future.

I. Introduction

The prevalence of two species of Asian Carp in the Chicago Area Waterway System (CAWS) is generating vigorous debate about how to prevent a sustainable population from making its way into the Great Lakes System. A variety of alternatives, including greater use of pesticides, additional “electronic fencing”, modified lock operations, and complete hydrologic separation have been proposed to lessen the possibility of this occurring. One method of partial hydrologic separation under review involves the permanent cessation of operations at the Chicago Controlling Works (“Chicago Lock”), the Thomas J. O’Brien Lock, the locks’ accompanying sluice gates, and the Wilmette Pumping Station.

This paper focuses on the potential economic effects of the latter alternative. It offers economic and financial estimates of the impact terminating operations at these facilities would have in two areas relevant to the policymaking process. First, it provides estimates of the aggregate spending by consumers and commercial shippers on goods and services directly tied to marine vessels that would be directly and indirectly affected by closing the locks. Second, it estimates the economic value that would be lost from closure, through reductions in consumer surplus, diminished land value, and costs imposed on government agencies. This second section also illustrates how costs are distributed between consumers and institutions, as well as how these losses would be spread out over time.

To formulate these estimates, this study draws primarily on existing data and scholarly research that has been subject to professional review. In areas where little or no published research exists regarding the probable impact closure would have on metropolitan Chicago, it reviews the economic valuation and “benefit transfer” literature to identify measurements made in comparable settings in other parts of the country that can be appropriately applied to this region.

There is a particular dearth of published information about how recreational activities involving use of locks affect the metropolitan economy. Previous studies on recreational boating evaluate the CAWS and the Great Lakes as an integrated unit rather than as distinct resources to be evaluated separately. Similarly, prior studies tend to focus on single aspects of the waterway system, such as recreation, commercial shipment, or flood-abatement. For example, the Illinois Terminal Port District commissioned a study in 2003 that showed more than 8,500 jobs are directly or indirectly linked to the Port of Chicago. Although these studies are useful, they do not provide the U.S. Army Corps of Engineers (USACE) with the full range of analysis needed to evaluate the costs of alternatives related to preventing carp from entering the Great Lakes.

The author and research contributors acknowledge that preparing the estimates for this study required dealing with a great deal of uncertainty. It was not possible to expand the scope of the study to include the collection of extensive primary data, and it was necessary to make informed judgments about variables that have not been accurately quantified in the past, such as

the mix of boats that use the river system. In some areas, we base our estimates on information provided informally by professionals involved with the regional waterway system. Nonetheless, we have attempted to make our assumptions and calculations as transparent as possible, and make available a “computational spreadsheet” on the Chaddick Institute web site to help readers understand the nature of our analysis.

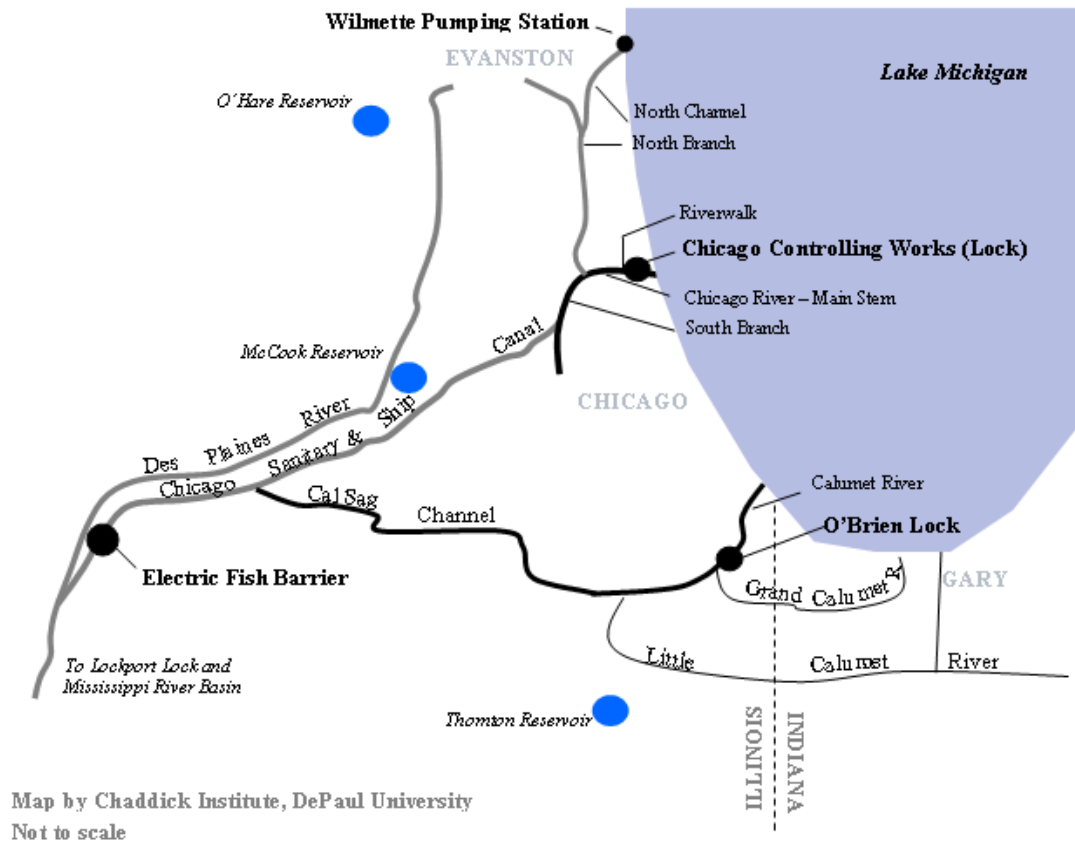
Although we evaluate a broad range of economic activities in this paper, some of the most significant effects of closing the locks are beyond our scope. We do not estimate, for example, the possible declines in the value of specialized transportation equipment and facilities, and the potential induced effects of changing shipping patterns on employment at suppliers of barge services. Nor do we estimate the probable changes in tax revenue to municipal governments or how changing water quality may affect the demand for river-oriented recreation, such as paddling trips and fishing trips. Considering that commodities and products valued at an estimated \$16 billion move through CAWS annually, and that river property within 800 feet of the shoreline has a market value of \$10.22 billion (see discussion in Section III), more research is needed to understand the full effects of lock closing.

II. Background Perspective

For more than 160 years boat traffic has moved through a system of natural and man-made inland waterways linking the Great Lakes and Mississippi River basins together. Starting in 1849, commerce flowed through an elaborate system of rivers and lakes including the 96-mile Illinois & Michigan Canal. The present day Chicago Lock, located roughly one-half mile east of the Michigan Avenue Bridge, was built in 1898 to replace an older lock in this system and to support the impending reversal of the flow of the Chicago River.

