Upper Mississippi River – Illinois Waterway System Navigation Study

Preliminary Economic Findings Released to the Public

ROCK ISLAND, IL – The U.S. Army Corps of Engineers, Rock Island District, has completed an Internal Technical Review of the economic aspects of the Upper Mississippi River - Illinois Waterway System Navigation Study. These critical items included completing development and verification of the economic model, traffic forecasts, alternative modes analysis, cost and performance data on alternative measures, and preliminary economic model runs. Additional progress was also made on testing the environmental impact models.

The study purpose is to assess the need for navigation improvements on the Upper Mississippi River (UMR) and Illinois Waterway (IWW) for the years 2000-2050 and the impacts of providing these improvements.

Preliminary economic analyses, including evaluation of future economic assumptions, provide estimates of improvement needs and reveal the extreme sensitivity of results to economic assumptions. Using mean estimates for forecasted traffic growth and moderate price sensitivity of demand for waterborne transportation, adjacent moorings and approach channel improvements are immediately justified. Analyses also indicate what economic assumptions would require a greater level of capital investment, such as guidewall extensions with powered kevels, lock extensions, or both. These initial analyses provide a basis for the plan formulation process and a range of alternative plans for further evaluation and comparison. However, additional information is required to continue economic analyses and coordination. Additional information and coordination are also required to determine the environmental effects of various plans and to incorporate this information into the plan formulation process.

Prior to the preliminary economic model runs, the final evaluation of the potential small-scale measures led to the selection of five measures (guidewall extensions with powered kevels, switchboats with guidewall extensions, congestion tolls/lockage time charges, mooring facilities, and approach channel improvements) for use in the development of alternative plans and final systemic evaluation of costs, benefits, and impacts. These measures fall under the study's definition of "small-scale" measures, as operational improvements or lower cost construction items. In addition, the study is evaluating large-scale measures that include extending the existing 600-foot lock to 1,200 feet or constructing an additional 600- or 1,200-foot lock.

In the coming months, the most appropriate economic assumptions will be determined and validated and plan formulation and coordination with stakeholders will continue. Requests for input to the evaluation process has already begun and will be intensified over the next several months. Study updates will occur through direct contact, newsletters, technical workshops, and public meetings. Because of the additional analyses and coordination, it is likely that the overall study schedule will be extended beyond the currently planned completion date of Dec. 1999.

If you have questions or need additional information, contact Mr. Dudley Hanson or Mr. Dave Tipple through the Public Involvement Work Group at (309) 794-4687 or write to the U.S. Army Corps of Engineers, ATTN: Planning, Programs, and Project Management Division (PM-A), Clock Tower Building, P.O. Box 2004, Rock Island, IL 61204-2004. If you would like to make comments, call the study's toll free number 1(800)872-8822; messages can be left in the public involvement menu. Additional information on the initial analyses can be found on the Navigation Study website, http://www.mvr.usace.army.mil/pdw/nav_study.htm.

Preliminary Economic Evaluations

As part of testing the economic model and to help obtain public input, a number of scenarios have been run to determine the sensitivity of the model outcomes to various economic assumptions (e.g. traffic levels and price sensitivity of demand for waterborne transportation). In general, this testing has revealed that the model results are very sensitive to the input assumptions, especially the price sensitivity of demand.

Investment Strategies Analyzed

The economic evaluation includes four potential investment strategies. These are two small-scale investments and two involving large-scale measures (graphs showing preliminary economic analysis to follow). These include:

1) Adjacent moorings (UMR Locks 12, 14, 18, 20, 22, 24, and 25 and LaGrange Lock on the IWW) and approach channel improvements (UMR Locks 15 and 22 and Marseilles Lock on the IWW)
2) Guidewall extensions at UMR Locks 20-25
3) Lock extensions at UMR Locks 20-25
4) Lock extensions at UMR Locks 20-25 and guidewall extensions at UMR Locks 14-18.

