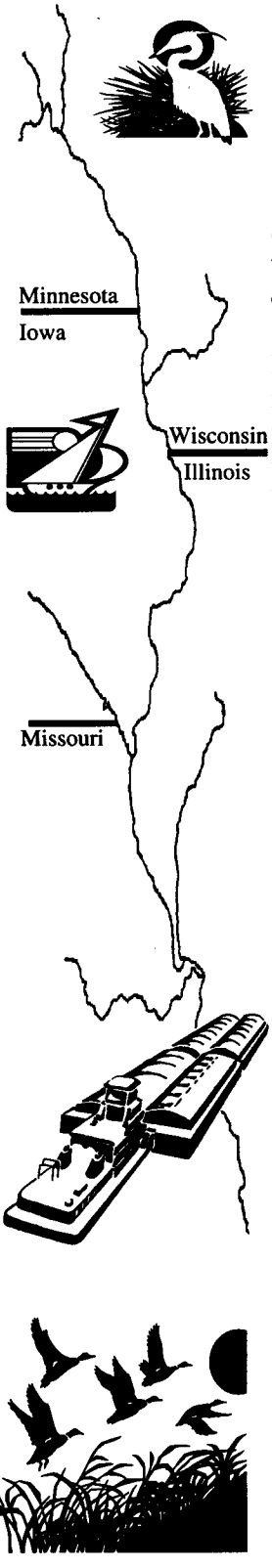
US Army Corps of Engineers

Upper Mississippi River - Illinois Waterway System Navigation Study

UMR-IWW System Navigation Study Newsletter January 1997 Vol. 4 No. 1



Draft Unconstrained Traffic Projections Released

Traffic on the Upper Mississippi River will steadily increase between the years 2000 and 2050, growing by about 63 percent over these years, according to a preliminary traffic forecast based on commodity trends.

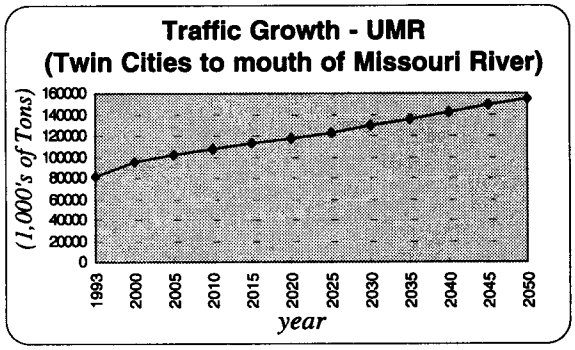
However, the independent forecast prepared for the Navigation Study indicates river traffic will increase at a rate slightly lower than projected in a similar 1988 study done by the Institute for Water Resources. The 1988 projections were used for the U.S. Army Corps of Engineers Reconnaissance Study.

"The new projections tell us congestion is still going to occur, but at a slower rate," said Paul Soyke, chief of the Economic and Social Analysis Branch of the Rock Island District and a member of the Economics Work Group.

If the draft projections are adopted as they now stand, potential navigation improvements might be smaller -- or implemented later -- than originally forecast in the Reconnaissance Study.

"As part of the plan formulation process, we'll be looking at what the forecast means in terms of overall traffic delays at the locks," said Dave Tipple, study manager. "The numbers are key in determining the need for and timing of improvements."

The traffic forecast, independently developed by Jack Faucett Associates of Maryland, indicates tonnage carried on the Upper Mississippi River will increase from the average of 81 million tons hauled each year in the early 1990s to 155 million tons by 2050. Tonnage on the Illinois Waterway is projected to increase from 44 million tons annually in 1991-1993 to 81 million tons in 2050.



The forecast predicts an average growth rate of 2 percent per year on the Upper Mississippi River during the remainder of the 1990s, a growth rate similar to projections made in the earlier study. However, the new traffic report shows a slightly lower percentage increase of approximately 1.5 percent a year between 2000 and 2005 and an approximate 1 percent growth rate for the remainder of the study period (2005-2050). The Illinois Waterway is expected to see a similar trend with a 1.8 percent annual increase in the 1990s, followed by an increase of 1.4 percent in the first five study years and

