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# Missouri Department of Transportation – Low-Flow Water Study for the Missouri River

## Executive Summary

### 1.1 Background and Scope

The Missouri Department of Transportation (MoDOT) retained TranSystems to identify and review low-flow industry trends, equipment and strategies used in inland navigation settings throughout the United States and worldwide which may be transferable to the Missouri River and which could support an increase in barge activity on the Missouri River. TranSystems undertook several tasks to accomplish the study objectives, as follows:

- Low-Flow Issues of the Missouri River – an evaluation of current challenges faced by tugs and barges operating on the Missouri River.
- Interview Survey – a survey to determine challenges of moving cargo on the Missouri River and potential solutions to support expansion of cargo activity. Organizations interviewed include shippers of cargo, terminal operators, tug and barge operators, and government agencies.
- Market Analysis and Trends – a review of historical trends in cargo activity on the Missouri River and developments in the barge industry.
- Best Practice Identification – an evaluation of low-flow technologies used on other river systems in the U.S. and Europe.
- Potential Technology Solutions – based on the interview survey and technology evaluation, the identification of potential solutions that could support cargo activity on the Missouri River.
- Public Sector Benefits and Costs – proposed policy actions for MoDOT, and their impacts.

### 1.2 Findings and Conclusions

#### 1.2.1 *Low-Flow Issues of the Missouri River*

Research on Missouri River navigational conditions has identified competing opinions from stakeholder groups. Today it seems the demands of environmentalists and their concern for endangered species outweighs the demand for river transportation, although the United States Army Corps of Engineers (USACE) operating plan states transportation on the lower Missouri is still one of its major criteria. Private interests maintain the timing of releases of upstream dams do not fit with tourist or fishing seasons and impact potential development to support those industries. The following developments were considered during the execution of subsequent tasks:

- The 2008 Annual Operating Plan (AOP) for the Missouri River continues to emphasize conservation efforts.
- The AOP anticipates releasing only enough water to provide minimum navigation flows for the entire season and shortening the season by 17 to 60 days. It was shortened by 35 days in 2007.

The USACE announced March 27, 2008, that it would be adjusting releases from five tributary dams in Missouri and Kansas. The USACE will be able to raise water levels in the reach above Kansas City, while not increasing the amount of water that flows below that point. This plan is designed to mimic the natural flow of the river before the six large upstream dams and reservoirs were built. It is hoped the plan will improve habitat for the pallid

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sturgeon, a federally protected endangered species. Releases are regulated in late spring through the summer to protect the nests and chicks of the least tern and piping plover, both protected by the Endangered Species Act.

### *1.2.2 Interview Survey*

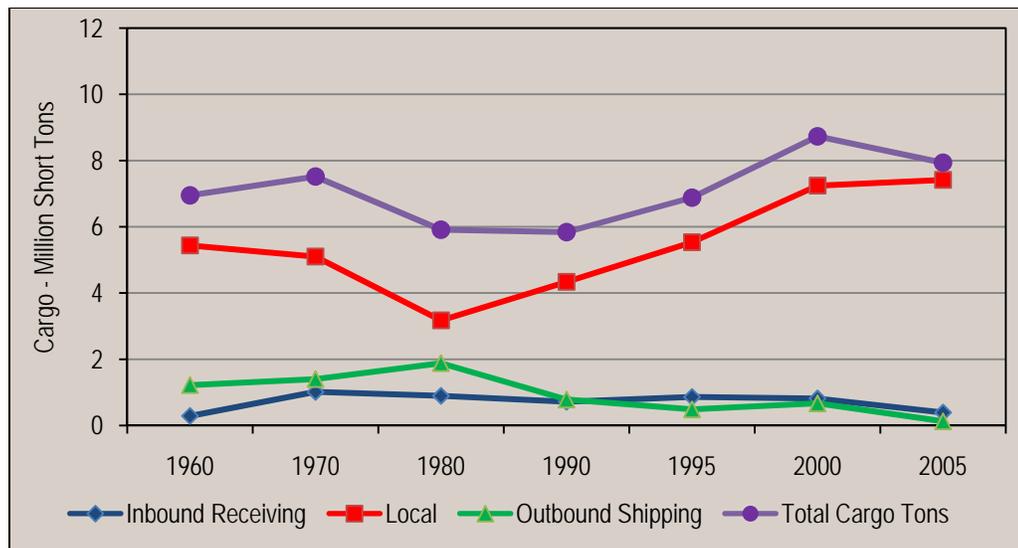
The interview survey provides guidance on potential actions required to support the renewal and growth of barge traffic on the Missouri River. The following items should be considered for further evaluation by the Missouri Department of Transportation:

- Support the development of barge service on the Missouri River by identifying funds to assist with the construction of shallow draft tugs
- Explore the potential for USACE to invest in shallow draft equipment, which could be consistent with its Missouri Navigation mission. Increased river traffic will aid in keeping river channels clear.
- Support new fleet operations by funding the start-up of new fleet services.
- Encourage a program for channel maintenance and monitoring.
- Establish river tug crew training program. Many tug crews are reaching retirement age. Training programs will also promote safety on the Missouri River, as crews are made aware of local navigational issues.
- Create strategic partnerships with Louisiana Lower Mississippi River ports to market use of inland waterways for emerging cargos (e.g. ethanol and DDGS).
- Market and promote environmental benefits of barge service. Identify government supported environmental funds for attainment of clean air and water.

