

NATIONAL
WATERWAYS STUDY-
A FRAMEWORK FOR
DECISION MAKING-
A SUMMARY



AUTHORITY FOR THE NATIONAL WATERWAYS STUDY

The Congress authorized the National Waterways Study (NWS) and provided the instructions for its conduct in Section 158 of the Water Resources Development Act of 1976 (Public Law 94-587).

The Secretary of the Army, acting through the Chief of Engineers, is authorized and directed to make a comprehensive study and report on the system of waterway improvements under his jurisdiction. The study shall include a review of the existing system and its capability for meeting the national needs including emergency and defense requirements and an appraisal of additional improvements necessary to optimize the system and its intermodal characteristics. The Secretary of the Army, acting through the Chief of Engineers, shall submit a report to Congress on this study within three years after funds are first appropriated and made available for the study, together with his recommendations. The Secretary of the Army, acting through the Chief of Engineers, shall upon request, from time to time, make available to the National Transportation Policy Study Commission established by Section 154 of Public Law 94-280, the information and data developed as a result of the study

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NATIONAL WATERWAYS STUDY A FRAMEWORK FOR DECISION MAKING A SUMMARY

BACKGROUND

From its beginning, the nation has looked to its waterways as a vital natural and commercial resource, guiding its westward development and shaping its role as the world's dominant industrial force. The U.S. Army Corps of Engineers has played an important role in managing this resource by executing the national policies which have maintained an unimpeded flow of foreign and domestic commerce and by managing the use of the waterways for a broad range of public and private purposes.

The waterways and ports displayed in Figures S-1 and S-2 have served the nation well, promoting national development, wealth and defense. The role of transportation in the U.S. economy has gradually changed in response to the shifts in population and in industrial production, the expansion of agriculture, and a growing national dependence upon foreign trade. The strategic role of the waterways in this dynamic interaction of production and distribution also has changed.

The free flow of commerce was a paramount objective in the earliest days of the nation. The Commerce Clause of the Constitution provided the basis for establishment of the Federal interest in the ports and waterways. The Ordinance of 1787 and other acts of Congress emphasized the importance of unimpeded access to the waterways for all users on an equal basis.

Today, there are over 25,000 miles of inland, intracoastal and coastal waterways in the United States. Of these, the modern waterways system includes 11,000 miles of shallow draft channels (9-17 feet) and another 1,000 miles of deep draft channels (18 feet or greater). Over 200 lock and dam sites, in addition to thousands of training structures, are located throughout the modern system

In reviewing the development of the waterway system over the past 200 years, Congress determined that there was a need for a more comprehensive analysis of the waterway system from a national perspective. Its concerns included the serious constraints that exist on the efficient use of our principal waterways, the fact that it was an aging system with increasing maintenance and rehabilitation problems, and the changing trends in world and U.S. trade, particularly in coal and agricultural commodities. Through Section 158 of the Water Resources Development Act of 1976,

Congress directed the Secretary of the Army, acting through the Chief of Engineers, to prepare a National Waterways Study to review the capacity of the existing system for meeting a variety of national goals and objectives.

In undertaking this study, the Corps set forth a framework for critical decisions that will enable the nation to enter the 21st century with a strong and viable national waterway system.

TRAFFIC PROJECTIONS

In order to determine potential system needs, the National Waterways Study (NWS) projected unconstrained waterborne commerce under seven scenarios specifically constructed to show the wide range of potential conditions and events that might impact on future use of the waterways. None of the scenarios considered increases in user-charges beyond the fuel tax specified in P.L. 95-502.

Based on these scenarios, increases for total waterborne traffic ranging between 24 and 51 percent were projected for the period 1977 through 2003. The four leading growth commodity groups and their maximum potential growth include:

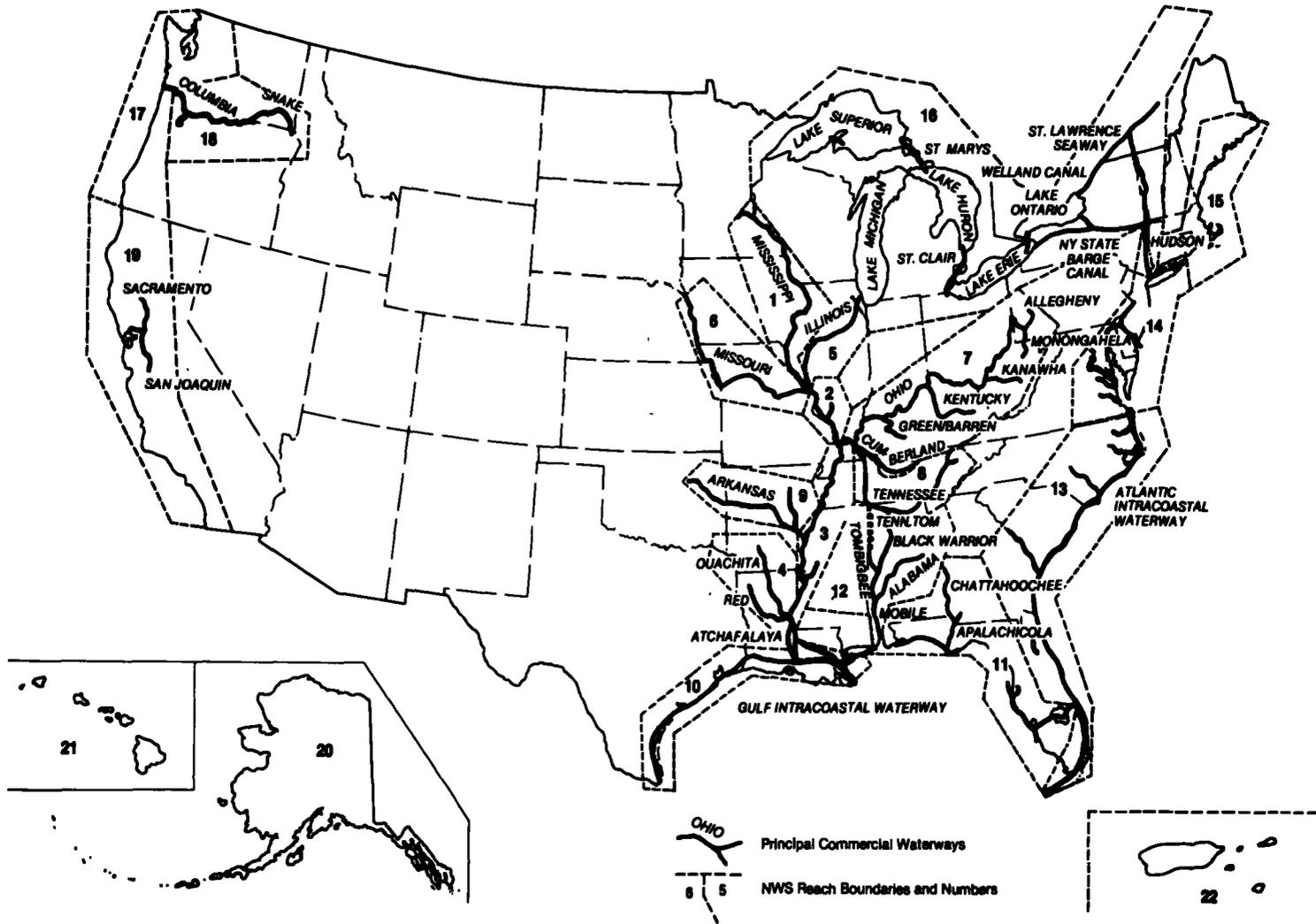
—Coal	280%
—Agricultural Products	127%
—Metals and Ores	112%
—Chemicals/Fertilizers	83%

In contrast, petroleum is projected to decline by as much as 37 percent between 1977 and 2003. With the increased emphasis on coal, domestic traffic in energy products begins to grow at an increasing rate as foreign imports of petroleum decline. Figure S-3 presents one set of these projections.

Coal is forecast to make up 24 percent of the nation's waterborne commerce by 2003, up from 11 percent in 1977. Agricultural products and metals and ores account for the next largest increase; the former is expected to grow from 11 to 17 percent of total traffic, while the latter is expected to grow from 8 to 11 percent during the same period.

The number one growth leader geographically, in terms of total tonnage by 2003, is the Lower Mississippi River, south of Baton Rouge. Agricultural product exports play a key role in the growth within this reach. For purposes of this study the waterways were organized by reaches, see Figure S-1. Metal and ores play a corresponding role on the second ranking reach, the Great Lakes

**Figure S-1
NATIONAL WATERWAYS**



- | | | | |
|--|----------------------------------|--|------------------------------------|
| 1. Upper Mississippi River | 7. Ohio River System | 13. South Atlantic Coast | 19. California Coast |
| 2. Lower Upper Mississippi River | 8. Tennessee River | 14. Middle Atlantic Coast | 20. Alaska |
| 3. Lower Mississippi River: Cairo to Baton Rouge | 9. Arkansas River | 15. North Atlantic Coast | 21. Hawaii and Pacific Territories |
| 4. Lower Mississippi River: Baton Rouge to Gulf | 10. Gulf Coast - West | 16. Great Lakes System | 22. Caribbean |
| 5. Illinois Waterway | 11. Gulf Coast - East | 17. Washington/Oregon Coast | |
| 6. Missouri River | 12. Mobile River and Tributaries | 18. Columbia-Snake Waterway/Willamette River | |