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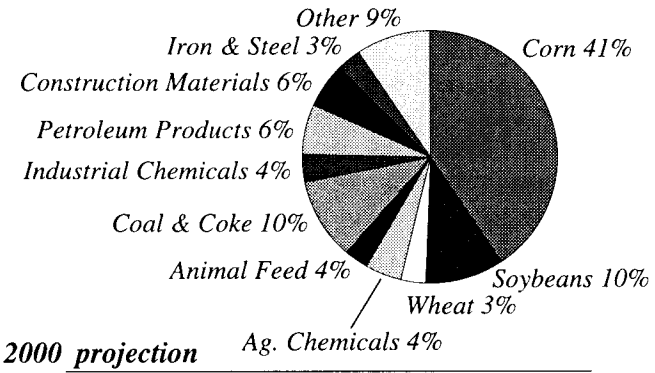
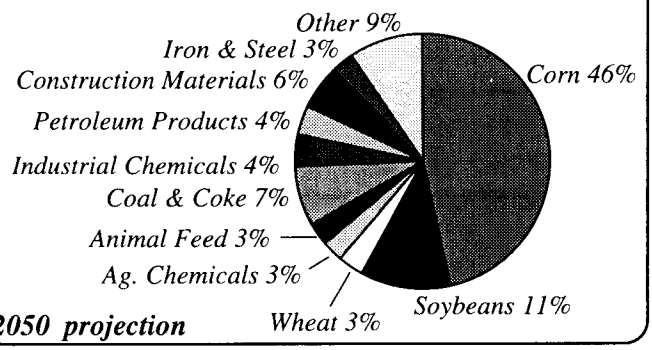
approximately a 1 percent annual increase for the remaining study years.

The figures will remain tentative, however, until contractors from Jack Faucett Associates have a chance to respond to comments or concerns generated by the Corps and members of the Governors' Liaison and Economic Coordinating Committees. The traffic forecast report is expected to be finalized in mid-March. It will then become a critical piece of the overall Navigation Study, which is determining the feasibility of navigation improvements on the system including eight locks and 348 miles of the Illinois Waterway and 29 locks and 854 miles of the Upper Mississippi River.

The projected increase in traffic does indicate a likely need for some form of improvement to a river navigation system already facing some bottlenecks, said Paul Bertels, an economist with the U.S. Department of Agriculture and a member of the Economics Coordinating Committee. According to Corps analysis, there was an average delay of seven hours per tow (towboat pushing up to 16 barges) at Lock 22 in 1995, with an average of three hours delay per tow at the locks down-

Percentage of Traffic Movements on the Upper Mississippi River by Commodity
(Twin Cities to mouth of Missouri River)



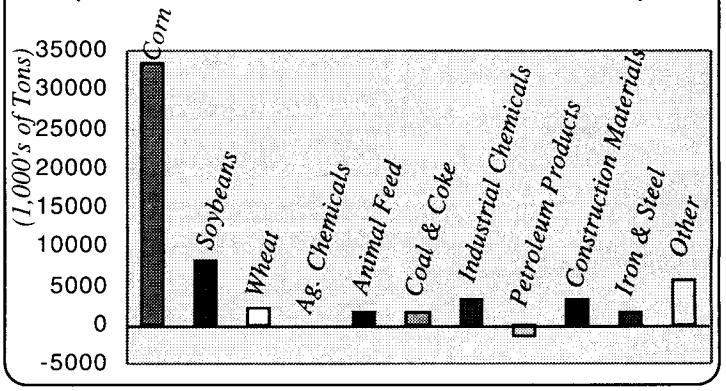


"When you look at what they're forecasting, they're showing a doubling of exports between now and 2050," Bertels said. "You don't have to go very far up the expansion line (without making any improvements) and we start hitting very serious delays."

Commodity Trends

The relative volume of the commodities carried on the river also will look very different by the year 2050, according to the traffic report. Grain, prepared animal feed and agricultural chemicals are forecast to move from about half of total river traffic in 1988 to some two-thirds of total traffic by the year 2050, mainly due to increased corn production. While about 27 million tons of corn were carried on the Upper Mississippi River annually in the early 1990s, the forecasts say approximately 72 million tons will be shipped in 2050.

Change in commodities shipped from 2000 to 2050
(UMR: Twin Cities to mouth of Missouri River)



Bertels, who works with the transportation and marketing division of the USDA, said he supports the grain-related forecasts because of the study methodology. Consultants have projected a continuation of the yield increase seen every year for the past 20 years, mainly due to increased efficiency stemming from technological improvements. The study methodology also included factors like recent policy changes which are expected to bring more land into production. By combining production and consumption forecasts of the various commodities, they were able to predict the tonnages that would be shipped between 2000 and 2050.