In 1900, the river’s reversal was achieved with the opening of major portions of the Chicago Sanitary & Ship Canal (CSSC) on the southwest side of the city, which provided a more expedient passage for boats, better sanitation, and increased flood control in the region. Boats navigating the Chicago River’s Main Stem and South Branch, the CSSC, the Des Plaines River, and the Illinois River now traveled downstream the entire distance, from Lake Michigan to the Mississippi River basin, and the original canal was eventually abandoned. Another improvement, the North Shore Channel, was completed between Chicago and Wilmette in 1920 to support flood control around the Chicago River’s North Branch. In the process, the ecology of the Great Lakes and Mississippi basin became more interconnected than ever.

**Figure 1
Chicago Area Waterway System**



More major improvements for waterborne commerce came in 1922 with the opening of the 16-mile Cal Sag Channel, which forged a more southerly route between the CSSC and Lake Michigan. The O'Brien Lock, located several miles from the Illinois-Indiana boundary at the southeastern edge of Chicago, was built as part of these improvements and is situated where the Channel meets the Calumet River, an estuary of Lake Michigan. The overwhelming majority of commercial tonnage (presently more than 98%) shipped over the Illinois waterway system en route to the Great Lakes has used this lock for many decades

Like the older Chicago Lock, the O'Brien Lock and the Lockport Lock (a third lock facility in metropolitan Chicago that is further downstream) serve both navigational and flood-control functions. Today, these locks together with the region's navigable rivers and channels form the Chicago Area Waterway System, which stretches 78 miles. Like most of the other inland waterways in the United States serving commercial navigation, USACE maintains the CAWS.

There are several dozen companies regularly involved in barge movements or maintenance activity services on the CAWS. Vessels carrying approximately 30 million tons of cargo move through the system annually. This commerce predominately involves Chicago-area industries, but a small fraction of the total tonnage is "through traffic" that originates and

terminates outside the metropolitan area (this is primarily tonnage arriving from or destined for Milwaukee, Wisconsin). Barges entering the Great Lakes typically do not travel beyond southern Lake Michigan, leaving most Great Lakes shipping to deep-draft vessels.

As we illustrate below, other stakeholders in the lock closure discussion include commercial tours operators and sightseeing services, public agencies, recreational boaters, marinas, and real-estate developers. In addition, the Metropolitan Water Reclamation District of Greater Chicago (MWRD) manages the sluice gates adjacent to the Chicago Locks and Wilmette Pumping Station, located approximately 15 miles north of downtown Chicago, to control the flow of water in and out of CAWS, thereby facilitating stormwater and flood control for the region.

III. Annual Expenditures on Boat and Barge Service

The approximate scale of economic activity directly tied to the two locks can be estimated by totaling expenditures by consumers as well as shippers and receivers on watercraft that pass through the locks or depend on their availability in other ways. These estimates include expenditures made for boat-related trips, services, and closely related activities that would be affected by the termination of lock operations.

The accounting of expenditures is a useful way to understand the direct and indirect impacts of money flowing through a regional economy. These estimates should not be interpreted as representative of the net economic *costs* associated with terminating operations at the two locks. For example, if commerce in one sector diminishes, some expenditures will likely be redirected to other sectors of the economy. Nevertheless, the estimates offer a perspective on the breadth of the market that would be affected by the unavailability of the locks.

Commercial Shipping. Industrial enterprises spend an estimated \$101 million annually on barge transport services that involve shipments through the two locks examined in this study. Our calculation is based on self-reported industry estimates of the average shipping price (\$13.50 per ton) and the three-year average of shipping volumes through the locks, which is 7,462,000 tons.¹ More than 98% of this commercial traffic involved use of the more southerly O'Brien Lock.²

Others shippers in the CAWS, whose shipments do not use either of these two locks, also have a stake in decisions made regarding the locks, albeit to a lesser extent. This is due to the potentially adverse effects that terminating operations could have on barge utilization, the potential changes in water levels on rivers and canals, and lost access to barge-related services on the Calumet River if the locks cease to be regularly opened. (For a more detailed discussion of this, see Section IV). A particularly large number of services used by barge companies, such as repair and maintenance facilities and barge-tow providers, are located upstream of the O'Brien Lock. This market generates estimated \$309 million annually, making total yearly expenditures for all barge services around \$412 million.³

Recreational Boating. An estimated 2,550 boats pass through the locks every spring and summer to gain access to boat slips and other mooring facilities on Lake Michigan, primarily harbors managed by the Chicago Park District; this represents 45% of the approximate 5,600 boats that moor in Lake Michigan harbors. Other boats are permanently moored or stored downstream from the locks but make regular or occasional trips to the lake. Of these, an estimated 500 are moored during the summer season in marinas that are downstream of the locks

and thus would be unable to reach the lake if lock operations are terminated. Finally, there are boats that access the CAWS system using boat ramps or private facilities. Based on the number of recreational boats reported as operating through the locks annually, and taking into account the number of “marina boats” mentioned above, we estimate that, as a rough approximation, these boats account for about 8,000 – 10,000 roundtrips annually. We use a 9,000 roundtrip estimate in the analysis below.⁴

Estimates of annual spending by owners of watercraft in Illinois can be found in published USACE data that report expenditures for various types of “marina boats” and “non-marina” boats in Illinois. For the purposes of this analysis, we assume the same mix of large and smaller boats reported in these data. We project annual spending by boats at CPD facilities and riverfront marinas is equivalent to the weighted “marina boat” average elsewhere in the state, or \$13,700 per boat. This estimate is inclusive of ancillary consumer expenses on boat trips, such as restaurant meals and retail expenditures. It is likely that boats moored on Lake Michigan harbors are larger than those moored on inland rivers and lakes, making this a relatively conservative estimate. For boats not moored at marinas, which tend to be smaller, we use the non-marina figures of \$6,435 per boat.

These estimates suggest that recreational boaters using the locks to gain access to the lake cumulatively spend approximately \$58.9 million annually on trip-related or craft-related goods and services. (See the computation spreadsheet for more details about these expenses). The total does not include spending by recreational boaters who use the river system but do not use the locks, such as those using canoes and inflatable craft. Nor does it consider the potential revenue impact of recreational boaters who make long excursions between the Mississippi Basin and the Great Lakes.

Commercial Cruises and Tours. An estimated 760,100 passengers purchase tickets for sightseeing and tour boats that pass through the locks annually.⁵ These passengers pay an average of \$31.00 per trip. Industry representatives estimate that these customers spend \$5 - \$10 per trip in addition to their fare on food, drink, and other items. (We use the midpoint of \$7.50, making total spending of \$38.50, in the analysis below).⁶ Not included in these estimates (unlike that for recreational boats) is off-boat spending, such as that on parking and restaurant meals. We provide a more detailed summary of this industry in Section IV.