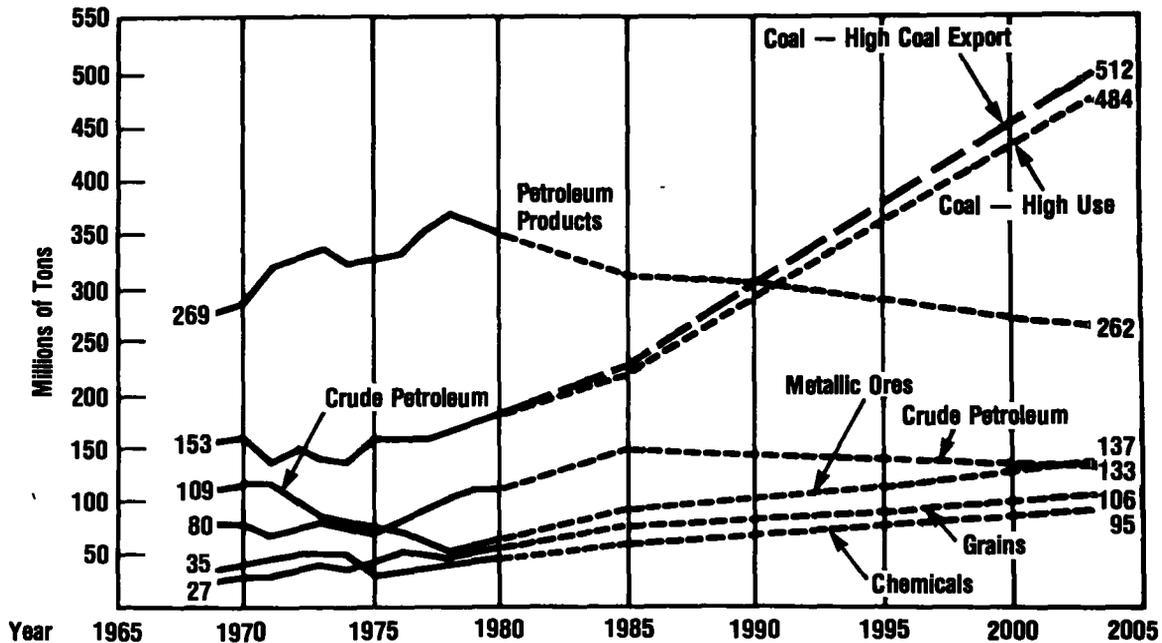
S-2

**Figure S-2
INLAND, COASTAL AND GREAT LAKES PORTS (Handling Over 5 Million Tons)**



Figure S - 3

**MAJOR COMMODITIES IN U.S. DOMESTIC WATERBORNE COMMERCE
HISTORICAL AND PROJECTED (HIGH USE AND HIGH COAL EXPORT
SCENARIO), 1969-2003**



System. Growth in the third and fourth ranked reaches — the Ohio River System and the Mobile River and Tributaries — is based on expected increases in the transport of coal.

The requirements of maintaining a viable waterway system for national defense purposes were given special consideration in one NWS scenario. This scenario is based on the logistic requirements of a 5-year, two-front conflict. Under these assumptions, the Great Lakes system would dominate in terms of total traffic increases. The nation, during the hypothetical conflict, would use more of domestic iron ore, thereby raising the importance of the Great Lakes. And, to make up for the potential interruption in foreign petroleum shipments, U.S. refineries would need to rely upon coastal waterways as a route for shipments of crude oil from Alaska and other Western Hemisphere sources.

Figure S-4 presents the range of lowest to highest projections (excluding those prepared for the Defense scenario) for total and foreign traffic. The lowest projections developed for the NWS provide a reasonable lower bound for traffic growth.

SYSTEM CAPABILITY

The potential water transportation-related problems addressed in NWS were classified as

those associated with increasing age and technological obsolescence of facilities in the system and those due to limited system capacity. These problems are summarized in Table S-1.

The most common problem limiting capability of the waterway system is that of aging locks for which projected traffic levels will either exceed physical lock capacity or result in severe delays. Aging, coupled with obsolescence, increases the likelihood that some locks may go out of service during critical use periods. A few newer locks are expected to experience significant congestion and delays because of capacity limitations. Seventy locks are candidates for major renovation or replacement. Forty-four of those locks are probable sources of significant congestion and delay. Early in the 21st century, if high levels of coal traffic materialize, capacity beyond that available within two locks may be required on the Ohio River System.

Several coastal ports may require deepening to facilitate the loading of vessels in excess of 100,000 deadweight tons (DWT), if the potential foreign markets for U.S. coal are to be fully developed. Draft restrictions in Eastern and Gulf coast ports limit utilization of the most cost effective vessels which can access many foreign ports.

INDUSTRIAL MOBILIZATION — SUPPORT FOR MILITARY GOODS PRODUCTION

Waterways historically have been a critical element of the U.S. transportation system, which provides for the rapid expansion of the industrial base in support of the nation's defense. The industrial base necessary for defense mobilization was defined by Defense Mobilization Order No. 23, issued by the Director of Defense Mobilization on November 23, 1953:

The mobilization base is that capacity available to permit rapid expansion of production, sufficient to meet military, war supporting, essential civilian, and export requirements in event of a full-scale war. It includes such elements as essential services, food, raw materials, facilities, production, equipment, organization and manpower.