The five-state study region of Minnesota, Wisconsin, Illinois, Iowa and Missouri now grows about half the country's supply of corn and 40 percent of the nation's soybeans. Changes in agriculture and federal policy will lead to more land being planted in grain than in prior years, according to the study report. Over the long term, greater productivity is expected in the form of bushels per acre as researchers develop different hybrids and better seeds.

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Small Scale Measures: An In-Depth Look

Small-scale measures to reduce delays to commercial navigation are being considered as the Navigation Study moves forward. Brief descriptions of the 16 measures now being examined by the study team were given in the October 1995 newsletter. Here, we begin a more in-depth look at two of them. The first, a guidewall extension with a powered traveling kevel, would require additional construction; the second, a helper boat, would involve expanded usage of a safety and efficiency measure already being used on a limited basis.

GUIDEWALL EXTENSIONS are among the structural changes being considered within the 16 small-scale measures. This measure involves the extension of the existing 600-foot guidewalls to 1,200 feet -- both above and below the lock.

Extending the guidewalls would reduce the time problem caused when 1,200-foot tows go through the existing 600-foot lock through what is called a double-lockage process. Half of a tow's barges are sent through the lock unpowered, then pulled out with a cable system while the towboat and remaining barges complete the process. The lengthy reattachment process that must be completed with half the tow still in the lock chamber then prevents the lock from immediately being made ready for the next, waiting tow.

A guidewall extension would allow the first cut of barges coming out of a double lockage to be taken to the end of the extended guidewall and the second cut to completely leave the chamber before starting reattachment. This would allow the lock chamber to immediately be made ready for the next tow heading in the same direction.

Under the proposed measure, the unpowered cut of barges would be moved to the end of the guidewall with a powered traveling kevel (described later in this story), switch boat (towboats with more horsepower than helper boats), or helper boat. Extended guidewalls also provide a larger landing surface for tows to steer toward when approaching the lock.

As part of guidewall extensions, the use of powered traveling kevels, devices shaped like steer horns used to tie off boats, is being considered. The powered kevel attaches to the unpowered cut, runs along a rail and holds the tow close to the guidewall -- physically holding and towing the cut from the lock chamber to the end of the extended guidewall faster than the current cable system.

The time savings provided by a guidewall extension varies with location, flow conditions, weather and skill of the crew moving the tow through a lock. Construction is estimated to save between 12 and 19 minutes on a double lockage when the next tow in line is going the same direction. A kevel or helper boat also is needed to pull the unpowered cuts from the chamber, if the projected time savings is to be achieved.

The **HELPER BOAT**, a low-power, typically 800 horsepower towboat (push boat) used to assist tows on a downbound (downstream) approach to a lock chamber, is now used for safety purposes at certain locks, primarily when there is high water flow or an especially strong current. The study is examining the feasibility of expanding their use as a way to also reduce delays.

What a helper boat does is guide the front of a tow (a 2,000 - 5,000 horsepower towboat pushing up to 16 barges) along the upstream guidewall for entry into the lock. Helper boats help counter the effects of outdraft -- the current along the upstream guidewall, prevalent during high water flow conditions -- that tend to pull a towboat away from the guidewall and toward the dam. The helper boat allows a more controlled and efficient entry into the lock.

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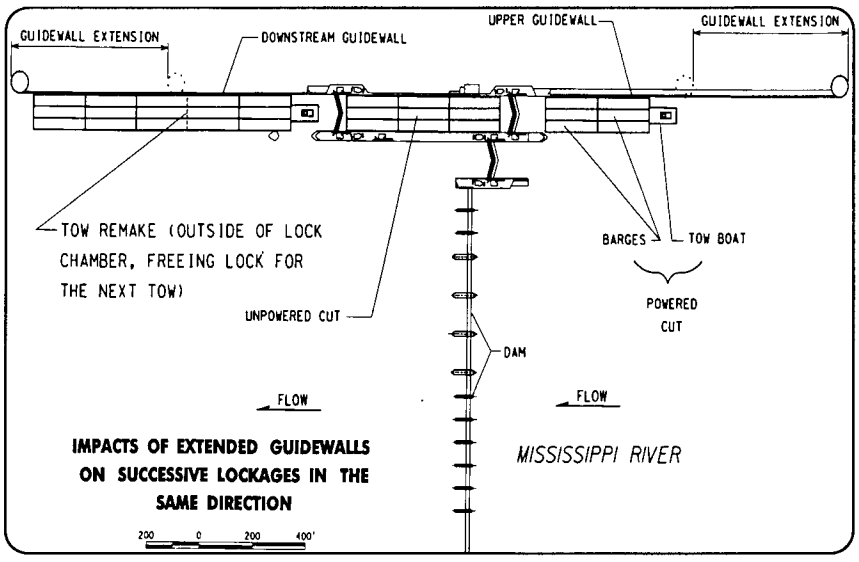
Guidewall Extension



