Upper Mississippi River System
Flow Frequency Study

Hydrology & Hydraulics
Appendix C
Mississippi River

Rock Island District

August 2003

UPPER MISSISSIPPI RIVER SYSTEM FLOW FREQUENCY STUDY
Rock Island District
Mississippi River
Hydrology & Hydraulics Appendix C
Table of Contents

-

HYDRAULIC ANALYSIS **Page Number**

-

Index of Tables **Page Number**

Index of Plates

-

Upper Mississippi River System
Flow Frequency Study
Appendix C
Mississippi River
Hydrology & Hydraulics
Rock Island District

INTRODUCTION

PURPOSE

The purpose of the Upper Mississippi River System Flow Frequency Study is to update the discharge frequency relationships and water surface profiles for the Mississippi River and Illinois River above Cairo, Illinois, and the Missouri River downstream from Gavins Point Dam. The study area as shown on Plate C-M-1 includes five Corps Districts (Omaha, Kansas City, St. Paul, Rock Island, and St. Louis). The purpose of this appendix is to describe the work accomplished by the Rock Island District. Plate C-M-2 presents the study area encompassed by the Rock Island District (MVR).

AUTHORITY

The study was authorized by Section 216 of the 1970 Flood Control Act, which reads:

> *The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significant changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest.*

STUDY BACKROUND

Flood discharges and profiles for the Upper Mississippi River (St. Paul, Minnesota to Alton, Illinois) were first developed and coordinated by three Corps Districts (St. Paul, Rock Island, and St. Louis) in 1966. Flow records at primary gaging stations along the river were analyzed and flow frequency curves developed. The station statistics (mean, standard deviation, and skew) were smoothed to obtain consistent flood flows for the entire reach of the river. Then the stage-discharge rating curves at these stations were extrapolated to yield consistent stage-frequency values at these stations. In 1971 impacts of tributary reservoirs were incorporated into the 1966-profiles and were in use until 1979 by the Rock Island and St. Paul Districts. The St. Louis District had developed new hydraulic profiles through modeling following the 1973 flood. In 1979, the Technical Flood Plain Management Task Force of the Upper Mississippi River Basin Commission published a new set of flood profiles. These profiles were developed with the same general methodologies as described, however, discharge-frequency relationships along the Mississippi River were determined following the guidelines contained in the US Water Resources Council Bulletin 17, Guidelines for Determining Flood Flow Frequency (USGS, 1976). Technical representatives from five states (Minnesota, Wisconsin, Illinois, Iowa, Missouri), and five Federal agencies (Department of Agriculture,

-

Department of the Interior, Corps of Engineers, Housing and Urban Development, and Upper Mississippi River Commission) were involved to arrive at these results (USACE, 1979). The Upper Mississippi River Water Surface Profiles, River Mile 0.0 to 847.7 (1979) profiles have been the official flood profiles used by State and Federal agencies to manage flood plains and to design flood control projects along the Upper Mississippi River. However, since the 1979 profiles, twenty plus years of additional flow records including the 1993 flood event have occurred and hydrologic and hydraulic modeling capabilities have improved. Therefore the Secretary of the Army for Civil Works directed the Corps of Engineers to conduct a study to review, update, and revise, as appropriate, the existing flood frequency data for the study area.

PREVIOUS STUDIES

Flood Plain Management Assessment of the Upper Mississippi River and Lower Missouri Rivers and Tributaries. U.S. Army Corps of Engineers, June 1995. The Flood Plain Management Assessment (FPMA) recommended several actions that should be undertaken including, but not limited to: update hydrology and hydraulics data of the Upper Mississippi River and Lower Missouri Rivers and Tributaries, including discharge-frequency relationships and water surface profiles; investigate a system-wide plan for flood damage reduction, and investigate developing a systemic management plan for natural resources.

Sharing the Challenge: Floodplain Management into the 21st Century. Report of the Interagency Floodplain Management Review Committee to the Administration Floodplain Management Task Force (a.k.a. "The Galloway Report"), June 1994. The Galloway report supports a management strategy for controlling runoff, managing ecosystems for all their benefits, planning the use of the land and identifying those areas at risk. Where the risk cannot be avoided, damage minimization approaches should be implemented in a systems approach to flood damage reduction in the Mississippi River basin. The Galloway Report also recommended that the methodology utilized for flow-frequency analysis be reassessed.

ACKNOWLEDGEMENTS

This appendix is the result of the dedicated efforts of a number of employees of the Rock Island District and the Hydrologic Engineering Center. These employees include: S.K. Nanda, Task Force Chairman and Rock Island District Hydraulics Branch Chief; Marvin Martens, Hydrologic Engineering Section Chief; David Martin and John Burant, Hydraulic Engineers; Shirley Johnson, Hydrologist; and Dr. David Goldman, Hydraulic Engineer, Hydrologic Engineering Center.

BASIN DESCRIPTION

WATERSHED CHARACTERISTICS

The Rock Island District covers 78,318 square miles and includes 314 miles of the Mississippi River from Guttenberg, Iowa, downstream to Saverton, Missouri and 268 miles of the Illinois Waterway from Lake Street in downtown Chicago and the Thomas J. O'Brien Lock on the Calumet River to the LaGrange Lock and Dam, southwest of Beardstown, Illinois (see plate C-M-2). Agriculture has been and continues to be the predominant land use in the basin. Precipitation falling within its boundaries is the source of nearly all surface water runoff in the Upper Mississippi River basin. Runoff is subject to seasonal variations of temperature and precipitation. The average annual precipitation over the basin is 32 inches. Of this amount, an estimated 24 inches returns to the atmosphere by means of evaporation and transpiration. The remaining

-

8 inches or approximately 25 percent pass out of the basin as surface water runoff via the Mississippi River. However, the annual runoff as a percentage of the annual precipitation varies greatly over the basin. The months of highest runoff are generally March through June, roughly paralleling the monthly precipitation pattern. After June the average monthly flows generally taper off, reaching minimum values during the winter months. March and April flows in the northern half of the basin are augmented by melting snow which has accumulated during the winter months. Major flood events over the 120+ years of record are split between snowmelt and rainfall generated flood events. The largest flood events are often a combination of snowmelt and rainfall. Monthly flows in the southern portion of the basin are relatively high during the winter months compared to the northern parts because annual precipitation is more evenly distributed and temperatures are more moderate.

FLOOD HISTORY

Mississippi River

Flood of 1965. The April 1965 flood is the flood of record for the 500-mile reach of the Mississippi River between Royalton, Minnesota, one hundred miles upstream of Minneapolis, to just below Clinton, Iowa. The flood was caused by an early fall freeze that resulted in an unusually deep frost penetration prior to the snow cover and a February thaw with rain in southern Minnesota and northern Iowa under conditions of nearly impermeable surface ground conditions. A third contributing factor was the March snowfall (300 percent above normal) in east-central Minnesota, together with a late period of cold weather in March and early April that prevented the gradual runoff of the snow-pack.

Flood of 1973. Periods of snow and severe cold temperatures occurring during December 1972 and early January 1973 alternated with short periods of warmer weather accompanied by rainfall. Unseasonably warm weather during the second half of January and all of February caused considerable surface thawing and melting of snow cover. Flooding was generally caused by torrential rains falling on saturated soil and rivers with extremely high base stream flows. Flooding on the Mississippi River consisted of three district crests. In each case, the crests of the tributary stream rises coincided with the crest of the Mississippi River as it progressed downstream. This synchronization of tributary inflow augmented the main-stem flows sufficiently to cause the second crest to surpass all previous stages below Burlington, Iowa. The peak flow was 414,000 c.f.s. on April 25. In 1973, the crests at Hannibal, Missouri (28.59 feet) and Quincy, Illinois (28.90 feet) was four feet higher than 1965. The flood displaced 10,000 people and inundated 180,000 acres. The river was above flood stage at Hannibal for 106 days.

Flood of 1993. The Great Flood of 1993 was unique in its areal extent as well as its duration. Excessive precipitation during April through July 1993 produced severe or record flooding in a nine-state area in the upper Mississippi River basin. Every gaging station along the main stem of the Mississippi River below Lock and Dam No. 15 to Thebes, Illinois experienced a new flood of record. Above Lock and Dam 15, the 1993 flood was surpassed by only one other event (1965). Although, typically, floods occur in the spring, this flood occurred throughout the summer along the Mississippi River. Flooding and water levels above the flood stage continued from April through September in many regions along the Mississippi River. Record flow in excess of 500,000 c.f.s. was estimated for the Hannibal, Missouri record stage of 31.8 feet. In Hannibal, Missouri the Mississippi River remained above flood stage (16.0 feet) for more than six months.

-

MISSISSIPPI RIVER
HYDROLOGIC ANALYSIS

HYDROLOGIC STUDY ASSUMPTIONS

1. Period of Record - The period 1898-1998 was chosen because land use was relatively consistent, the period of record flows can be adequately adjusted for the effects of channelization by using hydraulic models, and this period of record is long enough to provide useful estimates of flood frequency.

2. Climate Change - The climate for the period of record, 1898-1998, is assumed to be stationary; i.e., not significantly changing. The analysis by the Corps of Engineers' Institute for Water Resources (IWR) showed possible trends for some stations but no clear climate change trend for this period. The Institute of Water Resources' recommendation was to assume that the period of record was stationary given the difficulty in distinguishing a climatic trend from overall climatic variability. Consequently, standard flood frequency statistical analysis is used to capture the overall variability in the flood record.

3. Unregulated Flow Frequency - The log-Pearson Type III analytical frequency distribution will be used for the unregulated (without dams) flow-frequency analysis. The Rock Island District has three flood control reservoirs within its District. The Coralville Reservoir went into operation on the Iowa River in 1958. The Red Rock and Saylorville Reservoirs went into operation on the Des Moines River in 1969 and 1977, respectively. The unregulated (without dams) flow- frequency analysis is developed without these flood control reservoirs in-place. Log Pearson Type III is the recommended method for flood flow frequency analysis used by all Federal agencies. Several new analytical distributions and parameter estimation methods were evaluated using the period of record. Significant differences between the application of the log-Pearson and other distributions were not found and hence it was decided to continue to use this standard distribution. The Technical Advisory Group recommended estimating the mean and standard deviation of the peak annual flow distribution from the gage record and interpolating these values with drainage area for locations on the main stem river between the gages. The regional skew is obtained by taking a best average estimate from gages situated in similar hydrologic and meteorologic conditions.

4. Regulated Flow Frequency - The regulated flow (with dams) frequency curve will be determined using a regulated vs. unregulated flow relationship (determined from UNET river-hydraulic flood routings or reservoir simulation models) and the unregulated frequency curve.

5. Regulated Stage Frequency - Risk and uncertainty will be evaluated in the frequency analysis per current Corps requirements.

METHODOLOGY

The primary objective of the hydrology analysis was to establish the discharge frequency relationships for the Mississippi River. The overall approach to accomplish this task was as follows:

1) Evaluate gage data
2) Perform period-of-record/reservoir model simulation to obtain unregulated flows where needed
3) Compute unregulated flow frequency curves at gage locations using a regional shape estimation method. In this methodology the flow frequency curve is computed using the Bulletin 17B (IACWD, 1982) log-Pearson III distribution from the at-site mean and standard deviation, and a regional skew coefficient.

-

4) Compute unregulated flow frequency curves at river cross sections between gages from the mean and standard deviation obtained by interpolation with drainage area between the values obtained at study area stream gages and from the regional skew
5) Develop regulated versus unregulated flow relationship (extend period-of-record as needed)
6) Develop regulated flow frequency curves

UNREGULATED FLOW

Stream Flow Records

USGS mean daily stream flow gage records were used for unregulated gage locations. Flow rating relationships for (non-USGS) gages at Dubuque, Iowa and Hannibal, Missouri were examined. This involved a comparison of discharges published by the USGS and discharges recorded by the Corps of Engineers. At gage locations where stream flow was altered by regulation the unregulated flows were reconstructed for that portion of the stream flow record. For the two locations impacted by regulation (Keokuk, Iowa and Hannibal, Missouri) the Rock Island District reservoir simulation-routing model was used to compute a homogenous unregulated period of record based on the current plan of reservoir operation.

Hydrologic Model Description

Watershed models were developed for the main tributaries of the Mississippi River to verify: (1) reservoir flow routing with the Rock Island District reservoir simulation model data; and (2) tributary inflow routing with the period-of-record model data. The watershed models were developed using the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS). HEC-HMS is part of the 'new-generation' of software being developed by HEC. HMS models were built for ten Illinois River tributary rivers and fifteen Mississippi River tributary rivers (see plate C-M-3). The building of the HMS models included the following tasks: GIS watershed delineation, precipitation and flow data retrieval, routing reach definition, and calibration event and parameter selection. The design of the HMS watershed models included features that would make these models compatible with the MODCLARK technique to estimate runoff with NEXRAD precipitation data. Sub-basins were delineated corresponding to the location of the Corps and USGS stream gaging stations. The HMS models each contain from one to thirty-one sub-basins.

Input Data Development. The GIS watershed delineation was accomplished using USGS 90 meter digital elevation model ARCINFO grid coverage and a series of arc macros (GRIDPARM) developed by HEC. GRIDPARM was used to develop basin work maps and arc macros were developed by the Rock Island District to develop Thiessen polygons for weighting of precipitation gages. Sub-basin drainage areas were based on Corps of Engineers (COE) and USGS published values.

The design of the HMS watershed models included features that would make these models compatible with the MODCLARK technique to estimate runoff using NEXRAD rainfall data. Hourly flow data (COE/USGS) and a combination of hourly and daily precipitation data (COE/NWS) were used for model calibration. COE flow data was used where available, otherwise USGS flow data was used. The period of record considered for this effort was limited to 1985-1997, due to the availability of hourly flow data. USGS hourly data prior to 1985 would have required data entry by the USGS from archived strip charts (requiring additional time and funding). Often large rainfall event data (1993) was not available—rainfall gages stopped recording, data was missing, or data was inaccurate.

-

Model Calibration/Verification. The selection of calibration events included: (a) examination of USGS/COE hourly flow records for isolated large flow events and (b) examination of hourly rainfall data to verify that the large flow event was caused by an isolated rainfall event. The calibration of the models for infrequent events (1 and .5 percent chance exceedance) was not possible due to the lack of large events with which to calibrate the models—most readily available data was for more frequent events (50 and 20 percent chance exceedance). Missing precipitation and flow data as well as conflicting flow data from several data sources (COE/USGS) hampered model calibration.

The HMS hydrologic elements include: losses, runoff transformation, and routing. The methods used for calculating losses were the SCS curve number and initial and constant loss. The SCS curve number losses are compatible with the MODCLARK techniques, however, were found to be inadequate during parameter optimization of long duration events. Transformations of precipitation excess to direct runoff were achieved using the Clark unit hydrograph method. Because cross-section data was not readily available, the Muskingum routing method was used in all of the HMS models. Differences in computed unit hydrograph parameters between events are the result of temporal and spatial variability of rainfall across the basin, gage recording errors (both flow and precipitation), and the interaction between local runoff and flows routed from an upstream watershed.

Routing parameters were estimated through a combination of modeling in HMS and through examination of historical flow records and observed flood travel times between gages. The travel time between gages varies with the magnitude of the event and the mode of flow (i.e., in or out of bank). The routing methods selected for the HMS models (Muskingum / Lag) are not appropriate for computing the attenuation typical of over-bank flow routing. Modified-Puls and/or Muskingum-Cunge routing methods will improve the model results when cross-sectional data becomes available for these basins and is incorporated into the models. Except for the large flood control reservoirs on the Des Moines and Iowa Rivers, water control structures were not included in the HMS models. Detailed routing computations for these water control structures (usually not of significant consequence for large/extreme run-off events) were beyond the scope of this study.

Approximately 85 percent of the Rock Island District's Mississippi River watershed was modeled using HEC-HMS. The Mississippi River tributary HEC-HMS models covering 50,000 square miles of drainage area (Des Moines-Raccoon Rivers, Fabius River, Fox River, Iowa-Cedar Rivers, North River, Rock River, Skunk River and Wyaconda River) are described and discussed in detail in a separate report available at the Rock Island District Headquarters office (USACE).

Rock Island District Reservoir Simulation-Routing Models

The Rock Island District's reservoir simulation computer model for Coralville Reservoir (CORSIM) was used to compute the unregulated and regulated period of record daily flow data base for three stream gage locations on the Iowa River (Iowa City, Lone Tree, and Wapello). The data base period of record is 1904 to present. The unregulated database consists of the actual flow record from 1904 to 1959 (Coralville began operation in October 1958) and the calculated unregulated after 1958. The unregulated flow was calculated by routing daily holdouts from the reservoir down stream and adding them to the actual regulated flow. The program routes holdouts using Tatum routing coefficients developed by the Rock Island District for the Iowa River basin. Tatum routing is a coefficient based hydrologic routing technique that attenuates flood waves as the waves propagate downstream. The Rock Island Districts' Coralville reservoir simulation computer model computes regulated flow by using the regulation plan to simulate the period of record flow

-

data sequentially on a daily basis.

The Rock Island District's tandem reservoir system computer simulation model for the dual operation of Saylorville and Red Rock reservoirs (SAYRED) was used to compute the unregulated and regulated period of record daily flow data base for five stream gage locations on the Des Moines River (Saylorville Reservoir, SE 6th Street (old SE 14th Street), Red Rock Reservoir (Tracy), Ottumwa, and Keosauqua). The data base period of record is 1917 to present. The unregulated database consists of the actual flow record from 1917 to when the reservoirs went into operation (Red Rock 1969, Saylorville 1977) and the calculated unregulated flow after the reservoirs were placed in operation. The unregulated flow was calculated by routing the holdouts from the reservoirs downstream and adding them to the actual flow record. The program routes holdouts using Tatum routing coefficients developed for the Rock Island District for the Des Moines River basin. Tatum routing is a coefficient based hydrologic routing technique that attenuates flood waves as the waves propagate downstream. The Rock Island District's tandem reservoir system computer simulation model for the dual operation of Saylorville and Red Rock reservoirs computes regulated flow by using the regulation plan of both reservoirs including the balancing of flood control storage between them. The program routes the period of record unregulated flow through the reservoirs and simulates how the reservoirs would be operated while following the regulation plan. Pool elevation and downstream flows are determined by calculating holdouts and routing them downstream.

FREQUENCY ANALYSIS

UNREGULATED FLOW FREQUENCY ANALYSIS

The Corps districts, HEC, Technical and Interagency Advisory Groups selected regional shape estimation methodology from among available statistical methods for estimating the annual peak flood distributions (Hydrologic Engineering Center, 1999 and 2000, and Appendix A of the main report). Regional shape estimation employs the log-Pearson III distribution estimated from the method of moments as recommended in the federal guideline (Bulletin 17B, IACWD, 1982). However, this estimation method differs from the guideline method in that a regional skew is used instead of a weighted skew. The regional skew is taken as the average skew for stations within a homogenous flood region. The flow frequency estimates were developed using maximum daily discharges. A comparison of the 1% Chance Exceedance flow frequency estimates obtained in this and past studies is shown at selected locations in Table C-M-1.

Historic information or systematic records prior to 1898 were not used in estimating flood frequency distributions because the changes in land use and channel characteristics prior to this date made this data either not relevant to present day conditions; or, the information available made the flood estimates unreliable. The Mississippi River levee systems reflecting land use since 1898 is shown on Plate C-M-4. Methodology for the analysis was based on recommendations from the Technical and Interagency Advisory Groups (TAG and IAG). The TAG methodology recommendations are discussed in detail in the Main Report and Appendix A of this study documentation (see also HEC 1999 and 2000).

-

Table C-M-1
Mississippi River Flow Frequency
One Percent Chance Exceedance

River Mile	Gage Location	Drainage Area (sq.mi.)	Published 1979 (1% chance exceed) CFS	Flow Frequency 2003 Study (1% chance exceed) CFS	At-site Mean	At-site Standard Deviation	Regional Skew	Record (CY) (years)
583.0	L/D11	81,600						
	Dubuque 1979 adopted statistics		*281,000*		*5.09*	*0.1600*	*-0.2*	
579.9	**Dubuque(unregulated) Adopted ***	**82,100**		**274,000**	**5.100**	**0.1499**	**-0.1**	**101**
556.7	L/D12	82,400						
522.5	L/D13	85,500						
	Clinton 1979 adopted statistics		*295,000*		*5.11*	*0.1586*	*-0.2*	
511.8	**Clinton (unregulated) Adopted ***	**85,600**		**283,000**	**5.114**	**0.1499**	**-0.1**	**101**
493.3	L/D14	88,400						
482.9	L/D15	88,500						
479.1	Rock River @ mouth 10,915 sqmi							
457.2	L/D16	99,400						
437.0	L/D17	99,600						
433.4	Iowa River @ mouth 12,640 sqmi							
410.5	L/D18	113,600						
396.0	Skunk River @ mouth 4,355 sqmi							
364.2	L/D19	119,000						
	Keokuk 1979 adopted statistics		*351,000*		*5.248*	*0.1515*	*-0.2*	
364.2	**Keokuk (regulated) Adopted**	**119,000**		**366,000**				
361.3	Des Moines River@ mouth 14,800 sqmi							
343.2	L/D20	134,300						
324.9	L/D21	135,000						
	Hannibal 1979 adopted statistics		*374,000*		*5.304*	*0.1498*	*-0.2*	
309.0	**Hannibal (regulated) Adopted**	**137,200**		**440,000**				
301	L/D22	137,500						
Notes	(**CY**) Calendar Year							
Notes	* Average standard deviation							

-

Mississippi River Flow Records

Dubuque, Iowa. The Dubuque, Iowa USACE gage is located at Mississippi River mile 579.9. The drainage area at this gage site is 82,100 square miles. Dubuque gage is maintained by the USACE and has a long daily stage record. The rating curve (circa 1973) has been verified. Using this rating the flows were computed from the historic gage record 1940 to present. Previous to 1940 the navigation dams did not exist so the low flow portions of the 1973-rating curve were not valid. This lower flow portion of the rating curve was estimated from the Dam 11 tail-water rating. The calendar year annual peak mean daily period of record and flow frequency analysis for the Dubuque gage is shown on Plate C-M-5. The flow at this location is unregulated by water control structures. Plates C-M-5 and C-M-6 show a small decrease in the 1% event between Dubuque and Clinton despite the application of regional shape estimation. This irregular variation for gages relatively close together in drainage area can be due to various factors such as flow measurement and statistical sampling errors. In these cases, a reasonable approach is to estimate an index distribution for the reach; or equivalently, a frequency curve scaled by the annual mean peak discharge. This can be accomplished by using the average of the Dubuque and Clinton gage standard deviations. The resulting 1% discharges, shown in Table C-M-1, result in less than a 2% difference in the frequency curves (see Plates C-M-5 and C-M-6) while resulting in a regularly varying estimates of quantiles between Dubuque and Clinton.

Clinton, Iowa. The Clinton, Iowa USGS gage (05420500) is located at Mississippi River mile 511.8. The drainage area at this gage site is 85,600 square miles. The calendar year annual peak mean daily period of record and flow frequency analysis for the Clinton gage is shown on Plate C-M-6. The flow at this location unregulated by water control structures. Plates C-M-5 and C-M-6 show a small decrease in the 1% event between Dubuque and Clinton despite the application of regional shape estimation. This irregular variation for gages relatively close together in drainage area can be due to various factors such as flow measurement and statistical sampling errors. In these cases, a reasonable approach is to estimate an index distribution for the reach; or equivalently, a frequency curve scaled by the annual mean peak discharge. This can be accomplished by using the average of the Dubuque and Clinton gage standard deviations. The resulting 1% discharges, shown in Table C-M-1, result in less than a 2% difference in the frequency curves (see Plates C-M-5 and C-M-6) while resulting in a regularly varying estimates of quantiles between Dubuque and Clinton.

Keokuk, Iowa. The Keokuk, Iowa USGS gage (05474500) is located at Mississippi River mile 364.2. The drainage area at this gage site is 119,000 square miles. The gage is downstream from Coralville reservoir. The Coralville Lake Project is located on the Iowa River upstream from Iowa City and began operation in October 1958. The dam controls runoff from 3,115 square miles. The unregulated flow record was developed for Keokuk by routing the holdouts from Coralville downstream to Keokuk and adding the routed flow to the Keokuk daily flow for the period of Coralville operation (1958-present). The unregulated calendar year annual peak mean daily flow period of record and flow frequency analysis for the Keokuk gage is shown on Plate C-M-7.

Hannibal, Missouri. The Hannibal, Missouri USACE stage gage is located at Mississippi River mile 309.0. The drainage area at this gage site is 137,200 square miles. The unregulated calendar year annual peak mean daily flow period of record and flow frequency analysis for Hannibal is shown on Plate C-M-8. The unregulated flow values at this gage site were developed using Rock Island District reservoir simulation-routing model. The model simulates the period of record without the Coralville Lake Project, the Lake Red Rock Project, and the Saylorville Lake Project. The Lake Red Rock Project is located on the Des Moines

-

River approximately 60 miles downstream of the City of Des Moines and the drainage area at the dam site is 12,323 square miles. The Lake Red Rock Project began operation in 1969. The Saylorville Lake Project is located on the Des Moines River approximately 11 miles upstream of the City of Des Moines and the drainage area at the dam site is 5,823 square miles. The Saylorville Project began operation in April 1977. To obtain consistent estimates of flow statistics and quantiles for gages that are located relatively close together, such as Hannibal and Louisiana, Missouri the average standard deviation of the two gages was used for both gages with the regional skew and their at-site mean. It was felt that this approach satisfies the spirit of the TAG recommendation since the at-site mean is still used. The application was made because the regional shape estimation procedure resulted in a decrease in the 0.5% and 0.2% chance exceedance floods with increase in drainage area from Hannibal to Louisiana.

REGIONALIZED FLOW FREQUENCY STATISTICS

The regional skew is taken as the average skew for stations within a homogenous flood region. An investigation of the variation of skew for the study drainage areas was performed (see HEC, 2000) to determine the appropriate regions. Based on this investigation, the TAG and IAG recommended, and the Corps adopted, average skew estimates for reaches of Mississippi River mainstem affected by similar climate and with similar flood response characteristics. This average skew value is used with the at-site estimates of the mean and standard deviation of the flow logarithms to estimate the log-Pearson III distribution.

UNREGULATED FLOW FREQUENCY ANALYSIS

The unregulated flow frequency curves computed using the regional shape estimation method at selected gages are shown in Plates C-M-9 and C-M-10. The adopted flow frequency values are shown Table C-M-2. Table C-M-3 compares these estimates with those obtained from previous studies. Flow frequency estimates between these gages are obtained by combining interpolated values of the mean and standard deviation of the log-flows with drainage area between gages and the regional skew coefficient.

UNREGULATED-REGULATED RELATIONSHIPS

Unregulated and regulated flow relationships at Keokuk and Hannibal were determined using the Mississippi River period-of-record UNET models and verified with the district reservoir simulation models. The unregulated-regulated flow relationship for Keokuk is shown on Plate C-M-11 and the unregulated-regulated flow relationship for Hannibal is shown on Plate C-M-12. The unregulated-regulated relationships were extended beyond the period-of-record.

REGULATED FLOW FREQUENCY ANALYSIS

The regulated frequency curves were estimated by converting the unregulated flow frequency curves to regulated flow frequency curves using unregulated versus regulated flow frequency relationships as recommended by Corps guidance (USACE, 1993). These relationships were obtained by relating the peak annual flow values obtained from reservoir simulation routing studies of the period of record for unregulated conditions and reservoir regulated conditions. These frequency curves were coordinated with the adjacent/boundary districts. The adopted unregulated and regulated flow frequency values are shown in Table C-M-2. The frequency curves for the regulated USGS and USACE gage locations at Keokuk and Hannibal on the Mississippi River are shown on Plates C-M-13 and C-M-14. Table C-M-3 compares these estimates with

those obtained from previous studies. The U.S. Army Engineer District, Rock Island, Corps of Engineers, 1979, Upper Mississippi River Basin Commission, Upper Mississippi River Water Surface Profiles, River Mile 0.0 to 847.7 used expected probability adjustment values.

TABLE C-M-2
Mississippi River
Adopted 2003 Unregulated VS. Adopted 2003 Regulated
DISCHARGES AT SELECTED STREAM GAGES

FREQUENCY	**Dubuque Gage**	**Clinton Gage**	**Keokuk Gage**		**Hannibal Gage**	
	Unregulated	Unregulated	Unregulated	Regulated	Unregulated	Regulated
	Flow (CFS)	Flow (CFS)	Flow (CFS)	Flow (CFS)	Flow (CFS)	Flow (CFS)
2-YEAR	127,000	131,000	178,000	178,000	212,000	209,000
5-YEAR	169,000	174,000	234,000	228,000	284,000	259,000
10-YEAR	195,000	202,000	269,000	262,000	329,000	304,000
25-YEAR	230,000	235,000	310,000	298,000	390,000	352,000
50-YEAR	251,000	259,000	341,000	331,000	424,000	397,000
100-YEAR	274,000	283,000	370,000	366,000	464,000	440,000
200-YEAR	297,000	306,000	399,000	394,000	502,000	484,000
500-YEAR	326,000	337,000	437,000	429,000	553,000	536,000

TABLE C-M-3
Mississippi River
Published 1979 Study* and Adopted 2003 Study
DISCHARGES AT SELECTED STREAM GAGES

FREQUENCY	**Clinton Gage**		**Keokuk Gage (Regulated)**		**Hannibal Gage (Regulated)**	
	1979 Study	2003 Study	1979 Study	2003 Study	1979 Study	2003 Study
	Flow (CFS)	Adopted	Flow (CFS)	Adopted	Flow (CFS)	Adopted
	(w/ expected probability)	Flow (CFS)	(w/ expected probability)	Flow (CFS)	(w/ expected probability)	Flow (CFS)
Mean	**5.113**	**5.114**	**5.248**	**5.2488**	**5.304**	**5.3248**
Stand Dev	**.1586**	**.1499**	**.1515**	**.1419**	**.1498**	**.1515**
Skew	**-.2**	**-.1**	**-.2**	**-.1**	**-.2**	**-.1**
2-YEAR	130,000	131,000	170,000	178,000	195,000	209,000
5-YEAR	177,000	174,000	218,000	228,000	245,000	259,000
10-YEAR	205,000	202,000	247,000	262,000	277,000	304,000
50-YEAR	271,000	259,000	320,000	331,000	348,000	397,000
100-YEAR	295,000	283,000	351,000	366,000	374,000	440,000
200-YEAR	321,000	306,000	377,000	394,000	404,000	484,000
500-YEAR	354,000	337,000	410,000	429,000	441,000	536,000

* U.S. Army Engineer District, Rock Island, Corps of Engineers, 1979, Upper Mississippi River Basin Commission, Upper Mississippi River Water Surface Profiles, River Mile 0.0 to 847.7
In cooperation with St. Paul District, North Central Division, and St. Louis District, November 1979.

-

MISSISSIPPI RIVER
HYDRAULIC ANALYSIS

STUDY AREA DESCRIPTON

Geographic Coverage

The Rock Island District hydraulic model was developed for the reach of the Mississippi River from near Guttenberg, Iowa at river mile 615 to Saverton, Missouri at river mile 301.2. (The Mississippi River UNET model schematic is shown on Plate C-M-15). The model contains an additional reach of the river from Saverton, MO to Grafton, IL at river mile 218. This portion of the model lies within the St. Louis District. The model also includes additional routing reaches for 18 tributaries within the Rock Island District.

Basin Description

The drainage area of the Mississippi River within the Rock Island District ranges from 79,200 square miles near Guttenberg to 137,500 square miles at Saverton. The average bed slope of the river along this reach is 0.5 feet per mile except in the vicinity of Rock Island, Illinois where prior to construction of the navigation locks and dams, the slope of the river was 1.5 feet per mile. Topography is generally characterized by high bluffs and rolling hills which descend to a wide, flat, floodplain adjacent to the river. Many small ungaged tributary streams as well as major rivers flow into the river along this reach.

Tributary System

Rock River. Headwaters of the Rock River originate in the lake region of Fond du Lac County in Southeastern Wisconsin. The general direction of flow is south-southwest to the confluence with the Mississippi River at river mile 479.1 below Rock Island, Illinois. The drainage area is 10,915 square miles at the mouth. The topography varies from flat and gently rolling farmland to steep uncultivated forest.

Iowa River. The Iowa River has a drainage area of 12,640 square miles, of which 7,870 square miles are contributed by its major tributary, the Cedar River. The average slope of the Iowa River is 1.9 feet per mile while the Cedar is slightly steeper with an average slope of 2.6 feet per mile. Both basins are long and narrow and roughly parallel one another with flow following a southeast path. The Cedar River joins the Iowa River 29.6 miles upstream from the confluence with the Mississippi River at Columbus Junction, Iowa. The Iowa River enters the Mississippi River at R.M. 433.4.

Skunk River. The Skunk River basin extends from the north central region of Iowa to the Mississippi River in the southeast. The drainage area is 4,355 square miles. Land use within the basin land is nearly all agricultural. The general shape of the basin is long and narrow with a length of 180 miles and an average width of 24 miles. The Skunk River splits into two main channels in Keokuk County forming the North Skunk and the South Skunk rivers. Below the junction, the river meanders through a narrow floodplain entering the Mississippi River at river mile 396.0 in Lee County.

Des Moines River. The Des Moines River basin extends across central Iowa to the southeastern part of the state. The watershed has an area of 14,470 square miles. The Des Moines River basin has an average width of 40 miles and extends 360 miles from its headwaters north of Slayton, Minn., to its confluence with the Mississippi River below Keokuk, Iowa at river mile 361.3.

-

Connections with Other Districts

The Rock Island District portion of the Mississippi River is located between the St. Paul and St. Louis Districts. The UNET model begins at Lock and Dam 10 Tailwater at Guttenberg, IA and continues downstream to Grafton, IL. The portion of the model from Lock and Dam 22 at Saverton, MO, the downstream limit of the Rock Island District, to Grafton is located in the St. Louis District. This additional river reach, developed as part of the St. Louis District UNET model, is necessary to prevent the influence of the downstream boundary on the Rock Island District portion of the model.

UNET APPLICATION

UNET Hydraulic Modeling Computer Program

UNET is the hydraulic analysis computer program selected and used for the Upper Mississippi River System Flow Frequency Study (FFS). UNET is a one-dimensional, unsteady open-channel flow computer model that can simulate flow in single reaches or complex networks of interconnected reaches. UNET also has the capability to simulate storage areas, which is used in this study to simulate the interaction of the river with levees. Storage areas are lake-like regions that can either divert water from, or provide water to, a channel. Primary development and application of UNET was accomplished by Dr. Robert L Barkau. The Hydrologic Engineering Center (HEC) maintains, distributes, and supports the standard version of UNET for Corps of Engineers' offices. The Hydraulic Technical Advisory Group for the Flow Frequency Study, Dr. Danny Fread and Mr. Tony Thomas, P.E., has reviewed the hydraulic modeling assumptions and has provided quality control reviews of hydraulic modeling results.

Previous Modeling

The Rock Island District developed a UNET hydraulic model for the Mississippi River in 1992 and has used the model for river forecasting and flood plain assessment modeling. This model was built using available sounding data for channel geometry (circa 1940-80's) and USGS 7-minute quadrangle mapping for overbank areas geometry.

UNET Model Development—Model Geometry

The geometry of the newly developed model consists of the Mississippi River and tributary cross sections, navigation dams, and the levees and levee systems. The geometric layout of the UNET computer model of the Mississippi River in the Rock Island District is illustrated by the schematic diagram on Plates C-M-15. The cross sections are grouped into routing reaches in the cross section file. The mainstem routing reaches extend between tributary inflow points, and each tributary is a routing reach. The levees are defined as storage cells in a separate file, commonly referred to as the "Include" file. The Include file, contains the properties for each levee, such as top of levee crown elevation, elevation-volume relationship, upstream and downstream locations where overtopping will occur, and linear routing coefficients.

River Geometry

The main-stem geometry consists primarily of a series of geospatial cross sections extending bluff to bluff across the river valley. The cross sections were extracted from a digital surface of the river valley created

from a combination of floodplain digital terrain models and digital hydrographic surveys. The floodplain digital terrain models were developed from 1998 aerial photography and photogrammetry. Mississippi River floodplain ("bluff-to-bluff") digital terrain model data was designed and compiled so that spot elevations on well-defined features would be within 0.67 feet (vertical) of the true position (as determined by a higher order method of measurement) 67% of the time. The 0.67 feet (vertical) is as per ASPRS Class I Standards as stated in the USACE EM 1110-1-1000, dated 31 March 1993. It is approximately 1/6th of a contour interval (4 foot contours). The level of detail in the elevation data was kept to the minimum for this purpose. Mass points and break-lines to depict roads, railroads and levees were specified.

The hydrographic surveys were assembled from navigation channel maintenance surveys, dam periodic inspection surveys, and environment management project surveys. All digital hydrographic surveys date from 1997 or later. The horizontal accuracy of the hydrographic survey data is the accuracy usually attributed to the US Coast Guards Differential GPS (DGPS). The published accuracy of this system is +/- 9 feet (horizontal). The vertical accuracy is published as being +/- 0.5 ft as per ASPRS Class III Standards as stated in the USACE EM1110-1-1000, dated 31 March 1993. Upper Midwest Environmental Sciences Center (UMESC 1997) "on-the-river-mile" bank-to-bank surveys (no metadata available) complemented the MVR surveys. Navigation Pools 13 and 21 have complete gridded bathymetry from UMESC (1997) of navigation channel and all side channels at 10-meter and 5-meter postings, respectively (no metadata available). For areas where no digital hydrographic surveys were available, such as in some side channels and chutes, depths were estimated from the most current printed surveys available. Approximately 680 cross sections were incorporated into the final Mississippi River UNET model, spaced roughly every half mile. Bridge structures were not added to the model, as it is assumed that that bridge decks are sufficiently high and bridge piers sufficiently small compared with channel area as to not significantly alter the computed Mississippi River water surface. Reach lengths between cross sections, bank stations, and effective flow limits were added to the geometry files.

Model development consisted of constructing HEC-RAS models for the individual navigation pools from the original cross sections, formatted specifically for RAS. Any necessary ineffective flow areas or obstructions not included in the original cross sections were added during this phase of development.

To form the UNET geometry of the main-stem, the individual HEC-RAS models were converted to UNET format using the HEC-developed application, RAS2UNET. Each of the converted RAS models was combined to create one continuous UNET geometry. The additional components required by UNET, such as navigation dams, levees and tributary reaches were added at this point.

Tributary Geometry

Cross section geometry is included in the UNET model for all tributaries that have USGS gaging stations. These gaging stations supply the inflow data needed to run the UNET model. Each tributary is modeled from its confluence with the Mississippi River upstream to the USGS gaging station location. Tributary gaging stations are located between 4 and 50 river miles upstream of the confluence with the Mississippi River. Tributary cross section data were taken either from preexisting HEC2 hydraulic models or developed from a combination of channel soundings taken at the USGS gage during flow measurements and USGS 7.5 minute series quadrangle topographic maps. The assembled cross section data for each tributary is suitable for flow routing only. Accurate stage computation on the tributaries is not possible with the coarse data employed in the development of the tributary cross sections.

-

Boundary Conditions

Boundary conditions are required at every location where water passes into or out of the model. The inflow and stage data (input data), which drive the computations of the UNET program, are accessed via the boundary condition file. The primary boundaries for the model are the upstream end of the Mississippi at Lock and Dam 10, the downstream end of the Mississippi at Grafton, and the most downstream USGS gage on each of the Mississippi River tributaries. At Lock and Dam 10, observed flow is used as the upstream boundary condition for all simulations. At Grafton, observed stage is used. For tributaries, observed flow is applied at the USGS gage for each, except for the Iowa and Des Moines Rivers, where the boundary condition may be observed flow, simulated reservoir-regulated flow or simulated unregulated flow, depending on simulation purpose. The input data is stored in Data Storage System files called "DSS" files. All observed stage and flow data for the period January 1, 1940 to September 30, 2000 have been assembled into DSS files for use in the FFS hydraulic modeling effort. Daily stages and flows are used in the UNET hydraulic analysis.

Levees

Levees protect much of the floodplain along the Mississippi River in the Rock Island District from high river stages. The river in the lower half of the district, from Muscatine, IA downstream, is almost entirely confined between levees. These levees were built for either agricultural, environmental management or community flood protection purposes.

The consensus of the Flood Insurance Rate Map Subtask Force (the Corps of Engineers, Federal Emergency Management Agency (FEMA), and the States of Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, and Wisconsin) was that the final flood profiles should be based on existing conditions. The UNET model utilizes existing line and grade of all levees. Levee failure is modeled to occur at the actual overtopping elevation of the levee at two selected points (one each near the upstream and downstream ends of the main-stem levee). Potential future modifications of any structure are not incorporated into the existing conditions profiles. In previous flow frequency studies of the Mississippi River, the levees were assumed to confine flood stages to an infinite level.

Levee Storage Areas

The model represents the areas protected by levees as storage areas with connections to the river channel. These storage areas are defined separately from the model cross sections. Each storage area is defined by an elevation versus volume relationship, a location and elevation for each connection to the river, and by inflow and outflow parameters associated with levee overtopping flow. The elevation versus volume relationship is calculated from the same digital survey of the floodplain used to generate model cross sections. Connections between the river and the storage area are located where the levee is likely to overtop first. Typically, there are two connection locations, one each near the upstream and downstream ends of the mainstem levee. The elevation of each connection is determined from the most recently verified survey available. For many levees, the 1998 Digital Terrain Models from aerial photography represent this survey, though other recent, ground survey have been provided by levee associations for this task.

-

All levees along the Mississippi were considered for this analysis. However, a few levees were not defined as storage areas in the model, either because the area protected was small and the levee was sufficiently high to hold out the 500-year event or because the levee crown was too low to assume that the storage area approach would accurately define the flow into and through the levee area for the full range of frequency flows. The Environmental Management levees at Spring Lake, Princeton, and Mark Twain Wildlife Refuges overtop well below the computed 100-year stage. These levees are not modeled as storage areas, but rather as part of the full cross section with ineffective flow limits to the crown of each levee.

The Mississippi River levee system is shown on Plates C-M-4. The Mississippi River levee overtopping elevations and storage areas are shown in Table C-M-4. This table was modified to reflect changes that were necessary from a public review period during this study. The crown elevations were verified with current as-built drawings and recent kinematic GPS levee profile surveys. Levee overtopping was assumed to occur at the top-of-levee elevation. Mississippi River levee crown DTM data was supplemented with USACE ground GPS levee survey for Indian Graves (1999) and Hunt-Lima (2000) levee and drainage districts (predicted accuracy ± 2 cm. [0.07 ft.] in the x, y, and z axis). Additional levee crown survey data was provided by Klingner and Associates for Henderson 1and 2 (1997), Fabius River (1999), and Sny Island (2001) levee and drainage districts.

Levee Exceedance

When the computed river stage exceeds the elevation of a levee at one or more levee connections the levee storage area begins to fill. If the levee is overtopped at only one connection location, the storage area only acts to store the water from the river. A levee storage area may convey flow if the levee is overtopped at two connections and the storage volume is sufficiently full that flow enters the storage area through one connection and simultaneously leaves the storage area through another. The computation of conveyance into and out of a storage area is a dynamic process that uses linear routing to simulate the flow through a levee breach, considering available storage area volume.

The levees have the ability within the UNET model to recover to initial conditions after a simulated levee overtopping. After a levee is overtopped, once the river stage had receded to a predefined level that is below the levee toe, the levee is repaired within the model to protect against the next high water event. Any residual water within the storage area after the levee has recovered is pumped back to the river.

