US Army Corps
of Engineers
Huntington District

Great Lakes and Ohio River Navigation Systems Commerce Report, 2004

U.S. Army Corps of Engineers
Great Lakes and Ohio River Division

Cover Photo: November 2004 aerial photo of Marmet Locks and Dam under construction on the Kanawha River.

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TABLE OF CONTENTS

PART 1. OVERVIEW

PART 2. THE GREAT LAKES NAVIGATION SYSTEM (GLNS)

PART 3: THE OHIO RIVER NAVIGATION SYSTEM (ORS)

PART 4. OTHER SOURCES OF WATERWAY INFORMATION

PART 1. OVERVIEW

1. <u>Purpose</u>. This *Great Lakes and Ohio River Navigation Systems Commerce Report* offers a ready source of descriptive statistics and information on two great inland navigation systems: the Ohio River System (ORS) and the Great Lakes Navigation System (GLNS). The Great Lakes and Ohio River Division's Navigation Planning Center, located in the Huntington District of the U.S. Army Corps of Engineers, prepared, published, and distributed this 2004 edition. The waterway data provided in this report are made available in response to requests for commercial navigation data from shippers, port authorities, state and local government agencies, regional waterway transportation entities, and others.

The Federal and state governments, port authorities, and carriers share responsibility for the nation's waterway transportation system, and in the case of the GLNS, this shared responsibility extends to the Canadian federal government, provincial governments, shipping lines, ports and the St. Lawrence Seaway Management Corporation (SLSMC). The U.S. Army Corps of Engineers has the responsibility of managing the nation's waterways and harbors, which includes planning, development, maintenance, and operation consistent with its Environmental Operating Principles. The U.S. Coast Guard is tasked with oversight of the safe use of these waters. The two agencies work closely with the towing and shipping lines to fulfill these commitments. The inland waterway transportation industry involves public and private interaction between commercial fleets or towboats, barges, and lake vessels, wharves and other waterfront facilities, and the waterway navigation projects built and maintained by the Corps.

2. <u>Organization</u>. The report is organized into four parts: **Part 1** -- Overview, **Part 2 --** The Great Lakes Navigation System (GLNS), **Part 3** -- The Ohio River Navigation System (ORS) and **Part 4 –** Other Sources of Waterway Information.   The Overview describes both navigation systems and discusses how the Corps, as their stewards, plans for their modernization with innovative initiatives. Parts 2 and 3 provide descriptive statistics and information and Part 4 lists waterway data publications for both systems. Parts 2 and 3 are organized in five sections:

Section 1 offers a geographical and physical description of the system, its history and dominant industries and natural resources, and historic commodity traffic.

Section 2 discusses the state of each system, its modernization status, any planned innovative applications and on-going studies.

Section 3 presents information on the impact of each system on the regional economy and year 2002 waterborne commerce data for each region.

Section 4 provides 2002 & 2003 Lock Performance Monitoring System (LPMS) statistics.

Section 5 provides Waterborne Commerce Statistics Center (WCSC) data on state and port commerce for the year 2002.

3. Overview. Traffic on these systems moves through or by twelve U.S. states and the province of Ontario, Canada (see **Figure 1**). Ontario and eight states – Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, and New York – border the GLNS. Pennsylvania, West Virginia, Kentucky, Tennessee, Alabama, Mississippi, Illinois, Indiana, and Ohio are touched by the ORS. All 12 states are within the boundaries of the U.S. Army Corps of Engineers' Great Lakes and Ohio River Division (LRD) and its seven districts. The four river districts – Pittsburgh, PA; Huntington, WV; Louisville, KY; and Nashville, TN -- fulfill the Corps' navigation mission by managing the operation of 60 lock and dam projects on nine navigable rivers and by maintaining channels on these and several other navigable tributaries. The three Great Lakes districts – Buffalo, NY; Detroit, MI; and Chicago, IL – operate three lock and dam projects and maintain three major connecting channels and the main channels into numerous ports. In addition, the Canadian St. Lawrence Seaway Management Corporation (SLSMC) operates and maintains eight locks on the Welland Canal, which allows navigation between Lake Erie and Lake Ontario.

Figure 1
States and Provinces Bordering the GLNS/ORS

The ORS has over 2,600 miles of nine foot draft navigable channel; the GLNS nearly 1,300 miles of 25.5 foot navigable channel. Extensive though these systems are, they are only parts of even larger inland navigation systems. The ORS is part of the Mississippi River System and the GLNS is part of the Great Lakes/St. Lawrence Waterway (GLSLW).[1] Shippers have access to ocean ports through both these larger systems. The GLNS reaches the ocean through its junction with the St. Lawrence River (and the Montreal-Lake Ontario section of the Seaway) at Kingston, Ontario. The ORS reaches the Gulf of Mexico through its junction with the Mississippi River at Cairo, Illinois. Regardless of the system definition, these two North American transportation networks are the most extensive and economically developed inland waterway systems in the world. Only the Suez and Panama Canals, shortcuts linking two oceans, handle similar amounts of traffic.

The United States has over 25,000 miles of inland, intra-coastal, and coastal waterways. The Federal government improves and maintains almost 11,000 miles or about 45 percent of the total channel length. This work includes the installation and maintenance of navigation structures such as locks and dams, river training devices (dikes and revetments, and groins), and dredging.

Open river or open lake navigation is preferred over navigation on channels created by locks and dams. Navigation on improved channels created by locks and dams takes longer due to the time spent transiting any locks, which can also be points of river or channel congestion. The Mississippi River below St. Louis and the Missouri River system are of open river design, and navigation on the Great Lakes is open lake navigation, with the exception of transits of the St. Marys River and the Welland Canal. Other major channels like the Arkansas, Illinois and Ohio rivers consist of a system of slack water pools created by a series of locks and dams. The dams in these rivers help maintain a more constant depth to permit navigation during dry seasons, while the locks are the means by which river traffic is passed from one level of water to the other created by the dam. On the Atlantic and Gulf Intra-coastal waterways, strong winds and tidal currents often require locks and dams to maintain pools and fresh water integrity. On the GLNS, locks on the St. Marys River and the Welland Canal are used to traverse water falls.

Industries utilizing the waterways include the steel, electric power, chemical, petroleum products, aluminum, chemical, paper and agricultural products industries. In 2002, almost 1.1 billion tons of domestic waterborne commerce moved on the U.S. waterway system. Over 69 percent of this tonnage consisted of lake and inland waterway commerce; origins and destinations within the inland waterway. From 1982 to 2002, internal domestic traffic on the waterways increased from 495 million tons to 608 million tons, an annual growth rate of 1.03 percent.

[1]/ The GLSLW stretches from the Head-of-the-Lakes in Lake Superior to Father Point, Quebec where the St. Lawrence River meets the Gulf of St. Lawrence. The Great Lakes/St. Lawrence Seaway system is a subsystem between Head-of-the-Lakes and Montreal, the downstream terminus of the St. Lawrence Seaway.

Petroleum, the nation's largest bulk import commodity, and petroleum products accounted for about 34 percent of domestic waterborne commerce and coal accounted for 22 percent. Iron ore and scrap accounted for 5.7 percent and grain, the nation's largest export commodity, amounted to almost 5.4 percent of domestic waterborne commerce.

4. Modernization Process. The Corps of Engineers' Great Lakes and Ohio River Division (LRD) strives to accommodate national needs for an efficient and reliable navigation system. The Corps partners with the navigation industry to operate existing projects to their highest level of efficiency and to plan for tomorrow's needs. The Corps works to assure that all technologies applicable to the modernization of the waterways are adequately evaluated in the interest of achieving modernization at the lowest practicable cost. Open, two-way communication is essential to meet this challenge. The Corps strives to employ state-of-the-art techniques in analyzing the feasibility of navigation modernization proposals. This modernization process involves four steps:

1. An initial *reconnaissance study* identifies issues, concerns, and opportunities in order to determine the federal interest in constructing navigation improvements.

2. If a federal interest is identified, the District Engineer will recommend that a *feasibility study* be initiated. This study allows the Corps to more fully examine nonstructural and structural alternatives and to identify a preferred option.

3. Feasibility is established when an improvement plan is found that provides more transportation savings than the improvement will cost, appropriately addresses environmental concerns, and is acceptable to users. The feasibility study is necessary, but alone is not sufficient for *a congressional authorization* of the improvement alternative.

4. From feasibility, the process moves into the *preconstruction engineering and design* (PED) phase. Following *authorization*, funding is *appropriated for construction*. During this final step of the modernization process, plans and specifications for construction are prepared.

A project is programmed for modernization if it falls into any one of these steps, including the transitory phase of awaiting authorization or appropriation. **Figure 2** shows the status for the more recent LRD projects programmed for modernization.

The modernization of the GLNS/ORS represents investment that will be repaid many times over. Modernization eradicates hazardous conditions and eliminates costly delays. Freight savings are just the beginning, as the economic effects of federal construction diffuse to a wide variety of producers of equipment, materials, energy forms, technical services and skills. Areas of high unemployment find relief through increased job openings.

The multiplier effect of this spending translates into increased incomes which generates local re-spending, creating additional income for retail stores, professional services and public agencies. Other spin-offs of GLNS/ORS improvement projects include greater supplies of hydroelectric power, increased municipal water sources, and improvements to roads, bridges and other facilities. Investment in waterway projects is good public policy.

Figure 2
LRD Modernization Projects

5. <u>Innovation Initiatives</u>. In response to our Industry partners' desires of achieving modernization at the lowest practicable cost, a Regional Navigation Design Team (RNDT) composed of the LRD Chief of Technical Engineering Division, Engineering Division Chiefs or their representatives from each of the districts in the Mississippi Valley Division (MVD) and LRD, and the Chief of the LRD Navigation Planning Center was formed in 1994 to assure that all technologies applicable to modernization of all rivers within LRD and MVD are adequately and efficiently evaluated. The goal of the team is to better share information on innovative design between districts, communicate better with industry regarding design, and to challenge existing design criteria and support engineers in promoting good design ideas. In the long run, the team plans to change the way the Corps designs and constructs navigation structures. To this end, team accomplishments to date include but are not limited to:

- Writing EP 1110-1-20 describing the first generation of innovation
- Producing design and construction cost savings

- Impacting the "Innovation in Navigation Program (INP)"[2] and subsequent research and development efforts
- Preparing a "Centralized Casting Facility" white paper as well as influencing new technical guidance documents
- Building a culture of innovation that enables the Corps to respond better to navigation customer needs
- Using shared physical hydraulic models between MVD and LRD to develop and test new types of filling and emptying (F&E) systems for navigation locks
- Developing "new tools" to guide management of existing assets and predict when system expenditures should be made (This was developed and utilized for the Ohio River Mainstem Systems Study)

Design innovations are being pursued to reduce costs and achieve earlier use of new locks. Innovative construction techniques can reduce construction costs and undesirable environmental impacts, expedite traffic movement during construction, shorten construction periods and ease project operations. Innovations under consideration broadly fall into four categories. These are:

i) Innovations to reduce/eliminate cofferdam size. Initiatives include:

- Underwater pile foundation preparation for anchoring structural shells
- Offsite casting yards to construct various components of lock walls, approach walls, gate piers and sills as hollow shells
- Float-in components to the construction site
- Lift-in components with a large floating crane
- In the wet construction with tremie concrete and floating approach walls
- Drilled shaft technology to construct large diameter, reinforced concrete shafts that can be used to support approach walls, floating wall pylons, and to form thin lock walls
- Approach walls formed of long span beams constructed in the wet
- Thin lock walls constructed entirely in the wet using closely spaced drilled shafts faced with pre-cast concrete panels
- Float-in miter gate monoliths that involves the construction of an entire miter gate monolith as a floating structure

ii) Innovations that reduce the cost of lock walls. Initiatives include:

- Extensions of existing lock chambers
- Replacement of much of the structural concrete in lock walls with roller compacted concrete (RCC) in combination with either pre-cast panels or cast in place concrete at the chamber face

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[2/] The INP is an R&D program involving Corps-wide navigation experts as well as the influence of the Waterways Experiment Station (WES) Laboratory. Much of the INP effort is focused on in-the-wet construction innovation.

- Use of existing components to simplify construction of new walls
- Incorporation of temporary cofferdam walls into the permanent wall
- Use of floating approach walls where appropriate
- Use of pre-cast approach wall components

iii) Innovative filling and emptying systems. Initiatives include:

- Central culvert system to accommodate innovative lock walls
- Looped intake/discharge culverts as preferred alternative to sill-mounted butterfly valves

iv) Innovation in lock operating systems. Initiatives include:

- Hydraulic operating systems with direct connect cylinders to miter gates and electronically controlled sensing
- Central lock operating station

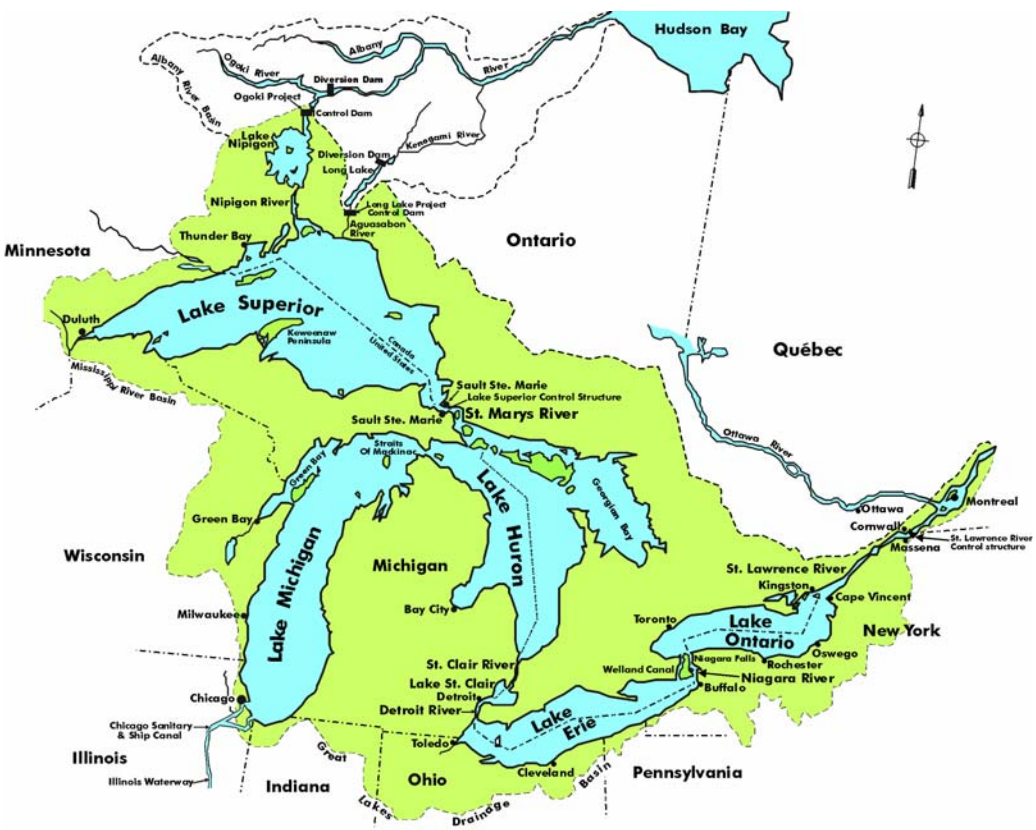
6. Conclusion. The Great Lakes and Ohio River Division is at the forefront of cost reduction initiatives for inland navigation projects; initiatives that blend economics with functionality. Currently, there are various innovative designs and/or construction initiatives being applied or considered throughout LRD. Project specific applications of innovations, for both navigation systems, are presented in Parts 2 and 3 of this report.

PART 2. THE GREAT LAKES NAVIGATION SYSTEM

1. General.

a. Geography and Physical Description. The Great Lakes/St. Lawrence Seaway system has two distinct subsystems -- the Great Lakes Navigation System (GLNS) and the St. Lawrence Seaway.[3] Discussions that follow focus only on the GLNS. The GLNS is situated in the Great Lakes Basin (GLB), a 297,000 square mile area. The GLB is defined to include an area that extends upstream to the point of origin (headwaters) of all streams and rivers flowing into the Great Lakes. The designation Great Lakes, or Lakes, pertains to five major lakes: lakes Superior, Michigan, Huron, Erie and Ontario. The smaller Lake St. Clair is considered part of the St. Clair-Detroit River System connecting channel (see **Figure 3**). The GLB drainage area encompasses parts of eight U.S. states and two Canadian provinces. Containing an estimated 5,435 cubic miles of freshwater, the GLB is the largest depository of freshwater in the world.

Figure 3
Great Lakes Basin



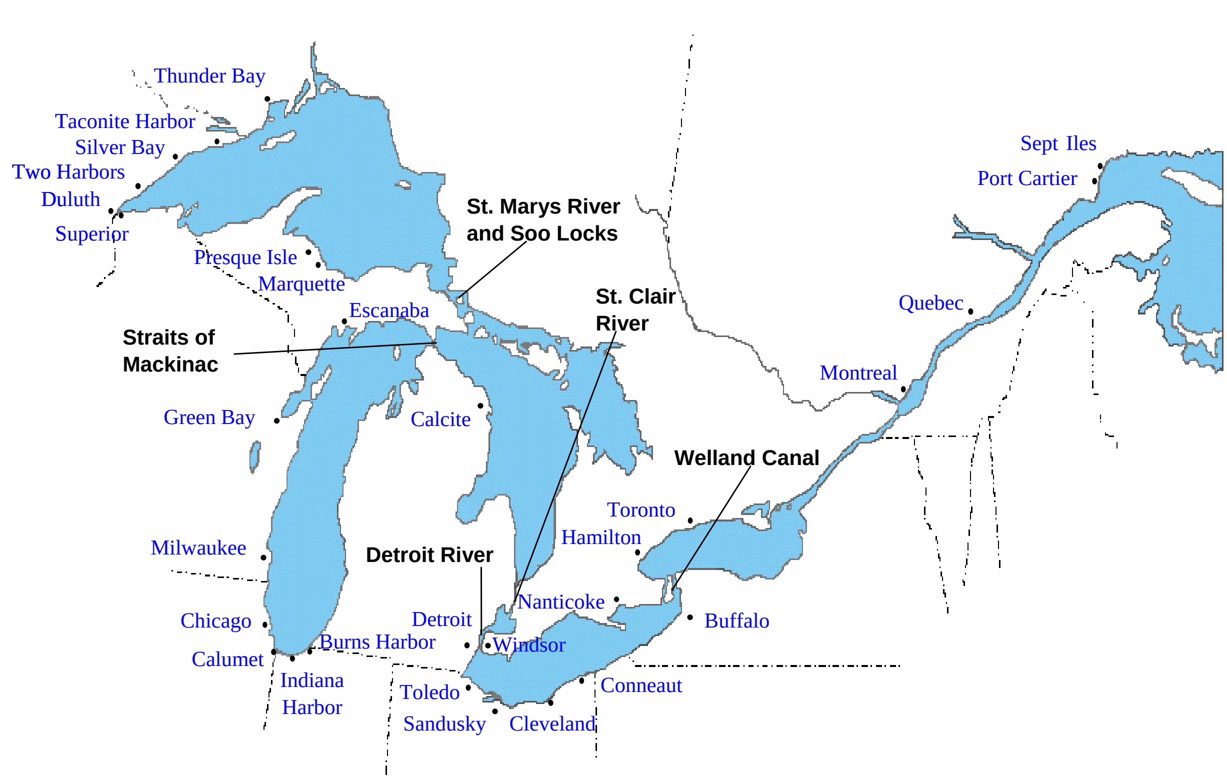
U.S. Army Corps of Engineers, Detroit District

The GLNS comprises the five Great Lakes and their navigable connecting channels – the St. Marys River, the Straits of Mackinac, the St. Clair/Detroit River System, and the Welland Canal (see **Figure 4**). The Great Lakes cover 95,170 square miles of water surface, about 61,000 in the

[3]/ The Great Lakes/St. Lawrence Seaway encompasses the GLNS and the St. Lawrence River to Montreal, Quebec. This river reach, the Montreal-Lake Ontario section of the Seaway, is not considered part of the GLNS.

U.S. and 34,000 in Canada, and defines a 10,000-mile coastline, which is longer than the entire U.S. Atlantic seaboard. Dozens of ports line the banks of the Great Lakes and are an integral part of this waterway system. Eight U.S. states (Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania and New York) and the Canadian province of Ontario border the GLNS.

Figure 4
Great Lakes Connecting Channels and Ports



The GLNS connects with the Atlantic Ocean trough the Seaway and with the Ohio River System (ORS) through the Cal Sag and Chicago Sanitary Ship Canal at Chicago. Ships moving on this vast inland system are self-propelled vessels capable of drafting up to 45 feet, though connecting channel depths limit safe draft between 25.5 to 27.5 feet.

The two dominant commercial navigation vessels on the GLNS are Class X lakers and Class VII bulk carriers. Class X lakers are 950-1,099 feet in length. These vessels are self-unloaders that principally transport iron ore from the Minnesota and Michigan ports to the integrated steel mills, and trans-shipment ports situated on lakes Michigan and Erie (including the Detroit River). The Class X lakers are increasingly used to move western coal from Superior, WI to electric utilities across the Great Lakes. They are, as a group, the largest and most efficient ships operating on the Great Lakes. Class VII sized vessels are 700-730 feet in length and are the largest vessel capable of using the locks on the St. Lawrence Seaway.[4] These vessels are primarily used to ship wheat down from Thunder Bay, Ontario and, on the return trip, transport iron ore from the St. Lawrence River ports to Canadian steel mills.

The vessels, waterways, and ports of the GLNS system provide consistently safe and reliable service, while still keeping transportation costs competitive for the industrial and agricultural heart of North America. Studies also indicate that marine transport uses less fuel and has lower emissions than either rail or truck for equivalent cargoes and distances.[5] The large cargo capacity relative to engine size and the operating characteristics of Great Lakes and Seaway vessels make them models of fuel efficiency. A laker, for instance, uses about one gallon of fuel per one ton of iron ore per round trip. A study by the Great Lakes Commission found that vessel transportation on the GLNS system uses considerably less fuel, produces fewer emissions, and is less prone to pollution causing spills than if the same cargoes were transported by either truck or rail. **Figure 5** compares the carrying capacity of lakers and railcars, and large semi-tractor trailers. The figure shows that a typical Great Lake Class X laker carrying 62,400 tons is the equivalent of 625 railcars (6.25 unit trains) and 2,400 trucks.

Photo 1: Two Lakers passing on the St. Clair River, Michigan.

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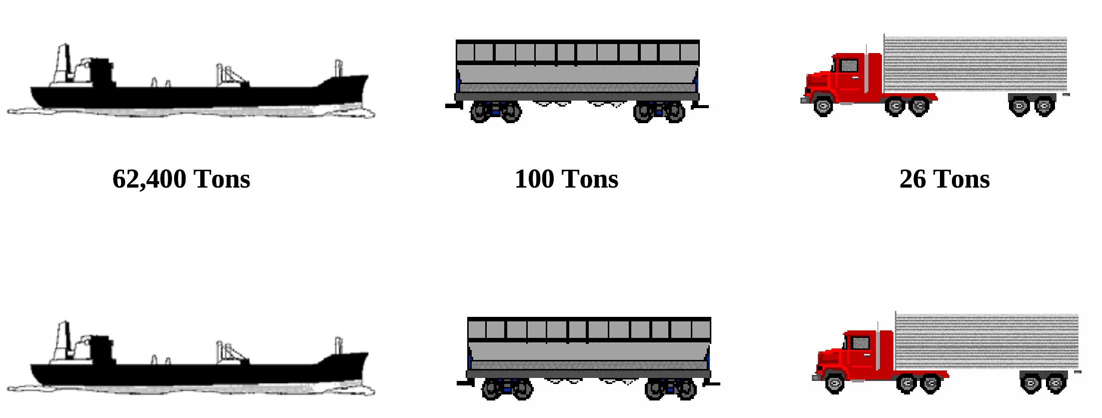
[4]/ The St. Lawrence Seaway runs from Long Point on Lake Erie to Montreal, Quebec at St. Lambert's lock. There are two canalized sections: the Welland Canal, which by-passes Niagara Falls, and the Montreal-Lake Ontario section, which by-passes numerous rapids in the St. Lawrence River.

[5]/ *Environmental Advantages of Inland Barge Transportation*, USDOT Maritime Administration, 1994; *Great Lakes and St Lawrence River Commerce: Safety, Energy and Environmental Implications of Modal Shifts*, Great Lakes Commission, 1993; *Environmental Efficiency of Marine Transportation*, Marine Policy & Programs Directorate, Transport Canada, 1993.

Figure 5
Modal Carrying Capacity



b. <u>History</u>. Commercial navigation on the Great Lakes was first reported in 1678 when La Salle built a small, 10-ton sailing vessel to transport supplies from what is now Kingston, Ontario to a site on the Niagara River. The first wave of major commercial navigation upon the Great Lakes began with the opening of the Northwest Territory in 1787. By the early 1800s, about two-dozen communities had been established along the shores of lakes Ontario and Erie. Grain and furs were the basic commodities transported out of the region. In 1797, the first of a series of locks that eventually culminated in the Soo Locks was constructed on the Canadian side of the St. Marys River, the connection between lakes Superior and Huron. This made the entire upper Great Lakes, the four lakes upstream of Niagara Falls, navigable to canoes and bateaux of the fur trade.

The opening of the Erie Canal in 1825, connecting the Hudson River with Lake Erie, initiated the second stage of commercial navigation on the lakes. The canal's four foot depth and 40-foot width enabled mule-drawn canal boats to transport as much as 30 tons of freight. The opening of the Erie Canal initiated the commercial grain trade on the lakes. With much less expensive water transportation across New York State, it was possible for grain grown as far west as Illinois to be efficiently transported to eastern markets. Chicago, with its proximity to the fertile, productive soils of the tall-grass prairie of central Illinois, became the leading grain shipping port on the lakes. Buffalo became the major grain receiving port and eventually the world's largest grain milling center.

Until the opening of the first Welland Canal across the Niagara Peninsula of southern Ontario in 1829, commercial navigation across the lakes was restricted to the Great Lakes Basin. With the exception of the Erie Canal, there was no access to the Atlantic Ocean because of the presence of Niagara Falls on the Niagara River and a series of falls and rapids on the St. Lawrence River.

Once the Welland Canal opened, boats originating on the Great Lakes could proceed into Lake Ontario and then into the St. Lawrence River. By 1850, a nine-foot channel had been established from the Atlantic Ocean to Lake Ontario. By that date, the second Welland Canal had been completed (in 1844) and all but Lake Superior was accessible to commercial navigation by ships.

Construction of a canal to bypass the falls on the St. Marys River between Lakes Huron and Superior had to await the need for commercial access to Lake Superior. That need developed with the discovery in 1844 and subsequent development of substantial iron ore deposits in the Upper Peninsula of Michigan. By 1855, a canal had been built to bypass the St. Marys Falls, and Lake Superior became accessible to commercial navigation. A nine-foot channel was available from the Atlantic Ocean to the "Head of the Lakes" (western end of Lake Superior).

In the second half of the 19th century, railroads gained preeminence over water carriage in the region. By 1905, largely as a result of Canadian investment in canals, a 14-foot channel was available from the Atlantic Ocean into Lake Superior. This marked the reemergence of water transportation across the lakes and brought to an end the dominance of rail transportation established a half-century earlier. Now, relatively large (for the time) freighters could move bulk commodities across the basin cheaper than could rail.

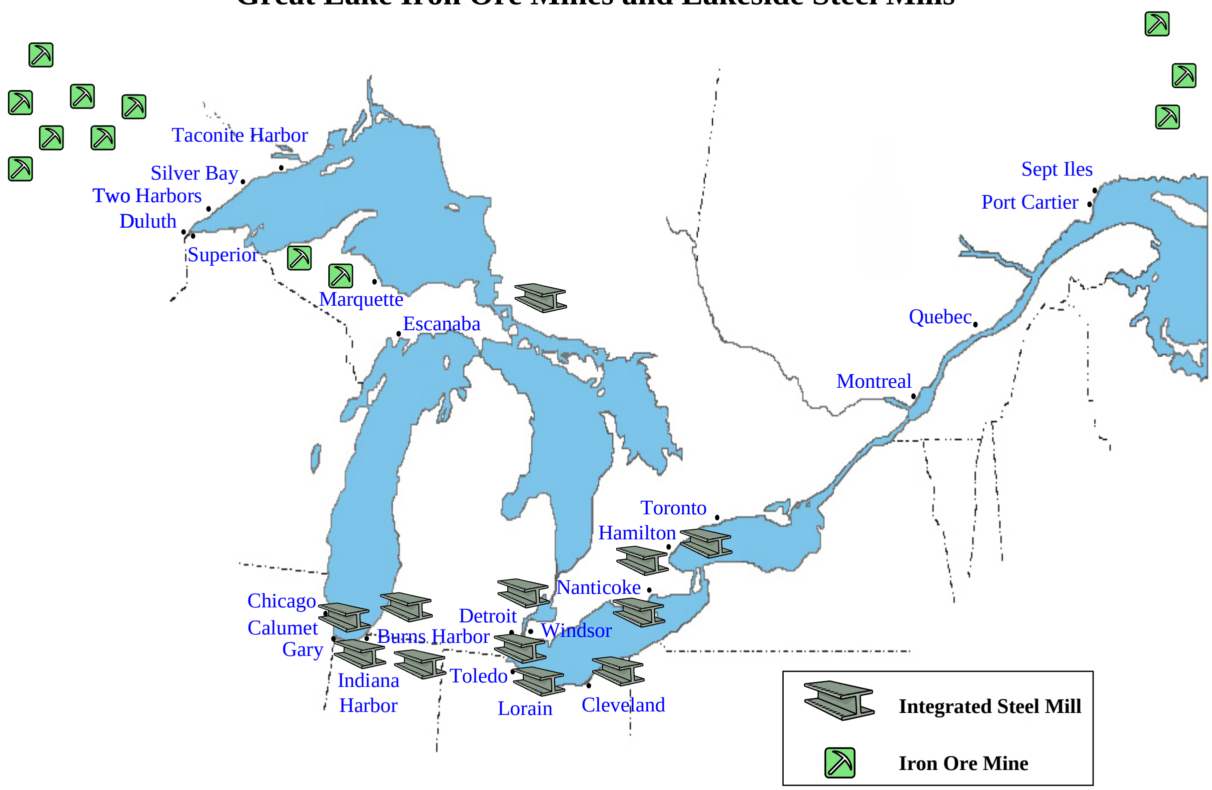
Probably the most important single construction project affecting commercial navigation on the Great Lakes was the construction of the new Welland Canal in 1932. Its design was farsighted in that it was designed to pass boats larger than any that existed on the Great Lakes at that time. It was not until the completion of the St. Lawrence portion of the Seaway in 1959, more than a quarter century after completion of the new Welland Canal, in which boats as long as 730 feet, as broad as 75 feet, drafting as much as 25 feet, began to appear on the lakes. These Seaway-size boats are capable of carrying 25,000 tons or more of cargo per trip.

c. <u>Industries and Natural Resources</u>. Great Lakes trade is dominated by the steel industry, which relies on lake vessels to move iron ore from Lake Superior and lower St. Lawrence River terminals to steel mills on lakes Ontario, Erie and Michigan. Iron ore, originating on Lake Superior, is primarily mined in the Arrowhead region of northeastern Minnesota referred to as the Mesabi Iron Range and the Marquette Iron Range in Michigan's Upper Peninsula. Lesser but substantial amounts of iron ore are mined in Canada in the vicinity of the Quebec-Labrador boundary. Iron ore has long been the backbone for Great Lakes shipping. **Figure 6** displays the location of GLNS iron ore mines and lakeside steel mills. The movement of iron ore from U.S. ports on Lake Superior to steel mills along Lake Michigan, the Detroit River, Lake Erie and Lake Ontario is the largest commodity flow on the Great Lakes.

In recent years, a downturn in the North American steel industry had curtailed iron ore movements. This trend reversed itself in 2003 and 2004. The U.S. iron ore mining industry will never be what it was in 1979, but rising demand for quality iron ore has stopped its shrinking slide and brightened the outlook for iron ore production. The opening of a previously closed mine in 2004 added 6.1 million tons of iron ore production. Iron ore demand is booming in North America. China's appetite for high quality ore is one key factor. Other contributing factors include a healthier domestic steel industry, booming steel production, soaring prices for scrap, a weakening American dollar and rising demand world-wide for high quality iron ore.

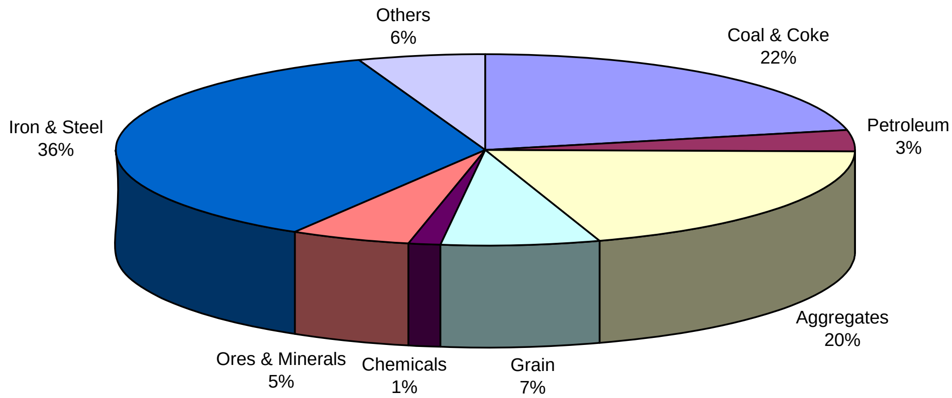
U.S. iron ore mines supply approximately two-thirds of the iron units needed to make pig iron in U.S. blast furnaces. The other one-third comes from Canadian mines, imports, and recycled scrap. Domestic steel production has rebounded from the bankruptcies in 2001 and 2002 that shut down 12 million tons of blast furnace capacity. Consolidation in the steel industry has led to the re-start of blast furnaces and another 20 million tons of annual steelmaking capacity.