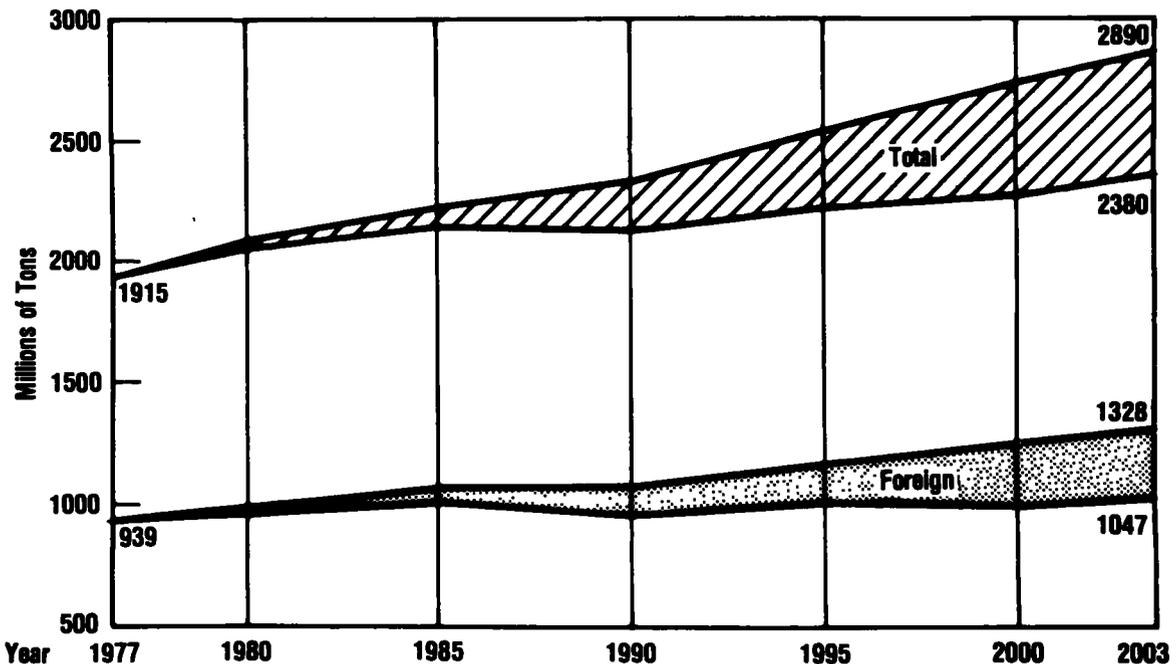
Success of a nation in military conflict is dependent on safe, reliable transportation of input material for production, as well as delivery of final products. A study of the potential movements of production materials by water strongly suggests that waterways will continue to be the prime and critical mover of bulk commodities during times of industrial mobilization.

The NWS evaluated the contribution that the waterway system could make to mobilizing strategic materials for a two-front overseas war of five years duration. The analysis was based on an assumption

of mobilization beginning in 1985 and ending in 1990. The Defense scenario is described in Appendix A to the NWS technical report, *Evaluation of the Present Navigation System*. The scenario envisions that steel mill production, grain exports, oil imports, domestic oil shipments, chemical movements, and other waterway commodity flows would be significantly affected. The scenario projects increases in domestic movements of metals and ores of over 140 percent, and in domestic petroleum flows of over 200 percent. In addition, domestic chemical flows are forecast to increase by over 20 percent and domestic agricultural and coal flows are forecast to increase by over 10 percent. The scenario assumes that foreign sources of strategic bulk commodities would be restricted, causing shifts to Western Hemisphere sources, affecting particularly Great Lakes and coastal waterways traffic.

Waterways problems identified during a hypothesized war of five years duration are situated on several reaches of the U.S. waterways. The Great Lakes and U.S. coastal reaches, respectively, face peak loadings of ores and petroleum. The Ohio River, Illinois Waterway, Lower Upper Mississippi River and Mobile River and Tributaries reaches face wartime-induced growth of a much broader mix of industrial support commodities. These traffic surges exacerbate problems associated with the aging and already congested lock structures.

Figure S-4
U.S. WATERBORNE COMMERCE, 1977-2003



FRAMEWORK

A framework of potential improvements was developed, based on the premise of maintaining the capability of the waterway system to meet the projected needs for service. The framework emphasizes maintaining and achieving reliability and efficiency within the water transportation system. The summary framework presented in Table S-2 reflects forecast needs organized within closely interrelated portions of the waterway system. It is within those portions of the waterway system that the NWS needs are evaluated. The "earliest date" shown in Table S-2 is the date when any one project is forecast as being required. This date highlights the need for process acceleration; that is, the need to shorten the current planning-construction process, which presently averages in excess of 15 years, in order to meet any given portion's earliest problem.

Aging lock structures requiring major rehabilitation, replacement or supplementation to

maintain safe, reliable and efficient performance are major factors influencing the capability of the waterways system through the remainder of this century and into the next. By 2003, congestion due to limited capacity is estimated to increase the waterborne freight bill by over \$1 billion annually. Based upon NWS physical evaluation parameters, 62 U.S. locks and 8 Canadian locks need to be considered for modernization — renovated, replaced and/or supplemented — in the next 20 years. Additionally, channel work in a limited number of waterways and in coastal channels would significantly contribute to achieving more efficient use of vessels and existing waterway structures.

Imposition of additional user fees and other changes in economic conditions may reduce traffic growth below the highest projection levels used to identify the capability limits of the waterway system in the NWS. If capability is assessed against the lowest NWS projections, the need for additional capacity at some sites would be delayed. Therefore, traffic should be monitored and projections systematically updated. The Inland Waterway Trust

Table S-1

WATER TRANSPORTATION PROBLEMS AND FORECAST MAXIMUM NEEDS THROUGH THE YEAR 2003

Reliability

- 105 locks (97 U.S. and 8 Canadian) are over 50 years old and/or technologically obsolete (56 of these have substantial commercial use and 30 of the 56 are forecast to be at or near capacity by 2003).
- Dredging and material disposal restrictions impede maintenance.

Safety

- 210 sites with hazardous navigation conditions, include 12 lock related problems.