-

Table C-M-4
Mississippi River
Levee Overtopping Elevations and Locations

Name/District	Location of Levee District Upstream River Mile	Location of Levee District Downstream River Mile	Bank	Approx. Area Protected (Acres)	Overtopping Levee Elevation Upstream / Location	Overtopping Levee Elevation Downstream / Location
Dubuque, IA LFPP	582.6	578.5	R	1100	622.6 @ RM 582.6	618.4 @ RM 578.6
Green Island Levee and Drainage District #1	548.5	545.9	R	4490	601.5 @ RM 548.1	599.9 @ RM 546.4
Fulton, IL LFPP	522.5	516.8	L	6800	601.9 @ RM 522.5	598.1 @ RM 517
Clinton, IA LFPP	520.6	513.7	R	1940	600.4 @ RM 520.6 (revised)	593.9 @ RM 513.9 (revised)
Meredosia	512.5	510.8	L	10410	591.5 @ RM 512	590.2 @ RM 511
East Moline, IL LFPP	490.4	488.4	L	920	580.8 @ RM 490	578.9 @ RM 488.6
Bettendorf, IA LFPP	487.8	485.4	R	470	580.4 @ RM 487.8 (revised)	574.6 @ RM 485.4
Rock Island, IL LFPP	482.7	480.1	L	650	571.7 @ RM 482.3	570.4 @ RM 480.1
Drury Drainage District	458.9	450.9	L	4170	561.5 @ RM 458.9	559 @ RM 451.5
Muscatine Island Levee District	454.9	441.7	R	26480	564.5 @ RM 454.7	558.6 @ RM 442
Louisa Co LD#13 (Lake Odessa)	441.1	434.8	R	6310*	554.9 @ RM 441	549.3 @ RM 435
Sub-Dist. #1 of Drainage Union #1 and Bay Island D&L District #1 Combined	451.0	434.1	L	22720	557.7 @ RM 451 (revised)	552.4 @ RM 434.4
Iowa River-Flint CR. L.D. #16 - Upper Unit (Louisa-Des Moines Co. D.D. #4)	433.7	422.2	R	17400	555.1 @ RM 433.4	546.4 @ RM 422.4 (revised)
Iowa River-Flint CR. L.D. #16 - Middle Unit (Des Moines Co. D.D. #7)	422.1	410.5	R	22500	545 @ RM 422.1	540.2 @ RM 410.6
Iowa River-Flint CR. L.D. #16 - Lower Unit (Des Moines Co. D.D. #8)	410.4	406.4 (revised)	R	2910	541.1 @ RM 410.2	539.1 @ RM 406.4 (revised)
Henderson County DD #3	414.6	411.6	L	2100	537.6 @ RM 414.9 (revised)	539.4 @ RM 412
Henderson County DD #1	411.4	403.2	L	6160	541 @ RM 411.4	536.8 RM 403.2
Henderson County DD #2	403.2	401.1	L	6970	536.2 @ RM 403.15	535.3 @ 401.5

* Protected area calculated using Geographic Information System (GIS)

Local Flood Protection Project (LFPP)

Note: (revised) indicates revised elevation data provided from public review (licensed land surveyor or professional engineer)

-

Table C-M-4 (continued)
Mississippi River
Levee Overtopping Elevations and Locations

Name/District	Location of Levee District Upstream River Mile	Location of Levee District Downstream River Mile	Bank	Approx. Area Protected (Acres)	Overtopping Levee Elevation Upstream / Location	Overtopping Levee Elevation Downstream / Location
Green Bay L&D District #2	395.8	386.6	R	13340	533.0 @ RM 395 (revised)	530.3 @ RM 386.9 (revised)
Des Moines & Mississippi LD #1	359.7	358.0	R	10990	503.4 @ RM 359.5	503.1 @ RM 358.4
Mississippi /Fox Drainage District - Upper Unit	358.2	357.5	R	2370*	500.3 @ RM 358	
Mississippi /Fox Drainage District - Lower Unit	357.0	354.3	R	4230*	499.2 @ RM 357.4	497.6 @ 355
Hunt & Lima Drainage Districts Combined	358.5	341.7	L	21290	501.8 @ RM 358.4	494.5 @ RM 344.9
Gregory Drainage District	354.4	347.8	R	8000	500.8 @ RM 354.4 (revised)	495.5 @ RM 348.1 (revised)
Indian Grave Upper District	341.7	335.7	L	12680	494.4 @ RM 341.5	492.7 @ RM 336 (revised)
Indian Grave Lower District	335.7	330.0	L	6960	492.7 @ RM 335.7 (revised)	488.8 @ RM 330 (revised)
Union Township Drainage District	335.3	331.5	R	4240	492.4 @ RM 334.6	490 @ RM 332
Fabius River Drainage District	331.5	323.5	R	14260	491 @ RM 331.5 (revised)	488 @ RM 324 (revised)
South Quincy D&L District	325.4	318.0	L	5520	492.8 @ RM 325.4	486.8 @ RM 318
Marion Co. Drainage District	323.5	321.2	R	4000	487.4 @ RM 323.4	484.2 @ RM 321.4
American Cyanamid Levee			R	within S. River	492 @ RM 320	490.5 @ RM 319
South River Drainage District	320.5	312.1	R	10300	484.4 @ RM 318.6	480.8 @ RM 312.7
Sny Island Reach I	315.7	296.9	L	44200	481.8 @ RM 314.6	474.3 @ RM 300.6
Sny Island Reach II	296.7	289.7	L	17280*	471.2 @ RM 294.3	469.4 @ RM 290.6
Sny Island Reach III	289.5	273.0	L	43100*	468.5 @ RM 288.9	461.8 @ RM 275.6
Sny Island Reach IV	272.8	266.1	L	8300	459.4 @ RM 270.5	458 @ RM 267

* Protected area calculated using Geographic Information System (GIS)

Local Flood Protection Project (LFPP)

Note: (revised) indicates revised elevation data provided from public review (licensed land surveyor or professional engineer)

-

Control Structures

The navigation channel depth of the Mississippi River within the Rock Island District is maintained by a series of twelve dams. The sole function of these dams is to maintain the nine-foot channel depth at all locations. Beyond the small amount of storage necessary to maintain the navigation pool level, the dam simply passes all the river flow. These dams have no capability to store water for flood control purposes. As river flows increase, dam gate openings are increased, so as not to increase the pool level. When the flows are high enough that the gates are no longer necessary to maintain the regulatory pool level, the gates are completely removed from the water and the entire river flow passes beneath. Each of the dams reaches this open gate condition at a different flow rate.

Navigation dams within the UNET model are operated according to the structure's regulation rules. In the Rock Island District, that generally means that the regulatory pool is held fixed immediately upstream of the dam until the river's flow rate rises to the level at which the gates are no longer needed to maintain the pool. At that point the pool stage at the dam is controlled by the tailwater stage plus the computed swellhead at the dam. Swellhead is the headloss created by the contraction of flow through the dam's structure. The amount of swellhead is different at each structure and can vary by flow rate, but is typically less than one foot. The swellheads used within the model are either set at single-value or computed dynamically by the model. The swellheads for dams 14, 17 and 18 are model-computed. However, the remaining dams in the model use set swellheads, based on average recorded swellhead.

In addition to simulating navigation dam operations according to the regulation rules, the UNET model also allows the dams to be operated exactly as observed historically, by using the recorded pool stages as an internal boundary condition in the model. The recorded pool stages will fluctuate slightly, within allowable regulation limits, due to fluctuations in flow rate and changes in gate settings. The pool stage internal boundary condition is useful when attempting to finely calibrate the model to observed stages. However, for hypothetical simulations the dams must be operated according to rule. Pertinent information about the lock and dam locations and main stem gages along the study reaches is shown in Table C-M-5.

UNET Calibration

The UNET model calibration is a multi-step process designed to adjust the model to reproduce observed stage and flow records for the entire period of record. The period of record is the length of observed record for which sufficient inflow data is available for the model such that the estimation of missing inflow data is minimized. For the Mississippi River in the Rock Island District the period of record used in the model covers the dates from 1940-2000. The major constraint for the period of record used in the model was the length of flow records available for the major tributaries. A single geometry set is used to reproduce flows and stages for the entire period of record. The Mississippi River channel within the Rock Island District has not experienced changes in depth and/or alignment large enough to violate this assumption. In general, the UNET model is calibrated to within one-half foot of observed stage at each gage location for the period of record. High water mark surveys from the 1993 and 2001 floods verify the calibration of the computed stage profile is within 1 foot of the observed profile for both flood events.

-

Table C-M-5
Mississippi River
Pertinent River Gage and Tributary Information

TRIBUTARIES TO MISSISSIPPI RIVER		River Mile	Drainage Area	Ungaged	Drainage Area
			@ mouth	Drainage Area	@ Gage or L/D
STATE	TRIBUTARY & LOCATION		(sq. mi.)		(sq.mi.)
IA	**LOCK & DAM 10**	**615.0**			**79,370**
IA	TURKEY RIVER AT GARBER, IA	608.1			1,850
WI	GRANT RIVER AT BURTON, WI	593.2			270
WI	PLATTE RIVER NEAR ROCKVILLE, WI	588.2			140
IA	**LOCK & DAM 11**	**583.0**			**82,100**
IL	GALENA RIVER AT BUNCOMBE, WI	563.4			125
IA	**LOCK & DAM 12**	**556.7**			**82,400**
IA	MAQUOKETA R NR MAQUOKETA, IA	548.6	1,879		1,550
IL	APPLE RIVER NEAR HANOVER, IL	545.1			250
IL	PLUM RIVER BELOW CARROLL CK, IL	536.8			230
IL	**LOCK & DAM 13**	**522.5**			**85,500**
IA	WAPSIPINICON RIVER NR DE WITT, IA	506.8	2,563		2,330
IA	**LOCK & DAM 14**	**493.3**			**88,400**
IL	**LOCK & DAM 15**	**482.9**			**88,500**
IL	ROCK RIVER NEAR JOSLIN, IL	479.1	10,915		9,549
IA	**LOCK & DAM 16**	**457.2**			**99,400**
IA	**LOCK & DAM 17**	**437.0**			**99,600**
IA	IOWA RIVER AT WAPELLO, IA	433.4	12,640		12,500
IL	EDWARDS RIVER NR NEW BOSTON, IL	431.2			450
IL	POPE CREEK NEAR KEITHSBURG, IL	427.8			180
IL	**LOCK & DAM 18**	**410.5**			**113,600**
IL	HENDERSON CRK NR OQUAWKA, IL	409.9			430
IA	SKUNK RIVER AT AUGUSTA, IA	396.0	4,355		4300
IA	**LOCK & DAM 19**	**364.2**			**119,000**
IA	DES MOINES R AT KEOSAUQUA, IA	361.3	14,800		14,040
MO	FOX RIVER AT WAYLAND, MO	353.6			400
IL	**LOCK & DAM 20**	**343.2**			**134,300**
IL	BEAR CREEK NEAR MARCELLINE, IL	341.0			350
MO	WYACONDA R. ABOVE CANTON, MO	337.3			390
IL	**LOCK & DAM 21**	**324.9**			**135,000**
MO	N. FABIUS RIVER NR TAYLOR, MO	323.0			840
MO	S. FABIUS RIVER NR TAYLOR, MO	323.0			620
MO	NORTH RIVER AT PALMYRA, MO	321.1			370
MO	**LOCK & DAM 22**	**301.2**			**137,500**
Drainage Area w/in Rock Island District				~ 6,735	**58,130**

-

Calibration data

The following data sources are used to verify the UNET calibration accuracy.

- USGS flow measurements at Clinton and Keokuk, IA and Louisiana, MO
- USGS daily discharge records at Clinton and Keokuk, IA
- USACE flow measurements at Rock Island, IL, Quincy, IL, and Hannibal, MO
- USACE stage measurements at Rock Island, IL, Quincy, IL, and Hannibal, MO
- Observed daily stage records at 38 mainstem gages, collected by the Corps.
- High water mark surveys conducted by the Corps for the 1993 and 2001 flood events

Manning Roughness Values

The calibration of the UNET model is a multi-step process, beginning with the selection and adjustment of channel and overbank roughness values. Manning's n-value is the roughness parameter used to establish the initial conveyance properties for each cross section. The placement and verification of n-values is completed in the early development of the hydraulic model using HEC-RAS software. Channel n-values were derived from experience gained in previous hydraulic modeling efforts of the Mississippi River and range between 0.02 and 0.028. Overbank n-values were estimated using GIS spatial land cover data and guidance provided in the HEC-RAS hydraulic reference manual and range between 0.03 and 0.12. HEC-RAS N-values were adjusted using the development HEC-RAS model to reproduce the 1998 and 2001 annual stage and flow series.

Null Internal Boundary Condition for Lateral Inflows

The Null Internal Boundary Condition (NIBC) is a tool for estimating ungaged lateral inflow in a river system. Use of the NIBC is an important component of calibrating the model to both flow and stage. The NIBC technique estimates ungaged inflow to reproduce either a stage hydrograph or a flow hydrograph at the NIBC station. When stage reproduction is the priority, the reproduction of flow is secondary, being dependent on the calibration of the model. Likewise, when flow reproduction is the priority, the reproduction of stage is secondary, being dependent on the calibration of the model. In either case, the ungaged inflow compensates for all the errors in the measurement of stage and flow and for systematic changes in roughness and geometry that may not be included in the model. As a result, the ungaged inflow determined using the NIBC procedure includes both flow and an error correction term.

The NIBC feature is used by the Rock Island District to reproduce flow at the USGS gage locations at Clinton, IA and Keokuk, IA. It is also used to reproduce stages at Lock and Dam 24 Tailwater, since no USGS flow gages are available within the model reach downstream of Keokuk. For the routing reaches between Lock and Dam 10 and Clinton and between Clinton and Keokuk, the estimation of ungaged inflows is an iterative process using the flow records at Clinton and Keokuk as the accepted river flow. Model inflows are initially routed from the model boundaries to the USGS gages. The routed flow hydrograph is subtracted from the record flow hydrograph at the gage. The difference between the routed flow hydrograph and the recorded flow hydrograph is considered to be the best estimate of ungaged inflow. This estimated ungaged inflow hydrograph is then lagged back in time and applied uniformly to the upstream routing reach. The backward lag is adjusted by distance. The upper one-half of the reach has a lag of one day and the lower one-half of the reach has no lag. Both the observed and estimated ungaged

-

inflows are then routed again through the model to the USGS gages and, again, the difference is calculated between the routed and recorded flows. The difference between the routed and recorded flows should be less than without the estimated ungaged inflow. To further refine the flow calibration the NIBC process may be repeated a number of times.

For the reach between Keokuk and Lock & Dam 24 Tailwater, where no USGS gages exist, the stage record at Lock and Dam 24 Tailwater is used in place of a flow record. The NIBC process for routing stage is similar to that of routing flow, except that instead of comparing model-routed flow to recorded flow at the gage, the routed flow is compared with model-computed flow based on the observed stage record at the gage. Like the upstream reaches, the routed flow hydrograph is subtracted from the computed flow hydrograph at the gage to establish the best estimated of ungaged inflow. This ungaged inflow hydrograph is lagged back in time an applied uniformly to upstream routing reach. The stage at Lock and Dam 24 Tailwater represents the best data set for computing ungaged inflow for the reach. The gage has been confined between levees throughout the period of record. The closest USGS flow gage is at Grafton, IL, but cannot be used in this analysis as it is located downstream of the confluence of the Mississippi and Illinois Rivers and thus contains Illinois River flow. Flow measurements at Hannibal, MO taken near the peak of the 1993 flood show that the model flow reproduction is within 4% of measured flow.

Application of Automatic Calibration Conveyance Adjustment

Automatic Calibration Conveyance Adjustment provides a method to adjust the conveyance in a model reach using rating curves. At each stage gage location, the model-computed flow record is combined with the observed stage record for a given period of time. The result is a scatter of data through which a single rating curve can be estimated, also known in the model as a KR curve. These KR curves provide a good estimate of the stage versus flow relationship at each gage location, when no measured relationship may be available. The UNET model geometry processor applies a series of steady-flow backwater computations to reaches between gage locations in which the KR curves serve as the downstream boundary of each reach. From each backwater computation the computed stage is compared with the KR curve of the next upstream gage. Any conveyance adjustments necessary to make the computed stage match the upstream KR curve are applied uniformly to the geometric property tables of each cross section in that reach. In the Rock Island District, KR curves are computed and applied at each of the mainstem stage gage location, using the time period between 1990 and 2000. These curves match closely with the measured rating curves at the USGS gages.

Calibration Fine-Tuning for Flow/Stage Effects

Manning's n-values alone cannot fully describe the changes in conveyance caused by changes in discharge, water temperature, and other factors. The UNET program has three tools for fine-tuning the stage calibration of the model. These tools are applied within the boundary condition file and consist of different methods to adjust the discharge-stage-conveyance relationship at a cross section or series of cross sections within the model. The individual adjustments (factors) are applied as ratios of conveyance within the property tables of each cross section. A factor less than 1.0 reduces the cross section conveyance and increases the computed stage. Likewise, a factor greater than 1.0 increases the cross section conveyance and decreases the computed stage.

The Conveyance Change Factors adjust the conveyance at all cross-sections in a specified calibration reach for all stages and flows. A unique factor is available for the channel and another for the overbank. These

factors simulate a systematic change in roughness that is apparent for all stages over the entire length of the simulation. For the Mississippi River, these factors range between 1.0 and 1.05, but are typically 1.0.

The Discharge-Conveyance Change Factors adjust conveyance based on a series of discharge ranges at all cross-sections in a specified calibration reach. These factors provide a conveyance change for changes in roughness specific to certain flow ranges. The factors are manually defined and applied to a table of equal intervals flow ranges that represent the full range of observed flows. For the Mississippi River, these factors range between 0.9 and 1.05, but are typically 1.0.

The Seasonal Conveyance Change Factors change the overall conveyance multiplier with time, allowing the simulation of seasonal shifts in roughness. The seasonal adjustment, given by a time series of factors, is applied to all the cross-sections in a calibration reach at all stages. The factors simulate the variability of stage due to changes in viscosity caused by changes in water temperature. In the Rock Island District, these changes are generally observed in the stage record in the upstream half of the district between December and February. However, since the peak annual flood stage in the District almost exclusively occurs between March and October of each year, these seasonal conveyance factors have minimal impact on the computed frequency stages.

PERIOD OF RECORD ANALYSIS

Mississippi River Period of Record Simulation

The calibrated UNET model was used to perform a period of record analysis. The period of record analysis computes river stages that would occur, given the present river condition with existing levee heights, if the historical flow record was repeated. The period of record for the Mississippi River model in the Rock Island District is 1940 to 2000. The period of record is the length of observed record for which sufficient inflow data is available to the model such that the estimation of missing inflow data is minimized. The major constraint for the period of record used in the model was the length of flow records available for the major tributaries.

UNET period of record simulations are necessary for reservoir-regulated (regulated) conditions and without-reservoir (unregulated) conditions. The Rock Island District has three flood control reservoirs. The Coralville reservoir went into operation on the Iowa River in 1958. The Red Rock and Saylorville reservoirs went into operation on the Des Moines River in 1969 and 1977, respectively. The reservoir-regulated condition (regulated) simulates the tributary flows from the Iowa and Des Moines Rivers for the 61-year period of record as if the flood control dams on each river were in place for the entire period of record using the current operation plan. The unregulated condition simulates the inflow of the Iowa and Des Moines Rivers as if no flood control dams were ever built. The simulated inflows from each of these two tributaries for both regulated and unregulated conditions were computed using a separate reservoir simulation model.

-

STAGE DISCHARGE FREQUENCY RELATIONSHIP

Stage-Frequency UNET Results

The purpose of the hydraulic modeling is to produce the stage-flow and regulated-unregulated flow relationships necessary to generate regulated stage frequency. The methodology to produce regulated stage frequency is prescribed in Corps guidance and endorsed by the Hydrology Technical Advisory Group. In this method, the unregulated flow frequency relationship is combined with a stage-flow relationship and a regulated-unregulated flow relationship to create a regulated stage frequency relationship at each model cross section. The ANNUAL MAXIMUM (AMX) option in the UNET model generates annual maximum stage and flow data sets at each model cross section for any given period of record. These annual maximum data sets are used to produce the two relationships needed for the stage frequency development.

Cross Section Flow Frequency

To generate stage frequency at each cross section, unregulated flow frequency also must be calculated at each cross section. The hydrologic analysis performed by the Rock Island District determined the unregulated flow-frequency statistics for the Mississippi River mainstem gaging stations at Dubuque, Clinton, Keokuk and Hannibal. Since the district extends beyond Dubuque and Hannibal, Mississippi River Mile 631 and Louisiana statistics, developed by St. Paul and St. Louis Districts respectively, were also incorporated. Using software provide by HEC, a regulated flow-frequency relationship was determined at each cross section. The HEC program uses the unregulated gage statistics and the drainage area at each cross section to interpolate statistics at all locations with the exception of the reach between Mississippi River Mile 631 and Dubuque where flow frequency statistics developed from the UNET period-of-record simulation were used to interpolate flow-frequency relationships. Mississippi River Mile 631 statistics and methodology rationale can be found in Appendix B of the Upper Mississippi River System Flow Frequency Study Report.

Association of Stages with Flows

Combining the annual maximum stages and flows computed by the UNET model develops the stage-flow relationships necessary to produce regulated stage frequency. Development of the maximum flow versus maximum stage relationships assumes that the maximum annual flow event causes the maximum stage. The accuracy of the stage-flow relationship depends on the accuracy of the model in reproducing observed annual peak stages and flows and in predicting annual peak stages and flows for flood events beyond the historic record. To generate the stage-flow relationship, each of the stage and flow data sets for the original 61 years of record is combined with those of additional factored simulations. With this combined data set, the stage values and flow values are separately ranked in increasing order, then combined to form the initial relationship. The relationship is then smoothed using a spline-fitting procedure with a four-point bandwidth. Also, the smoothing procedure does not force the resulting curve to exactly match the highest point. The spline fitting produces a relationship curve composed of pieces of simple functions defined on subintervals and joined at their endpoints to produce the smoothed relationship curve. Spline-fit relationship curves for Dubuque, Clinton, Keokuk, Hannibal on the Mississippi River with United States Geological Survey or COE measurements are shown in Plates C-M-16, C-M-17, C-M-18, and C-M-19, respectively. For the computation of stage-flow relationships, the regulated condition simulations were used.

-

Association of Regulated Flows with Unregulated Flows

The regulated-unregulated flow relationship is developed from the same UNET-computed annual maximum data used to create the stage-flow relationship. However, this relationship uses the annual maximum flows computed by the regulated and unregulated UNET simulations. The annual maximum flow data for the 61 years period of record are combined with those of additional factored simulations. Both the regulated and unregulated UNET simulations are separately ranked and then combined to form the initial relationship at each cross section. Like the stage-flow relationship, the regulated-unregulated flow relationship is then smoothed using a spline procedure with a four-point bandwidth. Again, the smoothing procedure does not force the resulting curve to exactly match the highest point.

Extension of Stage-Flow and Regulated-Unregulated Flow Relationships

The stage-flow and regulated-unregulated flow relationships are extended beyond the flow range experienced in the historic period of record. This extension is necessary upstream of the Des Moines River confluence as no flood in the historic record achieved 500-yr. flows on the Mississippi River. Therefore, using the observed record alone will not be sufficient. The regulated-unregulated relationship below the Des Moines River confluence did not require extension because observed flows already exceeded the 500-yr. level. The stage-flow relationship is extended in all areas. The stage-flow and regulated-unregulated flow relationships were extended by adding 6 additional UNET-simulated events to the observed 61 years of record. The additional events were created by multiplying the inflows of three high water events by the two factors of 1.2 and 1.4. The event years chosen were 1965, 1973, and 1993. These three events were generally high throughout the length of the district, though to a different degree in any given location. Extending the entire 61-years of inflow was considered, but discounted as it modified the regulated-unregulated flow relationship in a flow range for which the additional events were unnecessary. The additional events extend each relationship without significantly modifying the existing relationship in the flow range that was based solely on observed record. The 2001 flood event would have been another ideal event to use. Unfortunately, not enough verified inflow data was available at the time of the model simulations. The annual maximum stage and flow data from each of the six simulated events is combined with the annual maximum data for the original period of record before generating the stage-flow and regulated-unregulated flow relationships. For the factored regulated inflows from the Iowa and Des Moines Rivers, a separate reservoir simulation was conducted for each multiplying factor. For the factored unregulated inflows, the original estimation of unregulated flows was simply multiplied by the factor.

Backwater-Influenced Locations

In river reaches immediately upstream of tributaries, the backwater effect from the confluence causes increased variability in the stage-flow relationship. Stage upstream of a confluence is not simply a function of flow, but also a function of the stage immediately downstream of the confluence. Typically, a family of rating curves is developed to determine the stage in a backwater-influenced area. The stage frequency software used in this study develops a single stage-flow relationship at each location by best fitting a curve through the combination of ranked stage versus ranked flow data. Since the resulting stage-flow relationship does not represent all the possible stages which could occur for a given frequency flow, discontinuities in the computed stage frequency profiles may occur across the confluence. The discontinuities are simply smoothed out in the final profiles, using the same distance-weighted average smoothing technique applied everywhere along the river. Other methods developed to estimate the appropriate frequency profile through backwater areas did not provide reasonable results for the district.

-

Water Surface Profile

Maximum discharge and maximum stage relationships were computed for the 2, 5, 10, 25, 50, 100, 200 and 500-year flood events. These flow frequency study water surface profiles are shown on Plates C-M-20 through C-M-26 . The plotted profiles of previously published 500-year profile (1979) versus the 2003 study 500-year (.2%) profile are shown on Plates C-M-27 through C-M-38. The plotted profiles of previously published 100-year profile (1979) versus the 2003 study 100-year (1%) profile are shown on Plates C-M-39 through C-M-50. The plotted profiles have been smoothed using a distance-weighted averaging technique. The method averages the stage frequency value at each location with the distance–weighted average of the two values immediately upstream and the two immediately downstream. Stage values immediately upstream and downstream of each dam are not altered by the smoothing process. All Elevations are in MSL 1912 in the UNET model. Normally, Water Control Data is in 1912 datum along the Mississippi River throughout the Rock Island District. In general, elevations in MSL 1912 datum are approximately 0.5 foot higher than elevations in NGVD of 1929 datum along the Mississippi River within the Rock Island District. Mississippi River location, elevation, discharge Table C-M-6 is based upon 1912 datum and Mississippi River location, elevation, discharge Table C-M-7 is based upon 1929 datum

.

-

References

1. Barkau, R. L. UNET: Unsteady Flow through a Full Network of Open Channels, February 1992.

2. Barkau, 1994, Rating Curve Calibration. Hydrologic Engineering Center, September 1992, UNET, One-Dimensional Unsteady Flow Through a Full Network of Open Channels.

3. Hydrologic Engineering Center, 1997. UNET, One-Dimensional Unsteady Flow Through A Full Network of Open Channels, User's Manual, U. S. Army, Corps of Engineers, Davis, CA

4. Hydrologic Engineering Center, 1998. HEC-HMS, Hydrologic Modeling System, User's Manual (Draft), U. S. Army, Corps of Engineers, Davis, CA

5. Hydrologic Engineering Center, 1999. An Investigation of Flood Frequency Estimation Methods For the Upper Mississippi Basin, U.S. Army Corps of Engineers, Davis, CA.

6. Hydrologic Engineering Center, 2000. Investigation of Methods for Obtaining Regionally Consistent Flood Distributions, Upper Mississippi Flood Frequency Study, U.S. Army Corps of Engineers, Davis, CA.

7. Interagency Advisory Committee on Water Data (IACWD), 1976. Guidelines for Determining Flood Flow Frequency, Bulletin 17 of the Hydrology Committee, U.S. Water Resources Council, Washington, D.C.

8. Interagency Advisory Committee on Water Data (IACWD), 1982. Guidelines for Determining Flood Flow Frequency, Bulletin 17B, U.S. Department of the Interior, Geological Survey, Office of Water Data Collection, Reston, VA.

9. U. S. Army, Corps of Engineers, HEC-FDA, Flood Damage Reduction Analysis User's Manual, March 1998.

10. U. S. Army Corps of Engineers, Floodplain Management Assessment of the Upper Mississippi and Lower Missouri Rivers and Their Tributaries, Appendix A (Hydraulic Modeling), June 1995.

11. U.S. Army Engineer District, Rock Island, Corps of Engineers, 1979, Upper Mississippi River Basin Commission, Upper Mississippi River Water Surface Profiles, River Mile 0.0 to 847.7 In cooperation with St. Paul District, North Central Division, and St. Louis District, November 1979.

12. U.S. Army Engineer District, Rock Island, Corps of Engineers, 1992, Illinois River Water Surface Profiles, River Mile 80.0 to 290.0.

13. "Hydrologic Frequency Analysis," pg. 3-26, EM 1110-2-1415, March 1993, U.S. Army Corps of Engineers, Washington, D.C.

-

Glossary -- Upper Mississippi River System Flow Frequency Study

Acre – foot	A measure of volume equal to an acre of land uniformly flooded to one foot in depth.
Channel slope	The change in elevation of the channel bottom divided by the distance between the measured elevations.
Coefficient of variation	The standard deviation divided by the mean.
Cubic-feet-per-second	(CFS) unit of flow.
Discharge	The volume of water passing a location in the river per unit time (e.g., cubic feet per second).
Drainage area	The surface area of the watershed contributing runoff to a particular location on the river system.
Exceedance frequency	The exceedance probability multiplied by 100, sometimes interpreted as the number of exceedances per 100 years on the average (e.g. the 1% exceedance frequency flood is the 0.01 exceedance probability multiplied by 100).
Exceedance probability	The probability that the annual flood will be equaled or exceeded in a year (e.g., the 0.01 exceedance probability flood has a 1/100 chance of being equal or exceeded in any year).
Flood distribution	A function or graphical curve expressing the relationship between exceedance probability and annual maximum flow (e.g., the log-Pearson III distribution is typically used by federal agencies to represent the peak annual flood distribution).
Flood frequency curve	See flood distribution.
Flood population	The true flood distribution describing the likely occurrence of annual floods. An idealization in that it is based on assumptions regarding the random occurrence of floods. The population can never be known, but estimates are made from the observed period of record.
Hydrograph	The variation of river discharge or stage with time at a particular cross section, usually for some period corresponding to a flood event.

-

Flood rank The position in an ordered list from largest to smallest of the observed annual maximum floods (e.g, the largest flood has rank equal to one, the smallest has rank equal to the number of observed floods).

Operating rule The procedures to be followed and/or actions to be taken by dam operators given both reservoir inflows and downstream flow conditions.

Plotting position An estimate obtained of flood exceedance probability from the observed record of annual maximum flow values independent of an assumed distribution. Various plotting position formulas exist for estimating plotting positions (e.g., Weibull annual maximum flood plotting position = flood rank/(number of observations + one)).

Probability A number in the range 0 to 1 defining the likelihood of observing future values or magnitudes of a random variable (e.g., the probability of observing a head or a tail from flipping a coin is 0.5).

Quantile The probability distribution quantity corresponding to a particular exceedance probability (e.g., the 0.01 exceedance probability flood is 100000 cfs, where 100000 is the quantile).

Rating curve The relationship between discharge and river stage.

Regulated flows River flows affected by the presence of reservoirs and operation of dam outlets (a significant portion of the study area observed period of record was influenced by reservoir regulation).

Regulated flood frequency curve See regulated flood distribution.

Regulated flood distribution A flood distribution expressing the relationship between exceedance probability and regulated flows. Generally very non-linear and not describable by an analytic flood distribution, such as the log-Pearson III distribution.

Regulated vs unregulated relationship A relationship between the discharge that would occur without the influence of reservoirs to that occurring with present day reservoir operations.

River Basin (see watershed)

River cross section The area of river at a given location defined by the channel bottom, and possibly levees, at right angles to the flow.

-

River main channel	The portion of river cross section carrying flow under normal circumstances.
River overbank	The portion of the river cross section conveying additional flow to the main channel during flood periods.
Sample estimate	A quantity derived from the observed data used to approximate the unknown population value (e.g., sample mean, sample standard deviation, sample skew coefficient, sample flood distribution).
Sample mean	An estimate of the central tendency of the data. the average (the sum of the observed values/number of observations).
Sample skew coefficient	A measure of the asymmetry of the distribution, for the same mean and standard deviation, a positive value results in a greater 1% exceedance frequency flood than a negative value. The average of the cube deviations from the mean divided by the standard deviation cubed.
Sample standard deviation	Both a measure of the range of the observed data and the width of the flood distribution the square root of the average of the sum of squared deviations from the mean of the observations.
Unregulated flows	River flows unaffected by the influence of reservoir regulation (a major effort was undertaken by the Corps Districts to adjust the observed records for the influence of reservoir regulation).
Unsteady flow	The variation of stream flow at a given location with time, a condition always present within a river (note that although flow within a river is always unsteady, the change is gradual enough to be considered approximately steady for analysis purposes).
Volume duration frequency curves	A set of flood distribution curves for various annual maximum volumes defined for different durations at a particular location (e.g., flood distributions estimated from the observed 1-day, 3-day, 7-day, 10-day and 30-day maximum flood volumes obtained from the period of record).
Watershed	A closed boundary describing the land surface area contributing runoff to a particular location on a river.