Figure 6
Great Lake Iron Ore Mines and Lakeside Steel Mills



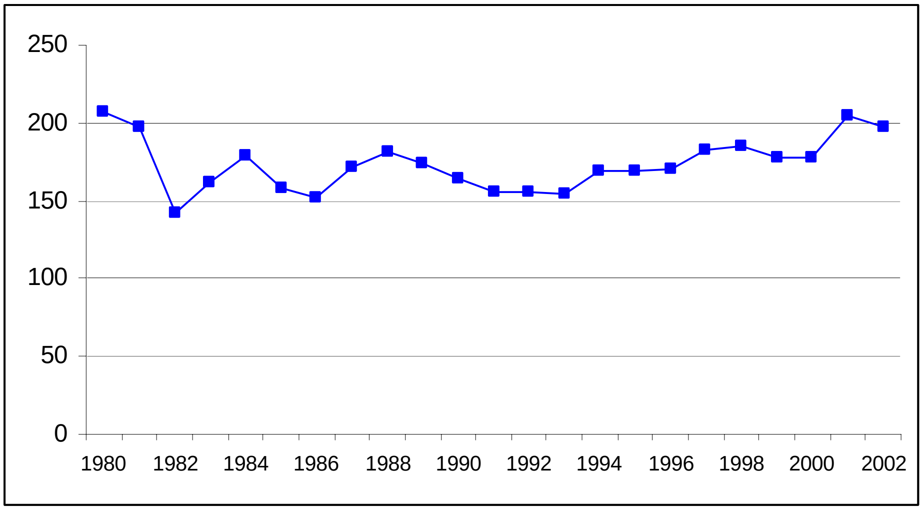
d. Historic Traffic. The principal commodities transported on the Great Lakes (see **Figure 7**) are iron ore, coal, limestone and grain. The largest commodity flow is the movement of iron ore from U.S. ports on Lake Superior to steel mills on Lake Michigan, the Detroit River, Lake Erie and Lake Ontario. The second largest flow is stone moving from U.S. ports on Lake Huron and Lake Erie, primarily to iron ore processing mills on Lake Superior, to steel mills, and to construction material yards in major metropolitan areas. Downbound flows of coal are the third largest commodity flow; Powder River Basin coals moving from Lake Superior to lakeside electric utility plant in both the U.S. and Canada dominate this flow. Quebec/Labrador iron ores moving up the St. Lawrence River to steel mills primarily on lakes Ontario and Erie is another dominant flow.

Figure 7
GLNS Commodity Traffic Share – 2002



In the past 24 years, the most dramatic change in U.S. GLNS traffic occurred between 1980 and 1982. Traffic declined by 64 million tons in this two year period; the drop coinciding with a recession-induced downsizing of the U.S. steel industry, primarily affecting integrated mills on Lake Erie and in the Ohio and Monongahela river valleys. Some recovery occurred over the next two years, and the GLNS reached the 200 million ton level for the first time since 1980. **Figure 8** shows GLNS traffic between 1980 and 2002.

Figure 8
U.S. Great Lakes Navigation System Traffic, 1980-2002



Note: There is no ready source for an historical series of bi-national GLNS traffic. The data used in this table is U.S. traffic provided by the Lake Carriers Association.

Table 1 shows the 1980s as a period of GLNS traffic decline, led by the dramatic decline in grain traffic. Iron ore traffic's rate of decline was less than that experienced by grain traffic, but greater in absolute terms. In the 1990s, both iron ore and grain held steady, while coal, stone, and cement all showed growth. During this same period petroleum traffic disappears from the data set, though it continues to move in small volumes on the lakes.

Table 1
Great Lakes Bulk Commodity Traffic, 1980, 1990, 2000
(Million Tons[6])

Commodity	1980	1990	2000	Growth Rate		
				80-90	90-00	80-00
Iron Ore	81.2	68.9	68.1	-1.6%	-0.1%	-0.9%
Coal	41.3	38.0	43.3	-0.8%	1.3%	0.2%
Stone	28.0	30.1	38.1	0.7%	2.4%	1.6%
Salt	6.8	5.9	6.7	-1.4%	1.3%	-0.1%
Cement	4.2	4.5	5.6	0.7%	2.2%	1.4%
Potash	0.9	1.5	0.7	5.2%	-7.3%	-1.2%
Petroleum	12.9	0.0	0.0	------	------	------
Grain	31.5	15.8	15.1	-6.7%	-0.5%	-3.6%
Total	**206.8**	**164.7**	**177.6**	-2.3%	0.8%	-0.8%

Source: Annual reports prepared by the Lake Carriers Association

[6]/ Short tons not metric. Multiply by .907 to get metric tons.

2. Waterway Improvements.

a. State of the GLNS. A system of locks, lakes and connecting channels, the GLNS combines remarkable natural resources with one of the world's great engineering feats to form a transportation network linking the middle of North America to the global marketplace. There are four operational commercial cargo locks in the GLNS.[7] Two locks on the St. Marys River – Poe and MacArthur are known collectively as Soo Locks. Chicago Harbor Lock, used mostly for recreational traffic is located at the junction of the Chicago River and Lake Michigan. Black Rock Lock in Buffalo, NY is located on the Black Rock Channel which connects the Niagara River and the New York State Barge Canal. **Table 2** displays general lock characteristics of the GLNS locks.

Table 2
GLNS General Lock Characteristics

River/ Project	Chamber	River Mile	Year Open	Length (--- in feet ---)	Width (--- in feet ---)	Sill Depth (--- in feet ---)	Lift (--- in feet ---)	Status	Owner/ Operator
St. Marys River									
Poe	Main	47.0	1963	1220	110	32.0	22.0	Operational	Corps/Corps
MacArthur	Main	47.0	1943	800	80	31.0	22.0	Operational	Corps/Corps
Davis	Main	47.0	1914	1350	80	23.0	22.0	Operational	Corps/Corps
Sabin	Main	47.0	1919	1350	80	23.0	22.0	Closed	Corps/Corps
Canadian	Main	47.0	1998	252	49	10.0	22.0	Operational	Canada
Chicago Harbor Channel									
Chicago Harbor Lock	Main	327.2	1939	600	80	22.4	4.0	Operational	Corps/Contractor
Black Rock Canal									
Black Rock Lock	Main	4.0	1914	650	70	21.6	5.0	Operational	Corps/Corps

All five of the Great Lakes are deep enough such that natural depths and rainfall variations do not affect vessel drafts, and winter ice conditions regularly leave open water in all save Lake Erie. Constraints to navigation are presented by the connecting channels and locks, and by approach channels to harbors. Connecting channels are maintained to allow a minimum of 25.5 feet of safe draft.[8] **Table 3** provides descriptive characteristics of the GLNS connecting channels. Vessel loadings beyond 25.5 feet are beneficial to lake operators and are frequently accommodated; however, in low water years, channel depths may support only the minimum drafts.

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[7]/ The Canadian government operates a small lock at Sault Ste. Marie for use by passenger and recreational vessels.
[8]/ A 27' deep channel is required to allow for a 25.5' draft and a safe under keel clearance of 1.5'.

Table 3
Great Lakes Navigation System Channels

Channel	Controlling Depth (feet)	Length (miles)	General Channel Width (feet)	Fall (feet)	Restrictive Width (feet)
St. Marys River	27.0	63-75	300-1,500	22	76,105[1/]
Straits of Mackinac	30.0	1	1,250	0	NA
St. Clair River	27.0	46	700-1,400	5	600[2/]
Lake St. Clair	27.5	17	700-800	0	NA
Detroit River	27.5	32	300-1,260	3	600
Welland Canal	27.0	27	193-350	326	78[3/]

[1/] 76 feet for MacArthur Lock,105 feet for Poe Lock.
[2/] width restrictions at the Blue Water Bridge
[3/] a 3.0 mile section of the reach between Locks 7 and 8 is restricted to one-way navigation
Source: *General Description of Great Lakes/St. Lawrence Seaway Physical Description*, submitted to the Department of the Army, North Central Division, Chicago, IL by ARCTEC, Inc., September 1981 as updated by the U.S. Army Corps of Engineers, Detroit District.

In addition, the climate within the basin places a significant constraint on navigation across the lakes. Seasonal climatic change in the mid-latitudes produces ice in the winter. Ice on the Great Lakes, principally ice at the Soo Locks and in the connecting channels between the lakes, limits the extent of the navigation season to March 15 through January 15.

b. Modernization Status. Chicago Harbor Lock and Soo Locks on the Great Lakes are currently under preconstruction engineering and design (PED). Plans and specifications for the first construction contract will be initiated when construction funds become available. The proposed new Soo Lock will be constructed in the foot prints of the existing Sabin and Davis locks. It is expected to take at least five years to complete.

In 1999, Congress provided a broad-range authority to review the feasibility of improving commercial navigation on the Great Lakes/St. Lawrence Seaway navigation system, including locks, dams, harbors, ports, channels and other related features. The first phase of the review was a reconnaissance study completed in the summer of 2002. The reconnaissance study recognized a Federal interest in improving navigation on the Great Lakes/St. Lawrence Seaway and recommends moving into a more detailed, feasibility level of analysis.

c. Application of Innovations.

1. Chicago Harbor Lock (Chicago Harbor Channel). The Metropolitan Sanitary District of Greater Chicago completed construction of the Chicago Harbor Lock in 1938. Operation and maintenance was turned over to the U.S. Army Corps of Engineers-Chicago District in 1984. Chicago Harbor Lock is the 2nd busiest lock in the country with approximately 40,000 vessels per year, 2nd only to Chittenden Lock, Seattle.

Photo2: Aerial view of Chicago Harbor Lock with Lake Michigan in the foreground and Chicago River winding through downtown Chicago in the background

In 1998, the innovative installation of an emergency dewatering system consisting of stop log slots and sills was completed. Stop log slots were added by local cofferdam and precast concrete sills were placed "in-the-wet" to allow the lock to remain operational (see photos 3 and 4 below). Future work at the Chicago Lock, currently in the design phase, includes replacement of sector gates, operating system, electrical system, and control house. Additional needs include resurfacing of the lock wall and guide walls.

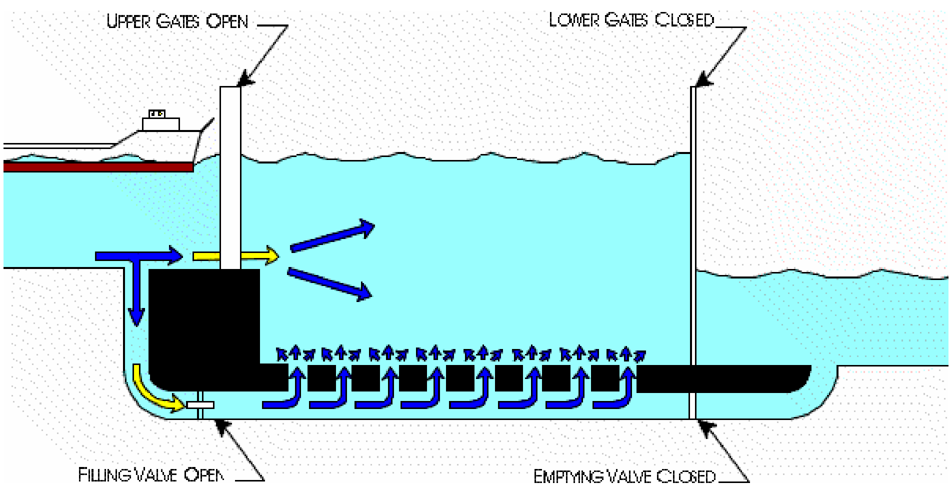
2. Soo Locks (St. Marys River). Detroit (LRE) and Huntington (LRH) districts are working together on the Soo Locks replacement study. The districts' team is evaluating replacing the Davis and Sabine locks, which are currently out of service, with a single 1200' x 110' lock. Through-the-sill intakes and a chamber culvert system are proposed, which is similar to the system that has been successfully used at the existing projects for many years. **Figure 9** shows a conventional lock filling/emptying system with valves and culverts. There is essentially no sedimentation or debris problem at these projects. The team is considering use of face-mounted filling and emptying valves on the upstream and downstream seals that can be removed as modules for maintenance.

Photo 3: Prefabricated slot being lowered into local cofferdam

Photo 4: Precast concrete sill being lowered "in-the-wet" down to lock floor for installation and grouting.

An existing problem at Soo Locks is the surge in the downstream approach channel during lock emptying. Vessels must now remain some 1,000 feet downstream of the lock during emptying cycles. It was suggested that consideration be given to using the existing lock chambers as a discharge bay instead of emptying the lock into the lower approach. Another concern is the design loads for the wall and fendering system caused by vessel impacts. Vessels frequently become misaligned in the approach because of winds and a dog-legged approach channel, and strike the approach walls. The district and the Corps of Engineer's Waterway Experiment Station (WES) will be collecting real-time vessel impact data using video cameras and load cells placed both on the vessels and existing walls. Lock daily log information will be used to estimate vessel tonnage to facilitate calculating ship impact loads.

Figure 9
Schematic Lock Empty/Fill System



Because of the deeper draft required, LRH is investigating use of rock anchors to overcome stability problems. It should be noted that the Pittsburgh District (LRP) is considering a similar design for the new land wall of the Charleroi Locks (LD 4 replacement locks) on the Monongahela River. The district is investigating emergency closure for the 110 foot lock consisting of bulkheads and means to place the bulkheads under flowing water.

d. <u>Ongoing GLNS Studies</u>.

1. <u>Soo Locks Limited Reevaluation Report</u>. Completed in April 2002, this report discusses the economic justification of replacing two technologically obsolete locks with one modern lock. The original feasibility report was completed in 1985, with authorization coming in WRDA 1986. The concept design presented in the report incorporates recent lock designs constructed at other Corps projects and reduces the replacement lock dimensions to that of the largest existing lock (Poe) at the Soo facility. The Great Lakes Commission has passed a resolution to act as non-Federal sponsor for the project and is working with the eight Great Lakes states to develop a financial plan. Current study activity involves detailed design activities and a

computer model study to determine the optimal alignment for the replacement lock. An economic update was completed in January 2004.

Photo 5: Vessel transiting the Poe Lock

2. Great Lakes Navigation Review, Reconnaissance Report. The review examined the potential feasibility of undertaking any capital improvements to the Great Lakes navigation system. The review identified factors and trends affecting the character of the existing system and projected future commodity flows and the external factors that affect them. Factors investigated include evolving transportation technologies, inter-modal linkages, characteristics of the Great Lakes fleet, changes affecting demand sectors, lock, channel and harbor capital improvements and related purposes.

The reconnaissance level study, completed in June of 2002, documented what improvements may be warranted for further investigation in a follow-on feasibility study. Once a determination regarding Federal interest has been made and a cost-sharing partner(s) identified, a feasibility report will be prepared and made available to the public. A feasibility study will quantify system capacity constraints limiting vessel movements, examine required modifications to improve the efficiency and reliability of the system and optimize an investment plan for meeting the needs and fulfilling the opportunities identified for the system.

Initial results from the reconnaissance level study indicate that both reliability and adequacy of the existing system suggest problems and opportunities. Suggested improvements worthy of further study include deepening connecting channels, the St. Lawrence Seaway and specific ports, and reconstruction of aging locks on the system.

Photo 6: Soo Locks on the St. Marys River

3. Great Lakes Fishery and Ecosystem Restoration Program. Recognizing that the Great Lakes comprise a nationally and internationally significant fishery and ecosystem, Congress approved the Great Lakes Fishery and Ecosystem Restoration Program in Section 506 of the Water Resources Development Act (WRDA) of 2000. This legislation provides the Corps with programmatic authority to support the restoration of the Great Lakes fishery and ecosystem in cooperation with other Federal, State and local agencies and the Great Lakes Fishery Commission. The program as legislated consists of 3 parts: a Support Plan, Projects, and an Evaluation Program.

The Support Plan defines how the Corps would support the management of Great Lakes fisheries, and has been developed in cooperation with the signatories to the '*Joint Strategic Plan for Management of the Great Lakes Fisheries'* (a bi-national group of fishery resource agencies and tribal governments) and other affected interests. Development of the Support Plan was cost shared with the Great Lakes Fishery Commission. The Support Plan has been reviewed by HQUSACE and is being revised for submittal to the Assistant Secretary of the Army for Civil Works (ASA(CW)). Signature by ASA(CW) is anticipated to occur in the 4th quarter of FY 05. Federal funding was first received in FY02 and used with the non-Federal cost share to contract for extensive coordination with Great Lakes fishery organizations and others interested in creating the Support Plan. FY 05 Federal funding consists of Construction General and General Investigation funds.

The second and third parts of the program are building and evaluating restoration projects. Section 506 authorizes the Corps to plan, design and construct projects that support the restoration of the fishery, ecosystem and beneficial uses of the Great Lakes. It further directs the Corps to develop a program to evaluate the success of these projects in meeting fishery and ecosystem restoration goals. Work on these parts of the program will begin when the Support Plan is approved by the ASA(CW) and funding is made available. Initial planning is underway for the first project at Red Mill Pond in Chicago District.

e. <u>Stakeholders – Industry, Agencies and Others</u>. The Great Lakes are an international water body shared by Canada and the United States. Thus, decisions, which for most inland waterways are made at the federal level in the United States, on the Great Lakes may have to be considered at the international level. Additionally, the federal government of each country has to interact with its constituents – states and provinces. Government agencies, industry groups and port authorities collectively work to improve the reliability and efficiency of the GLNS.

Photo 7: *The Detroit River with two 1000-foot ore boats passing*

The International Joint Commission (IJC) was established by the U.S. and Canadian governments to address boundary disputes and to regulate the Great Lakes. Historically, the principal area of concern for the IJC has been regulation of water volumes and levels in the lakes. Two of the Great Lakes, Superior and Ontario, are regulated to affect the level of their water surfaces. In both cases, the regulation does not ensure full control of the levels of the lake because the major factors that affect the supply of water to the Great Lakes – over-lake precipitation, evaporation and runoff – can neither be controlled nor can they be accurately predicted over the long term. The impact of regulation upon water levels of Lake Superior has been small compared to the natural factors that affect its water level. Upon various occasions, the regulation of Lake Ontario has had a significant effect on its water level.

The Great Lakes Commission (GLC) is a bi-national agency that promotes the orderly, integrated and comprehensive development, use and conservation of the water and related natural resources of the GLB. Since its establishment 45 years ago, the GLC has been a pioneer in applying principles of sustainability to the development, use and conservation of GLB resources. Commission activities are directed at realizing its vision of a strong and growing economy, a healthy environment, and a high quality of life for all citizens.

The U.S. Department of Transportation's Saint Lawrence Seaway Development Corporation (SLSDC) is a wholly owned government corporation created to construct, operate and maintain that part of the St. Lawrence Seaway between the Port of Montreal, Quebec and Lake Erie, within the territorial limits of the United States. The mission of the Corporation is to serve the U.S. inter-modal and international transportation system by improving the operation and maintenance of a safe, reliable, efficient and environmentally responsible deep-draft waterway in cooperation with its Canadian counterpart, the St. Lawrence Seaway Management Corporation. The SLSDC also encourages the development of trade through the Great Lakes Seaway system, which contributes to the comprehensive economic and environmental development of the Great Lakes region.

The St. Lawrence Seaway Management Corporation (SLSMC) is a not-for-profit corporation responsible for the safe and efficient movement of marine traffic through the Canadian Seaway facilities, which consist of 13 of the 15 locks between Montreal and Lake Erie. The Corporation plays a pivotal role in ensuring the waterway remains a safe and well-managed system, which it shares with its American counterpart, the Saint Lawrence Seaway Development Corporation.

3. Regional Commerce.

a. Waterway Impact on Regional Economy. The GLNS has an enormous economic impact on the North American economy. It generates over $3 billion annually and up to 17,000 jobs in Canada, and adds another $2 billion and some 50,000 jobs to the U.S. economy. For individual ports in the system, trade has been a catalyst for billions of dollars in capital investment and industrial growth. The base economies of many GLNS ports, and the entire Midwest, were defined by cost effective access to raw materials provided by the waterway. The GLNS and St. Lawrence Seaway have provided U.S. and Canadian farmers of the Great Plains an economical route to the world market for roughly 14 million metric tons a year of wheat, corn, soybeans and other products[9].

[9]/ *2001/02 Great Lakes/St. Lawrence Seaway System Directory*. Published in cooperation with the St. Lawrence Seaway Management Corporation and the St Lawrence Seaway Development Corporation.

Maritime commerce on the GLNS involves two general trade communities: traffic moved on the Seaway, much of which is overseas import/export trade, and inter-lake domestic trades contained within the Great Lakes. The two universes are largely distinct, though they do both service the steel industry. Lakers hauling iron ore and "salties" specializing in steel both service the Great Lakes' steel industry.

The GLNS is a multi-modal system. Seamless movements of goods and commodities flow from ship to rail and truck and from rail and truck to ship in well-synchronized trade patterns. Some of the most successful GLNS trades rely on multimodal connections, such as low-sulfur coal railed to Great Lakes loading ports from Wyoming and Montana for shipment by self-unloading vessels throughout the Lakes and grain railed from the Canadian Prairie Provinces to Thunder Bay for direct export by ocean freighters.

Photo 8: Ashtabula Harbor, a large commercial harbor maintained and constructed by the Buffalo District, on Lake Erie

It is no coincidence that the major rail and highway hubs of the mid-continent - such as Chicago, Toronto, Detroit and Toledo - are major GLNS ports as well. More than 40 provincial and interstate highways and nearly 30 rail lines link the 65 major and regional ports of the system with consumers and industries all over North America.

b. Great Lakes Basin Economy. The principal commodities transported on the Great Lakes are iron ore, coal, limestone and grain. Iron ore is primarily mined at the head of the Lakes in the Arrowhead region of northeastern Minnesota referred to as the Mesabi Iron Range and in the Marquette Iron Range in Michigan's Upper Peninsula. Lesser but substantial amounts of iron ore are mined in eastern Canada in the vicinity of the Quebec-Labrador boundary. Steel companies on lakes Michigan, Erie and Ontario are the predominate shippers of iron ore. Coal moving on the Great Lakes is principally mined in two regions – the Appalachian region of the eastern U.S. and the Powder River Basin of Wyoming and Montana in the western U.S. Coal produced in Appalachia is railed to harbors on Lake Erie for shipment to electric utilities with plants on the lakes in both Canada and the U.S. Limestone, or stone, is principally mined in the northern part of Michigan's Lower Peninsula and the eastern tip of Michigan's Upper Peninsula and is used in iron ore processing plants to make iron pellets and in construction activities. Grain (especially wheat, but including corn, soybeans and other grains and oilseeds) is produced extensively across the American Midwest and on the Great Plains of the U.S. and Canada. Though not a major commodity on the Great Lakes, potash is produced in the prairie province of Saskatchewan. Steel products also move in relatively smaller quantities, often brought-in by ocean-going vessels commonly referred to as salties.

Tables 5 & 6 display 2001 and 2002 total Great Lakes traffic by lake and by commodity. **Tables 7 & 8** display 2001 and 2002 Great Lakes traffic by country. In Table 6, US/US and CN/CN indicates Great Lake traffic that both originates and terminates in the country. US/CN indicates Great Lake traffic that moves between the US and Canada. US/Overseas or CN/Overseas represents other imports and exports. As the table shows, Great Lakes traffic is dominated by US/US traffic. **Figure 10** shows historic U.S. traffic on the Great Lakes has generally increased since 1991.

Table 5
2001 Great Lakes Navigation System Traffic by Lake and by Commodity

Lake	Coal & Coke	Petroleum	Aggregates	Grain	Chemicals	Ores & Minerals	Iron & Steel	Others	Total
Superior	19,892,840	390,558	3,692,032	11,229,375	664,260	736,850	40,240,898	2,789,333	79,636,146
Huron	23,138,251	3,955,243	29,485,191	11,995,327	1,479,318	9,006,706	41,867,970	7,437,210	128,365,216
Michigan	5,982,517	4,067,091	10,988,717	720,347	1,132,489	3,627,015	25,715,211	4,554,856	56,788,243
Erie	30,880,868	4,813,446	17,457,570	13,489,050	1,232,014	4,869,927	25,276,706	4,998,211	103,017,792
Ontario	8,517,334	4,423,231	5,500,071	12,227,566	1,073,747	3,363,033	18,896,631	5,118,898	59,120,511
Great Lakes	**45,095,412**	**7,498,062**	**42,103,684**	**14,354,002**	**2,482,916**	**11,904,389**	**68,572,989**	**13,083,388**	**205,094,842**

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

Table 6
2002 Great Lakes Navigation System Traffic by Lake and by Commodity

Lake	Coal & Coke	Petroleum	Aggregates	Grain	Chemicals	Ores & Minerals	Iron & Steel	Others	Total
Superior	21,119,511	272,102	3,229,516	10,721,378	655,874	804,718	46,642,143	2,244,885	85,690,127
Huron	23,123,717	12,205,264	26,779,182	11,780,822	1,674,740	7,718,405	48,494,887	6,857,893	138,634,910
Michigan	5,779,231	12,504,371	9,924,760	950,193	1,242,001	2,390,864	26,144,332	4,341,295	63,277,047
Erie	28,781,818	13,212,111	15,384,016	12,679,081	975,479	4,855,999	28,425,210	4,559,533	108,873,247
Ontario	5,495,665	12,459,523	3,151,349	11,543,682	1,000,457	3,398,021	18,343,981	4,905,927	60,298,605
Great Lakes	**42,902,870**	**6,767,063**	**39,288,361**	**13,380,939**	**2,688,666**	**10,746,075**	**70,455,602**	**11,078,847**	**197,308,423**

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

Table 7
2001 Great Lakes Navigation System Traffic by Country

Lake	US/US	US/CN	US/Overseas	subtotal	CN/CN	CN/US	CN/Overseas	subtotal	Overseas/US	Overseas/CN	Total
Superior	52,120,908	11,970,198	2,860,779	66,951,885	6,858,552	3,289,939	2,438,038	12,586,529	88,974	8,760	79,636,148
Huron	76,096,515	16,695,780	3,114,448	95,906,743	10,867,396	15,403,039	2,695,212	28,965,647	1,688,253	100,725	126,661,368
Michigan	44,043,126	3,446,278	253,669	47,743,073		5,713,305	-	5,713,305	1,599,279	-	55,055,657
Erie	36,081,249	32,229,494	3,159,251	71,469,994	11,769,314	11,769,314	2,864,444	26,403,072	2,914,703	353,714	101,141,483
Ontario	1,462,679	11,738,210	3,159,251	16,360,140	24,692,121	10,112,064	3,005,644	37,809,829	2,914,703	2,031,601	59,116,273
Great Lakes Total	104,435,006	37,948,232	3,159,251	145,542,489	30,253,527	21,375,615	3,005,644	54,634,786	2,914,703	2,031,601	205,123,579

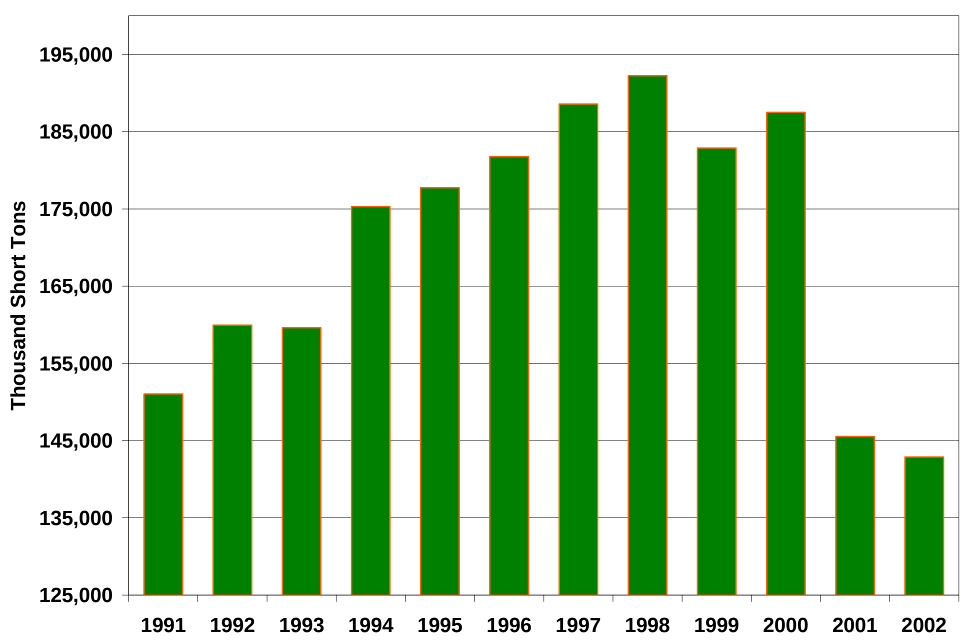
Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

Table 8
2002 Great Lakes Navigation System Traffic by Country

Lake	US/US	US/CN	US/Overseas	subtotal	CN/CN	CN/US	CN/Overseas	subtotal	Overseas/US	Overseas/CN	Total
Superior	57,208,957	13,862,988	2,333,506	73,405,451	6,504,827	3,058,329	2,605,766	12,168,922	110,947	4,807	85,690,127
Huron	80,718,996	18,290,033	2,575,564	101,584,593	10,848,967	11,532,536	2,770,687	25,152,190	1,481,180	218,295	128,436,258
Michigan	43,763,634	3,267,320	242,058	47,273,012	-	4,435,568	-	4,435,568	1,369,816	-	53,078,396
Erie	38,054,518	29,155,677	2,677,166	69,887,361	12,512,095	9,840,633	2,833,498	25,186,226	3,096,386	504,623	98,674,596
Ontario	2,301,720	8,833,237	2,677,166	13,812,123	21,282,162	6,183,941	2,954,590	30,420,693	3,096,386	2,770,752	50,099,954
Great Lakes Total	104,721,271	35,484,484	2,677,166	142,882,921	27,200,655	18,403,119	2,954,590	48,558,364	3,096,386	2,770,752	197,308,423

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

Figure 10
Historic U.S. Traffic Only on the Great Lakes



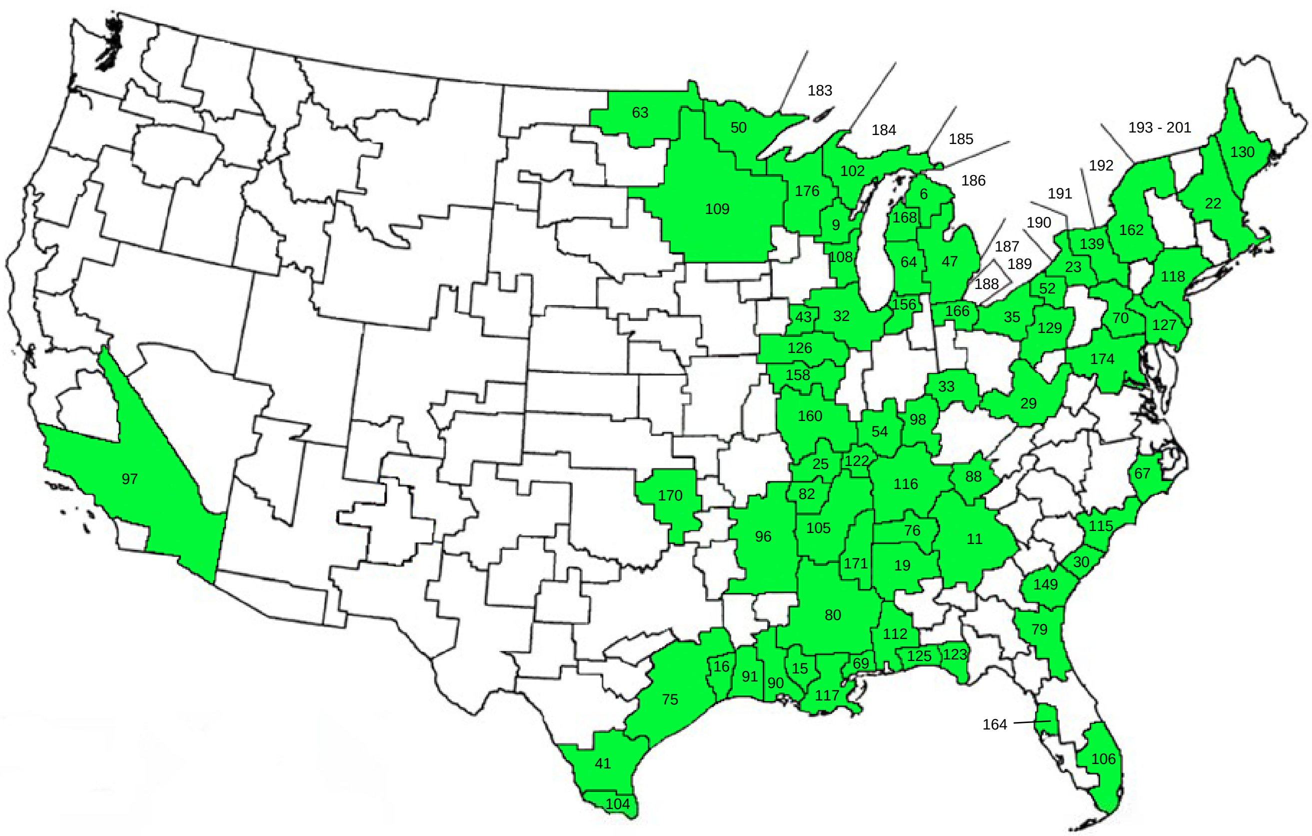
Source: USACE WCSC data.

A Bureau of Economic Analysis (BEA) economic area consists of a standard metropolitan statistical area (SMSA), which serves as a center of economic activity for its surrounding counties. **Figure 11** shows the 78 BEA economic areas that either shipped or received Great Lakes Basin (GLB) commerce in 2001 and 2002. Only 38 percent of the BEA economic areas are within the GLB indicating commerce extends well beyond basin boundaries. **Tables 9** through **12** show the distribution by commodity group of 2001 and 2002 GLB commerce to BEA economic areas.

In 2002, three BEA economic areas accounted for almost 43 percent of all GLB shipments. The largest-shipping BEA economic areas were Duluth, Alpena, MI and Cleveland with 51.4, 19.9, and 18.6 million tons, respectively. Iron ore and steel comprised almost 34 percent of this tonnage with 21 percent coal, and 19 percent aggregates.

In 2002, the major receiving BEA economic areas of GLB traffic are Chicago, Cleveland, Detroit, and Toronto with 33.4, 27.8, 32.5, and 20.6 million tons, respectively. About 34 percent of this tonnage consisted of iron ore and steel. These three BEA economic areas accounted for almost 55 percent of GLB commerce received.