For some consumers, the availability of river tours and excursions is a principal reason for planning a trip to Chicago. As such, tour-boat activity is directly responsible for spending on hotels, restaurants, parking, and other items. There has not been a detailed published study on the buying habits of the boat-riding sector. Nor does the Chicago Tourism Bureau publish data on the importance of tour boat services to tourism, although it does note that more than 30% of consumers consider sightseeing as their primary motive for visiting Chicago.

To estimate the extent of “out of water” revenues attributable to sightseeing and tour boats, we considered the percentage of passengers using these boat services who made reservations in advance. Industry representatives estimate that 33% of tourists/travel agencies reserve excursions in advance, often purchasing nonrefundable tickets, which suggests that an appreciable share consider the boat trip important enough to justify making a commitment prior to their arrival at the loading area.⁷ As a conservative measure, we assume that only a small fraction of these passengers (30%) are making trips to Chicago on account of these services. This suggests that 76,100 consumers annually come to the city for this reason; this number is equal to about 10% of all customers who use boat tours through the locks, or about three tenths of one percent of all tourists from out of town.

For these customers, whose trips can be directly tied to river cruises, we assign a value for consumer expenditures equal to the average daily spending reported by the Chicago Tourism Bureau—\$343 per person—rather than the lower \$38.50 amount assigned to the other 90%. Of course, more data collection (involving survey research) is necessary to obtain a more precise estimate, but the analysis suggests the overall spending attributable to scenic cruises and boats tours is in the vicinity of \$52.4 million annually.

Public Protection. The Chicago Police Department and the Chicago Fire Department, use the locks for their marine-based public services. We were unable to obtain estimates of annual spending, and have instead used as a proxy figures each provided that represent the labor costs associated with creating stand-alone river operations if lock operations were to be terminated (see discussion in the next section). This total, \$5,500,000 annually, provides a sense of the scale of their river operations, and should be interpreted as a lower-bound estimate, as it does not include fuel, supplies, and other costs.

Cumulatively, these estimates indicate that direct impact of boat activity involving vessels using the locks is approximately \$529 million annually (Table 1). Using standard multipliers for indirect and induced effects from this spending, we estimate the total impacts to be \$1.3 billion. (See Note A for a discussion of the expenditure multipliers we applied.) These totals do not include most spending by land-based consumers, such as those on the Chicago Riverwalk, in marina restaurants, and those using other amenities situated on CAWS. Nor do they include spending by the U.S. Coast Guard, for which no information was available.

Table 1
Estimated Financial Impact of Vessels
Using the Chicago Lock and O'Brien Lock

<u>Category</u>	<u>Annual Direct Spending</u>	<u>Multiplier for Induced and Indirect Effects</u>	<u>Cumulative Economic Impact</u>
Commercial Shipping	\$412,000,000	see Note A	\$992,920,000
Recreational Boating	\$58,885,000	“ “	\$141,912,850
Commercial Cruises and Tours	\$52,409,895	“ “	\$126,305,437
Municipal Protection	\$5,500,000	“ “	\$13,255,000
Total	\$528,686,580	“ “	\$1,274,393,287

Note A: An expenditure multiplier of 1.41 is used to estimate the induced and indirect impacts. This number was determined to be representative based on previous studies on transportation and recreational activities involving Illinois industry using RIMS. This multiplier is also similar to those used in other studies of Great Lakes shipping and boating activity.

As is evident in Table 1, commercial shipping and recreational boating are the largest categories, followed by commercial cruises and tours. As previously noted, these figures should not be interpreted as indicative of the economic costs of terminating operations at the locks, which we estimate in Section III. Furthermore, the impacts of commercial shipping expenditures will be divided between metropolitan Chicago and other river ports served by the barge industry. A much more extensive analysis will be necessary to consider this issue in greater detail; this analysis should be recognized as providing only an approximation.

IV. Lost Value and Added Costs due to the Termination of Lock Operation

This section offers estimates of the lost economic value and cost escalation that would result from the termination of operations at the locks, the sluice gates, and the Wilmette Pumping Station. These estimates include reductions in consumer surplus, declines in the value of economic assets, and the additional financial burden imposed on government departments to provide the same level of service.

Consumer surplus is a measure of the value a consumer gains from engaging in an economic activity. It is the net benefit to the consumer and is calculated as the total value from consuming a good or service minus the expenditure on that good or service. Consumer surplus is therefore distinct from price, which measures the unit cost to the consumer and not the benefit. This notion is particularly important for measuring recreational activity, as it can be used to measure how the value of an outdoor recreational experience is affected by changes in price, accessibility to the outdoor resource, quality of the resource, distance to a recreation area, and other factors. If the activity itself is no longer available due to changes in environment or accessibility, the expenditure can be recovered and spent on something else while the consumer surplus is lost.

Table 2
Major Categories of Economic Costs Evaluated

1. Changes in the cost of moving commodities due to the loss of two shipping lanes.

This category reflects the effects of higher transportation costs associated with the movement of goods. These estimates should also account for changes in the utilization of barge equipment, as well as changes in the speed and reliability of service. They should also include the non-market (external) costs associated with various forms of transportation.

2. Lost value resulting from the inability of recreational vessels, as well as commercial tour and cruise boats, to access the locks and the lake from the river system.

This category of costs is indicative of the loss of value to pleasure boaters and consumers of fee-for-service operations that involve use of the locks.

3. Costs imposed on the city as a result of the loss of public-utility functions using the river system, including flood prevention, stormwater management and emergency response.

These costs include the value of the locks in reducing water levels related to storm mitigation and flood prevention in the Chicago River, and the need to increase expenditures by various city departments to maintain comparable police and fire services.

4. The effects of lock closure on the value of the river as a conduit for real-estate development and as a cultural, recreational, and tourism amenity.

This category includes the loss of economic benefit resulting from the potential fall in property values due to factors such as diminished water quality and aesthetic qualities of the river system, and lack of access to the lake.

Most of the losses in value or cost increases can be assigned to one of four categories described above in Table 2. The first category emphasizes transportation costs, while the final three categories encompass issues of aesthetics, water quality, and consumer preference. Each is evaluated in separate sections below.

a. Costs of Commodity Movement

Barge transportation has consistently been shown to be less expensive for industries on the inland waterway system than rail and truck transportation for the shipment of bulk commodities.⁸ The cost difference per ton shipped tends to be less for bulky commodities (such as grain) than for denser ones (such as crushed rock) due to the relative advantages of water transport with respect to the heaviest loads. Nevertheless, the relationship between barge costs and that of other forms of transportation is dynamic. The availability of barges, for example, can be an incentive for railroads to keep their rates low.