-

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
301.4	462.4	209,000	465.2	261,000	467.5	306,000	469.9	354,000	471.7	399,000	473.2	442,000	474.6	485,000	476.0	537,000
301.7	462.5	209,000	465.4	261,000	467.7	306,000	470.1	354,000	471.9	398,000	473.5	442,000	474.8	485,000	476.3	537,000
302	462.6	209,000	465.5	261,000	467.8	306,000	470.2	354,000	472.0	398,000	473.6	442,000	475.0	485,000	476.5	537,000
302.5	462.8	209,000	465.7	261,000	468.0	306,000	470.4	354,000	472.2	398,000	473.9	442,000	475.2	484,000	476.7	537,000
303	463.0	209,000	465.9	261,000	468.2	306,000	470.6	354,000	472.5	398,000	474.2	441,000	475.5	484,000	477.0	537,000
303.6	463.4	209,000	466.2	261,000	468.5	305,000	471.0	354,000	472.9	398,000	474.6	441,000	476.0	484,000	477.4	537,000
304	463.7	209,000	466.5	261,000	468.8	305,000	471.2	353,000	473.2	398,000	474.9	441,000	476.3	484,000	477.8	537,000
304.5	463.9	209,000	466.7	260,000	469.0	305,000	471.4	353,000	473.4	398,000	475.1	441,000	476.6	484,000	478.0	537,000
305	464.1	209,000	466.9	260,000	469.2	305,000	471.6	353,000	473.6	398,000	475.4	441,000	476.8	484,000	478.3	536,000
305.4	464.3	209,000	467.1	260,000	469.4	305,000	471.9	353,000	473.9	398,000	475.7	441,000	477.1	484,000	478.6	536,000
306	464.7	209,000	467.5	260,000	469.7	305,000	472.2	353,000	474.2	397,000	476.0	441,000	477.5	484,000	478.9	536,000
306.5	464.9	209,000	467.7	260,000	470.0	305,000	472.4	353,000	474.5	397,000	476.3	441,000	477.8	484,000	479.2	536,000
307	465.1	209,000	467.9	260,000	470.2	305,000	472.6	353,000	474.7	397,000	476.5	441,000	478.0	484,000	479.4	536,000
307.5	465.4	209,000	468.1	260,000	470.4	304,000	472.8	353,000	474.9	397,000	476.8	441,000	478.3	484,000	479.8	536,000
308	465.6	209,000	468.3	260,000	470.6	304,000	473.1	353,000	475.2	397,000	477.1	441,000	478.6	484,000	480.0	536,000
308.5	465.8	209,000	468.5	260,000	470.8	304,000	473.2	352,000	475.4	397,000	477.3	441,000	478.8	484,000	480.3	536,000
309	466.0	209,000	468.7	260,000	471.0	304,000	473.4	352,000	475.6	397,000	477.5	441,000	479.0	484,000	480.4	536,000
309.15	466.1	209,000	468.8	260,000	471.0	304,000	473.5	352,000	475.6	397,000	477.5	441,000	479.1	484,000	480.5	536,000
309.2	466.1	209,000	468.8	260,000	471.0	304,000	473.5	352,000	475.6	397,000	477.5	441,000	479.1	484,000	480.5	536,000
309.25	466.1	209,000	468.8	260,000	471.1	304,000	473.5	352,000	475.7	397,000	477.6	441,000	479.1	484,000	480.6	536,000
309.5	466.2	209,000	468.9	259,000	471.2	304,000	473.7	352,000	475.8	397,000	477.7	441,000	479.3	484,000	480.7	536,000
309.75	466.2	209,000	469.0	259,000	471.2	304,000	473.7	352,000	475.8	397,000	477.7	440,000	479.3	484,000	480.7	536,000
309.8	466.2	209,000	469.0	259,000	471.2	304,000	473.7	352,000	475.8	397,000	477.7	440,000	479.3	484,000	480.7	536,000
309.85	466.2	209,000	469.0	259,000	471.2	304,000	473.7	352,000	475.9	397,000	477.8	440,000	479.4	484,000	480.8	536,000
310	466.3	209,000	469.0	259,000	471.3	304,000	473.8	352,000	476.0	397,000	477.9	440,000	479.5	484,000	480.9	536,000
310.5	466.5	209,000	469.2	259,000	471.5	304,000	474.0	352,000	476.2	397,000	478.2	440,000	479.8	484,000	481.3	536,000
311	466.6	209,000	469.5	259,000	471.8	303,000	474.3	352,000	476.5	396,000	478.5	440,000	480.1	484,000	481.5	535,000
311.4	466.8	209,000	469.6	259,000	472.0	303,000	474.5	351,000	476.7	396,000	478.8	440,000	480.4	484,000	481.8	535,000
312	467.1	209,000	469.9	259,000	472.3	303,000	474.8	351,000	477.0	396,000	479.0	440,000	480.6	484,000	482.0	535,000
312.7	467.5	209,000	470.3	259,000	472.6	303,000	475.1	351,000	477.4	396,000	479.3	440,000	480.9	484,000	482.4	537,000
313	467.7	209,000	470.5	259,000	472.9	303,000	475.3	351,000	477.6	396,000	479.6	440,000	481.2	484,000	482.6	537,000
313.5	468.0	209,000	470.8	259,000	473.1	303,000	475.5	350,000	477.8	396,000	479.8	440,000	481.4	484,000	482.7	537,000
314	468.4	209,000	471.1	259,000	473.4	303,000	475.9	350,000	478.1	396,000	480.1	440,000	481.7	484,000	483.0	536,000
314.5	468.6	209,000	471.3	259,000	473.7	303,000	476.1	350,000	478.3	396,000	480.3	440,000	481.9	483,000	483.2	537,000
315	468.9	209,000	471.7	258,000	474.0	302,000	476.4	350,000	478.7	396,000	480.7	440,000	482.2	483,000	483.5	537,000
315.5	469.1	209,000	471.9	258,000	474.3	302,000	476.7	350,000	478.9	396,000	480.9	440,000	482.5	483,000	483.8	536,000
316	469.4	209,000	472.2	258,000	474.5	302,000	477.0	350,000	479.2	395,000	481.2	439,000	482.7	483,000	484.0	536,000
316.7	469.6	209,000	472.4	258,000	474.8	302,000	477.2	350,000	479.4	395,000	481.4	439,000	482.9	483,000	484.2	536,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
317	469.7	209,000	472.5	258,000	474.9	302,000	477.3	350,000	479.5	395,000	481.5	439,000	483.0	483,000	484.4	536,000
317.5	469.9	209,000	472.7	258,000	475.1	302,000	477.6	350,000	479.8	395,000	481.7	439,000	483.2	483,000	484.6	536,000
318	470.1	209,000	472.9	257,000	475.3	301,000	477.8	349,000	480.0	395,000	482.0	439,000	483.5	482,000	484.9	536,000
318.6	470.3	209,000	473.2	257,000	475.6	301,000	478.1	349,000	480.3	394,000	482.3	439,000	483.9	482,000	485.3	536,000
319	470.6	209,000	473.4	257,000	475.8	301,000	478.4	349,000	480.6	394,000	482.6	438,000	484.2	482,000	485.6	536,000
319.6	470.9	209,000	473.8	257,000	476.2	301,000	478.8	349,000	481.0	394,000	483.0	438,000	484.6	482,000	486.0	536,000
320	471.3	209,000	474.2	257,000	476.6	301,000	479.2	349,000	481.4	394,000	483.4	438,000	485.0	482,000	486.4	536,000
320.5	471.9	209,000	474.7	257,000	477.0	301,000	479.6	349,000	481.8	394,000	483.8	438,000	485.4	482,000	486.9	536,000
321	472.1	209,000	474.9	257,000	477.3	300,000	479.8	349,000	482.0	394,000	484.0	438,000	485.6	482,000	487.1	536,000
321.4	472.3	208,000	475.1	255,000	477.5	298,000	480.0	345,000	482.1	390,000	484.1	434,000	485.7	479,000	487.3	536,000
321.6	472.4	208,000	475.2	255,000	477.6	297,000	480.1	345,000	482.2	390,000	484.2	434,000	485.8	479,000	487.4	536,000
322	472.7	208,000	475.4	255,000	477.8	297,000	480.3	345,000	482.4	390,000	484.4	434,000	486.0	479,000	487.6	536,000
322.5	472.8	208,000	475.5	255,000	477.9	297,000	480.5	345,000	482.7	390,000	484.6	434,000	486.2	479,000	487.9	536,000
323	473.0	208,000	475.7	255,000	478.2	297,000	480.8	345,000	482.9	390,000	484.8	434,000	486.4	479,000	488.1	536,000
323.4	473.3	205,000	476.1	253,000	478.5	287,000	481.4	337,000	483.5	381,000	485.3	426,000	486.8	470,000	488.5	528,000
324	473.5	205,000	476.3	253,000	478.7	287,000	481.6	337,000	483.8	381,000	485.6	426,000	487.0	471,000	488.7	529,000
324.8	473.7	205,000	476.5	253,000	478.9	287,000	481.8	337,000	483.9	381,000	485.7	426,000	487.2	470,000	488.8	529,000
325	474.5	205,000	477.3	253,000	479.7	287,000	482.6	337,000	484.7	381,000	486.5	426,000	488.0	470,000	489.6	529,000
325.4	474.7	205,000	477.5	253,000	479.9	287,000	482.8	337,000	484.9	380,000	486.7	426,000	488.2	470,000	489.9	529,000
326	474.9	205,000	477.6	253,000	480.0	287,000	482.9	337,000	485.0	380,000	486.9	425,000	488.4	470,000	490.0	529,000
326.5	475.0	205,000	477.7	253,000	480.1	287,000	483.0	336,000	485.1	380,000	487.0	425,000	488.4	470,000	490.1	529,000
326.8	475.1	205,000	477.9	253,000	480.2	287,000	483.2	336,000	485.2	380,000	487.1	425,000	488.6	470,000	490.3	529,000
327.1	475.2	205,000	478.0	253,000	480.3	287,000	483.3	336,000	485.3	380,000	487.2	425,000	488.7	470,000	490.4	529,000
327.6	475.3	205,000	478.1	254,000	480.4	287,000	483.4	336,000	485.5	380,000	487.3	425,000	488.8	470,000	490.6	529,000
328	475.5	205,000	478.3	254,000	480.5	287,000	483.5	336,000	485.6	379,000	487.4	425,000	488.9	470,000	490.7	528,000
328.5	475.7	205,000	478.5	254,000	480.7	287,000	483.7	336,000	485.8	379,000	487.6	425,000	489.1	470,000	490.9	528,000
329	475.9	204,000	478.7	254,000	480.9	287,000	483.9	335,000	485.9	379,000	487.8	425,000	489.3	470,000	491.1	528,000
329.6	476.1	204,000	478.9	254,000	481.1	287,000	484.0	335,000	486.0	379,000	487.9	424,000	489.4	470,000	491.2	528,000
330	476.3	204,000	479.1	254,000	481.2	287,000	484.1	335,000	486.1	378,000	487.9	425,000	489.5	470,000	491.3	529,000
330.6	476.6	204,000	479.4	254,000	481.5	287,000	484.3	334,000	486.3	378,000	488.1	424,000	489.6	470,000	491.4	529,000
331	476.8	204,000	479.6	255,000	481.7	287,000	484.5	334,000	486.4	378,000	488.2	424,000	489.7	470,000	491.5	529,000
331.5	477.0	204,000	479.8	255,000	481.9	287,000	484.7	334,000	486.5	375,000	488.2	416,000	489.7	457,000	491.4	511,000
332	477.3	204,000	480.1	255,000	482.1	287,000	484.8	333,000	486.7	376,000	488.4	419,000	489.8	463,000	491.5	519,000
332.5	477.6	204,000	480.4	255,000	482.4	288,000	485.1	333,000	486.9	376,000	488.6	419,000	490.0	463,000	491.7	519,000
333	477.9	204,000	480.7	255,000	482.6	288,000	485.2	333,000	487.1	375,000	488.8	419,000	490.2	463,000	491.9	519,000
333.6	478.2	204,000	480.9	255,000	482.9	288,000	485.4	333,000	487.3	375,000	489.0	419,000	490.4	463,000	492.1	520,000
334	478.4	204,000	481.2	255,000	483.1	288,000	485.6	332,000	487.4	375,000	489.1	419,000	490.6	463,000	492.2	520,000
334.6	478.8	204,000	481.5	256,000	483.4	288,000	485.9	332,000	487.7	374,000	489.4	419,000	490.8	463,000	492.5	520,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
335	479.1	204,000	481.8	256,000	483.7	288,000	486.0	332,000	487.8	374,000	489.5	418,000	491.0	463,000	492.6	520,000
335.5	479.4	204,000	482.1	256,000	483.9	288,000	486.2	332,000	488.0	374,000	489.7	418,000	491.1	463,000	492.8	521,000
336	479.7	204,000	482.4	256,000	484.1	288,000	486.4	331,000	488.1	373,000	489.8	417,000	491.2	460,000	492.8	517,000
336.4	479.9	204,000	482.6	256,000	484.3	288,000	486.5	331,000	488.2	373,000	489.9	417,000	491.3	460,000	492.9	517,000
337	480.1	204,000	482.9	256,000	484.5	287,000	486.7	331,000	488.3	373,000	490.0	416,000	491.4	460,000	493.0	517,000
337.5	480.4	203,000	483.3	255,000	484.8	286,000	487.0	327,000	488.5	366,000	490.1	409,000	491.5	454,000	493.1	512,000
338	480.6	203,000	483.5	255,000	485.0	286,000	487.2	327,000	488.6	365,000	490.2	409,000	491.6	454,000	493.3	512,000
338.5	480.8	203,000	483.8	255,000	485.2	286,000	487.4	326,000	488.8	365,000	490.4	409,000	491.8	454,000	493.4	513,000
339	481.1	203,000	484.1	255,000	485.5	286,000	487.6	326,000	489.1	365,000	490.6	409,000	492.0	454,000	493.7	513,000
339.5	481.3	203,000	484.3	255,000	485.7	286,000	487.8	326,000	489.3	365,000	490.8	409,000	492.2	454,000	493.8	513,000
339.9	481.5	203,000	484.5	255,000	485.9	286,000	487.9	326,000	489.4	364,000	490.9	408,000	492.3	454,000	494.0	513,000
340.5	481.8	203,000	484.7	255,000	486.1	286,000	488.1	326,000	489.6	364,000	491.1	408,000	492.5	454,000	494.2	513,000
341	482.0	203,000	484.9	255,000	486.3	286,000	488.4	325,000	489.8	364,000	491.3	408,000	492.6	454,000	494.3	513,000
341.4	482.2	202,000	485.1	250,000	486.5	286,000	488.6	323,000	490.0	359,000	491.4	403,000	492.7	449,000	494.4	510,000
341.6	482.3	202,000	485.2	250,000	486.6	286,000	488.7	323,000	490.1	358,000	491.4	402,000	492.8	449,000	494.4	510,000
342	482.4	202,000	485.3	250,000	486.7	286,000	488.8	323,000	490.2	358,000	491.5	402,000	492.8	449,000	494.4	510,000
342.3	482.6	202,000	485.5	250,000	486.9	286,000	488.9	322,000	490.3	358,000	491.6	402,000	492.9	449,000	494.5	510,000
342.6	482.7	202,000	485.6	250,000	487.0	286,000	489.0	322,000	490.4	358,000	491.8	402,000	493.1	449,000	494.7	510,000
343	482.8	202,000	485.7	250,000	487.2	286,000	489.2	322,000	490.6	358,000	492.0	402,000	493.3	449,000	494.9	510,000
343.2	483.3	202,000	486.2	250,000	487.7	286,000	489.7	322,000	491.1	358,000	492.5	402,000	493.8	449,000	495.4	510,000
343.7	483.5	202,000	486.5	250,000	487.9	286,000	489.9	322,000	491.3	358,000	492.8	401,000	494.1	448,000	495.7	510,000
343.9	483.6	202,000	486.6	250,000	488.0	286,000	490.0	322,000	491.4	357,000	492.9	401,000	494.2	448,000	495.8	510,000
344.2	483.6	202,000	486.6	250,000	488.0	286,000	490.1	322,000	491.5	357,000	492.9	401,000	494.2	448,000	495.9	509,000
344.5	483.7	202,000	486.8	250,000	488.2	286,000	490.2	322,000	491.5	357,000	493.0	401,000	494.3	448,000	495.9	509,000
345.1	483.9	202,000	487.0	249,000	488.4	286,000	490.4	322,000	491.7	357,000	493.1	401,000	494.4	448,000	496.0	509,000
345.7	484.2	202,000	487.3	249,000	488.7	286,000	490.7	322,000	492.0	357,000	493.4	401,000	494.7	448,000	496.3	509,000
346	484.5	202,000	487.5	249,000	489.0	286,000	490.9	321,000	492.2	357,000	493.6	400,000	494.9	447,000	496.5	509,000
346.4	484.7	202,000	487.7	249,000	489.2	286,000	491.1	321,000	492.5	357,000	493.9	400,000	495.1	447,000	496.7	509,000
347	484.9	202,000	487.9	249,000	489.4	286,000	491.4	321,000	492.7	356,000	494.1	400,000	495.4	447,000	496.9	508,000
347.6	485.1	202,000	488.1	249,000	489.6	286,000	491.5	321,000	492.9	356,000	494.3	400,000	495.5	447,000	497.1	508,000
347.8	485.2	202,000	488.2	248,000	489.7	286,000	491.6	321,000	493.0	356,000	494.4	400,000	495.7	447,000	497.2	508,000
348.1	485.3	202,000	488.3	248,000	489.9	286,000	491.7	320,000	493.1	355,000	494.5	397,000	495.7	445,000	497.3	507,000
348.5	485.5	202,000	488.5	248,000	490.0	286,000	491.9	320,000	493.2	354,000	494.6	397,000	495.8	444,000	497.4	507,000
349	485.7	202,000	488.7	248,000	490.2	286,000	492.1	320,000	493.4	354,000	494.8	396,000	496.0	444,000	497.6	506,000
349.4	485.8	202,000	488.8	248,000	490.3	286,000	492.2	320,000	493.5	354,000	494.9	396,000	496.2	444,000	497.8	506,000
350	485.9	202,000	488.9	248,000	490.4	286,000	492.3	320,000	493.6	354,000	495.0	396,000	496.3	444,000	497.9	506,000
350.5	486.0	202,000	489.0	248,000	490.6	286,000	492.4	320,000	493.8	354,000	495.2	396,000	496.5	444,000	498.1	506,000
351	486.2	202,000	489.3	247,000	490.9	286,000	492.7	320,000	494.1	354,000	495.5	396,000	496.8	443,000	498.4	506,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
351.3	486.4	202,000	489.4	247,000	491.0	285,000	492.8	320,000	494.3	354,000	495.7	396,000	497.0	443,000	498.6	505,000
352	486.7	202,000	489.7	247,000	491.3	285,000	493.1	320,000	494.6	354,000	496.0	396,000	497.4	443,000	498.9	505,000
352.6	487.0	202,000	490.0	247,000	491.6	285,000	493.4	320,000	494.9	354,000	496.4	396,000	497.7	444,000	499.2	505,000
353	487.2	202,000	490.2	247,000	491.8	285,000	493.6	320,000	495.1	354,000	496.6	397,000	497.9	444,000	499.5	505,000
353.4	487.3	201,000	490.3	247,000	492.0	285,000	493.7	319,000	495.2	354,000	496.8	397,000	498.1	444,000	499.7	505,000
354	487.6	200,000	490.6	245,000	492.2	282,000	494.0	317,000	495.6	351,000	497.1	396,000	498.5	442,000	500.1	503,000
354.4	487.8	200,000	490.7	245,000	492.4	282,000	494.2	317,000	495.7	351,000	497.3	395,000	498.7	441,000	500.3	502,000
355	488.0	200,000	491.0	245,000	492.6	282,000	494.4	318,000	495.9	353,000	497.5	396,000	498.8	442,000	500.4	502,000
355.4	488.2	200,000	491.1	245,000	492.7	282,000	494.5	317,000	496.0	353,000	497.6	396,000	499.0	442,000	500.6	502,000
356	488.4	200,000	491.3	245,000	493.0	282,000	494.7	317,000	496.2	353,000	497.8	396,000	499.2	442,000	500.8	502,000
356.4	488.6	200,000	491.4	245,000	493.1	282,000	494.9	317,000	496.4	353,000	497.9	396,000	499.3	442,000	501.0	502,000
357	488.9	200,000	491.7	245,000	493.3	282,000	495.1	317,000	496.6	353,000	498.1	396,000	499.5	441,000	501.2	502,000
357.4	489.1	200,000	491.8	245,000	493.5	282,000	495.2	316,000	496.6	351,000	498.2	392,000	499.6	439,000	501.3	501,000
358	489.3	200,000	492.0	245,000	493.7	282,000	495.3	316,000	496.8	351,000	498.3	392,000	499.8	439,000	501.5	500,000
358.4	489.5	200,000	492.2	244,000	493.9	282,000	495.5	316,000	496.9	350,000	498.4	392,000	499.9	438,000	501.5	498,000
359	489.6	200,000	492.3	244,000	494.0	282,000	495.6	316,000	497.1	350,000	498.5	392,000	500.0	438,000	501.6	498,000
359.2	489.7	200,000	492.4	244,000	494.1	282,000	495.7	316,000	497.1	350,000	498.6	392,000	500.1	438,000	501.8	498,000
359.5	489.8	200,000	492.5	244,000	494.2	282,000	495.8	316,000	497.2	350,000	498.7	392,000	500.3	438,000	502.0	498,000
360	490.0	200,000	492.7	244,000	494.4	282,000	496.0	316,000	497.4	350,000	499.0	392,000	500.6	438,000	502.3	498,000
360.4	490.2	200,000	492.9	244,000	494.7	282,000	496.3	316,000	497.7	350,000	499.3	392,000	500.9	438,000	502.7	498,000
361	490.3	200,000	493.2	244,000	495.0	282,000	496.5	316,000	498.0	350,000	499.6	392,000	501.2	438,000	503.0	498,000
361.5	490.5	200,000	493.4	244,000	495.3	282,000	496.7	316,000	498.2	350,000	499.9	391,000	501.5	437,000	503.2	498,000
362	490.5	179,000	493.6	227,000	495.6	263,000	496.9	297,000	498.5	331,000	500.1	366,000	501.5	394,000	503.3	428,000
362.5	490.6	179,000	493.8	227,000	495.8	263,000	497.1	297,000	498.7	331,000	500.3	366,000	501.7	394,000	503.4	428,000
363	490.9	179,000	494.0	227,000	496.1	263,000	497.3	297,000	498.9	331,000	500.6	366,000	501.9	394,000	503.6	428,000
363.5	491.1	179,000	494.2	227,000	496.2	263,000	497.4	297,000	499.1	331,000	500.7	366,000	502.1	394,000	503.8	428,000
363.8	491.2	179,000	494.4	227,000	496.4	263,000	497.6	297,000	499.2	331,000	500.9	366,000	502.3	394,000	503.9	428,000
363.9	491.3	179,000	494.4	227,000	496.4	263,000	497.6	297,000	499.3	331,000	501.0	366,000	502.3	394,000	504.0	428,000
364.05	491.5	179,000	494.6	227,000	496.6	263,000	497.9	297,000	499.5	331,000	501.2	366,000	502.6	394,000	504.2	428,000
364.2	491.7	179,000	494.8	226,000	496.8	262,000	498.1	298,000	499.7	331,000	501.4	366,000	502.8	394,000	504.5	428,000
364.3	491.8	179,000	494.9	226,000	496.9	262,000	498.3	298,000	499.9	331,000	501.6	366,000	503.0	394,000	504.7	429,000
364.4	491.9	179,000	495.0	226,000	497.0	262,000	498.3	297,000	500.0	331,000	501.7	366,000	503.1	394,000	504.8	429,000
364.5	518.2	179,000	518.2	226,000	518.2	262,000	518.2	297,000	518.2	331,000	518.2	366,000	518.2	394,000	518.2	429,000
364.7	518.3	179,000	518.3	226,000	518.3	262,000	518.4	297,000	518.4	331,000	518.4	366,000	518.5	394,000	518.5	428,000
365	518.3	179,000	518.4	226,000	518.5	262,000	518.6	297,000	518.7	331,000	518.8	366,000	518.8	394,000	519.0	429,000
365.5	518.4	179,000	518.6	226,000	518.7	262,000	518.8	297,000	519.0	331,000	519.2	366,000	519.3	394,000	519.5	429,000
366	518.5	179,000	518.7	226,000	518.9	262,000	519.1	297,000	519.3	331,000	519.5	366,000	519.6	394,000	519.9	429,000
366.5	518.6	179,000	518.8	226,000	519.0	262,000	519.3	297,000	519.5	331,000	519.8	366,000	520.0	394,000	520.2	429,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
367	518.6	179,000	518.9	226,000	519.1	262,000	519.4	297,000	519.7	331,000	520.0	366,000	520.2	394,000	520.5	429,000
367.5	518.7	179,000	519.0	226,000	519.2	262,000	519.5	297,000	519.8	331,000	520.2	366,000	520.4	394,000	520.7	429,000
368	518.8	179,000	519.1	226,000	519.4	262,000	519.7	297,000	520.0	331,000	520.4	366,000	520.6	394,000	521.0	429,000
368.5	518.8	179,000	519.2	226,000	519.5	262,000	519.8	297,000	520.2	331,000	520.6	366,000	520.9	394,000	521.3	429,000
369	518.9	179,000	519.3	226,000	519.6	262,000	520.0	297,000	520.3	331,000	520.8	366,000	521.1	394,000	521.5	429,000
369.5	518.9	179,000	519.4	226,000	519.7	262,000	520.1	297,000	520.5	331,000	520.9	366,000	521.3	394,000	521.7	429,000
370	519.0	179,000	519.4	226,000	519.8	262,000	520.2	297,000	520.7	331,000	521.1	366,000	521.5	394,000	521.9	429,000
370.5	519.0	179,000	519.5	226,000	519.9	262,000	520.4	297,000	520.8	331,000	521.3	366,000	521.7	394,000	522.1	429,000
371	519.1	179,000	519.6	226,000	520.0	262,000	520.5	297,000	521.0	331,000	521.5	366,000	521.9	394,000	522.4	429,000
371.5	519.2	179,000	519.7	226,000	520.2	262,000	520.7	297,000	521.2	331,000	521.7	366,000	522.1	394,000	522.7	429,000
372	519.3	179,000	519.8	226,000	520.3	262,000	520.9	297,000	521.4	331,000	522.0	366,000	522.4	394,000	523.0	429,000
372.5	519.4	179,000	520.0	226,000	520.5	262,000	521.1	297,000	521.6	331,000	522.2	366,000	522.7	394,000	523.2	429,000
373	519.4	179,000	520.1	226,000	520.6	262,000	521.2	297,000	521.8	331,000	522.4	366,000	522.9	394,000	523.5	429,000
373.5	519.5	179,000	520.2	226,000	520.8	262,000	521.4	297,000	522.0	331,000	522.6	366,000	523.1	394,000	523.7	429,000
374	519.6	179,000	520.3	226,000	520.9	262,000	521.6	297,000	522.2	331,000	522.9	366,000	523.4	394,000	524.0	429,000
374.5	519.7	179,000	520.5	226,000	521.2	262,000	521.8	297,000	522.5	331,000	523.2	366,000	523.7	394,000	524.4	429,000
375	519.8	179,000	520.7	226,000	521.3	262,000	522.0	297,000	522.7	331,000	523.4	366,000	524.0	394,000	524.7	429,000
375.6	519.9	179,000	520.8	226,000	521.5	262,000	522.3	297,000	523.0	331,000	523.7	366,000	524.3	394,000	525.0	429,000
376	520.0	179,000	520.9	226,000	521.7	262,000	522.4	297,000	523.1	331,000	523.9	366,000	524.5	394,000	525.2	429,000
376.4	520.1	179,000	521.1	226,000	521.8	262,000	522.6	297,000	523.3	331,000	524.1	366,000	524.7	394,000	525.4	429,000
377	520.2	178,000	521.2	226,000	521.9	262,000	522.7	297,000	523.4	330,000	524.2	366,000	524.8	394,000	525.6	429,000
377.3	520.2	178,000	521.2	226,000	522.0	262,000	522.8	297,000	523.5	330,000	524.3	365,000	524.9	394,000	525.6	429,000
378	520.3	178,000	521.3	226,000	522.1	262,000	522.9	297,000	523.7	330,000	524.4	365,000	525.1	394,000	525.8	429,000
378.6	520.4	178,000	521.4	226,000	522.2	262,000	523.0	297,000	523.8	330,000	524.6	365,000	525.2	394,000	526.0	429,000
379	520.5	178,000	521.5	226,000	522.3	262,000	523.2	297,000	523.9	330,000	524.7	365,000	525.4	394,000	526.1	429,000
379.5	520.6	178,000	521.6	226,000	522.4	262,000	523.3	297,000	524.0	330,000	524.8	365,000	525.5	394,000	526.2	429,000
380	520.7	178,000	521.8	226,000	522.6	262,000	523.4	297,000	524.2	330,000	525.0	365,000	525.7	394,000	526.4	429,000
380.5	520.8	178,000	521.9	226,000	522.8	262,000	523.6	297,000	524.4	330,000	525.2	365,000	525.8	394,000	526.6	429,000
381	521.0	178,000	522.1	226,000	522.9	262,000	523.8	296,000	524.6	330,000	525.4	365,000	526.0	394,000	526.8	429,000
381.4	521.1	178,000	522.2	226,000	523.1	262,000	523.9	296,000	524.7	330,000	525.6	365,000	526.2	394,000	527.0	429,000
381.9	521.1	178,000	522.3	226,000	523.2	262,000	524.0	296,000	524.8	330,000	525.7	365,000	526.3	394,000	527.1	429,000
382.4	521.3	178,000	522.4	226,000	523.3	262,000	524.2	296,000	525.0	330,000	525.9	365,000	526.5	394,000	527.3	429,000
382.9	521.3	178,000	522.6	226,000	523.5	262,000	524.4	296,000	525.2	330,000	526.0	365,000	526.7	394,000	527.5	429,000
383.4	521.4	178,000	522.6	226,000	523.6	262,000	524.5	296,000	525.3	330,000	526.1	365,000	526.8	394,000	527.6	429,000
383.75	521.5	178,000	522.7	226,000	523.6	262,000	524.5	296,000	525.4	329,000	526.2	365,000	526.9	394,000	527.7	429,000
383.8	521.4	178,000	522.7	226,000	523.6	262,000	524.5	296,000	525.4	329,000	526.2	365,000	526.9	394,000	527.7	429,000
383.9	521.5	178,000	522.7	226,000	523.7	262,000	524.6	296,000	525.4	329,000	526.3	365,000	527.0	394,000	527.8	429,000
384.5	521.6	178,000	522.8	226,000	523.8	262,000	524.7	296,000	525.6	329,000	526.5	365,000	527.2	394,000	528.0	429,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
384.9	521.6	178,000	522.9	226,000	523.9	262,000	524.9	296,000	525.7	329,000	526.7	365,000	527.4	394,000	528.2	429,000
385.6	521.8	178,000	523.1	226,000	524.1	262,000	525.1	296,000	526.0	329,000	527.0	365,000	527.7	394,000	528.6	429,000
385.8	521.9	178,000	523.2	226,000	524.3	262,000	525.3	296,000	526.2	329,000	527.2	365,000	527.9	394,000	528.8	429,000
386.9	522.1	178,000	523.5	226,000	524.6	262,000	525.6	296,000	526.6	329,000	527.6	365,000	528.4	394,000	529.3	429,000
388	522.3	178,000	523.8	226,000	524.9	262,000	526.0	296,000	527.0	330,000	528.0	365,000	528.8	394,000	529.7	429,000
388.8	522.4	178,000	524.0	226,000	525.2	262,000	526.3	296,000	527.3	330,000	528.3	365,000	529.1	394,000	530.1	429,000
389.5	522.6	178,000	524.2	226,000	525.4	262,000	526.5	296,000	527.5	330,000	528.6	365,000	529.4	394,000	530.4	429,000
390	522.7	178,000	524.4	226,000	525.6	262,000	526.8	297,000	527.8	330,000	528.9	365,000	529.7	394,000	530.7	429,000
390.9	523.0	178,000	524.7	226,000	525.9	261,000	527.1	297,000	528.2	330,000	529.3	365,000	530.2	394,000	531.1	429,000
392.1	523.3	178,000	525.1	226,000	526.3	261,000	527.5	297,000	528.6	330,000	529.7	365,000	530.6	394,000	531.6	429,000
393.1	523.6	178,000	525.4	226,000	526.7	261,000	527.9	297,000	529.0	330,000	530.1	365,000	531.0	394,000	532.0	430,000
393.5	523.7	178,000	525.6	226,000	526.9	261,000	528.1	297,000	529.2	330,000	530.3	365,000	531.2	394,000	532.2	430,000
394.1	523.9	178,000	525.8	226,000	527.1	261,000	528.4	297,000	529.5	330,000	530.6	365,000	531.5	394,000	532.5	429,000
394.7	524.1	178,000	526.1	226,000	527.4	261,000	528.7	297,000	529.8	330,000	530.9	365,000	531.8	394,000	532.8	430,000
395	524.3	178,000	526.3	226,000	527.6	261,000	529.0	297,000	530.1	330,000	531.2	365,000	532.1	393,000	533.1	428,000
395.9	524.5	178,000	526.6	226,000	527.9	261,000	529.4	297,000	530.5	330,000	531.6	365,000	532.5	393,000	533.5	428,000
396.6	524.7	170,000	527.1	221,000	528.2	253,000	530.1	291,000	531.3	321,000	532.3	350,000	533.2	380,000	534.1	417,000
397	524.9	170,000	527.3	221,000	528.4	253,000	530.4	291,000	531.6	321,000	532.6	350,000	533.5	380,000	534.4	417,000
397.5	525.1	170,000	527.4	221,000	528.5	253,000	530.5	291,000	531.7	321,000	532.8	350,000	533.7	380,000	534.6	417,000
398	525.3	170,000	527.7	221,000	528.8	253,000	530.7	291,000	532.0	321,000	533.0	350,000	533.9	380,000	534.8	417,000
398.5	525.5	170,000	527.8	221,000	529.0	253,000	530.9	291,000	532.1	321,000	533.2	350,000	534.1	380,000	534.9	417,000
399	525.6	170,000	527.9	221,000	529.1	253,000	531.0	291,000	532.3	321,000	533.3	350,000	534.2	380,000	535.1	417,000
399.5	525.7	170,000	528.1	221,000	529.2	253,000	531.1	291,000	532.4	321,000	533.4	350,000	534.3	380,000	535.2	417,000
400	525.9	170,000	528.3	221,000	529.4	253,000	531.3	291,000	532.6	321,000	533.6	350,000	534.5	380,000	535.4	417,000
400.5	526.2	170,000	528.5	221,000	529.7	253,000	531.6	291,000	532.8	321,000	533.9	350,000	534.8	380,000	535.7	417,000
401	526.4	170,000	528.8	221,000	530.0	253,000	531.9	291,000	533.1	321,000	534.2	350,000	535.0	380,000	536.0	417,000
401.5	526.6	170,000	529.0	221,000	530.2	253,000	532.1	290,000	533.3	320,000	534.4	349,000	535.2	379,000	536.2	417,000
402	526.8	170,000	529.2	221,000	530.4	253,000	532.2	290,000	533.4	320,000	534.5	349,000	535.4	379,000	536.3	417,000
402.5	526.8	170,000	529.3	221,000	530.5	253,000	532.3	291,000	533.5	320,000	534.6	349,000	535.4	379,000	536.4	417,000
403	526.9	170,000	529.3	221,000	530.5	253,000	532.3	291,000	533.5	320,000	534.6	349,000	535.5	379,000	536.5	417,000
403.15	526.9	170,000	529.3	221,000	530.5	253,000	532.4	291,000	533.5	320,000	534.6	349,000	535.4	377,000	536.4	414,000
403.2	526.9	170,000	529.3	221,000	530.5	253,000	532.3	291,000	533.5	320,000	534.6	349,000	535.5	377,000	536.5	414,000
403.25	526.9	170,000	529.3	221,000	530.6	253,000	532.4	291,000	533.6	320,000	534.6	349,000	535.5	377,000	536.5	414,000
403.5	527.0	170,000	529.4	221,000	530.7	253,000	532.5	291,000	533.8	320,000	534.8	349,000	535.7	377,000	536.7	414,000
404	527.1	170,000	529.5	221,000	530.8	253,000	532.7	291,000	533.9	320,000	534.9	349,000	535.8	377,000	536.8	414,000
404.09	527.1	170,000	529.5	221,000	530.8	253,000	532.7	291,000	533.9	320,000	535.0	349,000	535.9	377,000	536.9	414,000
404.1	527.1	170,000	529.5	221,000	530.8	253,000	532.7	291,000	533.9	320,000	535.0	349,000	535.9	377,000	536.9	414,000
404.11	527.1	170,000	529.5	221,000	530.8	253,000	532.7	291,000	533.9	320,000	535.0	349,000	535.9	377,000	536.9	414,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
404.3	527.2	170,000	529.6	221,000	530.9	253,000	532.9	291,000	534.1	320,000	535.1	349,000	536.1	377,000	537.1	414,000
405	527.4	170,000	529.8	221,000	531.2	253,000	533.1	291,000	534.3	320,000	535.4	349,000	536.4	377,000	537.5	414,000
405.5	527.6	170,000	530.1	221,000	531.4	253,000	533.4	291,000	534.6	320,000	535.8	349,000	536.7	377,000	537.8	414,000
406	527.8	170,000	530.3	221,000	531.7	253,000	533.6	291,000	534.9	321,000	536.0	349,000	537.0	377,000	538.1	414,000
406.4	527.9	170,000	530.5	221,000	531.8	253,000	533.8	292,000	535.1	321,000	536.2	349,000	537.2	377,000	538.3	413,000
407	528.1	170,000	530.6	221,000	532.0	253,000	533.9	292,000	535.3	321,000	536.4	349,000	537.4	377,000	538.5	413,000
407.5	528.2	170,000	530.8	221,000	532.2	253,000	534.1	292,000	535.4	321,000	536.6	349,000	537.6	377,000	538.7	413,000
408	528.3	170,000	530.9	221,000	532.3	253,000	534.2	292,000	535.5	321,000	536.7	349,000	537.7	377,000	538.8	413,000
408.5	528.5	170,000	531.0	221,000	532.4	253,000	534.4	292,000	535.7	321,000	536.9	349,000	537.9	377,000	539.0	413,000
408.9	528.7	170,000	531.2	221,000	532.6	253,000	534.6	292,000	535.9	321,000	537.1	350,000	538.1	378,000	539.2	414,000
409.2	528.7	170,000	531.3	221,000	532.7	253,000	534.6	292,000	536.0	321,000	537.2	350,000	538.2	378,000	539.4	413,000
409.7	528.9	170,000	531.4	221,000	532.8	253,000	534.8	292,000	536.1	321,000	537.3	350,000	538.3	378,000	539.5	413,000
410	528.9	170,000	531.5	221,000	532.9	253,000	534.9	292,000	536.3	321,000	537.5	350,000	538.5	378,000	539.7	413,000
410.3	529.0	169,000	531.6	219,000	533.1	252,000	535.1	290,000	536.5	319,000	537.7	347,000	538.7	376,000	539.9	412,000
410.6	529.5	169,000	532.1	219,000	533.5	252,000	535.6	290,000	536.9	319,000	538.1	346,000	539.1	373,000	540.3	406,000
411	529.6	169,000	532.2	219,000	533.7	252,000	535.7	290,000	537.1	319,000	538.3	347,000	539.3	373,000	540.4	406,000
411.4	529.7	169,000	532.3	219,000	533.8	252,000	535.9	290,000	537.2	319,000	538.4	347,000	539.4	373,000	540.5	406,000
412	529.9	169,000	532.5	219,000	534.0	252,000	536.0	290,000	537.4	319,000	538.6	347,000	539.6	373,000	540.7	406,000
412.4	530.1	169,000	532.7	219,000	534.2	252,000	536.2	290,000	537.6	319,000	538.7	347,000	539.7	373,000	540.8	406,000
413	530.5	169,000	533.0	219,000	534.5	252,000	536.5	290,000	537.8	319,000	539.0	347,000	540.0	373,000	541.1	407,000
413.5	530.7	169,000	533.3	219,000	534.7	252,000	536.7	290,000	538.0	319,000	539.1	347,000	540.1	373,000	541.2	407,000
414	530.9	169,000	533.4	219,000	534.9	252,000	536.8	290,000	538.1	319,000	539.2	347,000	540.2	373,000	541.3	407,000
414.4	531.2	169,000	533.6	219,000	535.1	252,000	536.9	290,000	538.2	319,000	539.3	347,000	540.3	373,000	541.4	407,000
415	531.4	169,000	533.9	219,000	535.3	252,000	537.1	290,000	538.4	319,000	539.5	347,000	540.5	373,000	541.5	407,000
415.7	531.7	169,000	534.1	219,000	535.5	252,000	537.3	290,000	538.5	319,000	539.6	347,000	540.6	373,000	541.7	407,000
416	531.8	169,000	534.3	219,000	535.7	252,000	537.5	290,000	538.7	319,000	539.8	347,000	540.7	373,000	541.8	407,000
416.6	532.0	169,000	534.5	219,000	536.0	252,000	537.7	290,000	539.0	319,000	540.0	347,000	541.0	373,000	542.0	407,000
417	532.2	168,000	534.7	219,000	536.1	252,000	537.9	290,000	539.1	319,000	540.2	347,000	541.1	373,000	542.2	407,000
417.4	532.3	168,000	534.8	219,000	536.3	252,000	538.0	290,000	539.3	319,000	540.3	347,000	541.3	373,000	542.4	407,000
418	532.4	168,000	534.9	219,000	536.4	252,000	538.2	290,000	539.4	319,000	540.5	347,000	541.4	373,000	542.5	407,000
418.6	532.7	168,000	535.2	219,000	536.8	252,000	538.6	290,000	539.8	319,000	540.9	347,000	541.8	373,000	542.9	407,000
419	532.9	168,000	535.5	219,000	537.0	252,000	538.8	290,000	540.0	319,000	541.1	347,000	542.0	373,000	543.1	407,000
419.4	533.1	168,000	535.7	219,000	537.2	252,000	539.0	290,000	540.3	319,000	541.3	347,000	542.3	373,000	543.4	407,000
420	533.4	168,000	536.0	219,000	537.5	251,000	539.3	290,000	540.5	319,000	541.6	347,000	542.5	373,000	543.6	407,000
420.5	533.7	168,000	536.3	219,000	537.8	251,000	539.6	290,000	540.8	319,000	541.8	347,000	542.8	373,000	543.8	407,000
421	534.1	168,000	536.6	219,000	538.2	251,000	539.9	290,000	541.1	319,000	542.2	347,000	543.1	373,000	544.1	407,000
421.5	534.3	168,000	536.8	219,000	538.4	251,000	540.1	290,000	541.3	319,000	542.4	347,000	543.3	373,000	544.3	407,000
422	534.6	168,000	537.1	219,000	538.7	251,000	540.4	290,000	541.6	319,000	542.7	347,000	543.5	373,000	544.5	407,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
422.4	534.7	168,000	537.3	219,000	538.9	251,000	540.6	290,000	541.8	319,000	542.8	347,000	543.7	373,000	544.6	405,000
423	535.0	168,000	537.6	219,000	539.2	251,000	540.9	290,000	542.1	319,000	543.1	347,000	543.9	373,000	544.9	405,000
423.5	535.2	168,000	537.8	219,000	539.4	251,000	541.1	290,000	542.2	319,000	543.2	347,000	544.1	373,000	545.0	406,000
424	535.5	168,000	538.1	219,000	539.6	251,000	541.3	290,000	542.5	319,000	543.5	347,000	544.3	373,000	545.3	406,000
424.4	535.6	168,000	538.2	219,000	539.8	251,000	541.5	290,000	542.6	319,000	543.6	347,000	544.5	373,000	545.4	406,000
425	535.9	168,000	538.5	219,000	540.1	251,000	541.8	290,000	542.9	319,000	543.9	347,000	544.7	373,000	545.7	406,000
425.5	536.1	168,000	538.7	219,000	540.3	251,000	542.0	290,000	543.1	319,000	544.1	347,000	544.9	373,000	545.9	406,000
426	536.4	168,000	539.0	218,000	540.6	251,000	542.3	290,000	543.4	319,000	544.4	347,000	545.2	373,000	546.1	406,000
427	536.7	168,000	539.3	218,000	540.9	251,000	542.6	290,000	543.7	319,000	544.7	347,000	545.5	373,000	546.5	406,000
427.6	536.9	168,000	539.6	218,000	541.1	251,000	542.8	289,000	543.9	319,000	544.9	346,000	545.8	373,000	546.7	406,000
427.95	537.0	168,000	539.7	218,000	541.3	251,000	542.9	289,000	544.1	319,000	545.1	347,000	545.9	373,000	546.8	406,000
428	537.0	167,000	539.7	218,000	541.3	250,000	543.0	289,000	544.1	318,000	545.1	346,000	545.9	372,000	546.9	406,000
428.05	537.1	167,000	539.8	218,000	541.4	250,000	543.1	289,000	544.2	318,000	545.2	346,000	546.0	372,000	547.0	406,000
428.7	537.4	167,000	540.0	218,000	541.6	250,000	543.3	289,000	544.5	318,000	545.5	346,000	546.3	372,000	547.3	406,000
429	537.5	167,000	540.2	218,000	541.8	250,000	543.5	289,000	544.7	318,000	545.7	346,000	546.6	372,000	547.5	406,000
429.5	537.7	167,000	540.3	218,000	542.0	250,000	543.7	289,000	544.9	318,000	545.9	346,000	546.8	372,000	547.8	406,000
430	537.9	167,000	540.6	218,000	542.2	250,000	543.9	289,000	545.2	318,000	546.2	346,000	547.1	372,000	548.1	406,000
430.5	538.1	167,000	540.8	218,000	542.5	250,000	544.2	289,000	545.5	318,000	546.6	346,000	547.5	372,000	548.5	406,000
431	538.3	167,000	541.1	218,000	542.8	250,000	544.6	289,000	545.8	318,000	546.9	346,000	547.8	372,000	548.8	406,000
431.5	538.7	166,000	541.4	217,000	543.2	248,000	545.1	287,000	546.4	315,000	547.5	342,000	548.5	370,000	549.4	406,000
432	539.0	166,000	541.8	217,000	543.5	248,000	545.5	287,000	546.8	315,000	547.9	342,000	548.9	370,000	549.9	406,000
432.5	539.2	166,000	542.1	217,000	543.8	248,000	545.8	287,000	547.1	315,000	548.2	342,000	549.2	370,000	550.2	406,000
433	539.6	166,000	542.4	216,000	544.2	248,000	546.2	287,000	547.5	315,000	548.6	342,000	549.7	370,000	550.7	406,000
433.4	539.8	166,000	542.6	216,000	544.4	248,000	546.5	287,000	547.7	315,000	548.9	342,000	550.0	370,000	551.0	406,000
434	540.0	166,000	543.0	216,000	544.7	248,000	546.8	287,000	548.1	315,000	549.4	342,000	550.5	370,000	551.5	406,000
434.4	540.2	166,000	543.3	216,000	544.9	248,000	547.1	287,000	548.5	315,000	549.7	342,000	550.8	370,000	551.9	406,000
435	540.4	149,000	544.1	197,000	545.2	227,000	547.6	264,000	549.2	291,000	550.4	315,000	551.5	338,000	552.5	370,000
435.6	540.5	149,000	544.4	197,000	545.3	227,000	547.8	264,000	549.5	291,000	550.7	315,000	551.7	338,000	552.7	370,000
436	540.6	149,000	544.4	197,000	545.4	227,000	547.8	264,000	549.5	291,000	550.7	315,000	551.8	338,000	552.8	370,000
436.5	540.7	149,000	544.5	197,000	545.5	227,000	548.0	264,000	549.6	291,000	550.9	315,000	551.9	338,000	553.0	370,000
437	540.8	149,000	544.6	197,000	545.7	227,000	548.1	264,000	549.8	291,000	551.1	315,000	552.1	338,000	553.2	370,000
437.1	541.0	149,000	544.8	197,000	545.9	227,000	548.4	264,000	550.1	291,000	551.3	315,000	552.4	338,000	553.5	370,000
437.5	541.2	149,000	545.0	197,000	546.1	227,000	548.6	264,000	550.3	291,000	551.6	315,000	552.6	338,000	553.7	370,000
438	541.4	149,000	545.2	197,000	546.3	227,000	548.8	264,000	550.5	291,000	551.8	315,000	552.8	338,000	553.9	371,000
438.4	541.5	149,000	545.3	197,000	546.4	227,000	548.9	264,000	550.6	291,000	551.9	315,000	552.9	338,000	554.0	371,000
439	541.6	149,000	545.4	197,000	546.6	227,000	549.1	264,000	550.7	291,000	552.0	315,000	553.1	338,000	554.2	371,000
439.5	541.7	149,000	545.5	197,000	546.7	227,000	549.2	264,000	550.8	291,000	552.1	315,000	553.2	338,000	554.3	371,000
440	541.8	149,000	545.6	197,000	546.8	227,000	549.3	264,000	550.9	291,000	552.3	315,000	553.3	338,000	554.4	371,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
440.3	541.9	149,000	545.7	197,000	547.0	227,000	549.4	264,000	551.1	291,000	552.4	315,000	553.5	338,000	554.6	371,000
441	542.1	149,000	546.0	197,000	547.2	227,000	549.6	264,000	551.3	291,000	552.7	315,000	553.7	339,000	554.8	371,000
441.5	542.3	149,000	546.1	197,000	547.3	227,000	549.8	264,000	551.5	291,000	552.8	315,000	553.9	339,000	555.0	371,000
442	542.4	149,000	546.2	197,000	547.5	227,000	549.9	264,000	551.6	291,000	552.9	315,000	554.0	339,000	555.1	371,000
442.4	542.6	149,000	546.3	197,000	547.6	227,000	550.0	264,000	551.7	291,000	553.1	315,000	554.2	339,000	555.2	371,000
443	542.7	149,000	546.5	197,000	547.8	227,000	550.1	264,000	551.8	291,000	553.2	315,000	554.3	339,000	555.3	371,000
443.5	542.8	149,000	546.6	197,000	547.9	227,000	550.3	264,000	551.9	291,000	553.3	315,000	554.4	339,000	555.5	372,000
444	543.0	149,000	546.8	197,000	548.1	227,000	550.4	264,000	552.1	291,000	553.5	315,000	554.6	339,000	555.6	372,000
444.4	543.1	149,000	546.8	197,000	548.2	227,000	550.5	264,000	552.2	291,000	553.6	315,000	554.7	339,000	555.7	372,000
445	543.3	149,000	547.0	197,000	548.4	227,000	550.7	264,000	552.4	291,000	553.7	315,000	554.9	339,000	555.9	372,000
445.3	543.4	149,000	547.1	197,000	548.4	227,000	550.8	264,000	552.4	291,000	553.8	315,000	554.9	339,000	556.0	372,000
446	543.5	149,000	547.2	197,000	548.6	227,000	550.9	264,000	552.6	291,000	554.0	315,000	555.1	340,000	556.1	372,000
446.4	543.6	149,000	547.3	197,000	548.6	227,000	551.0	264,000	552.6	291,000	554.0	315,000	555.1	339,000	556.2	372,000
447	543.7	149,000	547.4	197,000	548.8	227,000	551.1	264,000	552.8	291,000	554.2	315,000	555.3	340,000	556.4	372,000
447.2	543.8	149,000	547.5	197,000	548.9	227,000	551.2	264,000	552.9	291,000	554.3	315,000	555.4	340,000	556.5	372,000
448	544.0	149,000	547.7	197,000	549.2	227,000	551.5	264,000	553.2	291,000	554.6	315,000	555.7	340,000	556.8	372,000
449	544.3	149,000	548.0	197,000	549.5	227,000	551.8	264,000	553.5	291,000	554.9	315,000	556.1	340,000	557.1	372,000
449.4	544.6	149,000	548.3	197,000	549.8	227,000	552.1	264,000	553.8	291,000	555.2	315,000	556.4	340,000	557.4	373,000
450	544.8	149,000	548.5	197,000	550.0	227,000	552.4	264,000	554.1	291,000	555.5	315,000	556.7	340,000	557.7	373,000