Evaluation is not complete for all possible combinations nor is the optimization of location and timing of investments. Future evaluations will consider increased use of industry self-help and lock operating policies in both the without and with project condition. In addition, the need for guidewalls or locks on the Illinois Waterway and potential for implementing congestion tolls/lockage time charges have not yet been analyzed. These will be evaluated as additional analyses are conducted. However, Illinois Waterway sites are anticipated to have later implementation dates based on higher implementation costs, due to the lack of a winter closure period for construction, and open pass conditions at Peoria and LaGrange Locks.

Future Economic Conditions Analyzed

In combination with the four potential investment strategies as described above, the study team looked at a limited set of future economic assumptions to evaluate the potential benefits of making investments. These assumptions are based on variations in the traffic forecasts and price sensitivity of demand for waterborne transportation. The benefits of the four investment strategies associated with these assumptions are shown on Figures 1-4. Because of the high degree of uncertainty and extreme sensitivity of results to assumptions, it is necessary and appropriate to evaluate a range of investment strategies and economic assumptions.

In regard to traffic, two levels forecast by the independent contractor where used. These included the mean value and a value close to the upper bound. With respect to the price sensitivity of demand for water transportation, price elasticity, a number of varying assumptions have been considered. These varying assumptions regarding elasticity, result in varying shapes of the demand function, which in turn have an influence on waterway system benefits. In general, more elastic values indicate greater numbers of transportation alternatives and markets and, as a result, reduced navigation benefits. Scenarios 1 to 3 attempt to capture a range of possible values for the demand based on available information. More elastic values were not evaluated, since they would simply fall below Scenario 1, which does not show a need for most capital improvements. Since the study purpose is to assess the need for navigation improvements on the UMR-IWW System for the years 2000-2050, detailed pursuit of options below the level of Scenario 1 would be time consuming, costly, and not useful to the study purpose. Scenario 4 presents benefits based on demand values implicitly used in the UMR and IWW Reconnaissance Studies completed in 1991.

Future Economic Conditions (Traffic and Demand Curve Values)

Scenario 1
Mid-Line Traffic
Relatively Elastic Demand

Scenario 2
Mid-Line Traffic
Somewhat Inelastic Demand

Scenario 3
High Traffic
Somewhat Inelastic Demand

Scenario 4
Mid-Line Traffic
Inelastic Demand

The last section of this paper (Economic Appendix) gives more detailed information about the conditions described above.

Costs

The construction cost line portrays the annualized construction costs, site specific environmental costs, and impact (delays) to navigation and interest during construction. The first costs of construction average from $50,000 per mooring buoys to $500,000 per mooring cells, $36 million for upstream and downstream guidewall extensions per lock at UMR locks 14-25, and $127 million per lock for 600 foot lock extension at UMR Locks 20-25. Site specific environmental costs average $1.5 million for guidewall extensions and $3.0 million per lock extension.

The environmental cost range provides a rough indication of the total of the construction and site costs discussed above, plus the additional increment of system environmental cost estimates. System environmental costs are an estimate of the costs required to provide habitat-based measures and implement programs to offset detrimental impacts to the environment associated with increased traffic. However, these costs are not based on environmental impact model runs (these have not been made to date). A range of system environmental costs were estimated to reflect the uncertainty and likelihood of a wide possible range of costs. Formal mitigation planning in conjunction with an analysis of potential traffic increases and coordination with resource agencies must occur to arrive at more certain estimates. The environmental costs shown assume the need for an active avoid and minimize program in addition to habitat based compensation for environmental loses. It is possible that based on avoid and minimize measures, determination of significance, and mitigation planning that these figures may change considerably, and may be out of the range depicted on the graphs.

Uncertainties

It should be noted that some have questioned how demand characteristics should be included in the economic analysis. This is due to the uncertainty in defining the shape of the curves and the sensitivity of the economic models to the curves. There are also other uncertainties, such as possible additional costs for improvements to alternative modes of transportation, additional infrastructure improvements, etc. that are very difficult to quantify. Additional uncertainties are the environmental effects of shifting traffic to other modes of transportation. As noted above, the environmental costs shown are only a rough indication of the range of such costs, and may change significantly as more detailed analysis is completed.