Figure 11
BEA Economic Areas Shipping or Receiving GLNS Commerce[1/]



[1/]U.S BEAs are the 2004 definitions provided by U.S. Department of Commerce, Bureau of Economic Analysis available at http://www.bea.gov/bea/ARTICLES/2004/11November/1104Econ-Areas.pdf. Canadian BEAs are defined by the USACE, LRD Navigation Planning Center for convenience of analysis only.

Table 9
2001 Shipments by Bureau of Economic Analysis Area – Lakes[1/]

BEA	Coal & Coke	Petrol	Aggs	Grain	Chem	Ores & Minerals	Iron & Steel	All Other	Total Tonnage
6 Alpena, MI	32,713	8,695	16,359,760		24,700	46,500	22,400	3,683,587	20,178,355
9 Appleton-Oshkosh-Neenah, WI		2,085	21,036					101,501	124,622
15 Baton Rouge-Pierre Part, LA	290,511	0			49,925	17,882	61,757		420,075
16 Beaumont-Port Arthur, TX	3,076	0					1,400	1,622	6,098
19 Birmingham-Hoover-Cullman, AL		0						7,782	7,782
23 Buffalo-Niagara-Cattaraugus, NY	28,660	0	15,345						44,005
29 Charleston, WV		0					1,352		1,352
32 Chicago-Naperville-Michigan City, IL-IN-WI	2,657,458	2,017,399	65,778	341,573	72,217		587,126	412,856	6,154,407
35 Cleveland-Akron-Elyria, OH	18,305,399	19,913	782,498	64,602	21,499	1,679,604	3,078,528	162,477	24,114,520
41 Corpus Christi-Kingsville, TX		0			7,379				7,379
47 Detroit-Warren-Flint, MI	61,200	679,074	14,163		565,547	252,237	119,406	7,532	1,699,159
50 Duluth, MN-WI	4,004,712	0		2,265,216	35,861		27,404,327	29,680	33,739,796
52 Erie, PA		0	5,845						5,845
54 Evansville, IN-KY	1,414	0	50,274						51,688
63 Grand Forks, ND-MN		350	136					1,102	1,588
64 Grand Rapids-Muskegon-Holland, MI		0	470,871		308,684	20,358	6,270	23,138	829,321
67 Greenville, NC		0			20,503				20,503
75 Houston-Baytown-Huntsville, TX		16,462			30,806				47,268
76 Huntsville-Decatur, AL		0					16,872	46,370	63,242
91 Lake Charles-Jennings, LA		5,869							5,869
102 Marinette, WI-MI	23,788	3,644	4,622,529			76,624	13,700,355	1,424,171	19,851,111
105 Memphis, TN-MS-AR		0			6,972				6,972
108 Milwaukee-Racine-Waukesha, WI		0	184,172	364,948			32	24,676	573,828
109 Minneapolis-St. Paul-St. Cloud, MN-WI	12,829,682	0	54,463	1,655,642		92,441	5,349,550	88,731	20,070,509
116 Nashville-Davidson-Murfreesboro-Columbia, TN		0	89,328						89,328
117 New Orleans-Metairie-Bogalusa, LA	117,331	1,357			35,811		41,629	10,503	206,631
122 Paducah, KY-IL		0			1,507				1,507
126 Peoria-Canton, IL		0			5,581		1,602	5,208	12,391
129 Pittsburgh-New Castle, PA	2,722	0				5,907	7,661	217	16,507
160 St. Louis-St. Charles-Farmington, MO-IL		2,816			5,562			48,892	57,270
162 Syracuse-Auburn, NY		18		25				18	61
164 Tampa-St. Petersburg-Clearwater, FL		0			9,040				9,040
166 Toledo-Fremont, OH	4,325,675	417,531	4,031,469	1,711,850	119,852			224,506	10,830,883
170 Tulsa-Bartlesville, OK		1,400							1,400
174 Washington-Baltimore-Northern Virginia, DC-MD-VA-\	444,036	0							444,036
176 Wausau-Merrill, WI		2,757	6,212,843					115,030	6,330,630
183 Thunder Bay	1,691,912	65,973		7,259,801	520,737			1,966,624	11,505,047
184 East Lake Superior		0						42,586	42,586
185 Sault St. Marie	20,579	101,329	3,034,400			2,162,913	5,107	31,235	5,355,562
186 Lake Huron		0	2,554,430	166,433	15,435	4,562,363	4,211	723,523	8,026,394
187 St. Claire River (Sarnia)		1,548,429	73,589	209,830	174,618	104,518		12,900	2,123,884
188 Detroit River (Windsor)		34,963	414,027	137,566	117,138	1,786,290	1,077	222,425	2,713,486
189 Lake Erie (Nanticoke)		844,847	272,230	10,644	21,447		42,772	224,563	1,416,503
190 Welland Canal		0	445,972	41,725	8,265	50,884		76	546,922
191 Toronto	125,918	569,724	1,998,932	104,302	68,676	329,220	108,409	536,232	3,841,412
192 Kingston		0	88,090		32,178	30,768		1,338,910	1,489,946
193 Montreal		383,102			28,329	28,058	176,580	114,753	730,822
195 Quebec	44,262	340,220		13,826	17,175	103,386	352,223	107,505	978,595
196 Sept-Iles		0					14,768,893	2,010	14,770,903
197 New Brunswick		9,878							9,878
198 Nova Scotia		15,282	241,466			52,438		124	309,310
199 Prince Edward Island		0						558	558
200 Newfoundland		168,177							168,177
201 Other Canada		0				72,951			72,951
Foreign	84,365	236,768	38	19,845	168,147	429,046	2,713,451	1,344,005	4,995,665
Total	45,095,412	7,498,062	42,103,684	14,367,828	2,493,589	11,904,388	68,572,989	13,087,627	205,123,579

Source: WCSC Data.

[1/] A Bureau of Economic Analysis (BEA) area consists of a standard metropolitan statistical area (SMSA) serving as a center of economic activity and its surrounding counties. U.S BEAs are the 2004 definitions provided by U.S. Department of Commerce, Bureau of Economic Analysis available at http://www.bea.gov/bea/ARTICLES/2004/11November/1104Econ-Areas.pdf. Canadian BEAs are defined by the USACE, LRD Navigation Planning Center for convenience of analysis only.

Table 10
2002 Shipments by Bureau of Economic Analysis Area – Lakes [1/]

BEA	Coal & Coke	Petrol	Aggs	Grain	Chem	Ores & Minerals	Iron & Steel	All Other	Total Tonnage
6 Alpena, MI	13,452	0	16,148,965		10,200	25,500		3,713,703	19,911,820
9 Appleton-Oshkosh-Neenah, WI		1,734	6,452					4,643	12,829
11 Atlanta-Sandy Springs-Gainesville, GA-AL		0					10,573	1,309	11,882
15 Baton Rouge-Pierre Part, LA	525,062	4,549			59,223	14,001	211,036		813,871
16 Beaumont-Port Arthur, TX	1,551	0							1,551
22 Boston-Worcester-Manchester, MA-NH		0				17,084			17,084
25 Cape Girardeau-Jackson, MO-IL		0			1,497				1,497
29 Charleston, WV		0	13,122				4,168		17,290
32 Chicago-Naperville-Michigan City, IL-IN-WI	2,570,827	2,126,941	9,112	449,100	67,317	95,637	858,325	203,947	6,381,206
33 Cincinnati-Middletown-Wilmington, OH-KY-IN		0					1,405		1,405
35 Cleveland-Akron-Elyria, OH	14,946,078	4,691	489,509			870,729	2,156,789	133,879	18,601,675
43 Davenport-Moline-Rock Island, IA-IL		0					5,921		5,921
47 Detroit-Warren-Flint, MI	55,248	720,198	23,054		783,549	293,834	64,398	14,088	1,954,369
50 Duluth, MN-WI	17,728,672	0	77	2,241,720			31,431,495	6,325	51,408,289
52 Erie, PA		0	688					2,311	2,999
54 Evansville, IN-KY		0	17,294				6,246		23,540
63 Grand Forks, ND-MN		503	434				30	814	1,781
64 Grand Rapids-Muskegon-Holland, MI		0			277,903	6,409	54,924	22,883	362,119
67 Greenville, NC		0			20,200				20,200
75 Houston-Baytown-Huntsville, TX		0			22,764		1,470	1,500	25,734
76 Huntsville-Decatur, AL		0					44,095	1,554	45,649
82 Jonesboro, AR		0					3,125		3,125
88 Knoxville-Sevierville-La Follette, TN		0						1,523	1,523
90 Lafayette-Acadiana, LA		0				29,357			29,357
91 Lake Charles-Jennings, LA		23,081							23,081
96 Little Rock-North Little Rock-Pine Bluff, AR		1,500				1,505	6,169		9,174
97 Los Angeles-Long Beach-Riverside, CA		0						21	21
98 Louisville-Elizabethtown-Scottsburg, KY-IN		1,400							1,400
102 Marinette, WI-MI		0	4,803,356			93,500	12,176,300	10,609	17,083,765
104 McAllen-Edinburg-Pharr, TX		0					6,432	1,538	7,970
106 Miami-Fort Lauderdale-Miami Beach, FL		0						23	23
108 Milwaukee-Racine-Waukesha, WI		0	154,644	470,782			9,847	15,129	650,402
109 Minneapolis-St. Paul-St. Cloud, MN-WI	264,467	0		1,345,832		224,573	6,744,795	39,155	8,618,822
112 Mobile-Daphne-Fairhope, AL		0					3,971	250	4,221
116 Nashville-Davidson-Murfreesboro-Columbia, TN		0	116,264				1,430		117,694
117 New Orleans-Metairie-Bogalusa, LA	211,565	9,068	27,040		5,691	26,756	82,591	4,675	367,386
118 New York-Newark-Bridgeport, NY-NJ-CT-PA		4,045					3,052		7,097
122 Paducah, KY-IL		0					2,820		2,820
126 Peoria-Canton, IL		0						13,773	13,773
160 St. Louis-St. Charles-Farmington, MO-IL	1,400	0					10,297	47,358	59,055
162 Syracuse-Auburn, NY		22		25				10	57
166 Toledo-Fremont, OH	4,414,628	338,059	4,701,564	1,083,072	117,620			560	10,655,503
168 Traverse City, MI		0			8,114			0	8,114
170 Tulsa-Bartlesville, OK		0			6,155				6,155
174 Washington-Baltimore-Northern Virginia, DC-MD-VA-WV		24,879							24,879
176 Wausau-Merrill, WI		2,520	5,540,951					10,785	5,554,256
183 Thunder Bay	1,749,364	44,799	3,800	7,088,546	575,319	10,243	7,408	1,604,162	11,083,641
184 East Lake Superior		0						70,585	70,585
185 Sault St. Marie	56,340	59,683	2,142,886		26,021	267,640	279,372	296,874	3,128,816
186 Lake Huron		0	1,452,152	128,999	21,495	5,912,556	18,508	11,036	7,544,746
187 St. Claire River (Sarnia)	8,300	1,388,638	95,449	120,830	111,230	178,724	28,898	8,008	1,940,077
188 Detroit River (Windsor)		13,061	343,101	228,974	230,754	1,864,317	28,383	21,114	2,729,705
189 Lake Erie (Nanticoke)	58,040	662,941	799,271	12,083		75,521	178,784	237,595	2,024,234
190 Welland Canal	13,884	0							13,884
191 Toronto	92,191	286,928	2,036,819	73,626	130,726	310,864	162,660	609,917	3,703,732
192 Kingston		0	89,962		35,825			2,032,474	2,158,262
193 Montreal		554,647		2,232	6,615	21,941	132,607	96,526	814,568
194 Three Rivers		0				3,083	27,914	53,751	84,748
195 Quebec	191,800	241,818		20,345	8,560		555,998	300,180	1,318,701
196 Sept-Iles		27,664		30,311		26,910	11,349,557	29,412	11,463,854
197 New Brunswick		0						5,787	5,787
198 Nova Scotia		12,878	269,979					58,994	341,851
200 Newfoundland		131,174							131,174
Foreign		79,643	2,416	84,462	161,888	375,393	3,783,808	1,390,066	5,877,675
Total	42,902,870	6,767,063	39,288,361	13,380,939	2,688,666	10,746,075	70,455,602	11,078,847	197,308,423

Source: WCSC Data.

[1/] A Bureau of Economic Analysis (BEA) area consists of a standard metropolitan statistical area (SMSA) serving as a center of economic activity and its surrounding counties. U.S BEAs are the 2004 definitions provided by U.S. Department of Commerce, Bureau of Economic Analysis available at http://www.bea.gov/bea/ARTICLES/2004/11November/1104Econ-Areas.pdf. Canadian BEAs are defined by the USACE, LRD Navigation Planning Center for convenience of analysis only.

Table 11
2001 Receipts by Bureau of Economic Analysis Area – Lakes [1/]

	BEA	Coal & Coke	Petrol	Aggs	Grain	Chem	Ores & Minerals	Iron & Steel	All Other	Total Tonnage
6	Alpena, MI	780,453	358,644	345,220			112,028	27,083	108,131	1,731,559
9	Appleton-Oshkosh-Neenah, WI	728,460	70,059	564,134		24,121	200,105	98,488	654,881	2,340,248
16	Beaumont-Port Arthur, TX		0	196,319						196,319
22	Boston-Worcester-Manchester, MA-NH		8,980							8,980
23	Buffalo-Niagara-Cattaraugus, NY	218,401	183,168	217,706	330,079		150,931	2,908	183,281	1,286,474
30	Charleston-North Charleston, SC		0	169,827					37	169,864
32	Chicago-Naperville-Michigan City, IL-IN-WI	504,797	862,642	4,776,055		334,692	1,336,866	25,142,100	1,094,995	34,052,147
35	Cleveland-Akron-Elyria, OH	166,991	345,342	9,398,017	4,655	71,808	628,942	14,595,042	1,691,195	26,901,992
41	Corpus Christi-Kingsville, TX		0					4,077		4,077
47	Detroit-Warren-Flint, MI	10,279,908	875,900	8,947,753		187,883	2,225,216	8,058,982	2,668,993	33,244,635
50	Duluth, MN-WI	483,638	0	717,364			22,786	96,077	172,167	1,492,032
52	Erie, PA		0	1,120,095			42,551		2,225	1,164,871
63	Grand Forks, ND-MN		350	136					1,102	1,588
64	Grand Rapids-Muskegon-Holland, MI	981,818	59,764	824,515		19,308	311,500	6,118	447,701	2,650,724
69	Gulfport-Biloxi-Pascagoula, MS		0						7,400	7,400
70	Harrisburg-Carlisle-Lebanon, PA		0			5,614				5,614
75	Houston-Baytown-Huntsville, TX		0			23,642		84,999	4,772	113,413
76	Huntsville-Decatur, AL		0		1,532			59,872	2,800	64,204
79	Jacksonville, FL		0	521,695					40,380	562,075
80	Jackson-Yazoo City, MS		0					1,446		1,446
82	Jonesboro, AR		0					7,424	3,000	10,424
96	Little Rock-North Little Rock-Pine Bluff, AR		0					15,572		15,572
98	Louisville-Elizabethtown-Scottsburg, KY-IN		0					67,773		67,773
102	Marinette, WI-MI	3,693,918	30,017	1,680,081		35,861	268,085	1,981,801	776,784	8,466,547
104	McAllen-Edinburg-Pharr, TX		2,489							2,489
105	Memphis, TN-MS-AR		3,030					72,667	500	76,197
108	Milwaukee-Racine-Waukesha, WI	1,489,874	205,778	10,505			1,147,216	97,237	909,269	3,859,879
109	Minneapolis-St. Paul-St. Cloud, MN-WI	63,085	0	2,013,264	107,002	67,935	262,713	34,293	446,756	2,995,048
112	Mobile-Daphne-Fairhope, AL		0	216,649					9,943	226,592
115	Myrtle Beach-Conway-Georgetown, SC		0	71,825						71,825
116	Nashville-Davidson-Murfreesboro-Columbia, TN		0					8,236		8,236
117	New Orleans-Metairie-Bogalusa, LA	7,968	0	552	42,306	15,376		8,319	2,003	76,524
118	New York-Newark-Bridgeport, NY-NJ-CT-PA		0	41,569				72		41,641
123	Panama City-Lynn Haven, FL		0	131,011				31,589	1,600	164,200
125	Pensacola-Ferry Pass-Brent, FL		0	50,691						50,691
126	Peoria-Canton, IL		0					4,573		4,573
127	Philadelphia-Camden-Vineland, PA-NJ-DE-MD		0			6,317				6,317
130	Portland-Lewiston-South Portland, ME		8,650				11,522			20,172
139	Rochester-Batavia-Seneca Falls, NY		0						129,723	129,723
149	Savannah-Hinesville-Fort Stewart, GA		0	185,988					50	186,038
156	South Bend-Mishawaka, IN-MI	1,244,874	0	1,215,941			266,030		613,061	3,339,906
158	Springfield, IL		29,400							29,400
160	St. Louis-St. Charles-Farmington, MO-IL		9,786					6,395	10,628	26,809
162	Syracuse-Auburn, NY		159,441		25	40,433	268,718		98,053	566,670
164	Tampa-St. Petersburg-Clearwater, FL		0	592,521			10			592,531
166	Toledo-Fremont, OH	37,600	202,314	563,948	186,500	247,203	367,829	2,162,043	362,996	4,130,433
168	Traverse City, MI	72,047	273,555	151,516					22,649	519,767
170	Tulsa-Bartlesville, OK		0					31,230		31,230
176	Wausau-Merrill, WI	192,067	1,143	29,223			30,882		106,730	360,045
183	Thunder Bay	200,289	291,183	48,150	34,890	29,055	332,880	2,324	29,445	968,216
184	East Lake Superior		31,709							31,709
185	Sault St. Marie	310,471	237,343	52,915			206,646	91,951		899,326
186	Lake Huron	613,520	42,973	718,325	442,506	97,971	733,122		163,996	2,812,412
187	St. Claire River (Sarnia)	3,134,790	674,181	1,015,255	171,752	145,006	16,512		25,900	5,183,395
188	Detroit River (Windsor)	55,969	92,892	2,221,581	322,511	487,657	400,058	78,773	50,093	3,709,535
189	Lake Erie (Nanticoke)	12,396,523	242,745	142,780		22,351	47,870	3,521,831		16,374,100
190	Welland Canal	56,466	119,731		560,210	14,491	161,428		3,313	915,638
191	Toronto	4,422,454	1,049,152	2,570,761	155,883	245,203	1,219,370	12,139,406	1,495,996	23,298,224
192	Kingston	93,511	55,546	54,421	173,182		205,655		3,096	585,410
193	Montreal	61,607	209,252		1,279,904	22,610	675,306			2,248,680
194	Three Rivers	123,147	44,293		229,370	18,923			9,918	425,651
195	Quebec	86,350	106,526	32,824	1,213,205		87,856		25,915	1,552,675
196	Sept-Iles	458,726	314,625	485,483	3,855,602					5,114,436
197	New Brunswick	33,905	46,595							80,499
198	Nova Scotia	2,067,936	76,359	7,069	228,128	56,449	26,475			2,462,416
199	Prince Edward Island		0			56,147				56,147
200	Newfoundland		29,963							29,963
201	Other Canada		0		13,826	10,673			4,238	28,737
	Foreign	33,850	142,544	0	5,014,762	206,861	137,280	32,288	701,912	6,269,497
	Total	45,095,412	7,498,062	42,103,684	14,367,828	2,493,589	11,904,388	68,572,989	13,087,627	205,123,579

Source: WCSC Data.

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Table 12
2002 Receipts by Bureau of Economic Analysis Area – Lakes[1/]

BEA	Coal & Coke	Petrol	Aggs	Grain	Chem	Ores & Minerals	Iron & Steel	All Other	Total Tonnage
6 Alpena, MI	629,770	355,160	161,775			175,114	28,561	75,688	1,426,068
9 Appleton-Oshkosh-Neenah, WI	870,796	39,654	526,495		23,904	206,100	33,243	374,365	2,074,557
11 Atlanta-Sandy Springs-Gainesville, GA-AL		0					4,190		4,190
23 Buffalo-Niagara-Cattaraugus, NY	826,417	220,038	285,498	384,695		242,665	5,011	171,492	2,135,816
25 Cape Girardeau-Jackson, MO-IL		0					4,754	1,490	6,244
29 Charleston, WV		0					4,724		4,724
30 Charleston-North Charleston, SC		0						345	345
32 Chicago-Naperville-Michigan City, IL-IN-WI	739,578	530,647	4,702,470	30,311	276,660	663,984	25,109,245	1,351,079	33,403,974
33 Cincinnati-Middletown-Wilmington, OH-KY-IN		0					1,450		1,450
35 Cleveland-Akron-Elyria, OH	113,843	315,309	9,520,069	11,878	81,685	780,154	15,640,553	1,386,234	27,849,725
41 Corpus Christi-Kingsville, TX		0					44,158		44,158
47 Detroit-Warren-Flint, MI	9,422,295	704,557	8,572,908		253,252	2,247,394	8,642,233	2,658,431	32,501,070
50 Duluth, MN-WI	1,174,766	127	644,578	18,346		121,457		187,555	2,146,829
52 Erie, PA	13,884	7,153	1,263,748			50,668		23,234	1,358,687
54 Evansville, IN-KY		0					1,602		1,602
63 Grand Forks, ND-MN		376	434				30	732	1,572
64 Grand Rapids-Muskegon-Holland, MI	1,131,375	98,816	871,644		6,555	276,369	3,424	244,163	2,632,346
75 Houston-Baytown-Huntsville, TX		0			20,804		52,385		73,189
76 Huntsville-Decatur, AL		1,500		4,674			105,065		111,239
80 Jackson-Yazoo City, MS		0					2,790		2,790
82 Jonesboro, AR		0					22,332		22,332
88 Knoxville-Sevierville-La Follette, TN		0		4,959			1,261		6,220
96 Little Rock-North Little Rock-Pine Bluff, AR		0					2,693		2,693
98 Louisville-Elizabethtown-Scottsburg, KY-IN		0					25,977	1,447	27,424
102 Marinette, WI-MI	2,724,212	50,555	1,226,427			268,430	180,770	177,829	4,628,223
104 McAllen-Edinburg-Pharr, TX		2,830							2,830
105 Memphis, TN-MS-AR		0					60,753	1,529	62,282
108 Milwaukee-Racine-Waukesha, WI	1,288,176	209,418	18,566		1,482	680,786	46,550	1,006,662	3,251,640
109 Minneapolis-St. Paul-St. Cloud, MN-WI	43,122	0	1,785,587	56,509	51,114	184,421	27,708	344,885	2,493,346
112 Mobile-Daphne-Fairhope, AL		0					3,181		3,181
116 Nashville-Davidson-Murfreesboro-Columbia, TN		0					7,262		7,262
117 New Orleans-Metairie-Bogalusa, LA		9,183		175,109	1,498		13,155	1,436	200,381
118 New York-Newark-Bridgeport, NY-NJ-CT-PA		5,445			125			968	6,538
122 Paducah, KY-IL		0			4,693			1,500	6,193
123 Panama City-Lynn Haven, FL		0					80,432		80,432
126 Peoria-Canton, IL		0					8,600		8,600
129 Pittsburgh-New Castle, PA		0					2,850		2,850
130 Portland-Lewiston-South Portland, ME		0				19,901			19,901
139 Rochester-Batavia-Seneca Falls, NY		0						150,220	150,220
156 South Bend-Mishawaka, IN-MI	1,292,316	0	783,994			176,321		536,179	2,788,810
158 Springfield, IL		4,300							4,300
160 St. Louis-St. Charles-Farmington, MO-IL		0					34,380	6,389	40,769
162 Syracuse-Auburn, NY		127,503		25	44,821	106,371		151,434	430,154
164 Tampa-St. Petersburg-Clearwater, FL		6,681							6,681
166 Toledo-Fremont, OH	71,585	266,468	615,507	74,559	151,649	486,417	3,233,876	245,029	5,145,090
168 Traverse City, MI	235,664	270,022	107,159					0	612,845
170 Tulsa-Bartlesville, OK		0					56,499		56,499
171 Tupelo, MS		0					5,588		5,588
174 Washington-Baltimore-Northern Virginia, DC-MD-VA-WV		0			55,776				55,776
176 Wausau-Merrill, WI	178,465	1,017	527			22,839		10,785	213,633
183 Thunder Bay	169,040	194,969	37,002	24,214	25,154	187,488	2,914	75,410	716,191
184 East Lake Superior		30,814	4,000		4,287				39,101
185 Sault St. Marie	1,317,301	188,939	305,335			200,337	2,427,290	10,000	4,449,201
186 Lake Huron	35,993	24,482	585,142	439,273	60,742	619,991	3,052	193,936	1,962,610
187 St. Claire River (Sarnia)	3,957,122	734,725	1,179,310	93,073	138,581	27,000		17,396	6,147,207
188 Detroit River (Windsor)	85,901	99,895	2,953,014	126,772	737,439	302,632	175,916	31,395	4,512,964
189 Lake Erie (Nanticoke)	12,044,523	300,339	184,634	228,009	54,738	15,366	3,764,531	26,310	16,618,449
190 Welland Canal	59,645	119,063		505,320	3,366	29,692			717,086
191 Toronto	3,742,921	958,448	2,499,423	115,766	292,296	1,080,663	10,567,574	1,323,887	20,580,978
192 Kingston	191,090	119,110	54,917	140,961	8,200	518,604			1,032,882
193 Montreal	99,310	225,745		927,908	30,571	739,955			2,023,489
194 Three Rivers	90,085	64,795		216,003	8,200	10,243			389,327
195 Quebec	37,373	20,215	51,074	1,602,027		101,523			1,812,212
196 Sept-Iles	165,165	308,317	347,123	3,093,457		26,856		8,469	3,949,388
197 New Brunswick		1,113			14,891	553			16,558
198 Nova Scotia	56,885	37,717		155,401	73,195	61,854			385,052
199 Prince Edward Island		0			6,008				6,008
200 Newfoundland		22,032		8,474	3,582			35,052	69,140
201 Other Canada		0		28,048					28,048
Foreign	94,252	89,586		4,915,168	253,399	113,928	17,040	245,891	5,729,264
Total	42,902,870	6,767,063	39,288,361	13,380,939	2,688,666	10,746,075	70,455,602	11,078,847	197,308,423

Source: WCSC Data.

[1/]A Bureau of Economic Analysis (BEA) area consists of a standard metropolitan statistical area (SMSA) serving as a center of economic activity and its surrounding counties. U.S BEAs are the 2004 definitions provided by U.S. Department of Commerce, Bureau of Economic Analysis available at http://www.bea.gov/bea/ARTICLES/2004/11November/1104Econ-Areas.pdf. Canadian BEAs are defined by the USACE, LRD Navigation Planning Center for convenience of analysis only.

4. **<u>Project Statistics</u>**.

a. <u>Project Traffic</u>. Iron ore is the largest tonnage moved through the locks of the GLNS. Soo Locks moved almost 39 million tons of iron ore in 2001 and over 45 million tons in 2002 (see **Tables 13-14**). Coal and grains are two other prominent commodities shipped on the lakes. Total project traffic since 1995 is presented in **Table 15**. Chicago and Black Rock locks average only around 211 to 331 thousand tons of commercial cargo annually. **Tables 16** and **17** show lock commodity traffic by direction.

Table 13
2001 Lock Traffic by Commodity
(Kilotons)

				Crude Materials			Manufactured Goods						
Project	Coal	Petrol	Chem	Sand/ Gravel	Iron Ore	Other	Lime/Glass/ Cement	Iron/ Steel	Other	Grain	Machinery/ Equipment	Other	Total
Soo Locks													
Poe	15,178	205	136	3,572	36,363	251	130	128	0	4,230	0	240	60,433
MacArthur	3,782	58	414	751	2,414	498	394	63	0	6,991	0	582	15,947
Davis	0	8	0	0	0	0	0	0	0	0	0	0	8
Total	18,960	271	550	4,323	38,777	749	524	191	0	11,221	0	822	76,388
Chicago Lock	0	79	9	7	0	52	15	0	0	0	15	15	192
Black Rock Lock	79	169	0	0	0	0	0	0	0	0	0	0	248

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.

Table 14
2002 Lock Traffic by Commodity
(Kilotons)

				Crude Materials			Manufactured Goods						
Project	Coal	Petrol	Chem	Sand/ Gravel	Iron Ore	Other	Lime/Glass/ Cement	Iron/ Steel	Other	Grain	Machinery/ Equipment	Other	Total
Soo Locks													
Poe	15,702	143	181	3,136	41,160	171	92	326	0	3,730	242	28	64,911
MacArthur	4,045	43	407	728	4,202	466	365	203	0	6,177	518	83	17,237
Davis	0	6	0	0	0	0	0	0	0	0	0	1	7
Total	19,747	192	588	3,864	45,362	637	457	529	0	9,907	760	112	82,155
Chicago Lock	2	27	6	17	0	40	0	0	0	0	44	11	147
Black Rock Lock	278	229	0	0	0	0	0	0	0	0	0	0	507

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.

Table 15
Historic Total Traffic by Project
(Kilotons)

Project	1995	1996	1997	1998	1999	2000	2001	2002	Growth Rate 1995 - 2002
Soo Locks									
Poe	63,704	63,345	66,817	65,610	66,373	67,750	60,433	64,912	0.24%
MacArthur	20,968	20,726	23,922	21,829	16,044	17,174	15,947	17,238	-2.42%
Davis	11	0	3	0	0	6	8	7	-4.69%
Total	84,683	84,071	90,742	87,439	82,417	84,930	76,388	82,157	-0.38%
Chicago Lock	296	200	98	293	316	147	192	147	-8.38%
Black Rock Lock	346	340	329	296	286	303	248	507	4.89%

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.

Table 16
2001 Lock Traffic by Commodity by Direction
(Kilotons)

Project	Direction	Coal	Petrol	Chem	Crude Materials: Sand/ Gravel	Crude Materials: Iron Ore	Crude Materials: Other	Manufactured Goods: Lime/Glass/ Cement	Manufactured Goods: Iron/ Steel	Manufactured Goods: Other	Grain	Machinery/ Equipment	Other	Total
Soo Locks														
Poe	Up	1,431	205	-	3,320	-	174	130	98	-	13	-	82	5,453
	Down	13,747	-	136	252	36,363	77	-	30	-	4,217		158	54,980
MacArthur	Up	1,053	58	-	723	-	386	394	56	-	22	-	103	2,795
	Down	2,729	-	414	28	2,414	112	-	7	-	6,969	-	479	13,152
Davis	Up	-	8	-	-	-	-	-	-	-	-	-	-	8
	Down	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	18,960	271	550	4,323	38,777	749	524	191	-	11,221	-	822	76,388
Chicago Lock	Up	-	47	-	6	-	-	-	-	-	-	12	2	67
	Down	-	32	9	-	-	52	15	-	-	-	3	13	124
	Total	-	79	9	6	-	52	15	-	-	-	15	15	192
Black Rock Lock	Up	-	-	-	-	-	-	-	-	-	-	-	-	-
	Down	79	169	-	-	-	-	-	-	-	-	-	-	248
	Total	79	169	-	-	-	-	-	-	-	-	-	-	248

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.
Totals may not equal the sum of the commodities due to rounding.

Table 17
2002 Lock Traffic by Commodity by Direction
(Kilotons)

Project	Direction	Coal	Petrol	Chem	Crude Materials: Sand/ Gravel	Crude Materials: Iron Ore	Crude Materials: Other	Manufactured Goods: Lime/Glass/ Cement	Manufactured Goods: Iron/ Steel	Manufactured Goods: Other	Grain	Machinery/ Equipment	Other	Total
Soo Locks														
Poe	Up	1,396	143	-	3,027	66	166	92	224	-	39	34	22	5,209
	Down	14,306	-	181	109	41,094	5	-	102	-	3,691	208	6	59,702
MacArthur	Up	1,020	43	-	700	231	310	363	142	-	-	141	68	3,018
	Down	3,026	-	407	28	3,971	156	2	61	-	6,177	377	16	14,221
Davis	Up	-	6	-	-	-	-	-	-	-	-	-	1	7
	Down	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	19,748	192	588	3,864	45,362	637	457	529	-	9,907	760	113	82,157
Chicago Lock	Up	2	9	-	11	-	-	-	-	-	-	23	-	45
	Down	-	18	6	6	-	40	-	-	-	-	21	11	102
	Total	2	27	6	17	-	40	-	-	-	-	44	11	147
Black Rock Lock	Up	-	-	-	-	-	-	-	-	-	-	-	-	-
	Down	278	229	-	-	-	-	-	-	-	-	1	-	508
	Total	278	229	-	-	-	-	-	-	-	-	1	-	508

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.
Totals may not equal the sum of the commodities due to rounding.

b. Project Performance. **Tables 18** and **19** show project performance characteristics, where available, for 2001 and 2002. **Table 20** shows the historic number of commercial vessels (cargo and passenger) at each project and **Table 21** shows historic average lock delays.

Table 18
2001 Lock Performance Characteristics

Project	Cargo Vessels	Cargo Tons (000s)	Average Tons/Vessel	Average Time/Vessel (min): Delay	Average Time/Vessel (min): Process	Average Time/Vessel (min): Total	Commercial Lockages
Soo Locks [1/]							
Poe	2,888	60,433	20,926	13	49	62	3,403
MacArthur	1,531	15,947	10,416	4	30	34	3,330
Davis	4	8	2,000	2	32	34	25
Total	4,423	76,388	17,271	19	111	130	6,758
Chicago Lock	95	192	2,021	4.2	NA	4.2	88
Black Rock Lock	53	248	4,679	0.6	NA	0.6	62

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.

[1/] Data covers shipping year; March 15 of current year through January 15 of next year

Table 19
2002 Lock Performance Characteristics

Project	Cargo Vessels	Cargo Tons (000s)	Average Tons/Vessel	Average Time/Vessel (min) Delay	Process	Total	Commercial Lockages
Soo Locks [1/]							
Poe	3,029	64,912	21,430	15	47	62	3,645
MacArthur	1,605	17,238	10,740	6	31	37	3,426
Davis	4	7	1,750	4	33	37	23
Total	4,638	82,157	17,714	25	111	136	7,094
Chicago Lock	59	147	2,492	4.2	NA	4.2	63
Black Rock Lock	113	507	4,487	1.4	39.9	41.3	462

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.