450.5	545.0	149,000	548.6	197,000	550.2	227,000	552.6	264,000	554.3	291,000	555.7	315,000	556.9	340,000	557.9	373,000
451	545.1	149,000	548.8	197,000	550.4	227,000	552.7	264,000	554.4	291,000	556.0	319,000	557.1	346,000	558.0	380,000
451.5	545.2	149,000	548.9	197,000	550.5	227,000	552.8	264,000	554.6	291,000	556.2	319,000	557.2	346,000	558.1	380,000
452	545.3	149,000	549.0	197,000	550.6	227,000	553.0	264,000	554.7	291,000	556.3	319,000	557.4	346,000	558.2	380,000
452.5	545.4	149,000	549.1	197,000	550.7	227,000	553.1	264,000	554.8	291,000	556.4	319,000	557.5	346,000	558.4	380,000
453	545.5	149,000	549.2	197,000	550.9	227,000	553.2	264,000	555.0	291,000	556.6	319,000	557.7	346,000	558.6	380,000
453.6	545.7	149,000	549.4	197,000	551.1	227,000	553.4	264,000	555.2	291,000	556.8	319,000	557.9	346,000	558.8	380,000
454	545.8	149,000	549.5	197,000	551.2	227,000	553.6	264,000	555.3	291,000	557.0	319,000	558.1	346,000	559.0	379,000
454.3	545.9	149,000	549.6	197,000	551.2	227,000	553.6	264,000	555.4	291,000	557.0	319,000	558.2	346,000	559.1	379,000
454.7	546.0	149,000	549.7	197,000	551.3	227,000	553.7	264,000	555.5	291,000	557.1	319,000	558.3	346,000	559.2	379,000
455	546.0	149,000	549.7	197,000	551.3	227,000	553.7	264,000	555.5	291,000	557.1	319,000	558.3	346,000	559.2	379,000
455.6	546.1	149,000	549.7	197,000	551.3	227,000	553.8	264,000	555.5	291,000	557.2	319,000	558.3	346,000	559.3	379,000
455.9	546.1	149,000	549.8	197,000	551.4	227,000	553.9	264,000	555.6	291,000	557.3	319,000	558.4	346,000	559.4	379,000
456	546.2	149,000	549.8	197,000	551.5	227,000	553.9	264,000	555.7	291,000	557.4	318,000	558.5	346,000	559.5	379,000
456.6	546.4	149,000	550.0	197,000	551.7	227,000	554.1	264,000	555.9	291,000	557.6	318,000	558.7	346,000	559.8	379,000
457	546.4	149,000	550.0	197,000	551.7	227,000	554.2	264,000	556.0	291,000	557.7	318,000	558.8	346,000	559.9	379,000
457.2	546.9	149,000	550.5	197,000	552.2	227,000	554.7	264,000	556.5	291,000	558.2	318,000	559.3	346,000	560.4	379,000
457.6	547.1	149,000	550.7	197,000	552.4	227,000	554.9	264,000	556.7	291,000	558.4	318,000	559.5	346,000	560.6	379,000
458	547.1	149,000	550.8	197,000	552.5	227,000	555.0	264,000	556.8	291,000	558.4	318,000	559.6	346,000	560.7	379,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
458.6	547.2	149,000	550.9	197,000	552.6	227,000	555.1	264,000	556.9	291,000	558.5	318,000	559.8	346,000	560.8	379,000
459	547.4	149,000	550.9	197,000	552.7	227,000	555.2	264,000	557.0	291,000	558.7	318,000	559.9	346,000	560.9	380,000
459.5	547.5	149,000	551.0	197,000	552.8	227,000	555.3	264,000	557.1	291,000	558.8	318,000	560.0	346,000	561.1	380,000
460	547.6	149,000	551.1	197,000	552.8	227,000	555.3	264,000	557.2	291,000	558.9	318,000	560.1	346,000	561.2	380,000
460.5	547.8	149,000	551.2	197,000	552.9	227,000	555.4	264,000	557.3	291,000	559.0	318,000	560.2	345,000	561.3	379,000
461	548.0	149,000	551.3	197,000	553.0	227,000	555.5	264,000	557.4	291,000	559.1	318,000	560.3	345,000	561.4	379,000
461.5	548.2	149,000	551.4	197,000	553.1	227,000	555.6	264,000	557.5	291,000	559.2	318,000	560.4	345,000	561.6	379,000
462	548.3	149,000	551.5	197,000	553.2	227,000	555.7	264,000	557.6	291,000	559.2	318,000	560.5	345,000	561.7	379,000
462.5	548.3	149,000	551.5	197,000	553.2	227,000	555.7	264,000	557.6	291,000	559.3	318,000	560.5	345,000	561.7	379,000
463	548.4	149,000	551.5	197,000	553.3	227,000	555.8	264,000	557.7	291,000	559.4	318,000	560.7	345,000	561.9	379,000
463.6	548.5	149,000	551.6	197,000	553.4	227,000	555.9	264,000	557.8	291,000	559.5	318,000	560.8	345,000	562.0	379,000
464	548.7	149,000	551.8	197,000	553.5	227,000	556.0	264,000	557.9	291,000	559.6	318,000	560.9	345,000	562.1	379,000
464.5	548.9	149,000	551.9	197,000	553.6	227,000	556.1	264,000	558.1	291,000	559.7	318,000	561.0	345,000	562.2	379,000
465	549.2	149,000	552.2	197,000	553.8	227,000	556.3	264,000	558.2	291,000	559.9	318,000	561.1	345,000	562.4	379,000
465.5	549.5	149,000	552.5	197,000	554.1	227,000	556.6	264,000	558.4	291,000	560.0	318,000	561.3	345,000	562.6	379,000
466	549.7	149,000	552.7	197,000	554.3	227,000	556.7	264,000	558.6	290,000	560.2	318,000	561.4	344,000	562.7	378,000
466.5	550.0	149,000	552.9	197,000	554.5	227,000	556.9	264,000	558.7	290,000	560.3	318,000	561.6	344,000	562.8	378,000
467	550.4	149,000	553.2	197,000	554.8	227,000	557.2	264,000	559.0	290,000	560.5	318,000	561.8	344,000	563.0	378,000
467.6	550.7	149,000	553.5	197,000	555.1	227,000	557.4	264,000	559.1	290,000	560.7	317,000	561.9	344,000	563.1	378,000
468	550.9	149,000	553.7	197,000	555.3	227,000	557.6	264,000	559.3	290,000	560.8	317,000	562.1	344,000	563.3	378,000
469	551.3	149,000	554.1	197,000	555.7	227,000	557.9	264,000	559.6	290,000	561.1	317,000	562.4	344,000	563.6	378,000
469.5	551.5	149,000	554.3	197,000	555.9	227,000	558.1	264,000	559.8	290,000	561.3	317,000	562.6	344,000	563.8	378,000
470	551.6	149,000	554.5	197,000	556.0	227,000	558.3	264,000	560.0	290,000	561.5	317,000	562.7	344,000	563.9	378,000
470.6	551.9	149,000	554.7	197,000	556.3	227,000	558.5	264,000	560.2	290,000	561.7	317,000	562.9	344,000	564.1	378,000
471	552.1	149,000	554.9	197,000	556.5	227,000	558.7	264,000	560.4	290,000	561.9	317,000	563.1	344,000	564.3	378,000
471.5	552.3	149,000	555.1	197,000	556.7	227,000	558.9	264,000	560.6	290,000	562.0	317,000	563.2	344,000	564.5	378,000
472	552.5	149,000	555.3	197,000	556.9	227,000	559.0	264,000	560.7	290,000	562.2	317,000	563.4	344,000	564.6	378,000
472.6	552.6	149,000	555.4	197,000	557.0	227,000	559.2	264,000	560.8	290,000	562.3	317,000	563.5	344,000	564.7	378,000
473	552.7	149,000	555.5	197,000	557.1	227,000	559.3	264,000	560.9	290,000	562.4	317,000	563.6	344,000	564.8	377,000
473.5	552.8	149,000	555.7	197,000	557.2	227,000	559.4	264,000	561.1	290,000	562.5	317,000	563.8	344,000	565.0	377,000
474	553.0	149,000	555.9	197,000	557.5	227,000	559.7	264,000	561.3	290,000	562.8	317,000	564.0	344,000	565.2	377,000
474.5	553.2	149,000	556.1	197,000	557.6	227,000	559.8	264,000	561.5	290,000	562.9	317,000	564.2	344,000	565.4	377,000
475	553.4	149,000	556.3	197,000	557.9	227,000	560.0	264,000	561.7	290,000	563.1	317,000	564.4	344,000	565.6	377,000
476	553.7	149,000	556.6	197,000	558.2	227,000	560.4	264,000	562.0	290,000	563.5	317,000	564.7	344,000	565.9	377,000
476.5	553.9	149,000	556.8	197,000	558.5	227,000	560.6	264,000	562.2	290,000	563.7	317,000	564.9	344,000	566.1	377,000
477	554.2	149,000	557.1	197,000	558.7	227,000	560.8	264,000	562.5	290,000	563.9	317,000	565.1	344,000	566.3	377,000
477.6	554.4	149,000	557.3	197,000	558.9	227,000	561.0	264,000	562.6	290,000	564.0	317,000	565.2	343,000	566.5	377,000
477.9	554.4	149,000	557.3	197,000	559.0	227,000	561.1	264,000	562.7	290,000	564.1	317,000	565.3	343,000	566.6	377,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
478.2	554.6	149,000	557.5	197,000	559.1	227,000	561.2	264,000	562.8	290,000	564.2	317,000	565.4	343,000	566.7	377,000
478.25	554.6	149,000	557.5	197,000	559.1	227,000	561.2	264,000	562.8	290,000	564.2	317,000	565.4	343,000	566.7	377,000
478.3	554.6	149,000	557.5	197,000	559.2	227,000	561.2	264,000	562.9	290,000	564.3	317,000	565.5	343,000	566.7	377,000
478.6	554.7	149,000	557.6	197,000	559.3	227,000	561.3	264,000	562.9	290,000	564.4	317,000	565.6	343,000	566.8	377,000
479	554.9	149,000	557.7	197,000	559.4	227,000	561.3	264,000	563.0	290,000	564.5	317,000	565.7	343,000	566.9	377,000
480	555.3	134,000	558.0	179,000	559.5	207,000	561.2	241,000	563.0	266,000	564.6	290,000	565.8	314,000	567.1	345,000
480.1	555.4	134,000	558.1	179,000	559.6	207,000	561.3	241,000	563.1	266,000	564.6	290,000	565.8	314,000	567.1	345,000
480.7	555.6	134,000	558.3	179,000	559.9	207,000	561.5	241,000	563.3	266,000	564.8	290,000	566.0	314,000	567.3	345,000
481	555.7	134,000	558.4	179,000	560.0	207,000	561.6	241,000	563.4	266,000	564.9	290,000	566.1	314,000	567.4	345,000
481.5	555.9	134,000	558.5	179,000	560.2	207,000	561.8	241,000	563.6	266,000	565.2	290,000	566.3	314,000	567.6	345,000
482	556.0	134,000	558.6	179,000	560.3	207,000	561.9	241,000	563.7	266,000	565.3	290,000	566.5	314,000	567.8	345,000
482.1	556.0	134,000	558.6	179,000	560.3	207,000	562.0	241,000	563.8	266,000	565.3	290,000	566.5	314,000	567.8	345,000
482.3	556.1	134,000	558.7	179,000	560.4	207,000	562.1	241,000	563.9	266,000	565.4	290,000	566.6	314,000	567.9	345,000
482.7	556.2	134,000	558.9	179,000	560.6	207,000	562.3	241,000	564.1	266,000	565.6	290,000	566.8	314,000	568.1	345,000
482.9	561.0	134,000	561.0	179,000	561.5	207,000	562.9	241,000	564.7	266,000	566.3	290,000	567.5	314,000	568.8	345,000
483	561.0	134,000	561.1	179,000	561.6	207,000	563.1	241,000	564.9	266,000	566.4	290,000	567.6	314,000	568.9	345,000
483.15	561.1	134,000	561.1	179,000	561.7	207,000	563.3	241,000	565.1	266,000	566.6	290,000	567.8	314,000	569.1	345,000
483.3	561.1	134,000	561.2	179,000	561.9	207,000	563.4	241,000	565.2	266,000	566.8	290,000	568.0	314,000	569.3	345,000
483.45	561.2	134,000	561.3	179,000	562.0	207,000	563.6	241,000	565.4	265,000	567.0	290,000	568.2	314,000	569.5	345,000
483.6	561.2	134,000	561.3	179,000	562.1	207,000	563.7	241,000	565.6	265,000	567.2	290,000	568.4	314,000	569.7	345,000
484	561.3	134,000	561.5	179,000	562.3	207,000	564.0	241,000	565.9	265,000	567.5	290,000	568.7	314,000	570.0	345,000
484.4	561.5	134,000	561.7	179,000	562.6	207,000	564.3	241,000	566.2	265,000	567.9	290,000	569.1	314,000	570.4	345,000
484.7	561.5	134,000	561.8	179,000	562.8	207,000	564.5	241,000	566.5	265,000	568.1	290,000	569.4	313,000	570.7	345,000
485	561.7	134,000	562.0	179,000	563.1	207,000	564.9	241,000	566.8	265,000	568.5	290,000	569.8	313,000	571.0	345,000
485.4	561.9	134,000	562.5	179,000	563.6	207,000	565.3	241,000	567.4	265,000	569.1	290,000	570.3	313,000	571.6	345,000
485.8	562.2	134,000	562.9	179,000	564.1	207,000	565.9	241,000	567.9	265,000	569.6	290,000	570.9	313,000	572.2	345,000
486	562.4	134,000	563.3	179,000	564.5	207,000	566.3	241,000	568.3	265,000	570.0	290,000	571.3	313,000	572.6	345,000
487	562.9	134,000	564.0	179,000	565.2	207,000	567.1	241,000	569.0	265,000	570.7	290,000	572.0	313,000	573.3	345,000
487.6	563.2	134,000	564.5	179,000	565.7	207,000	567.6	241,000	569.5	265,000	571.2	290,000	572.5	313,000	573.9	345,000
487.8	563.3	134,000	564.7	179,000	566.0	207,000	567.9	241,000	569.8	265,000	571.5	290,000	572.8	313,000	574.2	345,000
488	563.5	134,000	564.9	178,000	566.3	206,000	568.2	241,000	570.1	265,000	571.7	289,000	573.0	313,000	574.4	344,000
488.6	563.9	134,000	565.4	178,000	566.7	206,000	568.6	241,000	570.5	265,000	572.1	289,000	573.4	313,000	574.8	344,000
489	564.1	134,000	565.7	178,000	567.1	206,000	569.0	241,000	570.9	265,000	572.5	289,000	573.8	313,000	575.2	344,000
489.5	564.4	134,000	566.0	178,000	567.4	206,000	569.3	241,000	571.2	265,000	572.8	289,000	574.1	313,000	575.6	344,000
489.75	564.6	134,000	566.3	178,000	567.7	206,000	569.6	241,000	571.4	265,000	573.1	289,000	574.4	313,000	575.8	344,000
490	564.8	134,000	566.5	178,000	567.9	206,000	569.8	241,000	571.7	265,000	573.3	289,000	574.6	313,000	576.1	344,000
490.6	565.2	134,000	567.0	178,000	568.4	206,000	570.3	241,000	572.2	265,000	573.8	289,000	575.1	313,000	576.6	344,000
491	565.5	134,000	567.3	178,000	568.8	206,000	570.7	241,000	572.5	265,000	574.1	289,000	575.4	313,000	576.9	344,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
491.3	565.8	134,000	567.6	178,000	569.1	206,000	571.0	241,000	572.8	265,000	574.4	289,000	575.7	313,000	577.1	344,000
492	566.1	134,000	568.0	178,000	569.4	206,000	571.3	241,000	573.1	265,000	574.7	289,000	576.0	313,000	577.4	344,000
492.5	566.3	134,000	568.2	178,000	569.7	206,000	571.6	241,000	573.3	265,000	574.9	289,000	576.2	313,000	577.7	344,000
493	566.5	134,000	568.4	178,000	569.9	206,000	571.8	241,000	573.6	265,000	575.2	289,000	576.5	313,000	578.0	344,000
493.2	566.6	134,000	568.5	178,000	569.9	206,000	571.8	241,000	573.6	265,000	575.2	289,000	576.5	313,000	578.0	344,000
493.4	572.0	134,000	572.0	178,000	572.2	206,000	574.1	241,000	576.1	265,000	577.8	289,000	579.2	313,000	581.0	344,000
494	572.2	134,000	572.2	178,000	572.7	206,000	574.7	241,000	576.5	265,000	578.2	289,000	579.6	313,000	581.3	344,000
494.6	572.3	134,000	572.4	178,000	573.1	206,000	575.1	240,000	576.9	265,000	578.5	289,000	579.9	313,000	581.6	344,000
495	572.4	134,000	572.5	178,000	573.4	206,000	575.4	240,000	577.2	265,000	578.8	289,000	580.1	313,000	581.8	344,000
495.3	572.6	134,000	572.7	178,000	573.8	206,000	575.8	240,000	577.6	265,000	579.1	289,000	580.5	313,000	582.1	344,000
496	572.9	134,000	573.0	178,000	574.4	206,000	576.4	240,000	578.1	265,000	579.6	289,000	581.0	313,000	582.6	344,000
496.5	573.2	134,000	573.4	178,000	575.1	206,000	577.1	240,000	578.7	265,000	580.2	289,000	581.5	313,000	583.1	344,000
496.8	573.4	134,000	573.7	178,000	575.4	206,000	577.5	240,000	579.0	265,000	580.5	289,000	581.8	313,000	583.3	344,000
497.1	573.5	134,000	573.9	178,000	575.7	206,000	577.8	240,000	579.3	265,000	580.8	289,000	582.1	313,000	583.6	344,000
498	573.7	134,000	574.3	178,000	576.1	206,000	578.2	240,000	579.8	265,000	581.3	289,000	582.6	313,000	584.1	344,000
498.5	573.8	134,000	574.5	178,000	576.4	206,000	578.5	240,000	580.1	265,000	581.6	289,000	582.9	313,000	584.4	344,000
499	574.0	134,000	574.7	178,000	576.6	206,000	578.7	240,000	580.3	265,000	581.8	289,000	583.1	313,000	584.7	344,000
499.5	574.2	134,000	575.0	178,000	576.9	206,000	579.1	240,000	580.6	265,000	582.1	289,000	583.4	313,000	585.0	344,000
500	574.3	134,000	575.2	178,000	577.2	206,000	579.3	240,000	580.9	265,000	582.3	289,000	583.7	313,000	585.2	344,000
500.5	574.4	134,000	575.4	178,000	577.4	206,000	579.5	240,000	581.1	265,000	582.5	289,000	583.9	313,000	585.4	344,000
501	574.5	134,000	575.6	178,000	577.6	206,000	579.7	240,000	581.3	265,000	582.7	289,000	584.0	313,000	585.6	344,000
501.5	574.6	134,000	575.8	178,000	577.8	206,000	579.9	240,000	581.5	265,000	582.9	289,000	584.3	313,000	585.8	344,000
501.74	574.7	134,000	575.9	178,000	577.9	206,000	580.0	240,000	581.6	265,000	583.1	289,000	584.4	313,000	585.9	344,000
502	574.8	134,000	576.0	178,000	578.0	206,000	580.2	240,000	581.7	265,000	583.2	289,000	584.5	313,000	586.1	344,000
502.5	575.0	134,000	576.3	178,000	578.3	206,000	580.4	240,000	582.0	265,000	583.5	289,000	584.8	313,000	586.4	344,000
502.9	575.1	134,000	576.4	178,000	578.4	206,000	580.6	240,000	582.2	265,000	583.7	289,000	585.0	313,000	586.6	344,000
503.1	575.2	134,000	576.6	178,000	578.6	206,000	580.8	240,000	582.3	265,000	583.8	289,000	585.1	313,000	586.7	344,000
503.3	575.3	134,000	576.8	178,000	578.8	206,000	581.0	240,000	582.5	265,000	584.0	289,000	585.3	313,000	586.8	344,000
504	575.8	134,000	577.3	178,000	579.3	206,000	581.3	240,000	582.8	265,000	584.2	289,000	585.5	313,000	587.1	344,000
505	576.2	134,000	577.8	178,000	579.8	206,000	581.8	240,000	583.3	265,000	584.6	289,000	585.9	313,000	587.4	344,000
505.5	576.5	134,000	578.2	178,000	580.1	206,000	582.1	240,000	583.6	265,000	584.9	289,000	586.2	313,000	587.7	344,000
506	576.7	134,000	578.5	178,000	580.4	206,000	582.4	240,000	583.8	265,000	585.2	289,000	586.4	313,000	587.8	344,000
506.9	576.9	134,000	578.8	178,000	580.7	206,000	582.7	240,000	584.1	265,000	585.6	289,000	586.8	313,000	588.1	344,000
507.4	577.2	131,000	579.2	174,000	581.1	202,000	583.1	235,000	584.7	260,000	586.1	283,000	587.3	307,000	588.6	337,000
507.9	577.4	131,000	579.5	174,000	581.4	202,000	583.4	235,000	585.0	260,000	586.4	283,000	587.6	307,000	588.9	337,000
508.6	577.7	131,000	579.8	174,000	581.7	202,000	583.7	235,000	585.3	260,000	586.7	283,000	587.9	307,000	589.2	337,000
509	577.8	131,000	580.0	174,000	581.9	202,000	583.9	235,000	585.5	260,000	586.9	283,000	588.1	307,000	589.3	337,000
509.3	578.0	131,000	580.2	174,000	582.1	202,000	584.1	235,000	585.7	260,000	587.1	283,000	588.3	307,000	589.5	337,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
510.1	578.3	131,000	580.6	174,000	582.5	202,000	584.5	235,000	586.1	260,000	587.5	283,000	588.6	306,000	589.8	337,000
511	578.5	131,000	580.9	174,000	582.8	202,000	584.8	235,000	586.4	259,000	587.8	283,000	588.9	306,000	590.1	337,000
511.6	578.7	131,000	581.1	174,000	583.1	202,000	585.1	235,000	586.6	259,000	588.0	283,000	589.1	306,000	590.3	337,000
512	578.9	131,000	581.4	174,000	583.3	202,000	585.4	235,000	586.9	259,000	588.3	283,000	589.4	306,000	590.6	337,000
512.7	579.1	131,000	581.6	174,000	583.6	202,000	585.6	235,000	587.2	259,000	588.6	283,000	589.7	306,000	590.9	337,000
513	579.2	131,000	581.8	174,000	583.8	202,000	585.9	235,000	587.4	259,000	588.9	283,000	590.0	306,000	591.2	337,000
514	579.5	131,000	582.2	174,000	584.1	202,000	586.3	235,000	587.8	259,000	589.3	283,000	590.4	306,000	591.5	337,000
514.4	579.7	131,000	582.4	174,000	584.3	202,000	586.5	235,000	588.0	259,000	589.5	283,000	590.6	306,000	591.7	337,000
515	579.9	131,000	582.6	174,000	584.6	202,000	586.7	235,000	588.3	259,000	589.8	283,000	590.9	306,000	592.0	337,000
515.5	580.1	131,000	582.9	174,000	584.9	202,000	587.0	235,000	588.6	259,000	590.0	283,000	591.1	306,000	592.3	337,000
516	580.4	131,000	583.1	174,000	585.1	202,000	587.2	235,000	588.8	259,000	590.2	283,000	591.3	306,000	592.5	337,000
516.6	580.5	131,000	583.3	174,000	585.3	202,000	587.4	235,000	589.0	259,000	590.4	283,000	591.5	306,000	592.7	337,000
517	580.6	131,000	583.4	174,000	585.4	202,000	587.6	235,000	589.1	259,000	590.6	283,000	591.7	306,000	592.8	337,000
517.7	580.8	131,000	583.6	174,000	585.6	202,000	587.8	235,000	589.4	259,000	590.8	283,000	591.9	306,000	593.0	337,000
517.95	580.8	131,000	583.6	174,000	585.6	202,000	587.9	235,000	589.5	259,000	590.9	283,000	592.0	306,000	593.2	337,000
518	580.9	131,000	583.7	174,000	585.7	202,000	587.9	235,000	589.5	259,000	590.9	283,000	592.0	306,000	593.1	337,000
518.05	580.8	131,000	583.7	174,000	585.7	202,000	587.9	235,000	589.5	259,000	591.0	283,000	592.1	306,000	593.2	337,000
518.1	580.9	131,000	583.7	174,000	585.8	202,000	588.0	235,000	589.6	259,000	591.0	283,000	592.1	306,000	593.2	337,000
518.15	581.0	131,000	583.8	174,000	585.9	202,000	588.1	235,000	589.7	259,000	591.2	283,000	592.3	306,000	593.4	337,000
518.4	581.1	131,000	584.0	174,000	586.0	202,000	588.3	235,000	589.9	259,000	591.4	283,000	592.5	306,000	593.6	337,000
519.1	581.3	131,000	584.2	174,000	586.3	202,000	588.6	235,000	590.2	259,000	591.7	283,000	592.8	306,000	593.9	337,000
519.6	581.4	131,000	584.3	174,000	586.4	202,000	588.7	235,000	590.4	259,000	591.9	283,000	593.0	306,000	594.1	337,000
519.75	581.4	131,000	584.4	174,000	586.5	202,000	588.8	235,000	590.4	259,000	591.9	283,000	593.0	306,000	594.2	337,000
519.9	581.5	131,000	584.4	174,000	586.5	202,000	588.8	235,000	590.5	259,000	592.0	283,000	593.1	306,000	594.2	337,000
519.95	581.5	131,000	584.5	174,000	586.6	202,000	588.9	235,000	590.6	259,000	592.1	283,000	593.2	306,000	594.3	337,000
520	581.6	131,000	584.5	174,000	586.6	202,000	589.0	235,000	590.6	259,000	592.2	283,000	593.3	306,000	594.4	337,000
520.4	581.7	131,000	584.7	174,000	586.8	202,000	589.2	235,000	590.8	259,000	592.4	283,000	593.5	306,000	594.7	337,000
520.6	581.8	131,000	584.8	174,000	586.9	202,000	589.3	235,000	591.0	259,000	592.6	283,000	593.7	306,000	594.9	337,000
521	581.9	131,000	585.0	174,000	587.1	202,000	589.5	235,000	591.2	259,000	592.8	283,000	593.9	306,000	595.1	337,000
521.2	581.9	131,000	585.0	174,000	587.2	202,000	589.6	235,000	591.3	259,000	592.9	283,000	594.0	306,000	595.2	337,000
521.7	582.0	131,000	585.1	174,000	587.3	202,000	589.8	235,000	591.5	259,000	593.1	283,000	594.3	306,000	595.5	337,000
522.2	582.1	131,000	585.2	174,000	587.4	202,000	589.9	235,000	591.6	259,000	593.2	283,000	594.4	306,000	595.6	337,000
522.3	582.1	131,000	585.3	174,000	587.5	202,000	589.9	235,000	591.7	259,000	593.3	283,000	594.5	306,000	595.7	337,000
522.4	582.1	131,000	585.3	174,000	587.5	202,000	590.0	235,000	591.7	259,000	593.3	283,000	594.5	306,000	595.7	337,000
522.5	582.2	131,000	585.3	174,000	587.5	202,000	590.0	235,000	591.7	259,000	593.3	283,000	594.5	306,000	595.8	337,000
522.6	583.0	131,000	585.7	174,000	587.9	202,000	590.4	235,000	592.1	259,000	593.7	283,000	594.9	306,000	596.2	337,000
522.7	583.1	131,000	585.9	174,000	588.0	201,000	590.5	235,000	592.2	259,000	593.8	283,000	595.0	306,000	596.2	337,000
522.8	583.1	131,000	585.9	174,000	588.1	201,000	590.5	235,000	592.2	259,000	593.8	283,000	595.0	306,000	596.2	337,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
523.1	583.2	131,000	586.0	174,000	588.1	201,000	590.6	235,000	592.3	259,000	593.9	283,000	595.0	306,000	596.3	337,000
523.6	583.3	131,000	586.1	174,000	588.2	201,000	590.7	235,000	592.4	259,000	593.9	283,000	595.1	306,000	596.3	337,000
524	583.4	131,000	586.1	174,000	588.2	201,000	590.7	235,000	592.4	259,000	594.0	283,000	595.1	306,000	596.4	336,000
524.5	583.6	131,000	586.2	174,000	588.3	201,000	590.8	235,000	592.4	259,000	594.0	283,000	595.2	306,000	596.4	336,000
525	583.8	131,000	586.3	174,000	588.4	201,000	590.8	235,000	592.5	259,000	594.0	283,000	595.2	306,000	596.4	336,000
526	584.1	131,000	586.5	174,000	588.5	201,000	590.9	235,000	592.5	259,000	594.1	283,000	595.2	306,000	596.5	336,000
526.6	584.2	131,000	586.6	174,000	588.5	201,000	590.9	235,000	592.6	259,000	594.1	283,000	595.2	306,000	596.5	336,000
527	584.4	131,000	586.7	174,000	588.6	201,000	591.0	235,000	592.6	259,000	594.1	283,000	595.3	306,000	596.5	336,000
528	584.7	131,000	586.9	174,000	588.7	201,000	591.1	235,000	592.7	259,000	594.2	283,000	595.3	306,000	596.6	336,000
528.5	584.9	131,000	587.0	174,000	588.8	201,000	591.1	235,000	592.7	259,000	594.2	282,000	595.3	306,000	596.6	336,000
529	585.1	131,000	587.2	174,000	589.0	201,000	591.2	235,000	592.8	259,000	594.3	282,000	595.4	306,000	596.6	336,000
529.7	585.3	131,000	587.4	174,000	589.1	201,000	591.3	235,000	592.9	259,000	594.4	282,000	595.5	306,000	596.7	336,000
530	585.5	130,000	587.5	174,000	589.2	201,000	591.4	235,000	593.0	259,000	594.4	282,000	595.5	306,000	596.8	336,000
530.9	585.7	130,000	587.8	174,000	589.4	201,000	591.6	235,000	593.1	259,000	594.5	282,000	595.7	306,000	596.9	336,000
531.7	586.0	130,000	588.1	174,000	589.7	201,000	591.8	235,000	593.3	259,000	594.7	282,000	595.8	306,000	597.1	336,000
532.3	586.2	130,000	588.3	174,000	589.9	201,000	592.0	235,000	593.4	259,000	594.8	282,000	595.9	306,000	597.1	336,000
532.55	586.3	130,000	588.4	174,000	590.0	201,000	592.0	235,000	593.5	259,000	594.8	282,000	596.0	306,000	597.2	336,000
532.8	586.5	130,000	588.5	174,000	590.1	201,000	592.2	235,000	593.6	259,000	594.9	282,000	596.1	306,000	597.3	336,000
533.5	586.7	130,000	588.8	174,000	590.4	201,000	592.5	235,000	593.9	259,000	595.2	282,000	596.2	306,000	597.5	336,000
534.1	586.9	130,000	589.0	174,000	590.6	201,000	592.7	234,000	594.1	259,000	595.3	282,000	596.4	305,000	597.6	336,000
535.1	587.1	130,000	589.3	174,000	590.9	201,000	593.0	234,000	594.3	259,000	595.5	282,000	596.5	305,000	597.8	336,000
535.5	587.2	130,000	589.5	174,000	591.1	201,000	593.2	234,000	594.5	259,000	595.7	282,000	596.7	305,000	597.9	336,000
535.7	587.3	130,000	589.6	174,000	591.2	201,000	593.3	234,000	594.7	259,000	595.8	282,000	596.9	305,000	598.0	336,000
535.9	587.4	130,000	589.7	173,000	591.4	200,000	593.4	234,000	594.8	258,000	595.9	281,000	597.0	305,000	598.1	335,000
536.4	587.6	130,000	589.9	173,000	591.6	200,000	593.7	234,000	595.0	258,000	596.1	281,000	597.2	305,000	598.4	335,000
537.1	587.9	130,000	590.3	173,000	591.9	200,000	594.0	234,000	595.3	258,000	596.5	281,000	597.5	305,000	598.7	335,000
537.7	588.1	130,000	590.6	173,000	592.3	200,000	594.3	234,000	595.6	258,000	596.8	281,000	597.8	304,000	598.9	335,000
538.1	588.3	130,000	590.7	173,000	592.5	200,000	594.6	234,000	595.9	258,000	597.0	281,000	598.0	304,000	599.2	335,000
538.5	588.5	130,000	591.0	173,000	592.8	200,000	594.8	234,000	596.1	258,000	597.3	281,000	598.3	304,000	599.4	335,000
538.8	588.7	130,000	591.2	173,000	593.0	200,000	595.0	234,000	596.3	258,000	597.4	281,000	598.4	304,000	599.6	335,000
539.1	588.8	130,000	591.4	173,000	593.1	200,000	595.2	234,000	596.5	258,000	597.6	281,000	598.6	304,000	599.8	335,000
539.9	589.1	130,000	591.6	173,000	593.4	200,000	595.4	234,000	596.7	258,000	597.8	281,000	598.8	304,000	600.0	335,000
540.6	589.2	130,000	591.8	173,000	593.5	200,000	595.6	234,000	596.9	258,000	598.0	281,000	599.0	304,000	600.1	335,000
541.2	589.4	130,000	592.0	173,000	593.7	200,000	595.7	234,000	597.0	258,000	598.1	281,000	599.1	304,000	600.2	335,000
541.8	589.6	130,000	592.2	173,000	593.9	200,000	595.9	234,000	597.2	258,000	598.3	281,000	599.3	304,000	600.4	335,000
542.6	589.8	130,000	592.4	173,000	594.1	200,000	596.2	233,000	597.4	257,000	598.5	281,000	599.5	304,000	600.6	334,000
543.3	590.1	130,000	592.7	173,000	594.4	200,000	596.4	233,000	597.7	257,000	598.8	281,000	599.7	304,000	600.9	334,000
543.7	590.3	130,000	592.9	173,000	594.6	200,000	596.6	233,000	597.9	257,000	598.9	281,000	599.9	304,000	601.0	334,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
544.3	590.6	130,000	593.2	173,000	594.9	200,000	596.9	233,000	598.1	257,000	599.2	281,000	600.1	304,000	601.3	334,000
544.8	590.7	130,000	593.3	173,000	595.0	200,000	597.0	233,000	598.3	257,000	599.3	281,000	600.3	304,000	601.4	334,000
545.4	590.9	130,000	593.5	172,000	595.2	200,000	597.2	233,000	598.4	257,000	599.4	280,000	600.4	303,000	601.5	333,000
546	591.0	129,000	593.7	172,000	595.4	200,000	597.4	233,000	598.6	257,000	599.6	280,000	600.5	303,000	601.7	333,000
546.4	591.2	129,000	593.9	172,000	595.6	200,000	597.6	233,000	598.7	257,000	599.7	280,000	600.7	303,000	601.9	333,000
547	591.4	129,000	594.2	172,000	595.9	200,000	597.9	233,000	599.0	257,000	600.0	280,000	601.0	303,000	602.2	333,000
547.5	591.6	129,000	594.3	172,000	596.1	200,000	598.1	233,000	599.2	257,000	600.2	280,000	601.2	303,000	602.4	333,000
548.1	591.8	129,000	594.6	172,000	596.3	200,000	598.3	233,000	599.5	257,000	600.5	280,000	601.5	303,000	602.7	333,000
548.6	591.9	129,000	594.7	172,000	596.4	200,000	598.5	233,000	599.6	257,000	600.7	280,000	601.7	303,000	602.9	333,000
549.1	592.1	127,000	595.0	169,000	596.6	196,000	598.7	229,000	599.9	252,000	600.9	275,000	601.9	298,000	603.1	328,000
549.7	592.3	127,000	595.2	169,000	596.9	196,000	598.9	229,000	600.1	252,000	601.2	275,000	602.2	298,000	603.4	328,000
550.05	592.4	127,000	595.4	169,000	597.0	196,000	599.0	229,000	600.3	252,000	601.3	275,000	602.3	298,000	603.5	328,000
550.4	592.5	127,000	595.5	169,000	597.1	196,000	599.2	229,000	600.4	252,000	601.5	275,000	602.5	298,000	603.6	328,000
551	592.6	127,000	595.6	169,000	597.2	196,000	599.3	229,000	600.5	252,000	601.6	275,000	602.6	298,000	603.7	328,000
552	592.8	127,000	595.8	169,000	597.4	196,000	599.4	229,000	600.7	252,000	601.7	275,000	602.7	298,000	603.9	327,000
552.8	593.0	127,000	595.9	169,000	597.6	196,000	599.6	229,000	600.9	252,000	601.9	275,000	602.9	298,000	604.1	327,000
553.3	593.2	127,000	596.1	169,000	597.8	196,000	599.8	229,000	601.0	252,000	602.1	275,000	603.1	298,000	604.2	327,000
554	593.4	127,000	596.3	169,000	597.9	196,000	600.0	229,000	601.2	252,000	602.2	275,000	603.2	298,000	604.4	327,000
554.5	593.5	127,000	596.4	169,000	598.0	196,000	600.1	229,000	601.3	252,000	602.3	275,000	603.3	298,000	604.5	327,000
555.2	593.6	127,000	596.5	169,000	598.1	196,000	600.2	229,000	601.4	252,000	602.4	275,000	603.4	298,000	604.6	327,000
555.7	593.7	127,000	596.6	169,000	598.2	196,000	600.3	228,000	601.5	252,000	602.5	275,000	603.5	298,000	604.7	327,000
556.2	593.8	127,000	596.7	169,000	598.3	196,000	600.4	228,000	601.6	252,000	602.6	275,000	603.6	298,000	604.8	327,000
556.6	593.8	127,000	596.7	169,000	598.4	196,000	600.4	228,000	601.7	252,000	602.7	275,000	603.7	298,000	604.8	327,000
556.65	593.9	127,000	596.8	169,000	598.4	196,000	600.5	228,000	601.7	252,000	602.7	275,000	603.7	298,000	604.9	327,000
556.7	593.9	127,000	596.8	169,000	598.5	196,000	600.5	228,000	601.7	252,000	602.8	275,000	603.7	298,000	604.9	327,000
556.8	594.3	127,000	597.2	169,000	598.9	196,000	600.9	228,000	602.1	252,000	603.2	275,000	604.1	298,000	605.3	327,000
557	594.3	127,000	597.3	169,000	598.9	196,000	601.0	228,000	602.2	252,000	603.2	275,000	604.2	298,000	605.4	327,000
557.2	594.4	127,000	597.4	169,000	599.0	196,000	601.1	228,000	602.3	252,000	603.3	275,000	604.3	298,000	605.4	327,000
557.6	594.5	127,000	597.4	169,000	599.1	196,000	601.1	228,000	602.4	252,000	603.4	275,000	604.4	298,000	605.5	327,000
557.9	594.6	127,000	597.6	169,000	599.2	196,000	601.3	228,000	602.5	252,000	603.5	275,000	604.5	298,000	605.7	327,000
558.5	594.7	127,000	597.7	169,000	599.3	196,000	601.4	228,000	602.6	252,000	603.6	275,000	604.6	298,000	605.8	327,000
559	594.9	127,000	597.8	169,000	599.5	196,000	601.5	228,000	602.8	252,000	603.8	275,000	604.8	298,000	605.9	327,000
559.4	595.1	127,000	598.0	169,000	599.7	196,000	601.7	228,000	603.0	252,000	604.0	275,000	605.0	298,000	606.1	327,000
560	595.4	127,000	598.3	169,000	599.9	196,000	602.0	228,000	603.2	252,000	604.2	275,000	605.2	297,000	606.4	327,000
560.7	595.6	127,000	598.5	169,000	600.1	196,000	602.2	228,000	603.4	252,000	604.5	275,000	605.4	297,000	606.6	327,000
561.2	595.7	127,000	598.6	169,000	600.3	196,000	602.3	228,000	603.6	252,000	604.6	275,000	605.6	297,000	606.8	327,000
561.5	595.9	127,000	598.8	169,000	600.4	196,000	602.5	228,000	603.7	252,000	604.8	275,000	605.8	297,000	606.9	327,000
562.1	596.0	127,000	598.9	169,000	600.5	196,000	602.6	228,000	603.8	252,000	604.9	275,000	605.9	297,000	607.0	327,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
562.4	596.1	127,000	599.0	169,000	600.6	196,000	602.6	228,000	603.9	252,000	605.0	275,000	606.0	297,000	607.1	327,000
562.8	596.2	127,000	599.0	169,000	600.7	196,000	602.7	228,000	604.0	252,000	605.0	275,000	606.0	297,000	607.2	327,000
563.3	596.2	127,000	599.1	169,000	600.8	196,000	602.8	228,000	604.1	252,000	605.2	275,000	606.2	297,000	607.4	327,000
563.8	596.3	127,000	599.2	169,000	600.9	195,000	602.9	228,000	604.3	251,000	605.3	274,000	606.3	297,000	607.5	326,000
564.3	596.4	127,000	599.3	169,000	601.0	195,000	603.0	228,000	604.4	251,000	605.4	274,000	606.4	297,000	607.6	326,000
564.6	596.5	127,000	599.4	169,000	601.0	195,000	603.1	228,000	604.4	251,000	605.5	274,000	606.5	297,000	607.7	326,000
565	596.6	127,000	599.5	169,000	601.2	195,000	603.2	228,000	604.6	251,000	605.7	274,000	606.7	297,000	607.9	326,000
565.4	596.7	127,000	599.6	169,000	601.3	195,000	603.4	228,000	604.7	251,000	605.8	274,000	606.9	297,000	608.1	326,000
566	596.8	127,000	599.8	169,000	601.5	195,000	603.6	228,000	604.9	251,000	606.0	274,000	607.1	297,000	608.3	326,000
566.7	597.0	127,000	600.0	169,000	601.7	195,000	603.8	228,000	605.2	251,000	606.3	274,000	607.4	297,000	608.6	326,000
567.3	597.2	127,000	600.2	169,000	601.9	195,000	604.0	228,000	605.4	251,000	606.5	274,000	607.6	297,000	608.8	326,000
567.7	597.3	127,000	600.3	169,000	602.0	195,000	604.1	228,000	605.5	251,000	606.6	274,000	607.7	297,000	609.0	326,000
568	597.4	127,000	600.5	169,000	602.1	195,000	604.3	228,000	605.7	251,000	606.8	274,000	607.9	297,000	609.1	326,000
568.4	597.6	127,000	600.6	169,000	602.3	195,000	604.4	228,000	605.8	251,000	607.0	274,000	608.0	297,000	609.3	326,000
569	597.7	127,000	600.7	169,000	602.4	195,000	604.6	228,000	606.0	251,000	607.2	274,000	608.2	297,000	609.5	326,000
569.4	597.8	127,000	600.9	169,000	602.6	195,000	604.7	228,000	606.1	251,000	607.3	274,000	608.4	297,000	609.7	326,000
570	598.0	127,000	601.1	169,000	602.8	195,000	605.0	228,000	606.4	251,000	607.5	274,000	608.6	297,000	609.9	326,000
570.6	598.2	127,000	601.3	169,000	603.0	195,000	605.2	228,000	606.6	251,000	607.8	274,000	608.9	297,000	610.2	326,000
571.2	598.3	127,000	601.4	169,000	603.1	195,000	605.3	228,000	606.8	251,000	608.0	274,000	609.0	297,000	610.3	326,000
571.6	598.5	127,000	601.6	169,000	603.3	195,000	605.5	228,000	607.0	251,000	608.1	274,000	609.2	297,000	610.5	326,000
572	598.5	127,000	601.7	169,000	603.4	195,000	605.6	228,000	607.1	251,000	608.2	274,000	609.3	297,000	610.7	326,000
572.3	598.6	127,000	601.7	169,000	603.4	195,000	605.7	228,000	607.2	251,000	608.3	274,000	609.4	297,000	610.8	326,000
573	598.8	127,000	601.9	169,000	603.6	195,000	605.8	228,000	607.3	251,000	608.5	274,000	609.6	297,000	610.9	326,000
573.5	598.9	127,000	602.0	169,000	603.7	195,000	606.0	228,000	607.5	251,000	608.7	274,000	609.8	297,000	611.1	326,000
574	599.1	127,000	602.2	169,000	603.9	195,000	606.2	228,000	607.7	251,000	608.9	274,000	610.0	297,000	611.3	326,000
574.7	599.3	127,000	602.4	169,000	604.1	195,000	606.3	228,000	607.8	251,000	609.0	274,000	610.1	297,000	611.5	326,000
574.9	599.3	127,000	602.5	169,000	604.2	195,000	606.4	228,000	607.9	251,000	609.2	274,000	610.3	297,000	611.6	326,000
575.4	599.5	127,000	602.6	169,000	604.4	195,000	606.6	228,000	608.1	251,000	609.4	274,000	610.5	297,000	611.8	326,000
576	599.7	127,000	602.8	169,000	604.6	195,000	606.8	228,000	608.3	251,000	609.6	274,000	610.7	297,000	612.1	326,000
576.6	599.9	127,000	603.0	169,000	604.8	195,000	607.1	228,000	608.6	251,000	609.9	274,000	611.0	297,000	612.4	326,000
577.1	600.1	127,000	603.3	169,000	605.1	195,000	607.4	228,000	608.9	251,000	610.2	274,000	611.3	297,000	612.7	326,000
578.2	600.3	127,000	603.5	169,000	605.3	195,000	607.7	228,000	609.2	251,000	610.5	274,000	611.6	297,000	613.0	326,000
578.6	600.4	127,000	603.7	169,000	605.5	195,000	607.8	228,000	609.4	251,000	610.7	274,000	611.8	297,000	613.2	326,000
579.1	600.5	127,000	603.8	169,000	605.6	195,000	608.0	228,000	609.5	251,000	610.8	274,000	612.0	297,000	613.3	326,000
579.4	600.6	127,000	603.9	169,000	605.7	195,000	608.1	228,000	609.7	251,000	611.0	274,000	612.1	297,000	613.5	326,000
579.7	600.7	127,000	604.0	169,000	605.8	195,000	608.2	228,000	609.8	251,000	611.1	274,000	612.2	297,000	613.6	326,000
580	600.7	127,000	604.0	169,000	605.9	195,000	608.2	228,000	609.8	251,000	611.1	274,000	612.3	297,000	613.7	326,000
580.5	600.8	127,000	604.2	169,000	606.0	195,000	608.4	228,000	610.0	251,000	611.3	274,000	612.4	297,000	613.9	326,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
580.9	600.9	127,000	604.2	169,000	606.1	195,000	608.5	228,000	610.0	251,000	611.3	274,000	612.5	297,000	614.0	326,000
581.05	600.9	127,000	604.3	169,000	606.2	195,000	608.5	228,000	610.1	251,000	611.4	274,000	612.6	297,000	614.0	326,000
581.2	601.0	127,000	604.4	169,000	606.2	195,000	608.6	228,000	610.2	251,000	611.5	274,000	612.7	297,000	614.1	326,000
581.8	601.1	127,000	604.5	169,000	606.4	195,000	608.7	228,000	610.3	251,000	611.6	274,000	612.7	297,000	614.2	326,000
582.2	601.2	127,000	604.7	169,000	606.6	195,000	608.8	228,000	610.4	251,000	611.6	274,000	612.8	297,000	614.2	326,000
582.6	601.4	127,000	604.9	169,000	606.7	195,000	609.0	228,000	610.4	251,000	611.7	274,000	612.9	297,000	614.3	326,000
582.8	601.5	127,000	604.9	169,000	606.8	195,000	609.0	228,000	610.5	251,000	611.7	274,000	612.9	297,000	614.3	326,000
583.2	603.0	127,000	605.3	169,000	607.2	195,000	609.4	228,000	610.9	251,000	612.1	274,000	613.3	297,000	614.7	326,000
583.6	603.0	127,000	605.4	169,000	607.3	195,000	609.5	228,000	610.9	251,000	612.2	274,000	613.3	297,000	614.7	326,000
584.1	603.2	127,000	605.5	169,000	607.4	195,000	609.6	228,000	611.1	251,000	612.3	274,000	613.5	297,000	614.9	326,000
585	603.4	127,000	605.8	169,000	607.6	195,000	609.8	228,000	611.3	251,000	612.5	274,000	613.7	297,000	615.1	327,000
585.7	603.5	127,000	605.9	169,000	607.7	195,000	609.9	228,000	611.4	251,000	612.6	274,000	613.8	297,000	615.2	327,000
586.3	603.6	127,000	606.0	169,000	607.8	195,000	610.0	228,000	611.5	252,000	612.7	275,000	613.9	297,000	615.3	327,000
586.7	603.6	127,000	606.0	169,000	607.9	195,000	610.0	228,000	611.5	252,000	612.8	275,000	613.9	297,000	615.3	327,000
587.5	603.8	127,000	606.2	169,000	608.0	196,000	610.1	228,000	611.6	252,000	612.9	275,000	614.0	297,000	615.4	327,000
588	603.9	127,000	606.3	169,000	608.1	196,000	610.2	228,000	611.7	252,000	612.9	275,000	614.1	297,000	615.5	327,000
588.5	604.0	127,000	606.4	169,000	608.2	196,000	610.3	228,000	611.8	252,000	613.0	275,000	614.2	297,000	615.6	327,000
589	604.1	127,000	606.5	169,000	608.2	196,000	610.4	228,000	611.9	252,000	613.1	275,000	614.3	298,000	615.7	328,000
589.5	604.2	127,000	606.6	169,000	608.3	196,000	610.5	228,000	611.9	252,000	613.2	275,000	614.3	298,000	615.7	328,000
590	604.3	127,000	606.7	169,000	608.4	196,000	610.6	228,000	612.0	252,000	613.3	275,000	614.4	298,000	615.8	328,000
590.6	604.6	127,000	606.9	169,000	608.7	196,000	610.8	229,000	612.2	252,000	613.5	275,000	614.6	298,000	616.0	328,000
591.1	604.7	127,000	607.1	169,000	608.8	196,000	610.9	229,000	612.3	252,000	613.6	275,000	614.7	298,000	616.1	328,000
591.6	604.8	127,000	607.2	169,000	608.9	196,000	611.0	229,000	612.4	252,000	613.7	275,000	614.8	298,000	616.2	328,000
592	604.9	127,000	607.3	169,000	609.0	196,000	611.1	229,000	612.5	252,000	613.8	276,000	614.9	298,000	616.3	328,000
592.5	605.0	127,000	607.4	169,000	609.1	196,000	611.2	229,000	612.6	252,000	613.9	276,000	615.0	298,000	616.4	328,000
593	605.2	127,000	607.5	169,000	609.2	196,000	611.3	229,000	612.7	253,000	614.0	276,000	615.1	299,000	616.5	329,000
593.6	605.3	127,000	607.7	169,000	609.3	196,000	611.4	229,000	612.8	253,000	614.1	276,000	615.2	299,000	616.6	329,000
594	605.4	127,000	607.8	169,000	609.5	196,000	611.5	229,000	612.9	253,000	614.2	276,000	615.3	299,000	616.7	329,000
594.4	605.6	127,000	608.0	169,000	609.6	196,000	611.6	229,000	613.0	253,000	614.3	276,000	615.4	299,000	616.8	329,000
595	605.9	127,000	608.2	169,000	609.8	196,000	611.8	229,000	613.2	253,000	614.4	276,000	615.6	299,000	616.9	329,000
595.4	606.1	127,000	608.4	169,000	610.0	196,000	612.0	229,000	613.4	253,000	614.6	276,000	615.7	299,000	617.0	329,000
596	606.4	127,000	608.7	169,000	610.2	196,000	612.2	229,000	613.5	253,000	614.7	276,000	615.9	299,000	617.2	329,000
596.2	606.5	127,000	608.8	169,000	610.3	196,000	612.3	229,000	613.7	253,000	614.9	276,000	616.0	299,000	617.3	330,000
597	606.8	127,000	609.0	169,000	610.6	196,000	612.5	229,000	613.8	253,000	615.0	276,000	616.1	299,000	617.5	330,000
597.6	607.0	127,000	609.3	169,000	610.8	196,000	612.7	229,000	614.0	253,000	615.2	276,000	616.3	299,000	617.6	330,000
598	607.3	127,000	609.5	169,000	611.0	196,000	612.9	229,000	614.2	253,000	615.4	276,000	616.5	299,000	617.8	330,000
598.5	607.5	127,000	609.7	169,000	611.2	196,000	613.1	229,000	614.4	253,000	615.6	277,000	616.7	300,000	618.0	330,000
599	607.7	127,000	610.0	169,000	611.5	196,000	613.3	229,000	614.6	253,000	615.8	277,000	616.9	300,000	618.2	330,000

