

# The Navigation Economic Technologies Program

September 1, 2005

NETS

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## SYSTEM-WIDE LOCK RELIABILITY ANALYSIS PHASE 0

*Proof of Concept*



US Army Corps  
of Engineers®

IWR Report 05-NETS-R-10

# Navigation Economic Technologies

The purpose of the Navigation Economic Technologies (NETS) research program is to develop a standardized and defensible suite of economic tools for navigation improvement evaluation. NETS addresses specific navigation economic evaluation and modeling issues that have been raised inside and outside the Corps and is responsive to our commitment to develop and use peer-reviewed tools, techniques and procedures as expressed in the Civil Works strategic plan. The new tools and techniques developed by the NETS research program are to be based on 1) reviews of economic theory, 2) current practices across the Corps (and elsewhere), 3) data needs and availability, and 4) peer recommendations.

The NETS research program has two focus points: expansion of the body of knowledge about the economics underlying uses of the waterways; and creation of a toolbox of practical planning models, methods and techniques that can be applied to a variety of situations.

## Expanding the Body of Knowledge

NETS will strive to expand the available body of knowledge about core concepts underlying navigation economic models through the development of scientific papers and reports. For example, NETS will explore how the economic benefits of building new navigation projects are affected by market conditions and/or changes in shipper behaviors, particularly decisions to switch to non-water modes of transportation. The results of such studies will help Corps planners determine whether their economic models are based on realistic premises.

## Creating a Planning Toolbox

The NETS research program will develop a series of practical tools and techniques that can be used by Corps navigation planners. The centerpiece of these efforts will be a suite of simulation models. The suite will include models for forecasting international and domestic traffic flows and how they may change with project improvements. It will also include a regional traffic routing model that identifies the annual quantities from each origin and the routes used to satisfy the forecasted demand at each destination. Finally, the suite will include a microscopic event model that generates and routes individual shipments through a system from commodity origin to destination to evaluate non-structural and reliability based measures.

This suite of economic models will enable Corps planners across the country to develop consistent, accurate, useful and comparable analyses regarding the likely impact of changes to navigation infrastructure or systems.

NETS research has been accomplished by a team of academicians, contractors and Corps employees in consultation with other Federal agencies, including the US DOT and USDA; and the Corps Planning Centers of Expertise for Inland and Deep Draft Navigation.

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# SYSTEM-WIDE LOCK RELIABILITY ANALYSIS PHASE 0

*Proof of Concept*

Prepared by:

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for Inland Navigation**

For the:

Institute for Water Resources  
U.S. Army Corps of Engineers  
Alexandria, Virginia

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## Executive Summary

This study was performed to serve two purposes. The first was to gather and analyze a limited amount of lock closure data recorded at the locks, and determine whether we have a high level of confidence in that data. The second purpose was to determine whether a nationwide study of this type is feasible. This study was accomplished by a team consisting of Corps team members at the Institute for Water Resources, the Great Lakes and Ohio River Division, and the Mississippi River Division. The study was conducted *virtually*, that is via telephone, email, NetMeeting, and other electronic means. No face-to-face meetings occurred during this study.

The first purpose of this study was accomplished by gathering 2003 lock closure data for St Louis, Rock Island and St Paul District locks. This data came from the Operations and Maintenance of Navigation Systems (OMNI) database. The OMNI data was cross-checked with other data sources, primarily information prepared for an August 2004 data call from Corps HQ, Notices to Navigation, and a cross-check performed by St Paul District Operations personnel. The cross-checks indicate that, with a few exceptions, the OMNI data contains reasonably accurate closure information. Cross-checks were performed on 19 lock chambers. Of those 19, the cross-check found 10 chambers where closures were omitted from OMNI. Most of the omitted closures were minor however. The cross-check found only 3 chambers where the omitted closures totaled more than 1 day. The largest closure omitted from OMNI was a 30 day closure at L&D 17 which occurred during the winter shutdown season.

We recommend that the nationwide study be conducted. The lessons learned during this study indicate that a nationwide study of this type is feasible with one caveat. That is, cross-checks are very expensive and should be made judiciously. Therefore, we recommend that the nationwide study begin by, first, gathering and analyzing all available electronic data. This includes the years 2000 and later OMNI and LPMS data, and pre-2000 data maintained by the Navigation Data Center, the Center of Expertise for Inland Navigation in Huntington WV, and any other readily available data sources. We recommend that a Stall-Stoppage database be populated with readily available data. This database will then be analyzed and compared across locks, Districts, and Division. If anomalies are found, the appropriate District office will be contacted, and cross-checks with other data sources will then proceed. We believe this approach can eventually lead to a reasonable accurate data source while keeping study costs to a minimum.

**System-wide Lock Reliability Analysis  
Phase 0 – Proof of Concept**

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**System-wide Lock Reliability Analysis  
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- Attachment 5 – Possible Errors Spreadsheet*
- Attachment 6 – Winter Closure Spreadsheet*

## Introduction

Senior Corps leaders have recently begun talking about an increased number of reliability related closures at Corps locks. Statistics showing an increased number of unscheduled and scheduled closures have been presented to Congressional staff, the Inland Waterways Users Board, at Public Meetings, before the National Waterways Conference, and at the Transportation Research Board conference. These statements are based on data which is recorded at every Corps lock. In order to insure that these statements are based on accurate information, the Institute for Water Resources (IWR) recently decided that this data should be reviewed for nation-wide consistency. It is critically important we have confidence in our data, so that our leaders don't make misleading statements based on inaccurate, incomplete, or biased data.

In order to insure that the Corps draws valid conclusions regarding lock reliability trends, three phases of study were initially developed. As originally envisioned, the first phase was intended to: 1) assemble a nationwide unavailability database, 2) review the data and determine the level of confidence we have in the data; 3) and identify trends in unavailability at several levels of aggregation. The second phase of study was intended to focus on unavailability related to maintenance only, especially unavailability caused by major maintenance activities. Finally, the third phase would seek to predict future reliability based on engineering reliability and economic techniques under alternative funding scenarios.

As we began to develop work plans for Phase 1, it became apparent that it was going to be a very large, expensive effort. At that time, IWR decided to embark on a Proof of Concept phase, Phase 0, which would be similar to Phase 1, but would be limited in geographic and temporal scope. Whereas Phase 1 would be a study of all locks nationwide for all available years of data, Phase 0 is a study of only the Upper Mississippi and Illinois rivers for the year 2003. The geographic area covered by Phase 0 includes all locks on the Upper Mississippi River and Illinois Waterway. Organizationally, Phase 0 includes locks in the St Louis, Rock Island, and St Paul Districts. **Table 1** below lists the locks included in this phase of study.



**Table 1  
Study Area Locks**

**Mississippi River**

District	Lock	River Mile	Chambers
St Louis	Lock & Dam 27	185	2
St Louis	Melvin Price Lock & Dam	201	2
St Louis	Lock & Dam 25	241	1
St Louis	Lock & Dam 24	273	1
Rock Island	Lock & Dam 22	301	1
Rock Island	Lock & Dam 21	325	1
Rock Island	Lock & Dam 20	343	1
Rock Island	Lock & Dam 19	364	2
Rock Island	Lock & Dam 18	410	1
Rock Island	Lock & Dam 17	437	1
Rock Island	Lock & Dam 16	457	1
Rock Island	Lock & Dam 15	483	2
Rock Island	Lock & Dam 14	493	2
Rock Island	Lock & Dam 13	522	1
Rock Island	Lock & Dam 12	557	1
Rock Island	Lock & Dam 11	583	1
St Paul	Lock & Dam 10	615	1
St Paul	Lock & Dam 9	648	1
St Paul	Lock & Dam 8	679	1
St Paul	Lock & Dam 7	703	1
St Paul	Lock & Dam 6	714	1
St Paul	Lock & Dam 5a	728	1
St Paul	Lock & Dam 5	738	1
St Paul	Lock & Dam 4	753	1
St Paul	Lock & Dam 3	797	1
St Paul	Lock & Dam 2	815	2
St Paul	Lock & Dam 1	848	2
St Paul	St. Anthony Falls - Lower Lock & Dam	853	1
St Paul	St. Anthony Falls - Upper Lock & Dam	854	1

**Illinois River**

District	Lock	River Mile	Chambers
Rock Island	LaGrange Lock & Dam	80	1
Rock Island	Peoria Lock & Dam	158	1
Rock Island	Starved Rock Lock & Dam	231	1
Rock Island	Marseilles Lock & Dam	245	1
Rock Island	Dresden Island Lock & Dam	272	1
Rock Island	Brandon Road Lock & Dam	286	1
Rock Island	Lockport Lock	291	1
Rock Island	Thomas J. OBrien Lock	326	1

## Study Purposes

This study was conducted with two purposes in mind. One was to gather and analyze a limited set of data to determine how confident we are with the data. The second was to provide insight into the feasibility of conducting this effort on a nation-wide basis. This report is structured to address both purposes by describing the major tasks accomplished, describe the findings of each major task as applicable, and provide an opinion on the level of effort required to accomplish these tasks on a nation-wide scale. The Scope of Work for this study is available as Attachment 1.

## Study Tasks

Phase 0 consisted of 6 major tasks and 2 lesser tasks.

The five major tasks were;

1. assemble, fund, and manage a Project Delivery Team (PDT)
2. assemble a database containing stall and stoppage records for the locks of interest, assemble a database that can be used to determine the impact of each closure, and assemble a database that can be used for internal cross-checking
3. crosscheck the databases with other information sources
4. crosscheck the indicated stall and stoppages with other fields in the database
5. review the database and cross-checks, and determine the level of confidence we have in the data
6. document the activities and results of this phase of study

The two lesser tasks were;

1. verify data contained on a Navigation Data Center web site
2. conduct an internal review of this study for quality assurance purposes

## Verify NDC Lock Characteristics Web Site Data

NDC web site data was compared to data published in the Upper Mississippi and Illinois Waterway System Navigation Feasibility Report. If the information was different, the locks were called to resolve differences. **Table 2** shows lock characteristics for the Mississippi and Illinois River locks. Rehabilitation information was added if the lock has been rehabilitated. The Status and Owner/Operator fields were not checked. In several cases, UMR-IWW data was incorrect. Those places where the NDC web site is incorrect are marked with **yellow background**. Note the NCD web site shows gate types as vertical at L&D 27, Mel Price and L&D 19. Actually those sites have vertical lift gates on the upper end of the lock and miter gates at the lower end. The rehabilitation at L&D 9 is 99% complete, and should be complete by the time navigation begins in the spring of 2005. The rehabilitations in St Paul District, Locks 10 through St Anthony Falls, have not had the embankments or guide walls rehabilitated.

**Table 2**  
**Lock Characteristics General Report**

River/Lock	Chamber	River Mile	Year Open / Last Rehabed	Length	Width	Lift	Status	Owner/Operator	Gatetype
<b>Illinois</b>									
Lagrange	Main	80.2	1939/1991	600	110	10	Operational	Corps/Corps	Miter
Peoria	Main	157.7	1938/1991	600	110	11	Operational	Corps/Corps	Miter
Starved	Main	231.0	1933/1984	600	110	19	Operational	State/Corps	Miter
Marseilles	Main	244.6	1933/1996	600	110	24	Operational	State/Corps	Miter
Dresden	Main	271.5	1933/1996	600	110	22	Operational	State/Corps	Miter
Brandon	Main	286.0	1933/1996	600	110	34	Operational	State/Corps	Miter
Lockport	Main	291.1	1933/1996	600	110	40	Operational	Corps/Corps	Miter
Thomas J O'Brien	Main	326.5	1960	1000	110	4	Operational	Corps/Corps	Sector
<b>Mississippi</b>									
27	Main	185.5	1953	1200	110	21	Operational	Corps/Corps	Vertical/Miter
27	Aux	185.5	1953	600	110	21	Operational	Corps/Corps	Miter
Melvin Price	Main	200.8	1990	1200	110	24	Operational	Corps/Corps	Vertical/Miter
Melvin Price	Aux	200.8	1994	600	110	24	Operational	Corps/Corps	Miter
25	Main	241.4	1939/2001	600	110	15	Operational	Corps/Corps	Miter
24	Main	273.4	1940	600	110	15	Operational	Corps/Corps	Miter
22	Main	301.2	1938/1990	600	110	10	Operational	Corps/Corps	Miter
21	Main	324.9	1938/1990	600	110	10	Operational	Corps/Corps	Miter
20	Main	343.2	1936/1990	600	110	10	Operational	Corps/Corps	Miter
19	Main	364.3	1957	1200	110	38	Operational	Corps/Corps	Vertical/Miter
18	Main	410.5	1937/1993	600	110	10	Operational	Corps/Corps	Miter
17	Main	437.1	1939/1993	600	110	8	Operational	Corps/Corps	Miter
16	Main	457.2	1937/1994	600	110	9	Operational	Corps/Corps	Miter
15	Main	482.9	1934/1996	600	110	16	Operational	Corps/Corps	Miter
15	Aux	482.9	1934	360	110	16	Operational	Corps/Corps	Miter
14	Main	493.0	1939/2000	600	110	11	Operational	Corps/Corps	Miter
14	Aux	493.0	1922	320	80	11	Seasonal	Corps/Corps	Miter
13	Main	522.5	1939/1997	600	110	11	Operational	Corps/Corps	Miter
12	Main	556.7	1939/2004	600	110	9	Operational	Corps/Corps	Miter
11	Main	583.0	1937	600	110	11	Operational	Corps/Corps	Miter
10	Main	615.1	1936	600	110	8	Seasonal	Corps/Corps	Miter
9	Main	647.9	1938/2005	600	110	9	Seasonal	Corps/Corps	Miter
8	Main	679.2	1937/2004	600	110	11	Seasonal	Corps/Corps	Miter
7	Main	702.5	1937/2000	600	110	8	Seasonal	Corps/Corps	Miter
6	Main	714.3	1936/1998	600	110	6	Seasonal	Corps/Corps	Miter
5A	Main	728.5	1936/1999	600	110	5	Seasonal	Corps/Corps	Miter
5	Main	738.1	1935/1997	600	110	9	Seasonal	Corps/Corps	Miter
4	Main	752.8	1935/1995	600	110	7	Seasonal	Corps/Corps	Miter
3	Main	796.9	1938/1994	600	110	8	Seasonal	Corps/Corps	Miter
2	Main	815.2	1948/1995	600	110	12	Seasonal	Corps/Corps	Miter
1	Main	847.6	1930/1983	400	56	38	Seasonal	Corps/Corps	Miter
1	Aux	847.6	1932	400	56	38	Seasonal	Corps/Corps	Miter
Lower St Anthony Falls	Main	853.3	1959	400	56	25	Seasonal	Corps/Corps	Miter
Upper St Anthony Falls	Main	853.9	1963	400	56	49	Seasonal	Corps/Corps	Miter

## Assemble Project Delivery Team

Assembling the properly staffed team for this study was challenging due to the wide geographic area covered and the fact that the management team in the Great Lakes and Ohio River Division (LRD) did not personally know the people in the Mississippi Valley Division (MVD). In spite of these challenges, an effective team was assembled that consisted of people from IWR, St Louis and Rock Island Districts in MVD, and

Huntington and Louisville Districts in LRD. The team consisted of information management specialists, engineers, economists, administrative support personnel, and managers. This entire study was conducted in a virtual environment. No face-to-face meetings occurred between IWR, MVD, and LRD. The team had one, all hands teleconference. From that point on, all communication was conducted by email supplemented by telephone calls between individual team members and NetMeeting® sessions. An emergency closure of Melvin Price L&D, and hurricanes in Florida occupied the time of key personnel in MVD. The loss of their services hindered the data gathering efforts.

One *lesson learned* from Phase 0 was that the team should have included people from the Operations side of the house. If Phase 1 goes forward, and the decision is made to cross-check electronic data with lock log books and other data sources, the team needs to include Operations personnel from every District involved. These people could be either someone from the District office, or a field manager that has responsibility for several locks. In addition, the team would also need to include a representative from each repair facility, or a District office person that knows the major maintenance activities in the District or Division.

## **Assemble Databases**

This activity consisted of several sub-tasks:

1. Define and assemble a Stall-Stoppage database table
2. Define and assemble several Impacts database tables
3. Check for definitional differences between OMNI and LPMS

**Corps of Engineers Data Systems.** It should be noted here that the Corps of Engineers currently uses two systems for recording lockage data, a web browser based input system known as Lock Performance Monitoring System (LPMS), and an application known as Operation and Maintenance of Navigation Installations (OMNI). The two systems reside on separate computer hardware systems, and are structured differently. The OMNI system is used by the St Louis, Rock Island and St Paul Districts in MVD; Pittsburgh, Huntington, Louisville, Nashville and Chicago Districts in LRD; and Little Rock District in Southwest Division. The LPMS web based system is used everywhere else. Since this phase of study is geographically limited to the St Louis, Rock Island and St Paul Districts, OMNI was used as the data source.

**Define and Assemble Stall-Stoppage Database.** This sub-task consisted of defining and populating a database table structure to serve as the repository of all stalls or stoppages recorded at the study locks. The PDT, in consultation with both OMNI and LPMS system administrators, decided on the structure shown in **Table 3**.