[1/] Data covers shipping year; March 15 of current year through January 15 of next year

Table 20
Historic Number of Commercial Vessels

Project	1995	1996	1997	1998	1999	2000	2001	2002
Soo Locks [1/]								
Poe	3,683	4,003	3,922	3,816	3,688	3,568	3,474	3,730
MacArthur	4,040	4,605	4,440	4,227	3,303	3,126	3,441	3,520
Davis	1,150	16	816	-	444	35	27	23
Total	8,873	8,624	9,178	8,043	7,435	6,729	6,942	7,273
Chicago Lock	14,321	10,978	12,003	13,860	13,950	12,085	11,445	12,188
Black Rock Lock	507	537	326	372	505	398	373	462

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.

[1/] Data covers shipping year; March 15 of current year through January 15 of next year

Table 21
Historic Average Lock Delays
(minutes)

Project	1995	1996	1997	1998	1999	2000	2001	2002
Soo Locks [1/]								
Poe	9	10.2	10.2	7.8	12	NA	13.0	15.0
MacArthur	6	7.2	6	6	6.6	NA	4.0	6.0
Davis	3.6	4.8	2.4	0	2.4	NA	2.0	4.0
Chicago Lock	5.4	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Black Rock Lock	2.4	2.4	2.4	4.8	1.8	42.0	0.6	1.4

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.

[1/] Data covers shipping year; March 15 of current year through January 15 of next year

c. <u>Recreational Traffic and Passenger Trips</u>. Great Lakes navigation locks have always entertained thousands of recreation boaters and cruise passengers. The cruise industry on the Great Lakes is experiencing a recent resurgence. The resurgence results from the formation of new coalitions, resources and entrepreneurs to capitalize on an area that is expected to experience continued growth in tourism. The Great Lakes offer a new destination for seasoned ship travelers and a perceived safer alternative to overseas cruises. **Tables 22** and **23** show historic recreational traffic and passenger trips, respectively, at GLNS navigation locks.

Table 22
Historic Recreational Traffic
(Number of Vessels)

Project	1995	1996	1997	1998	1999	2000	2001	2002
Soo Locks [1/]								
Poe	500	682	295	195	87	73	454	434
MacArthur	1,220	1,430	672	660	413	314	1,405	1,021
Davis	762	-	237	-	135	2	29	24
Total	2,482	2,112	1,204	855	635	389	1,888	1,479
Chicago Lock	44,396	38,790	35,058	36,457	36,547	38,717	35,986	37,289
Black Rock Lock	6,332	6,016	5,050	4,341	3,330	2,571	1,969	1,737

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.
[1/] Data covers shipping year; March 15 of current year through January 15 of next year

Table 23
Historic Passenger Trips
(Trips / Passengers)

Project	Trips/Passengers	1995	1996	1997	1998	1999	2000	2001	2002
Soo Locks [1/]									
Poe	Trips						397	395	458
	Passengers						NA	NA	NA
	Passengers/trip						NA	NA	NA
MacArthur	Trips						1,481	1,477	1,479
	Passengers						NA	NA	NA
	Passengers/trip						NA	NA	NA
Davis	Trips						16	16	18
	Passengers						NA	NA	NA
	Passengers/trip						NA	NA	NA
Total	Trips						1,894	1,888	1,955
	Passengers						NA	NA	NA
	Passengers/trip						NA	NA	NA
	Trips	13,171	10,181	11,274	13,105	12,871	11,975	9,559	10,522
	Passengers	837,625	683,790	732,662	880,618	825,777	838,317	677,337	695,261
Chicago Lock	Passengers/trip	64	67	65	67	64	70	71	66
	Trips						250	206	231
	Passengers						21,457	20,527	23,728
Black Rock Lock	Passengers/trip						86	100	103

Source: US Army Corps of Engineers, Lock Performance Monitoring System and Detroit District's Soo Area Office Data.
[1/] Data covers shipping year; March 15 of current year through January 15 of next year

5. **State and Port Commerce.**

a. State-to-State. State-to-state movements of 2001 and 2002 GLB traffic are summarized in **Tables 24 – 29**. Michigan, Minnesota, Ohio and Wisconsin each ship over 27 million tons of cargo. Predominant commodities include iron ore, coal, aggregates and steel. Canada shipped over 48 million tons in 2002 (see **Table 27**). Major receivers of Great Lakes traffic include Michigan, Ohio and Indiana (see **Table 28**).

b. Port Statistics. GLB port statistics are shown for twenty-two principal U.S. and Canadian Great Lakes ports in **Tables 30 - 31**. The first shows port statistics for 2002 by commodity. The second table shows shipments and receipts at these principal ports. Duluth-Superior is the largest shipping port of Great Lakes traffic with Hamilton and Nanticoke the largest receiving ports.

Table 24
Great Lakes Navigation System State to State Tonnage, 2001

Receiving State	Shipping State/Country												
	Illinois	Indiana	Michigan	Minnesota	New York	Ohio	Pennsylvania	Wisconsin	Other	Subtotal U.S.	Canada	Overseas	Total
Illinois	34,120	466,614	2,071,777	-	-	51,738	-	14,250	-	**2,638,499**	1,915,360	-	**4,553,859**
Indiana	196,679	194,865	9,279,961	11,204,325	-	131,345	8,846	5,229,041	901,889	**27,146,951**	1,374,493	1,067,883	**29,589,327**
Michigan	1,454,523	835,338	17,371,552	4,646	-	4,781,585	-	13,743,102	-	**38,190,746**	8,018,603	498,739	**46,708,088**
Minnesota	-	96,772	2,301,096	13,938	-	65,185	-	507,434	-	**2,984,425**	619,181	88,974	**3,692,580**
New York	23,774	-	363,944	33,000	61	194,627	-	283,851	-	**899,257**	1,080,774	3,408	**1,983,439**
Ohio	76,447	225,679	8,007,557	9,035,595	-	6,732,235	5,845	1,204,080	246,695	**25,534,133**	4,537,122	776,455	**30,847,710**
Pennsylvania	-	-	623,706	-	-	480,613	-	-	-	**1,104,319**	58,391	2,225	**1,164,935**
Wisconsin	809,143	212,099	2,470,719	24,428	-	1,665,034	-	312,193	-	**5,493,616**	1,351,819	477,519	**7,322,954**
Other	-	423,813	18,747	-	-	-	-	-	-	**442,560**	2,419,872	-	**2,862,432**
Subtotal U.S.	**2,594,686**	**2,455,180**	**42,509,059**	**20,315,932**	**61**	**14,102,362**	**14,691**	**21,293,951**	**1,148,584**	**104,434,506**	**21,375,615**	**2,915,203**	**128,725,324**
Canada	566,705	409,375	5,724,734	5,119,292	44,005	20,524,774	-	4,961,953	597,394	**37,948,232**	30,224,790	2,031,601	**70,204,623**
Overseas	-	146,589	32,952	1,303,535	-	43,435	-	1,632,740	-	**3,159,251**	3,005,644	-	**6,164,895**
Total	**3,161,391**	**3,011,144**	**48,266,745**	**26,738,759**	**44,066**	**34,670,571**	**14,691**	**27,888,644**	**1,745,978**	**145,541,989**	**54,606,049**	**4,946,804**	**205,094,842**

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

Table 25
Great Lakes Navigation System State to State Tonnage, 2002

Receiving State	Shipping State/Country												
	Illinois	Indiana	Michigan	Minnesota	New York	Ohio	Pennsylvania	Wisconsin	Other	Subtotal U.S.	Canada	Overseas	Total
Illinois	-	384,950	2,020,136	-	-	4,594	-	26,645	-	**2,436,325**	837,252	-	**3,273,577**
Indiana	255,768	170,435	6,880,024	11,537,666	-	123,574	-	7,340,025	1,468,698	**27,776,190**	1,494,315	925,049	**30,195,554**
Michigan	1,343,986	889,963	15,496,969	1,279,728	-	4,038,421	-	13,235,430	1,500	**36,285,997**	7,376,471	824,740	**44,487,208**
Minnesota	-	39,911	2,048,353	1,927	-	43,122	-	1,093,926	-	**3,227,239**	432,091	110,947	**3,770,277**
New York	182,165	-	480,791	36,367	57	688,741	-	306,318	-	**1,694,439**	1,022,185	5,011	**2,721,635**
Ohio	86,217	200,345	8,508,875	10,142,704	-	6,338,059	688	1,068,739	64,193	**26,409,820**	5,605,708	986,861	**33,002,389**
Pennsylvania	-	-	791,960	-	-	413,268	-	-	-	**1,205,228**	151,113	2,346	**1,358,687**
Wisconsin	930,926	215,523	2,392,181	-	-	1,357,636	-	70,161	19,619	**4,986,046**	1,281,876	241,432	**6,509,354**
Other	3,700	689,887	-	-	-	-	-	6,400	-	**699,987**	202,108	-	**902,095**
Subtotal U.S.	**2,802,762**	**2,591,014**	**38,619,289**	**22,998,392**	**57**	**13,007,415**	**688**	**23,147,644**	**1,554,010**	**104,721,271**	**18,403,119**	**3,096,386**	**126,220,776**
Canada	513,514	416,072	6,170,747	3,852,988	-	16,141,546	2,311	8,227,588	159,718	**35,484,484**	27,200,655	2,770,752	**65,455,891**
Overseas	-	83,224	72,187	1,031,826	-	44,024	-	1,445,905	-	**2,677,166**	2,954,590	-	**5,631,756**
Total	**3,316,276**	**3,090,310**	**44,862,223**	**27,883,206**	**57**	**29,192,985**	**2,999**	**32,821,137**	**1,713,728**	**142,882,921**	**48,558,364**	**5,867,138**	**197,308,423**

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

Table 26
Great Lakes Navigation System State Commodity Shipments 2001

Commodity	Shipping State/Country												
	Illinois	Indiana	Michigan	Minnesota	New York	Ohio	Pennsylvania	Wisconsin	Other	Subtotal U.S.	Canada	Overseas	Total
Coal & Coke	2,337,355	321,517	93,913	1,840,384	28,660	22,631,074	2,722	15,001,264	890,935	**43,147,824**	1,899,204	48,384	**45,095,412**
Petroleum Fuels	559,382	1,460,833	689,583	350	18	437,444	-	3,228	25,088	**3,175,926**	4,085,368	236,768	**7,498,062**
Aggregates	37,220	28,558	27,707,748	54,599	15,345	4,539,150	5,845	205,748	386,297	**32,980,510**	9,123,136	38	**42,103,684**
Grain	82,552	259,021	-	1,626,749	25	1,776,452	-	2,659,057	-	**6,403,856**	7,930,301	19,845	**14,354,002**
Chemicals	71,813	7,492	898,931	-	-	141,351	-	35,861	166,052	**1,321,500**	993,324	168,093	**2,482,916**
Ores & Minerals	-	-	377,869	92,441	-	1,679,604	5,907	-	27,723	**2,183,544**	9,301,639	419,205	**11,904,388**
Iron & Steel	32,725	556,003	13,799,416	23,034,403	-	3,078,528	-	9,721,411	130,671	**50,353,157**	15,506,381	2,713,451	**68,572,989**
Others	40,344	377,720	4,699,285	89,833	18	386,968	217	262,575	119,212	**5,976,172**	5,766,697	1,340,519	**13,083,388**
Total	**3,161,391**	**3,011,144**	**48,266,745**	**26,738,759**	**44,066**	**34,670,571**	**14,691**	**27,889,144**	**1,745,978**	**145,542,489**	**54,606,049**	**4,946,304**	**205,094,842**

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

Table 27
Great Lakes Navigation System State Commodity Shipments 2002

Commodity	Shipping State/Country												
	Illinois	Indiana	Michigan	Minnesota	New York	Ohio	Pennsylvania	Wisconsin	Other	Subtotal U.S.	Canada	Overseas	Total
Coal & Coke	2,456,574	114,253	68,700	264,467	-	19,360,706	-	17,728,672	739,578	**40,732,950**	2,169,920	-	**42,902,870**
Petroleum Fuels	460,983	1,667,358	721,701	503	22	342,750	-	2,751	71,228	**3,267,296**	3,424,230	75,537	**6,767,063**
Aggregates	6,500	2,612	26,515,889	511	-	5,126,880	688	161,533	237,913	**32,052,526**	7,233,419	2,416	**39,288,361**
Grain	95,075	354,025	-	1,345,832	25	1,083,072	-	2,712,502	-	**5,590,531**	7,705,946	84,462	**13,380,939**
Chemicals	62,623	6,191	1,079,766	-	-	117,620	-	-	114,033	**1,380,233**	1,146,545	161,888	**2,688,666**
Ores & Minerals	-	95,637	419,243	224,573	-	870,729	-	-	88,703	**1,698,885**	8,671,798	375,393	**10,746,075**
Iron & Steel	202,381	664,654	12,295,622	26,007,282	-	2,156,789	-	12,178,885	396,091	**53,901,704**	12,770,090	3,783,808	**70,455,602**
Others	32,140	185,580	3,761,302	40,038	10	134,439	2,311	36,794	66,182	**4,258,796**	5,436,416	1,383,635	**11,078,847**
Total	**3,316,276**	**3,090,310**	**44,862,223**	**27,883,206**	**57**	**29,192,985**	**2,999**	**32,821,137**	**1,713,728**	**142,882,921**	**48,558,364**	**5,867,138**	**197,308,423**

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

Table 28
Great Lakes Navigation System State Commodity Receipts 2001

Commodity	Receiving State/Country												
	Illinois	Indiana	Michigan	Minnesota	New York	Ohio	Pennsylvania	Wisconsin	Other	Sutotal U.S.	Canada	Overseas	**Total**
Coal & Coke		504,797	16,047,634	511,220	218,401	204,591		2,366,342	7,968	**19,860,953**	25,200,609	33,850	**45,095,412**
Petroleum Fuels	511,435	383,593	1,597,880	350	342,609	547,656	0	276,980	29,949	**3,690,452**	3,665,066	142,544	**7,498,062**
Aggregates	1,368,619	3,407,436	12,800,801	2,189,560	217,706	9,973,832	1,108,228	1,089,276	2,197,394	**34,352,852**	7,750,832		**42,103,684**
Grain				107,002	330,104	191,155			148,275	**776,536**	8,667,141	4,910,325	**14,354,002**
Chemicals	105,375	229,317	207,191	67,935	40,433	319,011	11,931	24,121	39,020	**1,044,334**	1,231,724	206,859	**2,482,916**
Ores & Minerals	1,074,284	262,582	3,128,380	262,713	419,649	996,771	42,551	1,412,468	11,532	**7,610,930**	4,156,178	137,280	**11,904,388**
Iron & Steel	808,143	24,392,610	8,092,308	105,942	2,980	16,757,085		310,713	345,519	**50,815,300**	17,725,401	32,288	**68,572,989**
Others	686,003	408,992	4,833,894	447,858	411,057	1,857,609	2,225	1,843,054	83,275	**10,573,967**	1,807,671	701,750	**13,083,388**
Total	**4,553,859**	**29,589,327**	**46,708,088**	**3,692,580**	**1,982,939**	**30,847,710**	**1,164,935**	**7,322,954**	**2,862,932**	**128,725,324**	**70,204,623**	**6,164,895**	**205,094,842**

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

Table 29
Great Lakes State Navigation System Commodity Receipts 2002

Commodity	Receiving State/Country												
	Illinois	Indiana	Michigan	Minnesota	New York	Ohio	Pennsylvania	Wisconsin	Other	Sutotal U.S.	Canada	Overseas	**Total**
Coal & Coke	-	739,578	15,547,735	1,160,690	826,417	185,428	13,884	2,282,532	-	**20,756,264**	22,052,353	94,252	**42,902,870**
Petroleum Fuels	302,265	232,682	1,479,110	503	352,986	581,777	7,153	250,089	20,194	**3,226,759**	3,450,718	89,586	**6,767,063**
Aggregates	1,352,164	3,350,306	11,720,207	1,867,503	285,498	10,135,576	1,263,748	1,108,684	3,700	**31,087,386**	8,200,975	-	**39,288,361**
Grain	30,311	-	-	56,509	384,720	86,437	-	18,346	243,767	**820,090**	7,704,706	4,856,143	**13,380,939**
Chemicals	135,645	145,708	259,807	51,114	44,821	233,334	-	25,386	82,857	**978,672**	1,461,250	248,745	**2,688,666**
Ores & Minerals	469,420	194,564	3,097,745	260,452	349,036	1,266,571	50,668	1,001,034	19,901	**6,709,391**	3,922,756	113,928	**10,746,075**
Iron & Steel	251,607	24,910,855	8,690,639	27,738	5,011	18,882,003	-	244,142	485,290	**53,497,285**	16,941,277	17,040	**70,455,602**
Others	732,165	621,861	3,691,965	345,768	473,146	1,631,263	23,234	1,579,141	46,386	**9,144,929**	1,721,856	212,062	**11,078,847**
Total	**3,273,577**	**30,195,554**	**44,487,208**	**3,770,277**	**2,721,635**	**33,002,389**	**1,358,687**	**6,509,354**	**902,095**	**126,220,776**	**65,455,891**	**5,631,756**	**197,308,423**

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

Table 30
Commodities at Principal U.S. and Canadian Great Lakes Ports, 2002

Port	Coal & Coke	Petroleum	Aggregates	Grain	Chemicals	Ores & Minerals	Iron & Steel	Others	Total
Duluth-Superior, MN-WI	18,093,459	0	2,348,683	3,662,407	51,114	530,451	18,936,931	537,789	**44,160,834**
Nanticoke, ON	11,953,185	935,835	0	28,657	23,868	31,100	3,787,178	235,900	**16,995,722**
Hamilton, ON	2,801,033	632,523	275,613	189,392	351,942	512,597	10,420,244	425,669	**15,609,013**
Two Harbors, MN	0	0	0	0	0	0	14,895,295	0	**14,895,295**
Indiana Harbor, IN	611,554	1,629,232	1,139,794	0	32,080	173,555	9,922,186	401,893	**13,910,294**
Cleveland, OH	56,102	320,000	5,387,235	0	31,410	581,104	3,945,504	1,200,111	**11,521,466**
Toledo, OH	4,469,213	600,727	655,093	1,157,631	269,269	486,417	3,233,876	244,469	**11,116,695**
Presque Isle, MI	2,057,264	0	76,895	0	0	25,835	8,432,403	0	**10,592,397**
Conneaut Harbor, OH	5,654,343	0	825,068	0	0	185,117	3,771,786	37,750	**10,474,064**
Dearborn, MI	701,401	1,038,345	2,178,761	0	114,653	513,835	4,535,212	1,100,982	**10,183,189**
Ashtabula, OH	5,081,713	0	593,734	0	20,762	75,532	3,884,679	181,142	**9,837,562**
Gary, IN	147,991	145,738	197,313	0	0	57,252	8,827,440	106,292	**9,482,026**
Thunder Bay, ON	1,217,140	166,748	37,002	7,015,501	314,956	151,051	2,914	108,689	**9,014,001**
Burns Harbor, IN	94,286	122,405	766,431	354,025	119,819	59,394	6,805,074	297,809	**8,619,243**
Calcite, MI	0	82,501	8,436,460	0	0	56,455	0	0	**8,575,416**
Stoneport, MI	8,300	0	7,386,854	0	0	40,027	0	19,363	**7,454,544**
Lorain, OH	0	0	643,172	0	29,513	78,244	5,820,175	101,110	**6,672,214**
Detroit, MI	632,996	37,730	556,801	0	74,070	206,224	3,774,211	677,964	**5,959,996**
Chicago, IL [1/]	2,456,574	731,243	1,074,419	125,386	178,305	469,420	300,137	481,575	**5,817,059**
Sault Ste. Marie, ON	1,373,641	248,622	333,582	0	26,021	353,897	2,706,662	306,874	**5,349,299**
Escanaba, MI	385,711	0	472,839	0	0	42,639	3,743,897	0	**4,645,086**
Sandusky, OH	4,267,763	0	44,107	0	0	72,074	71,426	0	**4,455,370**
Port Dolomite, MI	0	0	3,053,299	0	0	93,500	0	0	**3,146,799**
Taconite Harbor, MN	645,437	0	0	0	0	0	0	0	**645,437**
Sault Ste. Marie, MI	0	0	40,000	0	0	52,207	0	0	**92,207**

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics

1/ Port of Chicago traffic that did not move on the Great Lakes is excluded from this table.

Photo9: Laker approaching the Blue Water Bridge at the mouth of the St. Clair River

Table 31
Shipments and Receipts at Principal U.S. and Canadian Great Lakes Ports, 2002

Port	Receipt	Shipment	Intraport	Total
Duluth-Superior, MN-WI	3,400,936	40,759,898	0	**44,160,834**
Nanticoke	16,011,405	984,317	0	**16,995,722**
Hamilton, ON	14,399,242	1,209,771	0	**15,609,013**
Two Harbors, MN	0	14,895,295	0	**14,895,295**
Indiana Harbor, IN	11,938,792	1,828,916	71,293	**13,839,001**
Cleveland, OH	11,116,820	185,244	109,701	**11,411,765**
Toledo, OH	5,131,145	5,981,950	1,800	**11,114,895**
Presque Isle, MI	2,159,994	8,432,403	0	**10,592,397**
Dearborn, MI	9,026,351	825,652	165,593	**10,017,596**
Ashtabula, OH	4,801,119	5,036,443	0	**9,837,562**
Gary, IN	9,099,987	382,039	0	**9,482,026**
Thunder Bay, ON	391,452	8,622,548	0	**9,014,001**
Burns Harbor, IN	7,813,886	805,357	0	**8,619,243**
Calcite, MI	166,288	8,409,128	0	**8,575,416**
Stoneport, MI	145,103	7,309,441	0	**7,454,544**
Lorain, OH	4,414,315	2,257,899	0	**6,672,214**
Windsor, ON	3,631,828	2,377,495	0	**6,009,324**
Lake Huron	5,819,383	0	0	**5,819,383**
Chicago, IL [1/]	2,554,516	3,262,543	0	**5,817,059**
Detroit, MI	5,723,221	86,303	0	**5,809,524**
Sault Ste. Marie, ON	4,330,637	1,018,662	0	**5,349,299**
Escanaba, MI	901,189	3,743,897	0	**4,645,086**
Sandusky Harbor, OH	187,607	4,267,763	0	**4,455,370**
Alpena Harbor, MI	571,778	2,645,940	0	**3,217,718**
Port Dolomite, MI	0	3,146,799	0	**3,146,799**
Taconite Harbor, MN	645,437	0	0	**645,437**
Sault Ste. Marie, MI	52,207	40,000	0	**92,207**

Source: Compiled by the LRD Navigation Planning Center from Canadian waterborne shipment database prepared by TAF Consultants for Transport Canada using Statistics Canada data, and U.S. waterborne commerce data collected and compiled by the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

1/ Port of Chicago traffic that did not move on the Great Lakes is excluded from this table.

PART 3. THE OHIO RIVER NAVIGATION SYSTEM

1. General.

a. Geography and Physical Description. The Ohio River Navigation System (ORS) is situated in the Ohio River Basin (ORB), which is a 204,000 square mile area drained by the Ohio River and its tributaries. The drainage area encompasses all or portions of fourteen states, including Alabama, Georgia, Kentucky, Indiana, Illinois, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. **Figure 12** displays the navigable rivers of the ORS. The topography of the basin varies from rugged mountains to flat plains, with the Appalachian Mountains dominating the eastern portion. West of these mountains and south of the Ohio River, the landscape contains considerable local relief that gradually modifies to rolling plains through most of Kentucky and Tennessee. North of the Ohio River, broad valleys with only minor relief extend from southwestern and central Ohio through central Indiana into southern Illinois.

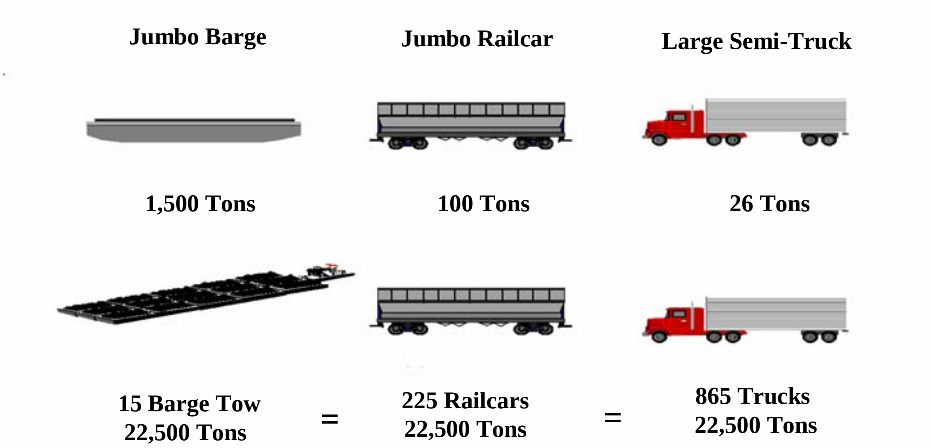
Figure 12
Navigable Rivers in the Ohio River Basin

The Ohio River forms the southern boundary of the state of Ohio and is the main artery of the Ohio River navigation system (ORS). The ORS is a major portion of the nation's inland navigation system, providing for commercial navigation in the eastern one-third of the country. The ORS consists of more than 2,600 miles of commercially navigable waterways. It includes the Ohio River and the navigable portions of the Allegheny, Monongahela, Kanawha, Big Sandy, Green, Tennessee, Cumberland and Kentucky rivers. The Ohio River serves as a collector of system traffic for distribution to points within and outside the Ohio basin, while the tributary streams serve major mining areas and industrial concentrations within the Basin. Through interconnections with the Mississippi River and its tributaries, ORS traffic has access to mid-western states and deep-draft ports on the Great Lakes and Gulf Coast. Year-round navigation on the Ohio River is provided by a system of 20 locks and dams and annual maintenance dredging.

Tows moving on the ORS system are configured to operate as efficiently as possible along each waterway segment. Lock size and channel dimensions are critical in limiting the most efficient tow configuration. Currently, the Ohio River fleet consists mostly of jumbo barges. A typical Ohio River tow is a 4,500 horsepower towboat moving 15 barges, while tows for tributaries are smaller, due to channel and lock restrictions.

Barge transportation is an energy efficient mode for carrying large quantities of bulk commodities. A typical barge can carry as much coal or grain as 15 rail cars for about the same energy per ton-mile. On certain river segments, river efficiency is much greater than rail due to the back haul opportunities barging provides. **Figure 13** compares the average carrying capacity for jumbo barges, railcars, and large semi-tractor trailers. The figure shows that a typical Ohio River tow carrying 22,500 tons is the equivalent of 225 railcars (2.25 unit trains) and 865 trucks.

Figure 13
Modal Carrying Capacity



b. History. The ORS was constructed to maintain navigation during the low water season when water transportation historically came to a halt. Federal involvement in improving the Ohio River for commercial navigation began in 1824, when Congress directed the Corps to find a method of removing sandbars and snags. In 1906, the Rivers and Harbors Board recommended construction of 54 locks and dams providing a nine-foot channel the entire length of the Ohio River. This plan, which called for 600-foot long lock chambers, was completed by the Corps between 1910 and 1929.

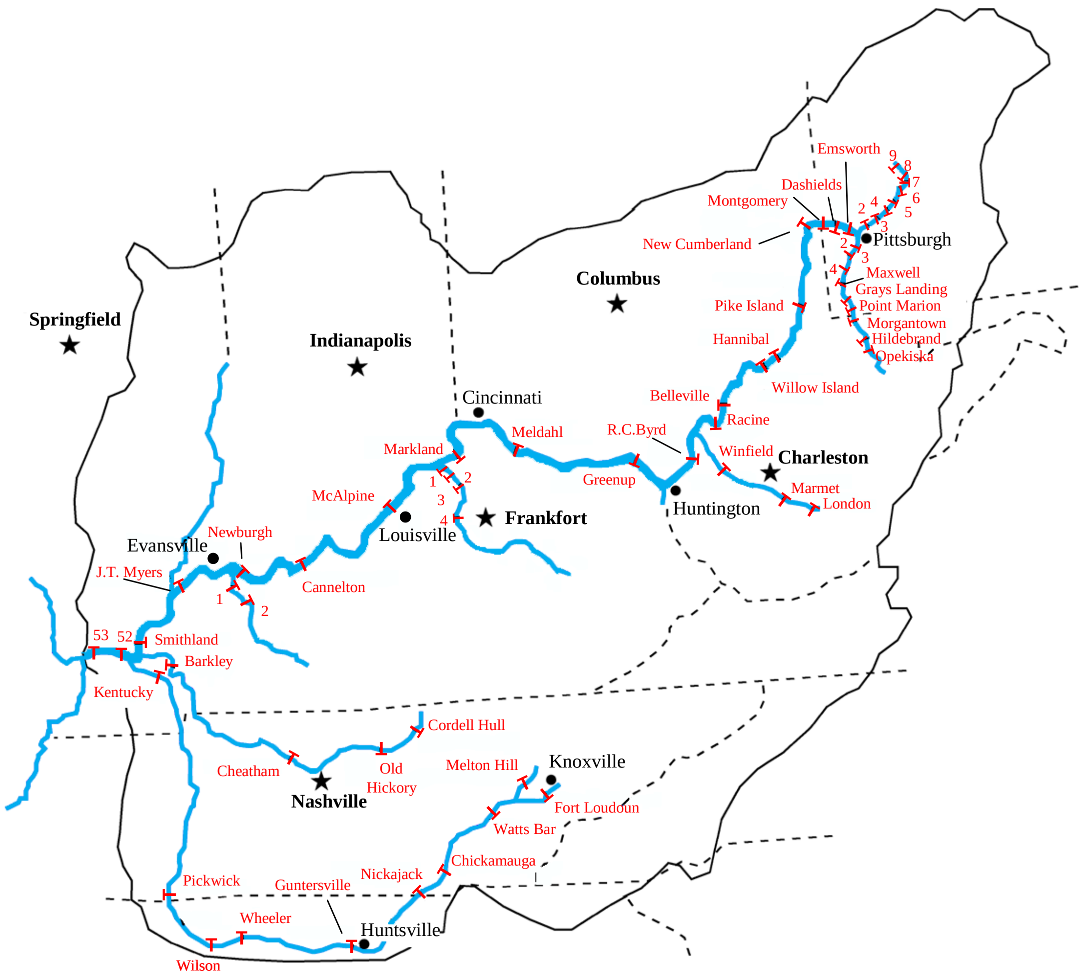
Once canalization was completed, the waterway spurred economic growth and assisted the rapid nationwide mobilization during World War II. Sustained post-war expansion of the national economy increased the use of all types of commodities carried on the river. This rapid growth in traffic exceeded the government's ability to increase lock capacity and by the 1950s serious delay problems had become obvious. The original 600-foot lock chambers built during the days of steamboats and small wooden barges were obsolete and could not handle modern tows (flotillas of bigger, steel barges pushed by diesel powered boats) in a single lockage.

Diesel towboats and newer, larger barges brought increased efficiency to the movement of the energy, construction, and food products demanded by a world newly re-constructed following WW II. These efficiencies, however, could not be fully realized because the Ohio River navigation system remained a system designed to accommodate the transportation technology of the previous century. Lock chambers were small, typically a main chamber 600 by 110 feet and an auxiliary of 360 by 56 feet, and because wicket dams were low-lift structures, the projects were relatively close together. As a result, plans were formulated in the 1950s to modernize the navigation system. The plans developed called for the replacement of earlier low-lift structures with fewer high-lift locks. The modernized structures provide higher-lift dams with longer pool-reaches between projects and larger lock dimensions. The modernization program envisioned 19 modern high-lift projects and began in 1954 with construction of Greenup Locks and Dam with a 30-foot lift, a 1200 by 110-foot main chamber, and a 600 by 110-foot auxiliary chamber.

The Ohio River modernization program continues today with the construction of Olmsted Locks and Dam on the lower Ohio River and McAlpine Locks and Dam located near Louisville, Kentucky. The new Olmsted Lock and Dam project at river mile 964.4 will replace old Locks and Dam 52 and Locks and Dam 53 and provide twin 1200 by 110-foot locks and a new dam with submersible gates to allow tow passage over the dam during higher flow conditions. With completion of Olmsted, the Ohio River mainstem will be reduced from 20 to 19 projects. The Water Resources Development Act of 1990 authorized improvement of McAlpine Locks and Dam at river mile 606.8. This project will replace the old 600-foot auxiliary lock with a new 1200-foot chamber -- providing this site with twin 1200 by 110-foot locks. The last vestiges of the turn-of-the-century system are at Emsworth, Dashields, and Montgomery locks and dams. These three Upper Ohio River projects have the old 600-foot main chamber and 360-foot auxiliary.