Analysis of Results

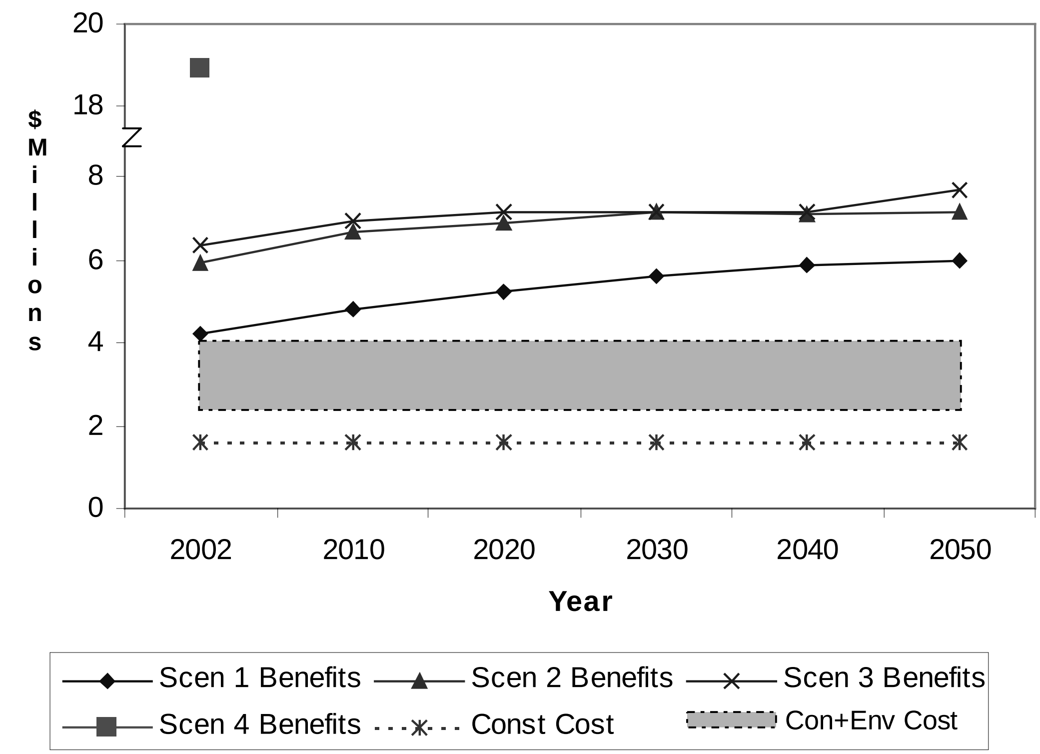
The following graphs depict the results of the preliminary economic model runs. The graphs show the construction costs and construction plus environmental cost range (dashed lines) as well as the investment strategy (solid lines). The cost lines reflect average annual costs assuming a 50-year life and discount rate of 6 $^{7}/_{8}$ percent, and the benefit lines reflect the benefits in the year indicated. The point where the scenario benefit line crosses the annual cost line provides an indication of the time at which the investment strategy should be implemented to maximize total net benefits.

It is easiest to understand the following graphs focusing on just one cost and one benefit line at a time. For example in Figure 1, looking at the construction plus environmental cost range (roughly $2 to $4 million) and the Scenario 1 benefits ($4 mil increasing to $6 mil), we see that lock approach channel improvements and adjacent mooring facilities are immediately justified (i.e. the benefits are greater than costs in the year 2002 and all following years).

Figures 2-4, demonstrate the relationship between cost level and the timing/need for improvements. For example, looking at Scenario 2 on Figure 2, we see that in comparison with just the construction costs, guidewalls would be immediately justified. However, when environmental costs are considered the timing is less certain. Under the lower part of the construction and environmental cost range and Scenario 2 benefits, it would remain advantageous to implement guidewalls. However, it may be desirable to wait a little longer to implement them. If environmental costs turn out to be at the top of the range or considerably higher than the range shown, justification of guidewalls would be less likely. The figures also show a point associated with Scenario 4 or completely inelastic demand. Under those economic conditions, all of the improvements would be immediately justified.

In general these results reveal that the higher the traffic and more inelastic the demand, the greater the need for improvements and the sooner the improvements are needed. The level of environmental compensation costs could also play a major role in the justification and timing of any improvements.