Efficiency

- 44 locks (36 U.S. and 8 Canadian) are congested (30 of these also pose reliability problems).
- 37 percent increase in domestic linehaul costs from 1977 to 2003 will occur in the absence of system improvements.
- Absence of deep draft ports (50-55 feet) on Gulf and Atlantic coasts reduces competitive position of the U.S. in world trade.
- Agricultural products and coal are most affected by efficiency-related problems.

Capacity

- 28 locks (20 U.S. and 8 Canadian) are forecast to constrain traffic physically (18 of these also pose reliability problems).
- Over 100 million tons are foreseen as not being handled by 2003 due to lock constraints.
- Agricultural products and coal are most affected by capacity limitations.

Defense

- 70 million tons of commerce cannot be handled due to lock restraints.
- Metals and ores are most affected.
- Sault Ste. Marie lock site is a major bottleneck.
- 24 locks (16 U.S. and 8 Canadian) congest or constrain traffic.
- Traffic in coastal reaches increases drastically, principally petroleum.

1 Mobilization impact at the end of 5-year, 2-front conflict, ending in 1990.

Table S-2
SUMMARY FRAMEWORK — POTENTIAL INVESTMENT NEEDS¹

Potential Investment Needs ²		System Study ¹	Earliest Date Project Required ⁴		Need for Process Acceleration ⁵
Maintain	Improve		Aged	Congested	
<u>L. Up. Miss.</u>	Second Lock 26	Lock 26	—	1981	Yes
<u>Great Lakes (3)</u>	Sault Ste Marie	Sault Ste. Marie	—	1990	Yes
<u>Ohio River System and Tenn. R. (4)</u>					
Gallipolis		Gallipolis	1985	1985	Yes
Emsworth		Upper Ohio	1980	1990	Yes
Montgomery					
Dashields					
Kentucky-Tenn.	McAlpine Newburgh Uniontown Lock 52 Lock 53 Deepen Channel	Lower Ohio and Tennessee	1995	1990	Yes
Monongahela-3, 4, 7 & 8		Monongahela	1980	—	Yes
Winfield-Kanawha		Kanawha	1985	—	No
Marmet-Kanawha					
<u>Illinois Waterway (2) (4)</u> <u>and Lower Upper Miss (3)</u>					
Marseilles		Illinois	1983	1985	Yes
Peoria					
LaGrange					
Lockport					
Brandon Road					
Dresden Island					
Starved Rock	Lock 27				
<u>Gulf Coast-West (2)</u>					
Harvey	Algiers	Gulf Coast-West	1985	1995	No
Calcasieu					
<u>Mobile River and Tributaries (1) (3)</u>					
Oliver	Demopolis Coffeeville Warrior Holt Bankhead Channel Mod	Mobile River and Trib.	1989	1990	Yes
<u>Upper Mississippi (1) (3)</u>					
Locks 2-17		Upper Mississippi	1986	1990	Yes
Locks 18, 20-25					
<u>Gulf Coast-East (0) (3)</u>					
Inner Harbor		Inner Harbor	1980	1980	Yes
<u>Columbia-Snake Waterway (0) (2)</u>					
Bonneville		Bonneville	1987	1990	No

1. Based on consideration of four objectives — economics, energy, exports and defense, framework is for shallow draft and Great Lakes Waterway System.
2. Reaches are listed according to number of times (first numeral in parentheses) each one is among the leading four contributors to the four national objectives. A second number (in parentheses), is shown only if different from the first, to reflect the total number of objectives the reach contributes significantly to, but need not be among the leading four contributors. Projects are listed under the "maintain" column if the site includes a project which is both 50 years old and is heavily used by 2003. If the need involves projects which are less than 50 years old, but exhibit serious congestion by 2003, it is listed under "improve".
3. Studies are identified by the approximate geographical coverage, given the interrelationships between and within reaches.
4. Earliest date any one need in a closely interrelated group of projects is exceeded. Need is expressed when a lock exceeds its 50 year engineering life (aged) or 80 percent utilization (congested).
5. The existing civil works process (median time of 15 years) as applied to any one project's status where that process requires process acceleration (Yes) or not (No) to meet the earliest forecast need.

Fund would provide a reliable source of funds from which needed improvements could be made

Costs, estimated in 1982 dollars, to complete the U.S. navigation projects currently under construction are \$2.9 billion; another \$8.9 billion is estimated for rehabilitation and improvement of the inland waterway system as shown in Table S-2.

FINDINGS AND CONCLUSIONS

The National Waterways Study findings, conclusions and their implications for decision makers cover a wide breadth of areas. These findings will influence the nation's achievement of a modern water transportation system and consequently, the nation's economic revitalization.

TRAFFIC AND MODAL SHARES

Waterborne forecasts indicate a growth of between 24 and 51 percent from 1977 to 2003. Coal and grain are the chief contributors to this growth, increasing by as much as 280 and 127 percent, respectively. The Ohio River leads in total tonnage growth based on the High Coal Export scenario. In percentage terms, the Mobile River and Tributaries reach leads.

Rail is forecast to increase its share of the total movements of domestic commerce carried by three competing modes — rail, water and pipeline — from 39 to 48 percent by 2003. The share of domestic traffic moved by water is forecast to decline slightly from 28 to 26 percent, while that transported by pipeline drops from 33 to 26 percent

WATERWAY CAPABILITY

Insufficient lock capacity at 28 locks, 20 U.S. and 8 Canadian, may restrict the transit of more than 100 million tons by 2003. An additional 16 locks are likely to reach significant delay levels. Increasing congestion due to capacity limitations will increase shippers' operating costs by nearly a billion dollars on the inland system and by another half-billion dollars on the Great Lakes by 2003.