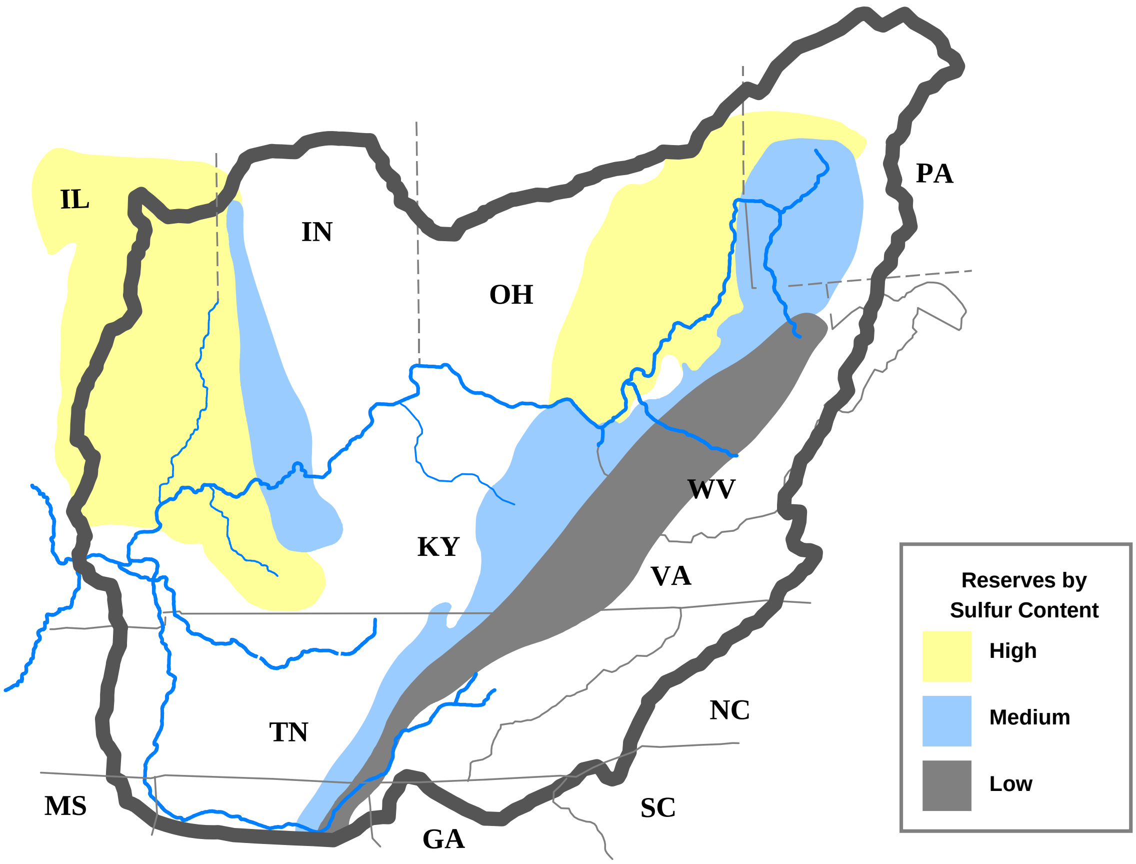
The mainstem Ohio River is currently a large canalized river consisting of 20 pools formed by 20 lock and dam structures. The existing system of tributary reservoirs provides storage for many purposes, one of which is to maintain low flow during periods of drought. The Ohio River and most of its navigable tributaries are maintained at a minimum depth of nine feet by a system of locks and dams and channel improvements. **Figure 14** displays ORS locks and dams.

Figure 14
Locks and Dams of the ORS



c. <u>Industries and Natural Resources</u>. Coal is the most transported commodity on the ORS. There are two major coal fields within the ORB: the Appalachian Region and the Illinois Basin. **Figure 15** shows the location of these reserves. The Ohio, Monongahela, Kanawha, Big Sandy, and Tennessee rivers are principal coal routes for Appalachian coal. These waterways provide a natural advantage to waterside Appalachian coal mines. In 2003, the Appalachian region produced over 376 million short tons of coal; about 35 percent of total U.S. coal produced that year. The Appalachian region contains over 16 percent of the nation's highly prized low sulfur coal.

Figure 15
Ohio River Basin Coal Reserves

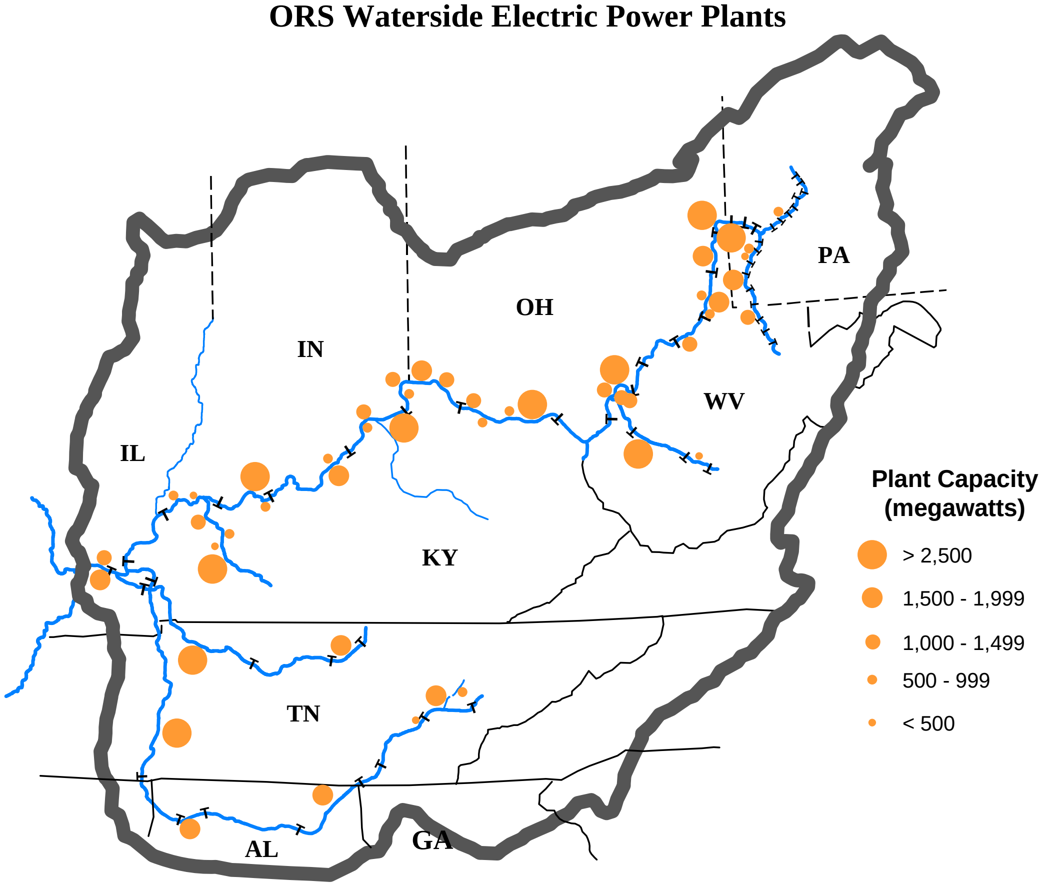


Almost 37 percent of Appalachian coal is shipped by waterway, 41 percent by rail, 16 percent by truck, and 6 percent by conveyor/slurry. Illinois Basin coal also transits the ORS and supplies many of the coal-consuming cement, steel, and power plants situated along the ORS. **Figure 16** displays the location and relative size of ORS waterside power plants.

The Clean Air Act of 1990 stimulated increased production of low-sulfur coals in the Powder River Basin (PRB) of Wyoming and in the central Appalachian region of West Virginia and Kentucky and dampened production in the Illinois basin coal region. Waterway flows reflect these changes. Docks handling PRB and central Appalachian coals showed strong growth in the 1990s, while those handling Illinois basin coals generally showed declines.

Photo 10: Down-bound 15 barge tow on the Cumberland River.

Figure 16
ORS Waterside Electric Power Plants



Changes in ORS traffic levels tend to reflect general economic cycles. The Ohio River mainstem has experienced relatively steady growth in traffic since the mid-1960s with some decline during the recession of the early 1980s, the 1991 recession and the 2002 recession.

d. Historic Traffic. Traffic on the Ohio River and its navigable tributaries decreased slightly to 279.1 million tons in 2002, after reaching an all time high of almost 280.0 million tons in 2001. Commercial navigation on the Ohio River and its tributaries accounted for over 40 percent of the domestic waterway freight tonnage in 2002. ORS traffic has access to the entire inland navigation system, the Great Lakes, and most U.S. coastal ports and overseas markets. Waterborne commerce on the ORS reflects the basin's energy and farm oriented economy. Two-thirds of Ohio River traffic consists of bulk forms of energy fuels: coal, crude oil, and petroleum products. Other major commodities transported include sand, gravel, chemicals, and grain. Historic ORS traffic by river, from 1993 to 2002, is presented in **Table 25**. System historic traffic, by commodity group, is presented in **Table 26**. ORS traffic, led by iron and steel, petroleum products, aggregates and grain grew at an average annual rate of 1.0 percent from 1993-2002.

Photo 11: Electric utility on the Monongahela River

Table 25
Historic Ohio River System Traffic by River (1993-2002)
(Million Tons)

Waterway	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Annual Rate 1993-2002
Ohio River	228.4	238.1	235.8	239.0	241.3	242.0	240.8	236.5	242.5	243.1	0.6%
Kanawha River	22.3	22.3	23.1	24.8	24.8	23.0	21.3	21.8	22.2	19.2	-1.5%
Monongahela River	33.4	36.9	34.4	36.6	37.2	36.7	37.7	36.7	38.1	38.2	1.4%
Allegheny River	3.1	3.2	3.4	3.3	3.9	3.8	4.0	3.8	3.0	2.8	-1.0%
Green/Barren Rivers	7.8	7.8	6.7	7.7	7.3	5.9	4.0	4.1	7.8	10.4	2.9%
Cumberland River	14.3	14.4	17.8	17.2	23.5	22.6	24.0	22.7	23.2	22.6	4.7%
Tennessee River	48.1	48.7	46.3	45.4	48.4	50.5	50.3	49.6	47.9	43.9	-0.9%
Barkley Canal	8.0	8.7	9.8	8.8	11.3	14.5	14.8	13.5	14.4	9.5	1.7%
Big Sandy River	23.5	22.2	20.8	17.7	18.2	19.7	20.9	23.2	24.2	25.1	0.7%
Little Kanawha River	0.3	0.2	0.1	0.3	0.1	0.2	0.2	0.2	0.3	0.3	0.0%
Kentucky River	0.3	0.3	0.3	0.2	0.3	0.3	0.2	0.0	0.1	0.0	NA
Clinch River	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA
Hiwassee River	0.8	0.8	0.8	0.8	0.7	0.8	0.5	0.1	0.4	0.4	-6.7%
Ohio River System [1/]	253.1	267.0	263.5	267.2	271.5	274.6	274.9	271.7	279.9	279.1	1.0%

Source WCSC Data

[1/] Ohio River System totals are adjusted to prevent double entry; they are not the sum of the above waterway totals.

Photo 12: Bridge construction at McAlpine Locks, mile 606.8, on the Ohio River

Table 26
Historic Ohio River System Traffic by Commodity (1993-2002)
(Million Tons)

Commodity	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Annual Rate 1993-2002
Coal & Coke	149.7	158.6	152.0	157.2	159.3	156.9	150.8	146.1	157.1	158.8	0.6%
Petroleum	13.5	14.2	13.7	13.3	12.9	20.3	20.7	20.4	20.5	20.2	4.1%
Aggregates	33.6	36.4	38.1	42.1	45.3	49.0	49.1	47.0	46.7	45.3	3.0%
Grains	14.2	12.2	12.2	11.0	11.1	14.1	15.4	15.7	18.2	17.1	1.9%
Chemicals	10.7	10.7	10.8	10.0	10.3	10.2	10.2	10.8	10.6	10.5	-0.2%
Ores & Minerals	6.0	6.6	6.8	7.6	6.8	6.0	6.7	6.9	6.9	6.4	0.6%
Iron & Steel	7.3	9.7	10.2	9.8	9.6	10.5	12.5	14.5	11.0	12.5	5.5%
Other	18.3	18.6	19.7	16.3	16.3	7.6	9.6	10.3	8.9	8.4	-7.5%
Total Traffic [1/]	253.1	267.0	263.5	267.2	271.5	274.6	274.9	271.7	279.9	279.1	1.0%

Source: WCSC Data
[1/] Totals may not equal the sum of the commodities due to rounding.

2. Waterway Improvements.

a. State of the ORS. A system of 60 locks and dams (see **Table 27**), over 2,800 miles of navigable channel, and navigation aids provided by the federal government comprise the Ohio River System's navigation infrastructure. Shippers and terminal operators manage the loading docks and terminals on the basin's rivers and waterway carriers operate towboats, barges, and maintenance facilities. Government expenditures go primarily to operate and maintain the locks and dams. Many of the locks no longer satisfy today's operating standards or tow sizes.

In general, this equates to locks which are too small, slow to fill and empty, costly to operate, and expensive to maintain. Older locks are also closed for maintenance more frequently than are modern locks, which impose delay costs on the shippers that utilize the waterway system.

Lock capacities correlate with lock sizes and many of the smaller locks have become congested due to increased traffic. This congestion produces delays, adds to industry's costs, and reduces transportation savings. Kanawha River congestion was relieved with the 1997 opening of a new larger Winfield Lock. Marmet L&D on the Kanawha River is now the busiest in the system. Due to its small size and incompatibility with modern tows, 15,677 lockage cuts were required to process Marmet's 2003 traffic level of 14.1 million tons, resulting in an average chambering time of 1.5 hours and an average delay per tow of 1.6 hours for an average total transit time of 3.2 hours per tow (see **Table 37**). By contrast, Smithland L&D on the lower Ohio River with its twin 1200' long chambers processed 72.3 million tons in 6,811 lockage cuts with an average delay of 0.3 hours and an average chambering time of only 0.8 hours.

Table 27
Lock and Dam Specifications

River/		Operational			Rehabilitated			Lock Size	
Project	**@Mile**	**Main**	**Aux.**	**Dam**	**Main**	**Aux.**	**Dam**	**Main**	**Aux**
Ohio River									
Emsworth	6.2	1921	1921	1922	1984	1984	1984	600x110	360x56
Dashields	13.3	1929	1929	1929	1990	1990	1990	600x110	360x56
Montgomery	31.7	1936	1936	1936	1989	1989	1989	600x110	360x56
N. Cumberland	54.4	1959	1959	1961				1200x110	600x110
Pike Island	84.2	1965	1965	1965				1200x110	600x110
Hannibal	126.4	1972	1972	1975				1200x110	600x110
Willow Island	162.4	1972	1972	1973				1200x110	600x110
Belleville	203.9	1968	1968	1969				1200x110	600x110
Racine	237.5	1967	1967	1970				1200x110	600x110
R.C. Byrd	279.2	1993	1993	1937			2000	1200x110	600x110
Greenup	341.0	1959	1959	1962				1200x110	600x110
Meldahl	436.2	1962	1962	1964				1200x110	600x110
Markland	531.5	1959	1959	1964				1200x110	600x110
McAlpine	606.8	1961	1961	1964		1965		1200x110	600x110
Cannelton	720.7	1971	1971	1971				1200x110	600x110
Newburgh	776.1	1975	1975	1975				1200x110	600x110
J.T. Myers	846.0	1975	1975	1975				1200x110	600x110
Smithland	918.5	1979	1979	1979				1200x110	1200x110
L&D No. 52	938.9	1969	1928	1929		1983	1984	1200x110	600x110
L&D No. 53	962.6	1980	1929	1929		1982	1984	1200x110	600x110
Kanawha River									
London	82.8	1933	1933	1934	2003			407x56	360x56
Marmet	67.8	1934	1934	1934				360x56	360x56
Winfield	31.1	1998	1935	1937				800x110	2(360x56)
Monongahela River									
Opekiska	115.4	1964		1967				600x84	
Hilderbrand	108.0	1959		1960				600x84	
Morgantown	102.0	1950		1950				600x84	
Point Marion	90.8	1993		1994				720x84	
Grays Landing	82.0	1993		1995				720x84	
Maxwell	61.2	1964	1964	1965				720x84	720x84
No. 4	41.5	1932	1932	1933	1964	1964	1967	720x84	360x56
No. 3	23.8	1906	1906	1907	1981	1981	1979	720x84	360x56
No. 2	11.2	1905	1905	1906	1953	1953		720x110	360x56

Table 27 (cont'd.)
Lock and Dam Specifications

River/		Operational			Rehabilitated			Lock Size	
Project	@Mile	Main	Aux.	Dam	Main	Aux.	Dam	Main	Aux
Allegheny River									
No. 9	62.2	1938		1938				360x56	
No. 8	52.6	1931		1931		1937		360x56	
No. 7	54.7	1930		1931				360x56	
No. 6	36.3	1928		1928				360x56	
No. 5	30.4	1927		1927				360x56	
No. 4	24.2	1934		1934				360x56	
No. 3	14.5	1934		1934				360x56	
No. 2	6.7	1934		1934				360x56	
Green River									
No. 2	63.1	1956		1957				600x84	
No. 1	6.7	1956		1957			1970	600x84	
Cumberland River									
Cordell Hull	313.5	1973		1974				400x84	
Old Hickory	216.2	1954		1957				400x84	
Cheatham	148.7	1952		1954				800x110	
Barkley	30.6	1964		1966				800x110	
Tennessee River									
Fort Loudoun	602.3	1943		1943				360x60	
Watts Bar	529.3	1941		1944				360x60	
Chickamauga	471.0	1939		1940				360x60	
Nickajack	424.7	1967		1968				600x110	
Guntersville	349.0	1965	1937	1939				600x110	360x60
Gen. Wheeler	274.9	1963	1934	1937		1962		600x110	400x60
Wilson [1/]	259.4		1927			1961			300x60
Wilson [1/]	259.4	1959	1927	1925		1967		600x110	292x60
Pickwick	206.7	1984	1937	1938				1000x110	600x110
Kentucky	22.4	1942		1944				600x110	
Clinch River									
Melton Hill	23.1	1963		1963				400x75	
Kentucky River									
No. 5-14 [2/]									
No. 4	65.0	1844		1844				145x38	
No. 3	42.0	1844		1844				145x38	
No. 2	31.0	1839		1839				145x38	
No. 1	4.0	1839		1839				145x38	

[1/] Two auxiliary locks in series to form a single, dual lift lock.

[2/] Federal Govt. no longer operates.

The Corps' waterway management program for the ORS is designed to ensure that the basin's waterways will be capable of meeting both current and future traffic demands in a safe, reliable, and efficient manner. The upkeep of ORS navigation structures involves maintenance, rehabilitation, and replacement. Maintenance includes periodic minor repair as well as emergency repairs and is funded through the operations and maintenance budget. Rehabilitation involves improving the reliability or operational efficiency of an existing structure and is funded under the construction budget. Replacement involves congressional approval and authorization for construction.

b. Modernization Status. Recently constructed new locks are operational at Winfield on the Kanawha and R.C. Byrd on the Ohio. On the upper Monongahela, Grays Landing replaced an outdated lock and dam structure (L&D 7) and Point Marion (formerly known as L&D 8) was fitted with a larger chamber. Current construction on the lower Monongahela will provide twin 720' x 84' chambers at L&D 4. Work is in progress on the Ohio constructing twin 1200' x 110' locks at Olmsted and a new 1200' x 110' lock to replace the existing 600' x 110' auxiliary chamber at McAlpine. Construction on the Tennessee has begun at Kentucky Lock. On the Kanawha, a new 800' x 110' lock at Marmet is under construction and a major rehabilitation at London that included extending the river chamber was completed in 2003. J.T. Myers and Greenup on the Ohio and Chickamauga Lock on the Tennessee are currently under advanced engineering and design. Refer to **Figure 2** on page 5.

Photo 13: Chickamauga Lock at mile 471.0 on the Tennessee River

c. Application of Innovations.

1. Winfield Lock & Dam (Kanawha River). Construction of the new 800' x 110' lock at Winfield, formerly the site of one of the most congested locks in the inland navigation system, began in 1990 and the new lock became operational in the fall of 1997. This project was a pioneer, using two innovative, cost effective features that are now under active consideration for other projects. These are hydraulic operators for the new tainter gate and long span prefabricated beams for the upper approach wall.

Photo 14: The new Winfield Lock at mile 31.1 on the Kanawha River

2. Olmsted Locks and Dam (Ohio River). The Olmsted project consists of twin 1200' locks and a new dam to replace Locks 52 and 53. Construction began in early 1993. The Olmsted project involves underwater foundation preparation, lift-in construction of the tainter gates and navigable pass shells for the dam, floating approach walls, directly connected hydraulic cylinder operation of the culvert valves, miter gates, tainter gates, and a central station to operate both the dam and the twin locks. The project is currently scheduled for a 2012 completion, depending upon funding.

Photo 15: Olmsted Locks at mile 964.6 on the Ohio River

The concrete shells for the Olmsted Dam will be fabricated in the pre-cast yard adjacent to the dam site. The pre-cast yard provides shell fabrication, eliminates cofferdam construction and maintains river navigation during construction. Dam construction sequence includes the following:

- Dredge foundation area
- Drive foundation piles underwater
- Transport pre-cast concrete shell to site
- Lower shell to foundation
- Fill shell with tremie concrete

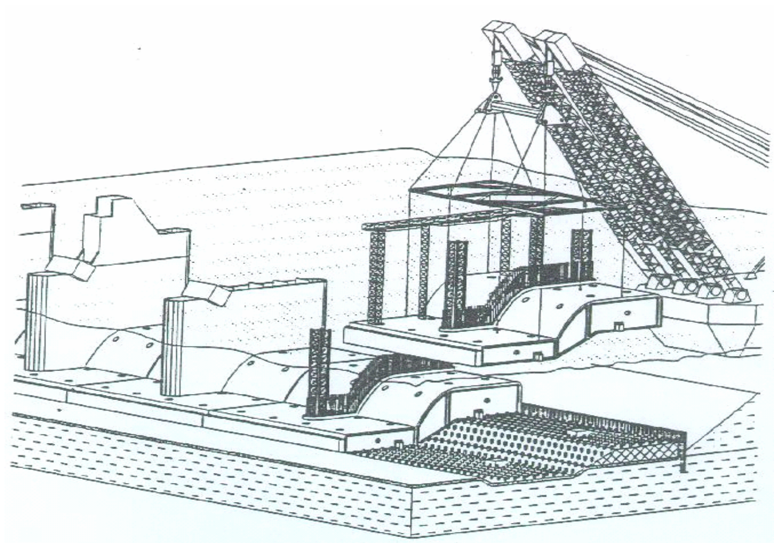


Photo 16: Artist rendering of the construction of Olmsted Dam

3. Monongahela River Locks and Dams 2, 3 and 4. This project was authorized in the Water Resources Development Act of 1992 (WRDA 92) and provides for a "two for three" lock replacement. The project consists of a new gated dam at L&D 2, removal of L&D 3, and two new 720' x 84' locks at L&D 4. The Corps completed a two-segment float in dam for L&D 2 at Braddock, PA. This dam involved underwater foundation preparation, float-in components, and tainter gates operated by hydraulic cylinders. The new locks at L&D 4 will be constructed in stages in order to maintain navigation. The project will include a new 34'-6" wide middle wall constructed in the existing river chamber. A system of temporary wall and floor struts will be used to stabilize the lock walls. The river and middle lock walls will consist of combined sections of welded sheet piles, pipe piles socketed into rock and filled with tremie concrete. The land foundation for the walls will be on drilled shafts. Filling will be controlled with vertical slide gates located in the sill. Options for lock discharge include crossover culverts to the river with emptying valves placed in the walls. Pittsburgh and Louisville Districts investigated working together on acquiring floating wall units for L&D 4. Construction began in 1995 and is currently scheduled for completion in 2013, depending upon funding. The modernized L&D 2 has been named Braddock L&D and the new L&D 4 has been named Charleroi L&D. The Braddock project won an Award of Merit under the American Society of Civil Engineers (ASCE) 2004 Outstanding Civil Engineering Achievement Awards Program (OCEA).

Photo 17: Float in concrete segment 1 of Braddock dam passing Pittsburgh

4. McAlpine Locks & Dam (Ohio River). This project will add a second 1200' lock in place of the existing 600' lock. Innovations associated with this project include roller compacted concrete walls, wrap around filling and emptying system with in-chamber culverts, a shortened guide wall and reduced cofferdam length. Construction began in 1996 and is scheduled for completion in 2008. During construction, the McAlpine project is reduced to a single chamber project because the new 1200' lock is being constructed in the foot-print of the auxiliary 600' chamber. There was a complete river closure to navigation from August 9-19, 2004 when the existing main chamber was closed for emergency repairs. Diver inspections earlier in the summer discovered cracks in the lock gates. The cracks were caused by metal fatigue and the repairs involved steel plating and welding. The Corps used twice as many workers as it normally does for such repairs. The additional labor and the advance notice by the Corps, coupled with arrangements between industry and its customers, helped to minimize the cost impact of the lock closure.

5. Kentucky Lock (Lower Cumberland and Tennessee Rivers). The project, as authorized for construction by WRDA 96, recommends construction of a new lock chamber at Kentucky L&D measuring 1200' by 110', to be located landward of the existing 600'lock. The new lock will use in-sill intakes with wall filling valves and culverts located in lock walls. A multi-port filling and emptying system will be used to fill and empty the lock chamber. The Corps will use floating approach wall in the upper approach (similar to Olmsted walls) and is considering the use of pre-cast cofferdam which will become a

permanent lock wall. This would help to reduce congestion and interference with traffic using the existing lock. The lower guide wall combines roller compacted concrete (RCC) with the foundation constructed "in-the-wet" (cast-in-place) to avoid costly cofferdam construction. The upper guide wall and guard wall will be floating concrete pontoon walls. Construction on the project began in July of 1998 and the scheduled completion date is 2011, depending upon funding.

Photo 18: Aerial view of Kentucky Lock, mile 22.4 on the Tennessee River

6. Marmet Locks and Dam (Kanawha River). Marmet Locks and Dam, built in 1934, are currently the busiest locks in the Ohio River System in terms of commercial lockage cuts. Small twin 360'x 56' chambers can process only one modern jumbo (195'-200' x 35') barge at a time. The Marmet project, as authorized for construction by WRDA 96, recommends construction of a new 800' x 110' lock landward of the existing locks. This project contains a number of innovative features which have greatly reduced expected construction costs. These features include long-span prefabricated beams for the upper approach wall; sill face intakes for the filling and emptying (F&E) system (which eliminates mass concrete upper approach walls), a central culvert F&E system (which permits smaller chamber monoliths), and a minimal cofferdam footprint. Construction began in 2002 and the project is approximately 40 percent fiscally complete. The new lock chamber is expected to be operational in 2008 with all construction completed by 2009.

Photo 19: Marmet Locks and Dam, mile 67.7 on the Kanawha River

7. London Locks and Dam (Kanawha River). London Locks and Dam have been in operation since September 1933. The landward lock chamber is 360' x 56'. The riverward lock chamber was extended 47 feet in 2003 and is now 407' x 56'. The upstream guard wall was also replaced in 2003. The new upstream guard wall is 525' long and consists of 5 precast, pre-stressed concrete beams, 105' long each, founded on concrete filled sheet pile cells. This new wall provides a major improvement in the downbound approach to the lock. A new dike was constructed downstream of the dam to control out-draft currents from the hydropower plant. The dike was constructed of rubble from the demolition of the old upstream guard wall. Lengthening the riverward lock chamber has reduced downbound movements of a full upper Kanawha River tow from 5 cuts to 3 cuts. Construction of the major rehabilitation project at London began in 1999 and concluded in 2003.

Photo 20: London Locks and Dam, mile 82.8 on the Kanawha River

8. Greenup Locks and Dam (Ohio River). The existing 600’ x 110’ auxiliary chamber will be extended to 1200’. The lock extension will be constructed utilizing float-in construction for the new miter gate bay to help minimize interference with traffic utilizing the main lock chamber. After completion of the new miter gate bay, connection of the new miter gate bay to the existing middle wall and construction of a short section of cofferdam on the land side, lock maintenance bulkheads can be installed on the downstream end of the new miter gate bay and the extension of the land wall and the laterals for the filling and emptying system can be constructed in the dry. Upon completion of the auxiliary lock extension, Greenup will have a set of spare miter gate leaves. Scheduled completion is 2012, depending upon funding.

9. J.T. Myers Locks and Dam (Ohio River). The existing 600’ x 110’ auxiliary chamber will be extended to 1200’. Cost savings were incorporated into the authorization (base line cost) based on results of the innovative lock design program and model tests at WES. Additional savings have been designed-in based on using an innovative F&E system and float in wall extension and miter gate monoliths. Floating approach wall extensions which were optimized and shortened with physical model tests utilized in conjunction with user industry input will be a part of the project. Estimated completion is approximately 2012, depending upon funding.

10. Chickamauga Lock and Dam (Tennessee River). The existing lock requires aggressive maintenance to confront its Alkali Aggregate Reaction (AAR) problem. This expansion of concrete features is causing misalignment of mechanical components and would eventually cause the lock to be closed. Congress has authorized construction of a 110' x 600' replacement lock riverward of the existing structure which will remove four of the existing spillway bays. Project construction began with utility relocations in 2004 and will continue with road and bridge relocations in 2005. The current schedule calls for cofferdam construction to begin in 2006 and lock construction in 2008, depending upon funding.

d. Ongoing ORS Studies. Studies are underway at problem areas in the ORS. The problems at these sites are generally related to traffic congestion and structure condition. Current modernization studies are listed as follows:

1. Ohio River Mainstem System Study (ORMSS). The primary study purpose is to develop the best plan for maintaining a reliable navigation system on the mainstem of the Ohio River. Specifically, the study will evaluate maintenance, rehabilitation, and new construction investment needs for 19 navigation locks and dams, and will identify the optimum plan for meeting those needs. As navigation traffic grows throughout the Ohio River Valley, several lock structures will experience increasing delays. These delays may be particularly severe during times of maintenance such as when one of the existing chambers at any one of the facilities must be closed for routine or emergency repairs or accidents. Other locks may become increasingly unreliable due to age and cycles of use. The ORMSS will produce a system investment plan (SIP).

Earlier in the study, two site specific lock facilities were identified where initiation of construction is warranted prior to 2020. Feasibility level documentation and full NEPA analysis were produced for these 'near-term' sites; J.T. Myers and Greenup Locks and Dam. These projects were authorized by the Water Resource Development Act (WRDA) 2000. Follow-on feasibility level of detail study reports with NEPA analysis will be required for all other projects indicated within the study planning horizon by the Ohio River Mainstem System Investment Plan (SIP).

The SIP will include a timetable and cost estimates for future anticipated navigation investments along the Ohio River Mainstem through the year 2070, including both large-scale investments and small-scale navigation improvements. The report document will include the culmination of the various plan formulation, economic, engineering, and environmental study analyses using such tools and techniques as structural reliability modeling, water transportation economic modeling, and environmental modeling. Environmental analysis will meet NEPA requirements and will include a Cultural Resources Programmatic Agreement and Programmatic Environmental Impact Statement (PEIS) having programmatic environmental considerations. The system-wide cumulative effects assessment (CEA) in the PEIS will initially assume implementation of a maximum navigation improvements plan to insure that all potential impacts are covered. Completion of this document is scheduled for September 2005.

Photo 21: Hannibal L&D, mile 126.4, on the Ohio River

2. Ohio River Ecosystem Restoration Program. The need for an Ohio River Ecosystem Restoration Program was identified by the Corps of Engineers, U.S. Fish and Wildlife Service, and state natural resources agencies during the course of the ORMSS which is evaluating long-term investment strategies for major navigation improvements along the entire Ohio River. An interagency, multi-disciplinary, environmental team was established to develop ecosystem restoration objectives and study alternatives for an environmental program separable from the ORMSS initiative. The team prepared a study report that recommended authorization of a cost-shared ecosystem restoration program for the Ohio River. The program was authorized in WRDA 2000. As of yet, however, the Corps has not received its initial appropriation and there is no funding in the FY 05 appropriation.

The Ohio River Ecosystem Restoration Program would enable the Corps and its non-Federal cost-sharing sponsors to restore and protect lost or degraded aquatic, wetland and terrestrial habitats along the Ohio River corridor. Projects to be implemented within this program include the restoration and protection of aquatic embayments, wetlands, islands, bottomland hardwood forests, and other ecosystem resources. These activities will be accomplished by implementing various site-specific ecosystem restoration projects formulated within the context of an overall strategic plan. After Federal funds are appropriated, the Corps will develop a partnership, composed of representatives from government resource agencies, universities, and other environmental concerns, for monitoring, evaluating and managing the Ohio River ecosystem.

In conjunction with the identification of long-term navigation needs, the Corps is identifying long-term ecosystem sustainability needs for the Ohio River. This is being accomplished through a collaborative process involving government agency personnel, academic researchers, and non-governmental interests. Products of this assessment can be used by a variety of users to plan research, management, restoration, and mitigation efforts.

3. Kanawha River Navigation Study. The Kanawha River Navigation Study was initiated with the Resolution of the Senate Committee on Environment and Public Works, 1 October 1979. To date, reports for each of the three navigation projects on the river have been completed. The two interim reports on Winfield and Marmet have resulted in improvement authorization. A major rehabilitation evaluation on London resulted in rehabilitation authorization. The London rehabilitation is completed. The modernization at Marmet will complete improvements to the Kanawha River projects. The last phase of the Kanawha River Navigation Study will be to analyze the river reaches for efficiency and environmental improvement.

e. Stakeholders - Industry Partners, Agencies and Others. The waterway industry plays an essential role in improving the reliability and capacity of the waterways. The industry contributes half the cost of the replacement of federally owned and operated navigation projects on fuel-taxed waterways. Since 1980, when fuel taxes were first imposed, waterway users have been contributing to the Inland Waterways Trust Fund. This tax began at $.04 per gallon in October 1980 and gradually increased to its current level of $.20 per gallon in 1995. The fund is used to provide the industry's share of the cost of lock and dam modernization.

The waterway industry has been a valuable participant in modernization planning as it helps the Corps establish priorities, choose among plan alternatives, and establish navigability of improvement plans. This function was formalized when Congress established the Inland Waterway Users Board in 1986. The primary purpose of this 11-member board of waterway users and shippers is to represent the various segments of the waterway and to recommend the prioritization of projects to the Assistant Secretary of the Army and Congress.

The Board advocates rehabilitating and extending the life of the existing system to preserve its efficiency as a long-term policy objective. They also recommend a program for constructing needed new facilities under a cost-reduction program that is being implemented with the Corps' Regional Navigation Design Team (see page 5, Part 1, Overview).

Photo 22: A waterside industrial chemical plant on the Kanawha River

The cost-reduction initiatives focus on incorporating innovative and non-traditional design and construction techniques into program formulation in order to reduce project costs. Further partnering and communication between the Corps and industry with respect to design and construction technology is critical to the success of these initiatives.

The merger of the Association for the Development of Inland Navigation in America's Ohio Valley (DINAMO) and Waterways Work! has produced a very effective Waterways Council, Inc. that promotes the investment in navigation improvements. Two other important associations in the ORB working toward a better navigation system are the Waterways Association of Pittsburgh and the Huntington District Waterways Association. The latter is comprised of three important committees: the Huntington District Waterways Advisory Committee, the Kanawha River Advisory Committee, and the Big Sandy Improvement Committee. Other important groups in the ORB working towards a better navigation system are the Tennessee River Valley Association and its partner the Tennessee-Cumberland Waterways Council, the Ohio River Ice Committee and the Waterway Industry Executive Task Group.