Costs of lock closure for existing shippers. A Tennessee Valley Authority study using data from the late 1990s demonstrated that there were significant cost advantages to barge transportation. The Texas Transportation Institute (TTI), adjusting this estimate for inflation, reported that in 2005, the approximate difference was \$11/ton. A University of Missouri study

concluded that the cost differences were \$6.76 for asphalt projects, \$13.05 for cement, \$13.16 for fertilizer, and a lesser amount for agricultural commodities. This latter study examines shipping costs from points on the Missouri River, which is also part of the Mississippi River basin and thus has certain geographic similarities to the Illinois Waterway system.

The USACE estimated in its Interbasin Transfer Study, which is slated for completion in 2011, that closing the Chicago and O'Brien locks would cost shippers between \$5 and \$26 more per ton, depending on the type of commodity involved. This study is not yet complete, however, and the underlying methodology has not yet been formally disclosed. Therefore, we do not use these estimates in the analysis below.

For purposes of this study, we use a composite estimate that uses the midpoint between the TTI and Missouri estimates. (With regard to the Missouri estimate, we tabulated the average cost difference by considering the mix of agricultural and non-agricultural commodities shipping through the two locks.⁹) We then convert all figures into current (2010) dollars. According to this approach, the average cost increase will be roughly \$11.96/ton.

An argument can be made that this figure is either too high or too low. As in each of the other studies, we made the simplifying assumption that demand is completely inelastic. Furthermore, the \$11.96/ton estimate does not account for the higher cost of truck transportation in congested metropolitan areas. It does not fully account for the prevalence of tanker operations on CAWS, for which shifting to rail and truck transport is relatively difficult. The argument could also be made that Chicago's status as a highly competitive transportation hub would make switching to other modes less costly.

Regardless, this approach provides a reasonable, middle ground estimate. With 7,289,428 tons moving through the Chicago and O'Brien locks annually (this is a three year moving average for 2006 – 2008), the increase in costs for shippers is estimated at approximately \$89 million.

Costs to other Barge Users in Illinois. Although terminating operation of the locks will principally affect customers who ship through the affected locks, it would affect other users on Illinois and Indiana waterway systems as well. Closure could also reduce the level of barge utilization, reduce the density of operations, and separate shippers from businesses operating barge tow and tugboat services as well as repair/maintenance services.

An important factor affecting barge utilization is the extent to which "upstream" and "downstream" traffic can be effectively balanced. At the O'Brien Lock, upstream traffic exceeds downstream traffic by a wide margin.¹⁰ As you move south of the Lockport Lock, conversely, downstream traffic exceeds upstream traffic by an ever-widening margin. The growing imbalance is partially due to the rising volume of grain that is shipped to Mississippi River ports from downstate terminals.

Ending operations at the two locks would most directly affect upstream traffic, aggravating the traffic-imbalance problem. At present, barge companies often "cycle" their equipment through the CAWS system to minimize the costs of moving empties. For example, a company may transport a load from the Mississippi basin through the locks to a manufacturing facility in Gary, Indiana. That same barge might then return as an empty through the O'Brien Lock before picking up a load destined for a downstream destination.

The importance of the O'Brien Lock for such equipment positioning is exemplified by the number of empties that move through it annually. In 2007, 30% of all of its barge movements were empties, an appreciably higher percentage than most other locks on the state's waterway system.¹¹ If the movement of upstream barges (for reasons noted earlier) is reduced by 40% on account of the closing of the O'Brien Lock due to the diversion of tonnage to rail and truck transport, it is likely that at least 750 fewer empty barges would return to the CAWS for downstream shipments. Several hundred more barges may need to deadhead from New Orleans to customers shipping downstream.

To illustrate the potential this creates for cost escalation, consider the approximate cost of transporting 750 barges an additional 600 miles to support downstream movements.¹² Industry representatives put the transporting and opportunity costs of tying up an unloaded barge for a single day at roughly \$750.¹³ With barges traveling at roughly 6 m.p.h., and assuming an additional 600 miles of deadheading, each barge would be lost for slightly more than four days—at a total cost of about \$3,125/barge. The total annual cost for decreased barge utilization and increased dead-heading cost for 750 barges would be roughly \$2.3 million annually. Under a less favorable scenario, in which an appreciable percentage of barges would travel empty the entire 1,400-mile distance from New Orleans, the increased costs would be much greater.

This estimate does not include the costs imposed on downstream shippers resulting from their separation of barge-tow and repair facilities. Nor does it account for the losses that would be incurred by operators who have built specialized barge equipment that cannot be easily utilized elsewhere. A more extensive analysis will be necessary to approximate these costs.

Costs to Intra-Lake Michigan Barge Users. Several shippers rely on barges to move traffic between points on or near the southern part of Lake Michigan. This traffic does not directly use the locks but would be affected nonetheless. If the locks are no longer available, these operations would probably not be sustainable on a stand-alone basis. Moving the affected commodities on deep-draft vessels would be difficult or impossible in many instances, due to the associated terminal costs and the limited depth of the loading areas some of these barges serve.

Without barge traffic moving through the locks, the equipment used for these operations would likely not be effectively utilized, as these movements tend to fluctuate from week to week. It would likely be difficult to justify keeping barges upstream of the locks. Each autumn, barge operators would need to make a complicated equipment transfer to warmer water. This would entail towing barges through the Straits of Mackinac and Lake Erie, through the New York Barge Canal, and down the Intercoastal Waterways. This journey back to the Mississippi Basin is more than 750 miles longer than the present routing through the O'Brien Lock. A reverse trip would be necessary in the spring.

Accurate data on the size of this market is not available. Based on reported shipping patterns noted by industry representatives, a conservative estimate would be that this market encompassed 1 million annual tons (or about 1/7 of the tonnage moving through the O'Brien lock). Due to the short-haul nature of these movements, we assign a value of \$5.98 ton—half of the \$11.96 estimate used earlier—for the added transportation cost to this market due to the probable discontinuation of barge service. This results in a total additional cost of lock closure of \$5.9 million. More research will be needed to develop more accurate measures of the costs as well as a precise estimate of tonnage.

External Costs and Highway Cost Responsibility. All transportation modes generate external costs in the form of pollution, congestion, and safety risks. For some modes, these are

not offset by user fees, creating inefficiency in the use of resources. To develop estimates on changes in these costs, we use widely accepted and frequently cited economic estimates by David Forkenbrock. Forkenbrock's research estimates the external costs to be 0.38 cents/ton for rail service and 1.13 cents/ton for motor carrier (truck) estimate.¹⁴ This study does not measure the external costs of barge traffic. Other studies, however, have suggested the external costs for barge movements are much lower (see Bray, et. al, 1998). Since barge transport has been shown to be more than 33% more fuel efficient than rail service and subject to significantly less accident risk than these other modes, the external costs are almost certainly smaller per ton mile. However, to be conservative, we use a rate for barge transport equal to that of rail transportation.