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
599.3	607.9	127,000	610.1	169,000	611.6	196,000	613.4	229,000	614.7	253,000	615.9	277,000	616.9	300,000	618.2	330,000
599.9	608.0	127,000	610.3	169,000	611.8	196,000	613.6	229,000	614.9	253,000	616.1	277,000	617.1	300,000	618.4	330,000
600.8	608.2	127,000	610.5	169,000	612.0	197,000	613.9	230,000	615.2	254,000	616.4	277,000	617.4	300,000	618.7	330,000
601.5	608.4	127,000	610.8	169,000	612.3	197,000	614.2	230,000	615.4	254,000	616.6	277,000	617.7	300,000	619.0	330,000
602	608.7	127,000	611.1	169,000	612.6	197,000	614.5	230,000	615.7	254,000	616.9	277,000	618.0	300,000	619.3	330,000
602.3	608.9	127,000	611.3	169,000	612.8	197,000	614.7	230,000	615.9	254,000	617.1	277,000	618.1	300,000	619.4	330,000
602.7	609.1	127,000	611.5	169,000	613.0	197,000	614.8	230,000	616.1	254,000	617.2	277,000	618.3	300,000	619.6	330,000
603.1	609.2	127,000	611.7	170,000	613.1	197,000	615.0	230,000	616.2	254,000	617.4	277,000	618.4	300,000	619.7	331,000
603.5	609.3	127,000	611.8	170,000	613.3	197,000	615.1	230,000	616.4	254,000	617.5	277,000	618.6	300,000	619.8	331,000
604	609.5	127,000	612.0	170,000	613.5	197,000	615.3	230,000	616.6	254,000	617.7	277,000	618.8	301,000	620.0	331,000
604.4	609.7	127,000	612.2	170,000	613.7	197,000	615.5	230,000	616.8	254,000	617.9	277,000	619.0	301,000	620.2	331,000
604.9	609.9	127,000	612.4	170,000	613.9	197,000	615.8	230,000	617.0	254,000	618.2	277,000	619.2	301,000	620.5	331,000
605.5	610.1	127,000	612.7	170,000	614.2	197,000	616.0	230,000	617.3	254,000	618.4	277,000	619.4	301,000	620.7	331,000
606.1	610.2	127,000	612.9	170,000	614.4	197,000	616.2	230,000	617.5	254,000	618.7	278,000	619.7	301,000	621.0	331,000
607	610.5	127,000	613.2	170,000	614.7	197,000	616.6	230,000	617.9	254,000	619.0	278,000	620.0	301,000	621.3	331,000
607.5	610.8	127,000	613.5	170,000	615.0	197,000	616.9	230,000	618.2	254,000	619.3	278,000	620.4	301,000	621.6	331,000
608	611.1	127,000	613.8	170,000	615.3	197,000	617.2	230,000	618.5	254,000	619.6	278,000	620.7	301,000	622.0	331,000
608.6	611.6	126,000	614.2	169,000	615.7	197,000	617.7	230,000	619.0	254,000	620.1	278,000	621.1	302,000	622.4	333,000
609	611.8	126,000	614.4	169,000	615.9	197,000	617.9	230,000	619.2	254,000	620.3	278,000	621.3	302,000	622.6	333,000
609.5	612.0	126,000	614.6	169,000	616.1	197,000	618.1	230,000	619.4	255,000	620.5	278,000	621.5	302,000	622.8	333,000
610	612.2	126,000	614.8	169,000	616.3	197,000	618.3	230,000	619.5	255,000	620.7	278,000	621.7	302,000	623.0	333,000
610.6	612.3	126,000	615.0	169,000	616.5	197,000	618.4	230,000	619.7	255,000	620.8	278,000	621.8	302,000	623.1	333,000
611.2	612.5	126,000	615.1	169,000	616.7	197,000	618.6	230,000	619.8	255,000	621.0	278,000	622.0	302,000	623.3	333,000
612	612.6	126,000	615.3	169,000	616.8	197,000	618.7	230,000	620.0	255,000	621.1	278,000	622.2	302,000	623.5	333,000
612.5	612.8	126,000	615.5	169,000	617.0	197,000	618.9	230,000	620.2	255,000	621.3	278,000	622.4	302,000	623.7	333,000
613	612.9	126,000	615.7	169,000	617.2	197,000	619.1	230,000	620.3	255,000	621.5	279,000	622.5	302,000	623.8	333,000
613.6	613.1	126,000	615.8	169,000	617.3	197,000	619.2	231,000	620.5	255,000	621.6	279,000	622.7	302,000	624.0	333,000
614	613.2	126,000	616.0	169,000	617.5	197,000	619.4	231,000	620.6	255,000	621.8	279,000	622.8	302,000	624.1	333,000
614.5	613.3	126,000	616.0	169,000	617.5	197,000	619.4	231,000	620.7	255,000	621.8	279,000	622.9	303,000	624.2	334,000
614.7	613.4	126,000	616.1	169,000	617.6	197,000	619.5	231,000	620.8	255,000	621.9	279,000	622.9	303,000	624.3	334,000
614.9	613.4	126,000	616.0	169,000	617.6	197,000	619.5	231,000	620.8	255,000	621.9	279,000	623.0	303,000	624.3	334,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
301.4	462.0	209,000	464.8	261,000	467.1	306,000	469.5	354,000	471.3	399,000	472.8	442,000	474.2	485,000	475.6	537,000
301.7	462.1	209,000	465.0	261,000	467.3	306,000	469.7	354,000	471.5	398,000	473.1	442,000	474.4	485,000	475.9	537,000
302	462.3	209,000	465.1	261,000	467.4	306,000	469.8	354,000	471.7	398,000	473.3	442,000	474.6	485,000	476.1	537,000
302.5	462.4	209,000	465.3	261,000	467.6	306,000	470.0	354,000	471.8	398,000	473.5	442,000	474.8	484,000	476.3	537,000
303	462.7	209,000	465.6	261,000	467.8	306,000	470.3	354,000	472.2	398,000	473.8	441,000	475.2	484,000	476.7	537,000
303.6	463.0	209,000	465.8	261,000	468.2	305,000	470.6	354,000	472.5	398,000	474.2	441,000	475.6	484,000	477.1	537,000
304	463.3	209,000	466.1	261,000	468.5	305,000	470.9	353,000	472.8	398,000	474.5	441,000	475.9	484,000	477.4	537,000
304.5	463.5	209,000	466.3	260,000	468.7	305,000	471.1	353,000	473.0	398,000	474.8	441,000	476.2	484,000	477.7	537,000
305	463.8	209,000	466.6	260,000	468.9	305,000	471.3	353,000	473.3	398,000	475.1	441,000	476.5	484,000	478.0	536,000
305.4	464.0	209,000	466.8	260,000	469.1	305,000	471.5	353,000	473.5	398,000	475.3	441,000	476.8	484,000	478.2	536,000
306	464.3	209,000	467.1	260,000	469.4	305,000	471.8	353,000	473.8	397,000	475.6	441,000	477.1	484,000	478.5	536,000
306.5	464.5	209,000	467.3	260,000	469.6	305,000	472.0	353,000	474.1	397,000	475.9	441,000	477.4	484,000	478.8	536,000
307	464.8	209,000	467.5	260,000	469.8	305,000	472.3	353,000	474.3	397,000	476.2	441,000	477.7	484,000	479.1	536,000
307.5	465.0	209,000	467.7	260,000	470.0	304,000	472.5	353,000	474.6	397,000	476.4	441,000	477.9	484,000	479.4	536,000
308	465.2	209,000	468.0	260,000	470.2	304,000	472.7	353,000	474.8	397,000	476.7	441,000	478.2	484,000	479.6	536,000
308.5	465.4	209,000	468.1	260,000	470.4	304,000	472.9	352,000	475.0	397,000	476.9	441,000	478.4	484,000	479.9	536,000
309	465.7	209,000	468.4	260,000	470.6	304,000	473.1	352,000	475.2	397,000	477.1	441,000	478.7	484,000	480.1	536,000
309.15	465.7	209,000	468.4	260,000	470.7	304,000	473.1	352,000	475.3	397,000	477.2	441,000	478.7	484,000	480.1	536,000
309.2	465.7	209,000	468.4	260,000	470.7	304,000	473.2	352,000	475.3	397,000	477.2	441,000	478.8	484,000	480.2	536,000
309.25	465.8	209,000	468.5	260,000	470.7	304,000	473.2	352,000	475.3	397,000	477.2	441,000	478.8	484,000	480.2	536,000
309.5	465.8	209,000	468.5	259,000	470.8	304,000	473.3	352,000	475.4	397,000	477.4	441,000	478.9	484,000	480.4	536,000
309.75	465.9	209,000	468.6	259,000	470.9	304,000	473.3	352,000	475.5	397,000	477.4	440,000	479.0	484,000	480.4	536,000
309.8	465.9	209,000	468.6	259,000	470.9	304,000	473.3	352,000	475.5	397,000	477.4	440,000	479.0	484,000	480.4	536,000
309.85	465.9	209,000	468.6	259,000	470.9	304,000	473.3	352,000	475.5	397,000	477.4	440,000	479.0	484,000	480.4	536,000
310	466.0	209,000	468.7	259,000	471.0	304,000	473.4	352,000	475.6	397,000	477.5	440,000	479.1	484,000	480.5	536,000
310.5	466.1	209,000	468.9	259,000	471.2	304,000	473.6	352,000	475.9	397,000	477.8	440,000	479.4	484,000	480.9	536,000
311	466.3	209,000	469.1	259,000	471.4	303,000	473.9	352,000	476.2	396,000	478.2	440,000	479.8	484,000	481.2	535,000
311.4	466.4	209,000	469.3	259,000	471.6	303,000	474.1	351,000	476.4	396,000	478.4	440,000	480.0	484,000	481.4	535,000
312	466.7	209,000	469.6	259,000	471.9	303,000	474.4	351,000	476.7	396,000	478.7	440,000	480.3	484,000	481.7	535,000
312.7	467.1	209,000	469.9	259,000	472.2	303,000	474.7	351,000	477.0	396,000	479.0	440,000	480.6	484,000	482.0	537,000
313	467.4	209,000	470.1	259,000	472.5	303,000	474.9	351,000	477.2	396,000	479.2	440,000	480.8	484,000	482.2	537,000
313.5	467.7	209,000	470.4	259,000	472.7	303,000	475.2	350,000	477.5	396,000	479.4	440,000	481.0	484,000	482.4	537,000
314	468.0	209,000	470.7	259,000	473.0	303,000	475.5	350,000	477.7	396,000	479.7	440,000	481.3	484,000	482.6	536,000
314.5	468.2	209,000	471.0	259,000	473.3	303,000	475.7	350,000	478.0	396,000	480.0	440,000	481.5	483,000	482.8	537,000
315	468.5	209,000	471.3	258,000	473.6	302,000	476.1	350,000	478.3	396,000	480.3	440,000	481.9	483,000	483.2	537,000
315.5	468.8	209,000	471.5	258,000	473.9	302,000	476.3	350,000	478.5	396,000	480.5	440,000	482.1	483,000	483.4	536,000
316	469.0	209,000	471.8	258,000	474.2	302,000	476.6	350,000	478.8	395,000	480.8	439,000	482.3	483,000	483.7	536,000
316.7	469.3	209,000	472.1	258,000	474.4	302,000	476.8	350,000	479.0	395,000	481.0	439,000	482.5	483,000	483.9	536,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
317	469.4	209,000	472.2	258,000	474.5	302,000	477.0	350,000	479.2	395,000	481.2	439,000	482.7	483,000	484.0	536,000
317.5	469.5	209,000	472.4	258,000	474.7	302,000	477.2	350,000	479.4	395,000	481.4	439,000	482.9	483,000	484.3	536,000
318	469.7	209,000	472.6	257,000	474.9	301,000	477.4	349,000	479.6	395,000	481.6	439,000	483.1	482,000	484.5	536,000
318.6	469.9	209,000	472.8	257,000	475.2	301,000	477.7	349,000	479.9	394,000	481.9	439,000	483.5	482,000	484.9	536,000
319	470.2	209,000	473.1	257,000	475.5	301,000	478.0	349,000	480.3	394,000	482.2	438,000	483.8	482,000	485.2	536,000
319.6	470.6	209,000	473.4	257,000	475.8	301,000	478.4	349,000	480.7	394,000	482.6	438,000	484.3	482,000	485.7	536,000
320	471.0	209,000	473.9	257,000	476.2	301,000	478.8	349,000	481.0	394,000	483.0	438,000	484.6	482,000	486.0	536,000
320.5	471.5	209,000	474.3	257,000	476.7	301,000	479.2	349,000	481.5	394,000	483.4	438,000	485.1	482,000	486.5	536,000
321	471.8	209,000	474.5	257,000	476.9	300,000	479.4	349,000	481.7	394,000	483.6	438,000	485.2	482,000	486.7	536,000
321.4	472.0	208,000	474.7	255,000	477.1	298,000	479.6	345,000	481.8	390,000	483.7	434,000	485.3	479,000	486.9	536,000
321.6	472.1	208,000	474.8	255,000	477.2	297,000	479.7	345,000	481.9	390,000	483.8	434,000	485.5	479,000	487.1	536,000
322	472.3	208,000	475.0	255,000	477.4	297,000	479.9	345,000	482.0	390,000	484.0	434,000	485.6	479,000	487.3	536,000
322.5	472.5	208,000	475.2	255,000	477.6	297,000	480.1	345,000	482.3	390,000	484.2	434,000	485.9	479,000	487.5	536,000
323	472.7	208,000	475.4	255,000	477.8	297,000	480.4	345,000	482.6	390,000	484.5	434,000	486.1	479,000	487.7	536,000
323.4	472.9	205,000	475.7	253,000	478.1	287,000	481.0	337,000	483.1	381,000	485.0	426,000	486.4	470,000	488.1	528,000
324	473.1	205,000	475.9	253,000	478.3	287,000	481.2	337,000	483.4	381,000	485.2	426,000	486.6	471,000	488.3	529,000
324.8	473.3	205,000	476.1	253,000	478.5	287,000	481.4	337,000	483.5	381,000	485.3	426,000	486.8	470,000	488.4	529,000
325	474.1	205,000	476.9	253,000	479.3	287,000	482.2	337,000	484.3	381,000	486.1	426,000	487.6	470,000	489.2	529,000
325.4	474.3	205,000	477.1	253,000	479.5	287,000	482.4	337,000	484.5	380,000	486.4	426,000	487.8	470,000	489.5	529,000
326	474.5	205,000	477.2	253,000	479.6	287,000	482.5	337,000	484.6	380,000	486.5	425,000	488.0	470,000	489.7	529,000
326.5	474.6	205,000	477.4	253,000	479.7	287,000	482.7	336,000	484.7	380,000	486.6	425,000	488.1	470,000	489.8	529,000
326.8	474.7	205,000	477.5	253,000	479.8	287,000	482.8	336,000	484.8	380,000	486.7	425,000	488.2	470,000	489.9	529,000
327.1	474.8	205,000	477.6	253,000	479.9	287,000	482.9	336,000	484.9	380,000	486.8	425,000	488.3	470,000	490.0	529,000
327.6	475.0	205,000	477.8	254,000	480.0	287,000	483.0	336,000	485.1	380,000	486.9	425,000	488.4	470,000	490.2	529,000
328	475.1	205,000	477.9	254,000	480.2	287,000	483.2	336,000	485.2	379,000	487.1	425,000	488.6	470,000	490.4	528,000
328.5	475.3	205,000	478.1	254,000	480.3	287,000	483.3	336,000	485.4	379,000	487.2	425,000	488.8	470,000	490.6	528,000
329	475.5	204,000	478.3	254,000	480.5	287,000	483.5	335,000	485.5	379,000	487.4	425,000	488.9	470,000	490.7	528,000
329.6	475.7	204,000	478.5	254,000	480.7	287,000	483.6	335,000	485.6	379,000	487.5	424,000	489.0	470,000	490.8	528,000
330	476.0	204,000	478.8	254,000	480.9	287,000	483.8	335,000	485.7	378,000	487.6	425,000	489.1	470,000	490.9	529,000
330.6	476.2	204,000	479.0	254,000	481.1	287,000	483.9	334,000	485.9	378,000	487.7	424,000	489.2	470,000	491.0	529,000
331	476.5	204,000	479.3	255,000	481.3	287,000	484.1	334,000	486.0	378,000	487.8	424,000	489.3	470,000	491.1	529,000
331.5	476.7	204,000	479.5	255,000	481.5	287,000	484.3	334,000	486.2	375,000	487.8	416,000	489.3	457,000	491.0	511,000
332	476.9	204,000	479.7	255,000	481.7	287,000	484.5	333,000	486.3	376,000	488.0	419,000	489.5	463,000	491.2	519,000
332.5	477.2	204,000	480.0	255,000	482.0	288,000	484.7	333,000	486.6	376,000	488.2	419,000	489.7	463,000	491.3	519,000
333	477.5	204,000	480.3	255,000	482.2	288,000	484.8	333,000	486.7	375,000	488.4	419,000	489.8	463,000	491.5	519,000
333.6	477.8	204,000	480.5	255,000	482.5	288,000	485.0	333,000	486.9	375,000	488.6	419,000	490.0	463,000	491.7	520,000
334	478.1	204,000	480.8	255,000	482.7	288,000	485.2	332,000	487.0	375,000	488.8	419,000	490.2	463,000	491.9	520,000
334.6	478.4	204,000	481.2	256,000	483.0	288,000	485.5	332,000	487.3	374,000	489.0	419,000	490.4	463,000	492.1	520,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
335	478.7	204,000	481.4	256,000	483.3	288,000	485.6	332,000	487.4	374,000	489.1	418,000	490.6	463,000	492.3	520,000
335.5	479.0	204,000	481.7	256,000	483.5	288,000	485.8	332,000	487.6	374,000	489.3	418,000	490.7	463,000	492.4	521,000
336	479.3	204,000	482.0	256,000	483.7	288,000	486.0	331,000	487.7	373,000	489.4	417,000	490.8	460,000	492.5	517,000
336.4	479.5	204,000	482.2	256,000	483.9	288,000	486.1	331,000	487.8	373,000	489.5	417,000	490.9	460,000	492.5	517,000
337	479.8	204,000	482.5	256,000	484.2	287,000	486.3	331,000	488.0	373,000	489.6	416,000	491.0	460,000	492.6	517,000
337.5	480.0	203,000	482.9	255,000	484.4	286,000	486.6	327,000	488.1	366,000	489.7	409,000	491.1	454,000	492.7	512,000
338	480.2	203,000	483.1	255,000	484.6	286,000	486.8	327,000	488.3	365,000	489.8	409,000	491.2	454,000	492.9	512,000
338.5	480.4	203,000	483.4	255,000	484.8	286,000	487.0	326,000	488.4	365,000	490.0	409,000	491.4	454,000	493.1	513,000
339	480.7	203,000	483.7	255,000	485.1	286,000	487.2	326,000	488.7	365,000	490.2	409,000	491.6	454,000	493.3	513,000
339.5	480.9	203,000	483.9	255,000	485.3	286,000	487.4	326,000	488.9	365,000	490.4	409,000	491.8	454,000	493.4	513,000
339.9	481.1	203,000	484.1	255,000	485.5	286,000	487.5	326,000	489.0	364,000	490.5	408,000	491.9	454,000	493.6	513,000
340.5	481.4	203,000	484.3	255,000	485.7	286,000	487.7	326,000	489.2	364,000	490.7	408,000	492.1	454,000	493.8	513,000
341	481.6	203,000	484.5	255,000	485.9	286,000	488.0	325,000	489.4	364,000	490.9	408,000	492.2	454,000	493.9	513,000
341.4	481.8	202,000	484.7	250,000	486.1	286,000	488.2	323,000	489.6	359,000	491.0	403,000	492.3	449,000	494.0	510,000
341.6	481.9	202,000	484.8	250,000	486.2	286,000	488.3	323,000	489.7	358,000	491.0	402,000	492.4	449,000	494.0	510,000
342	482.0	202,000	484.9	250,000	486.3	286,000	488.4	323,000	489.8	358,000	491.1	402,000	492.4	449,000	494.1	510,000
342.3	482.2	202,000	485.1	250,000	486.5	286,000	488.5	322,000	489.9	358,000	491.2	402,000	492.6	449,000	494.2	510,000
342.6	482.3	202,000	485.2	250,000	486.6	286,000	488.6	322,000	490.0	358,000	491.4	402,000	492.7	449,000	494.3	510,000
343	482.4	202,000	485.3	250,000	486.8	286,000	488.8	322,000	490.2	358,000	491.6	402,000	492.9	449,000	494.5	510,000
343.2	482.9	202,000	485.8	250,000	487.3	286,000	489.3	322,000	490.7	358,000	492.1	402,000	493.4	449,000	495.0	510,000
343.7	483.1	202,000	486.1	250,000	487.5	286,000	489.5	322,000	490.9	358,000	492.4	401,000	493.7	448,000	495.3	510,000
343.9	483.2	202,000	486.2	250,000	487.6	286,000	489.6	322,000	491.0	357,000	492.5	401,000	493.8	448,000	495.4	510,000
344.2	483.2	202,000	486.2	250,000	487.6	286,000	489.7	322,000	491.1	357,000	492.5	401,000	493.8	448,000	495.5	509,000
344.5	483.3	202,000	486.4	250,000	487.8	286,000	489.8	322,000	491.2	357,000	492.6	401,000	493.9	448,000	495.5	509,000
345.1	483.5	202,000	486.6	249,000	488.0	286,000	490.0	322,000	491.3	357,000	492.7	401,000	494.0	448,000	495.6	509,000
345.7	483.8	202,000	486.9	249,000	488.3	286,000	490.3	322,000	491.6	357,000	493.0	401,000	494.3	448,000	495.9	509,000
346	484.1	202,000	487.1	249,000	488.6	286,000	490.5	321,000	491.9	357,000	493.3	400,000	494.5	447,000	496.1	509,000
346.4	484.3	202,000	487.3	249,000	488.8	286,000	490.7	321,000	492.1	357,000	493.5	400,000	494.7	447,000	496.3	509,000
347	484.5	202,000	487.5	249,000	489.0	286,000	491.0	321,000	492.3	356,000	493.7	400,000	495.0	447,000	496.5	508,000
347.6	484.7	202,000	487.7	249,000	489.2	286,000	491.1	321,000	492.5	356,000	493.9	400,000	495.2	447,000	496.7	508,000
347.8	484.8	202,000	487.8	248,000	489.3	286,000	491.2	321,000	492.6	356,000	494.0	400,000	495.3	447,000	496.8	508,000
348.1	484.9	202,000	487.9	248,000	489.5	286,000	491.3	320,000	492.7	355,000	494.1	397,000	495.3	445,000	496.9	507,000
348.5	485.1	202,000	488.1	248,000	489.6	286,000	491.5	320,000	492.8	354,000	494.2	397,000	495.4	444,000	497.0	507,000
349	485.3	202,000	488.3	248,000	489.8	286,000	491.7	320,000	493.0	354,000	494.4	396,000	495.6	444,000	497.2	506,000
349.4	485.4	202,000	488.4	248,000	489.9	286,000	491.8	320,000	493.1	354,000	494.5	396,000	495.8	444,000	497.4	506,000
350	485.5	202,000	488.5	248,000	490.1	286,000	491.9	320,000	493.3	354,000	494.7	396,000	495.9	444,000	497.5	506,000
350.5	485.6	202,000	488.6	248,000	490.2	286,000	492.0	320,000	493.4	354,000	494.8	396,000	496.1	444,000	497.7	506,000
351	485.8	202,000	488.9	247,000	490.5	286,000	492.3	320,000	493.7	354,000	495.1	396,000	496.4	443,000	498.0	506,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
351.3	486.0	202,000	489.0	247,000	490.6	285,000	492.4	320,000	493.9	354,000	495.3	396,000	496.6	443,000	498.2	505,000
352	486.3	202,000	489.3	247,000	490.9	285,000	492.7	320,000	494.2	354,000	495.6	396,000	497.0	443,000	498.5	505,000
352.6	486.6	202,000	489.6	247,000	491.2	285,000	493.0	320,000	494.5	354,000	496.0	396,000	497.3	444,000	498.8	505,000
353	486.8	202,000	489.8	247,000	491.4	285,000	493.2	320,000	494.7	354,000	496.2	397,000	497.5	444,000	499.1	505,000
353.4	486.9	201,000	489.9	247,000	491.6	285,000	493.3	319,000	494.8	354,000	496.4	397,000	497.7	444,000	499.3	505,000
354	487.2	200,000	490.2	245,000	491.8	282,000	493.6	317,000	495.2	351,000	496.7	396,000	498.1	442,000	499.7	503,000
354.4	487.3	200,000	490.3	245,000	492.0	282,000	493.8	317,000	495.3	351,000	496.9	395,000	498.3	441,000	499.9	502,000
355	487.6	200,000	490.6	245,000	492.2	282,000	494.0	318,000	495.5	353,000	497.1	396,000	498.4	442,000	500.0	502,000
355.4	487.8	200,000	490.7	245,000	492.3	282,000	494.1	317,000	495.6	353,000	497.2	396,000	498.6	442,000	500.2	502,000
356	488.0	200,000	490.9	245,000	492.6	282,000	494.3	317,000	495.8	353,000	497.4	396,000	498.8	442,000	500.4	502,000
356.4	488.2	200,000	491.0	245,000	492.7	282,000	494.5	317,000	496.0	353,000	497.5	396,000	498.9	442,000	500.6	502,000
357	488.5	200,000	491.3	245,000	492.9	282,000	494.7	317,000	496.1	353,000	497.7	396,000	499.1	441,000	500.8	502,000
357.4	488.7	200,000	491.4	245,000	493.1	282,000	494.8	316,000	496.2	351,000	497.8	392,000	499.2	439,000	500.9	501,000
358	488.9	200,000	491.6	245,000	493.3	282,000	494.9	316,000	496.4	351,000	497.9	392,000	499.4	439,000	501.0	500,000
358.4	489.1	200,000	491.8	244,000	493.5	282,000	495.1	316,000	496.5	350,000	498.0	392,000	499.5	438,000	501.1	498,000
359	489.2	200,000	491.9	244,000	493.6	282,000	495.2	316,000	496.7	350,000	498.1	392,000	499.6	438,000	501.2	498,000
359.2	489.3	200,000	492.0	244,000	493.7	282,000	495.3	316,000	496.7	350,000	498.2	392,000	499.7	438,000	501.3	498,000
359.5	489.4	200,000	492.1	244,000	493.8	282,000	495.4	316,000	496.8	350,000	498.3	392,000	499.9	438,000	501.6	498,000
360	489.6	200,000	492.3	244,000	494.0	282,000	495.6	316,000	497.0	350,000	498.6	392,000	500.1	438,000	501.9	498,000
360.4	489.8	200,000	492.5	244,000	494.3	282,000	495.9	316,000	497.3	350,000	498.9	392,000	500.5	438,000	502.3	498,000
361	489.9	200,000	492.8	244,000	494.6	282,000	496.1	316,000	497.6	350,000	499.2	392,000	500.8	438,000	502.6	498,000
361.5	490.1	200,000	493.0	244,000	494.9	282,000	496.3	316,000	497.8	350,000	499.5	391,000	501.0	437,000	502.8	498,000
362	490.1	179,000	493.2	227,000	495.2	263,000	496.5	297,000	498.1	331,000	499.7	366,000	501.1	394,000	502.8	428,000
362.5	490.2	179,000	493.4	227,000	495.4	263,000	496.6	297,000	498.2	331,000	499.9	366,000	501.3	394,000	502.9	428,000
363	490.5	179,000	493.6	227,000	495.7	263,000	496.9	297,000	498.5	331,000	500.2	366,000	501.5	394,000	503.2	428,000
363.5	490.6	179,000	493.8	227,000	495.8	263,000	497.0	297,000	498.6	331,000	500.3	366,000	501.7	394,000	503.3	428,000
363.8	490.8	179,000	494.0	227,000	496.0	263,000	497.2	297,000	498.8	331,000	500.5	366,000	501.9	394,000	503.5	428,000
363.9	490.9	179,000	494.0	227,000	496.0	263,000	497.2	297,000	498.9	331,000	500.5	366,000	501.9	394,000	503.6	428,000
364.05	491.1	179,000	494.2	227,000	496.2	263,000	497.5	297,000	499.1	331,000	500.8	366,000	502.2	394,000	503.8	428,000
364.2	491.3	179,000	494.4	226,000	496.4	262,000	497.7	298,000	499.3	331,000	501.0	366,000	502.4	394,000	504.0	428,000
364.3	491.4	179,000	494.5	226,000	496.5	262,000	497.8	298,000	499.5	331,000	501.2	366,000	502.6	394,000	504.3	429,000
364.4	491.5	179,000	494.6	226,000	496.6	262,000	497.9	297,000	499.6	331,000	501.3	366,000	502.7	394,000	504.4	429,000
364.5	517.8	179,000	517.8	226,000	517.8	262,000	517.8	297,000	517.8	331,000	517.8	366,000	517.8	394,000	517.8	429,000
364.7	517.9	179,000	517.9	226,000	517.9	262,000	518.0	297,000	518.0	331,000	518.0	366,000	518.1	394,000	518.1	428,000
365	517.9	179,000	518.0	226,000	518.1	262,000	518.2	297,000	518.3	331,000	518.4	366,000	518.4	394,000	518.6	429,000
365.5	518.0	179,000	518.2	226,000	518.3	262,000	518.4	297,000	518.6	331,000	518.7	366,000	518.9	394,000	519.1	429,000
366	518.1	179,000	518.3	226,000	518.5	262,000	518.7	297,000	518.9	331,000	519.1	366,000	519.2	394,000	519.5	429,000
366.5	518.2	179,000	518.4	226,000	518.6	262,000	518.8	297,000	519.1	331,000	519.3	366,000	519.5	394,000	519.8	429,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
367	518.2	179,000	518.5	226,000	518.7	262,000	519.0	297,000	519.3	331,000	519.6	366,000	519.8	394,000	520.1	429,000
367.5	518.3	179,000	518.6	226,000	518.8	262,000	519.1	297,000	519.4	331,000	519.7	366,000	520.0	394,000	520.3	429,000
368	518.4	179,000	518.7	226,000	519.0	262,000	519.3	297,000	519.6	331,000	520.0	366,000	520.2	394,000	520.6	429,000
368.5	518.4	179,000	518.8	226,000	519.1	262,000	519.4	297,000	519.8	331,000	520.2	366,000	520.5	394,000	520.9	429,000
369	518.5	179,000	518.9	226,000	519.2	262,000	519.6	297,000	519.9	331,000	520.4	366,000	520.7	394,000	521.1	429,000
369.5	518.5	179,000	519.0	226,000	519.3	262,000	519.7	297,000	520.1	331,000	520.5	366,000	520.9	394,000	521.3	429,000
370	518.6	179,000	519.0	226,000	519.4	262,000	519.8	297,000	520.3	331,000	520.7	366,000	521.1	394,000	521.5	429,000
370.5	518.6	179,000	519.1	226,000	519.5	262,000	520.0	297,000	520.4	331,000	520.9	366,000	521.3	394,000	521.7	429,000
371	518.7	179,000	519.2	226,000	519.6	262,000	520.1	297,000	520.6	331,000	521.1	366,000	521.5	394,000	522.0	429,000
371.5	518.8	179,000	519.3	226,000	519.8	262,000	520.3	297,000	520.8	331,000	521.3	366,000	521.7	394,000	522.3	429,000
372	518.9	179,000	519.4	226,000	519.9	262,000	520.5	297,000	521.0	331,000	521.6	366,000	522.0	394,000	522.6	429,000
372.5	519.0	179,000	519.6	226,000	520.1	262,000	520.7	297,000	521.2	331,000	521.8	366,000	522.2	394,000	522.8	429,000
373	519.0	179,000	519.7	226,000	520.2	262,000	520.8	297,000	521.4	331,000	522.0	366,000	522.5	394,000	523.1	429,000
373.5	519.1	179,000	519.8	226,000	520.4	262,000	521.0	297,000	521.6	331,000	522.2	366,000	522.7	394,000	523.3	429,000
374	519.2	179,000	519.9	226,000	520.5	262,000	521.1	297,000	521.8	331,000	522.4	366,000	522.9	394,000	523.6	429,000
374.5	519.3	179,000	520.1	226,000	520.7	262,000	521.4	297,000	522.1	331,000	522.7	366,000	523.3	394,000	523.9	429,000
375	519.4	179,000	520.2	226,000	520.9	262,000	521.6	297,000	522.3	331,000	523.0	366,000	523.6	394,000	524.2	429,000
375.6	519.5	179,000	520.4	226,000	521.1	262,000	521.8	297,000	522.5	331,000	523.3	366,000	523.9	394,000	524.6	429,000
376	519.6	179,000	520.5	226,000	521.2	262,000	522.0	297,000	522.7	331,000	523.5	366,000	524.1	394,000	524.8	429,000
376.4	519.7	179,000	520.6	226,000	521.4	262,000	522.2	297,000	522.9	331,000	523.6	366,000	524.2	394,000	525.0	429,000
377	519.8	178,000	520.7	226,000	521.5	262,000	522.3	297,000	523.0	330,000	523.8	366,000	524.4	394,000	525.1	429,000
377.3	519.8	178,000	520.8	226,000	521.6	262,000	522.4	297,000	523.1	330,000	523.9	365,000	524.5	394,000	525.2	429,000
378	519.9	178,000	520.9	226,000	521.7	262,000	522.5	297,000	523.3	330,000	524.0	365,000	524.7	394,000	525.4	429,000
378.6	520.0	178,000	521.0	226,000	521.8	262,000	522.6	297,000	523.4	330,000	524.2	365,000	524.8	394,000	525.5	429,000
379	520.1	178,000	521.1	226,000	521.9	262,000	522.8	297,000	523.5	330,000	524.3	365,000	525.0	394,000	525.7	429,000
379.5	520.2	178,000	521.2	226,000	522.0	262,000	522.9	297,000	523.6	330,000	524.4	365,000	525.1	394,000	525.8	429,000
380	520.3	178,000	521.4	226,000	522.2	262,000	523.0	297,000	523.8	330,000	524.6	365,000	525.3	394,000	526.0	429,000
380.5	520.4	178,000	521.5	226,000	522.4	262,000	523.2	297,000	524.0	330,000	524.8	365,000	525.4	394,000	526.2	429,000
381	520.5	178,000	521.7	226,000	522.5	262,000	523.3	296,000	524.1	330,000	525.0	365,000	525.6	394,000	526.4	429,000
381.4	520.6	178,000	521.8	226,000	522.6	262,000	523.5	296,000	524.3	330,000	525.1	365,000	525.7	394,000	526.5	429,000
381.9	520.7	178,000	521.9	226,000	522.8	262,000	523.6	296,000	524.4	330,000	525.3	365,000	525.9	394,000	526.7	429,000
382.4	520.8	178,000	522.0	226,000	522.9	262,000	523.8	296,000	524.6	330,000	525.5	365,000	526.1	394,000	526.9	429,000
382.9	520.9	178,000	522.1	226,000	523.0	262,000	523.9	296,000	524.7	330,000	525.6	365,000	526.2	394,000	527.0	429,000
383.4	521.0	178,000	522.2	226,000	523.1	262,000	524.0	296,000	524.8	330,000	525.7	365,000	526.4	394,000	527.2	429,000
383.75	521.0	178,000	522.3	226,000	523.2	262,000	524.1	296,000	524.9	329,000	525.8	365,000	526.5	394,000	527.3	429,000
383.8	521.0	178,000	522.3	226,000	523.2	262,000	524.1	296,000	524.9	329,000	525.8	365,000	526.5	394,000	527.3	429,000
383.9	521.1	178,000	522.3	226,000	523.3	262,000	524.2	296,000	525.0	329,000	525.9	365,000	526.6	394,000	527.4	429,000
384.5	521.2	178,000	522.4	226,000	523.4	262,000	524.3	296,000	525.2	329,000	526.1	365,000	526.8	394,000	527.6	429,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
384.9	521.2	178,000	522.5	226,000	523.5	262,000	524.5	296,000	525.3	329,000	526.2	365,000	527.0	394,000	527.8	429,000
385.6	521.4	178,000	522.7	226,000	523.7	262,000	524.7	296,000	525.6	329,000	526.6	365,000	527.3	394,000	528.2	429,000
385.8	521.4	178,000	522.8	226,000	523.9	262,000	524.9	296,000	525.8	329,000	526.8	365,000	527.5	394,000	528.4	429,000
386.9	521.7	178,000	523.1	226,000	524.2	262,000	525.2	296,000	526.2	329,000	527.2	365,000	527.9	394,000	528.9	429,000
388	521.8	178,000	523.3	226,000	524.5	262,000	525.5	296,000	526.5	330,000	527.6	365,000	528.3	394,000	529.3	429,000
388.8	522.0	178,000	523.6	226,000	524.7	262,000	525.8	296,000	526.8	330,000	527.9	365,000	528.7	394,000	529.7	429,000
389.5	522.2	178,000	523.8	226,000	525.0	262,000	526.1	296,000	527.1	330,000	528.2	365,000	529.0	394,000	530.0	429,000
390	522.3	178,000	524.0	226,000	525.2	262,000	526.3	297,000	527.4	330,000	528.4	365,000	529.3	394,000	530.2	429,000
390.9	522.6	178,000	524.3	226,000	525.5	261,000	526.7	297,000	527.8	330,000	528.8	365,000	529.7	394,000	530.7	429,000
392.1	522.9	178,000	524.6	226,000	525.9	261,000	527.1	297,000	528.2	330,000	529.2	365,000	530.1	394,000	531.1	429,000
393.1	523.1	178,000	524.9	226,000	526.2	261,000	527.4	297,000	528.5	330,000	529.6	365,000	530.5	394,000	531.5	430,000
393.5	523.3	178,000	525.2	226,000	526.5	261,000	527.7	297,000	528.8	330,000	529.9	365,000	530.8	394,000	531.8	430,000
394.1	523.5	178,000	525.4	226,000	526.7	261,000	527.9	297,000	529.0	330,000	530.2	365,000	531.1	394,000	532.1	429,000
394.7	523.7	178,000	525.6	226,000	527.0	261,000	528.2	297,000	529.3	330,000	530.5	365,000	531.4	394,000	532.4	430,000
395	523.8	178,000	525.8	226,000	527.2	261,000	528.5	297,000	529.6	330,000	530.7	365,000	531.7	393,000	532.6	428,000
395.9	524.0	178,000	526.1	226,000	527.4	261,000	528.9	297,000	530.1	330,000	531.2	365,000	532.1	393,000	533.0	428,000
396.6	524.3	170,000	526.6	221,000	527.8	253,000	529.7	291,000	530.9	321,000	531.9	350,000	532.8	380,000	533.7	417,000
397	524.5	170,000	526.8	221,000	527.9	253,000	529.9	291,000	531.1	321,000	532.2	350,000	533.1	380,000	534.0	417,000
397.5	524.7	170,000	527.0	221,000	528.1	253,000	530.1	291,000	531.3	321,000	532.4	350,000	533.3	380,000	534.1	417,000
398	524.8	170,000	527.2	221,000	528.3	253,000	530.3	291,000	531.5	321,000	532.5	350,000	533.4	380,000	534.3	417,000
398.5	525.0	170,000	527.3	221,000	528.5	253,000	530.4	291,000	531.7	321,000	532.7	350,000	533.6	380,000	534.5	417,000
399	525.2	170,000	527.5	221,000	528.7	253,000	530.6	291,000	531.8	321,000	532.9	350,000	533.8	380,000	534.6	417,000
399.5	525.3	170,000	527.7	221,000	528.8	253,000	530.7	291,000	532.0	321,000	533.0	350,000	533.9	380,000	534.8	417,000
400	525.5	170,000	527.8	221,000	529.0	253,000	530.9	291,000	532.1	321,000	533.2	350,000	534.1	380,000	535.0	417,000
400.5	525.7	170,000	528.1	221,000	529.3	253,000	531.2	291,000	532.4	321,000	533.5	350,000	534.3	380,000	535.3	417,000
401	526.0	170,000	528.3	221,000	529.5	253,000	531.4	291,000	532.6	321,000	533.7	350,000	534.6	380,000	535.5	417,000
401.5	526.2	170,000	528.6	221,000	529.8	253,000	531.6	290,000	532.8	320,000	533.9	349,000	534.7	379,000	535.7	417,000
402	526.3	170,000	528.7	221,000	529.9	253,000	531.7	290,000	532.9	320,000	534.0	349,000	534.9	379,000	535.9	417,000
402.5	526.4	170,000	528.8	221,000	530.0	253,000	531.8	291,000	533.0	320,000	534.1	349,000	534.9	379,000	535.9	417,000
403	526.4	170,000	528.8	221,000	530.0	253,000	531.9	291,000	533.0	320,000	534.1	349,000	535.0	379,000	536.0	417,000
403.15	526.4	170,000	528.9	221,000	530.1	253,000	531.9	291,000	533.1	320,000	534.2	349,000	535.0	377,000	536.0	414,000
403.2	526.5	170,000	528.9	221,000	530.1	253,000	531.9	291,000	533.1	320,000	534.2	349,000	535.0	377,000	536.0	414,000
403.25	526.5	170,000	528.9	221,000	530.1	253,000	532.0	291,000	533.2	320,000	534.2	349,000	535.1	377,000	536.1	414,000
403.5	526.5	170,000	528.9	221,000	530.2	253,000	532.1	291,000	533.3	320,000	534.3	349,000	535.2	377,000	536.2	414,000
404	526.6	170,000	529.0	221,000	530.3	253,000	532.2	291,000	533.4	320,000	534.5	349,000	535.4	377,000	536.4	414,000
404.09	526.7	170,000	529.1	221,000	530.4	253,000	532.2	291,000	533.5	320,000	534.5	349,000	535.4	377,000	536.4	414,000
404.1	526.7	170,000	529.1	221,000	530.4	253,000	532.3	291,000	533.5	320,000	534.5	349,000	535.4	377,000	536.5	414,000
404.11	526.7	170,000	529.1	221,000	530.4	253,000	532.3	291,000	533.5	320,000	534.5	349,000	535.4	377,000	536.5	414,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
404.3	526.8	170,000	529.2	221,000	530.5	253,000	532.4	291,000	533.6	320,000	534.7	349,000	535.6	377,000	536.7	414,000
405	526.9	170,000	529.4	221,000	530.7	253,000	532.7	291,000	533.9	320,000	535.0	349,000	536.0	377,000	537.0	414,000
405.5	527.1	170,000	529.6	221,000	531.0	253,000	532.9	291,000	534.2	320,000	535.3	349,000	536.3	377,000	537.4	414,000
406	527.3	170,000	529.8	221,000	531.2	253,000	533.1	291,000	534.4	321,000	535.6	349,000	536.5	377,000	537.6	414,000
406.4	527.5	170,000	530.0	221,000	531.4	253,000	533.3	292,000	534.6	321,000	535.8	349,000	536.7	377,000	537.8	413,000
407	527.6	170,000	530.2	221,000	531.5	253,000	533.5	292,000	534.8	321,000	536.0	349,000	536.9	377,000	538.0	413,000
407.5	527.8	170,000	530.3	221,000	531.7	253,000	533.6	292,000	535.0	321,000	536.1	349,000	537.1	377,000	538.2	413,000
408	527.9	170,000	530.5	221,000	531.8	253,000	533.8	292,000	535.1	321,000	536.3	349,000	537.3	377,000	538.4	413,000
408.5	528.0	170,000	530.6	221,000	532.0	253,000	533.9	292,000	535.3	321,000	536.5	349,000	537.5	377,000	538.6	413,000
408.9	528.2	170,000	530.7	221,000	532.1	253,000	534.1	292,000	535.4	321,000	536.6	350,000	537.6	378,000	538.8	414,000
409.2	528.3	170,000	530.8	221,000	532.2	253,000	534.2	292,000	535.5	321,000	536.7	350,000	537.7	378,000	538.9	413,000
409.7	528.4	170,000	530.9	221,000	532.3	253,000	534.3	292,000	535.7	321,000	536.9	350,000	537.9	378,000	539.1	413,000
410	528.4	170,000	531.0	221,000	532.4	253,000	534.5	292,000	535.8	321,000	537.0	350,000	538.0	378,000	539.2	413,000
410.3	528.5	169,000	531.1	219,000	532.6	252,000	534.6	290,000	536.0	319,000	537.2	347,000	538.2	376,000	539.4	412,000
410.6	529.0	169,000	531.6	219,000	533.0	252,000	535.1	290,000	536.4	319,000	537.6	346,000	538.6	373,000	539.8	406,000
411	529.1	169,000	531.7	219,000	533.2	252,000	535.3	290,000	536.6	319,000	537.8	347,000	538.8	373,000	539.9	406,000
411.4	529.3	169,000	531.9	219,000	533.4	252,000	535.4	290,000	536.8	319,000	538.0	347,000	539.0	373,000	540.1	406,000
412	529.5	169,000	532.1	219,000	533.6	252,000	535.6	290,000	537.0	319,000	538.1	347,000	539.1	373,000	540.2	406,000
412.4	529.7	169,000	532.3	219,000	533.8	252,000	535.8	290,000	537.1	319,000	538.3	347,000	539.3	373,000	540.4	406,000
413	530.0	169,000	532.6	219,000	534.0	252,000	536.0	290,000	537.3	319,000	538.5	347,000	539.5	373,000	540.6	407,000
413.5	530.3	169,000	532.8	219,000	534.3	252,000	536.2	290,000	537.5	319,000	538.6	347,000	539.6	373,000	540.7	407,000
414	530.5	169,000	533.0	219,000	534.5	252,000	536.3	290,000	537.6	319,000	538.8	347,000	539.8	373,000	540.9	407,000
414.4	530.7	169,000	533.2	219,000	534.6	252,000	536.5	290,000	537.8	319,000	538.9	347,000	539.9	373,000	541.0	407,000
415	530.9	169,000	533.4	219,000	534.8	252,000	536.6	290,000	537.9	319,000	539.0	347,000	540.0	373,000	541.1	407,000
415.7	531.2	169,000	533.6	219,000	535.1	252,000	536.9	290,000	538.1	319,000	539.2	347,000	540.1	373,000	541.2	407,000
416	531.3	169,000	533.8	219,000	535.2	252,000	537.0	290,000	538.2	319,000	539.3	347,000	540.3	373,000	541.3	407,000
416.6	531.6	169,000	534.1	219,000	535.5	252,000	537.3	290,000	538.5	319,000	539.6	347,000	540.5	373,000	541.6	407,000
417	531.7	168,000	534.2	219,000	535.7	252,000	537.4	290,000	538.7	319,000	539.7	347,000	540.7	373,000	541.7	407,000
417.4	531.8	168,000	534.3	219,000	535.8	252,000	537.6	290,000	538.8	319,000	539.9	347,000	540.8	373,000	541.9	407,000
418	532.0	168,000	534.5	219,000	536.0	252,000	537.8	290,000	539.0	319,000	540.1	347,000	541.0	373,000	542.1	407,000
418.6	532.2	168,000	534.8	219,000	536.3	252,000	538.1	290,000	539.3	319,000	540.4	347,000	541.3	373,000	542.4	407,000
419	532.5	168,000	535.0	219,000	536.6	252,000	538.4	290,000	539.6	319,000	540.7	347,000	541.6	373,000	542.7	407,000
419.4	532.7	168,000	535.3	219,000	536.8	252,000	538.6	290,000	539.8	319,000	540.9	347,000	541.8	373,000	542.9	407,000
420	533.0	168,000	535.6	219,000	537.1	251,000	538.9	290,000	540.1	319,000	541.2	347,000	542.1	373,000	543.2	407,000
420.5	533.3	168,000	535.8	219,000	537.4	251,000	539.1	290,000	540.3	319,000	541.4	347,000	542.3	373,000	543.4	407,000
421	533.6	168,000	536.1	219,000	537.7	251,000	539.4	290,000	540.6	319,000	541.7	347,000	542.6	373,000	543.6	407,000
421.5	533.8	168,000	536.4	219,000	537.9	251,000	539.7	290,000	540.9	319,000	541.9	347,000	542.8	373,000	543.8	407,000
422	534.1	168,000	536.7	219,000	538.2	251,000	540.0	290,000	541.1	319,000	542.2	347,000	543.1	373,000	544.1	407,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
422.4	534.3	168,000	536.9	219,000	538.4	251,000	540.2	290,000	541.3	319,000	542.4	347,000	543.2	373,000	544.1	405,000
423	534.5	168,000	537.1	219,000	538.7	251,000	540.4	290,000	541.6	319,000	542.6	347,000	543.4	373,000	544.4	405,000
423.5	534.7	168,000	537.3	219,000	538.9	251,000	540.6	290,000	541.8	319,000	542.8	347,000	543.6	373,000	544.6	406,000
424	535.0	168,000	537.6	219,000	539.1	251,000	540.8	290,000	542.0	319,000	543.0	347,000	543.8	373,000	544.8	406,000
424.4	535.1	168,000	537.8	219,000	539.3	251,000	541.0	290,000	542.2	319,000	543.2	347,000	544.0	373,000	545.0	406,000
425	535.5	168,000	538.1	219,000	539.7	251,000	541.3	290,000	542.5	319,000	543.5	347,000	544.3	373,000	545.2	406,000
425.5	535.7	168,000	538.3	219,000	539.9	251,000	541.5	290,000	542.7	319,000	543.6	347,000	544.5	373,000	545.4	406,000
426	535.9	168,000	538.6	218,000	540.1	251,000	541.8	290,000	542.9	319,000	543.9	347,000	544.7	373,000	545.7	406,000
427	536.2	168,000	538.9	218,000	540.4	251,000	542.1	290,000	543.2	319,000	544.2	347,000	545.0	373,000	546.0	406,000
427.6	536.4	168,000	539.1	218,000	540.7	251,000	542.3	289,000	543.4	319,000	544.4	346,000	545.3	373,000	546.2	406,000
427.95	536.5	168,000	539.2	218,000	540.8	251,000	542.5	289,000	543.6	319,000	544.6	347,000	545.4	373,000	546.4	406,000
428	536.5	167,000	539.2	218,000	540.8	250,000	542.5	289,000	543.6	318,000	544.6	346,000	545.5	372,000	546.4	406,000
428.05	536.6	167,000	539.3	218,000	540.9	250,000	542.6	289,000	543.7	318,000	544.7	346,000	545.6	372,000	546.5	406,000
428.7	536.9	167,000	539.5	218,000	541.2	250,000	542.9	289,000	544.0	318,000	545.0	346,000	545.9	372,000	546.8	406,000
429	537.0	167,000	539.7	218,000	541.3	250,000	543.0	289,000	544.2	318,000	545.2	346,000	546.1	372,000	547.0	406,000
429.5	537.2	167,000	539.9	218,000	541.5	250,000	543.2	289,000	544.4	318,000	545.4	346,000	546.3	372,000	547.3	406,000
430	537.4	167,000	540.1	218,000	541.8	250,000	543.5	289,000	544.7	318,000	545.8	346,000	546.7	372,000	547.6	406,000
430.5	537.6	167,000	540.3	218,000	542.0	250,000	543.8	289,000	545.0	318,000	546.1	346,000	547.0	372,000	548.0	406,000
431	537.8	167,000	540.6	218,000	542.3	250,000	544.1	289,000	545.4	318,000	546.4	346,000	547.4	372,000	548.3	406,000
431.5	538.2	166,000	541.0	217,000	542.7	248,000	544.6	287,000	545.9	315,000	547.0	342,000	548.0	370,000	549.0	406,000
432	538.5	166,000	541.3	217,000	543.1	248,000	545.0	287,000	546.3	315,000	547.4	342,000	548.4	370,000	549.4	406,000
432.5	538.8	166,000	541.6	217,000	543.3	248,000	545.3	287,000	546.6	315,000	547.7	342,000	548.7	370,000	549.7	406,000
433	539.1	166,000	541.9	216,000	543.7	248,000	545.7	287,000	547.0	315,000	548.2	342,000	549.2	370,000	550.2	406,000
433.4	539.3	166,000	542.2	216,000	544.0	248,000	546.0	287,000	547.3	315,000	548.5	342,000	549.6	370,000	550.6	406,000
434	539.5	166,000	542.5	216,000	544.2	248,000	546.3	287,000	547.7	315,000	548.9	342,000	550.0	370,000	551.0	406,000
434.4	539.7	166,000	542.9	216,000	544.4	248,000	546.6	287,000	548.0	315,000	549.2	342,000	550.3	370,000	551.4	406,000
435	539.9	149,000	543.6	197,000	544.7	227,000	547.1	264,000	548.7	291,000	550.0	315,000	551.0	338,000	552.0	370,000
435.6	540.0	149,000	543.9	197,000	544.8	227,000	547.3	264,000	549.0	291,000	550.2	315,000	551.2	338,000	552.3	370,000
436	540.1	149,000	543.9	197,000	544.9	227,000	547.4	264,000	549.1	291,000	550.3	315,000	551.3	338,000	552.4	370,000
436.5	540.2	149,000	544.0	197,000	545.1	227,000	547.5	264,000	549.2	291,000	550.4	315,000	551.5	338,000	552.5	370,000
437	540.3	149,000	544.1	197,000	545.2	227,000	547.6	264,000	549.3	291,000	550.6	315,000	551.6	338,000	552.7	370,000
437.1	540.5	149,000	544.3	197,000	545.4	227,000	547.9	264,000	549.6	291,000	550.8	315,000	551.9	338,000	553.0	370,000
437.5	540.7	149,000	544.5	197,000	545.7	227,000	548.1	264,000	549.8	291,000	551.1	315,000	552.1	338,000	553.2	370,000
438	540.9	149,000	544.7	197,000	545.8	227,000	548.3	264,000	550.0	291,000	551.3	315,000	552.3	338,000	553.4	371,000
438.4	541.0	149,000	544.8	197,000	545.9	227,000	548.4	264,000	550.1	291,000	551.4	315,000	552.4	338,000	553.5	371,000
439	541.1	149,000	544.9	197,000	546.1	227,000	548.6	264,000	550.2	291,000	551.5	315,000	552.6	338,000	553.7	371,000
439.5	541.2	149,000	545.0	197,000	546.2	227,000	548.7	264,000	550.3	291,000	551.7	315,000	552.7	338,000	553.8	371,000
440	541.3	149,000	545.1	197,000	546.4	227,000	548.8	264,000	550.5	291,000	551.8	315,000	552.9	338,000	554.0	371,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
440.3	541.5	149,000	545.3	197,000	546.5	227,000	549.0	264,000	550.6	291,000	552.0	315,000	553.0	338,000	554.1	371,000
441	541.6	149,000	545.5	197,000	546.7	227,000	549.1	264,000	550.8	291,000	552.2	315,000	553.3	339,000	554.4	371,000
441.5	541.8	149,000	545.6	197,000	546.8	227,000	549.3	264,000	551.0	291,000	552.3	315,000	553.4	339,000	554.5	371,000
442	541.9	149,000	545.7	197,000	547.0	227,000	549.4	264,000	551.1	291,000	552.4	315,000	553.5	339,000	554.6	371,000
442.4	542.1	149,000	545.8	197,000	547.1	227,000	549.5	264,000	551.2	291,000	552.6	315,000	553.7	339,000	554.7	371,000
443	542.2	149,000	546.0	197,000	547.3	227,000	549.6	264,000	551.3	291,000	552.7	315,000	553.8	339,000	554.8	371,000
443.5	542.4	149,000	546.1	197,000	547.4	227,000	549.8	264,000	551.5	291,000	552.9	315,000	554.0	339,000	555.0	372,000
444	542.6	149,000	546.3	197,000	547.6	227,000	549.9	264,000	551.6	291,000	553.0	315,000	554.1	339,000	555.1	372,000
444.4	542.6	149,000	546.4	197,000	547.7	227,000	550.0	264,000	551.7	291,000	553.1	315,000	554.2	339,000	555.2	372,000
445	542.8	149,000	546.5	197,000	547.9	227,000	550.2	264,000	551.9	291,000	553.2	315,000	554.4	339,000	555.4	372,000
445.3	542.9	149,000	546.6	197,000	547.9	227,000	550.3	264,000	551.9	291,000	553.3	315,000	554.4	339,000	555.5	372,000
446	543.0	149,000	546.7	197,000	548.1	227,000	550.4	264,000	552.1	291,000	553.5	315,000	554.6	340,000	555.6	372,000
446.4	543.1	149,000	546.8	197,000	548.2	227,000	550.5	264,000	552.2	291,000	553.6	315,000	554.7	339,000	555.7	372,000
447	543.2	149,000	546.9	197,000	548.3	227,000	550.6	264,000	552.3	291,000	553.7	315,000	554.8	340,000	555.9	372,000
447.2	543.3	149,000	547.0	197,000	548.4	227,000	550.8	264,000	552.4	291,000	553.8	315,000	554.9	340,000	556.0	372,000
448	543.6	149,000	547.3	197,000	548.7	227,000	551.0	264,000	552.7	291,000	554.1	315,000	555.2	340,000	556.3	372,000
449	543.8	149,000	547.5	197,000	549.0	227,000	551.3	264,000	553.0	291,000	554.5	315,000	555.6	340,000	556.6	372,000
449.4	544.1	149,000	547.8	197,000	549.3	227,000	551.7	264,000	553.3	291,000	554.8	315,000	555.9	340,000	557.0	373,000
450	544.3	149,000	548.0	197,000	549.6	227,000	551.9	264,000	553.6	291,000	555.1	315,000	556.2	340,000	557.2	373,000
450.5	544.5	149,000	548.1	197,000	549.7	227,000	552.1	264,000	553.8	291,000	555.3	315,000	556.4	340,000	557.4	373,000
451	544.6	149,000	548.3	197,000	549.9	227,000	552.2	264,000	553.9	291,000	555.5	319,000	556.6	346,000	557.5	380,000
451.5	544.7	149,000	548.4	197,000	550.0	227,000	552.3	264,000	554.1	291,000	555.7	319,000	556.7	346,000	557.6	380,000
452	544.8	149,000	548.5	197,000	550.1	227,000	552.5	264,000	554.2	291,000	555.8	319,000	556.9	346,000	557.8	380,000
452.5	544.9	149,000	548.6	197,000	550.3	227,000	552.6	264,000	554.4	291,000	556.0	319,000	557.0	346,000	557.9	380,000
453	545.0	149,000	548.8	197,000	550.4	227,000	552.8	264,000	554.5	291,000	556.1	319,000	557.2	346,000	558.1	380,000
453.6	545.2	149,000	548.9	197,000	550.6	227,000	553.0	264,000	554.7	291,000	556.4	319,000	557.5	346,000	558.4	380,000
454	545.3	149,000	549.0	197,000	550.7	227,000	553.1	264,000	554.8	291,000	556.5	319,000	557.6	346,000	558.5	379,000
454.3	545.4	149,000	549.1	197,000	550.7	227,000	553.1	264,000	554.9	291,000	556.5	319,000	557.7	346,000	558.6	379,000
454.7	545.5	149,000	549.2	197,000	550.8	227,000	553.2	264,000	555.0	291,000	556.6	319,000	557.8	346,000	558.7	379,000
455	545.5	149,000	549.2	197,000	550.8	227,000	553.2	264,000	555.0	291,000	556.6	319,000	557.8	346,000	558.7	379,000
455.6	545.6	149,000	549.2	197,000	550.9	227,000	553.3	264,000	555.1	291,000	556.7	319,000	557.8	346,000	558.8	379,000
455.9	545.7	149,000	549.3	197,000	550.9	227,000	553.4	264,000	555.1	291,000	556.8	319,000	557.9	346,000	558.9	379,000
456	545.7	149,000	549.3	197,000	551.0	227,000	553.4	264,000	555.2	291,000	556.9	318,000	558.0	346,000	559.0	379,000
456.6	545.9	149,000	549.5	197,000	551.2	227,000	553.7	264,000	555.5	291,000	557.1	318,000	558.3	346,000	559.3	379,000
457	545.9	149,000	549.5	197,000	551.2	227,000	553.7	264,000	555.5	291,000	557.2	318,000	558.3	346,000	559.4	379,000
457.2	546.4	149,000	550.0	197,000	551.7	227,000	554.2	264,000	556.0	291,000	557.7	318,000	558.8	346,000	559.9	379,000
457.6	546.6	149,000	550.2	197,000	551.9	227,000	554.4	264,000	556.2	291,000	557.9	318,000	559.0	346,000	560.1	379,000
458	546.6	149,000	550.3	197,000	552.0	227,000	554.5	264,000	556.3	291,000	557.9	318,000	559.1	346,000	560.2	379,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
458.6	546.8	149,000	550.4	197,000	552.1	227,000	554.6	264,000	556.4	291,000	558.1	318,000	559.3	346,000	560.3	379,000
459	546.9	149,000	550.4	197,000	552.2	227,000	554.7	264,000	556.5	291,000	558.2	318,000	559.4	346,000	560.4	380,000
459.5	547.0	149,000	550.5	197,000	552.3	227,000	554.8	264,000	556.6	291,000	558.3	318,000	559.5	346,000	560.6	380,000
460	547.1	149,000	550.6	197,000	552.3	227,000	554.8	264,000	556.7	291,000	558.4	318,000	559.6	346,000	560.7	380,000
460.5	547.3	149,000	550.7	197,000	552.4	227,000	554.9	264,000	556.8	291,000	558.5	318,000	559.7	345,000	560.8	379,000
461	547.5	149,000	550.8	197,000	552.5	227,000	555.0	264,000	556.9	291,000	558.6	318,000	559.8	345,000	560.9	379,000
461.5	547.7	149,000	550.9	197,000	552.6	227,000	555.1	264,000	557.0	291,000	558.7	318,000	559.9	345,000	561.1	379,000
462	547.8	149,000	551.0	197,000	552.7	227,000	555.2	264,000	557.1	291,000	558.7	318,000	560.0	345,000	561.2	379,000
462.5	547.8	149,000	551.0	197,000	552.7	227,000	555.2	264,000	557.1	291,000	558.8	318,000	560.1	345,000	561.3	379,000
463	547.9	149,000	551.1	197,000	552.8	227,000	555.3	264,000	557.2	291,000	558.9	318,000	560.2	345,000	561.4	379,000
463.6	548.0	149,000	551.1	197,000	552.9	227,000	555.4	264,000	557.3	291,000	559.0	318,000	560.3	345,000	561.5	379,000
464	548.2	149,000	551.3	197,000	553.0	227,000	555.5	264,000	557.4	291,000	559.1	318,000	560.4	345,000	561.6	379,000
464.5	548.4	149,000	551.5	197,000	553.1	227,000	555.7	264,000	557.6	291,000	559.2	318,000	560.5	345,000	561.7	379,000
465	548.7	149,000	551.7	197,000	553.3	227,000	555.8	264,000	557.7	291,000	559.4	318,000	560.6	345,000	561.9	379,000
465.5	549.0	149,000	552.0	197,000	553.6	227,000	556.1	264,000	557.9	291,000	559.5	318,000	560.8	345,000	562.1	379,000
466	549.2	149,000	552.2	197,000	553.8	227,000	556.2	264,000	558.1	290,000	559.7	318,000	560.9	344,000	562.2	378,000
466.5	549.5	149,000	552.5	197,000	554.1	227,000	556.4	264,000	558.2	290,000	559.8	318,000	561.1	344,000	562.3	378,000
467	549.9	149,000	552.8	197,000	554.4	227,000	556.7	264,000	558.5	290,000	560.0	318,000	561.3	344,000	562.5	378,000
467.6	550.2	149,000	553.0	197,000	554.6	227,000	556.9	264,000	558.6	290,000	560.2	317,000	561.4	344,000	562.6	378,000
468	550.4	149,000	553.2	197,000	554.8	227,000	557.1	264,000	558.8	290,000	560.4	317,000	561.6	344,000	562.8	378,000
469	550.8	149,000	553.6	197,000	555.2	227,000	557.4	264,000	559.1	290,000	560.7	317,000	561.9	344,000	563.1	378,000
469.5	551.0	149,000	553.8	197,000	555.4	227,000	557.6	264,000	559.3	290,000	560.8	317,000	562.1	344,000	563.3	378,000
470	551.2	149,000	554.0	197,000	555.6	227,000	557.8	264,000	559.5	290,000	561.0	317,000	562.2	344,000	563.4	378,000
470.6	551.4	149,000	554.2	197,000	555.8	227,000	558.0	264,000	559.7	290,000	561.2	317,000	562.4	344,000	563.6	378,000
471	551.6	149,000	554.4	197,000	556.0	227,000	558.2	264,000	559.9	290,000	561.4	317,000	562.6	344,000	563.8	378,000
471.5	551.8	149,000	554.6	197,000	556.2	227,000	558.4	264,000	560.1	290,000	561.5	317,000	562.7	344,000	564.0	378,000
472	552.0	149,000	554.8	197,000	556.4	227,000	558.5	264,000	560.2	290,000	561.7	317,000	562.9	344,000	564.1	378,000
472.6	552.1	149,000	554.9	197,000	556.5	227,000	558.7	264,000	560.3	290,000	561.8	317,000	563.0	344,000	564.2	378,000
473	552.2	149,000	555.0	197,000	556.6	227,000	558.8	264,000	560.4	290,000	561.9	317,000	563.1	344,000	564.3	377,000
473.5	552.3	149,000	555.2	197,000	556.8	227,000	558.9	264,000	560.6	290,000	562.1	317,000	563.3	344,000	564.5	377,000
474	552.5	149,000	555.4	197,000	557.0	227,000	559.2	264,000	560.8	290,000	562.3	317,000	563.5	344,000	564.7	377,000
474.5	552.7	149,000	555.6	197,000	557.1	227,000	559.3	264,000	561.0	290,000	562.4	317,000	563.7	344,000	564.9	377,000
475	552.9	149,000	555.8	197,000	557.4	227,000	559.5	264,000	561.2	290,000	562.6	317,000	563.9	344,000	565.1	377,000
476	553.2	149,000	556.1	197,000	557.7	227,000	559.9	264,000	561.5	290,000	563.0	317,000	564.2	344,000	565.4	377,000
476.5	553.4	149,000	556.3	197,000	558.0	227,000	560.1	264,000	561.7	290,000	563.2	317,000	564.4	344,000	565.6	377,000
477	553.7	149,000	556.6	197,000	558.2	227,000	560.3	264,000	562.0	290,000	563.4	317,000	564.6	344,000	565.8	377,000
477.6	553.9	149,000	556.8	197,000	558.4	227,000	560.5	264,000	562.1	290,000	563.5	317,000	564.7	343,000	566.0	377,000
477.9	553.9	149,000	556.8	197,000	558.5	227,000	560.6	264,000	562.2	290,000	563.6	317,000	564.8	343,000	566.1	377,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
478.2	554.1	149,000	557.0	197,000	558.6	227,000	560.7	264,000	562.3	290,000	563.7	317,000	564.9	343,000	566.2	377,000
478.25	554.1	149,000	557.0	197,000	558.6	227,000	560.7	264,000	562.3	290,000	563.7	317,000	564.9	343,000	566.2	377,000
478.3	554.1	149,000	557.0	197,000	558.7	227,000	560.7	264,000	562.4	290,000	563.8	317,000	565.0	343,000	566.2	377,000
478.6	554.2	149,000	557.1	197,000	558.8	227,000	560.8	264,000	562.4	290,000	563.9	317,000	565.1	343,000	566.3	377,000
479	554.4	149,000	557.2	197,000	558.9	227,000	560.8	264,000	562.5	290,000	564.0	317,000	565.2	343,000	566.4	377,000
480	554.8	134,000	557.5	179,000	559.0	207,000	560.7	241,000	562.5	266,000	564.1	290,000	565.3	314,000	566.6	345,000
480.1	554.9	134,000	557.6	179,000	559.1	207,000	560.8	241,000	562.6	266,000	564.1	290,000	565.3	314,000	566.6	345,000
480.7	555.1	134,000	557.8	179,000	559.3	207,000	561.0	241,000	562.8	266,000	564.3	290,000	565.5	314,000	566.8	345,000
481	555.2	134,000	557.9	179,000	559.5	207,000	561.1	241,000	562.9	266,000	564.4	290,000	565.6	314,000	566.9	345,000
481.5	555.4	134,000	558.0	179,000	559.7	207,000	561.3	241,000	563.1	266,000	564.7	290,000	565.8	314,000	567.1	345,000
482	555.5	134,000	558.1	179,000	559.8	207,000	561.4	241,000	563.2	266,000	564.8	290,000	566.0	314,000	567.3	345,000
482.1	555.5	134,000	558.1	179,000	559.8	207,000	561.5	241,000	563.3	266,000	564.8	290,000	566.0	314,000	567.3	345,000
482.3	555.6	134,000	558.2	179,000	559.9	207,000	561.5	241,000	563.3	266,000	564.9	290,000	566.1	314,000	567.4	345,000
482.7	555.7	134,000	558.4	179,000	560.1	207,000	561.8	241,000	563.6	266,000	565.1	290,000	566.3	314,000	567.6	345,000
482.9	560.5	134,000	560.5	179,000	561.0	207,000	562.4	241,000	564.2	266,000	565.8	290,000	567.0	314,000	568.3	345,000
483	560.5	134,000	560.6	179,000	561.1	207,000	562.6	241,000	564.4	266,000	565.9	290,000	567.1	314,000	568.4	345,000
483.15	560.6	134,000	560.6	179,000	561.2	207,000	562.8	241,000	564.6	266,000	566.1	290,000	567.3	314,000	568.6	345,000
483.3	560.6	134,000	560.7	179,000	561.4	207,000	562.9	241,000	564.7	266,000	566.3	290,000	567.5	314,000	568.8	345,000
483.45	560.7	134,000	560.8	179,000	561.5	207,000	563.1	241,000	564.9	265,000	566.5	290,000	567.7	314,000	569.0	345,000
483.6	560.7	134,000	560.8	179,000	561.6	207,000	563.2	241,000	565.0	265,000	566.7	290,000	567.9	314,000	569.2	345,000
484	560.8	134,000	561.0	179,000	561.8	207,000	563.5	241,000	565.4	265,000	567.0	290,000	568.2	314,000	569.5	345,000
484.4	560.9	134,000	561.2	179,000	562.1	207,000	563.8	241,000	565.7	265,000	567.4	290,000	568.6	314,000	569.9	345,000
484.7	561.0	134,000	561.3	179,000	562.3	207,000	564.0	241,000	566.0	265,000	567.6	290,000	568.9	313,000	570.2	345,000
485	561.2	134,000	561.5	179,000	562.6	207,000	564.3	241,000	566.3	265,000	568.0	290,000	569.3	313,000	570.5	345,000
485.4	561.4	134,000	561.9	179,000	563.1	207,000	564.8	241,000	566.9	265,000	568.6	290,000	569.8	313,000	571.1	345,000
485.8	561.7	134,000	562.4	179,000	563.6	207,000	565.4	241,000	567.4	265,000	569.1	290,000	570.4	313,000	571.7	345,000
486	561.9	134,000	562.8	179,000	564.0	207,000	565.8	241,000	567.8	265,000	569.5	290,000	570.8	313,000	572.1	345,000
487	562.3	134,000	563.5	179,000	564.7	207,000	566.6	241,000	568.5	265,000	570.2	290,000	571.5	313,000	572.8	345,000
487.6	562.7	134,000	563.9	179,000	565.2	207,000	567.1	241,000	569.0	265,000	570.7	290,000	572.0	313,000	573.3	345,000
487.8	562.8	134,000	564.2	179,000	565.5	207,000	567.4	241,000	569.3	265,000	571.0	290,000	572.3	313,000	573.7	345,000
488	563.0	134,000	564.4	178,000	565.8	206,000	567.7	241,000	569.6	265,000	571.2	289,000	572.5	313,000	573.9	344,000
488.6	563.4	134,000	564.9	178,000	566.2	206,000	568.1	241,000	570.0	265,000	571.6	289,000	572.9	313,000	574.3	344,000
489	563.6	134,000	565.2	178,000	566.6	206,000	568.5	241,000	570.4	265,000	572.0	289,000	573.3	313,000	574.7	344,000
489.5	563.9	134,000	565.5	178,000	566.9	206,000	568.8	241,000	570.7	265,000	572.3	289,000	573.6	313,000	575.1	344,000
489.75	564.0	134,000	565.7	178,000	567.1	206,000	569.0	241,000	570.9	265,000	572.5	289,000	573.9	313,000	575.3	344,000
490	564.3	134,000	566.0	178,000	567.4	206,000	569.3	241,000	571.2	265,000	572.8	289,000	574.1	313,000	575.6	344,000
490.6	564.7	134,000	566.5	178,000	567.9	206,000	569.8	241,000	571.7	265,000	573.3	289,000	574.6	313,000	576.1	344,000
491	565.0	134,000	566.8	178,000	568.3	206,000	570.2	241,000	572.0	265,000	573.6	289,000	574.9	313,000	576.4	344,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
491.3	565.3	134,000	567.1	178,000	568.6	206,000	570.5	241,000	572.3	265,000	573.9	289,000	575.2	313,000	576.6	344,000
492	565.6	134,000	567.4	178,000	568.9	206,000	570.8	241,000	572.6	265,000	574.2	289,000	575.5	313,000	576.9	344,000
492.5	565.8	134,000	567.7	178,000	569.1	206,000	571.0	241,000	572.8	265,000	574.4	289,000	575.7	313,000	577.2	344,000
493	566.0	134,000	567.9	178,000	569.4	206,000	571.3	241,000	573.0	265,000	574.6	289,000	575.9	313,000	577.4	344,000
493.2	566.1	134,000	568.0	178,000	569.4	206,000	571.3	241,000	573.1	265,000	574.7	289,000	576.0	313,000	577.5	344,000
493.4	571.5	134,000	571.5	178,000	571.7	206,000	573.6	241,000	575.6	265,000	577.3	289,000	578.7	313,000	580.5	344,000
494	571.7	134,000	571.7	178,000	572.2	206,000	574.1	241,000	576.0	265,000	577.7	289,000	579.1	313,000	580.8	344,000
494.6	571.8	134,000	571.8	178,000	572.6	206,000	574.5	240,000	576.4	265,000	578.0	289,000	579.4	313,000	581.1	344,000
495	571.9	134,000	571.9	178,000	572.9	206,000	574.9	240,000	576.7	265,000	578.2	289,000	579.6	313,000	581.3	344,000
495.3	572.1	134,000	572.1	178,000	573.3	206,000	575.3	240,000	577.1	265,000	578.6	289,000	580.0	313,000	581.6	344,000
496	572.4	134,000	572.5	178,000	573.9	206,000	575.9	240,000	577.6	265,000	579.1	289,000	580.5	313,000	582.0	344,000
496.5	572.7	134,000	572.9	178,000	574.6	206,000	576.6	240,000	578.2	265,000	579.7	289,000	581.0	313,000	582.6	344,000
496.8	572.9	134,000	573.2	178,000	574.9	206,000	577.0	240,000	578.5	265,000	580.0	289,000	581.3	313,000	582.8	344,000
497.1	573.0	134,000	573.4	178,000	575.2	206,000	577.2	240,000	578.8	265,000	580.3	289,000	581.6	313,000	583.1	344,000
498	573.2	134,000	573.8	178,000	575.6	206,000	577.7	240,000	579.2	265,000	580.7	289,000	582.0	313,000	583.6	344,000
498.5	573.3	134,000	574.0	178,000	575.9	206,000	578.0	240,000	579.5	265,000	581.0	289,000	582.3	313,000	583.9	344,000
499	573.5	134,000	574.2	178,000	576.1	206,000	578.2	240,000	579.8	265,000	581.3	289,000	582.6	313,000	584.2	344,000
499.5	573.6	134,000	574.5	178,000	576.4	206,000	578.5	240,000	580.1	265,000	581.6	289,000	582.9	313,000	584.5	344,000
500	573.8	134,000	574.7	178,000	576.6	206,000	578.8	240,000	580.3	265,000	581.8	289,000	583.1	313,000	584.7	344,000
500.5	573.9	134,000	574.9	178,000	576.9	206,000	579.0	240,000	580.6	265,000	582.0	289,000	583.4	313,000	584.9	344,000
501	574.0	134,000	575.1	178,000	577.1	206,000	579.2	240,000	580.8	265,000	582.2	289,000	583.5	313,000	585.1	344,000
501.5	574.1	134,000	575.2	178,000	577.2	206,000	579.4	240,000	581.0	265,000	582.4	289,000	583.7	313,000	585.3	344,000
501.74	574.2	134,000	575.4	178,000	577.4	206,000	579.5	240,000	581.1	265,000	582.6	289,000	583.9	313,000	585.4	344,000
502	574.3	134,000	575.5	178,000	577.5	206,000	579.7	240,000	581.2	265,000	582.7	289,000	584.0	313,000	585.6	344,000
502.5	574.4	134,000	575.7	178,000	577.7	206,000	579.9	240,000	581.5	265,000	583.0	289,000	584.3	313,000	585.8	344,000
502.9	574.5	134,000	575.9	178,000	577.9	206,000	580.1	240,000	581.7	265,000	583.1	289,000	584.5	313,000	586.0	344,000
503.1	574.6	134,000	576.1	178,000	578.1	206,000	580.2	240,000	581.8	265,000	583.3	289,000	584.6	313,000	586.2	344,000
503.3	574.8	134,000	576.2	178,000	578.3	206,000	580.4	240,000	582.0	265,000	583.4	289,000	584.8	313,000	586.3	344,000
504	575.2	134,000	576.8	178,000	578.8	206,000	580.8	240,000	582.3	265,000	583.7	289,000	585.0	313,000	586.6	344,000
505	575.6	134,000	577.3	178,000	579.2	206,000	581.3	240,000	582.7	265,000	584.1	289,000	585.4	313,000	586.9	344,000
505.5	575.9	134,000	577.7	178,000	579.6	206,000	581.6	240,000	583.0	265,000	584.4	289,000	585.6	313,000	587.1	344,000
506	576.2	134,000	578.0	178,000	579.9	206,000	581.9	240,000	583.3	265,000	584.6	289,000	585.9	313,000	587.3	344,000
506.9	576.4	134,000	578.3	178,000	580.2	206,000	582.2	240,000	583.6	265,000	585.0	289,000	586.3	313,000	587.6	344,000
507.4	576.6	131,000	578.7	174,000	580.6	202,000	582.6	235,000	584.1	260,000	585.6	283,000	586.8	307,000	588.1	337,000
507.9	576.9	131,000	579.0	174,000	580.9	202,000	582.9	235,000	584.5	260,000	585.9	283,000	587.1	307,000	588.4	337,000
508.6	577.1	131,000	579.3	174,000	581.2	202,000	583.2	235,000	584.8	260,000	586.2	283,000	587.4	307,000	588.6	337,000
509	577.3	131,000	579.5	174,000	581.4	202,000	583.4	235,000	585.0	260,000	586.4	283,000	587.6	307,000	588.8	337,000
509.3	577.4	131,000	579.7	174,000	581.6	202,000	583.6	235,000	585.2	260,000	586.6	283,000	587.7	307,000	589.0	337,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
510.1	577.7	131,000	580.1	174,000	582.0	202,000	584.0	235,000	585.5	260,000	586.9	283,000	588.0	306,000	589.3	337,000
511	578.0	131,000	580.4	174,000	582.3	202,000	584.3	235,000	585.9	259,000	587.3	283,000	588.3	306,000	589.6	337,000
511.6	578.2	131,000	580.6	174,000	582.5	202,000	584.5	235,000	586.1	259,000	587.5	283,000	588.6	306,000	589.8	337,000
512	578.4	131,000	580.9	174,000	582.8	202,000	584.8	235,000	586.4	259,000	587.8	283,000	588.9	306,000	590.1	337,000
512.7	578.6	131,000	581.1	174,000	583.1	202,000	585.1	235,000	586.7	259,000	588.1	283,000	589.2	306,000	590.4	337,000
513	578.7	131,000	581.3	174,000	583.3	202,000	585.4	235,000	586.9	259,000	588.4	283,000	589.5	306,000	590.6	337,000
514	579.0	131,000	581.6	174,000	583.6	202,000	585.7	235,000	587.3	259,000	588.7	283,000	589.8	306,000	591.0	337,000
514.4	579.2	131,000	581.9	174,000	583.8	202,000	586.0	235,000	587.5	259,000	589.0	283,000	590.1	306,000	591.2	337,000
515	579.4	131,000	582.1	174,000	584.1	202,000	586.2	235,000	587.8	259,000	589.3	283,000	590.4	306,000	591.5	337,000
515.5	579.6	131,000	582.3	174,000	584.3	202,000	586.5	235,000	588.0	259,000	589.5	283,000	590.6	306,000	591.7	337,000
516	579.8	131,000	582.5	174,000	584.5	202,000	586.7	235,000	588.2	259,000	589.7	283,000	590.8	306,000	591.9	337,000
516.6	580.0	131,000	582.7	174,000	584.7	202,000	586.9	235,000	588.5	259,000	589.9	283,000	591.0	306,000	592.2	337,000
517	580.1	131,000	582.9	174,000	584.9	202,000	587.1	235,000	588.6	259,000	590.1	283,000	591.2	306,000	592.3	337,000
517.7	580.2	131,000	583.0	174,000	585.0	202,000	587.2	235,000	588.8	259,000	590.2	283,000	591.3	306,000	592.5	337,000
517.95	580.3	131,000	583.1	174,000	585.1	202,000	587.3	235,000	588.9	259,000	590.4	283,000	591.5	306,000	592.6	337,000
518	580.3	131,000	583.1	174,000	585.1	202,000	587.4	235,000	589.0	259,000	590.4	283,000	591.5	306,000	592.6	337,000
518.05	580.3	131,000	583.2	174,000	585.2	202,000	587.4	235,000	589.0	259,000	590.5	283,000	591.6	306,000	592.7	337,000
518.1	580.3	131,000	583.2	174,000	585.2	202,000	587.4	235,000	589.0	259,000	590.5	283,000	591.6	306,000	592.7	337,000
518.15	580.4	131,000	583.3	174,000	585.3	202,000	587.6	235,000	589.2	259,000	590.7	283,000	591.8	306,000	592.9	337,000
518.4	580.6	131,000	583.5	174,000	585.5	202,000	587.8	235,000	589.4	259,000	590.9	283,000	592.0	306,000	593.1	337,000
519.1	580.7	131,000	583.7	174,000	585.7	202,000	588.0	235,000	589.6	259,000	591.1	283,000	592.2	306,000	593.4	337,000
519.6	580.8	131,000	583.8	174,000	585.9	202,000	588.2	235,000	589.8	259,000	591.3	283,000	592.5	306,000	593.6	337,000
519.75	580.9	131,000	583.9	174,000	586.0	202,000	588.3	235,000	589.9	259,000	591.4	283,000	592.5	306,000	593.7	337,000
519.9	581.0	131,000	583.9	174,000	586.0	202,000	588.3	235,000	590.0	259,000	591.5	283,000	592.6	306,000	593.7	337,000
519.95	581.0	131,000	584.0	174,000	586.1	202,000	588.4	235,000	590.0	259,000	591.5	283,000	592.6	306,000	593.8	337,000
520	581.1	131,000	584.0	174,000	586.1	202,000	588.5	235,000	590.1	259,000	591.6	283,000	592.7	306,000	593.9	337,000
520.4	581.2	131,000	584.2	174,000	586.3	202,000	588.7	235,000	590.3	259,000	591.9	283,000	593.0	306,000	594.2	337,000
520.6	581.3	131,000	584.3	174,000	586.4	202,000	588.8	235,000	590.5	259,000	592.0	283,000	593.1	306,000	594.3	337,000
521	581.3	131,000	584.4	174,000	586.5	202,000	589.0	235,000	590.6	259,000	592.2	283,000	593.4	306,000	594.6	337,000
521.2	581.4	131,000	584.5	174,000	586.6	202,000	589.1	235,000	590.8	259,000	592.4	283,000	593.5	306,000	594.7	337,000
521.7	581.5	131,000	584.6	174,000	586.8	202,000	589.2	235,000	590.9	259,000	592.5	283,000	593.7	306,000	594.9	337,000
522.2	581.5	131,000	584.7	174,000	586.9	202,000	589.3	235,000	591.1	259,000	592.7	283,000	593.9	306,000	595.1	337,000
522.3	581.6	131,000	584.7	174,000	586.9	202,000	589.4	235,000	591.1	259,000	592.7	283,000	593.9	306,000	595.2	337,000
522.4	581.6	131,000	584.8	174,000	587.0	202,000	589.4	235,000	591.2	259,000	592.8	283,000	594.0	306,000	595.2	337,000
522.5	581.7	131,000	584.8	174,000	587.0	202,000	589.5	235,000	591.2	259,000	592.8	283,000	594.0	306,000	595.3	337,000
522.6	582.5	131,000	585.2	174,000	587.4	202,000	589.9	235,000	591.6	259,000	593.2	283,000	594.4	306,000	595.7	337,000
522.7	582.5	131,000	585.3	174,000	587.5	201,000	589.9	235,000	591.6	259,000	593.2	283,000	594.4	306,000	595.7	337,000
522.8	582.6	131,000	585.4	174,000	587.5	201,000	590.0	235,000	591.7	259,000	593.3	283,000	594.5	306,000	595.7	337,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
523.1	582.7	131,000	585.5	174,000	587.6	201,000	590.1	235,000	591.8	259,000	593.3	283,000	594.5	306,000	595.7	337,000
523.6	582.8	131,000	585.5	174,000	587.7	201,000	590.1	235,000	591.8	259,000	593.4	283,000	594.6	306,000	595.8	337,000
524	582.9	131,000	585.6	174,000	587.7	201,000	590.2	235,000	591.9	259,000	593.4	283,000	594.6	306,000	595.8	336,000
524.5	583.1	131,000	585.7	174,000	587.8	201,000	590.2	235,000	591.9	259,000	593.5	283,000	594.6	306,000	595.9	336,000
525	583.3	131,000	585.8	174,000	587.8	201,000	590.3	235,000	591.9	259,000	593.5	283,000	594.7	306,000	595.9	336,000
526	583.5	131,000	585.9	174,000	587.9	201,000	590.4	235,000	592.0	259,000	593.5	283,000	594.7	306,000	595.9	336,000
526.6	583.7	131,000	586.1	174,000	588.0	201,000	590.4	235,000	592.0	259,000	593.6	283,000	594.7	306,000	596.0	336,000
527	583.9	131,000	586.2	174,000	588.1	201,000	590.5	235,000	592.1	259,000	593.6	283,000	594.7	306,000	596.0	336,000
528	584.1	131,000	586.4	174,000	588.2	201,000	590.5	235,000	592.2	259,000	593.7	283,000	594.8	306,000	596.0	336,000
528.5	584.4	131,000	586.5	174,000	588.3	201,000	590.6	235,000	592.2	259,000	593.7	282,000	594.8	306,000	596.1	336,000
529	584.5	131,000	586.7	174,000	588.4	201,000	590.7	235,000	592.3	259,000	593.8	282,000	594.9	306,000	596.1	336,000
529.7	584.7	131,000	586.8	174,000	588.6	201,000	590.8	235,000	592.4	259,000	593.8	282,000	594.9	306,000	596.2	336,000
530	584.9	130,000	587.0	174,000	588.7	201,000	590.9	235,000	592.5	259,000	593.9	282,000	595.0	306,000	596.3	336,000
530.9	585.2	130,000	587.2	174,000	588.9	201,000	591.1	235,000	592.6	259,000	594.0	282,000	595.1	306,000	596.4	336,000
531.7	585.5	130,000	587.5	174,000	589.1	201,000	591.2	235,000	592.7	259,000	594.1	282,000	595.3	306,000	596.5	336,000
532.3	585.7	130,000	587.7	174,000	589.3	201,000	591.4	235,000	592.9	259,000	594.2	282,000	595.4	306,000	596.6	336,000
532.55	585.8	130,000	587.8	174,000	589.4	201,000	591.5	235,000	593.0	259,000	594.3	282,000	595.5	306,000	596.7	336,000
532.8	585.9	130,000	588.0	174,000	589.6	201,000	591.6	235,000	593.1	259,000	594.4	282,000	595.6	306,000	596.8	336,000
533.5	586.1	130,000	588.2	174,000	589.8	201,000	591.9	235,000	593.3	259,000	594.6	282,000	595.7	306,000	596.9	336,000
534.1	586.3	130,000	588.5	174,000	590.1	201,000	592.2	234,000	593.5	259,000	594.8	282,000	595.8	305,000	597.1	336,000
535.1	586.5	130,000	588.8	174,000	590.4	201,000	592.4	234,000	593.8	259,000	595.0	282,000	596.0	305,000	597.2	336,000
535.5	586.7	130,000	588.9	174,000	590.6	201,000	592.6	234,000	594.0	259,000	595.1	282,000	596.2	305,000	597.4	336,000
535.7	586.7	130,000	589.0	174,000	590.7	201,000	592.7	234,000	594.1	259,000	595.2	282,000	596.3	305,000	597.5	336,000
535.9	586.8	130,000	589.1	173,000	590.8	200,000	592.8	234,000	594.2	258,000	595.3	281,000	596.4	305,000	597.6	335,000
536.4	587.0	130,000	589.4	173,000	591.0	200,000	593.1	234,000	594.5	258,000	595.6	281,000	596.7	305,000	597.8	335,000
537.1	587.3	130,000	589.7	173,000	591.4	200,000	593.5	234,000	594.8	258,000	595.9	281,000	596.9	305,000	598.1	335,000
537.7	587.6	130,000	590.0	173,000	591.7	200,000	593.8	234,000	595.1	258,000	596.2	281,000	597.2	304,000	598.4	335,000
538.1	587.7	130,000	590.2	173,000	591.9	200,000	594.0	234,000	595.3	258,000	596.4	281,000	597.4	304,000	598.6	335,000
538.5	587.9	130,000	590.4	173,000	592.2	200,000	594.3	234,000	595.6	258,000	596.7	281,000	597.7	304,000	598.9	335,000
538.8	588.1	130,000	590.6	173,000	592.4	200,000	594.5	234,000	595.8	258,000	596.9	281,000	597.9	304,000	599.1	335,000
539.1	588.3	130,000	590.8	173,000	592.6	200,000	594.6	234,000	595.9	258,000	597.0	281,000	598.0	304,000	599.2	335,000
539.9	588.5	130,000	591.0	173,000	592.8	200,000	594.8	234,000	596.1	258,000	597.2	281,000	598.2	304,000	599.4	335,000
540.6	588.7	130,000	591.2	173,000	593.0	200,000	595.0	234,000	596.3	258,000	597.4	281,000	598.4	304,000	599.5	335,000
541.2	588.9	130,000	591.4	173,000	593.2	200,000	595.2	234,000	596.5	258,000	597.6	281,000	598.6	304,000	599.7	335,000
541.8	589.0	130,000	591.6	173,000	593.3	200,000	595.4	234,000	596.7	258,000	597.8	281,000	598.7	304,000	599.9	335,000
542.6	589.3	130,000	591.9	173,000	593.6	200,000	595.6	233,000	596.9	257,000	598.0	281,000	598.9	304,000	600.1	334,000
543.3	589.5	130,000	592.1	173,000	593.8	200,000	595.9	233,000	597.1	257,000	598.2	281,000	599.1	304,000	600.3	334,000
543.7	589.8	130,000	592.4	173,000	594.1	200,000	596.1	233,000	597.3	257,000	598.4	281,000	599.3	304,000	600.5	334,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
544.3	590.0	130,000	592.6	173,000	594.3	200,000	596.3	233,000	597.5	257,000	598.6	281,000	599.5	304,000	600.7	334,000
544.8	590.2	130,000	592.8	173,000	594.5	200,000	596.5	233,000	597.7	257,000	598.7	281,000	599.7	304,000	600.9	334,000
545.4	590.4	130,000	593.0	172,000	594.7	200,000	596.7	233,000	597.9	257,000	598.9	280,000	599.9	303,000	601.0	333,000
546	590.5	129,000	593.2	172,000	594.9	200,000	596.9	233,000	598.0	257,000	599.0	280,000	600.0	303,000	601.1	333,000
546.4	590.7	129,000	593.4	172,000	595.1	200,000	597.1	233,000	598.2	257,000	599.2	280,000	600.1	303,000	601.3	333,000
547	590.8	129,000	593.6	172,000	595.3	200,000	597.3	233,000	598.4	257,000	599.4	280,000	600.4	303,000	601.6	333,000
547.5	591.0	129,000	593.8	172,000	595.5	200,000	597.6	233,000	598.7	257,000	599.7	280,000	600.7	303,000	601.9	333,000
548.1	591.2	129,000	594.0	172,000	595.7	200,000	597.8	233,000	598.9	257,000	599.9	280,000	600.9	303,000	602.1	333,000
548.6	591.4	129,000	594.2	172,000	595.9	200,000	597.9	233,000	599.1	257,000	600.1	280,000	601.1	303,000	602.3	333,000
549.1	591.6	127,000	594.5	169,000	596.1	196,000	598.1	229,000	599.4	252,000	600.4	275,000	601.4	298,000	602.6	328,000
549.7	591.7	127,000	594.7	169,000	596.3	196,000	598.3	229,000	599.6	252,000	600.6	275,000	601.6	298,000	602.8	328,000
550.05	591.8	127,000	594.8	169,000	596.4	196,000	598.5	229,000	599.7	252,000	600.8	275,000	601.8	298,000	602.9	328,000
550.4	592.0	127,000	594.9	169,000	596.6	196,000	598.6	229,000	599.9	252,000	600.9	275,000	601.9	298,000	603.1	328,000
551	592.1	127,000	595.0	169,000	596.7	196,000	598.7	229,000	600.0	252,000	601.0	275,000	602.0	298,000	603.2	328,000
552	592.3	127,000	595.2	169,000	596.9	196,000	598.9	229,000	600.2	252,000	601.2	275,000	602.2	298,000	603.4	327,000
552.8	592.5	127,000	595.4	169,000	597.1	196,000	599.1	229,000	600.3	252,000	601.4	275,000	602.4	298,000	603.5	327,000
553.3	592.6	127,000	595.6	169,000	597.2	196,000	599.2	229,000	600.5	252,000	601.5	275,000	602.5	298,000	603.7	327,000
554	592.8	127,000	595.7	169,000	597.3	196,000	599.4	229,000	600.6	252,000	601.6	275,000	602.6	298,000	603.8	327,000
554.5	592.9	127,000	595.8	169,000	597.5	196,000	599.5	229,000	600.7	252,000	601.8	275,000	602.8	298,000	603.9	327,000
555.2	593.1	127,000	596.0	169,000	597.6	196,000	599.7	229,000	600.9	252,000	601.9	275,000	602.9	298,000	604.1	327,000
555.7	593.2	127,000	596.1	169,000	597.7	196,000	599.8	228,000	601.0	252,000	602.0	275,000	603.0	298,000	604.2	327,000
556.2	593.2	127,000	596.1	169,000	597.8	196,000	599.8	228,000	601.1	252,000	602.1	275,000	603.1	298,000	604.2	327,000
556.6	593.3	127,000	596.2	169,000	597.9	196,000	599.9	228,000	601.1	252,000	602.2	275,000	603.1	298,000	604.3	327,000
556.65	593.3	127,000	596.2	169,000	597.9	196,000	599.9	228,000	601.2	252,000	602.2	275,000	603.2	298,000	604.3	327,000
556.7	593.4	127,000	596.3	169,000	598.0	196,000	600.0	228,000	601.2	252,000	602.3	275,000	603.2	298,000	604.4	327,000
556.8	593.8	127,000	596.7	169,000	598.4	196,000	600.4	228,000	601.6	252,000	602.7	275,000	603.6	298,000	604.8	327,000
557	593.8	127,000	596.7	169,000	598.4	196,000	600.5	228,000	601.7	252,000	602.7	275,000	603.7	298,000	604.8	327,000
557.2	593.9	127,000	596.8	169,000	598.5	196,000	600.5	228,000	601.8	252,000	602.8	275,000	603.8	298,000	604.9	327,000
557.6	594.0	127,000	596.9	169,000	598.6	196,000	600.6	228,000	601.9	252,000	602.9	275,000	603.9	298,000	605.0	327,000
557.9	594.1	127,000	597.0	169,000	598.7	196,000	600.7	228,000	602.0	252,000	603.0	275,000	604.0	298,000	605.1	327,000
558.5	594.2	127,000	597.2	169,000	598.8	196,000	600.9	228,000	602.1	252,000	603.1	275,000	604.1	298,000	605.3	327,000
559	594.4	127,000	597.3	169,000	599.0	196,000	601.0	228,000	602.3	252,000	603.3	275,000	604.3	298,000	605.4	327,000
559.4	594.6	127,000	597.5	169,000	599.2	196,000	601.2	228,000	602.5	252,000	603.5	275,000	604.5	298,000	605.6	327,000
560	594.8	127,000	597.7	169,000	599.4	196,000	601.4	228,000	602.7	252,000	603.7	275,000	604.7	297,000	605.8	327,000
560.7	595.0	127,000	597.9	169,000	599.6	196,000	601.6	228,000	602.9	252,000	603.9	275,000	604.9	297,000	606.1	327,000
561.2	595.2	127,000	598.1	169,000	599.7	196,000	601.8	228,000	603.0	252,000	604.1	275,000	605.1	297,000	606.2	327,000
561.5	595.4	127,000	598.2	169,000	599.9	196,000	601.9	228,000	603.2	252,000	604.2	275,000	605.2	297,000	606.4	327,000
562.1	595.5	127,000	598.3	169,000	600.0	196,000	602.0	228,000	603.3	252,000	604.3	275,000	605.3	297,000	606.5	327,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
562.4	595.6	127,000	598.4	169,000	600.1	196,000	602.1	228,000	603.4	252,000	604.5	275,000	605.5	297,000	606.6	327,000
562.8	595.7	127,000	598.5	169,000	600.2	196,000	602.2	228,000	603.5	252,000	604.5	275,000	605.5	297,000	606.7	327,000
563.3	595.7	127,000	598.6	169,000	600.3	196,000	602.3	228,000	603.6	252,000	604.7	275,000	605.7	297,000	606.8	327,000
563.8	595.8	127,000	598.7	169,000	600.4	195,000	602.4	228,000	603.7	251,000	604.8	274,000	605.8	297,000	607.0	326,000
564.3	595.9	127,000	598.8	169,000	600.5	195,000	602.5	228,000	603.9	251,000	604.9	274,000	605.9	297,000	607.1	326,000
564.6	596.0	127,000	598.9	169,000	600.5	195,000	602.6	228,000	603.9	251,000	605.0	274,000	606.0	297,000	607.2	326,000
565	596.1	127,000	599.0	169,000	600.7	195,000	602.7	228,000	604.1	251,000	605.2	274,000	606.2	297,000	607.4	326,000
565.4	596.2	127,000	599.1	169,000	600.8	195,000	602.9	228,000	604.2	251,000	605.3	274,000	606.4	297,000	607.6	326,000
566	596.3	127,000	599.3	169,000	601.0	195,000	603.1	228,000	604.4	251,000	605.5	274,000	606.6	297,000	607.8	326,000
566.7	596.5	127,000	599.5	169,000	601.2	195,000	603.3	228,000	604.6	251,000	605.7	274,000	606.8	297,000	608.1	326,000
567.3	596.6	127,000	599.7	169,000	601.3	195,000	603.5	228,000	604.9	251,000	606.0	274,000	607.1	297,000	608.3	326,000
567.7	596.8	127,000	599.8	169,000	601.5	195,000	603.6	228,000	605.0	251,000	606.1	274,000	607.2	297,000	608.5	326,000
568	596.9	127,000	599.9	169,000	601.6	195,000	603.8	228,000	605.2	251,000	606.3	274,000	607.4	297,000	608.6	326,000
568.4	597.0	127,000	600.1	169,000	601.7	195,000	603.9	228,000	605.3	251,000	606.5	274,000	607.5	297,000	608.8	326,000
569	597.2	127,000	600.2	169,000	601.9	195,000	604.1	228,000	605.5	251,000	606.7	274,000	607.7	297,000	609.0	326,000
569.4	597.3	127,000	600.4	169,000	602.0	195,000	604.2	228,000	605.6	251,000	606.8	274,000	607.9	297,000	609.1	326,000
570	597.5	127,000	600.6	169,000	602.2	195,000	604.4	228,000	605.9	251,000	607.0	274,000	608.1	297,000	609.4	326,000
570.6	597.7	127,000	600.8	169,000	602.4	195,000	604.6	228,000	606.1	251,000	607.2	274,000	608.3	297,000	609.6	326,000
571.2	597.8	127,000	600.9	169,000	602.6	195,000	604.8	228,000	606.3	251,000	607.4	274,000	608.5	297,000	609.8	326,000
571.6	597.9	127,000	601.0	169,000	602.7	195,000	605.0	228,000	606.4	251,000	607.6	274,000	608.7	297,000	610.0	326,000
572	598.0	127,000	601.2	169,000	602.9	195,000	605.1	228,000	606.6	251,000	607.7	274,000	608.8	297,000	610.1	326,000
572.3	598.1	127,000	601.2	169,000	602.9	195,000	605.2	228,000	606.6	251,000	607.8	274,000	608.9	297,000	610.2	326,000
573	598.3	127,000	601.4	169,000	603.1	195,000	605.3	228,000	606.8	251,000	608.0	274,000	609.1	297,000	610.4	326,000
573.5	598.4	127,000	601.5	169,000	603.2	195,000	605.5	228,000	607.0	251,000	608.2	274,000	609.3	297,000	610.6	326,000
574	598.6	127,000	601.7	169,000	603.4	195,000	605.6	228,000	607.1	251,000	608.3	274,000	609.4	297,000	610.8	326,000
574.7	598.7	127,000	601.9	169,000	603.6	195,000	605.8	228,000	607.3	251,000	608.5	274,000	609.6	297,000	611.0	326,000
574.9	598.8	127,000	602.0	169,000	603.7	195,000	605.9	228,000	607.4	251,000	608.6	274,000	609.7	297,000	611.0	326,000
575.4	599.0	127,000	602.1	169,000	603.9	195,000	606.1	228,000	607.6	251,000	608.9	274,000	610.0	297,000	611.3	326,000
576	599.1	127,000	602.3	169,000	604.0	195,000	606.3	228,000	607.8	251,000	609.1	274,000	610.2	297,000	611.5	326,000
576.6	599.4	127,000	602.5	169,000	604.3	195,000	606.6	228,000	608.1	251,000	609.4	274,000	610.5	297,000	611.9	326,000
577.1	599.5	127,000	602.8	169,000	604.5	195,000	606.8	228,000	608.4	251,000	609.7	274,000	610.8	297,000	612.2	326,000
578.2	599.8	127,000	603.0	169,000	604.8	195,000	607.1	228,000	608.7	251,000	610.0	274,000	611.1	297,000	612.5	326,000
578.6	599.9	127,000	603.2	169,000	605.0	195,000	607.3	228,000	608.9	251,000	610.2	274,000	611.3	297,000	612.7	326,000
579.1	600.0	127,000	603.3	169,000	605.1	195,000	607.5	228,000	609.0	251,000	610.3	274,000	611.5	297,000	612.8	326,000
579.4	600.1	127,000	603.4	169,000	605.2	195,000	607.6	228,000	609.1	251,000	610.4	274,000	611.6	297,000	613.0	326,000
579.7	600.2	127,000	603.5	169,000	605.3	195,000	607.7	228,000	609.2	251,000	610.5	274,000	611.7	297,000	613.1	326,000
580	600.2	127,000	603.5	169,000	605.3	195,000	607.7	228,000	609.3	251,000	610.6	274,000	611.8	297,000	613.2	326,000
580.5	600.3	127,000	603.7	169,000	605.5	195,000	607.9	228,000	609.4	251,000	610.7	274,000	611.9	297,000	613.3	326,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