The very large number of old (50 years or more) structures, 97 U.S. locks by 2003, require a major program of site specific engineering and economic studies leading to resolution of a potentially major reliability crisis on the U.S. waterways.

Maintenance of the capability of the U.S. waterways will necessitate increased levels of funding for modernization of structures, possibly double the levels experienced in 1970s.

DEFENSE

Traffic on the Great Lakes was forecast to increase by 137 million tons of traffic, a 45 percent

increase over peacetime conditions, under the Defense scenario. This hypothesized surge resulted in a 70 million ton shortfall in lock capacity at the Sault Ste. Marie Locks. The eight heavily congested Welland Canal Locks (Canadian) were also forecast to remain congested under mobilization assumptions.

The U.S. waterways provide a key support for industrial base mobilization in times of war. The coastal channels are indispensable for successful rapid deployment and resupply. Defense and industrial mobilization considerations should be included in all future planning studies in the design of structural improvements and in the budget formulation process.

IMPEDIMENTS TO MAINTAINING AND IMPROVING WATERWAYS

The removal of physical constraints and the maintenance of a viable system of ports and waterways cannot be accomplished without first removing unnecessary administrative barriers. The time span from study authorization through construction averages 15 years, or more; procedural changes could reduce the time.

- Legislative authorization and appropriation processes are major contributory factors to this delay. As shown in Figure S-5, they consume almost half of the elapsed time for projects.
- Dredging and dredge material disposal have become increasingly complex due to the mix of restrictions associated with environmental and other regulatory policies. The Federal responsibility under the Interstate Commerce Clause requires that the Federal Government maintain waterways for free flow of interstate commerce. The rapidly increasing costs of dredging and disposal of dredged material in the 1970s, however, were linked to environmental and other regulatory policies, and to increasing fuel prices

POLICY IMPLICATIONS OF THE NWS

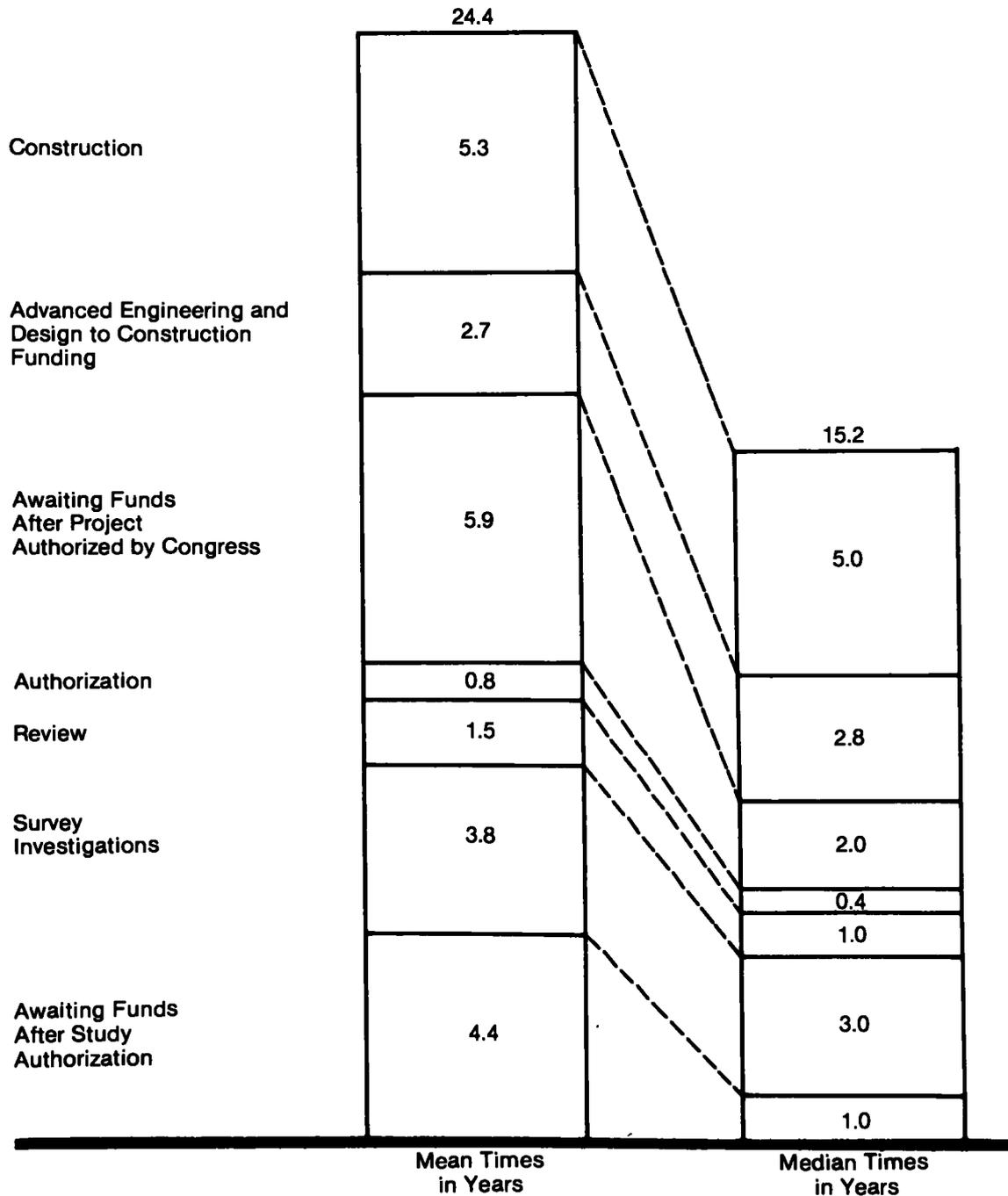
Two major categories of policy change are required if the United States waterways system is to be maintained as an effective transportation system into the 21st century: the first, in maintaining support capability for waterway system decisions, and the second, in making administrative changes to encourage and allow more timely actions.