Shifting traffic to heavy trucks also increases wear and tear on the highway system, most notably in the form of pavement and structural fatigue. Here, too, we use a widely accepted estimate by Forkenbrock, whose research estimates the uncompensated cost of road damage from heavy trucks at \$0.31 per ton. Using the traffic figures described above, and estimates on the approximate modal split indicated on our computational spreadsheet, we estimate the additional costs to be \$27.5 million annually.¹⁵ (This estimate is based on a scenario of trains and trucks handling 30% and 35%, respectively, of the ton-miles currently moving by barge through the two locks.) This figure does not account for possible offsetting reductions on the cost of maintaining the waterway system as barge traffic declines.

b. Lost value to recreational boaters and consumers of commercial tours and cruises due to the closure of the locks

The implications of terminating operation of the locks differ widely between the various types of boats that use them. We consider separately the various types of recreational boats in the analysis below.

Boats using Chicago Park District facilities and marinas on the Calumet River. Between April and June each year, an estimated 2,600 recreational boats depart marinas, boat ramps, or winter storage facilities on the Chicago River or Cal Sag Channel en route to Chicago Park District (CPD) facilities on Lake Michigan, where they remain for the summer season. The "flotilla" is reversed each autumn, when boat owners return to the rivers for winter storage. Altogether, boats transiting the locks to reach harbors and marinas appear to account for slightly less than half (we use an estimate of 45 percent) of the roughly 5,600 boats using CPD harbors during summer.

The remaining 55% of boats moored on Chicago's harbors tend to be pulled from the water at lakeside boat ramps or brought to marinas or boat ramps in Indiana or southern Wisconsin. These boats do not travel through the locks to access the lake, and we assume they would be completely unaffected. As a general rule, however, boats that use the locks to reach winter storage locations tend to be larger than those that do not.

If the locks were no longer available, it is not clear how the owners of the 2,600 boats would access the lakefront. A small share, about 10%, could be transported to the lakefront on trailers; they are small, light, and narrow enough to be pulled by the owner's car or light truck.¹⁶ The owners of many of these boats would likely drive to a lakefront ramp and face only relatively modest inconvenience. For these boaters, we assign a value of \$145 (see Appendix A) for the inconvenience of losing their preferred logistical alternative at the beginning and end of the boating season.¹⁷ (We assume these boaters already have access to a trailer.)

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The remaining 90% of boats would need to divert to distant marinas or storage areas, all of which are a considerable distance from CPD harbors. The owners of these estimated 2,360 boats would likely have difficulties finding marinas or boatyards able to provide winter storage. New capacity would need to be built.

Moreover, these boaters would incur additional monetary and nonmonetary costs, such as added transportation expense, boat wear-and-tear, and lost time. Fuel consumption varies widely by boat, but the overall average for most marina boats is around one mile per gallon. A roundtrip from Chicago to Kenosha, Wisconsin (a distance of 60 miles each way), consequently, would cost the average boater approximately \$550 in fuel. Most owners make several trips (typically by car) to their boats to perform preparatory activities before launching their craft during the spring season. These trips would become more costly and time consuming. Considering how marinas are distributed across the southern end of Lake Michigan, our estimates suggest that affected boat owners would incur 18 or more additional hours of travel time per person per year as well as \$720 in additional operating costs (boat and highway combined).

For purposes of this study, we use these estimates and the standard microeconomic assumption that travelers disvalue additional travel time at about one-half of their wage rate. We assume no additional costs for boat storage or necessary capital outlays (despite the apparent lack of existing capacity) beyond what these boaters already spend. We also assume that the added travel time would affect two people for each boat. This suggests additional costs for these vessel owners of \$1,638 per boat.¹⁸

The lost value to boat users from losing their preferred option would, as a rough approximation, be about \$5.1 million annually. (As a simplification, we assume that the demand for boat slips is inelastic with respect to cost of accessing the lake.)

Boaters Storing their Equipment Downstream of the Locks. An estimated 600 recreational boat owners use commercial boat slips at one of several marinas on the Chicago River or Cal Sag Channel. These boaters would be even more acutely affected by the lock closures. To understand their approximate economic losses, we reviewed the economic literature measuring value that consumers place on having access to a wide variety of water-related recreational amenities. This extensive body of work, summarized in the Appendix A, suggests an average loss of \$47 - \$87 per boat trip from the loss of a recreational alternative. We use the midpoint of this range, \$67 per boat, in our analysis.

To develop an annual cost per boat, we applied the \$67 estimate to USACE's estimates of the number of trips taken annually by boats moored in marinas. This suggests that closing the locks result in a \$1,005 loss in value for each affected boat. This appears to be a lower bound, considering that, as previously noted, the total annual spending for marina boats is more than \$13,000 annually.

Our analysis also considers the lost value for recreational boaters who do not operate out of marinas; instead, these boats launch their vessels through other means, such as by using public boat ramps or private boat slips. These boaters account for (as previously noted) an estimated 9,000 roundtrips to the lake annually. Altogether, using the above coefficient, this suggests that a cumulative estimate of the economic losses to recreational boaters is \$5.1 million annually (See computational spreadsheet for details).

Commercial Tours and Cruises. Approximately 75% of all tour and cruise activity in Chicago that uses the river system involves use of the locks. A recent survey by the Passenger

Vessel Association elicited responses from five of the seven tour operators. This survey showed that the river-cruise industry has a total boat capacity for 4,500 to 5,100 passengers. The five companies responding to the survey employ 604 workers and have an approximately \$7 million payroll. In 2009, their boats used the Chicago Lock 7,790 times.¹⁹

Accounting for the fact that several operators did not respond to the survey, we estimate that 760,000 paid customers pass through the locks each year. This represents about half of the total Chicago boat-cruise market, with the other half primarily operating off of Navy Pier. The Pier's operations tend to focus more heavily on dinner cruises and special-event outings, which are longer in duration and less educationally focused. These cruises generally do not use the locks.

Although tour operators could specialize in lake-only or river-only cruises as lock operations cease, the evidence suggests that the value of river-oriented operations would be diminished. The absence of through-boat activity, such as the passage of recreational boats and yachts, as well as a diminution of water quality, would likely hamper the appeal of river cruises. Moreover, the locks are a major tourist attraction themselves—many groups, for example, take cruises primarily to pass through them—and the separation of the lake and river system would hamper the utilization of boat equipment. Some boats primarily navigate the river by day and Lake Michigan by night, often in response to heavy demand for watching the sunset and fireworks (scheduled twice weekly) around Navy Pier. The nature of these markets suggest that most of the river market would be lost if tourists needed to travel via cab or bus to the pier for a different type of cruise.

For purpose of this analysis, we assume that the existing lake-only and river-only cruises would be completely unaffected—despite potential changes in water quality on the river system—while those using the locks would experience lost value roughly equivalent to the typical value observed in economic-valuation studies involving water-related excursion activities. These prior studies, which we summarize in Appendix A, suggest that people derive approximately \$18 – 34 consumer surplus from expenditures on these activities. For purposes of analysis, we use the midpoint value of \$26 per trip. The cumulative effect of this lost value is \$19.6 million/year.

c. Public Service, Public Protection and Stormwater

These costs can be divided into two categories: public protection and flood control.