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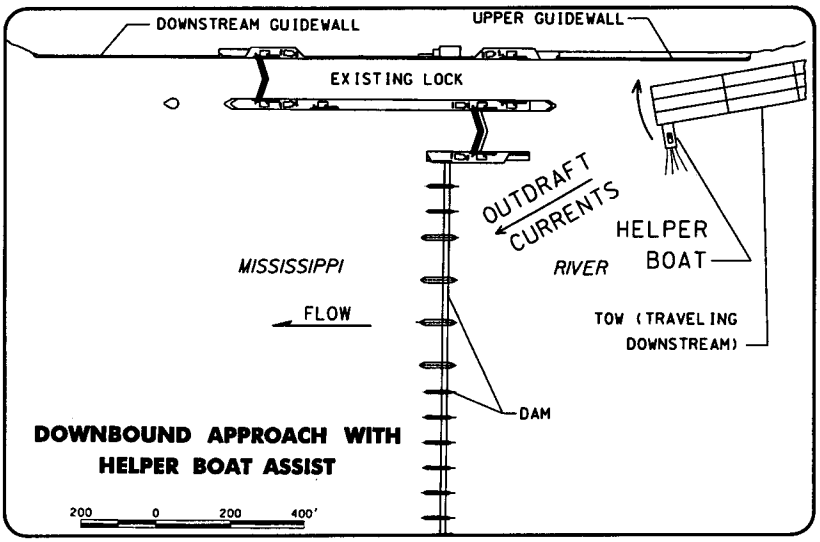
In addition to helping tows approach the lock chamber, they can be used to pull the unpowered cut to the end of the guidewall during a double lockage, remove ice and debris from the lock approach and chamber and provide emergency assistance.

Helper boats are available for hire from private companies most of the time at the following Mississippi River locks to assist with the downbound approach: Locks 3, 10, 12, 15, 20, 21, 22, 24 and 25. On the Illinois Waterway, a helper boat commonly is used at the Peoria Lock to help with the downbound approach. Several other locks have helper boats available on an "on call" basis.



Helper Boat

The time savings gained from a helper boat varies based on location, flow conditions, weather and other factors. Under normal flow conditions at most Upper Mississippi River sites, initial study analysis indicates a savings of approximately 5-to-15 minutes per lockage; in contrast, the Illinois Waterway locks typically report limited or no time savings. However, on both rivers, a greater time savings is gained during high water flows. An additional time savings can be gained by also using helper boats to pull the first cut to the end of the guidewall so that a 1,200-foot tow can be reattached outside of the chamber.

These measures will be among the large matrix of measures which is being prepared for further analysis, a matrix which will include cost and performance data for each measure being considered for the Upper Mississippi River and Illinois Waterway. The Economics Work Group will use economic models to determine which options will maximize benefits; an environmental assessment will be done concurrently.

Technology Improves Access to Study

Anybody can read summaries of completed Navigation Study reports - or the detailed minutes of committee meetings - with just the click of a mouse. A Navigation Study web page originally created in March 1994 has since been updated, allowing the study team to distribute information on the Internet as the information becomes finalized.

The same technology, meanwhile, is being used to give regular updates on river conditions and lock closings or delays. The flow condition data, now regularly updated on the Rock Island District's homepage, are being used by a lot of barge carriers. The web site will get increasingly useful as a tool for spreading Navigation Study information as more and more reports are finalized.

There are two sites containing study information. At **http://www.usace.army.mil/ncd/umriwws.htm** general write-ups on the study and work groups are available. The site also has hypertext versions of previous newsletters.