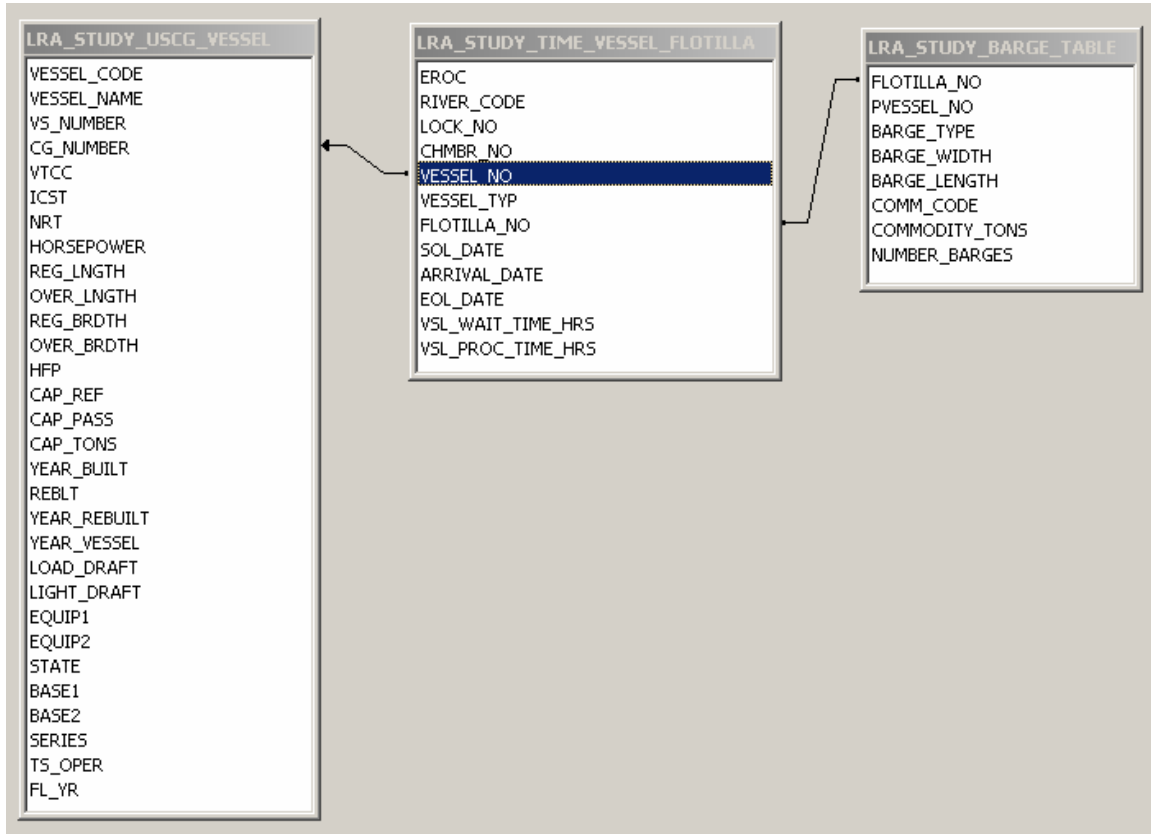
**Table 3**  
**Stall-Stoppage Database**  
**Table Structure**

Field Name	Data Type	Description
EROC	Text	2 Character District Identifier
RIVER_CODE	Text	2 Character River Identifier
LOCK_NO	Text	2 Character Lock Identifier
CHMBR_NO	Text	1 Character Chamber Identifier
BEG_STOP_DATE	Date/Time	Date and time event began
END_STOP_DATE	Date/Time	Date and time event ended
SCHEDULED	Text	Was the event scheduled (Y or N)
REASON_CODE	Text	2 character event cause code
NUM_HW_CYCLES	Number	Number of hardware cycles during the event

**Define and Assemble Detailed Impacts Database.** This sub-task consisted of defining and populating a table which could be used in future phases of study to determine closure impacts. The intent of this Phase of study was to assemble the database, not to determine the actual closure impacts. If this study progresses to Phase 1, 2 and 3, impact determination will be made in Phase 2.

This database is intended to serve as a source which can be queried to determine the cost of additional delay and processing time caused by each closure shown in the Stall-Stoppage table. Delay and processing time costs are primarily driven by the horsepower of the towboat pushing the tow, the number and types of barges in the tow, and amounts and types of commodities in the barges. **Figure 1** shows the database structure developed by the PDT.

**Figure 1**  
**Detailed Impacts Database Structure**



The *Time Vessel Flotilla* and *Barge Table* tables were created from OMNI data. The *USCG Vessel* table came from a CD published by the Navigation Data Center. When calculating costs, the horsepower will come from the *USCG Vessel* table. The number and types of barges, and amount and types of commodities will come from the *Barge Table*.

**Define and Assemble Daily Summaries Database.** This sub-task consisted of defining and populating a table which could be used in future phases of study to determine closure impacts. It is a simplified and summarized version of the *Detailed Impacts Database*. Whereas the *Detailed Impacts Database* contains information for every vessel passage at every lock, this database contains information summarized at a daily level. This database does not contain barge type or commodity type information. It is simplified to include only the total number of barges and total tonnage. Therefore, this database is much smaller than the *Detailed Impacts Database*. Like the *Detailed Impacts Database*, the intent of this Phase of study was to assemble the database, not to determine the actual closure impacts. If this study progresses to Phase 1, 2 and 3, impact determination will be made in Phase 2. **Table 4** shows the table structure of the *Daily Impacts Database*.

**Table 4**  
**Daily Summary Database**

Field Name	Data Type	Description
EROC	Text	2 character code District identifier
RIVER_CODE	Text	2 character river identifier
LOCK_NO	Text	2 character lock identifier
CHMBR_NO	Text	1 character chamber identifier
DATA_DATE	Date/Time	Applicable date
NUMBER_TOW_ARRIVALS	Number	Number of tow arrivals on applicable date
NUMBER_TOW_VESSELS	Number	Number of tow lockages on applicable date
NUMBER_OTHER_VESSELS	Number	Number of other vessel type lockages on applicable date
TOTAL_VSL_PROC_TIME_HRS	Number	Total processing time for all vessels on applicable date
TOTAL_TOW_VSL_WAIT_TIME_HRS	Number	Total tow wait time on applicable date
NUMBER_EMPTY_BARGES	Number	Total number of empty barges on applicable date
NUMBER_LOADED_BARGES	Number	Total number of loaded barges on applicable date
TOTAL_TONNAGE	Number	Total tonnage on applicable date
TOTAL_TOW_HORSEPOWER	Number	Sum of horsepowers for all tows whose horsepowers could be identified
TOTAL_TOWS_FOR_HP	Number	Total number of tows whose horsepowers could be identified
AVERAGE_TOW_HORSEPOWER	Number	Average horsepower of tows whose horsepower could be identified

**Define Summary Closure Impact Database.** A third database structure was defined by the PDT, but was not populated. This database was intended to contain one record for each closure event. **Figure 2** shows the structure of this table.

**Figure 2**  
**Closure Impact Summary**  
**Table Structure**

Field Name	Data Type	Description
EROC	Text	2 character code District identifier
RIVER_CODE	Text	2 character river identifier
LOCK_NO	Text	2 character lock identifier
CHMBR_NO	Text	1 character chamber identifier
BEG_STOP_DATE	Date/Time	Date and time closure begins
END_STOP_DATE	Date/Time	Date and time closure ends
SCHEDULED	Text	1 character was closure scheduled (Y or N)
REASON_CODE	Text	2 character closure reason code
NUMBER_TOWS_AFFECTED	Number	Long Integer number of tows affected by closure
ADDED_PROC_TIME	Number	Long Integer additional processing time caused by closure
ADDED_DELAY_TIME	Number	Long Integer additional delay time caused by closure
ADDED_DELAY_COST	Number	Long Integer additional delay cost caused by closure

This database table was not populated because it pertains to closure impact determination, not database assembly. Since Phase 2 will deal with impact determination, data will be added in that phase.

## Cross-Checks

The OMNI and LPMS systems are two ways that data is collected at Corps locks. They are by far the most comprehensive databases relating to lock operations. However, there are other data sources which can be used to cross-check OMNI and LPMS data,

especially when it comes to issues related to closures. Three other data sources were identified shortly after this study began. A fourth was identified during the cross-check.

**Log Books.** Each lock maintains a log that lists significant events at that lock. These books contain entries of all kinds, including events that close lock chambers to traffic. These books are maintained in book form at the lock and are not electronically searchable.

**Notices to Navigation.** Navigation notices are sent from the District office to entities interested in navigation. Like log books, they contain information relating to all kinds of river related activities, including scheduled or emergency lock closure information. These notices are now sent electronically to recipients and are posted on at least one District's web site. They are not contained in one searchable database however.

**Repair Crew Job Reports.** These reports relate specifically to work performed by the District's repair crews. Repair crews do the work that is beyond routine maintenance related activities performed by lock personnel. Therefore, these reports list the major closures that occur. These reports are especially helpful because they provide detailed descriptions of the work that was performed at the lock, including closure and reopening dates. These reports are not maintained electronically.

**Infrastructure Emergency Repairs - Data Call.** Shortly after the cross-check began, a 4<sup>th</sup> data source was identified. Corps headquarters, through the Operations office, sent a request to all Corps Major Support Commands asking for information related to emergency repairs during the last 5 years. St Louis District responded by having each lock prepare its own response. Melvin Price L&D and L&D 24 were directed to include closures that exceeded 8 hours duration. L&D 27 and L&D 25 included all closure durations. Rock Island prepared a consolidated response for all locks. St Paul District responded by saying they had no emergency closures during the last 5 years.

**Internal Cross-Check of OMNI Data.** An additional data cross-check was made by developing a procedure to look for periods of time where a vessel arrives and waits to use a lock, but the lock appears idle. **Table 5** provides an example of one of these occurrences. The third vessel (the third line in the table below) arrived at 6:30 AM on March 20, 2003. The previous vessel finished its lockage at 4:15 PM. This means the third vessel should have started its lockage shortly after 4:15 PM. Instead, it waited until 6:20 PM to start its lockage. OMNI data does not contain a stoppage event to indicate why the lock is idle from 4:15 to 6:20 PM.



**Table 5**  
**Internal Cross-Check Example**

EROC	River	Lock	Chamber	Arrival	Start of Lockage	End Of Lockage
B5	MI	17	1	3/20/03 12:40	3/20/03 13:50	3/20/03 14:15
B5	MI	17	1	3/20/03 14:40	3/20/03 14:40	3/20/03 16:15
B5	MI	17	1	3/20/03 6:30	3/20/03 18:20	3/20/03 19:00
B5	MI	17	1	3/20/03 21:40	3/20/03 21:40	3/20/03 22:12
B5	MI	17	1	3/21/03 0:45	3/21/03 0:45	3/21/03 3:30

## Summary and Conclusions

### ***Assemble Project Delivery Team.***

**PDT Composition.** If this study progresses to Phase 1, and the decision is made to cross-check OMNI/LPMS data with other data sources, the PDT must be heavily weighted with members from the Operations side of the organization. Operations personnel are best positioned to gather and review historic Notices to Navigation. Operations personnel are also best positioned to gather, review and summarize job reports produced when major maintenance is performed at a lock. Lastly, Operations personnel are best positioned to review lock log books and note all activities that affect the ability of a lock to process traffic. It must also be recognized that this will be an expensive undertaking. Assuming about 10 years of data are cross-checked, current estimates run from a minimum of 3 worker days per lock site, up to 10 or more worker days per lock site. It should also be recognized that it will take a significant period of time to identify the correct people to be part of the PDT.

If this study progresses to Phase 1, but the decision is made to use OMNI/LPMS data without cross-checking, the level of effort will be significantly reduced. In this case, the PDT will consist of information technology personnel, who will extract relevant data from its sources, and analysts, who will review the data and make conclusions.

***Assemble Databases.*** If Phase 1 is undertaken, three sources of data will be used to create the Stall-Stoppage, Detailed Impacts, and Daily Summaries databases. All three sources, OMNI, web based LPMS, and the pre-2000 ASCII Master files, contain the information necessary to create these databases. We anticipate no extraordinary problems creating databases for locks nationwide. However, we do not know how much of the pre-2000 data is available. We know that LRD has ASCII master files going back as far as 1980. We recommend that all easily attainable information be included in Phase 1, including pre-1991 data if available.

***All Stoppage Types and Reliability Related Stoppage Types.*** Table 6 and Table 7 show the number and total duration of stoppage events recorded in OMNI, and the percentage attributable to repairing or maintaining the lock.

Clearly, St Paul District locks are recording far fewer stoppages than Rock Island and St Louis District locks. Operations personnel in St Paul conducted a separate cross-check of lock log books, Notices to Navigation, and repair crew records for L&D 8 and L&D 10.

They found that winter shutdown was not recorded for L&D 10. Other than that, they found no additional closures at either lock.

**Table 6  
Stalls and Durations  
at Mississippi River Locks**

District	Lock	Chamber	All Event Types		Percent Reliability Related	
			# of Events	Duration (Days)	# of Events	Duration (Days)
St. Paul	Upper St Anthony's Falls	Main	1	0.02	0%	0%
St. Paul	Lower St Anthony's Falls	Main	0	0.00	-	-
St. Paul	Lock & Dam 1	Main	1	0.01	100%	100%
St. Paul	Lock & Dam 1	Auxiliary	0	0.00	-	-
St. Paul	Lock & Dam 2	Main	3	0.43	67%	75%
St. Paul	Lock & Dam 2	Auxiliary	0	0.00	-	-
St. Paul	Lock & Dam 3	Main	0	0.00	-	-
St. Paul	Lock & Dam 4	Main	1	0.09	0%	0%
St. Paul	Lock & Dam 5	Main	1	0.04	100%	100%
St. Paul	Lock & Dam 6	Main	5	0.53	0%	0%
St. Paul	Lock & Dam 7	Main	0	0.00	-	-
St. Paul	Lock & Dam 8	Main	5	0.55	0%	0%
St. Paul	Lock & Dam 9	Main	6	0.40	0%	0%
St. Paul	Lock & Dam 10	Main	0	0.00	-	-
Rock Island	Lock & Dam 11	Main	79	3.85	91%	86%
Rock Island	Lock & Dam 12	Main	64	1.91	80%	61%
Rock Island	Lock & Dam 13	Main	3	0.25	33%	6%
Rock Island	Lock & Dam 14	Main	34	2.39	3%	1%
Rock Island	Lock & Dam 14	Auxiliary	0	0.00	-	-
Rock Island	Lock & Dam 15	Main	58	2.31	0%	0%
Rock Island	Lock & Dam 15	Auxiliary	8	135.08	63%	100%
Rock Island	Lock & Dam 16	Main	57	2.53	11%	30%
Rock Island	Lock & Dam 17	Main	41	29.77	15%	91%
Rock Island	Lock & Dam 18	Main	19	1.96	5%	2%
Rock Island	Lock & Dam 19	Main	45	65.99	44%	98%
Rock Island	Lock & Dam 19	Auxiliary	0	0.00	-	-
Rock Island	Lock & Dam 20	Main	31	2.63	13%	9%
Rock Island	Lock & Dam 21	Main	14	1.82	7%	28%
Rock Island	Lock & Dam 22	Main	33	4.46	21%	25%
St. Louis	Lock & Dam 24	Main	72	95.86	56%	95%
St. Louis	Lock & Dam 25	Main	96	8.85	34%	38%
St. Louis	Melvin Price Lock & Dam	Main	131	7.42	28%	46%
St. Louis	Melvin Price Lock & Dam	Auxiliary	18	7.30	61%	36%
St. Louis	Lock & Dam 27	Main	50	10.82	62%	91%
St. Louis	Lock & Dam 27	Auxiliary	13	7.28	77%	48%

**Table 7**  
**Stalls and Durations**  
**at Illinois River Locks**

District	Lock	Chamber	All Event Types		Percent Reliability Related	
			# of Events	Duration (Days)	# of Events	Duration (Days)
Rock Island	LaGrange Lock & Dam	Main	55	8.45	42%	39%
Rock Island	Peoria Lock & Dam	Main	52	4.43	6%	4%
Rock Island	Starved Rock Lock & Dam	Main	30	2.29	57%	72%
Rock Island	Marseilles Lock & Dam	Main	42	2.85	40%	53%
Rock Island	Dresden Island Lock & Dam	Main	10	0.65	30%	23%
Rock Island	Brandon Road Lock & Dam	Main	129	6.29	85%	78%
Rock Island	Lockport Lock	Main	92	2.61	39%	51%
Rock Island	Thomas J. OBrien Lock	Main	385	7.95	7%	13%

**Scheduled and Unscheduled Stoppages.** Spreadsheets used to cross-check the data, shown in Attachment 2, indicate that very few closure events were recorded as scheduled. Of the 338 reliability related events recorded in OMNI, only 12 were recorded as scheduled. Among the unscheduled events were 7 that lasted a month. One advantage of doing the cross-checks would be to determine whether these events are correctly recorded as unscheduled. The cross-check could also determine whether the definition of an “unscheduled” closure is consistent across locks, Districts and Divisions. Some Districts record a closure as scheduled only if a Notice to Navigation is issued. Others consider a closure to be scheduled if the towing industry has time to reschedule shipments.

**Table 6** and **Table 7** show several lock chambers were closed for extensive periods of time. Mississippi L&D 15 auxiliary chamber was closed from August 18, 2003 through December 31, 2003. Two reasons are given for the closure. From August 18 through August 31, the stoppage code was *Repairing Lock or Lock Hardware*. The stoppage code from September 1 through December 31 was *Lock hardware or equipment malfunction*. This extensive closure was listed as **Not Scheduled** in OMNI. The cross-check with other data sources indicates that a Notice to Navigation was issued for this closure, but it was issued only 4 days before the closure began. According to the Notice, the closure was caused by deterioration to #5 and #8 miter gates. As of June 2005, the auxiliary chamber remains closed at L&D 15.

OMNI stoppage data indicates Mississippi L&D 19 was closed from January 1, 2003 through March 4, 2003 for *Maintaining lock or lock equipment*. Again, this closure is listed as **Not Scheduled**. The cross-check with other data sources could not find a Notice to Navigation associated with this closure.

OMNI stoppage data indicates Mississippi L&D 24 was closed from January 1, 2003 through March 14, 2003 for *Maintaining lock or lock equipment*. In this case, OMNI indicates that the closure was **Scheduled**. The cross-check with other data sources could not find Notices to Navigation for St Louis District. Therefore, we are unsure whether a Notice to Navigation was issued.

**Results of Cross-Check with Other Data Sources.** One PDT member was assigned this activity. Soon after work began, it became apparent that this activity was grossly under resourced and under funded. In addition, the PDT member was hindered by the unavailability of key personnel due to their reassignment to disaster duty in response to hurricanes in Florida. In spite of these handicaps, the PDT member was able to partially cross-check data at most Mississippi River locks in the Rock Island and St Louis Districts because of the response to the emergency repair data call.

The PDT member assigned to this task did not personally review any lock log books because the log books had been reviewed in response to the data call made by Corps HQ. The PDT member was able to find Navigation Notices for only one of the three Districts, Rock Island, and was unable to obtain or review repair crew job reports. The PDT team member's notes are included as Attachment 3. Spreadsheets used to cross-check the data are included as Attachment 2.

The most extensive data call information came from L&D 25 and L&D 27. Those locks noted all closure durations in their data call responses.

At L&D 25, OMNI data indicated 33 reliability related closures totaling 3 days, 9 hours, 17 minutes. Of those 33 closures, 18 were also noted in the data call. The data call noted 6 additional closures that were not recorded in OMNI. Those 6 additional closures totaled 15 hours, 51 minutes. Of those 6 additional closures recorded in the log book, 4 occurred between the end of lockage of one vessel and the arrival of another. This means we have no way of cross-checking those log records. One closure indicated miter gate #4 was inoperable, yet 4 lockages were recorded during the time the gate was noted as inoperable. Those lockages were very short durations however, so they could have been recreation craft. This means one miter gate could be inoperable, but if it was stuck in the position where it miters with the other gate, recreation craft could be locked through the facility using the one operable gate. The last of the six additional log book closures notes a computer problem in the upstream control panel. OMNI indicates that a vessel locked through during the event noted in the log book. This would seem to indicate that the log book entry is incorrect because a vessel was able to lock. However, lock personnel were consulted, and they indicated that vessels can lock during these types of computer failures. Therefore, the log book entry was correctly noted in the data call, but this type of event did not prevent the lock from servicing traffic.