Public protection: Police and Fire. The Chicago Police Department and Chicago Fire Department both maintain facilities designed to jointly support operations on the lake and river system. The Chicago Fire Department's Air Sea Rescue Division facility, located near the mouth of the Chicago River on Lake Michigan, is equipped with two fireboats, one 96-foot boat and one 33-foot boat. This facility allows the Department to respond to emergency locations on the inland Waterway System in 15 to 40 minutes and more quickly to those on the lake.

The Fire Department considers maintaining a marine presence on both sides of the locks to be essential to its mission. If lock operations cease, this would require adding a fireboat and personnel at a new location on the Chicago River. The CFD estimates that adding additional 33-foot and 96-foot vessels would cost \$350,000 and \$2.76 million, respectively, and that added personnel would cost another \$2.75 million annually. The department would also need to make capital investments to handle these boats and the associated personnel.²⁰

The Chicago Police Department's Marine & Helicopter Unit uses eight watercraft for search, rescue, and recovery operations as well as for law enforcement and homeland security patrols and inspections. These boats, housed on the South Branch of the Chicago River, are frequently users of the locks. In 2009, the boats used the locks, on average, several times daily and made 7,314 site inspections. If lock operations cease, the department would need to purchase an ice-breaking watercraft at a cost of approximately \$1 million and to budget for the addition of between 16 and 24 personnel, at a cost of between \$1.8 million and \$2.7 million annually. (We use \$2.3 million, which is near the midpoint of this range, in our analysis). Although appreciable capital costs to prepare facilities for the changes would also be incurred, there is uncertainty about their magnitude, so we assigned only a nominal value for these costs of \$150,000 each to both the CPD and CFD. The actual costs will likely be much higher.

We amortize the costs of the boats and facilities over an eight-year period, which suggests the total costs would be approximately \$5.7 million annually over this initial period and \$5.1 million thereafter. This is a lower-count estimate as it does not include the cost of additional fuel, supplies, and other necessary expenditures.

Stormwater, Flooding and Water Reclamation. Stormwater management and flooding has been a problem in metropolitan Chicago for more than a century. Due to the flat topography and the limited capacity of existing waterways to handle runoff, heavy emphasis has been placed on reducing the costs of flooded basements, flash floods, and the pollution attributable to excessive water runoff. A great deal of investment has been made to modify the river system to alleviate these problems. The decision to reverse the flow of the Chicago River and build the CSSC, for example, was motivated by these concerns. Moreover, the locks must be periodically opened to allow rising waters of the river to flow into the lake to compensate for the inadequacy of stormwater systems.

The efforts to control flooding crossed an important milestone in the late 1980s when the Metropolitan Water Reclamation District of Greater Chicago (MWRD) completed extensive portions of its Tunnel and Reservoir Plan (TARP). This system of tunnels and reservoirs, popularly called the "Deep Tunnel Project", channels stormwater over a 375 square-mile area into reservoirs so that it can be gradually discharged in the river system. MWRD has spent about \$3 billion on this initiative, and recent estimates suggest these improvements are providing \$41 million in annual benefits. The first of the two construction stages is slated for completion in 2014.²¹ For a variety of reasons, including funding concerns, however, the construction timetable will likely drag on more than 40 years longer than anticipated, and the second phase is not slated for completion until 2023.

The principal constraint on the system remains the limited capacity of the waterway system between Sag Junction to Lockport, which is capable of handling only 20,000 cubic feet of water per second, which is grossly insufficient after heavy rain. As the region's development footprint expands, consequently, the TARP system is strained. Basement flooding from sewer backup remains a problem, and has been estimated by USACE to cost \$150 million annually.²²

MWRD has reported to the Rapid Response Work Group that it would be necessary to bore a tunnel between the North Branch of the river from the facility at Foster Avenue to the McCook Reservoir, a distance of more than 10 miles, if operations at the locks, sluice gates, and pump station are halted. This proposed tunnel, which would provide protection for 1.2 million structures, was part of the original TARP package; construction, however, was cancelled when it was deemed unnecessary for controlling flooding. Other investments would also likely be

necessary due to the termination of operations at the O'Brien Lock, including expansion of the McCook Reservoir to provide protection to 182,000 structures.

Our assessment suggests that MWRD's estimate that it would cost approximately \$2.5 billion to build the tunnel (the equivalent of about \$1,500 per household served) to be credible. Another \$56 million would be needed to support improvements to the Little Calumet River. These improvements (which are in addition to the estimated \$726 million needed to finish the second phase of TARP) would require a lengthy construction timetable after planning and design. Although the expected costs of flood damage without the improvements aren't presently known, testimony by Dr. Yu-Chun Su suggests the costs could exceed \$1 billion annually.²³

For purposes of this study, we estimate the amortized cost of making these improvements deemed necessary by MWRD over an eight year construction period and assume no additional costs beyond that period. This suggests (with an allowance for 4% annual cost escalation) that the costs would be \$375 million/year over these eight years. Heavy investments could likely be necessary even if allowances were made to open the locks only during moments of rare flooding. The routine opening of locks serves to lower water levels on the Chicago River and Cal-Sag Channels after periods of heavy precipitation. Although our cost estimates are speculative (construction could not likely begin for several years) amortizing the costs over eight years illustrates the extent of the funding commitment that would be necessary to see the project through to completion.

d. Value of Property Along the River System and Other Issues Related to Proximity

There has been extensive analysis in recent years about the economic value of a "healthy" river system to the Chicago economy. Little of it, however, has been formally published in peer-reviewed journals. A report commissioned by local nonprofit organizations postulates that the vitality of the river system has resulted in property value increases of more than \$400 million in the early 2000s. It notes that the river's value as a recreational amenity has risen due to regulatory changes made in the 1980s that dramatically improved water quality. It also notes that there is data suggesting water quality has improved as a result.²⁴

This body of work also notes that effluent from reclamation plants operated by MWRD currently makes up about 30% of the Chicago River's annual flow—a percentage that would likely rise significantly if Lake Michigan water no longer passed through opened locks. Water from the lake tends to be cleaner than effluent from MWRD, suggesting that there would be a material reduction in water quality if the locks were closed.

Based on the Supreme Court testimony by Kevin Boyle of Virginia Polytechnic University, the loss of discretionary water diversion from Lake Michigan into the CAWS may lead to noxious conditions and fish kills which can only be partially overcome via existing alternative measures in the short term. Further, in his testimony, Colonel Vincent V. Quarles states that the lack of lake flows could lead to low water levels and stagnant conditions potentially affecting CAWS users.