Figure 1: Sensitivity of Timing to Econ Inputs - Appr. Channel Improvements & Adjacent Moorings



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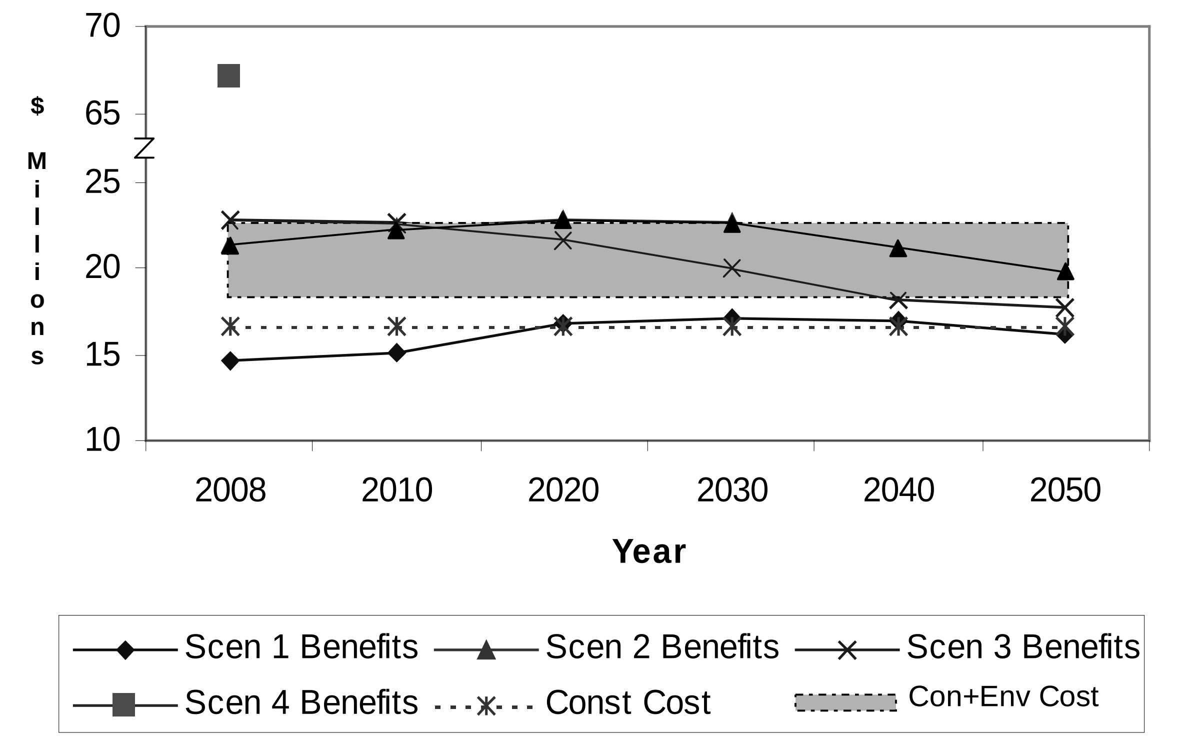
Costs

Construction Costs (annualized) – First cost of construction, site specific environmental costs, impacts (delay) to navigation during construction, and interest during construction.

Construction Cost plus Environmental Cost (annualized) – Includes estimated range of habitat based compensation for system impacts related to traffic increases.