At L&D 27, OMNI indicated 31 closures of the main chamber, totaling 9 days, 21 hours, 32 minutes. The data call contained only 4 events for this chamber. Every event noted in the data call was of long duration, with a minimum of 3 hours, 30 minutes and maximum of over 6 days. Several long duration closures noted in OMNI were not noted in the data call. This could be because the data call asked for only *emergency* repairs, not all repairs.

**Table 8** and **Table 9** summarize the results of the cross-check made during this phase. Even if a person analyzes these tables with care, the analysis produces conflicting results. For example, L&D 25 and L&D 27 included all durations in their emergency data call response. At L&D 25, the data call resulted in only 15 additional hours closure, and

L&D 27 resulted in no additional events. At Mel Price L&D auxiliary chamber, which included only events that exceeded 8 hours duration, one event was found that accounted for twice as much closure time as all the events listed in OMNI.

OMNI data at L&D 17 showed one of the largest total closure durations on the tables, yet the emergency data call uncovered an additional 32 day closure that was not recorded in OMNI. L&D 15, main chamber, had no closure in OMNI, yet the emergency data call uncovered a 16 day closure that was substantiated by a Notice to Navigation.

If we only consider the totals for all locks, the emergency data call uncovered closures that amounted to about 15% of the closures shown in OMNI. However, most of the additional 15% can be attributed to only 2 events.

One way of looking at these results is to say that cross-checking with other data sources will be very expensive, and based on this Phase, only a few large events will be found.

***Results of Cross-Check with Other Data Sources, Lessons Learned.*** The most important thing we found during the cross-check was that we had grossly underestimated the level of effort required to cross-check the data. We allocated 40 hours of time to this effort. A person in Louisville District, who cross-checked data at Louisville District locks for the Ohio River Main Stem System Study, estimates it takes 3 days per lock to review lock log books, repair crew records and Notices to Navigation. This estimate was to review about 17 years of data, and note only the closures that exceed 1 day duration. A lockmaster in St Louis District, who responded to the data call, estimated it takes 1 day per lock per year to review just the log books. This estimate is for a review that includes all closures, even short duration closures.

Another lesson learned was that Operations personnel need to either do the cross-check, or be heavily involved in the cross-check. If we proceed to Phase 1, we need to spend sufficient time to identify the people that are best positioned to do these cross-checks. One possible combination of people may be having personnel from each lock review the log books, and Operations personnel in each District office review the notices to navigation and repair crew records.

***Results of Internal Cross-Check.*** The internal cross-check was found to be a relatively easy, inexpensive, way to check whether apparent lock closures were recorded in OMNI data. A large number of apparent stoppages were identified through this cross check. Unfortunately, we do not know the reason for the apparent stoppage. If Phase 1 is undertaken, this internal cross-check procedure may be useful to help identify periods of time when log books are reviewed,

**Cross-Check Summary Table.** The results of the cross-check with other data sources and internal cross-check are presented in **Table 8** and **Table 9**.

**Table 8  
Cross-Check Summary Table, Mississippi River**

Lock	OMNI		Additional Events Not Listed in OMNI							
			Emergency Repair Data Call				Notices to Navigation		Internal Cross-Check *	
	# Events	Duration Days:Hrs:Mins	Log Books		Combination/Unknown		# Events	Duration Days:Hrs:Mins	# Events	Duration Days:Hrs:Mins
			# Events	Duration Days:Hrs:Mins	# Events	Duration Days:Hrs:Mins				
L&D 27 Main Chamber	31	09:21:32	0	-	Not Applicable	-	Unavailable	-	2	00:02:30
L&D 27 Auxiliary Chamber	10	03:11:40	0	-	Not Applicable	-	Unavailable	-	Unavailable	-
Melvin Price L&D Main	36	03:08:28	0	-	Not Applicable	-	Unavailable	-	1	00:01:20
Melvin Price L&D Auxiliary	11	02:15:09	1	04:12:00	Not Applicable	-	Unavailable	-	Unavailable	-
L&D 25	33	03:09:11	6	00:15:51	Not Applicable	-	Unavailable	-	1	00:01:00
L&D 24	39	91:06:28	0	-	-	-	Unavailable	-	4	00:06:12
L&D 22	6	01:01:30	Not Applicable	-	3	00:04:52	0	-	2	00:03:22
L&D 21	1	00:12:12	Not Applicable	-	0	-	0	-	1	00:02:00
L&D 20	4	00:05:55	Not Applicable	-	1	00:04:00	0	-	3	00:06:38
L&D 19	19	64:08:51	Not Applicable	-	0	-	0	-	0	-
L&D 18	1	00:00:47	Not Applicable	-	4	00:04:48	0	-	0	-
L&D 17	6	27:05:37	Not Applicable	-	4	32:12:00	2	01:00:00	1	00:16:05
L&D 16	6	00:18:04	Not Applicable	-	1	00:00:59	0	-	1	00:05:10
L&D 15 Main	0	-	Not Applicable	-	1	16:16:59	1	16:16:59	7	00:14:07
L&D 15 Auxiliary	5	134:23:50	Not Applicable	-	0	-	0	-	Unavailable	-
L&D 14	1	00:00:26	Not Applicable	-	0	-	0	-	11	00:16:34
L&D 13	1	00:00:21	Not Applicable	-	1	00:12:00	0	-	0	-
L&D 12	51	01:04:10	Not Applicable	-	0	-	0	-	0	-
L&D 11	72	03:07:04	Not Applicable	-	1	00:00:30	0	-	4	00:15:40
L&D 10	0	-	Unavailable	-	Unavailable	-	Unavailable	-	7	00:12:36
L&D 9	0	-	Unavailable	-	Unavailable	-	Unavailable	-	2	00:08:05
L&D 8	0	-	Unavailable	-	Unavailable	-	Unavailable	-	7	01:04:08
L&D 7	0	-	Unavailable	-	Unavailable	-	Unavailable	-	1	00:01:00
L&D 6	0	-	Unavailable	-	Unavailable	-	Unavailable	-	2	00:06:00
L&D 5a	0	-	Unavailable	-	Unavailable	-	Unavailable	-	4	00:05:07
L&D 5	1	00:01:02	Unavailable	-	Unavailable	-	Unavailable	-	1	00:01:45
L&D 4	0	-	Unavailable	-	Unavailable	-	Unavailable	-	2	00:03:45
L&D 3	0	-	Unavailable	-	Unavailable	-	Unavailable	-	2	00:03:01
L&D 2	2	00:07:43	Unavailable	-	Unavailable	-	Unavailable	-	2	00:03:00
L&D 1	1	00:00:15	Unavailable	-	Unavailable	-	Unavailable	-	1	00:02:08
Lower St Anthony's Falls	0	-	Unavailable	-	Unavailable	-	Unavailable	-	3	00:04:22
Upper St Anthony's Falls	0	-	Unavailable	-	Unavailable	-	Unavailable	-	4	06:08:36
<b>Totals =</b>	<b>337</b>	<b>348:03:14</b>	<b>7</b>	<b>4:23:02</b>	<b>16</b>	<b>50:08:08</b>	<b>3</b>	<b>17:16:59</b>	<b>76</b>	<b>13:10:11</b>

\* Closure type unknown. May not be reliability related.

**Table 9  
Cross-Check Summary Table, Illinois River**

Lock	Additional Events Not Listed in OMNI									
	OMNI		Data Call				Notices to Navigation		Internal Cross-Check *	
	# Events	Duration Days:Hrs:Mins	Log Books		Unknown		# Events	Duration Days:Hrs:Mins	# Events	Duration Days:Hrs:Mins
			# Events	Duration Days:Hrs:Mins	# Events	Duration Days:Hrs:Mins				
LaGrange L&D	23	03:07:09	Unavailable	-	Unavailable	-	Unavailable	-	17	01:16:35
Peoria L&D	3	00:03:26	Unavailable	-	Unavailable	-	Unavailable	-	3	00:06:26
Starved Rock L&D	17	01:15:40	Unavailable	-	Unavailable	-	Unavailable	-	27	01:15:37
Marseilles L&D	17	01:12:24	Unavailable	-	Unavailable	-	Unavailable	-	45	02:11:48
Dresden Island L&D	3	00:03:31	Unavailable	-	Unavailable	-	Unavailable	-	23	02:00:39
Brandon Road L&D	109	04:20:24	Unavailable	-	Unavailable	-	Unavailable	-	38	01:15:02
Lockport L&D	36	01:08:07	Unavailable	-	Unavailable	-	Unavailable	-	17	01:02:40
Thomas J O'Brien L&D	26	01:00:04	Unavailable	-	Unavailable	-	Unavailable	-	1	00:01:00
<b>Totals =</b>	<b>234</b>	<b>13:22:45</b>	<b>0</b>	<b>00:00:00</b>	<b>0</b>	<b>00:00:00</b>	<b>0</b>	<b>00:00:00</b>	<b>171</b>	<b>10:21:47</b>

**Cross-Check PDT Member's Notes.** The PDT member who conducted the cross-check with other data sources made several observations in their notes (see Attachment 3). This section contains a summary of those observations.

- Record keeping methods vary from site to site and District to District. Obtaining records for Phase 1 may be more difficult at some sites than others.
- There is a large difference in the estimated time it will take to cross-check data during Phase 1. The minimum estimate is 3 days per lock. The maximum estimate is 1 day per lock per year to review the log books only. One way to reduce this cost is to limit the search to closures that exceed a specified minimum duration.
- There is a disconnect between the pre-2000 data and post-2000 data. Prior to 2000, stoppages could only be recorded if the event impacted a lockage. In the year 2000 and later, events can be recorded even if they do not impact a lockage. This disconnect in recording criteria could result in data that shows more closures in 2000 and later data than would have been shown if pre-2000 rules were used.
- There are differing opinions on what constitutes a scheduled closure and what constitutes an unscheduled closure. One definition is an event is scheduled if there was a Navigation Notice announcing the closure. Another definition is that scheduled closures apply only to scheduled maintenance events. In order to accurately determine whether an event was scheduled or unscheduled, future studies will have to talk to each lock to determine the definition used.
- An agreed method must developed to determine whether closures should be added or removed from OMNI/LPMS indicated closures if conflicts are found with cross-checks.

## Recommendations

The Study Purposes section of this report states that this study serves two purposes. The first purpose is to gather a limited set of data and determine our level of confidence in that data. The second purpose is to determine the feasibility of conducting this type of study on a nationwide basis.

**Level of Confidence.** We conclude that we have a relatively high level of confidence in the OMNI data. One of the biggest questions initially, was with St Paul's lack of closure events. To check this, we asked Operations personnel in the St Paul District office to cross-check data for L&D 8 and L&D 10. Their cross-check of site logbooks, Notices to Navigation and repair records showed that, other than winter shutdown, there were no additional closures at these two locks. Therefore, we are left to conclude that St Paul's OMNI closure data is accurate.

The results of the cross-check are mixed. We were able to cross-check OMNI data with the Emergency Repair Data Call data for 19 lock chambers. The cross-check uncovered no additional closures at 9 of the 19 chambers. Of the 10 remaining chambers, the cross-check added less than 1 day of closure duration at 7 chambers. Of the three remaining



chambers, the cross-check discovered additional closure durations that varied from 4 additional days to 32 additional days.

***Feasibility of a Nationwide Study.*** We conclude that a nationwide study of reliability related closures is feasible if cross-checking is conducted on a limited basis. We recommend that the nationwide study be conducted by, first, gathering and analyzing all available electronic data. This includes the years 2000 and later OMNI and LPMS data, and pre-2000 data maintained by the Navigation Data Center, the Center of Expertise for Inland Navigation in Huntington WV, and any other readily available data sources. We recommend that the Stall-Stoppage database be populated with readily available data. This database will then be analyzed and compared across locks, Districts, and Division. If anomalies are found, the appropriate District office will be contacted, and cross-checks with other data sources will then proceed. We believe this approach can eventually lead to a reasonably accurate data source while keeping study costs to a minimum.

## **Attachment 1**

### **Scope of Work**

**System-wide Lock Reliability Analysis**  
**Scope of Work for Phase 0 – LPMS Lock Unavailability Analysis**

**INTRODUCTION AND BACKGROUND**

The Corps of Engineers currently faces funding constraints that impede efforts to complete necessary maintenance activities. In response, Corps management has intensified efforts to direct resources to those areas and activities with the greatest need and those that yield the greatest return. Making these management decisions requires good information related to project performance – metrics that cover items such as operational and maintenance costs, benefits, project condition, level of service delivered, service quality, and user satisfaction. For inland navigation infrastructure, the Lock Performance Monitoring System (LPMS) is a critical source of information as the Corps seeks to describe lock and navigation system performance, identify those variables that affect lock and system performance, and determine where scarce funds should be invested.

A number of initiatives have been proposed that seek to develop new information and improve the quality of the information available. Work completed under this scope of work would be a part of one of these initiatives.

Specifically, this scope of work addresses tasks in the first phase of a four phase plan of study.

Phase 0, outlined in this scope of work, serves as a Proof of Concept for Phase 1. This phase embodies the intent of Phase 1, but is limited in geographic scope and to only one year of data. Whereas Phase 1 is intended as national in scope, this phase is limited to the Upper Mississippi River and Illinois River (IMR-IWW) and the year will be 2003.

**PHASE 0 OBJECTIVES:**

Phase 0 is intended to serve as Proof of Scope for a national study currently (30 July 2004) defined as Phase 1.

**PHASE 0 MAJOR TASKS**

The major tasks associated with this phase of study are as follows:

1. Assemble the team and finalize scope of work. At this phase, the scope of the team will be limited to LRD, MVD, and IWR personnel
  - a. IWR – David Grier, Keith Hofseth
  - b. NDC - Arlene Dietz & Donna Wood, and Janette McKin
  - c. LRD – Wes Walker, LRH and Mark Lisney, LRL
  - d. MVD – John Zacher, MVS, LaVeta Bear, MVR, Tammy Loose, MVS

2. At this level, **assemble** lock specific unavailability, delay and processing time data set. This data set will be assembled from unaltered OMNI data for the year 2003. The following subtasks are envisioned:
  - a. Agree on database platform
  - b. Identify and resolve definitional differences
  - c. Agree on fields needed and table structure
  - d. Create database from available data
  - e. Verify newly created database against original data
3. **Crosscheck** unavailability related data items with other sources, for example CRREL ice data, safety data, Notice to Navigations, engineering reports.
  - a. Develop inventory of alternate sources
  - b. Perform Crosscheck
4. **Crosscheck** recorded stall and stoppage data with other fields within the LPMS database. For example, look for periods of time where the lock is idle but tows are arriving and not being processed, yet no stall/stoppage code is recorded.
  - a. Develop algorithm to perform this crosscheck
  - b. Execute algorithm
5. **Verify** age and rehabilitation related lock characteristics on the NDC website. This data set provides key dates of construction and rehabilitation for lock and dam completion and rehabilitation.
  - a. Round up the data from each of the Districts
  - b. Compare with NDC website.
  - c. Arrange to have NDC website updated
  - d. Verify that website was updated
6. Based on the crosschecking and verification above, **describe level of confidence** in data. The team will seek to identify recording error patterns by river, district and lock.
  - a. Note patterns in reporting and evaluate errors against users guide directions. Tabulate errors, incomplete fields, suspicious reports such as uniform times, rounding, unchanging flotilla from lock to lock, completeness, inconsistencies, definitional differences, data recording bias, omissions, and so on.
  - b. Report on violations and corrective actions needed by lock to correct errant practices (may be shift specific, lock specific, district, waterway...note current practice errors by lock (rounding of times, for example).
  - c. Recommend techniques for isolating, accounting for, and dealing with errors in historic data. Catalogue data errors/problems and recommended corrections for locks, districts, divisions etc. and provide to LPMS PDT for corrective action on future recording.
  - d. Correct reasonably correctable errors, and create working data set that will be used in all subsequent analysis.
7. **Document results** and share findings with the LPMS PDT team.
8. Conduct and complete concurrent **internal review** as part of the Planning Center of Expertise for Inland Navigation's quality assurance plan.

9. Make decision on whether and/or how this information will be released to the public.

## **SCHEDULE AND DELIVERABLES**

There are four deliverables: an unavailability data base, a report, and an internal review certification. The trend analysis may be in the form of a spreadsheet or some other numeric report template. As shown in the **Table 1** below, completion of Phase 1 is expected to take 48 weeks. Work shall begin upon receipt of funding, and scheduled task duration begins at that point. A completion date of 1 June 2004 assumes funding for this scope of work is received by 30 July 2004.

**Table 1**  
**Tasks, Deliverables and Schedule**

<b>Task Number and Description</b>	<b>Deliverable</b>	<b>From Start</b>	<b>Estimated Due Date</b>
1. Assemble team		8 weeks	1 Oct 2004
2. Assemble Lock Unavailability data set	data base	12 weeks	1 Nov 2004
3. Crosscheck data with other data sets		16 weeks	1 Dec 2004
4. Crosscheck data within LPMS		16 weeks	1 Dec 2004
5. Verify NDC's age and rehabilitation data		16 weeks	1 Dec 2004
6. Describe level of confidence		24 weeks	1 Feb 2005
7. Unavailability report	report	36 weeks	1 May 2005
8. Internal review	certification	40 weeks	1 June 2005
9. Project Management		1 week	Project Finish
10. All Other Project Activities		1 week	Project Finish

## **TASKS AND RESOURCE ESTIMATE**

**Table 2** estimates the cost of completing this task to be \$76,290. This estimate is based upon expected levels of participation by the team members tentatively identified as of this version of the scope of work. Hourly rates for each are rough estimates as of this time. Participation of key IWR staff is required; however, these costs are not included in the cost estimate. It is estimated that 400 person hours will be required from Donna Woods and Jan McKin, with oversight offered by Arlene Dietz, David Grier, and Keith Hofseth. A detailed spreadsheet with assumptions regarding participation by task is available.