The City of Chicago, after tabulating the Equalized Assessed Value (EAV) of property along the river system, postulated that property values rose by more than \$400 million due to the river's expanding role as a recreational and aesthetic amenity during the early 2000s. Nevertheless, this study did not control for exogenous factors, such as the proximity of many of the studied properties to the central business district. Recent expansion of residential housing along the Chicago River, however, lends credence to the view that the inland waterways have

been an important factor in real-estate development, particularly in the Central Area and along the North Branch. In addition to the established marinas such as Marina City and River City, several new ones on more outlying river segments, including the Chinatown Area, as well as the Trump Tower, Lake Shore East, and new condominium towers provide support for the notion that property along the river increasingly sells at a premium.

The city has invested approximately \$22 million and leveraged additional private investment for the Chicago Riverwalk, which extends from Lake Shore Drive to Franklin Street. This system of public walkways and seating areas along the water's edge is designed to showcase the "canyon of skyscrapers" while watching the boats go by. The Riverwalk presently has six cafes and is a jumping off point for boat cruises, water taxis, bike rentals and tours. The McCormick Tribune Bridgehouse and Chicago River Museum on Michigan Avenue also are illustrative of the river's role in tourism.

Many industrial properties along the river and canal system, however, do not appear to have benefitted from this effect. The demand for industrial property along the river system remains relatively weak, in part due to the economic downtown and the county's tax structure. Moreover, recreational activity that involves direct contact with the river, such as swimming and tubing, remains quite limited, partially due to variability in the level of water quality.

An informed estimate of the decline in property value that would occur as a result of the lock closures can be made by reviewing several different methodological approaches. Boyle's research indicates that even relatively modest *improvements* in water quality could generate \$1.05 billion in value for the region in the form of improved health, recreation, and tourism opportunities. This equates to a benefit of about \$47 per resident of the city. A Friends of the Chicago River report suggests that improved water quality could generate more than \$500 million in new economic activity over 20 year period, primarily in the form of increased recreation. The Brookings Institution maintains that improved water quality could increase property values in the Great Lakes by 1% to 2% percent in densely populated urban areas and a greater amount in other areas. (See the reference section for full citations on these studies.)

Economic analysis exploring changes in property values in other regions that are the result of changes in the quality of waterways are also useful to consider. As we note in Appendix B, there is a particularly extensive literature on the elasticity of property values with respect to water quality (as measured by the percent change in contaminants in the water). Using an estimate near the median of the elasticity estimates made in these studies (.05), and assuming a hypothetical 10% reduction in water quality, we estimate that property values would fall by 0.5%.

Data from the City of Chicago indicates that the market value of property within an 800-foot buffer of the river system was \$10.22 billion in 2006. This suggests a decline in property value of \$51 million dollars. This estimate should be recognized as being speculative, but it is also conservative, as it does not account for the effects that lost access to the lake and the diminishment of the other qualities of the river system (such as a decline in the recreational value and tourism role of the system) would likely have on property values. The decline in value is less than half the effect suggested by Austin, et.al, in the Brookings Institution study (2007) and only a small fraction of the estimate made by Sulski of the benefits of improved water quality. The costs to property owners could take the form of smaller increases in land value. Regardless, more research in this area is clearly needed.

V. Conclusions

The findings of this study about the implications of terminating operations at the lock facilities and the Wilmette Pumping Station suggest that the decision should not be made lightly. A summary of the economic losses from the termination of lock operations appears in Table 3.

Table 3

Summary of Economic Loss from Termination of Lock Operations

	<u>Year 1</u>	<u>Years 2 - 8</u>	<u>Years 9 - 20</u>
Commercial Shipping	\$95,230,082	\$95,230,082	\$95,230,082
External & Highway Costs	\$29,828,326	\$29,828,326	\$29,828,326
Recreational boating	\$5,077,920	\$5,077,920	\$5,077,920
River Cruises and Tours	\$19,762,600	\$19,762,600	\$19,762,600
Flood prevention	\$375,478,436	\$375,478,436	
Municipal protection	\$5,643,913	\$5,643,913	\$5,050,000
Property value loss	\$51,000,000		
Total	\$582,021,277	\$531,021,277	\$154,948,928

The economic value lost from permanent closure is estimated (as a lower bound estimate) to be \$582 million the first year, \$531 annually over the subsequent seven years, and \$153 million annually thereafter. The net present value of these costs, over a 20-year planning horizon at a four percent discount rate, is \$4.7 billion.

Additional research is needed for policymakers to understand the full effects of this policy alternative. The decision-making process could benefit from a careful consideration of other economic issues not included in this study, such as the investments that industries have made in specialized equipment and facilities, the effects of changing shipping patterns on employment at suppliers of barge services, and the effects that changes in barge transportation will have on the rates charged by competing transportation modes. Furthermore, the analysis should be expanded to consider changes in tax revenue and the effects of changing water quality on the demand for river-oriented recreation, such as paddling trips and fishing.

There is a particular need for more research on the value of recreational boating and tour-boat operations on urban waterways. Survey data could help reveal how local consumers make decisions regarding tour boat trips relative to other local activities, as well as how tour boat trips contribute to Chicago tourism from out-of-town visitors. This data could then be used to assess how various trip characteristics, such as lock passage, views and river water quality affect the overall economic value of the boat trips. Such a study could utilize some of the same techniques that researchers at the University of Chicago and RCF Economic and Financial Consulting used to measure the value of area beaches.

The computation spreadsheet prepared as part of this study allows for evaluation of different scenarios and testing different assumptions. This provides a tool that can be used to deal with some of the uncertainty about the long-range effects of lock closure.

VI. Appendix

A. Methods to Value Recreational Boating

The most common method used to measure the economic value associated with water-based recreation is the travel cost model. It is based on the travel costs and travel time required to engage in a recreational activity, while accounting for the next best use of an individual's time and the other available recreational alternatives. Since this method is survey based, it is often time and labor intensive to employ, and a commonly-utilized alternative to measuring recreation value relies on a case-specific and well-informed transfer of benefits from existing travel cost literature.

Numerous studies have provided estimates on the value of a recreational boating day either through primary valuation or through a benefit transfer or meta-analysis of existing estimates. Estimates of the consumer surplus of recreational boating are fairly consistent across locations and range from \$47 to \$87 per boat trip in 2009 dollars²⁵. We used the midpoint (\$67/day) in our analysis. Other estimates of water-related recreation include the value of a day at the beach, which are also consistent across locations and range from \$34-\$44 in 2009 dollars.²⁶

No estimates of the consumer surplus of a tour boat trip were found through an extensive literature search. While limited literature exists for luxury cruises, this is distinct from an urban boat tour which only lasts a couple of hours at most. In this case, the consumer surplus of a tour boat cruise is assumed to be proportion of the value of a recreational boat trip, based on the relative time difference of the trip. Wendella Boat Tours in Chicago offers three different tours ranging in length from 75 minutes to 2 hours and averaging 95 minutes in length. Assuming a recreational boating trip lasts an average of 4 hours, the average consumer surplus per hour is approximately \$11.75 to \$21.75²⁷. The implied consumer surplus per 95 minute tour boat excursion is then approximately \$18 - \$34. For purposes of analysis, we use the midpoint of \$26 per affected consumer.