3. Regional Commerce.

a. Waterway Impact on Regional Economy. The inland waterway system facilitates economic development through:

- Lowering transportation costs for bulk commodities
- Improving contact between internal and external markets
- Reducing energy costs for commercial and industrial activities
- Linking producers and markets raw material inputs to production
- Supplying of recreational and industrial water
- Deriving commercial and support activities
- Creating and providing jobs

In 2002, companies using the ORS shipped $34.6 billion worth of commodities by barge, saving over $2.1 billion in transportation costs. These savings result in additional national output estimated at over $11.0 billion, which made possible approximately 100,000 jobs and $3 billion in income.

Major port cities like Pittsburgh, Cincinnati, Louisville, and Huntington have developed as distribution centers for goods produced in the basin. Waterside developments involving electric power plants, steel, chemical and cement plants, quarries, and coal mines all play a significant role in local economies, as well as in the nation's economy.

While coal and coke products are the most important commodities hauled on the basin's rivers, measured in terms of their impact on the region's economy, recent growth in ORS waterborne commerce has been driven largely by increased ores, iron and steel, and aggregates traffic. As noted in **Table 26**, total ORS traffic has increased 10.3 percent since 1993 with a modest increase in coal traffic of 6.1 percent. During this same period, iron and steel traffic almost doubled from 7.3 million tons to 12.5 million tons and petroleum products increased by 49.6 percent. Aggregates traffic increased by more than 34 percent and conversely, chemical traffic decreased by almost 2 percent during this same decade. Normally empty coal backhaul movements are returning with inbound shipments of ores, scrap metals, and imported steel. Mini-mills along the ORS have contributed to the increased iron and steel traffic. A rise in aggregate traffic, which is largely local, correlates to the increased use of desulphurization equipment at electric power plants in the basin.

b. Ohio River Basin Economy. The majority of the waterborne commerce moved in the basin is loaded and unloaded in one of the eight states in the basin with navigable waterways, as previously discussed.

Of the 279.1 million tons of commerce moved in the basin in 2002, 84 percent was shipped from ORB states and 16 percent was shipped from states outside the basin (see **Table 28**). There were 234.2 million tons of ORB shipments and 234.5 million tons of receipts.

Photo 23: The port city of Pittsburgh at the confluence of the Allegheny and Monongahela rivers that form the Ohio River

A Bureau of Economic Analysis (BEA) economic area consists of a standard metropolitan statistical area (SMSA), which serves as a center of economic activity for its surrounding counties. **Figure 17** shows the 50 BEA economic areas that either shipped or received ORB commerce in 2002. Only 24 percent of the BEA economic areas are within the ORB indicating commerce extends well beyond basin boundaries. **Tables 29 & 30** show the distribution by commodity group of 2002 ORB commerce to BEA economic areas.

Three BEA economic areas accounted for over 57 percent of all ORB shipments. The largest-shipping BEA economic areas were Charleston, Paducah, and Pittsburgh with 64.6, 42.4, and 51.5 million tons, respectively. Coal comprised over 81 percent of this tonnage with 10 percent aggregates, and 6 percent petroleum products.

Table 28
2002 Basin-Wide Waterborne Commerce
(Million Tons)

Commodity	Shipments ORB	Shipments Outside	Shipments Total
Coal & Coke	153.5	5.3	158.8
Petroleum Fuels	11.1	9.1	20.2
Aggregates	44.8	0.4	45.2
Grains	13.6	3.5	17.1
Chemicals	2.3	8.1	10.4
Ores & Minerals	0.2	6.3	6.5
Iron & Steel	3.6	8.9	12.5
Other	5.1	3.2	8.3
Total	234.2	44.8	279.1

Commodity	Receipts ORB	Receipts Outside	Receipts Total
Coal & Coke	145.6	13.2	158.8
Petroleum Fuels	19.3	0.9	20.2
Aggregates	32.8	12.4	45.2
Grains	4.2	12.9	17.1
Chemicals	9.2	1.2	10.4
Ores & Minerals	6.3	0.1	6.4
Iron & Steel	10.2	2.3	12.5
Other	6.9	1.5	8.4
Total	234.5	44.5	279.1

Source: WCSC Data

The major receiving BEA economic areas of ORB traffic are Pittsburgh, Cincinnati, Charleston, Evansville, New Orleans, Nashville and Louisville with tonnage ranging from 59.2 to 20.8 million tons, respectively. Almost 60 percent of this tonnage consisted of coal. These seven BEA economic areas accounted for over 71 percent of ORB commerce received. Coal and grains destined for export comprised 85 percent of the ORB traffic received in New Orleans, LA.

Due to the presence of available flatlands with access to the river in the ORB and the economic advantage of water transportation for bulk commodities, it is anticipated that riverside industrial expansion and the related growth in navigation traffic will continue into the future.

Figure 17
BEA Economic Areas Shipping or Receiving ORB Commerce

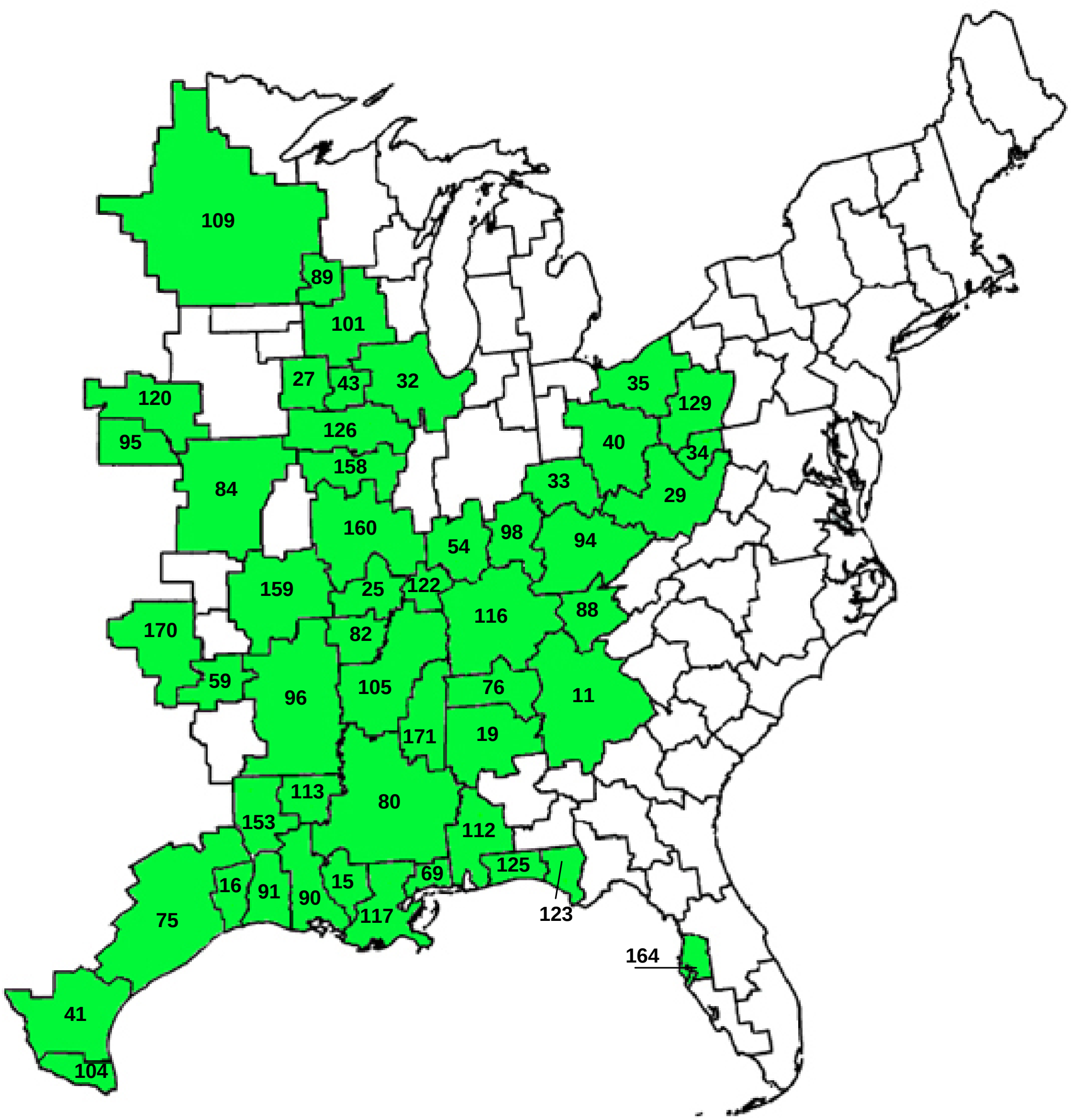


Table 29
2002 Shipments by Bureau of Economic Analysis Area – Rivers [1/]
(Kilotons)

BEA	Coal & Coke	Petrol	Aggs	Grains	Chem	Ores & Minerals	Iron & Steel	All Other	Total
11 Atlanta-Sandy Springs-Gainesville GA-AL	0	10	1,085	0	58	0	192	236	1,581
15 Baton Rouge-Pierre Part LA	196	1,441	61	8	1,596	1,417	842	238	5,799
16 Beaumont-Port Arthur TX	2	300	0	0	296	0	86	3	687
19 Birmingham-Hoover-Cullman AL	0	0	0	0	0	0	38	321	359
25 Cape Girardeau-Jackson MO-IL	218	15	19	4,321	191	2	1	546	5,313
27 Cedar Rapids IA	0	0	0	123	0	0	0	0	123
29 Charleston WV	54,127	9,155	686	0	440	33	82	94	64,617
32 Chicago-Naperville-Michigan City IL-IN-WI	811	474	9	660	143	0	227	89	2,413
33 Cincinnati-Middletown-Wilmington OH-KY-IN	477	24	3,208	2,377	8	0	332	1,520	7,946
34 Clarksburg WV + Morgantown WV	2,423	0	807	0	0	0	0	0	3,230
35 Cleveland-Akron-Elyria OH	0	353	0	13	4	0	30	0	400
40 Columbus-Marion-Chillicothe OH	4,292	0	964	0	160	45	2	7	5,470
41 Corpus Christi-Kingsville TX	0	31	0	0	457	2	0	0	490
43 Davenport-Moline-Rock Island IA-IL	0	0	0	272	19	1	2	1	295
54 Evansville IN-KY	17,043	442	2,549	4,590	182	0	210	155	25,171
59 Fort Smith AR-OK	0	0	0	3	2	0	0	0	5
69 Gulfport-Biloxi-Pascagoula MS	0	5	5	2	71	38	3	9	133
75 Houston-Baytown-Huntsville TX	32	416	8	9	1,831	532	42	9	2,879
76 Huntsville-Decatur AL	235	93	355	468	348	3	166	120	1,788
80 Jackson-Yazoo City MS	0	85	2	5	132	0	9	44	277
82 Jonesboro AR	2	0	0	2	106	0	229	58	397
84 Kansas City-Overland Park-Kansas City MO-KS	0	0	0	1	0	0	0	0	1
88 Knoxville-Sevierville-La Follette TN	0	0	2	147	157	10	82	40	438
89 La Crosse WI-MN	0	0	0	16	0	0	0	0	16
90 Lafayette-Acadiana LA	0	234	2	0	0	2,153	0	12	2,401
91 Lake Charles-Jennings LA	82	270	0	3	392	0	0	0	747
96 Little Rock-North Little Rock-Pine Bluff AR	0	0	4	10	0	0	23	0	37
98 Louisville-Elizabethtown-Scottsburg KY-IN	134	182	12,503	698	250	0	908	1,385	16,060
101 Madison-Baraboo WI	0	0	0	338	50	0	0	0	388
104 McAllen-Edinburg-Pharr TX	0	0	0	0	0	1	12	0	13
105 Memphis TN-MS-AR	0	1,376	1,016	4	19	10	3	35	2,463
109 Minneapolis-St. Paul-St. Cloud MN-WI	7	77	0	648	93	0	55	0	880
112 Mobile-Daphne-Fairhope AL	0	0	162	0	10	3	47	219	441
116 Nashville-Davidson--Murfreesboro--Columbia TN	0	4	1,730	402	5	2	202	43	2,388
117 New Orleans-Metairie-Bogalusa LA	584	3,610	20	100	2,399	2,066	7,128	988	16,895
120 Omaha-Council Bluffs-Fremont NE-IA	0	0	0	30	0	0	0	0	30
122 Paducah KY-IL	27,344	44	13,184	616	215	38	60	905	42,406
126 Peoria-Canton IL	0	0	28	643	188	0	44	4	907
129 Pittsburgh-New Castle PA	46,175	776	2,495	5	311	18	1,344	404	51,528
158 Springfield IL	0	0	2	171	23	0	0	0	196
159 Springfield MO	1	0	0	0	0	0	0	0	1
160 St. Louis-St. Charles-Farmington MO-IL	4,572	742	3,857	206	138	54	53	715	10,337
170 Tulsa-Bartlesville OK	31	11	18	186	175	0	1	0	422
171 Tupelo MS	0	0	495	3	0	0	6	203	707
Total	158,788	20,170	45,276	17,080	10,469	6,428	12,461	8,403	279,075

Source: WCSC Data. Totals may not equal the sum of the commodities due to rounding.

[1/] A Bureau of Economic Analysis (BEA) area consists of a standard metropolitan statistical area (SMSA) serving as a center of economic activity and its surrounding counties. U.S BEAs are the 2004 definitions provided by U.S. Department of Commerce, Bureau of Economic Analysis available at http://www.bea.gov/bea/ARTICLES/2004/11November/1104Econ-Areas.pdf. Canadian BEAs are defined by the USACE, LRD Navigation Planning Center for convenience of analysis only.

Table 30
2002 Receipts by Bureau of Economic Analysis Area – Rivers [1/]
(Kilotons)

BEA	Coal & Coke	Petrol	Aggs	Grains	Chem	Ores & Minerals	Iron & Steel	All Other	Total
11 Atlanta-Sandy Springs-Gainesville GA-AL	2	351	1,464	203	110	404	140	76	2,750
15 Baton Rouge-Pierre Part LA	40	65	1,589	1,471	40	17	21	105	3,348
16 Beaumont-Port Arthur TX	0	8	266	2	1	3	10	50	340
19 Birmingham-Hoover-Cullman AL	1	0	3	0	11	0	35	0	50
25 Cape Girardeau-Jackson MO-IL	65	2	137	335	39	0	2	8	588
27 Cedar Rapids IA	585	0	1	0	0	0	0	0	586
29 Charleston WV	7,100	2,631	4,176	0	1,235	974	1,117	592	17,825
32 Chicago-Naperville-Michigan City IL-IN-WI	150	82	169	8	163	8	181	305	1,066
33 Cincinnati-Middletown-Wilmington OH-KY-IN	29,794	3,242	2,745	17	1,597	532	1,601	1,012	40,540
34 Clarksburg WV + Morgantown WV	3,052	63	41	0	0	0	82	0	3,238
35 Cleveland-Akron-Elyria OH	397	34	48	0	154	89	58	46	826
40 Columbus-Marion-Chillicothe OH	15,331	383	351	0	675	69	55	448	17,312
41 Corpus Christi-Kingsville TX	5	0	3	11	0	0	0	0	19
43 Davenport-Moline-Rock Island IA-IL	205	0	9	2	5	35	5	10	271
54 Evansville IN-KY	16,469	4,463	6,365	241	1,344	1,586	227	735	31,430
57 Fayetteville-Springdale-Rogers AR-MO	0	0	99	0	0	0	0	0	99
59 Fort Smith AR-OK	0	0	0	6	0	1	15	0	22
69 Gulfport-Biloxi-Pascagoula MS	184	40	637	2	90	10	0	0	963
75 Houston-Baytown-Huntsville TX	0	118	154	5	366	2	246	36	927
76 Huntsville-Decatur AL	4,303	491	1,045	2,856	1,143	79	606	349	10,872
79 Jacksonville FL	0	0	6	0	0	0	0	0	6
80 Jackson-Yazoo City MS	885	0	965	18	11	0	0	6	1,885
82 Jonesboro AR	7	0	310	0	28	9	868	8	1,230
84 Kansas City-Overland Park-Kansas City MO-KS	0	0	1	0	4	0	0	0	5
88 Knoxville-Sevierville-La Follette TN	2	251	102	436	43	114	26	10	984
89 La Crosse WI-MN	15	0	0	11	1	0	0	0	27
90 Lafayette-Acadiana LA	0	5	668	0	3	0	0	0	676
91 Lake Charles-Jennings LA	7	63	901	5	7	0	0	76	1,059
96 Little Rock-North Little Rock-Pine Bluff AR	0	2	181	6	15	0	67	24	295
98 Louisville-Elizabethtown-Scottsburg KY-IN	10,007	3,064	4,598	62	607	192	1,640	638	20,808
101 Madison-Baraboo WI	150	0	0	2	6	0	0	0	158
104 McAllen-Edinburg-Pharr TX	0	29	0	0	0	0	132	0	161
105 Memphis TN-MS-AR	147	77	3,250	33	115	141	41	190	3,994
109 Minneapolis-St. Paul-St. Cloud MN-WI	495	3	1	13	16	0	8	9	545
112 Mobile-Daphne-Fairhope AL	373	3	1,047	0	32	0	116	22	1,593
113 Monroe-Bastrop LA	3	0	202	0	3	0	0	0	208
114 Montgomery-Alexander City AL	0	0	7	0	0	0	0	0	7
116 Nashville-Davidson--Murfreesboro--Columbia TN	14,366	742	4,417	6	390	301	415	955	21,592
117 New Orleans-Metairie-Bogalusa LA	6,747	340	1,986	11,264	56	17	110	586	21,106
122 Paducah KY-IL	1,160	1,303	2,121	0	841	335	85	126	5,971
123 Panama City-Lynn Haven FL	71	0	6	0	0	0	1	0	78
125 Pensacola-Ferry Pass-Brent FL	1,101	0	272	0	70	0	0	0	1,443
126 Peoria-Canton IL	393	0	8	0	10	0	104	6	521
129 Pittsburgh-New Castle PA	43,618	2,260	4,726	39	1,068	1,489	4,104	1,883	59,187
153 Shreveport-Bossier City-Minden LA	11	0	137	0	0	0	0	0	148
158 Springfield IL	43	37	16	0	14	0	0	0	110
160 St. Louis-St. Charles-Farmington MO-IL	1,476	7	3	3	150	18	146	42	1,845
164 Tampa-St. Petersburg-Clearwater FL	0	0	7	0	0	0	0	0	7
170 Tulsa-Bartlesville OK	41	1	0	21	6	0	141	13	223
171 Tupelo MS	0	15	45	5	0	0	65	1	131
Total	158,801	20,175	45,285	17,083	10,469	6,425	12,470	8,367	279,075

Source: WCSC Data. Totals may not equal the sum of the commodities due to rounding.

[1/]A Bureau of Economic Analysis (BEA) area consists of a standard metropolitan statistical area (SMSA) serving as a center of economic activity and its surrounding counties. U.S BEAs are the 2004 definitions provided by U.S. Department of Commerce, Bureau of Economic Analysis available at http://www.bea.gov/bea/ARTICLES/2004/11November/1104Econ-Areas.pdf. Canadian BEAs are defined by the USACE, LRD Navigation Planning Center for convenience of analysis only.

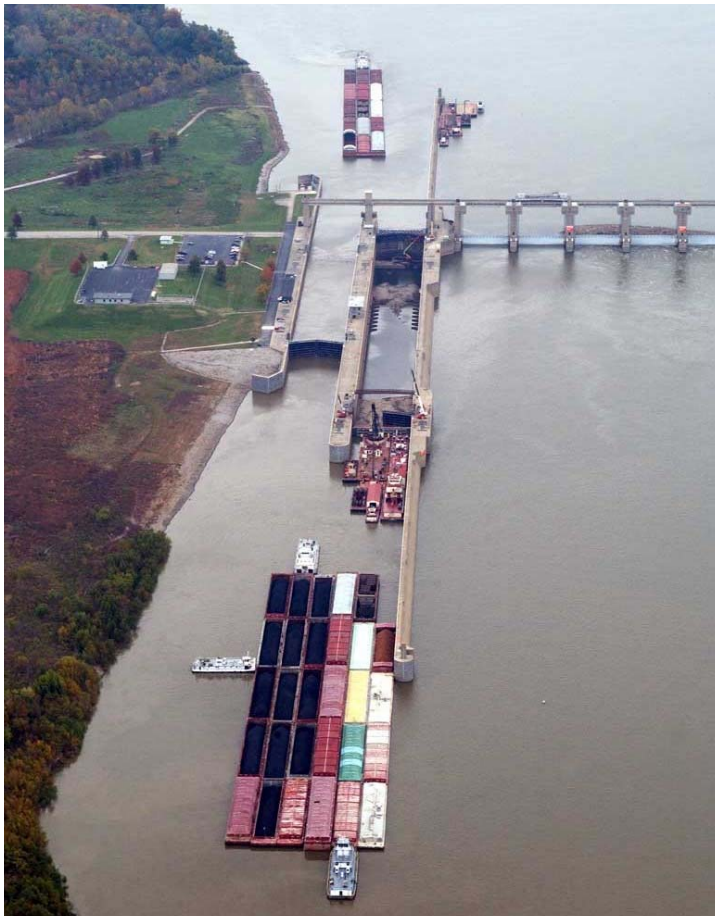


Photo 24: Tows queued at J.T. Myers L&D, mile 846.0 on the Ohio River, during a closure

4. <u>Project Statistics</u>.

a. <u>Project Traffic</u>. The pattern of commodity tonnage distribution is similar at all locks for any given river (see **Tables 31 - 32**). Coal is the largest tonnage moved at every lock on all rivers with the exception of the Allegheny River. In 2003, the largest tonnage commodity moved on the Allegheny River was aggregate. **Tables 33 - 34** show commodity tonnage by direction at each project for 2002 and 2003. Total project traffic, for the past 10 years, is listed in **Table 35**.

b. <u>Project Performance</u>. Most Ohio River locks averaged ten or more barges per tow. On the tributaries where the locks are smaller, the average tow size is also smaller, generally between two and six barges except for a few projects on the Cumberland and Tennessee rivers.

Tons per tow also relate to the ratio of unloaded to loaded barges. A majority of the Ohio Basin projects locked empty barges between 30 and 40 percent of the time, indicating that barges generally are dedicated to a particular movement and move full in only one direction. Sixty-eight percent of all barges locked at Barkley were empty in 2003, giving it the highest percentage of empty barge traffic in ORS. Loaded tows use the Kentucky Lock on the Tennessee River because of the high risk associated with the numerous tight bends on the lower Cumberland River.

Table 31
2002 Ohio River System Lock Traffic by Commodity
(Kilotons)

River/Project	Coal	Petrol	Aggs	Grain	Chem	Ores & Minerals	Iron & Steel	Other	Total
Ohio River									
Emsworth	18,938	757	1,578	27	792	439	696	460	23,687
Dashields	18,926	1,073	1,923	45	827	512	761	449	24,516
Montgomery	20,449	1,310	1,385	37	1,123	630	1,085	690	26,709
New Cumberland	25,158	2,207	1,195	81	1,835	926	2,119	1,730	35,251
Pike Island	30,197	2,532	1,244	142	1,790	1,076	4,428	2,225	43,634
Hannibal	36,200	2,495	1,569	146	1,880	1,683	4,464	2,762	51,200
Willow Island	32,996	2,542	1,628	156	1,731	1,679	4,464	3,226	48,422
Belleville	33,550	2,919	2,301	135	2,357	1,845	4,641	3,371	51,118
Racine	33,592	2,971	2,599	141	2,389	2,079	4,664	3,329	51,764
Robert C. Byrd	33,033	4,009	3,945	168	3,075	2,140	4,784	3,744	54,898
Greenup	39,279	7,114	4,145	238	3,825	2,278	5,703	3,331	65,915
Meldahl	31,080	7,201	3,933	249	3,817	2,383	5,781	3,328	57,771
Markland	19,364	4,880	3,531	2,265	5,229	3,098	6,926	4,332	49,625
McAlpine	18,840	5,133	3,306	3,035	5,793	3,448	8,015	4,323	51,893
Cannelton	22,027	3,857	5,047	3,051	6,028	3,997	7,900	3,932	55,841
Newburgh	27,198	4,420	4,530	4,021	6,435	5,066	8,060	4,470	64,199
J.T. Myers	30,065	5,447	1,325	6,362	7,238	5,402	8,506	4,615	68,960
Smithland	35,995	5,469	4,715	6,905	7,266	5,391	8,559	4,741	79,041
L/D 52	28,552	7,387	14,139	11,494	9,237	5,990	10,032	6,551	93,382
Kanawha River									
London	4,377	0	21	0	0	2	7	59	4,466
Marmet	12,595	310	315	0	155	48	4	50	13,477
Winfield	13,250	995	2,299	0	701	121	64	137	17,567
Monongahela River									
Opekiska	431	0	0	0	0	3	8	0	442
Hildebrand	420	0	3	0	0	3	17	0	442
Morgantown	444	0	468	0	0	3	9	0	924
Point Marion	4,621	62	880	0	5	6	17	3	5,594
Grays Landing	4,753	62	878	0	5	8	12	3	5,720
Maxwell	11,627	65	924	0	18	109	10	118	12,869
L/D 4	18,958	420	1,037	24	393	228	487	188	21,734
L/D 3	13,273	322	1,023	6	185	80	405	151	15,446
L/D 2	11,345	124	1,005	2	23	106	118	185	12,905
Allegheny River									
L/D 8	0	0	325	0	0	0	0	4	328
L/D 7	3	0	37	0	7	2	3	4	56
L/D 6	6	2	39	0	7	2	6	4	65
L/D 5	21	2	727	1	12	14	6	6	787
L/D 4	31	123	745	10	65	18	29	17	1,038
L/D 3	1,011	160	161	9	152	58	94	26	1,671
L/D 2	1,022	165	170	11	149	64	131	36	1,746
Green River									
L/D 2	5,943	0	21	77	0	0	13	29	6,083
L/D 1	8,896	0	109	75	0	306	15	114	9,514
Cumberland River									
Old Hickory	3,767	17	223	0	165	0	2	8	4,181
Cheatham	3,852	698	3,035	20	252	124	657	797	9,436
Barkley	1,484	387	3,589	280	168	88	328	577	6,901
Tennessee River									
Ft. Loudoun	2	265	72	7	6	141	53	12	558
Watts Bar	1	353	121	575	75	214	91	68	1,498
Chickamauga	1	355	125	563	147	544	88	78	1,902
Nickajack	74	600	961	861	283	318	401	444	3,941
Guntersville	2,073	673	1,253	2,579	373	499	674	965	9,089
Wheeler	2,217	736	1,457	3,881	1,745	586	1,219	1,279	13,120
Wilson	2,188	770	1,386	3,872	1,889	525	1,222	1,420	13,272
Pickwick	6,194	816	2,356	4,128	1,177	611	1,267	1,754	18,303
Kentucky	10,722	1,157	7,532	4,401	1,316	942	1,734	1,774	29,579

Source: COE LPMS data

Totals may not equal the sum of the commodities due to rounding.

Table 32
2003 Ohio River System Lock Traffic by Commodity
(Kilotons)

River/Project	Coal	Petrol	Aggs	Grain	Chem	Ores & Minerals	Iron & Steel	Other	Total
Ohio River									
Emsworth	14,507	635	1,623	51	760	640	648	346	19,211
Dashields	14,492	810	1,983	53	858	733	716	367	20,012
Montgomery	15,067	1,007	1,413	62	1,039	952	1,061	492	21,093
New Cumberland	22,809	2,044	866	134	1,860	1,318	1,787	1,371	32,189
Pike Island	26,540	2,262	873	137	1,862	1,400	4,353	1,634	39,062
Hannibal	34,830	2,280	1,299	149	2,095	1,904	4,504	1,823	48,884
Willow Island	32,156	2,362	1,466	158	1,890	1,961	4,479	2,120	46,592
Belleville	33,000	2,648	1,981	170	2,423	2,157	4,726	2,376	49,482
Racine	33,251	2,655	2,432	173	2,443	2,509	4,724	2,439	50,625
Robert C. Byrd	32,205	3,828	3,708	227	3,084	2,498	4,802	2,811	53,164
Greenup	35,254	6,633	3,803	272	3,783	2,777	6,945	2,668	62,135
Meldahl	26,722	6,585	3,449	297	3,867	2,948	6,923	2,430	53,222
Markland	14,829	4,895	3,113	1,948	5,498	4,028	7,968	2,968	45,248
McAlpine	16,015	5,207	2,809	2,567	6,088	4,362	9,139	3,296	49,482
Cannelton	18,552	4,359	5,154	2,568	6,514	4,868	9,173	2,814	54,002
Newburgh	23,905	4,586	4,650	3,463	6,903	6,029	9,429	3,511	62,476
J.T. Myers	23,660	5,076	995	5,640	7,686	6,302	9,731	3,566	62,656
Smithland	28,811	5,050	4,903	6,075	7,773	6,309	9,768	3,616	72,305
L/D 52	23,080	6,805	13,551	10,010	9,853	7,328	11,858	4,934	87,420
Kanawha River									
London	2,826	0	12	0	0	0	0	34	2,872
Marmet	13,127	297	371	3	174	80	0	55	14,107
Winfield	13,459	937	2,637	3	683	116	32	211	18,076
Monongahela River									
Opekiska	32	0	0	0	0	5	9	12	57
Hildebrand	32	0	0	0	0	5	9	2	47
Morgantown	42	0	433	0	0	5	9	3	491
Point Marion	3,516	59	905	0	0	5	11	13	4,508
Grays Landing	3,569	59	898	0	0	9	15	13	4,563
Maxwell	10,999	60	992	0	0	178	8	191	12,427
L/D 4	8,170	116	1,062	3	12	109	59	318	9,849
L/D 3	9,661	235	1,011	3	163	80	332	216	11,699
L/D 2	14,237	331	1,051	36	414	324	442	145	16,979
Allegheny River									
L/D 8	0	0	792	0	0	2	0	3	797
L/D 7	8	0	197	0	2	12	9	13	240
L/D 6	11	0	195	0	2	13	9	14	243
L/D 5	24	0	828	0	6	33	2	18	910
L/D 4	31	99	861	12	50	53	24	40	1,170
L/D 3	1,459	141	356	15	123	104	116	59	2,373
L/D 2	1,457	144	346	15	124	120	156	59	2,422
Green River									
L/D 2	3,667	0	2	91	0	0	0	21	3,781
L/D 1	6,231	0	59	83	0	341	0	132	6,845
Cumberland River									
Old Hickory	4,094	9	258	0	170	0	2	4	4,536
Cheatham	4,316	518	3,047	24	350	139	629	761	9,783
Barkley	343	299	1,065	77	73	11	103	322	2,294
Tennessee River									
Ft. Loudoun	4	271	58	0	14	143	32	8	530
Watts Bar	8	325	90	531	79	252	89	42	1,417
Chickamauga	8	335	106	532	140	571	97	56	1,845
Nickajack	101	572	445	751	303	524	537	464	3,696
Guntersville	1,263	588	671	2,288	440	854	752	755	7,610
Wheeler	1,333	674	925	3,609	2,293	881	2,132	1,028	12,874
Wilson	1,331	693	902	3,633	2,371	808	2,110	1,122	12,971
Pickwick	4,974	826	1,659	3,853	1,224	855	2,101	1,424	16,916
Kentucky	11,072	1,123	8,370	4,394	1,687	1,207	2,652	1,899	32,403

Source: COE LPMS data

Totals may not equal the sum of the commodities due to rounding.

Table 33
2002 Ohio River System Lock Commodity Traffic by Direction
(Kilotons)

River/Project	Direction	Coal	Petrol	Aggs	Grains	Chem	Ores & Minerals	Iron & Steel	Other	Total
Ohio River										
Emsworth	Up	8,190	629	1,012	27	601	420	381	312	11,571
	Down	10,748	128	567	0	191	20	315	148	12,116
Dashields	Up	8,040	904	1,738	44	642	458	405	322	12,552
	Down	10,886	170	184	2	185	54	356	127	11,964
Montgomery	Up	8,673	1,106	1,304	36	888	570	694	513	13,786
	Down	11,775	203	78	2	236	61	391	176	12,923
New Cumberland	Up	16,656	1,580	1,135	70	1,533	864	1,424	1,384	24,647
	Down	8,502	627	60	11	302	62	695	346	10,604
Pike Island	Up	20,514	1,781	1,166	106	1,567	1,035	3,279	1,797	31,245
	Down	9,683	751	79	36	223	41	1,149	427	12,389
Hannibal	Up	17,718	1,826	1,320	110	1,522	1,622	3,223	2,080	29,421
	Down	18,482	670	249	36	357	60	1,241	683	21,779
Willow Island	Up	17,643	1,806	1,461	113	1,365	1,611	3,233	2,467	29,699
	Down	15,353	736	167	43	366	68	1,231	758	18,723
Belleville	Up	18,213	2,318	2,155	112	2,016	1,749	3,390	2,620	32,573
	Down	15,337	601	146	22	341	96	1,250	750	18,545
Racine	Up	18,315	2,356	1,869	118	2,034	1,973	3,430	2,639	32,735
	Down	15,277	615	729	22	355	105	1,234	690	19,028
R.C. Byrd	Up	18,049	3,411	3,795	146	2,677	2,029	3,523	3,016	36,646
	Down	14,984	598	149	22	398	110	1,261	728	18,252
Greenup	Up	4,762	1,390	4,009	189	3,193	2,124	4,334	2,682	22,683
	Down	34,517	5,725	136	50	631	154	1,369	650	43,232
Meldahl	Up	3,403	1,521	3,679	197	3,234	2,184	4,428	2,402	21,050
	Down	27,677	5,680	254	51	583	198	1,353	926	36,721
Markland	Up	3,581	1,757	3,324	230	4,693	2,918	5,520	3,072	25,093
	Down	15,783	3,123	207	2,036	536	180	1,406	1,260	24,531
McAlpine	Up	8,606	1,921	2,664	326	5,045	3,297	6,364	3,172	31,396
	Down	10,234	3,212	642	2,709	749	150	1,651	1,150	20,497
Cannelton	Up	12,073	2,423	850	300	5,281	3,357	6,314	2,705	33,302
	Down	9,954	1,434	4,198	2,752	748	640	1,586	1,227	22,539
Newburgh	Up	19,262	3,003	883	574	5,711	4,383	6,469	3,069	43,354
	Down	7,936	1,417	3,648	3,447	724	683	1,591	1,401	20,846
J.T. Myers	Up	19,391	4,349	836	418	6,471	4,755	6,746	3,174	46,140
	Down	10,674	1,098	490	5,944	767	647	1,760	1,441	22,820
Smithland	Up	18,613	4,397	656	473	6,500	4,783	6,786	3,190	45,398
	Down	17,382	1,073	4,059	6,432	765	608	1,773	1,551	33,643
L/D 52	Up	19,989	6,642	1,640	3,697	8,042	5,547	7,995	4,001	57,553
	Down	8,563	745	12,499	7,797	1,195	443	2,037	2,551	35,829
Kanawha River										
London	Up	16	0	14	0	0	0	2	31	64
	Down	4,360	0	7	0	0	2	5	28	4,402
Marmet	Up	39	303	298	0	155	47	2	36	880
	Down	12,556	8	16	0	0	2	2	15	12,598
Winfield	Up	112	962	2,272	0	634	107	56	118	4,260
	Down	13,138	33	26	0	67	15	9	20	13,307
Monongahela River										
Opekiska	Up	83	0	0	0	0	3	8	0	93
	Down	349	0	0	0	0	0	0	0	349
Hildebrand	Up	59	0	3	0	0	3	17	0	81
	Down	361	0	0	0	0	0	0	0	361
Morgantown	Up	66	0	36	0	0	3	9	0	114
	Down	378	0	432	0	0	0	0	0	810
Point Marion	Up	2,737	62	39	0	5	6	17	0	2,865
	Down	1,884	0	842	0	0	0	0	3	2,729

Source: COE LPMS data
Totals may not equal the sum of the commodities due to rounding.