**Table 2**  
**Task and Resource Estimate**

<b>Task Number and Description</b>	<b>Person-hours</b>	<b>Cost</b>
1. Assemble team	52	\$ 4,480
2. Assemble Lock Unavailability data set	124	10,480
3. Crosscheck data with other data sets	60	5,200

4. Crosscheck data within LPMS	64	5,540
5. Verify NDC's age and rehabilitation data	76	6,480
6. Describe level of confidence	106	8,930
7. Unavailability report	72	6,420
8. Internal review	96	9,960
9. Project Management	98	8,800
10. All Other Project Activities	112	<u>10,000</u>
TOTAL		\$ 76,290

**CONCURRENCE**

Submitted by:

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Mark Lisney, Study Manager

Approved by:

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David Grier, Program Manager

## **Attachment 2**

### **Cross-Check Spreadsheets**

### Summary of Reliability Related Closures

District	River	Lock	Chamber	# Events	DURATION Days
MVP	Mississippi River	St. Anthony Falls - Upper Lock & Dam	Main	0	
MVP	Mississippi River	St. Anthony Falls - Lower Lock & Dam	Main	0	
MVP	Mississippi River	Lock & Dam 1	Main	1	0.01
MVP	Mississippi River	Lock & Dam 2	Main	2	0.32
MVP	Mississippi River	Lock & Dam 3	Main	0	
MVP	Mississippi River	Lock & Dam 4	Main	0	
MVP	Mississippi River	Lock & Dam 5	Main	1	0.04
MVP	Mississippi River	Lock & Dam 5a	Main	0	
MVP	Mississippi River	Lock & Dam 6	Main	0	
MVP	Mississippi River	Lock & Dam 7	Main	0	
MVP	Mississippi River	Lock & Dam 8	Main	0	
MVP	Mississippi River	Lock & Dam 9	Main	0	
MVP	Mississippi River	Lock & Dam 10	Main	0	
MVR	Mississippi River	Lock & Dam 11	Main	73	3.32
MVR	Mississippi River	Lock & Dam 12	Main	51	1.17
MVR	Mississippi River	Lock & Dam 13	Main	2	0.51
MVR	Mississippi River	Lock & Dam 14	Main	1	0.02
MVR	Mississippi River	Lock & Dam 15	Main	1	16.71
MVR	Mississippi River	Lock & Dam 15	Auxiliary	5	134.99
MVR	Mississippi River	Lock & Dam 16	Main	7	0.79
MVR	Mississippi River	Lock & Dam 17	Main	10	59.73
MVR	Mississippi River	Lock & Dam 18	Main	5	0.23
MVR	Mississippi River	Lock & Dam 19	Main	20	64.37
MVR	Mississippi River	Lock & Dam 20	Main	4	0.41
MVR	Mississippi River	Lock & Dam 21	Main	1	0.51
MVR	Mississippi River	Lock & Dam 22	Main	9	1.27
MVS	Mississippi River	Lock & Dam 24	Main	39	91.27
MVS	Mississippi River	Lock & Dam 25	Main	39	4.05
MVS	Mississippi River	Melvin Price Lock & Dam	Main	36	3.35
MVS	Mississippi River	Melvin Price Lock & Dam	Auxiliary	12	7.13
MVS	Mississippi River	Lock & Dam 27	Main	31	9.90
MVS	Mississippi River	Lock & Dam 27	Auxiliary	10	3.49
MVR	Illinois Waterway	Thomas J. OBrien Lock	Main	26	1.00
MVR	Illinois Waterway	Lockport Lock	Main	36	1.34
MVR	Illinois Waterway	Brandon Road Lock & Dam	Main	109	4.85
MVR	Illinois Waterway	Dresden Island Lock & Dam	Main	3	0.15
MVR	Illinois Waterway	Marseilles Lock & Dam	Main	17	1.52
MVR	Illinois Waterway	Starved Rock Lock & Dam	Main	17	1.65
MVR	Illinois Waterway	Peoria Lock & Dam	Main	2	0.14
MVR	Illinois Waterway	LaGrange Lock & Dam	Main	23	3.30

MVP Average Closures Per Lock Chamber = 0.31  
MVR Average Closures Per Lock Chamber = 27.83  
MVS Average Closures Per Lock Chamber= 20.10



DATE	Begin Time	End Date	End Time	LOCK	CHAMBER	LPMS	LPMS CLOSURE	DURATION	INDEXED REPAIR COST (Oct-04 \$\$\$)	DESCRIPTION OF REPAIR WORK (Source(s))	SOURCE OF CLOSURE INFORMATION				SCHEDULED?	
						SYMBOL	CLASSIFICATION	Days:Hrs:min	Log Books		OMNI/LPMS	Repair Crew Records	Nav Notice	OMNI/LPMS	Nav Notice	
1/1/2003	0:01	1/31/2003	23:59	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	30:23:58		Major Rehabilitation	X	X			Y	
2/1/2003	0:01	2/28/2003	23:59	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	27:23:58		Major Rehabilitation	X	X			Y	
3/1/2003	0:01	3/14/2003	14:30	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	13:14:29		Major Rehabilitation	X	X			Y	
3/25/2003	10:13	3/25/2003	11:04	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:00:51				X			N	
4/27/2003	16:16	4/27/2003	17:34	Lock & Dam 24	Main	R	Lock hardware or equipment malfunction	00:01:18				X			N	
4/29/2003	18:12	4/29/2003	19:02	Lock & Dam 24	Main	R	Lock hardware or equipment malfunction	00:00:50				X			N	
5/5/2003	10:01	5/5/2003	11:25	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	00:01:24				X			N	
5/9/2003	13:35	5/9/2003	14:00	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:00:25				X			N	
5/17/2003	20:25	5/17/2003	21:04	Lock & Dam 24	Main	R	Lock hardware or equipment malfunction	00:00:39				X			N	
5/29/2003	9:15	5/29/2003	9:39	Lock & Dam 24	Main	Y	Inspection or testing lock	00:00:24				X			N	
6/4/2003	3:12	6/4/2003	4:34	Lock & Dam 24	Main	R	Lock hardware or equipment malfunction	00:01:22				X			N	
6/14/2003	9:54	6/14/2003	10:51	Lock & Dam 24	Main	R	Lock hardware or equipment malfunction	00:00:57				X			N	
6/18/2003	21:58	6/18/2003	22:02	Lock & Dam 24	Main	R	Lock hardware or equipment malfunction	00:00:04				X			N	
6/19/2003	8:51	6/19/2003	10:26	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:01:35				X			N	
6/19/2003	14:54	6/19/2003	15:28	Lock & Dam 24	Main	R	Lock hardware or equipment malfunction	00:00:34				X			N	
6/25/2003	9:35	6/25/2003	10:40	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:01:05				X			N	
6/25/2003	11:51	6/25/2003	12:12	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:00:21				X			N	
7/11/2003	8:20	7/11/2003	9:45	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:01:25				X			N	
7/23/2003	11:45	7/23/2003	13:30	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:01:45				X			N	
7/25/2003	5:40	7/25/2003	6:20	Lock & Dam 24	Main	R	Lock hardware or equipment malfunction	00:00:40				X			N	
8/10/2003	3:56	8/10/2003	5:00	Lock & Dam 24	Main	R	Lock hardware or equipment malfunction	00:01:04				X			N	
8/18/2003	12:50	8/18/2003	14:40	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:01:50				X			N	
8/20/2003	10:40	8/20/2003	14:25	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:03:45				X			N	
8/21/2003	8:02	8/21/2003	10:14	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:02:12				X			N	
9/4/2003	9:15	9/4/2003	10:35	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:01:20				X			N	
9/4/2003	10:57	9/4/2003	12:25	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:01:28				X			N	
9/18/2003	7:15	9/18/2003	11:30	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:04:15				X			N	
9/29/2003	7:45	9/29/2003	9:50	Lock & Dam 24	Main	EE	Repairing lock or lock hardware	00:02:05				X			N	
10/28/2003	11:00	10/28/2003	11:28	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	00:00:28				X			N	
11/5/2003	8:09	11/5/2003	9:35	Lock & Dam 24	Main	R	Lock hardware or equipment malfunction	00:01:26				X			N	
11/12/2003	8:00	11/12/2003	9:38	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	00:01:38				X			N	
11/13/2003	9:30	11/13/2003	12:30	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	00:03:00				X			N	
11/17/2003	13:40	11/17/2003	15:00	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	00:01:20				X			N	
11/18/2003	9:00	11/18/2003	10:25	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	00:01:25				X			N	
11/19/2003	14:10	11/19/2003	15:30	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	00:01:20				X			N	
11/26/2003	8:13	11/26/2003	8:43	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	00:00:30				X			N	
12/1/2003	10:53	12/1/2003	11:38	Lock & Dam 24	Main	Y	Inspection or testing lock	00:00:45				X			N	
12/8/2003	9:28	12/8/2003	10:02	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	00:00:34				X			N	
12/15/2003	6:00	12/31/2003	23:59	Lock & Dam 24	Main	T	Maintaining lock or lock equipment	16:17:59		Major Rehabilitation	X	X			Y	
1/12/2003	11:00	1/14/2003	7:05	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	01:20:05				X			N	
3/12/2003	6:25	3/12/2004	6:41	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:16		Upstream tow haulage inoperable	X					
3/21/2003	18:01	3/21/2003	18:17	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:16				X			N	
3/22/2003	4:00	3/22/2003	4:19	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:19				X			N	
3/23/2003	7:42	3/23/2003	12:15	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:04:33		PLC not operating properly.	X					
3/27/2003	9:10	3/27/2003	10:03	Lock & Dam 25	Main	EE	Repairing lock or lock hardware	00:00:53		Embedded metals protruding into traffic area.	X	X			N	
4/14/2003	15:15	4/14/2003	15:45	Lock & Dam 25	Main	Y	Inspection or testing lock	00:00:30				X			N	
4/14/2003	17:50	4/14/2003	18:25	Lock & Dam 25	Main	Y	Inspection or testing lock	00:00:35				X			N	
4/15/2003	7:00	4/15/2003	8:08	Lock & Dam 25	Main	Y	Inspection or testing lock	00:01:08				X			Y	
4/15/2003	9:50	4/15/2003	10:32	Lock & Dam 25	Main	Y	Inspection or testing lock	00:00:42				X			Y	
4/15/2003	12:51	4/15/2003	13:27	Lock & Dam 25	Main	Y	Inspection or testing lock	00:00:36				X			Y	
4/15/2003	16:10	4/15/2003	16:53	Lock & Dam 25	Main	Y	Inspection or testing lock	00:00:43		Survey crew in chamber/approach	X	X			N	
4/16/2003	14:55	4/16/2003	15:40	Lock & Dam 25	Main	Y	Inspection or testing lock	00:00:45				X			N	
4/17/2003	22:29	4/18/2003	0:50	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:02:21		No pools equal on upstream miter gates	X	X			N	
4/22/2003	15:53	4/22/2003	16:30	Lock & Dam 25	Main	Y	Inspection or testing lock	00:00:37		Fish survey-Lock chamber.	X	X			N	
4/30/2003	3:46	4/30/2003	4:55	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:01:09		Hatch open/slack cable indicator, #4 valve	X	X			N	
5/2/2003	18:50	5/2/2003	20:40	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:01:50		E-stop indicator, emptying valve #3	X					
5/4/2003	11:47	5/4/2003	14:45	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:02:58		Emptying valve #3 inoperable.	X	X			N	
5/17/2003	9:15	5/17/2003	11:50	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:02:35		Upstream tow haulage inoperable	X					
5/25/2003	5:40	5/25/2003	7:14	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:01:34		No pools equal on upstream miter gates	X	X			N	
5/27/2003	12:31	5/27/2003	12:45	Lock & Dam 25	Main	Y	Inspection or testing lock	00:00:14		Survey crew in chamber/approach	X	X			N	
5/27/2003	13:45	5/27/2003	14:20	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:35		Upstream tow haulage inoperable.	X	X			N	
6/25/2003	23:30	6/25/2003	23:50	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:20		No pools equal on upstream miter gates	X	X			N	
7/10/2003	22:11	7/10/2003	22:41	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:30		Miter gate No. 4 will not miter	X	X			N	

7/11/2003	15:30	7/11/2003	18:30	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:03:00		Miter gate No. 4 inoperable	X				
7/12/2003	4:21	7/12/2003	6:10	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:01:49		Miter gate No. 4 out of calibration	X	X			N
7/12/2003	8:02	7/12/2003	8:58	Lock & Dam 25	Main	T	Maintaining lock or lock equipment	00:00:56				X			N
7/12/2003	22:18	7/13/2003	3:17	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:04:59		Miter gate No. 4 out of calibration	X	X			N
8/16/2003	19:05	8/16/2003	20:00	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:55				X			N
8/19/2003	8:30	8/19/2003	9:27	Lock & Dam 25	Main	T	Maintaining lock or lock equipment	00:00:57				X			N
8/20/2003	5:23	8/20/2003	6:18	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:55		No pools equal on upstream miter gates	X	X			N
8/20/2003	6:30	8/20/2003	6:45	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:15				X			N
8/24/2003	20:53	8/25/2003	0:30	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:03:37		Upstream control cabinet computer malfunction.	X				
8/25/2003	21:20	8/25/2003	22:09	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:49		Upstream control cabinet computer malfunction.	X	X			N
8/28/2003	2:32	8/28/2003	2:49	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:17				X			N
10/4/2003	18:02	10/4/2003	18:31	Lock & Dam 25	Main	R	Lock hardware or equipment malfunction	00:00:29		PLC glitch	X	X			N
11/3/2003	13:30	11/3/2003	14:26	Lock & Dam 25	Main	T	Maintaining lock or lock equipment	00:00:56				X			N
11/6/2003	7:30	11/6/2003	12:45	Lock & Dam 25	Main	T	Maintaining lock or lock equipment	00:05:15		Scour survery of chamber/approaches	X	X			N
11/17/2003	9:55	11/17/2003	11:50	Lock & Dam 25	Main	T	Maintaining lock or lock equipment	00:01:55		Lock stoppage-Service Base	X	X			N
1/21/2003	9:45	1/21/2003	14:55	Lock & Dam 27	Auxiliary	T	Maintaining lock or lock equipment	00:05:10				X			N
2/18/2003	8:00	2/20/2003	18:30	Lock & Dam 27	Auxiliary	Y	Inspection or testing lock	02:10:30				X			N
3/7/2003	9:45	3/7/2003	10:52	Lock & Dam 27	Auxiliary	T	Maintaining lock or lock equipment	00:01:07				X			N
4/10/2003	13:22	4/10/2003	15:40	Lock & Dam 27	Auxiliary	T	Maintaining lock or lock equipment	00:02:18				X			N
8/25/2003	10:00	8/25/2003	14:04	Lock & Dam 27	Auxiliary	T	Maintaining lock or lock equipment	00:04:04				X			N
10/6/2003	9:08	10/6/2003	11:30	Lock & Dam 27	Auxiliary	T	Maintaining lock or lock equipment	00:02:22				X			N
10/29/2003	13:00	10/29/2003	15:50	Lock & Dam 27	Auxiliary	T	Maintaining lock or lock equipment	00:02:50				X			N
11/6/2003	9:21	11/6/2003	11:25	Lock & Dam 27	Auxiliary	Y	Inspection or testing lock	00:02:04				X			N
12/2/2003	8:30	12/2/2003	11:36	Lock & Dam 27	Auxiliary	T	Maintaining lock or lock equipment	00:03:06				X			N
12/2/2003	13:31	12/2/2003	15:40	Lock & Dam 27	Auxiliary	T	Maintaining lock or lock equipment	00:02:09				X			N
1/8/2003	10:09	1/8/2003	11:14	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:01:05				X			N
1/15/2003	7:30	1/15/2003	11:33	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:04:03				X			N
1/16/2003	8:30	1/16/2003	16:08	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:07:38				X			N
1/21/2003	9:45	1/21/2003	15:15	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:05:30				X			N
1/24/2003	10:24	1/24/2003	11:30	Lock & Dam 27	Main	R	Lock hardware or equipment malfunction	00:01:06				X			N
2/19/2003	7:00	2/19/2003	10:30	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:03:30		Upper east valve	X	X			N
2/20/2003	7:26	2/20/2003	12:30	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:05:04			X	X			N
2/22/2003	15:01	2/22/2003	17:30	Lock & Dam 27	Main	R	Lock hardware or equipment malfunction	00:02:29				X			N
3/26/2003	13:31	3/26/2003	16:05	Lock & Dam 27	Main	EE	Repairing lock or lock hardware	00:02:34				X			N
4/2/2003	11:16	4/2/2003	12:20	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:01:04				X			N
4/10/2003	10:45	4/10/2003	11:40	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:00:55				X			N
4/10/2003	13:45	4/10/2003	14:27	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:00:42				X			N
6/9/2003	7:00	6/9/2003	16:56	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:09:56			X	X			N
6/11/2003	9:10	6/11/2003	11:30	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:02:20				X			N
6/24/2003	11:56	6/24/2003	13:55	Lock & Dam 27	Main	Y	Inspection or testing lock	00:01:59				X			N
7/18/2003	10:10	7/18/2003	18:50	Lock & Dam 27	Main	R	Lock hardware or equipment malfunction	00:08:40				X			N
8/18/2003	6:10	8/24/2003	18:55	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	06:12:45			X	X			N
8/25/2003	12:10	8/25/2003	12:39	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:00:29				X			N
8/28/2003	13:00	8/28/2003	13:24	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:00:24				X			N
9/3/2003	7:00	9/3/2003	9:22	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:02:22				X			N
9/4/2003	13:00	9/4/2003	14:48	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:01:48				X			N
9/10/2003	13:16	9/10/2003	14:07	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:00:51				X			N
10/8/2003	7:42	10/8/2003	8:01	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:00:19				X			N
10/10/2003	10:16	10/10/2003	11:20	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:01:04				X			N
10/10/2003	14:17	10/10/2003	16:37	Lock & Dam 27	Main	R	Lock hardware or equipment malfunction	00:02:20				X			N
10/16/2003	7:11	10/16/2003	10:55	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:03:44				X			N
10/22/2003	7:06	10/22/2003	8:21	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:01:15				X			N
11/5/2003	10:59	11/5/2003	12:22	Lock & Dam 27	Main	R	Lock hardware or equipment malfunction	00:01:23				X			N
11/6/2003	9:21	11/6/2003	11:25	Lock & Dam 27	Main	Y	Inspection or testing lock	00:02:04				X			N
11/18/2003	7:00	11/18/2003	10:00	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:03:00				X			N
12/11/2003	3:11	12/11/2003	4:20	Lock & Dam 27	Main	T	Maintaining lock or lock equipment	00:01:09				X			N
6/29/2003	16:40	6/29/2003	17:53	Melvin Price Lock & Dam	Auxiliary	R	Lock hardware or equipment malfunction	00:01:13				X			N
9/8/2003	7:55	9/8/2003	15:03	Melvin Price Lock & Dam	Auxiliary	T	Maintaining lock or lock equipment	00:07:08				X			Y
9/9/2003	8:30	9/9/2003	17:00	Melvin Price Lock & Dam	Auxiliary	T	Maintaining lock or lock equipment	00:08:30				X			N
9/10/2003	10:00	9/10/2003	15:00	Melvin Price Lock & Dam	Auxiliary	T	Maintaining lock or lock equipment	00:05:00				X			N
9/11/2003	8:00	9/11/2003	16:00	Melvin Price Lock & Dam	Auxiliary	T	Maintaining lock or lock equipment	00:08:00				X			N
9/16/2003	9:09	9/16/2003	13:58	Melvin Price Lock & Dam	Auxiliary	T	Maintaining lock or lock equipment	00:04:49				X			N
9/18/2003	8:51	9/18/2003	13:04	Melvin Price Lock & Dam	Auxiliary	T	Maintaining lock or lock equipment	00:04:13				X			N
9/26/2003	10:20	9/26/2003	15:45	Melvin Price Lock & Dam	Auxiliary	T	Maintaining lock or lock equipment	00:05:25				X			N
9/27/2003	10:00	9/27/2003	15:02	Melvin Price Lock & Dam	Auxiliary	T	Maintaining lock or lock equipment	00:05:02				X			N
9/28/2003	8:30	9/28/2003	17:09	Melvin Price Lock & Dam	Auxiliary	EE	Repairing lock or lock hardware	00:08:39				X			N
9/30/2003	7:50	9/30/2003	13:00	Melvin Price Lock & Dam	Auxiliary	T	Maintaining lock or lock equipment	00:05:10				X			N
11/24/2003	16:00			Melvin Price Lock & Dam	Auxiliary	T	Maintaining lock or lock equipment	04:12:00		Dredging lower end auxiliary lock	X				