SUPPORT FOR WATERWAY SYSTEM DECISIONS

The National Waterways Study may be used to identify an early action phase for waterway improvements and to help schedule a complete study program. However, its value over the long

Figure S- 5

MEAN AND COMPOSITE MEDIAN COMPLETION TIMES FOR MAJOR COMPONENTS IN THE PLANNING, DESIGN AND CONSTRUCTION OF CIVIL WORKS PROJECTS (YEARS)¹



1. Times are based on 36 projects completed in Fiscal Years 1973, 1974 and 1975.

run is in the process used in shaping the choices coming before decision makers. This can be done if new traffic trends, projections, needs, and priorities are consistently incorporated into waterway studies.

A central support capability should be provided for:

- Monitoring and Analysis of Traffic Trends
- Periodic Update of Traffic Projections
- Periodic Review of Waterway Investment Priorities
- Periodic Reassessment of Defense Mobilization Scenarios

The ability to plan and operate water transportation systems for their potential role of industrial base mobilization support during emergencies focuses attention on the need to develop systematic procedures for integration of defense mobilization requirements into the decision making process in the following areas:

- Project Operation and Maintenance
- Project Plan Formulation
- Project Design
- Budget Formulation

ADMINISTRATIVE CHANGES FOR TIMELINESS

Consideration should be given to additional administrative changes which could improve timeliness of decisions and implementation of actions. For example, one concept implemented by the Corps of Engineers in Fiscal Year 1982 allows for funding high priority projects for continued planning and engineering during Administration or Congressional review of the feasibility (survey)