### *1.2.3 Market Analysis and Trends*

The historical trend in Missouri River cargo volume is shown Figure 1-1. Cargo volume is currently at a higher level than in the 1960s, 1970s and 1980s due to expansion of local cargo (largely sand and gravel). Outbound cargo has declined compared to the earlier decades, which reflects a variety of factors including competition for grain shipments from the Arkansas River, drought in the 1988 to 1993 period and poor service reliability.

Figure 0-1: Historical Missouri River Cargo Tons



Source: US Army Corp of Engineers, Waterborne Commerce Statistics

#### 1.2.4 Best Practice Identification

The most common practice today on U.S. inland waterway systems for accommodating freight barge traffic during low-flow conditions is barge light loading. This practice is quite common today and is currently employed not only on the Missouri River but also on the McClellan/Kerr waterway in Arkansas, and the Tennessee-Tombigbee waterway in Alabama.

Inland waterway systems of Europe best represent navigation patterns matched to varying channel dimensions. The systems vary in traffic and cargo concentrations depending on the depth and width of each particular channel.

Research on existing and proposed technologies and operating practices on low-flow rivers has identified the following issues:

- Barge light loading is an acceptable practice although its use restricts expansion of river traffic and cargo volumes on the Missouri River.
- European inland waterway transportation and the supporting freight transportation market is much more dynamic than any U.S. inland waterway system.
- Standardization of lock dimensions on the Mississippi and connecting river systems is not conducive to new barge and work boat designs.

#### 1.2.5 Potential Technology Solutions

- The following conclusions have been developed concerning potential technology solutions to increased barge traffic on the Missouri River: The availability of shallow draft tugs for performing line haul and fleeting operations on the river is of greater importance than a supply of shallow draft barges.
- Shallow draft tugs would be expected to improve service reliability.
- Purpose built self-propelled shallow draft tugs could be used for intra Missouri River freight traffic.

- A vessel with a maximum draft of six feet could operate at under minimum service flow conditions throughout the Missouri River's regular navigational season.

### 1.2.6 *Costs and Benefits of Construction Subsidy for Shallow Draft Tugs*

An analysis of the costs and benefits for the deployment of shallow draft tugs by replacing rail with barge to move cargo between St. Joseph, MO and St. Louis, MO provided the following:

During a normal navigation season, from April 1 to December 1, the transport cost savings to shippers from replacing rail with barge are greater than the construction subsidy for a fleet of two shallow draft tugs at \$1.1 million. For a single season, the total transport cost savings of replacing rail and barge is over \$2.4 million.

Barge transportation generates 39 percent lower air emissions per cargo ton-mile than rail transportation. In this analysis, barge transportation would generate an 11 percent reduction in total emissions, based on the distance between St. Joseph and St. Louis, and the cargo tons shipped per season. The barge advantage comes from its greater fuel efficiency per cargo-ton mile:

**Estimated Air Pollutants per Season**

	Barge	Rail <sup>1</sup>
Air Pollutants	Total Emissions per Season	
Hydrocarbons (HC)	3,929,011	4,365,587
Carbon Monoxide (CO)	10,452,480	11,612,137
Nitrogen Oxides (NOx)	106,101,382	117,874,451
Particulate Matter (PM)	2,632,912	2,920,601
Fuel Consumption per Season (Gallons)	392,700	436,254

Barge transportation is a safer transportation mode than rail, generating fewer fatalities and injuries per cargo ton-mile. Fatalities and injuries per billion ton-miles for barge are 0.28 and 0.045, respectively. Barge is significantly lower than the estimated 0.649 and 5.814 fatalities and injuries per billion ton-miles on rail.

### 1.2.7 *Public Sector Benefits and Costs*

The interviews with shippers, barge operators, and government agencies, and the review of other technologies identified a number of preferred solutions to support the development of new cargo activity on the Missouri River. MoDOT could undertake the following actions:

- Provision of support for the construction and deployment of shallow draft tugs for fleet and line haul operations
- Provision of support for new fleet operations to improve operational performance on the river
- Provision of support for river crew training program
- Other policy actions
  - Enhance program for channel maintenance and monitoring to address shipper and operator concerns about channel reliability.
  - Create strategic partnerships with Louisiana, Lower Mississippi River ports to market use of inland waterways for emerging cargos (for example, ethanol and DDGS).

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- Promote environmental benefits of barge service.

These actions all have similar benefits and costs:

- Potential Public Sector Benefit:
  - Increased use of Missouri River assets (ports, etc.) with potential higher employment, tax revenues, etc.
  - Potential increased use of barge, which has a lower environmental footprint than other transport modes
  - Increased traffic aids channel maintenance, supporting river reliability
- Potential Public Sector Cost:
  - Financial support for incentive programs
- Potential Private Sector Benefit:
  - Increased transport options for shippers
  - Service reliability for shippers
  - Lower cost transport option (barge less expensive than rail and truck)
  - Increased cargo tonnage for terminal operators
  - Greater operational reliability for barge operators
- Potential Private Sector Cost:
  - Risks from increased use of Missouri River. For example, can water levels be maintained so shippers have confidence in long term service reliability?
  - Transfer of equipment from potentially more reliable and higher revenue/profit rivers to the Missouri River