1/18/2003	6:05	1/18/2003	10:44	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:04:39				X			N
1/18/2003	12:17	1/18/2003	12:44	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:27				X			N
3/14/2003	18:43	3/15/2003	1:44	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:07:01				X			N
4/9/2003	12:21	4/9/2003	16:27	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:04:06				X			N
4/10/2003	7:16	4/10/2003	9:00	Melvin Price Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:44				X			N
4/30/2003	10:43	4/30/2003	11:45	Melvin Price Lock & Dam	Main	Y	Inspection or testing lock	00:01:02				X			N
6/23/2003	13:24	6/23/2003	14:30	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:01:06				X			N
6/24/2003	13:35	6/24/2003	14:58	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:01:23				X			N
6/29/2003	13:41	6/29/2003	17:42	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:04:01				X			N
7/5/2003	5:06	7/5/2003	7:02	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:01:56				X			N
7/10/2003	9:41	7/10/2003	10:26	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:45				X			N
7/10/2003	11:10	7/10/2003	12:25	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:01:15				X			N
7/13/2003	15:10	7/13/2003	15:51	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:41				X			N
7/16/2003	14:34	7/16/2003	15:53	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:01:19				X			N
7/16/2003	16:16	7/16/2003	16:28	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:12				X			N
9/6/2003	16:41	9/6/2003	20:30	Melvin Price Lock & Dam	Main	T	Maintaining lock or lock equipment	00:03:49				X			N
9/8/2003	7:55	9/8/2003	11:22	Melvin Price Lock & Dam	Main	T	Maintaining lock or lock equipment	00:03:27				X			N
9/16/2003	11:40	9/16/2003	13:59	Melvin Price Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:19				X			N
9/19/2003	14:05	9/19/2003	15:00	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:55				X			N
9/22/2003	10:45	9/22/2003	11:04	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:19				X			N
9/22/2003	14:23	9/22/2003	14:33	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:10				X			N
9/26/2003	10:20	9/26/2003	15:45	Melvin Price Lock & Dam	Main	T	Maintaining lock or lock equipment	00:05:25				X			N
9/27/2003	10:00	9/27/2003	15:02	Melvin Price Lock & Dam	Main	T	Maintaining lock or lock equipment	00:05:02				X			N
9/27/2003	15:33	9/27/2003	17:39	Melvin Price Lock & Dam	Main	EE	Repairing lock or lock hardware	00:02:06				X			N
9/28/2003	8:30	9/28/2003	17:09	Melvin Price Lock & Dam	Main	EE	Repairing lock or lock hardware	00:08:39				X			N
9/30/2003	7:50	9/30/2003	13:00	Melvin Price Lock & Dam	Main	T	Maintaining lock or lock equipment	00:05:10				X			N
10/3/2003	14:11	10/3/2003	15:30	Melvin Price Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:19				X			N
10/8/2003	8:00	10/8/2003	10:25	Melvin Price Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:25				X			N
10/20/2003	11:24	10/20/2003	11:42	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:18				X			N
10/28/2003	2:36	10/28/2003	2:51	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:15				X			N
10/28/2003	3:13	10/28/2003	3:24	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:11				X			N
10/29/2003	17:28	10/29/2003	17:50	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:22				X			N
11/4/2003	7:15	11/4/2003	12:30	Melvin Price Lock & Dam	Main	T	Maintaining lock or lock equipment	00:05:15				X			N
11/25/2003	1:15	11/25/2003	1:40	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:25				X			N
11/28/2003	23:46	11/29/2003	0:14	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:28				X			N
12/9/2003	12:40	12/9/2003	13:12	Melvin Price Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:32				X			N

Notes:

- 1) Lock 24 and Melvin Price log book data includes only closures of 8 hours or more.
- 2) Lock 27 log book data includes only the main chamber.
- 3) The source of the work description is log books unless otherwise noted.



4/15/2003	6:45	4/15/2003	7:15	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
4/17/2003	9:46	4/17/2003	11:02	Lock & Dam 12	Main	Y	Inspection or testing lock	00:01:16					X			N		
4/25/2003	9:03	4/25/2003	9:45	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:42					X			N		
4/27/2003	19:05	4/27/2003	19:30	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:25					X			N		
5/1/2003	12:40	5/1/2003	13:20	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:40					X			N		
5/8/2003	6:30	5/8/2003	6:55	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:25					X			N		
5/13/2003	12:37	5/13/2003	12:58	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:21					X			N		
5/13/2003	17:00	5/13/2003	17:45	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:45					X			N		
5/21/2003	13:02	5/21/2003	13:33	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:31					X			N		
5/21/2003	18:33	5/21/2003	19:29	Lock & Dam 12	Main	R	Lock hardware or equipment malfunction	00:00:56					X			N		
5/30/2003	16:06	5/30/2003	16:35	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:29					X			N		
6/4/2003	6:00	6/4/2003	6:30	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
6/4/2003	9:14	6/4/2003	9:41	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:27					X			N		
6/12/2003	0:31	6/12/2003	1:29	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:58					X			N		
6/20/2003	17:44	6/20/2003	18:02	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:18					X			N		
6/22/2003	8:45	6/22/2003	9:45	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:01:00					X			N		
6/23/2003	18:00	6/23/2003	18:45	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:45					X			N		
7/22/2003	20:49	7/22/2003	21:11	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:22					X			N		
7/23/2003	6:00	7/23/2003	6:30	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
7/24/2003	9:15	7/24/2003	10:00	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:45					X			N		
7/30/2003	13:15	7/30/2003	14:12	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:57					X			N		
7/31/2003	5:25	7/31/2003	5:45	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:20					X			N		
7/31/2003	10:45	7/31/2003	11:40	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:55					X			N		
8/7/2003	6:30	8/7/2003	7:00	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
8/8/2003	6:35	8/8/2003	7:15	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:40					X			N		
8/9/2003	8:45	8/9/2003	9:15	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
8/18/2003	18:10	8/18/2003	18:40	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
8/20/2003	6:10	8/20/2003	7:10	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:01:00					X			N		
8/22/2003	10:30	8/22/2003	11:00	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
8/26/2003	6:31	8/26/2003	6:57	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:26					X			N		
8/27/2003	16:25	8/27/2003	16:55	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
8/30/2003	9:00	8/30/2003	9:30	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
9/1/2003	7:41	9/1/2003	7:44	Lock & Dam 12	Main	R	Lock hardware or equipment malfunction	00:00:03					X			N		
9/2/2003	6:30	9/2/2003	7:00	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
9/6/2003	11:45	9/6/2003	12:05	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:20					X			N		
9/10/2003	6:45	9/10/2003	7:27	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:42					X			N		
9/17/2003	20:44	9/17/2003	21:36	Lock & Dam 12	Main	R	Lock hardware or equipment malfunction	00:00:52					X			N		
9/18/2003	18:00	9/18/2003	18:25	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:25					X			N		
9/19/2003	14:45	9/19/2003	15:00	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:15					X			Y		
9/25/2003	6:40	9/25/2003	7:10	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
10/1/2003	6:45	10/1/2003	7:15	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
10/8/2003	18:00	10/8/2003	18:20	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:20					X			N		
10/9/2003	7:10	10/9/2003	7:35	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:25					X			N		
10/17/2003	6:30	10/17/2003	7:00	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
10/19/2003	17:45	10/19/2003	18:10	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:25					X			N		
10/22/2003	7:00	10/22/2003	7:25	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:25					X			N		
10/25/2003	16:45	10/25/2003	17:15	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:30					X			N		
11/9/2003	16:05	11/9/2003	16:30	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:25					X			N		
11/16/2003	7:00	11/16/2003	7:20	Lock & Dam 12	Main	T	Maintaining lock or lock equipment	00:00:20					X			N		
7/15/2003	12:35	7/15/2003	12:56	Lock & Dam 13	Main	R	Lock hardware or equipment malfunction	00:00:21					X			N		
10/3/2003	6:00	10/3/2003	18:00	Lock & Dam 13	Main	R	Lock hardware or equipment malfunction	00:12:00		#2 - Retrieve mule by divers.			X			N		
5/24/2003	22:40	5/24/2003	23:06	Lock & Dam 14	Main	R	Lock hardware or equipment malfunction	00:00:26		#2 - Repairs to #3 miter gate brake.			X	X		N		
8/18/2003	0:01	8/30/2003	23:59	Lock & Dam 15	Auxiliary	EE	Repairing lock or lock hardware	12:23:58		#4 - Deterioration on #5 and #8 miter gates.			X	X		X	N	4 days notice
9/1/2003	0:01	9/30/2003	23:59	Lock & Dam 15	Auxiliary	R	Lock hardware or equipment malfunction	29:23:58		#4 - Deterioration on #5 and #8 miter gates.			X	X		X	N	
10/1/2003	0:01	10/31/2003	23:59	Lock & Dam 15	Auxiliary	R	Lock hardware or equipment malfunction	30:23:58		#4 - Deterioration on #5 and #8 miter gates.			X	X		X	N	
11/1/2003	0:01	11/30/2003	23:59	Lock & Dam 15	Auxiliary	R	Lock hardware or equipment malfunction	29:23:58		#4 - Deterioration on #5 and #8 miter gates.			X	X		X	N	
12/1/2003	0:01	12/31/2003	23:59	Lock & Dam 15	Auxiliary	R	Lock hardware or equipment malfunction	30:23:58		#4 - Deterioration on #5 and #8 miter gates.			X	X		X	N	
12/15/2003	8:00	12/31/2003	23:59	Lock & Dam 15	Main	T	Maintaining lock or lock equipment	16:16:59		#4 - Repl of checkposts. Install of ladder recess. (Did closure occur?)			X			MR 03 - 25	Y	
3/12/2003	7:02	3/12/2003	8:44	Lock & Dam 16	Main	R	Lock hardware or equipment malfunction	00:01:42					X	X			N	
5/6/2003	7:00	5/6/2003	17:38	Lock & Dam 16	Main	EE	Repairing lock or lock hardware	00:10:38		#2, #4 - Replacing bonnet on #2 miter gate.			X	X		MR 03 - 01	Y	
7/16/2003	10:41	7/16/2003	12:20	Lock & Dam 16	Main	EE	Repairing lock or lock hardware	00:01:39		#2 - Tainter valve repairs.			X	X			N	
9/26/2003	12:00	9/26/2003	12:59	Lock & Dam 16	Main	EE	Repairing lock or lock hardware	00:00:59		#2 - Tainter valve repairs.			X				N	
10/15/2003	18:24	10/15/2003	19:29	Lock & Dam 16	Main	R	Lock hardware or equipment malfunction	00:01:05		#2 - Tainter valve repairs.			X	X			N	
10/30/2003	21:19	10/30/2003	23:55	Lock & Dam 16	Main	R	Lock hardware or equipment malfunction	00:02:36					X	X			N	
12/3/2003	9:15	12/3/2003	9:39	Lock & Dam 16	Main	R	Lock hardware or equipment malfunction	00:00:24		#2 - Tainter valve repairs.			X	X			N	
1/1/2003	0:00	1/31/2003	23:59	Lock & Dam 17	Main	EE	Repairing lock or lock hardware	30:23:59		#2 - Replace embedded gate anchors.			X				N	
2/1/2003	7:30	2/28/2003	7:30	Lock & Dam 17	Main	EE	Repairing lock or lock hardware	27:00:00		#2 - Replace embedded gate anchors.			X	X			N	
3/19/2003	10:16	3/19/2003	12:35	Lock & Dam 17	Main	R	Lock hardware or equipment malfunction	00:02:19		#2 - Miter gate repairs.			X	X			N	
3/30/2004	6:00	3/30/2003	18:00	Lock & Dam 17	Main	EE	Repairing lock or lock hardware	00:12:00		#2 - Replace spare gates with repaired lower gates.			X				N	
5/13/2003	8:41	5/13/2003	9:49	Lock & Dam 17	Main	Y	Inspection or testing lock	00:01:08					X	X			N	
6/4/2003	9:40	6/4/2003	10:20	Lock & Dam 17	Main	Y	Inspection or testing lock	00:00:40		#2 - Miter gate repairs.			X	X			N	
6/16/2003	12:05	6/16/2003	12:50	Lock & Dam 17	Main	T	Maintaining lock or lock equipment	00:00:45		#2 - Tainter valve motor repairs.			X	X			N	
6/24/2003	10:45	6/24/2003	11:30	Lock & Dam 17	Main	R	Lock hardware or equipment malfunction	00:00:45		#2 - Miter gate repairs.			X	X			N	
10/15/2003	7:00	10/15/2003	19:00	Lock & Dam 17	Main	EE	Repairing lock or lock hardware	00:12:00		#4 - Replace miter gates (Did closure occur?)			X			MR 03 - 19	Y	
10/16/2003	7:00	10/16/2003	19:00	Lock & Dam 17	Main	EE	Repairing lock or lock hardware	00:12:00		#4 - Replace miter gates (Did closure occur?)			X			MR 03 - 19	Y	
5/14/2003	12:43	5/14/2003	13:30	Lock & Dam 18	Main	Y	Inspection or testing lock	00:00:47					X				N	
5/22/2003	12:00	5/22/2003	13:45	Lock & Dam 18	Main	EE	Repairing lock or lock hardware	00:01:45		#2 - Tainter valve repairs.			X				N	
6/9/2003	12:00	6/9/2003	12:40	Lock & Dam 18	Main	EE	Repairing lock or lock hardware	00:00:40		#2 - Tainter valve repairs.			X				N	
7/30/2003	12:00	7/30/2003	13:28	Lock & Dam 18	Main	EE	Repairing lock or lock hardware	00:01:28		#2 - Loading material and equipment for tainter gate repair.			X				N	
8/15/2003	12:00	8/15/2003	12:55	Lock & Dam 18	Main	EE	Repairing lock or lock hardware	00:00:55		#2 - Loading material and equipment for tainter gate repair.			X				N	
1/1/2003	1:01	1/31/2003	23:59	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	30:22:58		#2 - Remove lower gates and replace with temporary gates.			X	X			N	