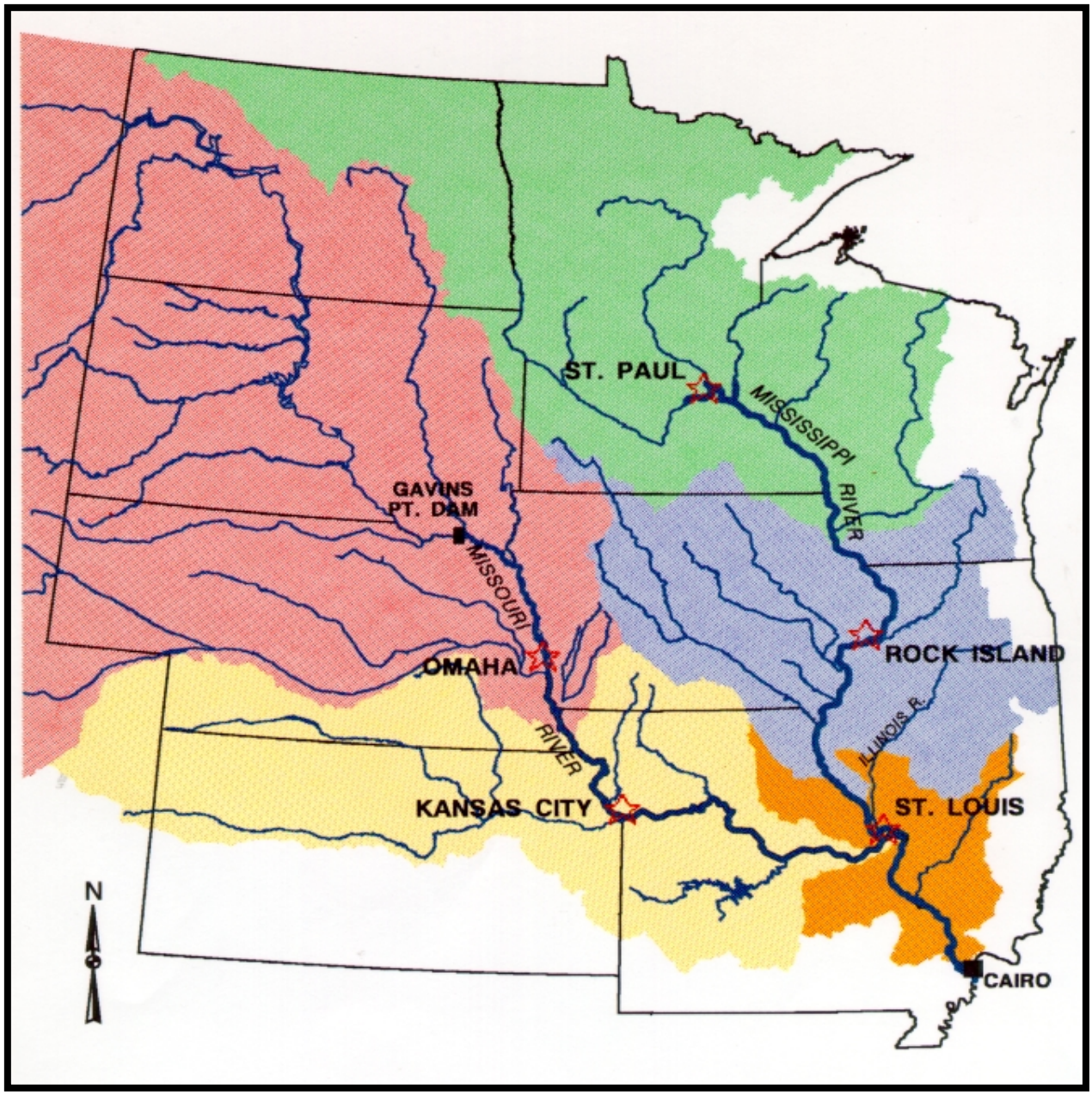
	Exceedance Probability															
River	0.5		0.2		0.1		0.04		0.02		0.01		0.005		0.002	
Mile	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs	feet	cfs
580.9	600.4	127,000	603.7	169,000	605.6	195,000	608.0	228,000	609.5	251,000	610.8	274,000	612.0	297,000	613.5	326,000
581.05	600.4	127,000	603.8	169,000	605.7	195,000	608.0	228,000	609.6	251,000	610.9	274,000	612.1	297,000	613.5	326,000
581.2	600.5	127,000	603.9	169,000	605.7	195,000	608.1	228,000	609.7	251,000	611.0	274,000	612.2	297,000	613.6	326,000
581.8	600.6	127,000	604.0	169,000	605.9	195,000	608.2	228,000	609.8	251,000	611.1	274,000	612.2	297,000	613.7	326,000
582.2	600.7	127,000	604.2	169,000	606.1	195,000	608.3	228,000	609.9	251,000	611.1	274,000	612.3	297,000	613.7	326,000
582.6	600.9	127,000	604.4	169,000	606.2	195,000	608.5	228,000	609.9	251,000	611.2	274,000	612.4	297,000	613.8	326,000
582.8	601.0	127,000	604.4	169,000	606.3	195,000	608.5	228,000	610.0	251,000	611.2	274,000	612.4	297,000	613.8	326,000
583.2	602.5	127,000	604.8	169,000	606.7	195,000	608.9	228,000	610.4	251,000	611.6	274,000	612.8	297,000	614.2	326,000
583.6	602.5	127,000	604.9	169,000	606.8	195,000	609.0	228,000	610.4	251,000	611.7	274,000	612.8	297,000	614.2	326,000
584.1	602.7	127,000	605.0	169,000	606.9	195,000	609.1	228,000	610.6	251,000	611.8	274,000	613.0	297,000	614.4	326,000
585	602.9	127,000	605.2	169,000	607.1	195,000	609.3	228,000	610.8	251,000	612.0	274,000	613.2	297,000	614.6	327,000
585.7	603.0	127,000	605.4	169,000	607.2	195,000	609.4	228,000	610.9	251,000	612.1	274,000	613.3	297,000	614.7	327,000
586.3	603.1	127,000	605.5	169,000	607.3	195,000	609.5	228,000	611.0	252,000	612.2	275,000	613.4	297,000	614.8	327,000
586.7	603.1	127,000	605.5	169,000	607.4	195,000	609.5	228,000	611.0	252,000	612.3	275,000	613.4	297,000	614.8	327,000
587.5	603.3	127,000	605.7	169,000	607.5	196,000	609.6	228,000	611.1	252,000	612.4	275,000	613.5	297,000	614.9	327,000
588	603.4	127,000	605.8	169,000	607.6	196,000	609.7	228,000	611.2	252,000	612.4	275,000	613.6	297,000	615.0	327,000
588.5	603.5	127,000	605.9	169,000	607.7	196,000	609.8	228,000	611.3	252,000	612.5	275,000	613.7	297,000	615.1	327,000
589	603.6	127,000	606.0	169,000	607.7	196,000	609.9	228,000	611.4	252,000	612.6	275,000	613.8	298,000	615.2	328,000
589.5	603.7	127,000	606.1	169,000	607.8	196,000	610.0	228,000	611.4	252,000	612.7	275,000	613.8	298,000	615.2	328,000
590	603.8	127,000	606.2	169,000	607.9	196,000	610.1	228,000	611.5	252,000	612.8	275,000	613.9	298,000	615.3	328,000
590.6	604.1	127,000	606.4	169,000	608.2	196,000	610.3	229,000	611.7	252,000	613.0	275,000	614.1	298,000	615.5	328,000
591.1	604.2	127,000	606.6	169,000	608.3	196,000	610.4	229,000	611.8	252,000	613.1	275,000	614.2	298,000	615.6	328,000
591.6	604.3	127,000	606.7	169,000	608.4	196,000	610.5	229,000	611.9	252,000	613.2	275,000	614.3	298,000	615.7	328,000
592	604.4	127,000	606.8	169,000	608.5	196,000	610.6	229,000	612.0	252,000	613.3	276,000	614.4	298,000	615.8	328,000
592.5	604.5	127,000	606.9	169,000	608.6	196,000	610.7	229,000	612.1	252,000	613.4	276,000	614.5	298,000	615.9	328,000
593	604.7	127,000	607.0	169,000	608.7	196,000	610.8	229,000	612.2	253,000	613.5	276,000	614.6	299,000	616.0	329,000
593.6	604.8	127,000	607.2	169,000	608.8	196,000	610.9	229,000	612.3	253,000	613.6	276,000	614.7	299,000	616.1	329,000
594	604.9	127,000	607.3	169,000	609.0	196,000	611.0	229,000	612.4	253,000	613.7	276,000	614.8	299,000	616.2	329,000
594.4	605.1	127,000	607.5	169,000	609.1	196,000	611.1	229,000	612.5	253,000	613.8	276,000	614.9	299,000	616.3	329,000
595	605.4	127,000	607.7	169,000	609.3	196,000	611.3	229,000	612.7	253,000	613.9	276,000	615.1	299,000	616.4	329,000
595.4	605.6	127,000	607.9	169,000	609.5	196,000	611.5	229,000	612.9	253,000	614.1	276,000	615.2	299,000	616.5	329,000
596	605.9	127,000	608.2	169,000	609.7	196,000	611.7	229,000	613.0	253,000	614.2	276,000	615.4	299,000	616.7	329,000
596.2	606.0	127,000	608.3	169,000	609.8	196,000	611.8	229,000	613.2	253,000	614.4	276,000	615.5	299,000	616.8	330,000
597	606.3	127,000	608.5	169,000	610.1	196,000	612.0	229,000	613.3	253,000	614.5	276,000	615.6	299,000	617.0	330,000
597.6	606.5	127,000	608.8	169,000	610.3	196,000	612.2	229,000	613.5	253,000	614.7	276,000	615.8	299,000	617.1	330,000
598	606.8	127,000	609.0	169,000	610.5	196,000	612.4	229,000	613.7	253,000	614.9	276,000	616.0	299,000	617.3	330,000
598.5	607.0	127,000	609.2	169,000	610.7	196,000	612.6	229,000	613.9	253,000	615.1	277,000	616.2	300,000	617.5	330,000
599	607.3	127,000	609.5	169,000	611.0	196,000	612.8	229,000	614.1	253,000	615.3	277,000	616.4	300,000	617.7	330,000