The majority of study information, however, can be found on the Navigation Study home page, **http://ncrsun7.ncr.usace.army.mil/nav_study.html**. Provided on the page are detailed minutes from the Economics Coordinating Committee meetings, dating back to January 1994, and minutes from the Navigation Environmental Coordination Committee meetings since December 1992. A summary of questions raised at a series of public meetings in 1994 and study team responses are also posted on the site as well as summary versions of an Accidents and Hazardous Spills report and the Transportation Rate Analysis. Additional reports and information from the Engineering and Environmental work groups should be available in the near future.

The technology is especially useful during a time of federal budget cuts. The study team now has to charge for interim report copies to recoup printing, shipping, and handling costs; the web access makes study information available to anyone with internet access and also saves on copying and mailing time.

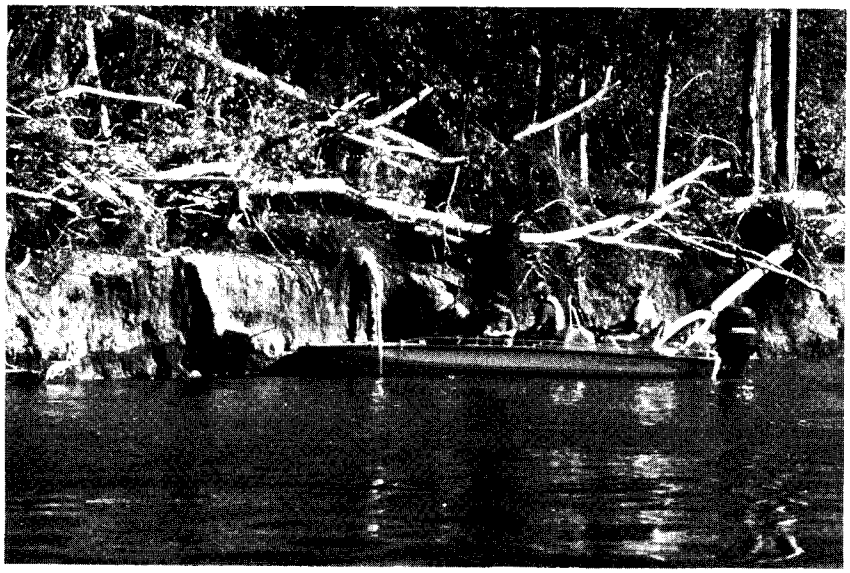
Bank Erosion Study

Following an examination of 72 sites, a multi-disciplined team has identified and described riverbank conditions and bank erosion sites on the Upper Mississippi River-Illinois Waterway System. The objective of this study was of identify major erosion sites and provide assessments to the significance of the various erosion and failure mechanisms at each location, with particular interest in the relative role of navigation in the erosion process.

The draft report summarizing the field survey will be distributed for concurrent review by the previously established Bank Erosion Study Technical Review Group and the Navigation Environmental Coordination Committee.

This report will present the results of the field reconnaissance survey conducted by a bank-erosion team during the summer and fall of 1995 and will document existing bank conditions along the Upper Mississippi River and Illinois Waterway.

The report will provide detailed information at 72 erosion sites which were determined by the study team to be representative. These sites will be classified following a system of classification attributes which can be used in combination with the Aquatic Areas Classification system being developed at the U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss., to apply knowledge gained at the 72 sites to the rest of the UMR-IWW system.



Representatives from the Illinois State Water Survey; Iowa Institute for Hydraulic Research; Rock Island, St. Paul, St. Louis and Huntington Districts, Corps of Engineers; and Anderson Environmental Consulting examine bank erosion.

Findings as to the relative significance of bank erosion due to various factors such as hydraulics of flow, floods, waves generated by commercial and/or recreational traffic, mooring and fleeting activities, wind and geotechnical factors will be provided. Follow-up studies to extract knowledge gained during the field survey to the UMR-IWW system are underway and scheduled for completion in 1997.

GLC Update

What role will the states play in formulating the final study recommendation? That was a topic of discussion at the Governors' Liaison Committee meeting Nov. 19.

GLC members gave their general acceptance to a plan that would have them meeting every six weeks between April and September 1998 to look at several different alternatives to the National Economic Development Analysis, expected to be finalized by March 1998. The regular brainstorming sessions will allow the GLC to have regular input while the final plan is being developed, while also giving state representatives a better understanding of the process used to develop final Navigation Study recommendations.