2/1/2003	0:01	2/28/2003	23:59	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	27:23:58		#2 - Remove lower gates and replace with temporary gates.		X	X		N		
3/1/2003	0:00	3/4/2003	9:00	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	03:09:00				X	X		N		
3/16/2003	10:06	3/16/2003	11:44	Lock & Dam 19	Main	EE	Repairing lock or lock hardware	00:01:38		#2 - Miter gate repairs.		X	X		N		
3/16/2003	13:58	3/16/2003	16:00	Lock & Dam 19	Main	EE	Repairing lock or lock hardware	00:02:02		#2 - Miter gate repairs.		X	X		N		
4/29/2003	8:26	4/29/2003	9:59	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	00:01:33					X		N		
5/15/2003	9:48	5/15/2003	10:54	Lock & Dam 19	Main	Y	Inspection or testing lock	00:01:06					X		N		
6/25/2003	13:00	6/25/2003	14:45	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	00:01:45					X		N		
7/25/2003	8:01	7/25/2003	12:20	Lock & Dam 19	Main	EE	Repairing lock or lock hardware	00:04:19					X		N		
7/29/2003	9:11	7/29/2003	12:10	Lock & Dam 19	Main	R	Lock hardware or equipment malfunction	00:02:59		#2 - Re-float sunken mooring bit.		X	X		N		
9/1/2003	1:47	9/1/2003	4:49	Lock & Dam 19	Main	R	Lock hardware or equipment malfunction	00:03:02		#2 - Electrical malfunction of the service gate.		X	X		N		
10/14/2003	8:00	10/14/2003	16:30	Lock & Dam 19	Main	Y	Inspection or testing lock	00:08:30		#2 Weld inspection on upper gates and leak seal on lower gates.		X	X		N		
10/15/2003	8:00	10/15/2003	15:54	Lock & Dam 19	Main	Y	Inspection or testing lock	00:07:54		#2 Weld inspection on upper gates and leak seal on lower gates.		X	X		N		
10/28/2003	8:00	10/28/2003	11:15	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	00:03:15					X		N		
11/4/2003	12:12	11/4/2003	13:50	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	00:01:38					X		N		
11/7/2003	10:00	11/7/2003	11:55	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	00:01:55					X		N		
11/20/2003	12:12	11/20/2003	13:45	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	00:01:33					X		N		
12/9/2003	13:41	12/9/2003	14:09	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	00:00:28					X		N		
12/10/2003	8:00	12/10/2003	10:48	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	00:02:48					X		N		
12/10/2003	12:30	12/10/2003	15:00	Lock & Dam 19	Main	T	Maintaining lock or lock equipment	00:02:30					X		N		
3/31/2003	0:25	3/31/2003	2:48	Lock & Dam 20	Main	R	Lock hardware or equipment malfunction	00:02:23		#2 - Miter gate #4 electrical malfunction.		X	X		N		
5/10/2003	19:05	5/10/2003	21:25	Lock & Dam 20	Main	R	Lock hardware or equipment malfunction	00:02:20					X		N		
6/3/2003	14:21	6/3/2003	15:00	Lock & Dam 20	Main	R	Lock hardware or equipment malfunction	00:00:39					X		N		
7/30/2003	12:00	7/30/2003	16:00	Lock & Dam 20	Main	R	Lock hardware or equipment malfunction	00:04:00		#2 - Tainter valve failure.		X			N		
9/18/2003	10:38	9/18/2003	11:11	Lock & Dam 20	Main	R	Lock hardware or equipment malfunction	00:00:33					X		N		
4/25/2003	22:03	4/26/2003	10:15	Lock & Dam 21	Main	R	Lock hardware or equipment malfunction	00:12:12					X		N		
6/4/2003	12:46	6/4/2003	13:46	Lock & Dam 22	Main	EE	Repairing lock or lock hardware	00:01:00		#2 - Miter gate timber replacement.		X	X		N		
6/16/2003	13:51	6/16/2003	14:34	Lock & Dam 22	Main	EE	Repairing lock or lock hardware	00:00:43					X		N		
10/21/2003	15:09	10/21/2003	16:00	Lock & Dam 22	Main	T	Maintaining lock or lock equipment	00:00:51					X		N		
10/22/2003	12:00	10/22/2003	13:18	Lock & Dam 22	Main	EE	Repairing lock or lock hardware	00:01:18		#2 - Miter gate timber replacement.		X			N		
10/27/2003	13:05	10/27/2003	15:15	Lock & Dam 22	Main	EE	Repairing lock or lock hardware	00:02:10					X		N		
10/28/2003	7:06	10/28/2003	17:25	Lock & Dam 22	Main	EE	Repairing lock or lock hardware	00:10:19		#4 - Replace upper miter gates.		X	X		MR 03 - 20	N	Y
10/29/2003	6:33	10/29/2003	17:00	Lock & Dam 22	Main	EE	Repairing lock or lock hardware	00:10:27		#4 - Replace upper miter gaates.		X	X		MR 03 - 20	N	Y
11/30/2003	12:00	11/30/2003	13:09	Lock & Dam 22	Main	EE	Repairing lock or lock hardware	00:01:09		#2 - Miter gate timber replacement.		X					
12/4/2003	12:00	12/4/2003	14:25	Lock & Dam 22	Main	EE	Repairing lock or lock hardware	00:02:25		#2 - Miter gate timber replacement.		X					
1/7/2003	8:30	1/7/2003	9:05	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:35					X			N	
1/11/2003	10:00	1/11/2003	11:00	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00					X			N	
1/11/2003	12:30	1/11/2003	13:45	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:15					X			N	
1/13/2003	13:18	1/13/2003	14:02	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:44					X			N	
1/14/2003	4:00	1/14/2003	6:50	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:50					X			N	
1/14/2003	21:00	1/14/2003	22:26	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:26					X			N	
1/15/2003	0:35	1/15/2003	1:55	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:20					X			N	
1/15/2003	4:00	1/15/2003	5:02	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:02					X			N	
1/15/2003	17:50	1/15/2003	18:35	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:45					X			N	
1/15/2003	20:00	1/15/2003	20:55	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/17/2003	23:42	1/18/2003	0:36	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:54					X			N	
1/18/2003	2:48	1/18/2003	3:57	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:09					X			N	
1/18/2003	5:33	1/18/2003	6:38	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:05					X			N	
1/18/2003	9:30	1/18/2003	10:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/18/2003	21:50	1/18/2003	22:55	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:05					X			N	
1/18/2003	23:50	1/19/2003	0:46	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:56					X			N	
1/19/2003	6:24	1/19/2003	7:22	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:58					X			N	
1/19/2003	8:35	1/19/2003	9:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50					X			N	
1/19/2003	21:40	1/19/2003	22:35	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/20/2003	9:05	1/20/2003	9:55	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50					X			N	
1/20/2003	11:55	1/20/2003	12:45	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50					X			N	
1/21/2003	4:30	1/21/2003	5:37	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:07					X			N	
1/21/2003	7:00	1/21/2003	8:12	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:12					X			N	
1/21/2003	10:25	1/21/2003	11:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00					X			N	
1/21/2003	16:30	1/21/2003	17:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/21/2003	19:30	1/21/2003	20:30	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00					X			N	
1/21/2003	22:00	1/21/2003	22:55	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/22/2003	1:00	1/22/2003	1:58	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:58					X			N	
1/22/2003	18:00	1/22/2003	18:55	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/22/2003	20:04	1/22/2003	20:58	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:54					X			N	
1/23/2003	6:38	1/23/2003	7:35	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:57					X			N	
1/23/2003	15:03	1/23/2003	15:37	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:34					X			N	
1/23/2003	20:00	1/23/2003	20:55	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/24/2003	6:00	1/24/2003	6:58	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:58					X			N	
1/24/2003	8:50	1/24/2003	9:55	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:05					X			N	
1/24/2003	20:00	1/24/2003	20:50	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50					X			N	
1/25/2003	5:30	1/25/2003	6:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/26/2003	10:45	1/26/2003	11:40	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/27/2003	0:30	1/27/2003	1:30	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00					X			N	
1/27/2003	3:30	1/27/2003	4:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/27/2003	5:30	1/27/2003	6:28	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:58					X			N	
1/27/2003	9:10	1/27/2003	10:00	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50					X			N	
1/27/2003	17:30	1/27/2003	18:42	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:12					X			N	
1/29/2003	4:00	1/29/2003	4:55	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/29/2003	5:50	1/29/2003	6:45	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	
1/30/2003	2:25	1/30/2003	3:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00					X			N	
1/30/2003	4:30	1/30/2003	5:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55					X			N	

2/5/2003	9:05	2/5/2003	10:00	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55						X			N		
2/5/2003	17:54	2/5/2003	18:51	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:57						X				N	
2/5/2003	20:40	2/5/2003	21:37	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:57						X				N	
2/5/2003	23:25	2/6/2003	0:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/6/2003	22:28	2/6/2003	23:23	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55						X				N	
2/7/2003	4:09	2/7/2003	5:11	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:02						X				N	
2/7/2003	6:10	2/7/2003	7:27	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:17						X				N	
2/7/2003	9:25	2/7/2003	10:10	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:45						X				N	
2/7/2003	11:55	2/7/2003	12:45	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50						X				N	
2/8/2003	2:05	2/8/2003	3:10	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:05						X				N	
2/8/2003	9:40	2/8/2003	10:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:45						X				N	
2/9/2003	4:10	2/9/2003	5:30	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:20						X				N	
2/9/2003	8:00	2/9/2003	8:45	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:45						X				N	
2/9/2003	16:09	2/9/2003	17:02	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:53						X				N	
2/9/2003	20:41	2/9/2003	21:33	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:52						X				N	
2/10/2003	21:30	2/10/2003	22:37	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:07						X				N	
2/11/2003	4:20	2/11/2003	5:40	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:20						X				N	
2/11/2003	6:10	2/11/2003	7:10	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/12/2003	12:57	2/12/2003	14:15	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:18						X				N	
2/13/2003	6:15	2/13/2003	7:15	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/14/2003	5:07	2/14/2003	6:18	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:11						X				N	
2/15/2003	1:55	2/15/2003	3:06	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:11						X				N	
2/15/2003	5:48	2/15/2003	6:58	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:10						X				N	
2/16/2003	4:57	2/16/2003	5:53	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:56						X				N	
2/17/2003	0:35	2/17/2003	1:32	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:57						X				N	
2/17/2003	3:34	2/17/2003	4:41	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:07						X				N	
2/18/2003	5:35	2/18/2003	6:40	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:05						X				N	
2/21/2003	3:25	2/21/2003	4:20	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55						X				N	
2/21/2003	5:35	2/21/2003	6:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50						X				N	
2/24/2003	3:25	2/24/2003	4:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/24/2003	5:25	2/24/2003	6:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/24/2003	8:30	2/24/2003	9:30	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/24/2003	11:30	2/24/2003	12:30	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/24/2003	14:30	2/24/2003	15:30	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/25/2003	0:01	2/25/2003	1:00	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:59						X				N	
2/25/2003	2:00	2/25/2003	3:00	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/25/2003	4:00	2/25/2003	4:55	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55						X				N	
2/25/2003	5:25	2/25/2003	6:25	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/25/2003	10:20	2/25/2003	11:20	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:00						X				N	
2/26/2003	5:00	2/26/2003	5:58	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:58						X				N	
3/3/2003	1:15	3/3/2003	2:00	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:45						X				N	
3/3/2003	3:15	3/3/2003	4:00	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:45						X				N	
3/3/2003	6:35	3/3/2003	7:20	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:45						X				N	
3/3/2003	8:33	3/3/2003	9:26	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:53						X				N	
3/10/2003	6:00	3/10/2003	7:35	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:35						X				N	
3/10/2003	9:30	3/10/2003	10:20	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50						X				N	
3/10/2003	14:30	3/10/2003	15:20	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50						X				N	
3/13/2003	23:52	3/14/2003	0:47	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55						X				N	
3/25/2003	11:23	3/25/2003	12:14	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:51						X				N	
3/25/2003	16:05	3/25/2003	16:19	Brandon Road Lock & Dam	Main	Y	Inspection or testing lock	00:00:14						X				N	
4/10/2003	8:10	4/10/2003	8:52	Brandon Road Lock & Dam	Main	Y	Inspection or testing lock	00:00:42						X				N	
4/22/2003	8:00	4/22/2003	10:04	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:04						X				N	
4/23/2003	8:00	4/23/2003	10:05	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:05						X				N	
4/23/2003	14:03	4/23/2003	16:35	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:32						X				N	
4/24/2003	6:40	4/24/2003	8:56	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:16						X				N	
11/11/2003	7:06	11/11/2003	8:04	Brandon Road Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:58						X				N	
12/4/2003	8:51	12/4/2003	9:49	Brandon Road Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:58						X				N	
12/6/2003	21:25	12/7/2003	1:13	Brandon Road Lock & Dam	Main	EE	Repairing lock or lock hardware	00:03:48						X				N	
12/11/2003	8:00	12/11/2003	10:47	Brandon Road Lock & Dam	Main	EE	Repairing lock or lock hardware	00:02:47						X				N	
12/12/2003	4:15	12/12/2003	5:10	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:55						X				N	
12/13/2003	3:55	12/13/2003	4:45	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50						X				N	
12/13/2003	13:30	12/13/2003	14:15	Brandon Road Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:45						X				N	
6/24/2003	8:20	6/24/2003	9:50	Dresden Island Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:01:30						X				N	
9/10/2003	8:31	9/10/2003	9:50	Dresden Island Lock & Dam	Main	EE	Repairing lock or lock hardware	00:01:19						X				N	
10/20/2003	13:55	10/20/2003	14:37	Dresden Island Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:42						X				N	
1/18/2003	1:21	1/18/2003	19:50	LaGrange Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:18:29						X				N	
6/17/2003	12:47	6/17/2003	15:20	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:33						X				N	
6/18/2003	9:01	6/18/2003	9:45	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:44						X				N	
6/18/2003	14:06	6/18/2003	16:12	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:06						X				N	
6/19/2003	8:33	6/19/2003	11:30	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:57						X				N	
6/19/2003	12:52	6/19/2003	13:38	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:46						X				N	
6/25/2003	9:50	6/25/2003	10:35	LaGrange Lock & Dam	Main	EE	Repairing lock or lock hardware	00:00:45						X				N	
6/25/2003	13:46	6/25/2003	16:05	LaGrange Lock & Dam	Main	EE	Repairing lock or lock hardware	00:02:19						X				N	
7/1/2003	9:01	7/1/2003	10:05	LaGrange Lock & Dam	Main	EE	Repairing lock or lock hardware	00:01:04						X				N	
7/2/2003	11:26	7/2/2003	11:49	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:23						X				N	
7/9/2003	8:59	7/9/2003	11:30	LaGrange Lock & Dam	Main	EE	Repairing lock or lock hardware	00:02:31						X				N	
7/9/2003	13:30	7/9/2003	14:48	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:18						X				N	
8/7/2003	9:18	8/7/2003	14:24	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:05:06						X				N	
8/12/2003	10:00	8/12/2003	12:45	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:45						X				N	
8/20/2003	12:11	8/20/2003	15:15	LaGrange Lock & Dam	Main	EE	Repairing lock or lock hardware	00:03:04						X				N	
8/23/2003	6:17	8/23/2003	8:05	LaGrange Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:01:48						X				N	

9/2/2003	13:00	9/2/2003	14:40	LaGrange Lock & Dam	Main	EE	Repairing lock or lock hardware	00:01:40				X			N	
9/16/2003	8:50	9/16/2003	9:49	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:59				X			N	
9/26/2003	12:40	9/26/2003	14:30	LaGrange Lock & Dam	Main	EE	Repairing lock or lock hardware	00:01:50				X			N	
11/6/2003	14:00	11/6/2003	15:02	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:02				X			N	
11/18/2003	5:57	11/18/2003	17:00	LaGrange Lock & Dam	Main	EE	Repairing lock or lock hardware	00:11:03		#4 Pull lower gates.		X		IW 03-13	N	Y
11/19/2003	6:31	11/19/2003	17:30	LaGrange Lock & Dam	Main	EE	Repairing lock or lock hardware	00:10:59		#4 Pull lower gates.		X		IW 03-13	N	Y
12/22/2003	9:31	12/22/2003	12:29	LaGrange Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:58				X			N	
1/15/2003	9:10	1/15/2003	9:50	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:40				X			N	
1/15/2003	11:30	1/15/2003	12:20	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:50				X			N	
1/17/2003	13:35	1/17/2003	14:00	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:25				X			N	
1/18/2003	9:00	1/18/2003	9:55	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:55				X			N	
1/19/2003	8:40	1/19/2003	9:15	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:35				X			N	
1/19/2003	10:49	1/19/2003	11:20	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:31				X			N	
1/22/2003	18:30	1/22/2003	18:55	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:25				X			N	
1/22/2003	20:45	1/22/2003	21:15	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:30				X			N	
1/23/2003	16:30	1/23/2003	17:00	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:30				X			N	
1/23/2003	21:00	1/23/2003	21:50	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:50				X			N	
1/23/2003	22:50	1/23/2003	23:20	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:30				X			N	
1/26/2003	16:40	1/26/2003	17:19	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:39				X			N	
1/26/2003	21:40	1/26/2003	22:00	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:20				X			N	
1/27/2003	8:35	1/27/2003	9:00	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:25				X			N	
2/24/2003	17:20	2/24/2003	17:45	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:25				X			N	
2/25/2003	17:40	2/25/2003	18:00	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:20				X			N	
2/26/2003	18:05	2/26/2003	21:44	Lockport Lock	Main	R	Lock hardware or equipment malfunction	00:03:39				X			N	
3/2/2003	22:15	3/2/2003	22:40	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:25				X			N	
3/3/2003	0:30	3/3/2003	0:48	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:18				X			N	
3/3/2003	2:30	3/3/2003	2:45	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:15				X			N	
3/6/2003	4:15	3/6/2003	4:40	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:25				X			N	
3/6/2003	6:50	3/6/2003	7:20	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:30				X			N	
3/10/2003	2:10	3/10/2003	2:30	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:20				X			N	
3/10/2003	4:10	3/10/2003	4:30	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:20				X			N	
3/10/2003	6:00	3/10/2003	6:20	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:20				X			N	
3/11/2003	0:30	3/11/2003	0:45	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:15				X			N	
4/28/2003	13:25	4/28/2003	15:25	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:02:00				X			N	
4/29/2003	13:00	4/29/2003	15:00	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:02:00				X			N	
4/30/2003	9:01	4/30/2003	10:39	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:01:38				X			N	
5/5/2003	13:15	5/5/2003	15:05	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:01:50				X			N	
5/19/2003	10:46	5/19/2003	11:05	Lockport Lock	Main	R	Lock hardware or equipment malfunction	00:00:19				X			N	
8/12/2003	14:00	8/12/2003	16:00	Lockport Lock	Main	EE	Repairing lock or lock hardware	00:02:00				X			N	
8/24/2003	16:45	8/24/2003	18:45	Lockport Lock	Main	R	Lock hardware or equipment malfunction	00:02:00				X			N	
11/25/2003	15:01	11/25/2003	15:59	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:58				X			N	
12/12/2003	3:45	12/12/2003	4:15	Lockport Lock	Main	T	Maintaining lock or lock equipment	00:00:30				X			N	
12/16/2003	11:00	12/16/2003	14:15	Lockport Lock	Main	Y	Inspection or testing lock	00:03:15				X			N	
9/19/2003	14:17	9/19/2003	15:34	Marseilles Lock & Dam	Main	EE	Repairing lock or lock hardware	00:01:17				X			N	
11/11/2003	7:50	11/11/2003	10:20	Marseilles Lock & Dam	Main	EE	Repairing lock or lock hardware	00:02:30				X			N	
11/11/2003	14:25	11/11/2003	16:45	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:20				X			N	
11/13/2003	11:00	11/13/2003	11:22	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:22				X			N	
11/17/2003	11:05	11/17/2003	12:28	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:23				X			N	
11/17/2003	13:38	11/17/2003	16:30	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:52				X			N	
11/18/2003	13:50	11/18/2003	15:35	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:45				X			N	
11/19/2003	10:31	11/19/2003	14:29	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:03:58				X			N	
11/19/2003	15:00	11/19/2003	18:30	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:03:30				X			N	
11/20/2003	12:00	11/20/2003	14:00	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:00				X			N	
11/24/2003	13:36	11/24/2003	14:49	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:13				X			N	
11/24/2003	15:10	11/24/2003	16:14	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:04				X			N	
11/25/2003	12:47	11/25/2003	16:44	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:03:57				X			N	
12/2/2003	7:20	12/2/2003	11:05	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:03:45				X			N	
12/3/2003	10:00	12/3/2003	11:58	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:58				X			N	
12/8/2003	11:00	12/8/2003	11:50	Marseilles Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:50				X			N	
12/8/2003	15:30	12/8/2003	17:10	Marseilles Lock & Dam	Main	EE	Repairing lock or lock hardware	00:01:40				X			N	
8/28/2003	22:01	8/29/2003	1:02	Peoria Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:03:01				X			N	
10/8/2003	7:01	10/8/2003	7:26	Peoria Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:25				X			N	
2/10/2003	18:28	2/10/2003	19:02	Starved Rock Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:34				X			N	
4/9/2003	9:26	4/9/2003	9:50	Starved Rock Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:24				X			N	
4/9/2003	10:56	4/9/2003	11:49	Starved Rock Lock & Dam	Main	T	Maintaining lock or lock equipment	00:00:53				X			N	
5/12/2003	12:40	5/12/2003	14:58	Starved Rock Lock & Dam	Main	EE	Repairing lock or lock hardware	00:02:18				X			N	
5/13/2003	8:31	5/13/2003	9:35	Starved Rock Lock & Dam	Main	EE	Repairing lock or lock hardware	00:01:04				X			N	
5/19/2003	12:51	5/19/2003	14:55	Starved Rock Lock & Dam	Main	EE	Repairing lock or lock hardware	00:02:04				X			N	
5/21/2003	10:31	5/21/2003	12:09	Starved Rock Lock & Dam	Main	EE	Repairing lock or lock hardware	00:01:38				X			N	
5/22/2003	7:03	5/22/2003	9:45	Starved Rock Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:42				X			N	
5/28/2003	8:31	5/28/2003	10:40	Starved Rock Lock & Dam	Main	EE	Repairing lock or lock hardware	00:02:09				X			N	
7/21/2003	12:48	7/21/2003	18:59	Starved Rock Lock & Dam	Main	EE	Repairing lock or lock hardware	00:06:11				X			N	
7/21/2003	19:23	7/21/2003	22:20	Starved Rock Lock & Dam	Main	EE	Repairing lock or lock hardware	00:02:57				X			N	
8/23/2003	8:48	8/23/2003	9:14	Starved Rock Lock & Dam	Main	R	Lock hardware or equipment malfunction	00:00:26				X			N	
11/20/2003	10:11	11/20/2003	12:29	Starved Rock Lock & Dam	Main	T	Maintaining lock or lock equipment	00:02:18				X			N	
12/2/2003	12:11	12/2/2003	15:24	Starved Rock Lock & Dam	Main	T	Maintaining lock or lock equipment	00:03:13				X			N	
12/3/2003	8:22	12/3/2003	9:25	Starved Rock Lock & Dam	Main	T	Maintaining lock or lock equipment	00:01:03				X			N	
12/3/2003	11:31	12/3/2003	15:58	Starved Rock Lock & Dam	Main	T	Maintaining lock or lock equipment	00:04:27				X			N	
12/4/2003	8:46	12/4/2003	14:05	Starved Rock Lock & Dam	Main	T	Maintaining lock or lock equipment	00:05:19				X			N	
1/4/2003	9:15	1/4/2003	9:40	Thomas J. OBrien Lock	Main	Y	Inspection or testing lock	00:00:25				X			N	
1/4/2003	11:15	1/4/2003	11:35	Thomas J. OBrien Lock	Main	Y	Inspection or testing lock	00:00:20				X			N	