Table C-M-7

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to NGVD 1929)

	Exceedance Probability															
River	**0.5**		**0.2**		**0.1**		**0.04**		**0.02**		**0.01**		**0.005**		**0.002**	
Mile	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**
599.3	607.4	127,000	609.6	169,000	611.1	196,000	612.9	229,000	614.2	253,000	615.4	277,000	616.5	300,000	617.8	330,000
599.9	607.5	127,000	609.8	169,000	611.3	196,000	613.1	229,000	614.4	253,000	615.6	277,000	616.7	300,000	618.0	330,000
600.8	607.7	127,000	610.1	169,000	611.6	197,000	613.4	230,000	614.7	254,000	615.9	277,000	616.9	300,000	618.2	330,000
601.5	608.0	127,000	610.3	169,000	611.8	197,000	613.7	230,000	615.0	254,000	616.1	277,000	617.2	300,000	618.5	330,000
602	608.2	127,000	610.6	169,000	612.1	197,000	614.0	230,000	615.3	254,000	616.4	277,000	617.5	300,000	618.8	330,000
602.3	608.4	127,000	610.8	169,000	612.3	197,000	614.2	230,000	615.4	254,000	616.6	277,000	617.6	300,000	618.9	330,000
602.7	608.6	127,000	611.0	169,000	612.5	197,000	614.3	230,000	615.6	254,000	616.7	277,000	617.8	300,000	619.1	330,000
603.1	608.7	127,000	611.2	170,000	612.6	197,000	614.5	230,000	615.7	254,000	616.9	277,000	617.9	300,000	619.2	331,000
603.5	608.8	127,000	611.3	170,000	612.8	197,000	614.6	230,000	615.9	254,000	617.0	277,000	618.1	300,000	619.3	331,000
604	609.0	127,000	611.5	170,000	613.0	197,000	614.8	230,000	616.1	254,000	617.2	277,000	618.3	301,000	619.5	331,000
604.4	609.2	127,000	611.7	170,000	613.2	197,000	615.0	230,000	616.3	254,000	617.4	277,000	618.5	301,000	619.7	331,000
604.9	609.4	127,000	611.9	170,000	613.4	197,000	615.3	230,000	616.5	254,000	617.7	277,000	618.7	301,000	620.0	331,000
605.5	609.6	127,000	612.2	170,000	613.7	197,000	615.5	230,000	616.8	254,000	617.9	277,000	618.9	301,000	620.2	331,000
606.1	609.8	127,000	612.4	170,000	613.9	197,000	615.8	230,000	617.0	254,000	618.2	278,000	619.2	301,000	620.5	331,000
607	610.0	127,000	612.7	170,000	614.3	197,000	616.1	230,000	617.4	254,000	618.5	278,000	619.5	301,000	620.8	331,000
607.5	610.3	127,000	613.0	170,000	614.5	197,000	616.4	230,000	617.7	254,000	618.8	278,000	619.9	301,000	621.2	331,000
608	610.6	127,000	613.3	170,000	614.8	197,000	616.7	230,000	618.0	254,000	619.1	278,000	620.2	301,000	621.5	331,000
608.6	611.1	126,000	613.7	169,000	615.2	197,000	617.2	230,000	618.5	254,000	619.6	278,000	620.7	302,000	622.0	333,000
609	611.3	126,000	613.9	169,000	615.4	197,000	617.4	230,000	618.7	254,000	619.8	278,000	620.8	302,000	622.1	333,000
609.5	611.5	126,000	614.2	169,000	615.7	197,000	617.6	230,000	618.9	255,000	620.0	278,000	621.0	302,000	622.3	333,000
610	611.7	126,000	614.3	169,000	615.8	197,000	617.8	230,000	619.0	255,000	620.2	278,000	621.2	302,000	622.5	333,000
610.6	611.8	126,000	614.5	169,000	616.0	197,000	617.9	230,000	619.2	255,000	620.3	278,000	621.3	302,000	622.6	333,000
611.2	612.0	126,000	614.6	169,000	616.2	197,000	618.1	230,000	619.3	255,000	620.5	278,000	621.5	302,000	622.8	333,000
612	612.1	126,000	614.8	169,000	616.4	197,000	618.3	230,000	619.5	255,000	620.7	278,000	621.7	302,000	623.0	333,000
612.5	612.3	126,000	615.0	169,000	616.5	197,000	618.4	230,000	619.7	255,000	620.8	278,000	621.9	302,000	623.2	333,000
613	612.4	126,000	615.2	169,000	616.7	197,000	618.6	230,000	619.8	255,000	621.0	279,000	622.0	302,000	623.3	333,000
613.6	612.6	126,000	615.3	169,000	616.8	197,000	618.7	231,000	620.0	255,000	621.1	279,000	622.2	302,000	623.5	333,000
614	612.8	126,000	615.5	169,000	617.0	197,000	618.9	231,000	620.1	255,000	621.3	279,000	622.3	302,000	623.6	333,000
614.5	612.8	126,000	615.5	169,000	617.0	197,000	618.9	231,000	620.2	255,000	621.3	279,000	622.4	303,000	623.7	334,000
614.7	612.9	126,000	615.6	169,000	617.1	197,000	619.0	231,000	620.3	255,000	621.4	279,000	622.5	303,000	623.8	334,000
614.9	612.9	126,000	615.5	169,000	617.1	197,000	619.0	231,000	620.3	255,000	621.4	279,000	622.5	303,000	623.8	334,000

Upper Mississippi River System
Flow Frequency Study Area Map



COE DISTRICT OFFICES

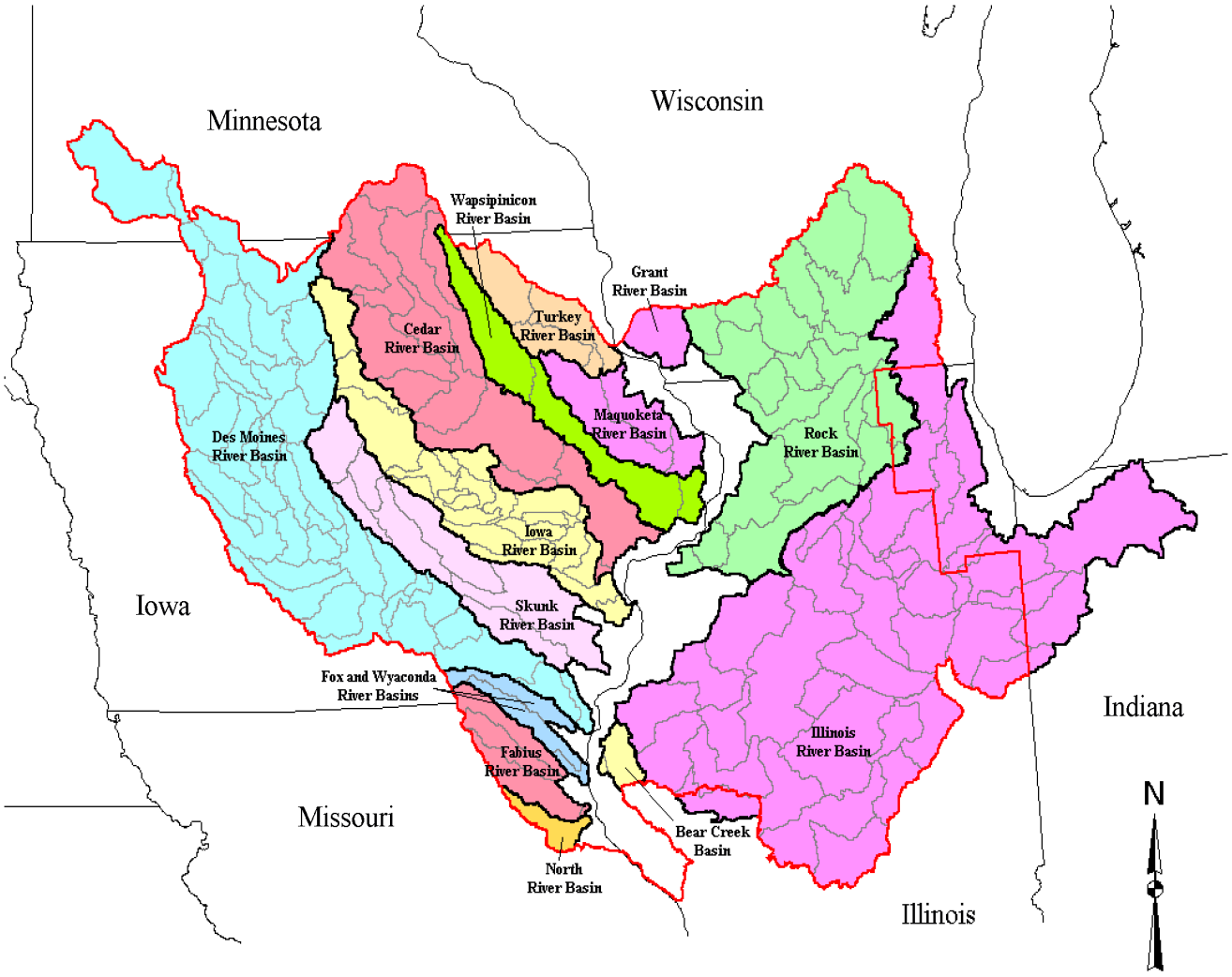
KANSAS CITY DIST.
OMAHA DIST.
ROCK ISLAND DIST.
SAINT LOUIS DIST.
SAINT PAUL DIST.

Plate C-M-1

Rock Island District Map

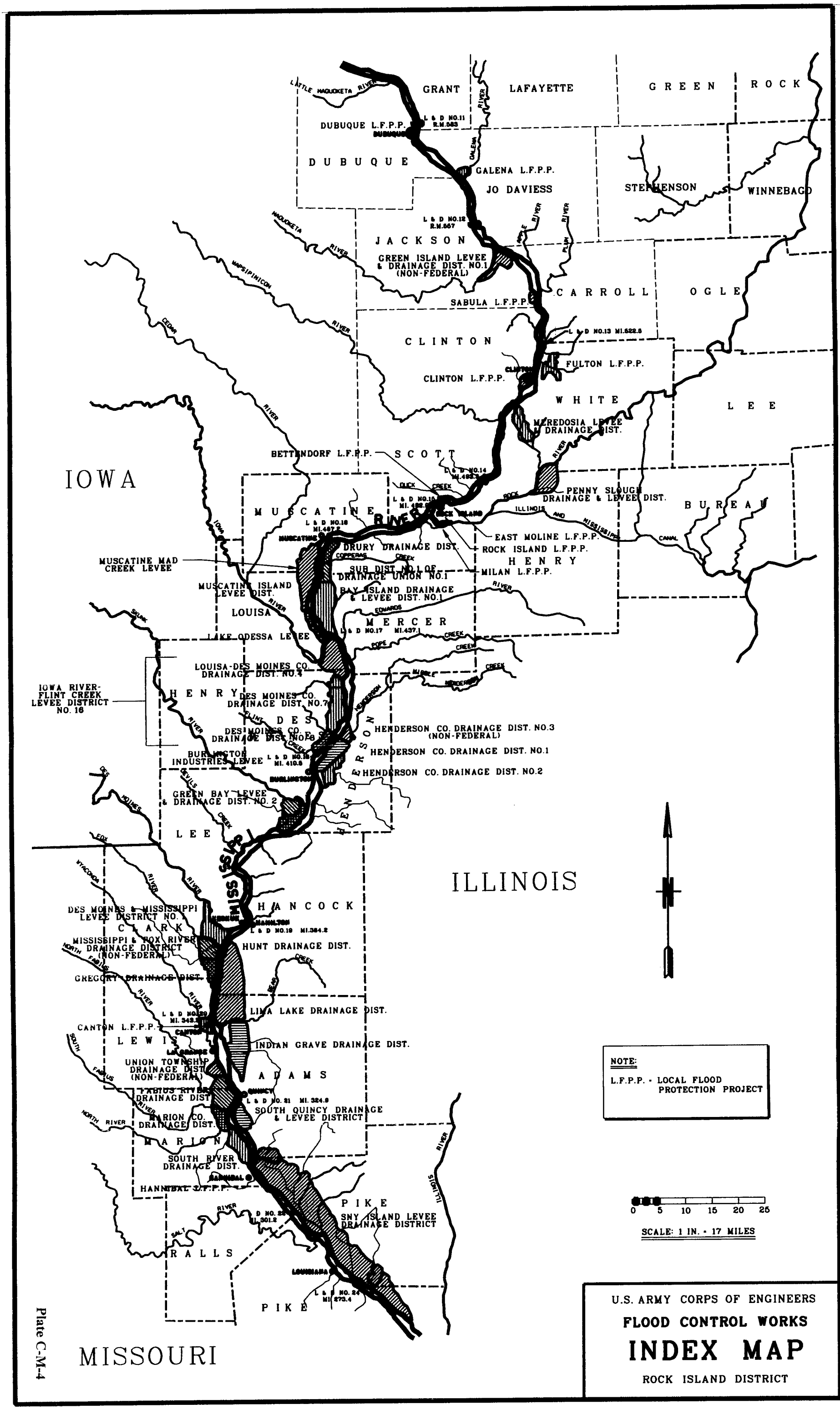
Plate C-M-2

Rock Island District HMS Basin Map



Rock Island District Drainage Basins

Plate C-M-3



...\Mississippi\umrbmap.dgn Feb. 05, 2001 13:30:01

```
**********************************
*            FFA                 *
*     PROGRAM DATE:  FEB 1995    *
*          VERSION:  3.1         *
*     RUN  DATE   AND   TIME:    *
*        12 DEC 00    16:15:52   *
*                                *
**********************************

 INPUT FILE NAME: DBQI4_00.DAT
 OUTPUT FILE NAME: DBQI4_00.OUT

 **TITLE RECORD(S)**
 TT    Dubuque Record
 TT    Use A.F.B. 7-17-57 for 1874-1954
 TT    Use T.Fero for 1955-1972
 TT    Use post-1973 for 1973-1998
```

FINAL RESULTS -PLOTTING POSITIONS

EVENTS ANALYZED				ORDERED EVENTS			
MON	DAY	YEAR	FLOW CFS	WATER RANK	YEAR	FLOW CFS	MEDIAN PLOT POS
6	22	1898	79000.	1	1965	307000.	.69
6	22	1899	138000.	2	1993	247000.	1.68
10	17	1900	135000.	3	1975	233000.	2.66
4	20	1901	94000.	4	1969	231000.	3.65
5	24	1902	104000.	5	1997	230000.	4.64
9	27	1903	161000.	6	1951	223000.	5.62
6	8	1904	95000.	7	1952	223000.	6.61
6	18	1905	161000.	8	1973	215000.	7.59
4	21	1906	151000.	9	1987	215000.	8.58
4	9	1907	145000.	10	1967	214000.	9.57
7	19	1908	131000.	11	1920	204000.	10.55
4	20	1909	111000.	12	1922	199000.	11.54
4	2	1910	69000.	13	1983	193000.	12.52
10	19	1911	123000.	14	1916	188000.	13.51
4	4	1912	96000.	15	1938	184000.	14.50
3	25	1913	100000.	16	1954	183000.	15.48
7	12	1914	121000.	17	1996	181000.	16.47
4	21	1915	95000.	18	1982	175000.	17.46
5	3	1916	188000.	19	1971	167000.	18.44
4	18	1917	133000.	20	1942	166000.	19.43
6	11	1918	112000.	21	1976	166000.	20.41
4	22	1919	147000.	22	1998	166000.	21.40
4	7	1920	204000.	23	1944	162000.	22.39
5	10	1921	77000.	24	1943	161000.	23.37
4	21	1922	199000.	25	1945	161000.	24.36
5	3	1923	94000.	26	1903	161000.	25.35
5	8	1924	87000.	27	1905	161000.	26.33
6	25	1925	81000.	28	1979	156000.	27.32
10	5	1926	82000.	29	1906	151000.	28.30
3	28	1927	130000.	30	1972	147000.	29.29
4	7	1928	104000.	31	1919	147000.	30.28
4	17	1929	140000.	32	1946	146000.	31.26
6	26	1930	73000.	33	1939	145000.	32.25
12	3	1931	47000.	34	1907	145000.	33.23
4	20	1932	94000.	35	1960	144000.	34.22
4	11	1933	81000.	36	1974	143000.	35.21
4	17	1934	82000.	37	1985	141000.	36.19
4	3	1935	130000.	38	1929	140000.	37.18
4	5	1936	137000.	39	1984	140000.	38.17
3	8	1937	84000.	40	1899	138000.	39.15
9	21	1938	184000.	41	1994	138000.	40.14
4	6	1939	145000.	42	1936	137000.	41.12
6	18	1940	72000.	43	1991	137000.	42.11
4	23	1941	129000.	44	1950	136000.	43.10
6	12	1942	166000.	45	1966	136000.	44.08
6	29	1943	161000.	46	1901	135000.	45.07
6	27	1944	162000.	47	1961	134000.	46.06
3	29	1945	161000.	48	1992	134000.	47.04
3	27	1946	146000.	49	1917	133000.	48.03
6	14	1947	118000.	50	1908	131000.	49.01
3	31	1948	104000.	51	1935	130000.	50.00
4	4	1949	83000.	52	1927	130000.	50.99
5	20	1950	136000.	53	1978	130000.	51.97
4	22	1951	223000.	54	1941	129000.	52.96
4	25	1952	223000.	55	1962	128000.	53.94
4	1	1953	103000.	56	1968	127000.	54.93
5	12	1954	183000.	57	1956	125000.	55.92
4	14	1955	95000.	58	1912	123000.	56.90
4	19	1956	125000.	59	1990	121000.	57.89
7	13	1957	99000.	60	1914	121000.	58.88
4	16	1958	59000.	61	1980	119000.	59.86
4	2	1959	105000.	62	1947	118000.	60.85
5	17	1960	144000.	63	1989	115000.	61.83
3	31	1961	134000.	64	1995	114000.	62.82
4	19	1962	128000.	65	1918	112000.	63.81
4	2	1963	86000.	66	1909	111000.	64.79
5	18	1964	83000.	67	1959	105000.	65.78
4	26	1965	307000.	68	1948	104000.	66.77
3	30	1966	136000.	69	1902	104000.	67.75
4	11	1967	214000.	70	1928	104000.	68.74
7	5	1968	127000.	71	1953	103000.	69.72
4	23	1969	231000.	72	1913	100000.	70.71
6	6	1970	91000.	73	1957	99000.	71.70
4	21	1971	167000.	74	1981	98000.	72.68
4	29	1972	147000.	75	1912	96000.	73.67
3	23	1973	215000.	76	1904	95000.	74.65
6	22	1974	143000.	77	1955	95000.	75.64
5	6	1975	233000.	78	1915	95000.	76.63
4	9	1976	166000.	79	1923	94000.	77.61
12	26	1977	90000.	80	1932	94000.	78.60
4	19	1978	130000.	81	1901	94000.	79.59
5	4	1979	156000.	82	1970	91000.	80.57
9	30	1980	119000.	83	1978	90000.	81.56
4	14	1981	98000.	84	1924	87000.	82.54
4	27	1982	175000.	85	1963	86000.	83.53
3	17	1983	193000.	86	1937	84000.	84.52
5	10	1984	140000.	87	1949	83000.	85.50
4	7	1985	141000.	88	1964	83000.	86.49
10	5	1986	215000.	89	1927	82000.	87.48
3	15	1987	66000.	90	1934	82000.	88.46
4	1	1988	78000.	91	1933	81000.	89.45
4	4	1989	115000.	92	1925	81000.	90.43
6	22	1990	121000.	93	1898	79000.	91.42
6	16	1991	137000.	94	1988	78000.	92.41
4	29	1992	134000.	95	1921	77000.	93.39
7	1	1993	247000.	96	1930	73000.	94.38
5	6	1994	138000.	97	1940	72000.	95.36
5	10	1995	114000.	98	1910	69000.	96.35
4	30	1996	181000.	99	1987	66000.	97.34
4	16	1997	230000.	100	1958	59000.	98.32
4	10	1998	166000.	101	1932	47000.	99.31

-OUTLIER TESTS -

LOW OUTLIER TEST

BASED ON 101 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 3.021
0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 43340.5

HIGH OUTLIER TEST

BASED ON 101 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 3.021
0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 366521.

-SKEW WEIGHTING -

BASED ON 101 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW =-99.000
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS -FREQUENCY CURVE

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	.95 FLOW IN CFS
334000.	343000.	.2	385000.	297000.
303000.	309000.	.5	345000.	272000.
279000.	284000.	1.0	315000.	253000.
255000.	259000.	2.0	286000.	233000.
223000.	225000.	5.0	246000.	206000.
197000.	198000.	10.0	215000.	184000.
170000.	170000.	20.0	183000.	159000.
127000.	127000.	50.0	134000.	120000.
93800.	93500.	80.0	100000.	87300.
79800.	79400.	90.0	85900.	73300.
69800.	69200.	95.0	75800.	63200.
54000.	53000.	99.0	59900.	47500.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	5.1005	HISTORIC EVENTS	0
STANDARD DEV	.1535	HIGH OUTLIERS	0
COMPUTED SKEW	-.0650	LOW OUTLIERS	0
REGIONAL SKEW	-99.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.1000	SYSTEMATIC EVENTS	101

```
**********************************
*            FFA                 *
*     FLOOD FREQUENCY ANALYSIS   *
*     PROGRAM DATE:  FEB 1995    *
*          VERSION:  3.1         *
*     RUN  DATE   AND   TIME:    *
*        05 OCT 01    16:22:49   *
*                                *
**********************************

INPUT FILE NAME: DUBQ00AV.DAT
OUTPUT FILE NAME: DUBQ00AV.OUT

**TITLE RECORD(S)**
TT    mean and st.dev from DBQI4_0
TT    input skew of -0.
TT

*INPUT STATISTICS**
      DURN IPART   ISTN  NSYS  NYR
SS PEAK                   101    0
        XM       S       G     SKEW      AG
SS 5.1005   .1499   .0000   .0000  -.1000
```

Mississippi River at Dubuque,Iowa FINAL RESULTS-FREQUENCY CURVE

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	.95 FLOW IN CFS
326000.	335000.	.2	375000.	292000.
297000.	303000.	.5	337000.	267000.
274000.	279000.	1.0	309000.	249000.
251000.	254000.	2.0	280000.	230000.
220000.	222000.	5.0	242000.	203000.
195000.	196000.	10.0	212000.	182000.
169000.	169000.	20.0	181000.	159000.
127000.	127000.	50.0	134000.	120000.
94400.	94200.	80.0	101000.	88000.
80700.	80300.	90.0	86700.	74200.
70800.	70100.	95.0	76700.	64200.
55100.	54000.	99.0	60900.	48600.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	5.1005	HISTORIC EVENTS	0
STANDARD DEV	.1499	HIGH OUTLIERS	0
COMPUTED SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.1000	SYSTEMATIC EVENTS	101

```
**********************************
*            FFA                 *
*     FLOOD FREQUENCY ANALYSIS   *
*     PROGRAM DATE:  FEB 1995    *
*          VERSION:  3.1         *
*     RUN  DATE   AND   TIME:    *
*        13 DEC 00    15:33:40   *
*                                *
**********************************
 INPUT FILE NAME: CLICY200.DAT
 OUTPUT FILE NAME: CLICY200.OUT

**TITLE RECORD(S)**
TT     Mississippi River at Clinton
TT     USGS station number 05420500
TT     Calander year run without historic
TT     Maximum daily flow
```

FINAL RESULTS -PLOTTING POSITIONS- 05420500

EVENTS ANALYZED				ORDERED EVENTS			
MON	DAY	YEAR	FLOW CFS	WATER RANK	YEAR	FLOW CFS	MEDIAN PLOT POS
6	24	1898	88800.	1	1965	307000.	.69
6	25	1899	149000.	2	1993	238000.	1.68
10	20	1900	142000.	3	1997	237000.	2.66
4	23	1901	106000.	4	1969	231000.	3.65
5	26	1902	123000.	5	1952	225400.	4.64
9	29	1903	176000.	6	1920	222000.	5.62
4	25	1904	113000.	7	1951	221500.	6.61
6	21	1905	172000.	8	1975	214000.	7.59
4	22	1906	169000.	9	1922	212000.	8.58
4	11	1907	171000.	10	1973	207000.	9.57
7	20	1908	134000.	11	1967	201000.	10.55
5	2	1909	123000.	12	1987	201000.	11.54
4	7	1910	73100.	13	1916	195000.	12.52
10	21	1911	120000.	14	1996	186000.	13.51
4	6	1912	104000.	15	1983	179000.	14.50
3	26	1913	123000.	16	1998	178000.	15.48
7	14	1914	111000.	17	1903	176000.	16.47
4	23	1915	92000.	18	1954	175900.	17.46
5	5	1916	195000.	19	1905	172000.	18.44
4	21	1917	142000.	20	1907	171000.	19.43
6	13	1918	123000.	21	1942	169600.	20.41
4	24	1919	166000.	22	1906	169000.	21.40
4	8	1920	222000.	23	1944	168500.	22.39
5	13	1921	85300.	24	1971	168000.	23.37
4	22	1922	212000.	25	1938	167400.	24.36
4	7	1923	106000.	26	1919	166000.	25.35
3	23	1924	106000.	27	1945	164400.	26.33
5	19	1925	93900.	28	1982	163000.	27.32
10	4	1926	97500.	29	1943	158700.	28.30
3	30	1927	133000.	30	1974	158000.	29.29
4	9	1928	116000.	31	1976	154000.	30.28
4	30	1929	146000.	32	1972	153000.	31.26
5	28	1930	83600.	33	1979	153000.	32.25
12	4	1931	59700.	34	1960	151000.	33.23
4	22	1932	97500.	35	1899	149000.	34.22
4	8	1933	92100.	36	1992	147000.	35.21
4	19	1934	81400.	37	1994	147000.	36.19
4	7	1935	123000.	38	1929	146000.	37.18
4	7	1936	133000.	39	1939	144900.	38.17
3	8	1937	95800.	40	1946	144800.	39.15
9	23	1938	167400.	41	1961	143000.	40.14
4	9	1939	144900.	42	1966	143000.	41.12
6	19	1940	74100.	43	1917	142000.	42.11
4	25	1941	128200.	44	1901	142000.	43.10
6	13	1942	169600.	45	1985	139000.	44.08
6	30	1943	158700.	46	1962	138000.	45.07
6	28	1944	168500.	47	1991	137000.	46.06
3	31	1945	164400.	48	1908	134000.	47.04
3	28	1946	144800.	49	1984	134000.	48.03
6	15	1947	125000.	50	1936	133000.	49.01
3	21	1948	108300.	51	1927	133000.	50.00
4	7	1949	85300.	52	1950	129900.	50.99
5	22	1950	129900.	53	1941	128200.	51.97
4	26	1951	221500.	54	1968	128000.	52.96
4	27	1952	225400.	55	1978	128000.	53.94
4	5	1953	104100.	56	1956	127000.	54.93
5	14	1954	175900.	57	1947	125000.	55.92
4	25	1955	96900.	58	1935	123000.	56.90
4	20	1956	127000.	59	1902	123000.	57.89
7	14	1957	103000.	60	1918	123000.	58.88
4	16	1958	64500.	61	1909	123000.	59.86
4	3	1959	112000.	62	1990	123000.	60.85
5	18	1960	151000.	63	1913	123000.	61.83
4	2	1961	143000.	64	1995	120000.	62.82
4	21	1962	138000.	65	1912	120000.	63.81
4	2	1963	90900.	66	1928	116000.	64.79
5	19	1964	84000.	67	1904	113000.	65.78
4	28	1965	307000.	68	1981	113000.	66.77
4	1	1966	143000.	69	1959	112000.	67.75
4	14	1967	201000.	70	1914	111000.	68.74
7	7	1968	128000.	71	1948	108300.	69.72
4	25	1969	231000.	72	1901	106000.	70.71
6	8	1970	93000.	73	1924	106000.	71.70
4	23	1971	168000.	74	1923	106000.	72.68
5	2	1972	153000.	75	1953	104100.	73.67
3	25	1973	207000.	76	1912	104000.	74.65
6	24	1974	158000.	77	1989	104000.	75.64
5	7	1975	214000.	78	1957	103000.	76.63
4	11	1976	154000.	79	1932	97500.	77.61
12	28	1977	57900.	80	1927	97500.	78.60
4	21	1978	128000.	81	1955	96900.	79.59
5	5	1979	153000.	82	1981	96800.	80.57
10	1	1980	113000.	83	1937	95800.	81.56
4	14	1981	96800.	84	1925	93900.	82.54
4	29	1982	163000.	85	1970	93000.	83.53
3	19	1983	179000.	86	1933	92100.	84.52
5	11	1984	134000.	87	1915	92000.	85.50
4	8	1985	139000.	88	1963	90900.	86.49
10	6	1986	201000.	89	1898	88800.	87.48
4	2	1987	66000.	90	1921	85300.	88.46
4	6	1988	65800.	91	1949	85300.	89.45
4	5	1989	104000.	92	1964	84000.	90.43
6	24	1990	123000.	93	1930	83600.	91.42
6	11	1991	137000.	94	1934	81400.	92.41
4	30	1992	147000.	95	1940	74100.	93.39
7	7	1993	238000.	96	1910	73100.	94.38
5	8	1994	147000.	97	1987	66000.	95.36
4	30	1995	120000.	98	1988	65800.	96.35
5	1	1996	186000.	99	1958	64500.	97.34
4	9	1997	237000.	100	1932	59700.	98.32
4	11	1998	178000.	101	1978	57900.	99.31

-OUTLIER TESTS -

LOW OUTLIER TEST

BASED ON 101 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 3.021
0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 47014.5

HIGH OUTLIER TEST

BASED ON 101 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 3.021
0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 359588.