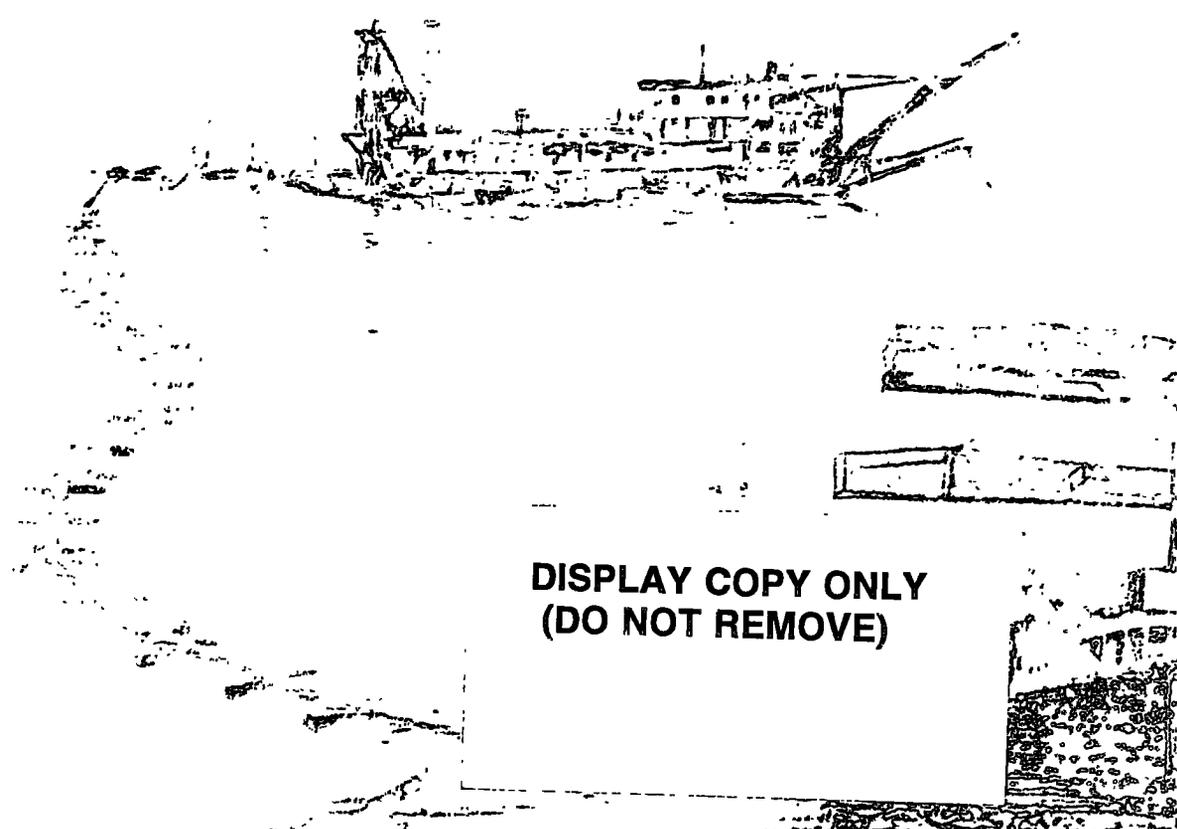
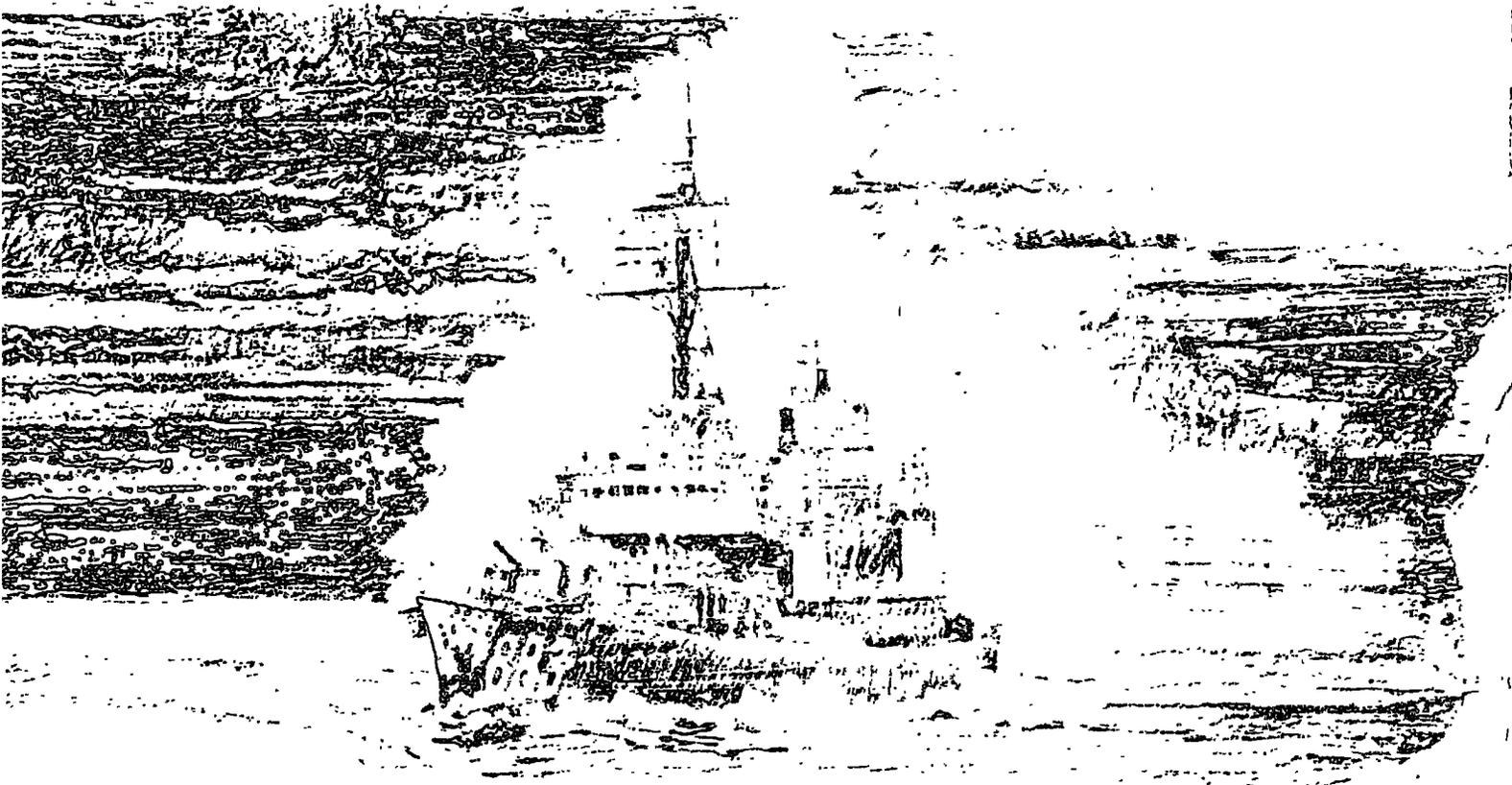
report. This would ready a project for construction start in the shortest possible time by maintaining momentum associated with the survey. It is expected that this technique alone will reduce project completion time by several years.

Other major changes identified by NWS as capable of improving timeliness substantially, but not yet acted upon, include.

- Implementation of a systems approach to modernization in order to maintain a viable waterway system. The interdependency of the various components of the inland navigation system, as demonstrated by the NWS, leads to the conclusion that systems approach to replacement and rehabilitation is needed. The criterion, furthermore, should be one of cost effectiveness, once the decision is made to maintain the system, per se. This procedure, as contrasted to the traditional benefit/cost analysis, would also provide the most efficient solution to accomplish a specific objective.

- Reduction of the number of projects which require full Congressional approval. This may be accomplished by authorizing the Secretary of the Army, acting through the Chief of Engineers, to undertake rehabilitations and improvements to the existing waterway facilities which, in his judgment, are necessary to accommodate projected navigation needs efficiently.

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