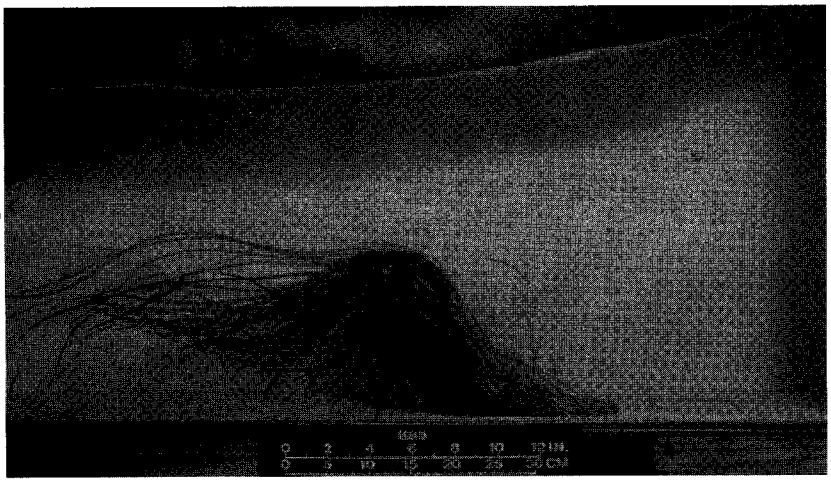
In Other Action:

• The GLC received an update on traffic projections from Don Sweeney, technical manager of the Economics Work Group. Sweeney highlighted the draft projections, which will play a large role in determining the timing and type of project that may be economically justifiable if any improvements are found to be needed. GLC members were asked to take the preliminary numbers back to their respective states and to submit comments on the projections. The request for comments was also made to the Economics Coordinating Committee.

Effects of Waves on Plants Studied

A completed laboratory study on how waves generated by river traffic affect aquatic plants is now under review by the Navigation Environmental Coordination Committee. The results indicate that waves generated by navigation traffic are capable of causing damage to plants (submersed macrophytes), but that the level of damage depends on the interaction of the velocity, wave height, exposure time, plant morphology and plant size.

The study found that aquatic plants with highly branching form, like the European water milfoil, are most vulnerable to damage from waves generated by navigation traffic. The damage is due primarily to entanglement and breakage, and it occurs at lower velocities when the plants are more upright in the water column. Aquatic plants with ribbon-like leaves, like water celery, are much less vulnerable to damage from waves and currents.



Aquatic plant in the wave flume

The findings are one piece of a larger study on the effects of navigation on plants. The study objective is to determine the extent to which navigation-induced hydraulic disturbances and sediment re-suspension affect the growth and distribution of submersed aquatic plant communities, and to predict the spatial extent and magnitude of the effects in the Upper Mississippi River - Illinois Waterway System.

The plant flume study involved a set of experiments conducted over the past year to determine the effects of waves and currents generated by navigation traffic. The experiments were conducted in a flume or large "bathtub" at the Waterways Experiment Station. The circulating water flume was equipped with a large pump to control current velocity through it along with a wave machine to generate waves of different heights. The flume has a large glass window on the side to allow observation of conditions within. Flats of aquatic plants were grown in a greenhouse and were carefully transferred to the flume, then subjected to a series of treatments of current velocities and waves.

In Brief...

• The collection of low flow prototype data on the Illinois Waterway for the sediment transport study, which had been hampered by high-water levels earlier this summer, was completed in September by the Waterways Experiment Station. The latest data provided information on velocity discharges, suspended sediment and waves present prior to and following vessel passage for low water levels. Data was also collected on bathymetry, bed sediments and weather. This effort completed the data collection for this study.

• An Accidents and Hazardous Spills report was completed in August 1996. The report found a very low number of accidents occurring on the Upper Mississippi River and Illinois Waterway. As a result, the report did not find a significant relationship between traffic volumes and accidents, based on the data available from the U.S. Coast Guard. An assessment of rail accidents and spills is planned for this year.

• The Site Specific Habitat Assessment Team (HAT) has completed its field data collection work at Locks and Dams 20, 21, 22, 24 and 25 on the Upper Mississippi River and Peoria and LaGrange locks and dams on the Illinois Waterway. The field work involved assessing water and land habitat types likely to be impacted by potential changes and their baseline suitability for the evaluation species. The U.S. Fish and Wildlife Service, Corps of Engineers and state resource agency biologists took part in conducting the field work. The information collected will now be used as input into the Habitat Evaluation Procedure models which will help gauge potential impacts on the species being evaluated.