Figure 2: Sensitivity of Timing to Econ Inputs - Guidewalls at UMR 20-25



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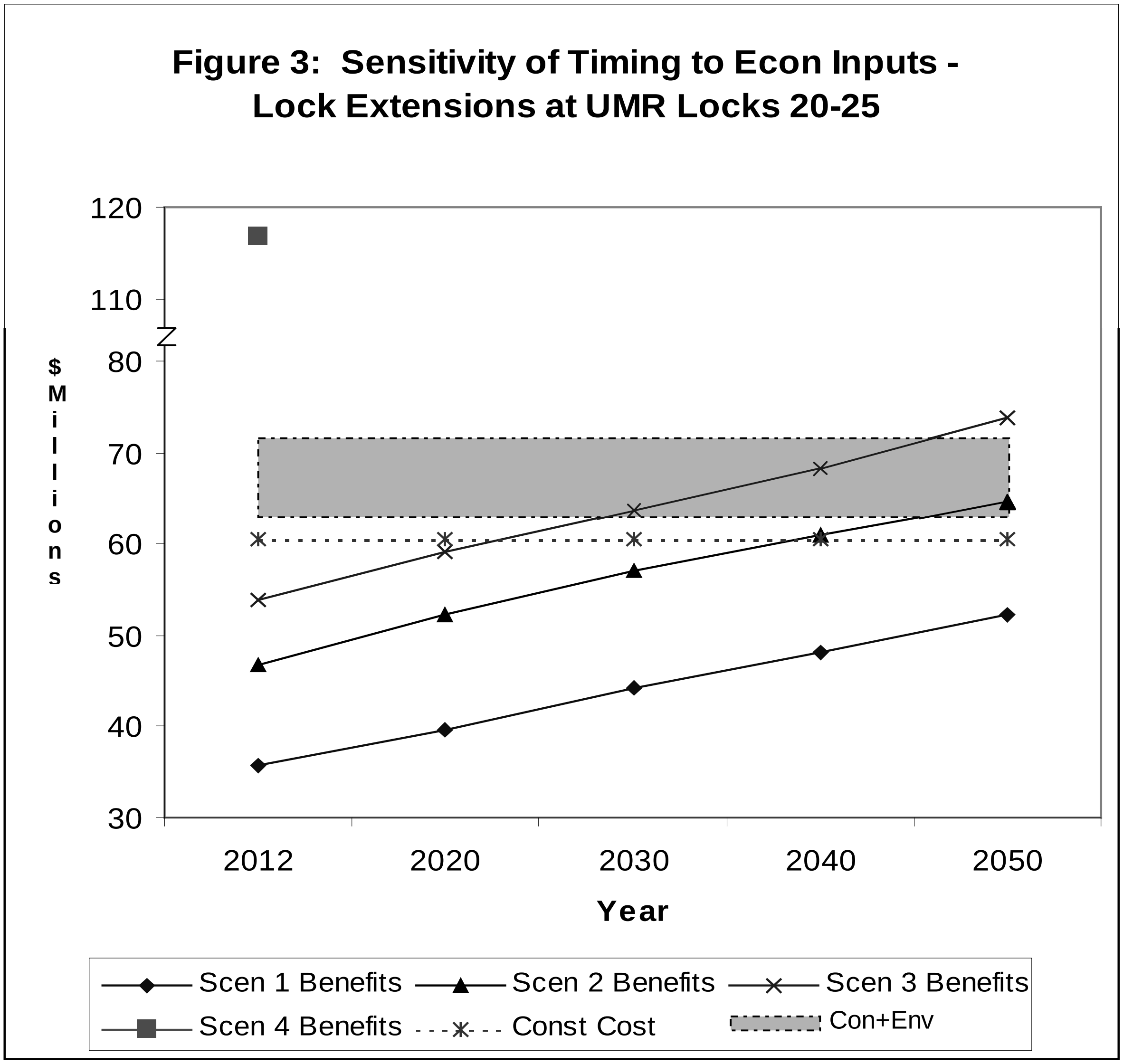