Table 33 (cont'd)
2002 Ohio River System Lock Commodity Traffic by Direction
(Kilotons)

River/Project	Direction	Coal	Petrol	Aggs	Grains	Chem	Ores & Minerals	Iron & Steel	Other	Total
Monongahela River										
Grays Landing	Up	2,703	62	39	0	5	8	12	0	2,828
	Down	2,050	0	840	0	0	0	0	3	2,892
Maxwell	Up	2,935	65	91	0	18	106	10	118	3,340
	Down	8,693	0	833	0	0	3	0	0	9,529
L/D 4	Up	816	124	195	2	23	104	107	183	1,551
	Down	10,530	0	810	0	0	2	11	2	11,354
L/D 3	Up	1,575	319	219	5	133	70	107	129	2,556
	Down	11,699	3	804	2	53	10	299	22	12,890
L/D 2	Up	7,413	346	313	24	239	208	218	154	8,915
	Down	11,544	74	724	0	155	20	269	34	12,819
Allegheny River										
L/D 8	Up	0	0	2	0	0	0	0	0	2
	Down	0	0	323	0	0	0	0	4	327
L/D 7	Up	3	0	3	0	7	2	3	0	17
	Down	0	0	34	0	0	0	0	4	38
L/D 6	Up	6	2	3	0	7	2	6	1	25
	Down	0	0	36	0	0	0	0	3	40
L/D 5	Up	15	2	8	1	9	9	6	3	52
	Down	6	0	719	0	3	5	0	3	736
L/D 4	Up	25	116	23	10	55	12	25	7	273
	Down	6	8	722	0	10	6	5	9	765
L/D 3	Up	1,005	153	50	9	145	52	85	17	1,517
	Down	6	7	110	0	7	6	9	9	154
L/D 2	Up	1,017	161	56	11	140	48	92	18	1,543
	Down	5	4	113	0	9	16	40	17	203
Green River										
L/D 2	Up	5,197	0	7	0	0	0	13	23	5,240
	Down	746	0	14	77	0	0	0	6	842
L/D 1	Up	6,326	0	100	3	0	306	15	100	6,850
	Down	2,570	0	9	72	0	0	0	14	2,665
Cumberland River										
Old Hickory	Up	2,728	17	220	0	165	0	2	5	4,136
	Down	38	0	4	0	0	0	0	3	45
Cheatham	Up	3,817	687	3,014	20	246	77	450	781	9,092
	Down	35	12	21	0	6	47	207	17	344
Barkley	Up	1,444	383	2,651	136	149	58	206	443	5,470
	Down	40	4	939	143	19	31	122	134	1,431
Tennessee River										
Ft. Loudoun	Up	2	265	65	4	3	83	22	4	448
	Down	0	0	7	3	3	58	32	7	110
Watts Bar	Up	1	283	112	434	13	141	42	38	1,064
	Down	0	70	9	141	61	73	49	31	435
Chickamauga	Up	1	290	111	419	13	467	38	47	1,387
	Down	0	65	14	144	134	77	50	31	515
Nickajack	Up	53	552	887	727	126	217	211	146	2,919
	Down	21	48	73	134	157	101	190	298	1,022
Guntersville	Up	1,818	611	1,079	2,161	217	438	392	527	7,244
	Down	255	62	174	418	156	61	282	438	1,845
Wheeler	Up	1,924	670	1,291	3,247	1,293	500	850	819	10,594
	Down	292	66	167	634	452	86	369	460	2,526
Wilson	Up	1,917	691	1,211	3,247	1,334	432	873	922	10,628
	Down	271	79	175	625	555	93	349	497	2,644
Pickwick	Up	5,790	753	2,015	3,509	793	483	908	724	14,975
	Down	404	63	340	620	384	128	359	1,029	3,328
Kentucky	Up	10,035	1,102	2,614	3,326	955	680	1,210	790	20,711
	Down	687	54	4,919	1,076	361	262	525	984	8,868

Source: COE LPMS data
Totals may not equal the sum of the commodities due to rounding.

Table 34
2003 Ohio River System Lock Commodity Traffic by Direction
(Kilotons)

River/Project	Direction	Coal	Petrol	Aggs	Grains	Chem	Ores & Minerals	Iron & Steel	Other	Total
Ohio River										
Emsworth	Up	7,555	546	1,035	48	596	572	288	277	10,919
	Down	6,952	89	587	3	164	68	360	69	8,292
Dashields	Up	7,515	688	1,799	50	687	629	314	294	11,978
	Down	6,977	122	184	2	171	104	402	72	8,034
Montgomery	Up	8,017	841	1,310	56	854	863	576	442	12,958
	Down	7,050	166	104	6	185	89	485	49	8,135
New Cumberland	Up	16,692	1,299	816	106	1,655	1,240	1,125	1,183	24,114
	Down	6,117	746	49	28	206	78	663	189	8,075
Pike Island	Up	20,418	1,470	831	110	1,672	1,325	3,028	1,414	30,269
	Down	6,122	791	42	27	190	75	1,326	219	8,793
Hannibal	Up	16,679	1,537	1,092	121	1,723	1,829	3,068	1,533	27,583
	Down	18,151	743	207	28	372	75	1,436	290	21,301
Willow Island	Up	16,930	1,552	1,215	131	1,522	1,865	3,051	1,814	28,080
	Down	15,226	810	251	27	368	96	1,428	305	18,512
Belleville	Up	17,511	2,020	1,823	141	2,099	2,044	3,297	2,024	30,959
	Down	15,488	629	158	29	324	113	1,429	352	18,524
Racine	Up	17,549	2,044	1,521	144	2,103	2,370	3,317	2,053	31,101
	Down	15,701	611	911	29	340	139	1,407	386	19,524
R.C. Byrd	Up	16,850	3,201	3,512	180	2,699	2,358	3,358	2,382	34,539
	Down	15,355	626	196	48	385	140	1,445	429	18,625
Greenup	Up	4,732	1,444	3,637	198	3,182	2,584	5,175	2,308	23,260
	Down	30,523	5,189	166	74	602	192	1,770	360	38,875
Meldahl	Up	2,330	1,517	3,220	222	3,204	2,734	5,376	1,878	20,482
	Down	24,392	5,067	229	75	663	214	1,547	552	32,740
Markland	Up	2,354	2,018	2,978	375	4,926	3,820	5,976	2,486	24,932
	Down	12,475	2,877	135	1,573	572	208	1,992	483	20,315
McAlpine	Up	7,676	2,208	2,559	431	5,342	4,125	6,735	2,794	31,871
	Down	8,339	2,999	250	2,136	746	237	2,404	501	17,612
Cannelton	Up	10,551	2,762	676	389	5,783	4,136	6,766	2,133	33,196
	Down	8,001	1,596	4,479	2,179	732	732	2,406	681	20,806
Newburgh	Up	17,369	3,154	739	633	6,204	5,258	6,925	2,652	42,934
	Down	6,536	1,432	3,911	2,830	700	772	2,504	858	19,542
J.T. Myers	Up	15,662	3,942	699	585	6,930	5,579	7,121	2,721	43,240
	Down	7,999	1,134	296	5,055	755	723	2,609	845	19,416
Smithland	Up	14,995	3,932	682	533	7,020	5,636	7,127	2,738	42,661
	Down	13,817	1,118	4,221	5,543	753	673	2,641	878	29,644
L/D 52	Up	15,646	6,054	1,418	3,545	8,469	6,791	8,571	3,267	53,762
	Down	7,434	750	12,134	6,465	1,384	537	3,286	1,667	33,658
Kanawha River										
London	Up	23	0	12	0	0	0	0	17	52
	Down	2,803	0	0	0	0	0	0	18	2,821
Marmet	Up	121	295	353	3	173	80	0	35	1,060
	Down	13,006	2	18	0	2	0	0	19	13,047
Winfield	Up	162	926	2,626	3	626	116	30	167	4,656
	Down	13,296	11	11	0	57	0	2	44	13,420
Monongahela River										
Opekiska	Up	32	0	0	0	0	5	9	11	56
	Down	0	0	0	0	0	0	0	1	1
Hildebrand	Up	32	0	0	0	0	5	9	1	46
	Down	0	0	0	0	0	0	0	1	1
Morgantown	Up	32	0	49	0	0	5	9	1	96
	Down	11	0	384	0	0	0	0	1	396
Point Marion	Up	2,360	59	49	0	0	5	9	1	2,483
	Down	1,156	0	856	0	0	0	2	12	2,026

Source: COE LPMS data
Totals may not equal the sum of the commodities due to rounding.

Table 34 (cont'd)
2003 Ohio River System Lock Commodity Traffic by Direction
(Kilotons)

River/Project	Direction	Coal	Petrol	Aggs	Grains	Chem	Ores & Minerals	Iron & Steel	Other	Total
Monongahela River										
Grays Landing	Up	2,310	59	49	0	0	9	14	1	2,442
	Down	1,259	0	849	0	0	0	2	12	2,121
Maxwell	Up	4,792	60	138	0	0	164	6	185	5,346
	Down	6,206	0	854	0	0	14	2	5	7,081
L/D 4	Up	401	116	208	3	12	100	41	308	1,189
	Down	7,770	0	854	0	0	9	18	10	8,660
L/D 3	Up	1,213	226	166	3	138	75	69	203	2,092
	Down	8,448	9	845	0	26	5	263	13	9,607
L/D 2	Up	6,401	281	249	35	264	299	148	129	7,805
	Down	7,836	49	802	2	150	25	294	16	9,174
Allegheny River										
L/D 8	Up	0	0	154	0	0	2	0	1	157
	Down	0	0	638	0	0	0	0	2	640
L/D 7	Up	8	0	147	0	2	12	9	13	190
	Down	0	0	50	0	0	0	0	0	50
L/D 6	Up	11	0	148	0	2	13	9	14	197
	Down	0	0	47	0	0	0	0	0	47
L/D 5	Up	17	0	149	0	5	27	2	15	213
	Down	8	0	678	0	2	6	0	3	696
L/D 4	Up	21	99	191	12	48	39	9	15	436
	Down	8	0	670	0	3	14	15	25	734
L/D 3	Up	1,445	140	219	15	120	92	93	33	2,157
	Down	14	2	137	0	3	12	23	27	216
L/D 2	Up	1,448	144	221	15	121	90	95	35	2,170
	Down	9	0	125	0	3	30	61	25	252
Green River										
L/D 2	Up	2,872	0	0	0	0	0	0	11	2,883
	Down	795	0	2	91	0	0	0	9	897
L/D 1	Up	3,613	0	59	2	0	332	0	112	4,117
	Down	2,618	0	0	81	0	9	0	20	2,728
Cumberland River										
Old Hickory	Up	4,084	9	258	0	170	0	2	2	4,525
	Down	10	0	0	0	0	0	0	2	12
Cheatham	Up	4,237	500	2,997	24	341	104	440	739	9,382
	Down	79	18	50	0	9	35	190	22	401
Barkley	Up	337	285	838	28	55	3	59	260	1,865
	Down	6	14	228	49	18	8	44	62	429
Tennessee River										
Ft. Loudoun	Up	3	268	52	0	14	112	14	6	469
	Down	1	3	6	0	0	31	18	2	61
Watts Bar	Up	7	259	89	418	28	202	46	34	1,081
	Down	1	67	1	114	52	50	44	8	337
Chickamauga	Up	7	259	103	418	29	523	46	42	1,427
	Down	1	77	3	114	111	48	50	14	418
Nickajack	Up	93	509	429	607	148	477	254	168	2,685
	Down	8	62	16	144	155	47	283	296	1,011
Guntersville	Up	1,124	543	642	2,013	226	761	380	386	6,075
	Down	139	44	29	275	214	92	371	369	1,535
Wheeler	Up	1,176	630	891	3,239	1,508	773	1,316	588	10,120
	Down	157	43	33	370	786	108	816	440	2,754
Wilson	Up	1,176	639	869	3,239	1,497	712	1,314	674	10,119
	Down	156	54	33	394	874	96	796	448	2,852
Pickwick	Up	4,692	749	1,434	3,481	594	737	1,282	497	13,467
	Down	282	78	225	372	630	118	819	926	3,449
Kentucky	Up	10,334	1,047	4,213	3,448	1,094	951	1,670	884	23,641
	Down	738	76	4,156	946	592	256	982	1,015	8,762

Source: COE LPMS data
Totals may not equal the sum of the commodities due to rounding.

Table 35
1994 – 2003 Ohio River System Total Traffic by Project
(Kilotons)

River/Project	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Annual Rate 1994-2003
Ohio River											
Emsworth	24,272	23,075	23,424	23,201	23,153	23,561	22,334	21,729	23,687	19,211	-2.3%
Dashields	25,602	24,551	24,765	24,452	24,563	24,528	23,230	22,839	24,516	20,012	-2.4%
Montgomery	27,313	25,515	27,132	26,480	26,866	26,560	25,974	25,555	26,709	21,093	-2.6%
New Cumberland	37,272	36,745	36,584	35,564	35,425	33,906	34,062	33,854	35,251	32,189	-1.5%
Pike Island	43,643	43,309	43,729	41,345	43,027	41,276	41,460	41,682	43,634	39,062	-1.1%
Hannibal	47,783	42,783	46,596	44,812	47,627	47,258	48,344	49,476	51,200	48,884	0.2%
Willow Island	45,802	44,534	43,932	42,299	44,766	44,320	45,635	46,975	48,422	46,592	0.2%
Belleville	48,641	47,122	47,869	45,511	48,688	47,983	49,201	49,243	51,118	49,482	0.2%
Racine	49,845	48,000	48,933	46,644	49,517	48,646	50,022	50,239	51,764	50,625	0.2%
R.C. Byrd	56,079	58,649	59,406	56,337	57,855	55,970	57,879	58,108	54,898	53,164	-0.5%
Greenup	68,695	67,573	67,262	69,891	70,635	70,044	71,713	70,563	65,915	62,135	-1.0%
Meldahl	64,627	63,376	61,270	62,246	63,739	62,784	63,391	63,813	57,771	53,222	-1.9%
Markland	60,011	57,757	54,680	55,090	55,119	54,850	56,062	55,807	49,625	45,248	-2.8%
McAlpine	61,943	57,609	53,980	52,823	52,857	54,835	55,790	56,170	51,893	49,482	-2.2%
Cannelton	64,257	59,513	56,782	56,240	54,386	56,650	55,786	56,653	55,841	54,002	-1.7%
Newburgh	76,779	72,052	68,300	65,407	64,131	64,509	64,433	66,527	64,200	62,475	-2.0%
J.T. Myers [1/]	85,718	82,108	77,603	76,218	74,151	71,393	72,447	75,290	68,961	62,655	-3.1%
Smithland	93,337	89,145	85,077	84,931	84,606	82,115	82,610	85,915	79,040	72,305	-2.5%
L/D 52	101,267	97,467	94,052	94,770	97,695	95,125	94,687	96,715	93,382	87,420	-1.5%
L/D 53 [2/]	---	---	---	---	---	87,814	89,161	87,085	85,638	81,742	n/a
Kanawha River											
London	7,518	8,010	8,605	8,163	7,278	6,505	6,017	4,662	4,466	2,872	-9.2%
Marmet	17,372	16,174	17,192	17,431	16,274	14,733	16,481	16,439	13,477	14,107	-2.1%
Winfield	22,272	22,008	22,618	22,352	21,356	19,537	20,693	20,309	17,567	18,076	-2.1%
Monongahela River											
Opekiska	548	370	259	242	179	28	66	289	442	57	-20.3%
Hildebrand	571	357	312	256	177	26	72	292	442	47	-22.1%
Morgantown	1,264	630	362	292	247	358	601	830	924	491	-9.0%
Point Marion	10,282	7,246	5,829	5,322	5,194	5,218	5,608	5,893	5,594	4,508	-7.9%
Grays Landing	11,442	8,883	6,946	5,453	5,658	5,777	5,855	6,073	5,720	4,563	-8.8%
Maxwell	15,116	12,267	10,535	10,577	10,886	13,384	12,338	12,565	12,869	12,427	-1.9%
L/D 4	16,453	13,299	11,492	10,862	10,880	13,220	11,960	11,928	12,905	9,849	-5.0%
L/D 3	16,602	14,416	15,765	15,416	16,110	18,011	15,613	14,660	15,446	11,699	-3.4%
L/D 2	20,188	18,232	19,326	19,328	20,534	21,137	20,088	19,706	21,734	16,979	-1.7%
Allegheny River											
L/D 8	516	579	632	711	463	673	702	229	328	797	4.4%
L/D 7	89	98	143	136	471	134	137	104	56	240	10.4%
L/D 6	117	113	135	154	179	164	137	119	65	243	7.6%
L/D 5	204	132	391	728	757	769	691	176	787	910	16.1%
L/D 4	753	728	1,134	1,543	1,789	1,630	1,410	502	1,038	1,170	4.5%
L/D 3	2,435	2,282	2,388	2,780	2,555	2,581	2,554	2,407	1,671	2,373	-0.3%
L/D 2	2,367	2,240	2,449	2,825	2,480	2,621	2,582	2,459	1,746	2,422	0.2%
Green River											
L/D 2	3,631	2,086	2,398	2,069	2,122	1,502	1,553	4,320	6,083	3,781	0.4%
L/D 1	5,712	4,272	5,174	4,951	4,783	4,371	3,984	7,200	9,514	6,845	1.8%
Cumberland River											
Old Hickory	443	462	450	1,940	3,511	3,942	3,836	3,850	4,181	4,536	26.2%
Cheatham	5,367	5,184	5,527	7,112	8,710	9,551	8,659	9,124	9,434	9,783	6.2%
Barkley	4,365	5,306	6,281	9,483	9,654	9,081	8,967	8,398	6,901	2,294	-6.2%
Tennessee River											
Ft. Loudoun	631	614	662	537	627	639	819	682	570	565	-1.1%
Watts Bar	1,541	1,442	1,491	1,808	1,701	1,768	1,995	1,586	1,498	1,417	-0.8%
Chickamauga	2,296	2,311	2,274	2,654	2,529	2,306	2,452	1,924	1,902	1,845	-2.2%
Nickajack	5,342	5,373	5,512	5,696	4,959	4,687	4,793	4,093	3,941	3,696	-3.6%
Guntersville	8,331	8,036	9,233	9,412	8,974	9,390	8,942	8,581	9,091	7,612	-0.9%
Wheeler	11,370	11,134	12,327	13,541	14,373	15,350	14,628	12,484	13,120	12,874	1.3%
Wilson	11,634	11,379	12,543	13,614	14,605	15,518	14,798	12,673	13,272	12,971	1.1%
Pickwick	18,416	15,400	17,536	18,930	20,388	20,405	19,153	17,628	18,303	16,916	-0.8%
Kentucky	33,427	33,728	33,490	34,014	33,356	31,767	28,836	27,737	29,579	32,403	-0.3%

Source: COE LPMS

[1/] Uniontown was renamed J.T. Myers in 1997

[2/] No data collected at L/D 53 before 1999

All of these factors affect processing times, which relate directly to the transportation cost borne by the shipper. In 2003, Chickamauga and Watts Bar locks on the Tennessee River had the highest average tow processing times in the ORS with 4 hours per tow each. Marmet Locks on the Kanawha River had an average tow processing time of 1.5 hours per tow. Project performance in 2002 and 2003 is shown in **Tables 36 - 37**. Historic delay performance is shown in **Table 38**.

On average, most projects in the ORS show historic traffic growth. Growth on the lower Ohio and Monongahela, with the exception of L&D2, has slowed in the last ten years. Both Green River locks exhibited a steady decline in the 1990s, but have shown growth over the last 3 years (**Table 35**). The historic number of tows (**Table 39**) reflects these same trends.

Photo 25: Tow with coal barges locking through Locks and Dam 2, Monongahela River

Table 36
2002 Performance Characteristics of Ohio River System

River/Project	No. Tows	Number of Barges Loaded	Empty	Total	Avg. Barges /Tow	Ktons	Avg. Tons /Tow	Delay	Avg. Time /Tow (min.) Process	Total	Comm. Lockages	Avg. Lock Cuts/Tow [1/]
Ohio River												
Emsworth	4,402	17,066	9,426	26,492	6.0	23,684	5,380	38.7	67.9	106.6	5,348	1.2
Dashields	4,184	18,037	10,119	28,156	6.7	24,514	5,859	37.7	65.1	102.8	5,169	1.2
Montgomery	4,416	18,936	9,470	28,406	6.4	26,751	6,058	178.4	69.5	247.9	6,176	1.4
New Cumberland	4,332	23,882	15,830	39,712	9.2	35,254	8,138	73.7	64.3	138.0	4,728	1.1
Pike Island	5,071	29,505	18,375	47,880	9.4	43,631	8,604	22.7	54.5	77.2	5,071	1.0
Hannibal	4,528	34,335	15,745	50,080	11.1	51,197	11,307	19.2	53.3	72.5	4,526	1.0
Willow Island	4,067	32,421	13,438	45,859	11.3	48,416	11,905	62.1	63.3	125.4	4,344	1.1
Belleville	4,167	34,052	14,300	48,352	11.6	51,106	12,265	21.3	55.0	76.3	4,167	1.0
Racine	4,416	34,440	15,017	49,457	11.2	51,742	11,717	30.1	61.9	92.0	4,415	1.0
R.C. Byrd	4,808	35,306	15,898	51,204	10.6	54,894	11,417	34.9	57.7	92.6	4,836	1.0
Greenup	6,347	41,398	27,314	68,712	10.8	65,910	10,384	45.8	50.7	96.5	6,472	1.0
Capt. A. Meldahl	5,085	35,823	20,604	56,427	11.1	57,761	11,359	198.7	61.4	260.1	5,656	1.1
Markland	4,625	30,925	14,209	45,134	9.8	49,597	10,724	51.9	59.8	111.7	4,706	1.0
McAlpine	5,016	32,359	13,115	45,474	9.1	51,847	10,336	62.4	58.9	121.3	4,981	1.0
Cannelton	4,816	35,539	16,063	51,602	10.7	55,767	11,580	39.5	59.7	99.2	4,874	1.0
Newburgh	5,832	40,940	22,223	63,163	10.8	64,137	10,997	31.6	51.0	82.6	5,970	1.0
J.T. Myers	5,734	43,006	21,753	64,759	11.3	68,908	12,017	42.5	51.7	94.2	5,869	1.0
Smithland	7,198	49,057	25,738	74,795	10.4	79,014	10,977	22.3	47.4	69.7	7,318	1.0
L/D 52	9,221	57,816	32,336	90,152	9.8	93,312	10,119	183.7	27.9	211.6	9,189	1.0
L/D 53	6,915	52,548	25,041	77,589	11.2	85,618	12,382	51.1	7.8	58.9	6,900	1.0
Kanawha River												
London	1,648	3,931	3,903	7,834	4.8	4,445	2,697	34.0	81.1	115.1	4,543	2.8
Marmet	3,793	10,529	10,199	20,728	5.5	13,465	3,550	45.3	95.1	140.4	14,618	3.9
Winfield	2,737	13,057	10,789	23,846	8.7	17,576	6,422	20.8	62.1	82.9	2,741	1.0
Monongahela River												
Opekiska	172	416	410	826	4.8	442	2,569	0.1	27.4	27.5	172	1.0
Hildebrand	172	416	410	826	4.8	442	2,570	2.4	38.2	40.6	172	1.0
Morgantown	402	811	811	1,622	4.0	919	2,286	0.4	28.5	28.9	402	1.0
Point Marion	1,680	5,027	3,938	8,965	5.3	5,594	3,329	2.2	34.8	37.0	1,680	1.0
Grays Landing	1,707	5,143	3,884	9,027	5.3	5,720	3,351	3.4	38.4	41.8	1,707	1.0
Maxwell	3,995	10,514	9,364	19,878	5.0	12,869	3,221	1.3	40.3	41.6	3,995	1.0
L/D 4	5,088	9,904	9,256	19,160	3.8	12,905	2,536	25.8	45.1	70.9	5,648	1.1
L/D 3	6,826	11,430	9,878	21,308	3.1	15,446	2,263	19.2	36.6	55.8	6,826	1.0
L/D 2	4,106	15,505	8,299	23,804	5.8	21,732	5,293	25.8	51.1	76.9	4,751	1.2
Allegheny River												
L/D 8	414	210	215	425	1.0	328	793	1.0	28.9	29.9	418	1.0
L/D 7	80	61	72	133	1.7	56	695	0.2	28.3	28.5	88	1.1
L/D 6	91	66	90	156	1.7	63	692	1.1	29.6	30.7	103	1.1
L/D 5	944	883	906	1,789	1.9	785	832	2.0	56.8	58.8	1,735	1.8
L/D 4	1,179	1,059	1,028	2,087	1.8	1,036	879	3.5	51.3	54.8	2,031	1.7
L/D 3	990	1,475	1,513	2,988	3.0	1,669	1,686	6.6	58.6	65.2	1,630	1.6
L/D 2	1,041	1,519	1,586	3,105	3.0	1,745	1,676	6.9	59.3	66.2	1,742	1.7
Green River												
L/D 2	1,937	4,058	3,174	7,232	3.7	6,081	3,139	1.9	21.4	23.3	1,937	1.0
L/D 1	2,691	6,388	3,519	9,907	3.7	9,511	3,534	0.8	22.1	22.9	2,691	1.0
Cumberland River												
Old Hickory	852	2,237	2,234	4,471	5.2	4,176	4,902	7.5	106.9	114.4	1,655	1.9
Cheatham	1,278	5,496	5,243	10,739	8.4	9,428	7,377	52.8	89.6	142.4	1,747	1.4
Barkley	1,262	4,405	5,318	9,723	7.7	6,890	5,460	28.0	73.5	101.5	1,586	1.3
Tennessee River												
Ft. Loudoun	204	312	253	565	2.8	565	2,769	12.7	178.0	190.7	629	3.1
Watts Bar	259	928	624	1,552	6.0	1,494	5,769	61.4	232.0	293.4	1,611	6.2
Chickamauga	299	1,226	868	2,094	7.0	1,897	6,344	57.0	249.4	306.4	2,154	7.2
Nickajack	835	2,505	1,939	4,444	5.3	3,933	4,710	7.9	64.5	72.4	1,002	1.2
Guntersville	1,123	5,874	4,219	10,093	9.0	9,080	8,085	25.4	110.7	136.1	1,805	1.6
Wheeler	1,640	8,261	5,759	14,020	8.5	13,099	7,987	105.5	109.2	214.7	2,762	1.7
Wilson	1,718	8,365	5,871	14,236	8.3	13,255	7,715	68.1	121.2	189.3	2,667	1.6
Pickwick	2,106	12,021	9,738	21,759	10.3	18,289	8,684	59.6	98.3	157.9	2,728	1.3
Kentucky	2,942	18,577	13,199	31,776	10.8	29,537	10,040	178.5	120.1	298.6	5,025	1.7

Source: COE LPMS Data

[1/] Statistic calculated on processed tows (non open pass).

Table 37
2003 Performance Characteristics of Ohio River System

		Number of Barges			Avg.		Avg.	Avg. Time /Tow (min.)				Avg.
River/Project	**No. Tows**	**Loaded**	**Empty**	**Total**	**Barges /Tow**	**Ktons**	**Tons /Tow**	**Delay**	**Process**	**Total**	**Comm. Lockages**	**Lock Cuts/Tow** [1/]
Ohio River												
Emsworth	4,287	14,036	10,261	24,297	5.7	19,211	4,481	52.2	63.5	115.7	5,063	1.2
Dashields	4,197	14,927	10,954	25,881	6.2	20,012	4,768	36.7	62.5	99.2	5,062	1.2
Montgomery	4,285	15,131	9,664	24,795	5.8	21,093	4,923	32.7	62.1	94.8	5,154	1.2
New Cumberland	4,306	21,782	16,601	38,383	8.9	32,189	7,475	18.5	57.0	75.5	4,302	1.0
Pike Island	4,799	26,230	19,480	45,710	9.5	39,062	8,140	21.6	53.6	75.2	4,799	1.0
Hannibal	4,470	32,622	15,603	48,225	10.8	48,884	10,936	23.7	53.5	77.2	4,470	1.0
Willow Island	4,068	31,134	13,730	44,864	11.0	46,592	11,453	25.3	57.9	83.2	4,068	1.0
Belleville	4,121	32,957	14,771	47,728	11.6	49,482	12,007	22.1	54.8	76.9	4,121	1.0
Racine	4,271	33,709	15,289	48,998	11.5	50,625	11,853	30.1	62.6	92.7	4,267	1.0
R.C. Byrd	4,666	34,272	14,513	48,785	10.5	53,164	11,394	33.6	58.3	91.9	4,684	1.0
Greenup	5,573	39,067	22,283	61,350	11.0	62,135	11,149	342.3	56.0	398.3	6,271	1.1
Capt. A. Meldahl	4,716	32,999	17,785	50,784	10.8	53,222	11,285	58.2	57.0	115.2	4,844	1.0
Markland	4,314	28,094	12,348	40,442	9.4	45,248	10,489	72.6	58.6	131.2	4,442	1.0
McAlpine	4,799	30,740	13,535	44,275	9.2	49,482	10,311	50.6	55.7	106.3	4,741	1.0
Cannelton	4,883	34,172	16,622	50,794	10.4	54,002	11,059	34.9	58.8	93.7	4,892	1.0
Newburgh	5,752	39,625	22,277	61,902	10.8	62,476	10,862	39.3	48.2	87.5	5,846	1.0
J.T. Myers	5,410	39,047	19,730	58,777	10.9	62,656	11,582	68.0	53.3	121.3	5,719	1.1
Smithland	6,737	44,792	22,436	67,228	10.0	72,305	10,733	16.3	49.9	66.2	6,811	1.0
L/D 52	8,522	54,087	29,314	83,401	9.8	87,420	10,258	28.7	9.0	37.7	8,521	1.0
L/D 53	6,433	50,298	23,078	73,376	11.4	81,742	12,707	1.3	0.3	1.6	6,433	1.0
Kanawha River												
London	1,095	2,597	2,541	5,138	4.7	2,872	2,623	30.2	82.7	112.9	2,882	2.6
Marmet	3,660	10,953	10,387	21,340	5.8	14,107	3,854	98.9	92.1	191.0	15,677	4.3
Winfield	2,577	13,450	10,611	24,061	9.3	18,076	7,014	24.9	64.5	89.4	2,587	1.0
Monongahela River												
Opekiska	30	42	34	76	2.5	57	1,900	0.0	30.5	30.5	30	1.0
Hildebrand	26	34	42	76	2.9	47	1,808	0.8	39.0	39.8	26	1.0
Morgantown	253	401	389	790	3.1	491	1,941	0.5	28.1	28.6	253	1.0
Point Marion	1,355	3,926	3,051	6,977	5.1	4,508	3,327	3.2	34.7	37.9	1,355	1.0
Grays Landing	1,387	3,980	3,115	7,095	5.1	4,563	3,290	2.3	38.2	40.5	1,387	1.0
Maxwell	3,713	10,270	9,616	19,886	5.4	12,427	3,347	1.3	42.4	43.7	3,713	1.0
L/D 4	4,010	7,527	7,809	15,336	3.8	9,849	2,456	26.0	47.3	73.3	4,696	1.2
L/D 3	5,271	8,740	8,106	16,846	3.2	11,699	2,220	13.3	36.3	49.6	5,271	1.0
L/D 2	3,508	12,159	8,871	21,030	6.0	16,979	4,840	15.4	49.5	64.9	4,043	1.2
Allegheny River												
L/D 8	939	584	589	1,173	1.2	797	849	1.2	28.3	29.5	951	1.0
L/D 7	223	267	257	524	2.3	240	1,076	1.2	31.3	32.5	253	1.1
L/D 6	225	263	270	533	2.4	243	1,080	1.2	31.6	32.8	255	1.1
L/D 5	1,018	1,014	1,032	2,046	2.0	910	894	2.2	51.4	53.6	1,767	1.7
L/D 4	1,254	1,177	1,197	2,374	1.9	1,170	933	3.2	49.4	52.6	2,094	1.7
L/D 3	1,235	2,160	2,196	4,356	3.5	2,373	1,921	8.0	60.8	68.8	2,137	1.7
L/D 2	1,314	2,196	2,299	4,495	3.4	2,422	1,843	8.3	61.5	69.8	2,253	1.7
Green River												
L/D 2	1,191	2,522	1,934	4,456	3.7	3,781	3,175	0.7	20.1	20.8	1,191	1.0
L/D 1	2,013	4,561	2,601	7,162	3.6	6,845	3,400	1.5	20.4	21.9	2,012	1.0
Cumberland River												
Old Hickory	932	2,509	2,528	5,037	5.4	4,536	4,867	8.6	106.1	114.7	1,787	1.9
Cheatham	1,312	5,700	5,545	11,245	8.6	9,783	7,457	31.8	88.9	120.7	1,788	1.4
Barkley	674	1,328	2,841	4,169	6.2	2,294	3,404	12.2	65.0	77.2	796	1.2
Tennessee River												
Ft. Loudoun	180	284	232	516	2.9	530	2,944	12.0	144.1	156.1	569	3.2
Watts Bar	249	933	701	1,634	6.6	1,417	5,691	91.4	237.1	328.5	1,676	6.7
Chickamauga	304	1,317	1,024	2,341	7.7	1,845	6,069	86.3	256.1	342.4	2,281	7.5
Nickajack	715	2,407	1,924	4,331	6.1	3,696	5,169	7.2	74.5	81.7	931	1.3
Guntersville	983	4,995	3,991	8,986	9.1	7,610	7,742	22.1	112.7	134.8	1,585	1.6
Wheeler	1,633	8,033	5,766	13,799	8.5	12,874	7,884	35.3	104.9	140.2	2,519	1.5
Wilson	1,696	8,128	5,829	13,957	8.2	12,971	7,648	160.7	121.0	281.7	2,897	1.7
Pickwick	1,843	11,120	8,977	20,097	10.9	16,916	9,179	47.5	97.9	145.4	2,364	1.3
Kentucky	3,282	20,797	15,017	35,814	10.9	32,403	9,873	257.1	117.7	374.8	5,666	1.7

Source: COE LPMS Data
[1/] Statistic calculated on processed tows (non open pass).