B. Changes in Water Quality

Methods to Value Changes in Water Quality

A commonly-used approach to measuring the economic value associated with changes in water quality is the hedonic property method, which observes the impact of changes in water quality on the value of properties near the water body. This approach has been used extensively for measuring the economic value of various types of environmental quality changes. An alternative approach relies less on market prices and instead directly engages individuals to state their willingness to pay for environmental quality improvements. This technique called the contingent valuation method relies on surveys and interviews to simulate a referendum vote, although in a hypothetical setting. Again, because primary valuation is costly and time-intensive, the transfer of benefit estimates using these methods from the existing literature are a commonly applied technique.

Changes in Property Value Associated with Water Quality

Numerous studies have observed the changes in water-proximate property given changes in water quality from fecal coliform, pollutants from run off and water clarity. The range of imputed home price elasticities from the economic literature using the property value approach is -0.0002 to -0.07 for water quality degradation and +0.04 for an improvement in water clarity²⁸.

In 2006, the estimated market value of properties within 800 feet of the Chicago River was \$10.22 billion. Using the range of -0.0002 to -0.07 for a 1% degradation in water quality, we use an elasticity of -0.05.

Willingness to Pay for Water Quality Changes

A common metric for measuring the willingness to pay for recreational water quality is a water quality ladder (WQL) scale which ranks recreational designation from 1 to 10, where 2.5 is “boatable”, 5.1 is “fishable” and 7.0 is “swimmable”²⁹. In a seminal study on the Clean Water Act, Carson and Mitchell estimated the mean household willingness to pay to improve water from “Non-boatable” to “Boatable” to range from \$106 - \$141 in 1983 dollars.

In testimony before the Illinois Pollution Control Board, Kevin Boyle reported an estimate of the willingness to pay for Cook County residents for an improvement in the CAWS water-quality index from 6.1 to 6.8 on the 10-point scale³⁰. Using results of a meta-analysis of 18 water quality studies by Van Houtven, et al, he estimated the willingness to pay for the water quality improvement to be \$47 per household per year in Cook County for a present value of \$1.05 billion over 20 years for the improvement in water quality.

In a 1986 survey about Chicago waterways, Croke, et al. determine the mean household willingness to pay in Cook County for improved water quality to range from \$33-\$46. The range of willingness to pay is for varying levels of water quality in the Chicago waterways from improving water for outings (\$33.49), outings and boating (\$37.76) and outings, boating and fishing (\$46.05).

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ENDNOTES

¹ No published information is available on the average cost of barge shipments per ton or ton-miles. This is a consensus based estimate provided by several shippers who do business in metropolitan Chicago.

² Based on average tonnage between 2006 and 2008 reported by the U.S. Army Corps of Engineers Data Navigation Center.

³ Included in this estimate are expenditures on Intra-Great Lake operation. See Section III for details.

⁴ This estimate was made in part by looking the approximate distribution of recreational boat trips in other previously mentioned categories and then determining how many more were taken so that the total is consistent with USACE estimates. These estimates suggest that the two locks serve slightly more than 40,000 recreational-vessel movements per year .

⁵ This estimate was determined by using the estimate provided in Passenger Vessel Association survey and account for non-responses, which was conservatively assumed to be 10% of the total.

⁶ Information on ticket prices and ancillary spending was provided by the Wendella Boat Company.

⁷ Information on advance bookings was provided by the Wendella Boat Company.

⁸ See especially studies by Texas Transportation Institute (2007) and University of Missouri (2004), listed in the reference section, to a discussion of differential costs of various modes of transportation.

⁹ The estimate from the Missouri study is based on the follow assumed mix of barge commodities: 7% agricultural (based on USACE data for the two locks being studied) and the remaining 93% split equally between cement, asphalt, and fertilizer.

¹⁰ Based on lock usage data from USACE Data Navigation Center.

¹¹ See computational spreadsheet on the Chaddick Institute web site for a summary of this calculation

¹² The estimate of 450 miles is based on a mix of shipments from various Mississippi River ports.

¹³ This estimate is used by a major barge service provider about the opportunity cost of tying up a barge. It should be recognized as an approximation.

¹⁴ David Forkenbrock (2001)

¹⁵ This assumes a 800 mile average trip distance. See computational spreadsheet.

¹⁶ These estimates are based on estimates made with assistance with area boat specialists, including Grant Crowley and other individuals affiliated with the Friends of the Chicago River.

¹⁷ This estimate is based on the economic value recreational boats placed on proximity to water amenities in previous research. Boaters are affected twice annually by the loss of their preferred alternative (\$72.50 per trip, once to launch their boat in spring and again to remove it in late summer or autumn).

¹⁸ This is based on a wage rate among owners of marina boats of \$40/hr. This likely understates the actual hourly earnings of the affected population.

¹⁹ See the U.S. Army Corps of Engineers 2008 study, "*Great Lakes Recreational Boating*".

²⁰ See testimony by Michael W. Fox, Chicago Police Department, and Steve E. Georgas, Chicago Fire Department. Citations provided in reference section.

²¹ Information about capital costs provided to the author by MDRD in March 2010..

²² See "Strategies for a Cleaner, Healthier, More Vibrant Chicago River," Friends of the Chicago River (2006).

²³ For reference to the Charles Quarles testimony, see reference list,

²⁴ Citation from Strategies document, 5.

²⁵ See Hushak and Bielen (2000), Wiggin, et al. (2009), Walsh, et al. (1992), Rosenberger and Loomis (2000).

²⁶ See Sohngen, et al. (1998), Shaikh (2006), Lew and Larson (2005).

²⁷ Consumer surplus may not necessarily be determined on an hourly basis and the marginal consumer surplus will likely be decreasing per hour. Given the limited information on the consumer surplus for boat tours, an average hourly consumer surplus is assumed to be the most appropriate method of calculation.

²⁸ See Poor, Pessango and Paul (2007), Leggett and Bockstael (2000), Ara, et al (2006)

²⁹ The Water Quality Ladder (WQL) was developed by Resources for the Future in 1986 and has been used by many researchers to assess recreational users' willingness to pay for steps up the WQL. See van Houtven, et al (2007) and Carson and Mitchell (1993) for more information on the WQL.

³⁰ Boyle's testimony before the Illinois Pollution Control Board focused on the economic benefits from improved CAWS water quality from recreation use designations by the Illinois EPA, which would be achieved with the implementation of additional wastewater disinfection.