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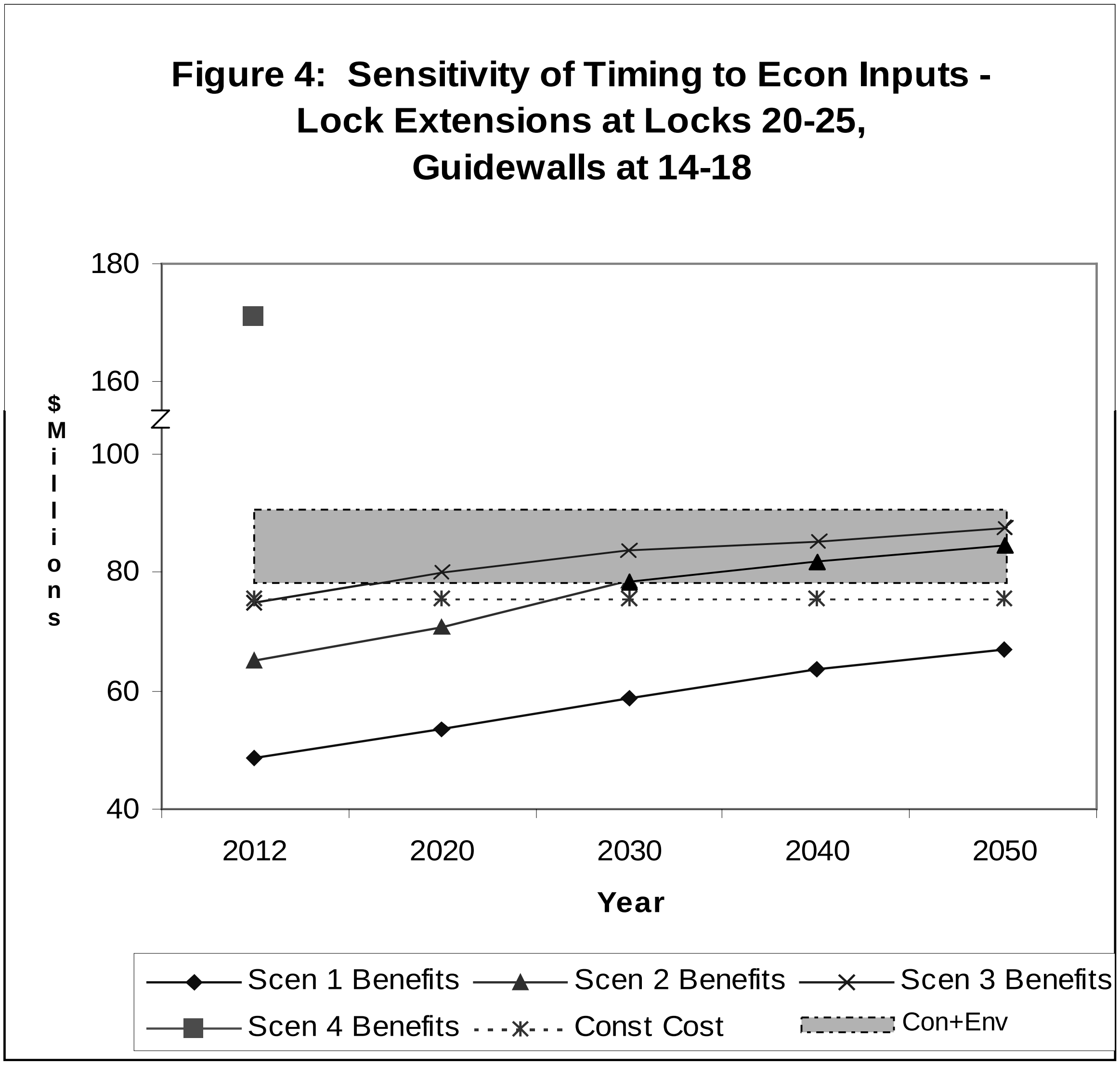

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Next Steps

Demand Evaluation

Due to the uncertainty and importance of understanding the nature of demand for all commodities which move on the UMR, the Corps will continue to research, by means of contractor assistance and public involvement, aspects of price versus demand for transportation.

To date the Corps has conducted a formal expert elicitation meeting to help define the demand characteristics for transportation of grains on the Upper Mississippi River and Illinois Waterway. Each of the individuals on the expert elicitation group was particularly knowledgeable about the production and marketing of the agricultural goods. The other commodity demand characteristics were developed less rigorously, using opinions of transportation analysts at the Tennessee Valley Authority and Marshall University.

The most productive approach to gathering additional demand data, which can be completed in a reasonable time frame, is gathering information from shippers and other experts to determine waterway usage for all commodity groups given differing levels of transportation costs. Immediately following this process, the Corps will use this and previously available information/data to establish a National Economic Development (NED – plan that maximizes net benefits to the Nation) plan, and several other alternatives to be used for plan formulation and ultimately the selection of a recommended plan. The Corps considers this an evolutionary process, and input received will be considered and evaluated and an agency decision will be made.