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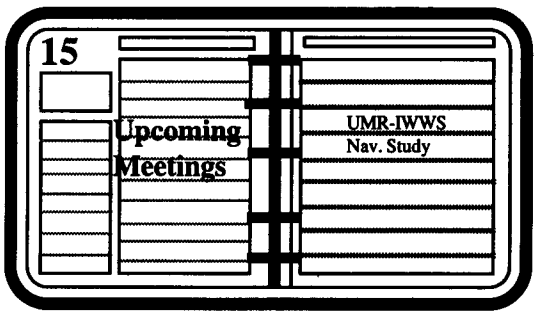
• 1996 field sampling of larval fish distributions and vessel impacts on adult fish is complete. Vessel impact sampling will continue next field season. Analysis of the larval fish samples will take place this winter. Laboratory results on the survival of larval fish exposed to propellers is currently being reviewed by the Navigation Environmental Coordination Committee.

• The archeological potential of lands which could be impacted by alternative construction measures at lock sites has been completed for the Illinois Waterway and is currently being assessed for Mississippi River lock sites. Information on the potential effects of increased traffic on archeological sites is currently being compiled for the system.

• The Governor's Liaison Committee (GLC) requested a demonstration on how the computerized economic simulation model will work. The model, which will be presented at the next GLC meeting, simulates movement of traffic through the system of locks. It allows the study team to determine what impact a change that reduces delays at a single lock will have on the entire navigation system.



Economics Coordination Committee
Feb 18 - Ramada Inn O'Hare, 6600 N. Mannheim Road, Rosemont, IL
10 a.m. - 3 p.m.

Governors' Liaison Committee
Feb. 18 - Ramada Inn O'Hare, 6600 N. Mannheim Road, Rosemont, IL
3:30 p.m. - 6:30 p.m.

Navigation Environmental Coordination Committee
April 8 - Holiday Inn, Moline, Ill.
8 a.m. - 2 p.m.

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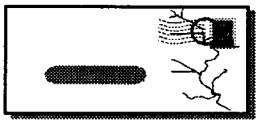

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Meanwhile, some of the increase in grain traffic will be moderated by projected slow growth or moderate declines in the hauling of coal, petroleum, and fertilizers, according to the draft traffic forecast.

The carrying of coal on the Illinois Waterway is predicted to decline in the early years before resuming slow growth, for example, because the type of coal typically carried on the Illinois Waterway and Upper Mississippi contains a high concentration of sulphur. More stringent phase II emission limits of the Clean Air Act amendments become effective in the year 2000. As a result, more coal is expected to be brought into the region from areas with lower sulphur concentration such as the Powder River Basin in north central Wyoming and southern Montana, areas served by rail transportation.

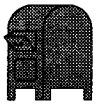
The overall forecasts could be affected by other changes including new legislation, relative shifts in demand from foreign producers, genetic engineering, changes in subsidies, or elimination of quotas, according to study contractors.

Questions?

o For general study information, call Mark Gmitro project manager, at 309/794-5279 or write to the address below, ATTN: CENCR-PP-M or visit our home page at: **http://ncrsun7.ncr.usace.army.mil/nav_study.html.**

o For information on Public Involvement meetings, call the toll-free telephone number, 800/USA(872)-8822. Meeting announcements will be in the Public Involvement menu. Or call Kevin Bluhm, public involvement coordinator, at 612/290-5247, or write to the address below, ATTN: CENCR-PD-C/Bluhm.

o To be added to the mailing list for future newsletters, study updates, and meeting announcements, write to the address below, ATTN: CENCR-PD-C, or call the toll-free telephone number and leave your information in the Public Involvement menu.



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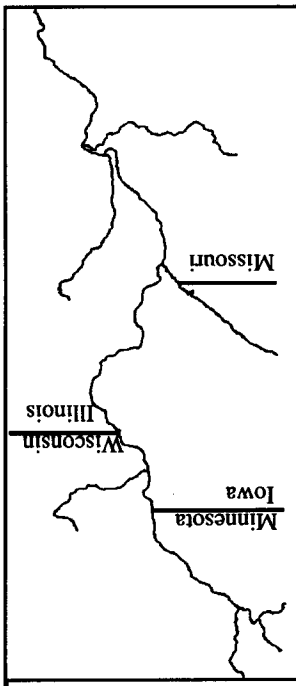

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