Table 38
Historic Average Lock Delays at Ohio River System Projects
(Minutes/Tow)

River/Project	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Ohio River										
Emsworth	180	56	48	63	57	51	40	86	39	52
Dashields	38	30	44	140	37	35	32	53	38	37
Montgomery	73	42	61	50	55	57	57	46	178	33
New Cumberland	19	19	65	18	17	15	15	17	74	19
Pike Island	19	16	15	14	20	15	66	18	23	22
Hannibal	18	14	15	51	15	16	15	21	19	24
Willow Island	21	17	20	17	21	43	25	25	62	25
Belleville	14	67	30	24	19	21	21	20	21	22
Racine	32	25	24	23	29	24	27	32	30	30
R.C. Byrd	59	35	40	34	38	37	40	35	25	34
Greenup	97	45	45	53	142	140	56	55	46	342
Capt. A. Meldahl	45	38	36	48	50	56	59	95	199	58
Markland	174	46	49	33	35	59	36	58	52	73
McAlpine	68	56	53	437	59	150	87	84	62	51
Cannelton	76	38	40	38	36	86	40	45	40	35
Newburgh	28	23	45	23	24	27	28	47	32	39
J.T. Myers [1/]	63	64	44	40	43	40	66	184	43	68
Smithland	18	17	8	9	14	4	2	4	22	16
L/D 52 [2/]	152	126	74	134	146	242	183	170	184	29
L/D 53									51	1
Kanawha River										
London	33	15	32	15	15	10	7	7	34	30
Marmet	370	109	175	136	153	85	93	109	45	99
Winfield	643	167	237	161	35	19	23	27	21	25
Monongahela River										
Opekiska	0	0	1	0	6	0	15	0	0	0
Hildebrand	4	3	1	9	4	0	1	0	2	1
Morgantown	1	1	3	1	0	1	0	0	0	1
Point Marion	10	9	3	3	3	2	2	2	2	3
Grays Landing	9	8	4	3	3	3	3	3	3	2
Maxwell	2	3	3	2	1	2	1	1	3	1
L/D 4	22	17	24	14	12	16	15	17	26	26
L/D 3	14	10	13	18	18	25	18	16	19	13
L/D 2	123	14	21	23	20	18	19	21	26	15
Allegheny River										
L/D 8	0	0	1	1	1	1	1	1	1	1
L/D 7	2	1	2	0	1	2	1	4	0	1
L/D 6	6	1	1	4	1	4	3	5	1	1
L/D 5	1	4	4	2	2	3	4	3	2	2
L/D 4	6	5	9	23	8	8	7	3	4	3
L/D 3	11	8	9	8	8	9	9	11	7	8
L/D 2	12	10	10	11	9	13	13	10	7	8
Green River										
L/D 2	1	1	0	0	1	1	0	9	2	1
L/D 1	1	1	1	1	0	0	1	0	1	2
Cumberland River										
Old Hickory	3	3	2	11	9	10	8	7	8	9
Cheatham	3	3	4	5	26	15	19	20	53	32
Barkley	14	17	28	97	68	32	18	61	28	12
Tennessee River										
Ft. Loudoun	24	22	17	14	18	31	23	18	13	12
Watts Bar	53	38	38	52	45	55	85	84	61	91
Chickamauga	80	90	78	144	100	85	75	91	57	86
Nickajack	10	10	9	13	19	8	8	6	8	7
Guntersville	60	23	27	24	19	54	37	24	25	22
Wheeler	34	29	38	83	33	36	41	37	106	35
Wilson	58	45	243	56	66	77	613	63	68	161
Pickwick	35	20	33	27	36	42	35	42	60	48
Kentucky	286	247	347	364	271	255	190	225	179	257

Source: COE LPMS Data.

[1/] Uniontown was renamed J.T. Myers in 1997

[2/] Average over all tows, including navigable pass

Table 39
Historic Number of Tows at Ohio River System Projects

River/Project	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Ann. Rate 1994-2003
Ohio River											
Emsworth	5,268	5,235	5,303	5,303	5,165	5,115	4,996	4,586	4,402	4,287	-2.0%
Dashields	4,994	4,876	5,004	5,075	5,108	4,700	4,738	4,400	4,184	4,197	-1.7%
Montgomery	4,831	4,523	4,816	4,627	4,868	4,685	4,624	4,316	4,416	4,285	-1.2%
New Cumberland	4,923	4,773	4,643	4,523	4,572	4,401	4,347	4,379	4,332	4,306	-1.3%
Pike Island	5,243	5,086	5,220	4,900	5,133	4,936	4,764	4,792	5,071	4,799	-0.9%
Hannibal	4,216	3,823	4,287	4,302	4,487	4,397	4,480	4,418	4,528	4,470	0.6%
Willow Island	4,060	4,062	3,844	3,883	4,121	4,002	4,083	4,084	4,067	4,068	0.0%
Belleville	4,140	4,096	4,046	3,934	4,514	4,080	4,236	4,090	4,167	4,121	0.0%
Racine	4,395	4,257	4,250	4,143	4,542	4,277	4,476	4,346	4,416	4,271	-0.3%
R.C. Byrd	5,164	5,250	5,398	5,183	5,263	5,012	5,082	4,994	4,808	4,666	-1.0%
Greenup	6,437	6,313	6,415	6,730	6,639	6,694	6,841	6,812	6,347	5,573	-1.4%
Capt. A. Meldahl	5,656	5,547	5,524	5,574	5,604	5,482	5,471	5,521	5,085	4,716	-1.8%
Markland	5,089	5,012	5,161	5,074	4,938	4,960	5,129	5,333	4,625	4,314	-1.6%
McAlpine	4,976	4,748	4,900	4,525	4,513	4,772	5,036	5,289	5,016	4,799	-0.4%
Cannelton	5,206	5,133	5,025	4,726	4,421	4,643	4,594	4,706	4,816	4,883	-0.6%
Newburgh	6,871	6,812	6,686	5,859	5,645	5,878	5,790	6,021	5,832	5,752	-1.8%
J.T. Myers [1/]	7,070	6,870	6,592	6,339	6,040	5,997	5,958	6,085	5,734	5,410	-2.6%
Smithland	8,252	7,972	7,866	7,731	7,376	7,338	7,265	7,540	7,198	6,737	-2.0%
L/D 52	10,621	10,428	9,901	9,904	9,472	9,621	9,557	9,695	9,221	8,522	-2.2%
Kanawha River											
London	3,010	3,048	3,181	3,006	2,797	2,428	2,145	1,624	1,648	1,095	-9.6%
Marmet	4,712	4,359	4,525	4,717	4,299	3,902	4,225	4,350	3,793	4,022	-1.6%
Winfield	5,119	4,840	5,074	4,776	3,087	2,909	3,075	3,269	2,737	2,577	-6.6%
Monongahela River											
Opekiska	293	200	138	121	107	19	50	128	172	30	-20.4%
Hildebrand	314	201	192	124	106	24	51	130	172	26	-22.1%
Morgantown	740	374	231	156	147	186	316	462	402	253	-10.2%
Point Marion	4,855	2,853	2,129	1,876	1,690	1,633	1,651	1,830	1,680	1,355	-12.0%
Grays Landing	5,151	3,969	2,695	1,953	1,949	1,868	1,777	1,899	1,707	1,387	-12.3%
Maxwell	4,787	4,058	3,959	3,786	3,677	4,074	3,826	4,139	3,995	3,713	-2.5%
L/D 4	5,705	4,737	4,709	4,398	4,368	4,901	4,619	4,695	5,088	4,010	-3.5%
L/D 3	7,148	6,501	7,005	6,690	6,650	7,142	6,521	6,354	6,826	5,271	-3.0%
L/D 2	4,521	4,360	4,415	4,385	4,257	5,042	4,412	4,369	4,106	3,508	-2.5%
Allegheny River											
L/D 8	652	728	782	886	575	859	884	288	414	939	3.7%
L/D 7	88	104	121	172	600	142	170	124	80	223	9.7%
L/D 6	137	127	147	191	225	191	175	148	91	225	5.1%
L/D 5	216	165	377	609	520	481	489	215	944	1,018	16.8%
L/D 4	783	801	1,174	1,676	1,540	1,438	1,210	483	1,179	1,254	4.8%
L/D 3	1,555	1,488	1,473	1,538	1,523	1,518	1,432	1,330	990	1,235	-2.3%
L/D 2	1,592	1,588	1,568	1,627	1,516	1,548	1,462	1,386	1,041	1,314	-1.9%
Green River											
L/D 2	1,281	823	848	751	824	648	672	1,389	1,937	1,191	-0.7%
L/D 1	2,052	1,616	1,803	1,693	1,703	1,428	1,328	2,139	2,691	2,013	-0.2%
Cumberland River											
Old Hickory	301	338	330	588	809	831	758	724	852	932	12.0%
Cheatham	1,148	1,126	1,177	1,321	1,451	1,564	1,422	1,372	1,278	1,312	1.3%
Barkley	1,142	1,252	1,383	1,766	1,798	1,710	1,520	1,421	1,262	674	-5.1%
Tennessee River											
Ft. Loudoun	237	239	247	253	242	269	246	195	204	180	-2.7%
Watts Bar	278	261	280	337	295	313	279	222	259	249	-1.1%
Chickamauga	382	361	385	385	407	370	349	272	299	304	-2.3%
Nickajack	895	894	935	936	967	889	900	863	835	715	-2.2%
Guntersville	1,198	1,146	1,314	1,353	1,365	1,397	1,204	1,171	1,123	983	-2.0%
Wheeler	1,627	1,714	1,816	1,870	1,966	2,129	1,891	1,655	1,640	1,633	0.0%
Wilson	1,709	1,777	1,882	1,920	2,055	2,211	1,937	1,741	1,718	1,696	-0.1%
Pickwick	2,315	2,034	2,290	2,378	2,336	2,312	2,227	2,033	2,106	1,843	-2.3%
Kentucky	3,556	3,510	3,401	3,227	3,078	3,167	2,911	2,788	2,942	3,282	-0.8%

Source: COE LPMS Data

[1/] Uniontown was renamed J.T. Myers in 1997

3. Recreational Traffic. The multi-purpose development of water resources in the Ohio River Basin has allowed for the recreational development of project lands and adjacent water surface areas. These facilities attracted over 100 million recreation visitors in 2002 -2003. The Ohio River main stem navigation pools provide a 981-mile long series of contiguous recreational lakes with nearly stable summer navigation pools and a substantial length of shoreline for private recreational development.

Most navigation projects in the basin process small recreational craft, in addition to commercial traffic. Current statistics on recreational traffic at ORB projects are displayed in **Table 40**.

Safety precautions prohibit mixed lockages of tows and recreation craft. At projects that contain more than a single chamber, recreational craft use the auxiliary chamber. This separation between commercial and recreational craft improves safety and efficiency for all users of the waterway.

Recreational craft have access to most public facilities developed for commercial towing, but generally use privately developed boat launching ramps, landings, and small boat harbors. They are generally located near population centers with convenient access to the pools formed by the navigation dams and are situated off the commercial navigation channels, in coves and embayments, or along smaller waterways that are not commercially navigable. Those situated along commercial waterways are frequently enhanced with facilities to serve a wide variety of recreation needs. There are over 750 such public and private pleasure craft facilities situated along the basin's waterways.

Photo 26: Recreation traffic at Guntersville L&D, mile 349.0 on the Tennessee River

Table 40
Historic Ohio River System Recreational Traffic
(Vessels)

River/Project	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Ohio River										
Emsworth	3,804	4,250	2,691	3,308	3,125	3,939	2,739	3,140	3,276	2,302
Dashields	2,828	2,958	1,816	2,281	2,468	2,717	2,093	2,677	2,215	1,769
Montgomery	2,388	2,532	1,504	1,807	2,120	2,455	1,756	1,899	1,123	998
New Cumberland	1,910	2,377	1,022	1,997	2,420	3,076	2,241	2,338	2,311	1,436
Pike Island	1,702	1,612	1,223	1,496	1,406	1,752	1,448	1,495	1,522	1,112
Hannibal	1,034	801	770	636	1,099	1,534	1,317	1,163	1,361	1,222
Willow Island	1,639	1,401	1,348	1,279	1,688	1,818	2,027	1,791	1,738	1,180
Belleville	1,362	1,324	1,129	867	1,165	1,246	1,096	940	1,066	668
Racine	912	853	645	776	881	1,246	1,051	896	884	637
R.C. Byrd	787	778	693	777	905	1,165	1,191	1,001	834	547
Greenup	395	1,009	693	698	1,051	1,452	940	762	636	460
Capt. A. Meldahl	5,194	3,984	260	3,924	5,595	6,564	5,388	2,984	2,037	2,668
Markland	3,005	3,214	3,554	3,856	4,561	4,880	4,296	3,033	3,413	2,340
McAlpine	1,081	924	2,839	642	1,121	1,184	746	595	595	523
Cannelton	1,013	971	794	1,009	1,147	1,162	1,038	859	1,012	923
Newburgh	2,654	1,943	1,524	1,405	1,608	1,942	1,744	1,141	1,272	933
J.T. Myers [1/]	2,740	2,293	1,409	2,246	2,750	3,439	2,389	2,299	2,519	1,211
Smithland	1,452	1,238	2,188	922	1,084	1,610	967	1,773	1,115	1,534
L/D 52	1,354	571	1,110	737	596	911	977	759	635	586
Kanawha River										
London	379	329	516	465	717	850	555	513	363	311
Marmet	381	711	512	526	361	544	469	385	422	264
Winfield	420	470	404	412	666	847	916	563	736	508
Monongahela River										
Opekiska	598	495	416	342	340	246	807	740	635	487
Hildebrand	247	298	204	194	275	129	389	315	287	172
Morgantown	576	656	358	487	584	754	736	642	523	309
Point Marion	287	420	309	434	513	688	501	463	515	350
Grays Landing	53	1,042	749	1,170	1,250	1,781	1,464	1,475	1,466	777
Maxwell	2,772	2,612	1,793	2,384	2,457	2,563	2,277	2,141	2,294	1,715
L/D 4	1,916	1,941	904	1,591	1,559	1,977	1,577	1,028	1,224	738
L/D 3	2,446	2,065	1,324	1,805	1,752	1,840	1,547	1,304	1,458	984
L/D 2	2,547	3,344	1,686	2,305	2,686	3,144	2,677	2,328	2,976	1,703
Allegheny River										
L/D 8	945	1,004	918	1,025	1,687	1,926	1,020	242	1,175	595
L/D 7	972	952	1,013	1,335	1,936	1,896	1,277	1,614	1,569	1,032
L/D 6	1,283	1,136	1,113	1,259	1,541	1,483	1,258	1,391	1,367	860
L/D 5	2,265	2,375	1,782	1,983	2,367	2,438	1,891	2,018	2,112	1,431
L/D 4	3,584	3,455	2,675	2,886	3,775	3,558	2,391	2,529	2,788	1,656
L/D 3	3,958	2,772	2,526	2,879	3,439	3,495	2,628	2,780	2,882	1,940
L/D 2	8,569	9,416	6,251	7,376	6,685	8,892	6,126	8,099	7,548	5,006
Green River										
L/D 2	132	111	154	162	161	313	153	165	210	113
L/D 1	1,348	734	654	659	1,187	1,608	1,901	2,128	1,256	1,099
Cumberland River										
Old Hickory	2,886	3,128	3,339	2,818	2,586	2,911	3,164	2,708	2,592	2,402
Cheatham	1,427	1,494	1,409	1,391	1,176	1,469	1,249	1,426	1,230	951
Barkley	1,753	1,752	1,451	1,476	2,050	1,867	1,759	1,191	1,412	1,506
Tennessee River										
Ft. Loudoun	1,983	2,055	2,081	2,748	2,992	2,755	2,952	2,147	2,507	1,985
Watts Bar	2,251	2,548	3,258	2,794	4,683	4,506	3,037	2,347	2,665	2,201
Chickamauga	4,656	4,490	4,332	3,737	4,821	4,537	4,803	4,335	4,356	3,556
Nickajack	2,002	1,861	1,626	1,766	1,847	1,914	1,888	1,740	1,916	1,856
Guntersville	3,951	3,895	3,357	3,247	4,555	4,436	2,875	2,315	2,462	2,310
Wheeler	2,086	2,108	1,908	1,777	2,989	2,843	1,964	1,865	1,624	1,813
Wilson	1,655	1,620	1,120	1,497	2,297	2,072	2,283	2,281	1,746	1,789
Pickwick	1,755	1,657	1,599	1,774	2,043	2,058	1,830	1,801	1,682	1,600
Kentucky	689	650	649	536	659	858	653	574	433	430

Source: COE LPMS Data

[1/] Uniontown was renamed J.T. Myers in 1997

5. State and Port Commerce.

a. State-to-State. In 2002, as **Table 41** indicates, more Kentucky commerce moved on the ORS than any other state. Approximately 113 million tons of commerce were moved on the ORS to or from or within the state of Kentucky. Roughly 66 million tons were shipped mainly to surrounding ORB states and some other states. It received 46.6 million tons of commerce on the ORS from those states. In addition there were 13.3 million tons of commerce that moved from one Kentucky dock to another. Over 51 percent of Kentucky's commerce that shipped on the ORS consisted of coal (see **Tables 42 - 43** for other State to State commodity receipts and shipments). Many of the industries utilizing bulk commodities in the state have their own waterfront facilities along the Ohio River or several of its tributaries, including the Green, Cumberland, and Tennessee rivers. There are over 50 coal-loading facilities on these waterways. Most of the major petroleum companies have riverside loading facilities in this area. There are also over 40 dry bulk commodity facilities, other than coal, which transfer grains, aggregates and various ores.

West Virginia's 2002 commercial waterway tonnage was the second largest in the basin with 90 million tons. West Virginia shipped 61.3 million tons of commerce on the ORS and received 28.7 million tons. Of these, over 77 percent was coal. Over one-fourth of the state's total coal output is transported to market via the inland waterway. Coal moves primarily out of the Kanawha River and the port of Huntington to electric generating facilities and coking plants throughout the region.

Ohio, in 2002, had the third largest tonnage of waterborne commerce on the ORS, moving almost 72 million tons of traffic on the ORS; shipping 18.6 million tons of goods, receiving 53.4 million tons of goods.

The state's Ohio River docks are dispersed along 450 miles of the river that forms the state's southern boundary. The largest group of ORS users in Ohio is the electric power generating industry. They power the valley's heavy industries, such as chemical and petroleum corporations. These companies also use the waterway system to receive manufacturing inputs.

Pennsylvania, in 2002 had the fourth largest tonnage of waterborne commerce on the ORS, moving over 69.4 million tons of traffic on the ORS; shipping 30.3 million tons of goods, receiving 39.1 million tons of goods. Of the total commerce shipped by Pennsylvania on the ORS about 88 percent was coal. Most of Pennsylvania's industries that use the ORS are consumers of coal. They include the electric power generating industry and the steel industry. Aggregates accounted for 9 percent of the commodity movements to, from, or within Pennsylvania. Petroleum movements have declined as more crude petroleum is piped to the East Coast.

Ohio River commerce at Indiana docks in 2002 amounted to 44.2 million tons. Following coal, aggregates comprised the second most prominent commodity group, accounting for over 29 percent of all commerce shipped by Indiana on the ORS; grain was third with 9 percent.

In 2002, Tennessee moved 34.7 million tons of traffic on the ORS. Tennessee docks received about 27.6 million tons and shipped 7.1 million tons of goods on the ORS.

In Alabama, the 200-mile reach of the Tennessee River has numerous docks, which in 2002, received over 13.4 million tons of commerce and shipped another 2.6 million tons. Almost 54 percent of Alabama's shipments went outside the ORB. About 42 percent of the state's receipts were coal, coming from Kentucky and other ORB states.

The Ohio River is only one of several navigable waterways within the state of Illinois, but it is critical to the transportation of bulk commodities between the southern part of the state and other ORB states. Illinois is an overall exporter, especially of coal and grains. In 2002, Illinois shipped more than five times the commerce it received. Most of Illinois' shipments went to Indiana, about 30 percent of all shipments.

State-to-State movements of 2002 ORB traffic are summarized in **Tables 41 - 43**. **Table 41** displays interstate as well as intrastate traffic while **Tables 42 - 43** show state distributions of shipments and receipts by commodity group.

Table 41
2002 Ohio River System State to State Tonnage

	Shipping State									
Receiving State	**WV**	**KY**	**PA**	**OH**	**IL**	**IN**	**AL**	**TN**	**Other**	**Total**
West Virginia	10.5	3.6	4.8	3.3	1.3	1.3	0.0	0.0	3.9	28.7
Kentucky	11.5	13.4	1.9	1.1	5.2	2.7	0.1	1.1	9.6	46.6
Pennsylvania	13.2	2.1	17.4	2.6	0.1	0.3	0.1	0.1	3.2	39.1
Ohio	19.4	10.7	3.9	8.2	1.3	2.1	0.1	0.0	7.7	53.4
Illinois	0.2	0.6	0.1	0.1	2.0	0.3	0.2	0.2	0.5	4.2
Indiana	2.7	2.7	0.6	0.9	12.4	4.5	0.1	0.4	3.2	27.5
Alabama	0.5	5.4	0.0	0.1	3.1	0.4	0.3	0.4	3.2	13.4
Tennessee	0.4	14.3	0.7	0.2	5.0	0.2	0.3	3.3	3.2	27.6
Other	2.9	13.6	0.9	2.1	11.2	4.9	1.4	1.6	0.0	38.6
Total[1]	61.3	66.4	30.3	18.6	41.6	16.7	2.6	7.1	34.5	279.1

Source: WCSC data
[1] Totals may not equal the sum of the commodities due to rounding.

Table 42
2002 Ohio River System State Commodity Shipments
(Million Tons)

	Shipping States[1]									
Commodity	**WV**	**KY**	**PA**	**OH**	**IL**	**IN**	**AL**	**TN**	**Other**	**Total**
Coal & Coke	51.4	33.4	26.6	14.3	26.7	3.8	0.2	0.0	2.4	158.8
Petroleum Fuels	7.4	2.2	0.5	0.5	1.2	0.3	0.1	1.2	6.7	20.1
Aggregates	1.8	21.6	2.1	1.6	4.2	7.6	0.4	4.0	2.0	45.3
Grains	0.0	2.8	0.0	1.3	6.5	3.7	0.5	0.5	1.8	17.1
Chemicals	0.2	0.6	0.1	0.2	0.7	0.4	0.4	0.2	7.7	10.5
Ores & Minerals	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	6.3	6.4
Iron & Steel	0.4	1.2	0.8	0.3	0.2	0.4	0.3	0.5	8.4	12.5
Other	0.1	3.0	0.2	0.1	1.2	0.1	0.7	0.3	2.7	8.4
Total[2]	61.3	64.9	30.4	18.4	40.6	16.4	2.5	6.6	38.0	279.1

Source: WCSC Data.

[1]Includes intrastate movements.

[2]Totals may not equal the sum of the commodities due to rounding.

Table 43
2002 Ohio River System State Commodity Receipts
(Million Tons)

	Receiving State[1]									
Commodity	**WV**	**KY**	**PA**	**OH**	**IL**	**IN**	**AL**	**TN**	**Other**	**Total**
Coal & Coke	18.5	21.7	29.1	39.7	0.7	17.8	5.6	14.5	11.2	158.8
Petroleum	1.9	9.9	1.7	2.2	0.2	1.8	0.5	1.4	0.7	20.3
Aggregates	4.5	7.4	4.2	2.3	1.8	5.1	2.1	7.4	10.3	45.1
Grain	0.0	0.2	0.0	0.0	0.3	0.1	2.9	0.7	12.8	17.0
Chemicals	0.9	2.0	0.9	2.7	0.4	0.9	1.2	0.6	0.8	10.4
Ores & Minerals	0.6	1.5	0.8	1.6	0.1	0.7	0.1	1.0	0.1	6.5
Iron & Steel	1.6	2.5	1.3	3.1	0.4	0.6	0.8	0.6	1.7	12.6
Other	0.9	1.3	1.2	1.7	0.4	0.4	0.4	1.2	0.9	8.4
Total[2]	28.9	46.5	39.1	53.4	4.3	27.4	13.6	27.4	38.5	279.1

Source: WCSC Data.

[1]Includes intrastate movements.

[2]Totals may not equal the sum of the commodities due to rounding.

b. <u>Port Statistics</u>. Ohio Basin commerce statistics are available for eight ports as shown in **Tables 44 - 45**. The first shows port statistics for 2002 by commodity for the five largest ports in the basin, all of which are on the Ohio River. The second table gives statistics by shipment and receipts for all eight ports. Port definitions are based upon dock locations. For example, the port of Pittsburgh includes all docks along 113 miles of waterway that extends to mile 40 on the Ohio, mile 43 on the Monongahela and mile 30 on the Allegheny River.

The port of Huntington is defined as 100 miles on the Ohio, 90 miles on the Kanawha and 9 miles on the Big Sandy and is now the largest port in the ORB with 81.1 million tons of traffic in 2002. Pittsburgh, with 52.1 million tons, is the second largest port on the ORS in terms of total tonnage. **Table 44** shows that in 2002, traffic at the ports of Huntington and Mt. Vernon grew from the previous year, while traffic at Pittsburgh, Louisville and Cincinnati declined. Of the 279.1 million tons of traffic moved in the basin in 2002, **Table 45** shows that 157.8 million tons (57 percent) were received or shipped at one of these ports. The ports of Pittsburgh and Huntington, due to their large area, demonstrate the most "local" traffic in which cargo is loaded and unloaded within the port's dimensions. Also, Huntington is primarily a shipping port while Pittsburgh is more of a receiving port.

Table 44
2002 Commerce at Principal Ohio River Ports
(Million Tons)

Commodity	Pittsburgh	Huntington[1]	Cincinnati	Louisville	Mt. Vernon
Coal & Coke	40.8	64.3	4.4	1.4	1.2
Petroleum Fuels	2.0	9.7	2.2	3.2	0.3
Aggregates	4.2	3.1	1.0	1.8	0.0
Grains	0.0	0.0	1.4	0.1	1.3
Chemicals	1.0	1.6	1.5	0.4	0.9
Ores & Minerals	0.8	0.4	0.5	0.1	0.1
Iron & Steel	2.0	1.2	1.3	0.3	0.0
Other	1.2	0.7	0.6	0.6	0.1
Total[2]	52.1	81.1	13.0	7.8	3.8
Percent Change from 2001	-1.7%	5.7%	-7.8%	-13.3%	26.7%

Source: WCSC Data

[1]Port of Huntington was expanded from 14 miles to 199 miles in 2000

[2]Totals may not equal the sum of the commodities due to rounding.

Table 45
2002 Ohio River System Port Commerce
(Million Tons)

Port	Receipt	Shipment	Intraport	Total
Pittsburgh	21.7	13.0	17.4	52.1
Huntington	13.9	60.7	6.5	81.1
Cincinnati	11.5	1.5	0.0	13.0
Louisville	6.9	0.9	0.0	7.8
Mt. Vernon	1.1	2.7	0.0	3.8
Nashville	4.0	0.2	0.0	4.2
Guntersville	1.8	0.7	0.0	2.5
Chattanooga	2.4	0.4	0.0	2.8
Total	63.3	80.1	23.9	167.3

Source: WCSC Data

Photo 27: A towboat pushes its 15-barge tow through Newburgh Lock and Dam on the Ohio River.

PART 4. OTHER SOURCES OF WATERWAY INFORMATION

1. <u>Waterborne Commerce Statistics Center</u>. The WCSC publishes a five volume annual report "Waterborne Commerce of the United States". Part 2 contains Ohio River System data and Part 3 contains Great Lakes data. Both can be purchased from:

Waterborne Commerce Statistics Center
U.S. Army Corps of Engineers
PO Box 61280
New Orleans, LA 70161-1280

They also annually update a data file compiled from their national origin-destination commerce file. To maintain confidentiality of shipper information, commerce data are made public in summary form only or as statistical abstracts. A response to an individual request will include all commerce data for the three most recently available years, summarized by reach and 15 commodity groups. This information is available on disk and in hard copy. These listings include:
-reach to reach combinations, sorted by the origin river reach;
-reach to reach combinations, sorted by the destination river reach;
-commodity groups sorted by the origin river reach.

For data requests or more information, call the Corps' WCSC Office in New Orleans at (504) 862-1470.

2. <u>Navigation Condition Report</u>. A navigation condition report is available for ORS navigation users. It is updated daily and provides information on gage readings, weather and ice conditions, dam conditions, precipitation, tows waiting, tows locked and delay times for each lock in the basin. This service is free to the public and access can be obtained at www.lrd-wc.usace.army.mil/navreps.html. For more information, call (513) 684-6055 or e-mail navinfo@www.lrd-wc.usace.army.mil.

3. <u>Lock Performance Monitoring System Statistics</u>. Lock specific statistics are available on the portions of the inland waterway system having locks. They are based on tow related data collected from towboat operators during lockages and are maintained by the Corps' Navigation Data Center (NDC) in a data base system known as the Lock Performance Monitoring System (LPMS).

The lock specific tonnage data contained in this file are based on a different collection methodology and data source than the WCSC database and will differ from those values. It is not possible to obtain tonnages and ton-miles for river systems from this source. For these reasons the WCSC records, which are usually a year behind the LPMS records, are used for river system statistics and the LPMS data are used for navigation project statistics.

The Navigation Data Center publishes a quarterly summary of lock statistics for use by waterway planners and shippers, which may be obtained free of charge from:

U.S. Army Corps of Engineers
CEWRC-NDC
7701 Telegraph Rd., Casey Building
Alexandria, VA 22315

The Water Resources Support Center will also respond to specific requests for more detailed file information subject to the Corps' confidentiality constraints. These reports are computer generated and are furnished at cost. Contact the NDC at (703) 428-9061 for more information.

4. Dock Listings. A listing of dock facilities is published by the Port Facilities Branch of the Navigation Data Center. The 57 separate reports in the Port Series cover the principal U.S. Coastal, Great Lakes, and Inland ports. They can be contacted at:

Navigation Data Center
CEWRC-NDC-P
7701 Telegraph Rd., Casey Building
Alexandria, VA 22315-3868
(703) 428-8059 or FAX (703) 428-6047

e-mail:
donna.l.norbutt@usace.army.mil

5. Relevant Web Pages.

U.S. Army Corps of Engineers Headquarters:
www.usace.army.mil

Great Lakes and Ohio River Division (CE-LRD):
www.lrd.usace.army.mil/ (main page)

Huntington District (CE-LRH):
www.lrh.usace.army.mil (main page)
outreach.lrh.usace.army.mil (Navigation Outreach page)
www.lrh.usace.army.mil/about/capabilities
inlandwaterways.lrh.usace.army.mil/ (Center of Expertise for Inland Navigation page)

Louisville District (CE-LRL):
www.lrl.usace.army.mil

Pittsburgh District (CE-LRP):
www.lrp.usace.army.mil

Nashville District (CE-LRN):
www.lrn.usace.army.mil

Buffalo District (CE-LRB):
www.lrb.usace.army.mil

Chicago District (CE-LRC):
www.lrc.usace.army.mil

Detroit District (CE-LRE):
www.lre.usace.army.mil

Navigation Data Center (NDC):
www.iwr.usace.army.mil/ndc

Waterborne Commerce Statistics Center (WCSC):
www.iwr.usace.army.mil/ndc/wcsc.htm

Navigation Information Connection (NIC):
www.mvr.usace.army.mil/navdata/nic.htm (main page)
www.mvr.usace.army.mil/navdata/boat-loc.htm (vessel locations)
www.mvr.usace.army.mil/navdata/boat-que.htm (vessels queued at locks)

Navigation Investment Technologies (NETS)
www.corpsnets.us

Government Printing Office (Navigation charts)
bookstore.gpo.gov

Rahall Transportation Institute at Marshall University
www.marshall.edu/ati

Coast Guard (USCG)
www.uscg.mil

Maritime Administration (MARAD)
marad.dot.gov

International Joint Commission (IJC)
www.ijc.org

Great Lakes Commission (GLC)
www.glc.org

Saint Lawrence Seaway Development Corporation (SLSDC) and St. Lawrence Seaway Management Corporation (SLSMC)
www.greatlakes-seaway.com

Tennessee Valley Authority (TVA)
www.tva.gov

6. Private-sector Organizations.

Waterway Councils, Inc.
www.waterwayscouncil.org

American Association of Port Authorities
www.aapa-ports.org

Port of Pittsburgh PA
www.port.pittsburgh.pa.us

Ports of Indiana
www.portsofindiana.com

National Waterways Conference
www.waterways.org