If you are aware of additional specific data sources that could augment this effort to better determine demand or other uncertainties, or would like to recommend experts to participate in the process, please contact the Corps of Engineers (at the numbers or address listed on page 1).

Study Schedule

Based on the additional efforts taken over the summer to complete and verify study products and the remaining need to further examine demand characteristics, it is likely that the overall study schedule will be extended beyond the currently planned completion date of December 1999. Once we are reasonably confident that economic assumptions are accurate, we will continue the plan formulation and public interaction processes. We will provide the GLC, Coordination Committees and the general public ample opportunity to review and provide input to the plan formulation process.

The remaining plan formulation steps include: (1) complete the economic and environmental analyses for the future without project condition, i.e. establish the baseline for evaluating the alternatives; (2) combine various measures such as adjacent moorings, channel improvements, guidewall extensions, and lock extensions into plans to meet the expected demand on the system; (3) evaluate the costs and impacts of the various alternative plans; (4) revise and reevaluate the alternative plans as needed based on the analysis results and public input; (5) identify the NED plan; (6) identify the locally preferred plan; and (7) recommend a plan for authorization by the Congress. The recommendation of a particular plan by the Corps of Engineers will depend upon the plan formulation and public involvement results as well as an evaluation of other decision factors that augment NED and environmental analyses, such as National competitiveness and the Federal tolerance for investments with uncertain outcomes. The public, with input from the GLC and Coordination Committees, may identify a locally preferred plan that may supplement the NED plan to fully meet the region's needs.

We expect to complete the first three steps in about six months, followed by public meetings to solicit input.

Economic Appendix

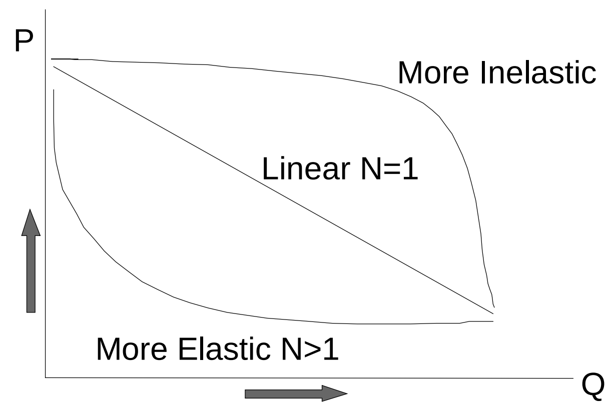
Demand Function Specification

The economic model used in the Upper Mississippi River–Illinois Waterway Navigation System Study, the Spatial Equilibrium Model (SEM), has defined the demand function for a given commodity movement as:

$$q = t * [(a - w)/(a - e)]^N,$$

where t is the 1992 equilibrium water tonnage, a is the minimum, same origin-destination, alternative mode cost, w is the water price, e is the 1992 equilibrium water price, and N is the parameter that characterizes the shape of the demand function.

The general representation of this functional form is depicted in the figure below.



The figure reveals that by varying the value of N, the shape of the demand function changes. For N values less than 1 the function becomes more inelastic, (quantity is less responsive to a change in price) in the region of the margin (the 1992 equilibrium). For N values greater than 1 the function becomes more elastic (quantity is more responsive to a change in price) in the region of the margin. In the extreme, a value of zero for N produces a perfectly inelastic demand function, while a value of N that approaches infinity produces a perfectly elastic demand function.

The commodity specific N values used in the four scenarios are as follows:

Commodity	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
Agriculture	1.5	1.0	1.0	0.0
Coal	0.75	0.5	0.5	0.0
Petroleum	0.5	0.5	0.5	0.0
Industrial Chem	0.33	0.33	0.33	0.0
Agricultural Chem	1.5	1.0	1.0	0.0
Iron & Steel	1.5	1.0	1.0	0.0
Aggregates	1.0	0.5	0.5	0.0
Miscellaneous	1.0	0.5	0.5	0.0