1/11/2003	0:20	1/11/2003	0:30	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:10					X			N
1/11/2003	3:50	1/11/2003	4:00	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:10					X			N
1/11/2003	6:00	1/11/2003	6:10	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:10					X			N
3/3/2003	15:00	3/3/2003	21:15	Thomas J. OBrien Lock	Main	R	Lock hardware or equipment malfunction	00:06:15					X			N
3/12/2003	9:00	3/12/2003	17:20	Thomas J. OBrien Lock	Main	R	Lock hardware or equipment malfunction	00:08:20					X			N
4/9/2003	8:15	4/9/2003	8:30	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
11/25/2003	0:05	11/25/2003	0:20	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
11/25/2003	5:05	11/25/2003	5:20	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/11/2003	17:30	12/11/2003	17:45	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/12/2003	16:20	12/12/2003	16:35	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/13/2003	21:00	12/13/2003	21:15	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/14/2003	21:00	12/14/2003	21:15	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/19/2003	3:30	12/19/2003	3:45	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/19/2003	6:30	12/19/2003	6:45	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/19/2003	12:00	12/19/2003	12:30	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:30					X			N
12/20/2003	0:30	12/20/2003	0:45	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/20/2003	5:30	12/20/2003	5:45	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/21/2003	0:15	12/21/2003	0:30	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/21/2003	3:30	12/21/2003	3:45	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/23/2003	1:31	12/23/2003	4:00	Thomas J. OBrien Lock	Main	R	Lock hardware or equipment malfunction	00:02:29					X			N
12/25/2003	3:00	12/25/2003	3:15	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/25/2003	5:30	12/25/2003	6:45	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:01:15					X			N
12/25/2003	7:15	12/25/2003	7:30	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N
12/25/2003	18:45	12/25/2003	19:00	Thomas J. OBrien Lock	Main	T	Maintaining lock or lock equipment	00:00:15					X			N

Notes:

1) The source of the work description is log books unless otherwise noted.

DATE	Begin Time	End Date	End Time	LOCK	CHAMBER	LPMS	LPMS CLOSURE	DURATION	INDEXED REPAIR	DESCRIPTION OF REPAIR WORK (Source(s))	SOURCE OF CLOSURE INFORMATION				SCHEDULED?	
						SYMBOL	CLASSIFICATION	Days:Hrs:min	COST (Oct-04 \$\$\$)		Log Books	OMNI/ LPMS	Repair Crew Records	Nav Notice	OMNI/ LPMS	Nav Notice
8/11/2003	19:30	8/11/2003	19:45	Lock & Dam 1	Main	EE	Repairing lock or lock hardware	00:00:15				X				N
10/27/2003	13:58	10/27/2003	15:17	Lock & Dam 2	Main	EE	Repairing lock or lock hardware	00:01:19				X				N
11/24/2003	9:31	11/24/2003	15:55	Lock & Dam 2	Main	T	Maintaining lock or lock equipment	00:06:24				X				N
10/18/2003	10:28	10/18/2003	11:30	Lock & Dam 5	Main	EE	Repairing lock or lock hardware	00:01:02				X				N

## **Attachment 3**

### **Cross-Check Notes**

## **Notes on the Crosscheck of 2003 Lock Closure Data for MVP, MVR and MVS**

11/16/04

### **Introduction**

A crosscheck of the 2003 lock closure data for locks in the St. Paul, Rock Island and St. Louis Districts was performed. Sources of information considered for use in the crosscheck were lock logbooks, repair crew reports and Navigation Notices. As the study progressed we identified an additional source, the August 2004 data call made by Michael Kidby. This data call was only for emergency closures, but some locks recorded all closures. It was not possible to gather information from all of these sources for all of the locks within the projects funding restraint. The information that was available was entered in a crosscheck spreadsheet that contains the OMNI data and columns for entry of data from the other sources (see Attachment 2). The crosscheck spreadsheet contains OMNI closures for 2003 that were coded as EE (repairing lock or lock hardware), R (lock hardware or equipment malfunction), T (maintaining lock or lock equipment), and Y (inspection or testing lock). Only these closure codes were included because these are the only closures that are related to correctable lock reliability. A description of the data obtained for each district and conclusions drawn from comparison with the OMNI data follows.

### **MVS Crosscheck Data**

#### *Lock Logbooks*

For the St. Louis District, a review of the lock logbooks for closures from 2000-2004 was conducted for the August 2004 Kidby data call. These reports generated by this data call were obtained for Locks 24, 25, Mel Price and 27 and the information for 2003 was entered into the crosscheck spreadsheet. For L25 and L27, the reports included events of any duration. For L24 and Mel Price, the reports included only closures with 8 hours or greater duration.

#### *Navigation Notices*

Navigation Notices were sought but could not be obtained. Some Navigation Notices were available from the District web site, but 2003 was not included.

#### *Repair Crew Records*

Much of lock repair work during closures in the St. Louis District is performed by lock personnel or under construction contracts. Consequently, repair crew reports for MVS were not considered to be a significant source of information for crosschecking lock closure data.

### **MVR Crosscheck Data**

#### *Lock Logbooks*

For the Rock Island District, a review of the lock logbooks, Navigation Notices and repair crew records for closures at the Mississippi River locks from 2000-2004 was conducted for the Kidby 2004 data call. The report from this review was obtained and the information was entered into the crosscheck spreadsheet. A new column, "unknown source", was added to the spreadsheet and used for entry of this data since it was not

known which sources generated which entries. The Illinois River locks were not included in the report and a review of their logbooks was not performed.

#### *Navigation Notices*

MVR Navigation Notices were obtained from the Rock Island web site for the Mississippi and Illinois River locks and were entered into the crosscheck spreadsheet.

#### *Repair Crew Records*

See Lock Logbooks above.

#### **MVP Crosscheck Data**

There are very few OMNI closure data entries for MVP locks in 2003. MVP personnel explained that they have upgraded their locks. Operating machinery, central controls, electrical systems, and concrete were replaced or repaired during winter shutdowns, and as a result of this program, there are very few reliability related closures at MVP locks. No crosscheck data was available and no crosscheck was performed.

#### **Questions, Comments and Conclusions**

This crosscheck relates to two tasks:

- 1) evaluating the confidence in the historical data (and correcting to increase confidence if possible)
- 2) improving the data collection methods, if needed, so as to provide better confidence or make more useful the data collected in the future

Operations personnel need to be included in the crosscheck task since the source records are generated and maintained by them. The Operations contact person for assistance in the collection of MVS source information was on TDY during this phase, making the collection of MVS source information more difficult. Record keeping methods vary from site to site and district to district and obtaining records may be more difficult at some sites than others.

The Phase 0 crosscheck was limited to 2003 data. This small sample size may not illustrate all of the potential issues with the Phase 1 crosscheck.

There is a range of estimates for the amount of effort required to perform this kind of crosscheck. It is believed that previous LRL work required approximately 3 days per lock for the 1987-2004 data. This work was apparently limited to events with duration of at least one day. Another estimate, from a previous MVS lock logbook review, is that it takes 1 person about 1 day to review 1 year of a logbook. This review noted all closures, even short duration events. Clearly these two man-hour estimates would provide a great range in the Phase 1 cost estimate and indicate the need to clarify and perhaps limit the scope.

Although only the repair/maintenance closures have been included in this study, it might be important to crosscheck all closures. Some studies might need analysis including the other closure types and could yield misleading results if they contained significant data

errors. Spreadsheets shown in Attachment 4, compiled in an earlier LRL data crosscheck, contain entries for closure types other than the repair/maintenance types. It also included entries for ½ speed events when culvert valves were repaired. These ½ speed events are not included in the current study since they are not part of the historical closure data. The economic impacts of these ½ speed events cannot be captured through analysis of closure data as it is currently structured. Additionally, the closures due to unreliability have a greater impact on locks that have increasing demand, increasing closures of all types, and possibly slowed performance due to aging. In other words, two days of closures per year would have a greater impact on today's locks than in the 1950's when demand was lower. Perhaps it is possible that closures of any type coincide with traffic more often than in past years.

The scope of the Phase 1 crosscheck could be adjusted to include only the longer closures, for example, disregarding all closures shorter than some specified duration (perhaps one day). In previous MVS experience, these longer closures are the data points that significantly alter the output statistics.

The OMNI /LPMS data collection has been refined over the years. Earlier data has potentially more problems. Attachment 5 lists long duration problematic data MVS found in an earlier study. These events would have altered the output due to their long duration and seemed to be of a type that were potentially correctable with a computer crosscheck. If the Phase 1 crosscheck only covers data from 1991 forward, some of the difficulties might be avoided, however there could be more problems with the 1991-99 data than the 2000-04. The 1991-99 data might not have recorded closures if no vessels were present. If only some data is corrected, would the uncorrected data be designated to avoid using it accidentally in the future? In determining a cost estimate for Phase 1, it should be considered that older paper records might be more difficult to obtain than more recent records.

The issue of whether there is a closure if no vessel is present needs to be clearly defined and a uniform method of data input adhered to by all. If a lock has no traffic and some repair work is done, is that entered as a closure? Should it be? Apparently in earlier data years, the software did not allow entry of closures if vessels weren't present. This raises questions about the earlier data for sites with auxiliary locks. For these sites, prior to the software change (1999 and earlier), how often did closures get recorded if the vessels could just use the main chamber when the auxiliary was closed, and visa versa? In Attachment 4 (referred to above), there are many closure events in the main and auxiliary chambers that were found in the crosscheck sources that were not in the OMNI /LPMS data. Could these be due to there being no vessels waiting since the vessels could have used the other chamber when one was closed? Now that the software allows recording of closures when no vessels are waiting, are they handled uniformly from lock to lock and district to district? The MVP closure data raises this question, despite their rehabilitation work, just based on the gap between their average number of closures and the MVR or MVS averages (0.3 closures/lock for MVP versus 20.1 for MVR and 27.8 for MVS). Changes in software like this could make statistics appear to have trends that don't really occur, i.e., a sudden increase in closures. This issue is confused by winter closures. Care

needs to be taken when the data is used to produce national closure statistics, since it may be necessary to separate in-season from out-of-season closure to avoid grouping events with inconsistent and vastly different economic impacts.

There is also a question about the definition of Scheduled Closure. One definition seems to be it is scheduled if there is a Navigation Notice. Another definition is that the scheduled closures would be for scheduled maintenance only. Under this definition, for example, a closure caused by an accident, but with the repair able to be delayed until a notice was in effect, would be unscheduled. This was determined to be an issue in previous MVS studies (see Attachment 6). Based on the limited 2003 Navigation Notice information reviewed, this is still a concern with 5 out of 8 notices being marked “N” in OMNI. If the historical data for scheduled events is not consistently defined, the data column is useless unless it can be corrected. Is there agreement that if there is a Navigation Notice, the closure should be coded as scheduled?

How would the crosscheck be used to produce an improved historical database? Is there agreement on what criteria would be used to ensure that there is better confidence in the corrected data set than in the uncorrected data set? There are two types of corrections to the data set that could be considered: adding closure data lines and removing closure data lines. Regarding adding data lines, if a crosscheck source indicates a difference from the OMNI /LPMS records, that raises the question of which is correct. If a crosscheck source indicated an additional closure that was not entered into the OMNI/LPMS database, is that enough information to alter the database? It is thought that if the crosscheck source were the lock logbooks, than it is probably correct to add it since this type of “error of omission” is not unreasonable. If the crosscheck source is a Navigation Notice, it is probably not sufficient information to add the closure since the closure could have been delayed or become an emergency. Regarding removing data lines, the lack of a closure in the Navigation Notices, operations records or log books would not be sufficient reason to remove the data line. There does not seem to be a method of removing data lines with high confidence based on source crosscheck.

In the MVR report, start and end times are not given so it was not always known if an entry was the same as an OMNI entry or an additional event. Also, the durations didn’t always match the OMNI durations so it was not known which was correct.

This crosscheck indicated the need for very few corrections or serious problems with the data, other than the issue of the scheduled/unscheduled code. For example, for Lock 25, which had a very thorough review of the logbook, there were a few short duration closures noted that were not in the OMNI data. Inclusion of the added closures would increase the 2003 closures by only 16%. Similarly, there were several short duration closures found in the MVR crosscheck sources that were not included in the OMNI data, including one somewhat more significant (12 hour) closure at Lock 13. There was one longer duration closure noted in the crosscheck sources that was not in the OMNI data. This closure was 4.5 days of closure at the Mel Price Auxiliary Lock. This raises the question again of data procedure for sites with auxiliary locks. If all vessels use the main

chamber and no vessels wait, would/should the closure be entered for the auxiliary chamber?

The few corrections to the 2003 data would indicate fairly high confidence in the accuracy. Note however that 2003 data is better than earlier data as stated above. Also, if more of the 2003 crosscheck sources were able to be obtained and if all of the closure types were checked, not just the repair/maintenance types, more additions would be found.

From an economics perspective, are there changes we want to make to the data collection that will facilitate future analysis? It has been noted that an estimate is required, during Phase 2, to account for the vessels that wait remotely and therefore aren't picked up as delay in OMNI/LPMS. It has also been noted that, if an approach follows a short lock closure, then the approach of a queued vessel could be longer than a typical approach due to the tow possibly being unprepared. It would seem that this additional time adds to delay as a result of closure, but is not a closure in itself.



## **Attachment 4**

### **JT Myers Cross-Check Spreadsheets**

DATE	Begin Time	End Date	End Time	LOCK	CHAMBER	LPMS SYMBOL	LPMS CLOSURE CLASSIFICATION	DURATION (DAYS)	ORMSS CATEGORY	INDEXED REPAIR COST (Oct-04 \$\$\$)	DESCRIPTION OF REPAIR WORK	SOURCE OF CLOSURE INFORMATION			
												Log Books	LPMS	Ops Records	Nav Notice
8/4/1989	1500	8/12/1989	800	J.T. Myers	Aux	Z	Other	8	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs		√	√	
9/24/1989	2026	9/26/1989	1644	J.T. Myers	Aux	T	Test / Maint	2	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs		√	√	
7/2/1990	0	7/31/1990	0	J.T. Myers	Aux	T	Test / Maint	29	Major Repair Dewatering	\$1,264,171	miter gate repairs			√	90-12
8/1/1990	0	8/31/1990	0	J.T. Myers	Aux	Culvert Valves	Main - 1/2 sp. Aux - close	30	Maintenance Closure		main chamber culvert valve repairs - auxiliary chamber closed			√	90-12
12/30/1990	1630	1/16/1991	1330	J.T. Myers	Aux	J	Flood	17	RM - No Cost	n/a	flood-related closure	√			
7/30/1993	2230	7/31/1993	1115	J.T. Myers	Aux	T	Test / Maint	1	RM - Repair		specific repairs not determined	√			
5/31/1995	0	6/12/1995	0	J.T. Myers	Aux	T	Test / Maint	12	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs				95-11
6/24/1995	222	6/30/1995	730	J.T. Myers	Aux	T	Test / Maint	6	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs		√		95-11
5/13/1996	0	5/19/1996	0	J.T. Myers	Aux	J	Flood	6	RM - No Cost	n/a	flood-related closure	√	√		
7/26/1996	1000	8/17/1996	1114	J.T. Myers	Aux	T	Test / Maint	22	Inspection Dewatering & Minor Repairs	\$1,133,920	miter gate and hydraulic piping repairs	√	√	√	96-14
3/6/1997	1300	3/19/1997	752	J.T. Myers	Aux	J	Flood	13	RM - No Cost	n/a	flood-related closure	√	√		
10/30/1998	0	12/13/1998	0	J.T. Myers	Aux	T	Test / Maint	44	Maintenance Closure		miter gate repairs	√			
8/5/2000	0	8/7/2000	0	J.T. Myers	Aux	T	Test / Maint	2	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs			√	00-13
1/31/2001	0	2/1/2001	0	J.T. Myers	Aux	T	Test / Maint	1	RM - Repair		random minor closure for maintenance of floating mooring bit	√			
10/8/2001	0	10/9/2001	0	J.T. Myers	Aux	T	Test / Maint	1	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs	√			01-17
10/20/2002	1912	11/22/2002	1120	J.T. Myers	Aux	Z	Other	33	Inspection Dewatering & Minor Repairs	\$430,504	miter gate inspection, replace upper miter gate cylinders, other repairs	√		√	02-15
6/25/2003	0	7/7/2003	728	J.T. Myers	Aux	Z	Other	12	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs	√	√		03-12
8/2/2003	1421	8/7/2003	530	J.T. Myers	Aux	Z	Other	5	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs	√	√	√	03-12
4/18/2004	0	6/4/2004	0	J.T. Myers	Aux	Culvert Valves	Main - 1/2 sp. Aux - close	47	Maintenance Closure		main chamber culvert valve repairs - auxiliary chamber closed	√		√	04-02
8/10/1987	0	11/18/1987	0	J.T. Myers	Main	T	Test / Maint	100	RM - Repair		this represents 100 single day 12-hr events not listed in LPMS data	√			87-27
8/20/1987	840	8/20/1987	2151	J.T. Myers	Main	T	Test / Maint	1	RM - Repair		specific repairs not determined	√			
9/3/1987	700	9/3/1987	2000	J.T. Myers	Main	T	Test / Maint	1	RM - Repair		specific repairs not determined	√			
9/4/1987	700	9/4/1987	1930	J.T. Myers	Main	T	Test / Maint	1	RM - Repair		specific repairs not determined	√			
9/22/1987	700	9/22/1987	2004	J.T. Myers	Main	T	Test / Maint	1	RM - Repair		specific repairs not determined	√			
11/12/1988	600	11/19/1988	1900	J.T. Myers	Main	T	Test / Maint	8	RM - Repair	\$262,931	emergency repair to damage miter gate pintle bolts	√	√	√	88-33
8/12/1989	600	9/24/1989	1900	J.T. Myers	Main	T	Test / Maint	44	Major Repair Dewater	\$2,381,755	repairs to upper and lower miter gates, sills, and pintles	√	√	√	89-25
8/1/1990	0	8/31/1990	0	J.T. Myers	Main	Culvert Valves	Main - 1/2 sp. Aux. close	30	Main @ 1/2 Speed and Auxiliary Closed	\$1,264,171	main chamber culvert valve repairs - auxiliary chamber closed			√	90-12
12/30/1990	1630	1/16/1991	1330	J.T. Myers	Main	J	Flood	17	RM - No Cost	n/a	flood-related closure	√			
9/24/1993	1000	9/24/1993	2300	J.T. Myers	Main	T	Test / Maint	1	RM - Repair		specific repairs not determined	√			
6/12/1995	557	6/24/1995	222	J.T. Myers	Main	T	Test / Maint	12	Maintenance Closure	\$1,241,813	miter gate repairs/inspection, anchorage repairs, hydraulic repairs		√	√	94-30
5/13/1996	0	5/19/1996	0	J.T. Myers	Main	J	Flood	6	RM - No Cost	n/a	flood-related closure	√	√		
3/6/1997	1300	3/19/1997	752	J.T. Myers	Main	J	Flood	13	RM - No Cost	n/a	flood-related closure	√	√		
8/12/1998	0	8/13/1998	0	J.T. Myers	Main	Q	Debris	1	RM - No Cost	n/a	debris-related closure	√			
7/7/2000	0	7/8/2000	0	J.T. Myers	Main	T	Test / Maint	1	RM - Repair		repairs to miter gates	√			
7/25/2000	0	8/4/2000	2350	J.T. Myers	Main	T	Test / Maint	11	Inspection Dewatering & Minor Repairs	\$680,569	replaced lower miter gate machinery cylinders, repaired damaged pintle bolts, quoin and miter block repairs	√	√	√	00-13
9/28/2001	0	11/6/2001	1658	J.T. Myers	Main	Z	Other	40	Major Repair Dewater	\$1,705,856	lower gates - replaced pintles, bushings, miter, and quoin blocks	√	√	√	01-17
3/10/2003	0	3/2/2003	0	J.T. Myers	Main	Culvert Valves	Main at 1/2 Speed	33	Culvert Valve Repairs	\$860,407	main chamber culvert valve repairs - auxiliary open/main @ 1/2 speed			√	
7/1/2003	0	7/3/2003	0	J.T. Myers	Main	T	Test / Maint	2	RM - Repair		specific repairs not determined	√			
7/7/2003	0	8/2/2003	1808	J.T. Myers	Main	T	Test / Maint	27	Inspection Dewatering & Minor Repairs	\$1,876,404	upper gates - replaced bushings, miter, and quoin blocks	√	√	√	03-12
4/18/2004	0	6/4/2004	0	J.T. Myers	Main	Culvert Valves	Main - 1/2 sp. Aux. close	47	Main @ 1/2 Speed and -Auxiliary Closed	\$1,502,875	main chamber culvert valve repairs - auxiliary chamber closed	√		√	04-02

DATE	LOCK	CHAMBER	LPMS SYMBOL	LPMS CLOSURE CLASSIFICATION	DURATION (DAYS)	ORMSS CLOSURE	ORMSS CATEGORY	INDEXED REPAIR COST (Oct-04 \$\$\$)	DESCRIPTION OF REPAIR WORK	SOURCE OF CLOSURE INFORMATION			
										Log Books	LPMS	Ops Records	Nav Notice
Aug-89	J.T. Myers	Aux	Z	Other	8	10	RM - Main Cost		staging and clean-up area for main chamber repairs		√	√	
Sep-89	J.T. Myers	Aux	T	Test / Maint	2	3	RM - Main Cost		staging and clean-up area for main chamber repairs		√	√	
Dec-90	J.T. Myers	Aux	J	Flood	17	15	RM - No Cost	n/a	flood-related closure	√			
Jul-93	J.T. Myers	Aux	T	Test / Maint	1	1	RM - Repair		specific repairs not determined	√			
May-95	J.T. Myers	Aux	T	Test / Maint	12	10	RM - Main Cost		staging and clean-up area for main chamber repairs				95-11
Jun-95	J.T. Myers	Aux	T	Test / Maint	6	5	RM - Main Cost		staging and clean-up area for main chamber repairs		√		95-11
May-96	J.T. Myers	Aux	J	Flood	6	5	RM - No Cost	n/a	flood-related closure	√	√		
Mar-97	J.T. Myers	Aux	J	Flood	13	15	RM - No Cost	n/a	flood-related closure	√	√		
Aug-00	J.T. Myers	Aux	T	Test / Maint	2	3	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs			√	00-13
Jan-01	J.T. Myers	Aux	T	Test / Maint	1	1	RM - Repair		random minor closure for maintenance of floating mooring bit	√			
Oct-01	J.T. Myers	Aux	T	Test / Maint	1	1	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs	√			01-17
Jun-03	J.T. Myers	Aux	Z	Other	12	10	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs	√	√		03-12
Aug-03	J.T. Myers	Aux	Z	Other	5	5	RM - Main Cost	n/a	staging and clean-up area for main chamber repairs	√	√	√	03-12
Aug-87	J.T. Myers	Main	T	Test / Maint	100	see note	RM - Repair		this represents 100 single day 12-hr events not listed in LPMS data	√			87-27
Aug-87	J.T. Myers	Main	T	Test / Maint	1	1	RM - Repair		specific repairs not determined	√			
Sep-87	J.T. Myers	Main	T	Test / Maint	1	1	RM - Repair		specific repairs not determined	√			
Sep-87	J.T. Myers	Main	T	Test / Maint	1	1	RM - Repair		specific repairs not determined	√			
Sep-87	J.T. Myers	Main	T	Test / Maint	1	1	RM - Repair		specific repairs not determined	√			
Nov-88	J.T. Myers	Main	T	Test / Maint	8	10	RM - Repair	\$262,931	emergency repair to damage miter gate pintle bolts	√	√	√	88-33
Dec-90	J.T. Myers	Main	J	Flood	17	15	RM - No Cost	n/a	flood-related closure	√			
Sep-93	J.T. Myers	Main	T	Test / Maint	1	1	RM - Repair		specific repairs not determined	√			
May-96	J.T. Myers	Main	J	Flood	6	5	RM - No Cost	n/a	flood-related closure	√	√		
Mar-97	J.T. Myers	Main	J	Flood	13	15	RM - No Cost	n/a	flood-related closure	√	√		
Aug-98	J.T. Myers	Main	Q	Debris	1	1	RM - No Cost	n/a	debris-related closure	√			
Jul-00	J.T. Myers	Main	T	Test / Maint	1	1	RM - Repair		repairs to miter gates	√			
Jul-03	J.T. Myers	Main	T	Test / Maint	2	3	RM - Repair		specific repairs not determined	√			

ESTABLISHING HISTORICAL COSTS FOR RANDOM MINOR CLOSURES @ J.T. MYERS

Date	Duration	Cost
Nov-88	8	\$262,931

Daily LRL Fleet Cost | \$34,864 | per day of random minor closure

DATE	LOCK	CHAMBER	LPMS SYMBOL	LPMS CLOSURE CLASSIFICATION	DURATION (DAYS)	ORMSS CLOSURE	ORMSS CATEGORY	INDEXED REPAIR COST (Oct-04 \$\$\$)	DESCRIPTION OF REPAIR WORK	SOURCE OF CLOSURE INFORMATION			
										Log Books	LPMS	Ops Records	Nav Notice
Jul-90	J.T. Myers	Aux	T	Test / Maint	29	30	Major Repair for Gates	\$1,264,171	miter gate repairs			√	90-12
Aug-90	J.T. Myers	Aux	Culvert Valves	Main - 1/2 sp. Aux - close	30	30	Maintenance Closure		main chamber culvert valve repairs - auxiliary chamber closed			√	90-12
Jul-96	J.T. Myers	Aux	T	Test / Maint	22	30	Maintenance Closure	\$1,133,920	miter gate and hydraulic piping repairs	√	√	√	96-14
Oct-98	J.T. Myers	Aux	T	Test / Maint	44	45	Major Repair for Gates		miter gate repairs	√			
Oct-02	J.T. Myers	Aux	Z	Other	15	15	Inspection Dewatering & Minor Repairs	\$430,504	miter gate inspection, replace upper miter gate cylinders, other repairs	√	√	√	02-15
Apr-04	J.T. Myers	Aux	Culvert Valves	Main - 1/2 sp. Aux - close	47	45	Maintenance Closure		main chamber culvert valve repairs - auxiliary chamber closed	√		√	04-02
Aug-89	J.T. Myers	Main	T	Test / Maint	44	45	Major Repair for Gates	\$2,381,755	repairs to upper and lower miter gates, sills, and pintles	√	√	√	89-25
Aug-90	J.T. Myers	Main	Culvert Valves	Main - 1/2 sp. Aux. close	30	30	Main @ 1/2 Speed and Auxiliary Closed	\$1,264,171	main chamber culvert valve repairs - auxiliary chamber closed			√	90-12
Jun-95	J.T. Myers	Main	T	Test / Maint	12	15	Inspection Dewatering & Minor Repairs	\$1,241,813	miter gate repairs/inspection, anchorage repairs, hydraulic repairs		√	√	94-30
Jul-00	J.T. Myers	Main	T	Test / Maint	10	10	Inspection Dewatering & Minor Repairs	\$680,569	replaced lower miter gate machinery cylinders, repaired damaged pintle bolts, quoin and miter block repairs	√	√	√	00-13
Sep-01	J.T. Myers	Main	Z	Other	10	10	Maintenance Closure	\$1,705,856	lower gates - replaced pintles, bushings, miter, and quoin blocks	√	√	√	01-17
Mar-03	J.T. Myers	Main	Culvert Valves	Main at 1/2 Speed	53	45	Culvert Valve Repairs	\$860,407	main chamber culvert valve repairs - auxiliary open/main @ 1/2 speed			√	
Jul-03	J.T. Myers	Main	T	Test / Maint	15	15	Inspection Dewatering & Minor Repairs	\$1,042,447	upper gates - replaced busings, miter, and quoin blocks	√	√	√	03-12
Apr-04	J.T. Myers	Main	Culvert Valves	Main - 1/2 sp. Aux. close	47	45	Main @ 1/2 Speed and Auxiliary Closed	\$1,502,875	main chamber culvert valve repairs - auxiliary chamber closed	√		√	04-02

ESTABLISHING HISTORICAL OPERATING COSTS FOR LRL FLEET @ J.T. MYERS

	MAIN CHAMBER				AUXILIARY CHAMBER	
	Closure	Days @	Indexed	Indexed Closure	Closure	Indexed Closure
	Days	1/2 Speed	1/2 Speed \$	Cost (Oct-04 Level)	Days	Cost (Oct-04 Level)
Aug-89	44			\$2,381,755		
Jul-90					29	\$1,264,171
Aug-90		30	\$1,264,171			
Jun-95	12			\$1,241,813		
Jul-96					22	\$1,133,920
Jul-00	10			\$680,569		
Sep-01	10			\$1,705,856		
Oct-02					15	\$430,504
Mar-03		53	\$860,407			
Jul-03	15			\$1,042,447		
Apr-04		47	\$1,502,875			
<b>TOTALS</b>	<b>90</b>	<b>130</b>	<b>\$3,627,453</b>	<b>\$7,052,440</b>	<b>66</b>	<b>\$2,828,595</b>

Historical Main Chamber LRL Daily Fleet Cos \$78,012 per day of main lock closure  
Historical Main Chamber 1/2 Speed Daily Cos \$27,903 per day of main lock 1/2 speed operations  
Historical Auxiliary Chamber LRL Daily Fleet Cos \$42,827 per day of auxiliary lock closure

ADDITIONAL CLOSURES REQUIRED FOR MITER GATE CHANGEOUT MODIFICATIONS @ J.T. MYERS

Date	MAIN CHAMBER		AUX. CHAMBER		Description
	Closure Days	Indexed Closure \$	Closure Days	Indexed 2004 Cost	
Oct-98			1	\$465,660	Modify Lower 600' Miter Gates
Jul-00	1	\$54,893			Modify UM 1200' Miter Gates
Oct-01	10	\$548,932			Modify Remaining 1200' Miter Gates
Nov-02			18	\$476,153	Modify Upper 600' Miter Gates
Jul-03	12	\$833,957			Anchorage Changeout for Upper 1200-ft Gates

\*\*Note: Anchorage changeouts for Lower 1200' Gates, Upper 600' Gates, and Lower 600' Gates Still Required

## **Attachment 5**

### **Possible Errors Spreadsheet**

DIST_CD	RIVER_CODE	LOCK_NO	CHMBR_NO	BEG_UNAVLBL_MONTH	BEG_UNAVLBL_DAY	BEG_UNAVLBL_YEAR	BEG_UNAVLBL_TIME	END_UNAVLBL_MONTH	END_UNAVLBL_DAY	END_UNAVLBL_YEAR	END_UNAVLBL_TIME	UNAVAIL_CODE	DESCRIPTION	SCH_CODE	UNAVL_TM	
B5	MI	15	1	10	31	1980	0719	1	31	1980	0755	X	Bridge or other structure (i.e. railway, pontoon, swing etc.)	0	32516	Start date after end date - deleted line
B3	MI	25	1	9	3	1981	0740	7	3	1981	0900	A	Fog	0	36400	25 day fog closure unlikely. Start date after c
B3	MI	25	1	6	19	1981	0040	2	14	1981	0216	R	Lock hardware or equipment malfunction	0	45696	Start date after end date - deleted line
B5	MI	22	1	10	30	1988	1057	10	4	1988	1150	T	Maintaining lock or lock equipment	0	44693	Start date after end date - deleted line
B5	MI	22	1	5	17	1983	0645	5	17	1983	1818	Z	Other	0	693	Deleted line - overlap
B5	MI	22	1	5	17	1983	0945	5	18	1983	1250	Z	Other	0	1625	Deleted line - overlap
B5	MI	22	1	5	17	1983	0650	5	19	1983	0912	Z	Other	0	3022	Kept this line
B5	MI	21	1	10	3	1986	1135	10	10	1986	0850	J	Flood	0	9915	Deleted line - overlap
B5	MI	21	1	10	3	1986	1012	10	10	1986	0850	J	Flood	0	9998	Kept this line
B5	MI	21	1	4	3	1983	1130	4	8	1983	0802	J	Flood	0	6992	Deleted line - overlap
B5	MI	21	1	4	3	1983	0630	4	8	1983	0802	J	Flood	0	7292	Deleted line - overlap
B5	MI	21	1	4	3	1983	0615	4	8	1983	0802	J	Flood	0	7307	Deleted line - overlap
B5	MI	21	1	4	3	1983	0210	4	8	1983	0802	J	Flood	0	7552	Deleted line - overlap
B5	MI	21	1	4	3	1983	0117	4	8	1983	0802	J	Flood	0	7605	Kept this line
B5	MI	20	1	12	2	1985	1400	12	3	1985	0035	H	Ice on or around tow	0	635	Deleted line - overlap
B5	MI	20	1	12	2	1985	1300	12	3	1985	1555	H	Ice on or around tow	0	1615	Deleted line - overlap
B5	MI	20	1	12	2	1985	1300	12	3	1985	1748	H	Ice on or around tow	0	1728	Deleted line - overlap
B5	MI	20	1	12	2	1985	1450	12	4	1985	0802	H	Ice on or around tow	0	2472	Deleted line - overlap
B5	MI	20	1	12	2	1985	1550	12	5	1985	0021	H	Ice on or around tow	0	3391	Kept this line
B5	MI	20	1	6	13	1987	0906	11	13	1987	1129	R	Lock hardware or equipment malfunction	0	20463	Deleted line - start and end dates don't match
B5	MI	20	1	6	14	1987	2250	6	14	1987	2326	S	Lock staff occupied with other duties	0	36	Shows overlap with line above

and date - deleted lin

h time and overlap next lines

## **Attachment 6**

### **Winter Closure Spreadsheet**









The NETS research program is developing a series of practical tools and techniques that can be used by Corps navigation planners across the country to develop consistent, accurate, useful and comparable information regarding the likely impact of proposed changes to navigation infrastructure or systems.

The centerpiece of these efforts will be a suite of simulation models. This suite will include:

- A model for forecasting **international and domestic traffic flows** and how they may be affected by project improvements.
- A **regional traffic routing model** that will identify the annual quantities of commodities coming from various origin points and the routes used to satisfy forecasted demand at each destination.
- A **microscopic event model** that will generate routes for individual shipments from commodity origin to destination in order to evaluate non-structural and reliability measures.

As these models and other tools are finalized they will be available on the NETS web site:

<http://www.corpsnets.us/toolbox.cfm>

The NETS bookshelf contains the NETS body of knowledge in the form of final reports, models, and policy guidance. Documents are posted as they become available and can be accessed here:

<http://www.corpsnets.us/bookshelf.cfm>