-SKEW WEIGHTING -

BASED ON 101 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW =-99.000
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS -FREQUENCY CURVE- 05420500

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	.95 FLOW IN CFS
329000.	337000.	.2	377000.	295000.
300000.	306000.	.5	340000.	271000.
278000.	282000.	1.0	312000.	252000.
255000.	258000.	2.0	283000.	234000.
224000.	226000.	5.0	246000.	207000.
199000.	200000.	10.0	216000.	186000.
173000.	173000.	20.0	185000.	163000.
131000.	131000.	50.0	138000.	124000.
98100.	97800.	80.0	104000.	91600.
84200.	83700.	90.0	90200.	77600.
74000.	73400.	95.0	80100.	67400.
58000.	56900.	99.0	64000.	51300.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	5.1140	HISTORIC EVENTS	0
STANDARD DEV	.1462	HIGH OUTLIERS	0
COMPUTED SKEW	-.1487	LOW OUTLIERS	0
REGIONAL SKEW	-99.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.1000	SYSTEMATIC EVENTS	101

```
*********************************
*            FFA                *
*     FLOOD FREQUENCY ANALYSIS  *
*     PROGRAM DATE:  FEB 1995   *
*          VERSION:  3.1        *
*     RUN  DATE   AND   TIME:   *
*        05 OCT 01    16:07:30  *
*                               *
*********************************

NPUT FILE NAME: CLIN00AV.DAT
OUTPUT FILE NAME: CLIN00AV.OUT
**TITLE RECORD(S)**
TT     mean and st.dev from CLICY200
TT     input skew of -0.
TT

*INPUT STATISTICS**
      DURN IPART   ISTN  NSYS  NYR
SS  PEAK                  101    0
        XM       S       G     SKEW      AG
SS  5.1140   .1499   .0000   .0000  -.1000
```

Mississippi River at Clinton, Iowa FINAL RESULTS-FREQUENCY CURVE

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	.95 FLOW IN CFS
337000.	346000.	.2	387000.	301000.
306000.	312000.	.5	348000.	276000.
283000.	287000.	1.0	319000.	257000.
259000.	262000.	2.0	289000.	237000.
227000.	229000.	5.0	250000.	210000.
202000.	203000.	10.0	219000.	188000.
174000.	175000.	20.0	187000.	164000.
131000.	131000.	50.0	138000.	124000.
97400.	97100.	80.0	104000.	90800.
83200.	82800.	90.0	89400.	76600.
73000.	72400.	95.0	79100.	66300.
56800.	55800.	99.0	62900.	50200.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	5.1140	HISTORIC EVENTS	0
STANDARD DEV	.1499	HIGH OUTLIERS	0
COMPUTED SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.1000	SYSTEMATIC EVENTS	101

```
**************************************
*              FFA                   *
*     FLOOD FREQUENCY ANALYSIS       *
*     PROGRAM DATE:  FEB 1995        *
*          VERSION:  3.1             *
*     RUN  DATE   AND   TIME:        *
*        13 DEC 00     15:40:52      *
*                                    *
**************************************
 INPUT FILE NAME: KEOCY200.DAT
 OUTPUT FILE NAME: KEOCY200.OUT

**TITLE RECORD(S)**
TT     05474500  Natural Flow  Calendar Year
TT     MISSISSIPPI RIVER AT KEOKUK, IOWA
TT     Keokuk peak flows from USGS w/Coralville taken out
```

FINAL RESULTS -PLOTTING POSITIONS- 05474500

EVENTS ANALYZED				ORDERED EVENTS			
			FLOW	WATER	FLOW	MEDIAN	
MON	DAY	YEAR	CFS	RANK	YEAR	CFS	PLOT POS
3	20	1898	108000.	1	1993	440700.	.69
6	29	1899	159000.	2	1973	362000.	1.68
10	5	1900	138000.	3	1965	334000.	2.66
3	25	1901	150000.	4	1960	307000.	3.65
7	21	1902	181000.	5	1974	278000.	4.64
6	6	1903	270000.	6	1990	275000.	5.62
4	30	1904	171000.	7	1987	272900.	6.61
6	10	1905	212000.	8	1979	271000.	7.59
4	27	1906	192000.	9	1903	270000.	8.58
4	17	1907	178000.	10	1951	265100.	9.57
6	9	1908	178000.	11	1997	257000.	10.55
5	6	1909	181000.	12	1969	256000.	11.54
3	20	1910	124000.	13	1975	256000.	12.52
2	21	1911	156000.	14	1944	254000.	13.51
4	6	1912	220000.	15	1952	253800.	14.50
3	29	1913	169000.	16	1998	250758.	15.48
6	24	1914	122000.	17	1929	247000.	16.47
2	28	1915	142000.	18	1947	245700.	17.46
5	9	1916	213000.	19	1922	240000.	18.44
6	17	1917	163000.	20	1996	239200.	19.43
6	12	1918	192000.	21	1962	234000.	20.41
5	8	1919	205000.	22	1948	233600.	21.40
4	10	1920	230000.	23	1920	230000.	22.39
5	12	1921	108000.	24	1983	225000.	23.37
4	24	1922	240000.	25	1946	223300.	24.36
4	9	1923	148000.	26	1982	223000.	25.35
8	24	1924	160000.	27	1967	221000.	26.33
6	23	1925	112000.	28	1976	221000.	27.32
9	28	1926	147000.	29	1912	220000.	28.30
4	3	1927	175000.	30	1995	214500.	29.29
4	12	1928	150000.	31	1916	213000.	30.28
3	23	1929	247000.	32	1961	212000.	31.26
6	18	1930	163000.	33	1905	212000.	32.25
11	28	1931	105000.	34	1985	210000.	33.23
4	24	1932	106000.	35	1919	205000.	34.22
4	9	1933	160000.	36	1945	203300.	35.21
12	5	1934	85000.	37	1942	200900.	36.19
4	11	1935	138000.	38	1984	200000.	37.18
4	9	1936	148000.	39	1991	198000.	38.17
3	10	1937	190000.	40	1938	193800.	39.15
9	26	1938	193800.	41	1918	192000.	40.14
3	16	1939	156000.	42	1972	192000.	41.12
4	19	1940	81700.	43	1906	192000.	42.11
4	27	1941	154400.	44	1937	190000.	43.10
6	16	1942	200900.	45	1959	188000.	44.08
4	18	1943	174000.	46	1971	185000.	45.07
5	27	1944	254000.	47	1992	183000.	46.06
3	26	1945	203300.	48	1954	181400.	47.04
1	11	1946	223300.	49	1909	181000.	48.03
6	21	1947	245700.	50	1902	181000.	49.01
3	23	1948	233600.	51	1978	179000.	50.00
3	12	1949	150700.	52	1907	178000.	50.99
4	25	1950	175900.	53	1908	178000.	51.97
4	29	1951	265100.	54	1950	175900.	52.96
4	27	1952	253800.	55	1927	175000.	53.94
4	1	1953	137200.	56	1943	174000.	54.93
5	17	1954	181400.	57	1904	171000.	55.92
4	25	1955	156600.	58	1913	169000.	56.90
4	22	1956	131500.	59	1966	166000.	57.89
7	15	1957	106000.	60	1930	163000.	58.88
6	13	1958	99000.	61	1981	163000.	59.86
4	5	1959	188000.	62	1917	163000.	60.85
4	4	1960	307000.	63	1924	160000.	61.83
4	5	1961	212000.	64	1933	160000.	62.82
4	7	1962	234000.	65	1899	159000.	63.81
3	22	1963	130000.	66	1994	156900.	64.79
5	21	1964	96300.	67	1955	156600.	65.78
5	1	1965	334000.	68	1939	156000.	66.77
4	3	1966	166000.	69	1911	156000.	67.75
4	17	1967	221000.	70	1941	154400.	68.74
7	9	1968	143000.	71	1949	150700.	69.72
4	26	1969	256000.	72	1928	150000.	70.71
5	17	1970	141000.	73	1901	150000.	71.70
4	27	1971	185000.	74	1923	148000.	72.68
5	11	1972	192000.	75	1936	148000.	73.67
4	24	1973	362000.	76	1926	147000.	74.65
5	22	1974	278000.	77	1968	143000.	75.64
5	9	1975	256000.	78	1915	142000.	76.63
4	28	1976	221000.	79	1980	141000.	77.61
8	9	1977	107100.	80	1970	141000.	78.60
4	24	1978	179000.	81	1935	138000.	79.59
4	6	1979	271000.	82	1901	138000.	80.57
6	16	1980	141000.	83	1953	137200.	81.56
4	16	1981	163000.	84	1956	131500.	82.54
4	17	1982	223000.	85	1963	130000.	83.53
4	6	1983	225000.	86	1989	126000.	84.52
6	29	1984	200000.	87	1910	124000.	85.50
3	6	1985	210000.	88	1914	122000.	86.49
10	6	1986	272900.	89	1925	112000.	87.48
8	28	1987	95700.	90	1921	108000.	88.46
4	8	1988	107000.	91	1898	108000.	89.45
4	8	1989	126000.	92	1977	107100.	90.43
6	21	1990	275000.	93	1988	107000.	91.42
4	21	1991	198000.	94	1957	106000.	92.41
4	30	1992	183000.	95	1932	106000.	93.39
7	10	1993	440700.	96	1932	105000.	94.38
5	10	1994	156900.	97	1958	99000.	95.36
5	14	1995	214500.	98	1964	96300.	96.35
5	13	1996	239200.	99	1987	95700.	97.34
4	22	1997	257000.	100	1935	85000.	98.32
4	15	1998	250758.	101	1940	81700.	99.31

-OUTLIER TESTS -

LOW OUTLIER TEST

BASED ON 101 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 3.021
0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 66090.5

HIGH OUTLIER TEST

BASED ON 101 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 3.021
0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 475761.

-SKEW WEIGHTING -

BASED ON 101 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW =-99.000
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS -FREQUENCY CURVE- 05474500

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	.95 FLOW IN CFS
436000.	447000.	.2	498000.	392000.
399000.	406000.	.5	450000.	361000.
370000.	376000.	1.0	414000.	338000.
341000.	345000.	2.0	378000.	313000.
301000.	303000.	5.0	329000.	279000.
269000.	270000.	10.0	290000.	251000.
234000.	234000.	20.0	250000.	220000.
178000.	178000.	50.0	188000.	169000.
135000.	135000.	80.0	143000.	126000.
116000.	116000.	90.0	124000.	107000.
103000.	102000.	95.0	111000.	93700.
81000.	79600.	99.0	89100.	72000.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	5.2488	HISTORIC EVENTS	0
STANDARD DEV	.1419	HIGH OUTLIERS	0
COMPUTED SKEW	-.0829	LOW OUTLIERS	0
REGIONAL SKEW	-99.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.1000	SYSTEMATIC EVENTS	101

```
**************************************
*              FFA                   *
*     FLOOD FREQUENCY ANALYSIS       *
*     PROGRAM DATE:  FEB 1995        *
*          VERSION:  3.1             *
*     RUN  DATE   AND   TIME:        *
*        03 NOV 00     15:23:53      *
*                                    *
**************************************

 INPUT FILE NAME: KEO00ST.DAT
 OUTPUT FILE NAME: KEO00ST.OUT

**TITLE RECORD(S)**
TT     mean and st.dev from keocy200
TT     input skew of -0.1
**INPUT STATISTICS**
      DURN IPART    ISTN  NSYS  NYR
SS  PEAK                  101    0
        XM        S       G     SKEW      AG
SS  5.2488    .1419   .0000   .0000  -.1000
```

MISSISSIPPI RIVER AT KEOKUK,IOWA FINAL RESULTS -FREQUENCY CURVE

COMPUTED CURVE FLOW IN CFS	EXPECTED PROBABILITY FLOW IN CFS	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	.95 FLOW IN CFS
437000.	447000.	.2	498000.	392000.
399000.	407000.	.5	450000.	362000.
370000.	376000.	1.0	414000.	338000.
341000.	345000.	2.0	378000.	313000.
301000.	303000.	5.0	329000.	279000.
269000.	270000.	10.0	290000.	251000.
234000.	234000.	20.0	250000.	220000.
178000.	178000.	50.0	188000.	169000.
135000.	135000.	80.0	143000.	126000.
116000.	116000.	90.0	124000.	107000.
103000.	102000.	95.0	111000.	93700.
81000.	79600.	99.0	89100.	72000.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	5.2488	HISTORIC EVENTS	0
STANDARD DEV	.1419	HIGH OUTLIERS	0
COMPUTED SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.1000	SYSTEMATIC EVENTS	101

```
**********************************
*            FFA                 *
*     FLOOD FREQUENCY ANALYSIS   *
*          VERSION:  3.1         *
*     RUN  DATE   AND   TIME:    *
*        13 DEC 00    16:03:03   *
*                                *
**********************************
 INPUT FILE NAME: HANATNEW.DAT
 OUTPUT FILE NAME: HANATNEW.OUT

**TITLE RECORD(S)**
TT   Mississippi River at Hannibal
TT   Natural flow conditions - hannat2.dat
TT   Use A.F.B. 6-20-57 1879-1953
TT   Hold outs routed to Hnnm7 from
TT   Coralville, Saylorville, Red Rock
TT   Use D.L.M. stages/flows 1954-1998
TT   1948 study /1973 ratings
TT   1984-1998 use 1973 rating w/
TT   1993 measured shift.
```

FINAL RESULTS -PLOTTING POSITIONS-

EVENTS ANALYZED				ORDERED EVENTS			
			FLOW	WATER		FLOW	MEDIAN
MON	DAY	YEAR	CFS	RANK	YEAR	CFS	PLOT POS
5	21	1898	128000.	1	1993	537200.	.69
5	23	1899	183000.	2	1973	435900.	1.68
3	15	1900	159000.	3	1990	384400.	2.66
4	8	1901	148000.	4	1996	359900.	3.65
6	23	1902	211000.	5	1974	359400.	4.64
6	8	1903	340000.	6	1987	355500.	5.62
4	28	1904	208000.	7	1965	344000.	6.61
6	13	1905	238000.	8	1903	340000.	7.59
4	25	1906	187000.	9	1947	339000.	8.58
7	23	1907	178000.	10	1960	335900.	9.57
6	1	1908	229000.	11	1979	330500.	10.55
7	9	1909	211000.	12	1983	326200.	11.54
3	20	1910	117000.	13	1969	319300.	12.52
2	22	1911	144000.	14	1976	315600.	13.51
4	8	1912	256000.	15	1998	312100.	14.50
4	1	1913	171000.	16	1951	307000.	15.48
6	25	1914	124000.	17	1944	305000.	16.47
8	5	1915	203000.	18	1985	304900.	17.46
5	16	1916	250000.	19	1995	300200.	18.44
6	9	1917	228000.	20	1929	296000.	19.43
6	13	1918	222000.	21	1975	293300.	20.41
5	8	1919	267000.	22	1948	287000.	21.40
4	22	1920	256000.	23	1952	287000.	22.39
5	3	1921	123000.	24	1997	280900.	23.37
4	25	1922	242000.	25	1962	278500.	24.36
4	11	1923	141000.	26	1991	269000.	25.35
6	30	1924	178000.	27	1982	268600.	26.33
6	24	1925	122000.	28	1919	267000.	27.32
10	3	1926	205000.	29	1984	263900.	28.30
4	22	1927	226000.	30	1920	256000.	29.29
11	19	1928	215000.	31	1912	256000.	30.28
4	27	1929	296000.	32	1945	251000.	31.26
6	19	1930	173000.	33	1916	250000.	32.25
11	27	1931	125000.	34	1967	245700.	33.23
4	25	1932	105000.	35	1922	242000.	34.22
5	27	1933	178000.	36	1946	241000.	35.21
12	2	1934	94000.	37	1950	240000.	36.19
6	4	1935	185000.	38	1905	238000.	37.18
4	10	1936	149000.	39	1961	236800.	38.17
3	12	1937	213000.	40	1908	229000.	39.15
9	27	1938	218000.	41	1917	228000.	40.14
3	15	1939	216000.	42	1927	226000.	41.12
4	18	1940	90000.	43	1970	225700.	42.11
11	7	1941	168000.	44	1978	223800.	43.10
6	19	1942	212000.	45	1918	222000.	44.08
6	18	1943	210000.	46	1971	221400.	45.07
5	28	1944	305000.	47	1972	219800.	46.06
6	18	1945	251000.	48	1992	218700.	47.04
1	12	1946	241000.	49	1938	218000.	48.03
6	10	1947	339000.	50	1939	216000.	49.01
3	24	1948	287000.	51	1929	215000.	50.00
3	13	1949	175000.	52	1981	214900.	50.99
6	22	1950	240000.	53	1937	213000.	51.97
5	13	1951	307000.	54	1942	212000.	52.96
4	25	1952	287000.	55	1902	211000.	53.94
4	2	1953	193000.	56	1909	211000.	54.93
7	2	1954	193000.	57	1943	210000.	55.92
4	26	1955	174800.	58	1904	208000.	56.90
4	22	1956	130600.	59	1927	205000.	57.89
7	16	1957	117400.	60	1915	203000.	58.88
6	14	1958	130600.	61	1959	197200.	59.86
4	6	1959	197200.	62	1954	193000.	60.85
4	4	1960	335900.	63	1953	193000.	61.83
4	6	1961	236800.	64	1978	188800.	62.82
4	9	1962	278500.	65	1906	187000.	63.81
3	23	1963	147500.	66	1935	185000.	64.79
4	22	1964	142600.	67	1994	184300.	65.78
5	1	1965	344000.	68	1899	183000.	66.77
4	4	1966	179600.	69	1966	179600.	67.75
4	17	1967	245700.	70	1924	178000.	68.74
7	11	1968	153900.	71	1907	178000.	69.72
7	11	1969	319300.	72	1933	178000.	70.71
9	25	1970	225700.	73	1980	177700.	71.70
2	27	1971	221400.	74	1949	175000.	72.68
5	12	1972	219800.	75	1955	174800.	73.67
4	25	1973	435900.	76	1930	173000.	74.65
5	22	1974	359400.	77	1913	171000.	75.64
5	10	1975	293300.	78	1942	168000.	76.63
4	27	1976	315600.	79	1900	159000.	77.61
11	3	1977	188800.	80	1968	153900.	78.60
3	30	1978	223800.	81	1936	149000.	79.59
4	14	1979	330500.	82	1901	148000.	80.57
6	17	1980	177700.	83	1963	147500.	81.56
7	6	1981	214900.	84	1911	144000.	82.54
4	19	1982	268600.	85	1964	142600.	83.53
4	5	1983	326200.	86	1923	141000.	84.52
6	30	1984	263900.	87	1988	137900.	85.50
3	6	1985	304900.	88	1987	134200.	86.49
10	4	1986	355500.	89	1989	134000.	87.48
4	16	1987	134200.	90	1956	130600.	88.46
2	4	1988	137900.	91	1958	130600.	89.45
4	8	1989	134000.	92	1898	128000.	90.43
6	22	1990	384400.	93	1932	125000.	91.42
4	21	1991	269000.	94	1914	124000.	92.41
5	2	1992	218700.	95	1921	123000.	93.39
7	16	1993	537200.	96	1925	122000.	94.38
5	9	1994	184300.	97	1957	117400.	95.36
5	26	1995	300200.	98	1910	117000.	96.35
5	30	1996	359900.	99	1932	105000.	97.34
4	22	1997	280900.	100	1935	94000.	98.32
4	16	1998	312100.	101	1940	90000.	99.31

LOW OUTLIER TEST

BASED ON 101 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 3.021
0 LOW OUTLIER(S) IDENTIFIED BELOW TEST VALUE OF 72698.8

HIGH OUTLIER TEST

BASED ON 101 EVENTS, 10 PERCENT OUTLIER TEST VALUE K(N) = 3.021
0 HIGH OUTLIER(S) IDENTIFIED ABOVE TEST VALUE OF 613871.

-SKEW WEIGHTING -

BASED ON 101 EVENTS, MEAN-SQUARE ERROR OF STATION SKEW =-99.000
DEFAULT OR INPUT MEAN-SQUARE ERROR OF GENERALIZED SKEW = .302

FINAL RESULTS -FREQUENCY CURVE

COMPUTED CURVE FLOW IN CFS		EXPECTED PROBABILITY	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	.95
559000.	574000.	.2		645000.	498000.
507000.	518000.	.5		578000.	456000.
468000.	476000.	1.0		528000.	424000.
428000.	433000.	2.0		478000.	390000.
374000.	377000.	5.0		412000.	345000.
331000.	332000.	10.0		360000.	308000.
285000.	286000.	20.0		306000.	267000.
212000.	212000.	50.0		225000.	200000.
157000.	157000.	80.0		168000.	146000.
134000.	133000.	90.0		144000.	123000.
117000.	116000.	95.0		127000.	106000.
90500.	88800.	99.0		100000.	79700.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	5.3248	HISTORIC EVENTS	0
STANDARD DEV	.1534	HIGH OUTLIERS	0
COMPUTED SKEW	-.1115	LOW OUTLIERS	0
REGIONAL SKEW	-99.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.1000	SYSTEMATIC EVENTS	101

```
**********************************
*            FFA                 *
*     FLOOD FREQUENCY ANALYSIS   *
*     PROGRAM DATE:  FEB 1995    *
*          VERSION:  3.1         *
*     RUN  DATE   AND   TIME:    *
*        13 NOV 01    13:18:22   *
*                                *
**********************************

INPUT FILE NAME: H200AV.DAT
OUTPUT FILE NAME: H200AV.OUT

**INPUT STATISTICS**
      DURN IPART   ISTN  NSYS  NYR
SS  PEAK                  101    0
       XM       S       G      SKEW      AG     NHIS  NOUTL  NLOW
SS 5.3248   .1515   .0000   .0000  -.1000     0      0      0
```

FINAL RESULTS

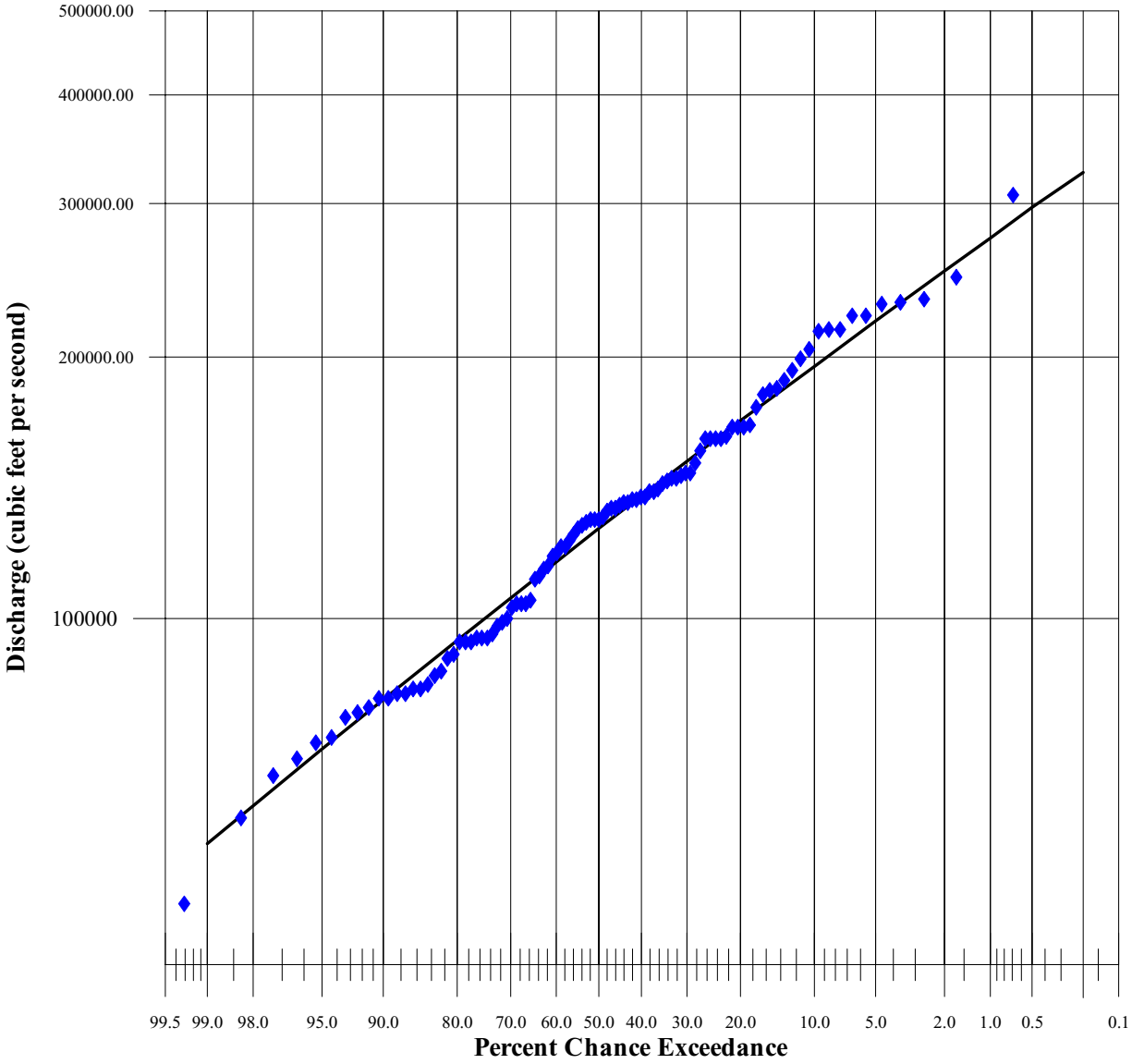
-FREQUENCY CURVE-

COMPUTED CURVE FLOW IN CFS		EXPECTED PROBABILITY	PERCENT CHANCE EXCEEDANCE	CONFIDENCE LIMITS .05 FLOW IN CFS	.95
553000.	567000.	.2		636000.	493000.
502000.	512000.	.5		571000.	452000.
464000.	471000.	1.0		523000.	420000.
424000.	430000.	2.0		474000.	388000.
371000.	374000.	5.0		408000.	343000.
329000.	331000.	10.0		358000.	306000.
284000.	285000.	20.0		305000.	266000.
212000.	212000.	50.0		225000.	201000.
158000.	157000.	80.0		168000.	147000.
135000.	134000.	90.0		145000.	124000.
118000.	117000.	95.0		128000.	107000.
91500.	89800.	99.0		101000.	80700.

SYSTEMATIC STATISTICS

LOG TRANSFORM: FLOW, CFS		NUMBER OF EVENTS	
MEAN	5.3248	HISTORIC EVENTS	0
STANDARD DEV	.1515	HIGH OUTLIERS	0
COMPUTED SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.1000	SYSTEMATIC EVENTS	101

Unregulated Flow Frequency Curve
Mississippi River at Dubuque, Iowa

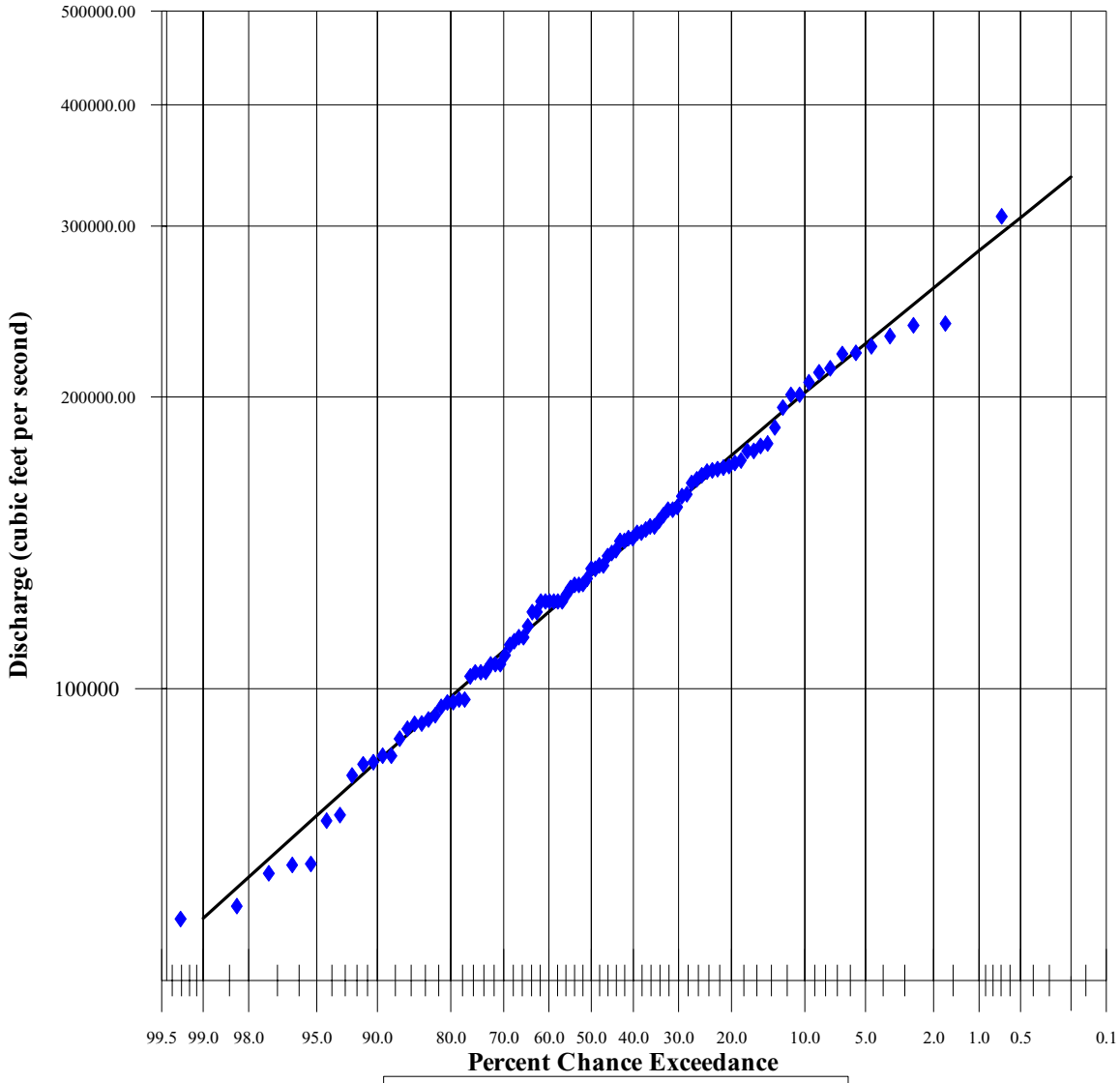


Mississippi River @ Dubuque, Iowa
Unregulated COE Gage
Annual Mean Daily Peak
Computed Frequency Curve
Median Plotting Positions
Calendar Years (1898-1998)
Adopted Statistics
Mean 5.1005
Standard Deviation .1499
Regional Skew -.1

%Chance Exceedance	Discharge
0.2	326,000
0.5	297,000
1.0	274,000
2.0	251,000
10.0	195,000
20.0	169,000
50.0	127,000

Plate C-M-9

Unregulated Flow Frequency Curve
Mississippi River at Clinton, Iowa



Mississippi River @ Clinton, Iowa
Unregulated USGS Gage 05420500
Annual Mean Daily Peak
Computed Frequency Curve
Median Plotting Positions
Calendar Years (1898-1998)
Adopted Statistics
Mean 5.1140
Standard Deviation .1499
Regional Skew -.1

%Chance Exceedance	Discharge
0.2	337,000
0.5	306,000
1.0	283,000
2.0	259,000
10.0	202,000
20.0	174,000
50.0	131,000

Plate C-M-10

Mississippi River at Keokuk, Unregulated versus Regulated Flow Relationships
MVR Simulation (Blue) and UNET (Black) Flow Relationships

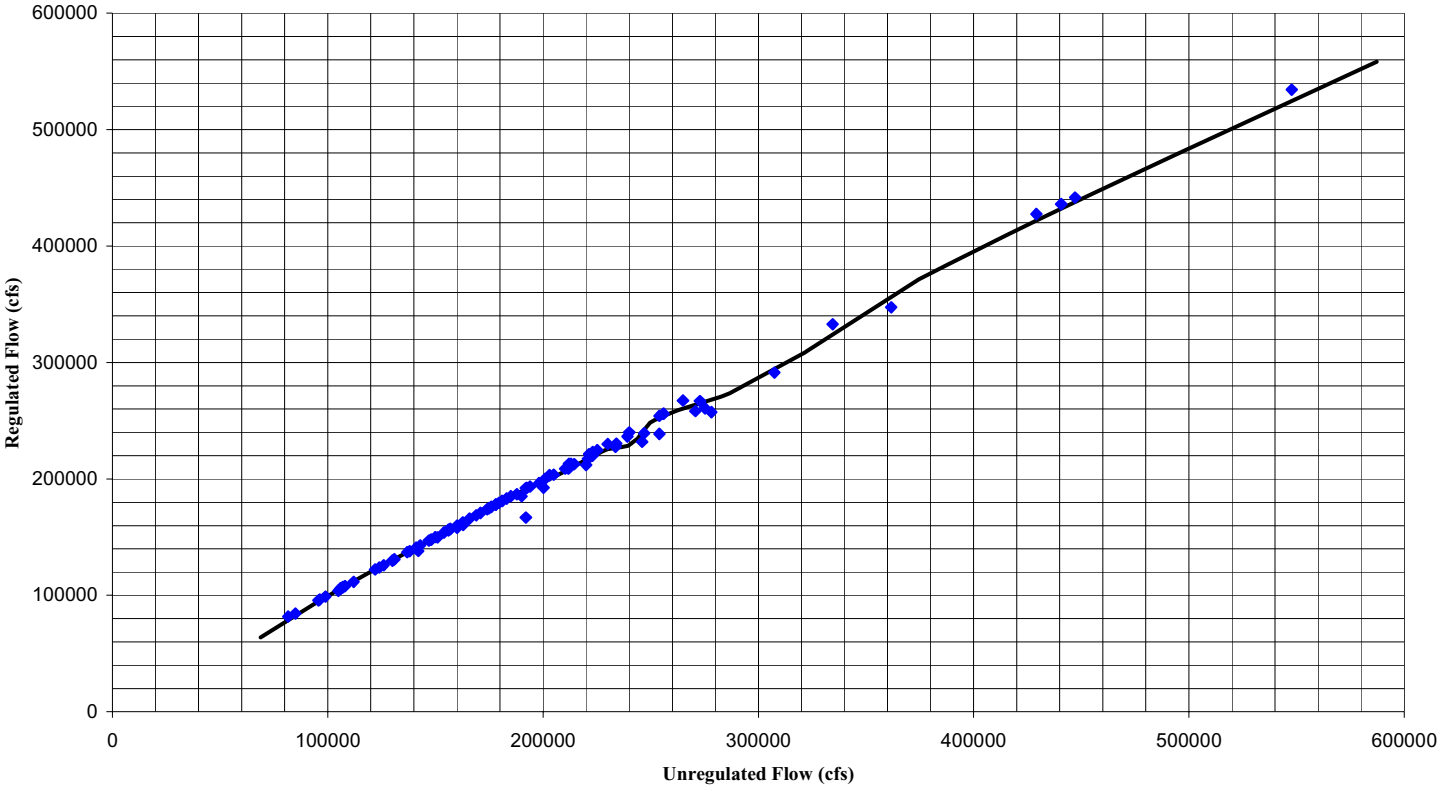


Plate C-M-11

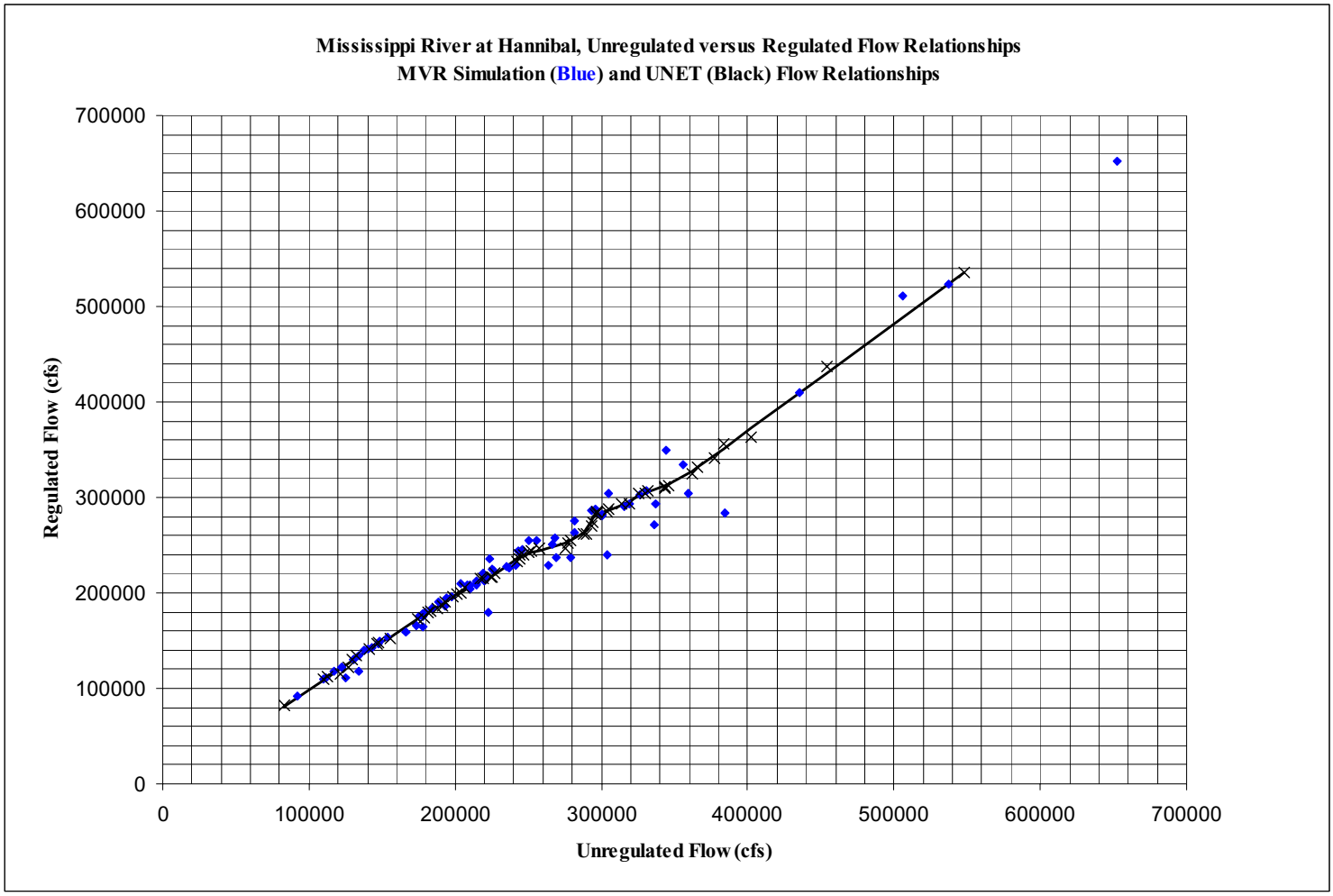
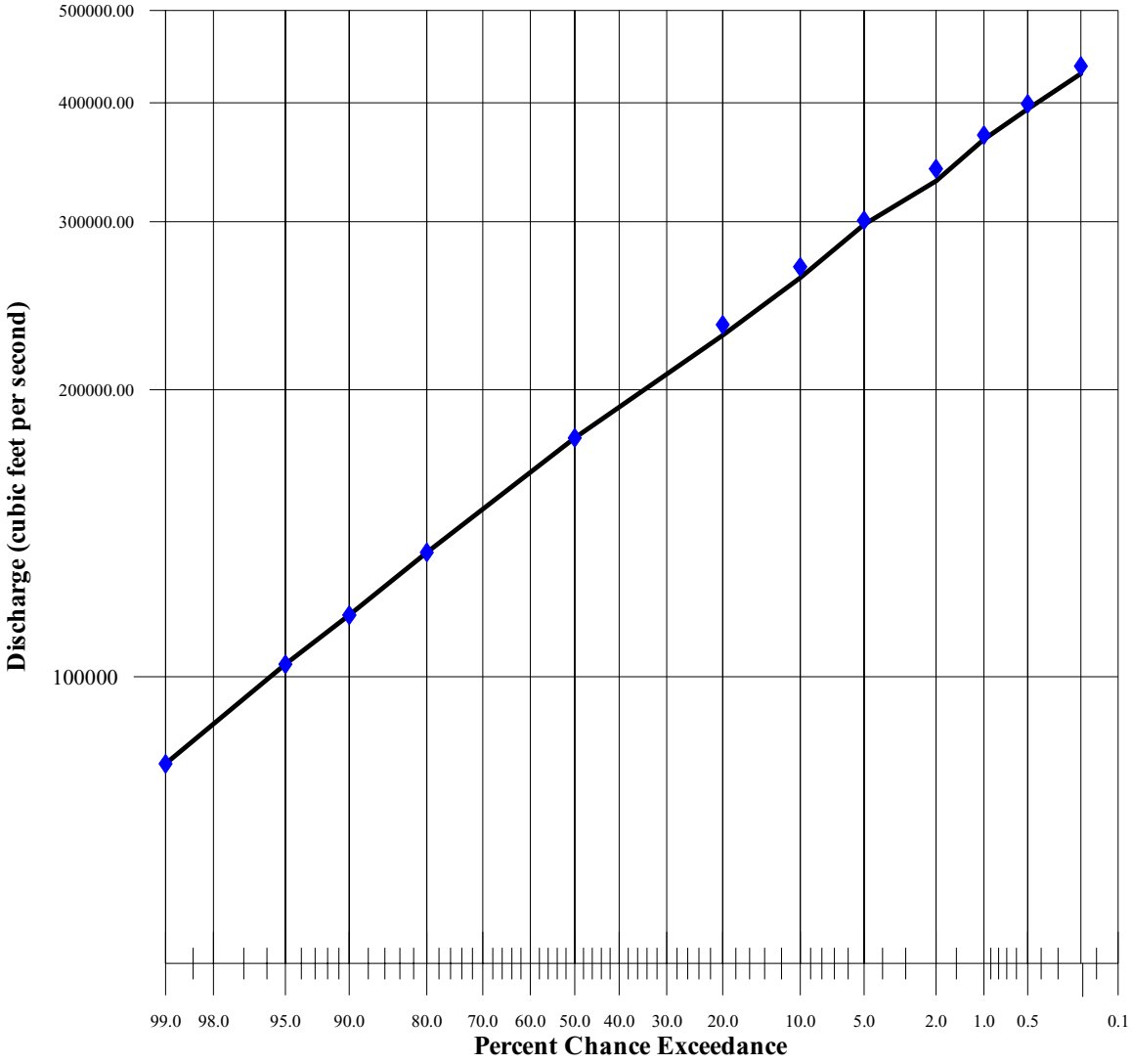

Mississippi River at Hannibal, Unregulated versus Regulated Flow Relationships
MVR Simulation (Blue) and UNET (Black) Flow Relationships
Regulated Flow (cfs)
Unregulated Flow (cfs)
0
100000
200000
300000
400000
500000
600000
700000

Plate C-M-12

Regulated Flow Frequency Curve
Mississippi River at Keokuk, Iowa

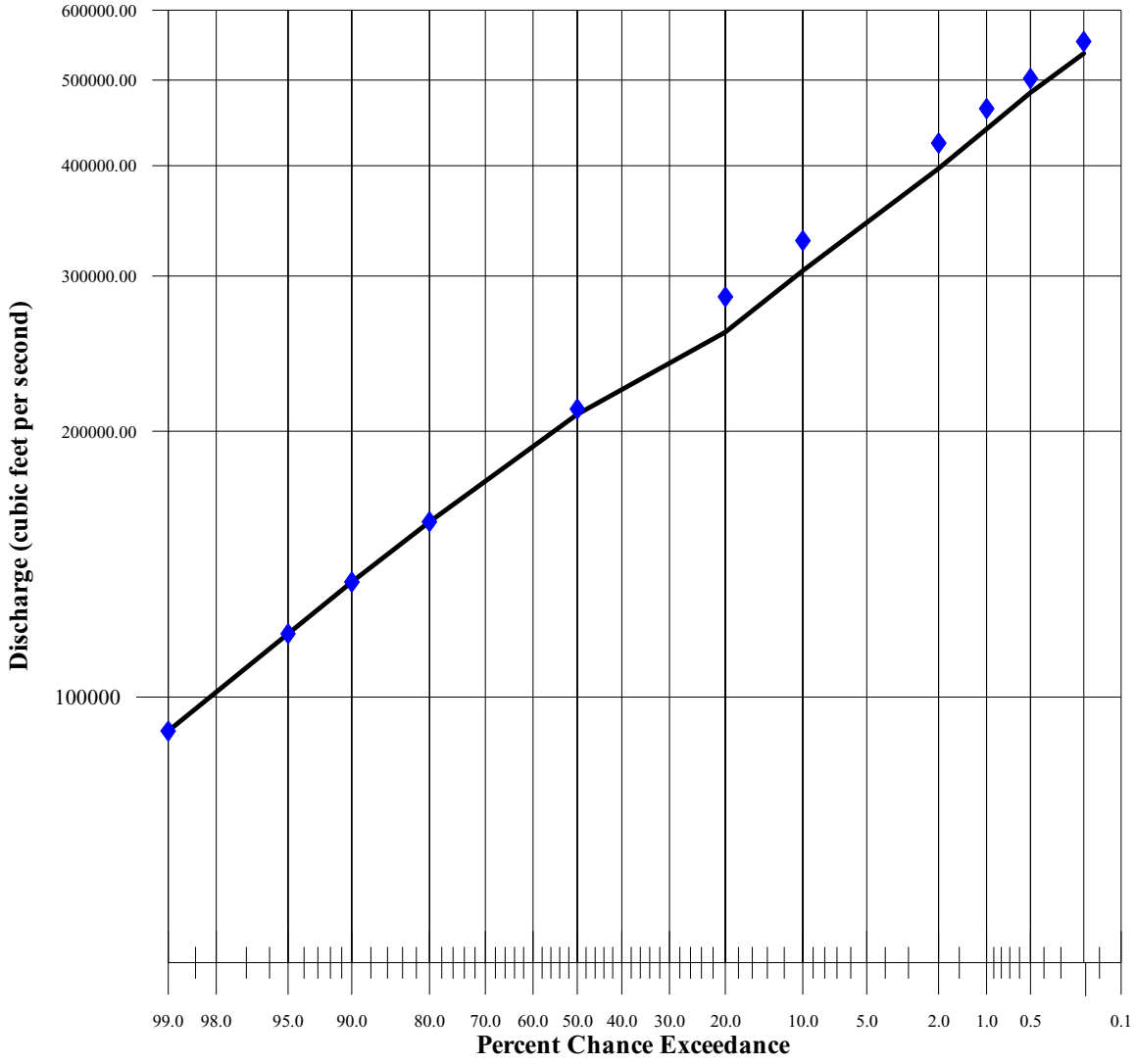


Mississippi River @ Keokuk, Iowa
USGS/COE Gage 05474500
Annual Mean Daily Peak
Computed Frequency Curve
Median Plotting Positions
Calendar Years (1898-1998)
Adopted Statistics
Mean 5.2488
Standard Deviation .1419
Regional Skew -.1

%Chance Exceedance	Unregulated Discharge	Regulated Discharge
0.2	437,000	429,000
0.5	399,000	394,000
1.0	370,000	366,000
2.0	341,000	331,000
10.0	269,000	262,000
20.0	234,000	228,000
50.0	178,000	178,000

Plate C-M-13

Regulated Flow Frequency Curve
Mississippi River at Hannibal, Missouri



Mississippi River @ Hannibal, Missouri (COE Gage)
Regulated Frequency Curve (line)
Unregulated Computed Frequency Curve (points)
Annual Mean Daily Peak
Median Plotting Positions
Calendar Years (1898-1998)
Adopted Statistics
Mean 5.3248
Standard Deviation (Averaged) .1515
Regional Skew -.1

%Chance Exceedance	Unregulated Discharge	Regulated Discharge
0.2	553,000	536,000
0.5	502,000	484,000
1.0	464,000	440,000
2.0	424,000	397,000
10.0	329,000	304,000
20.0	284,000	259,000
50.0	212,000	209,000

Plate C-M-14

UPPER MISSISSIPPI RIVER SYSTEM

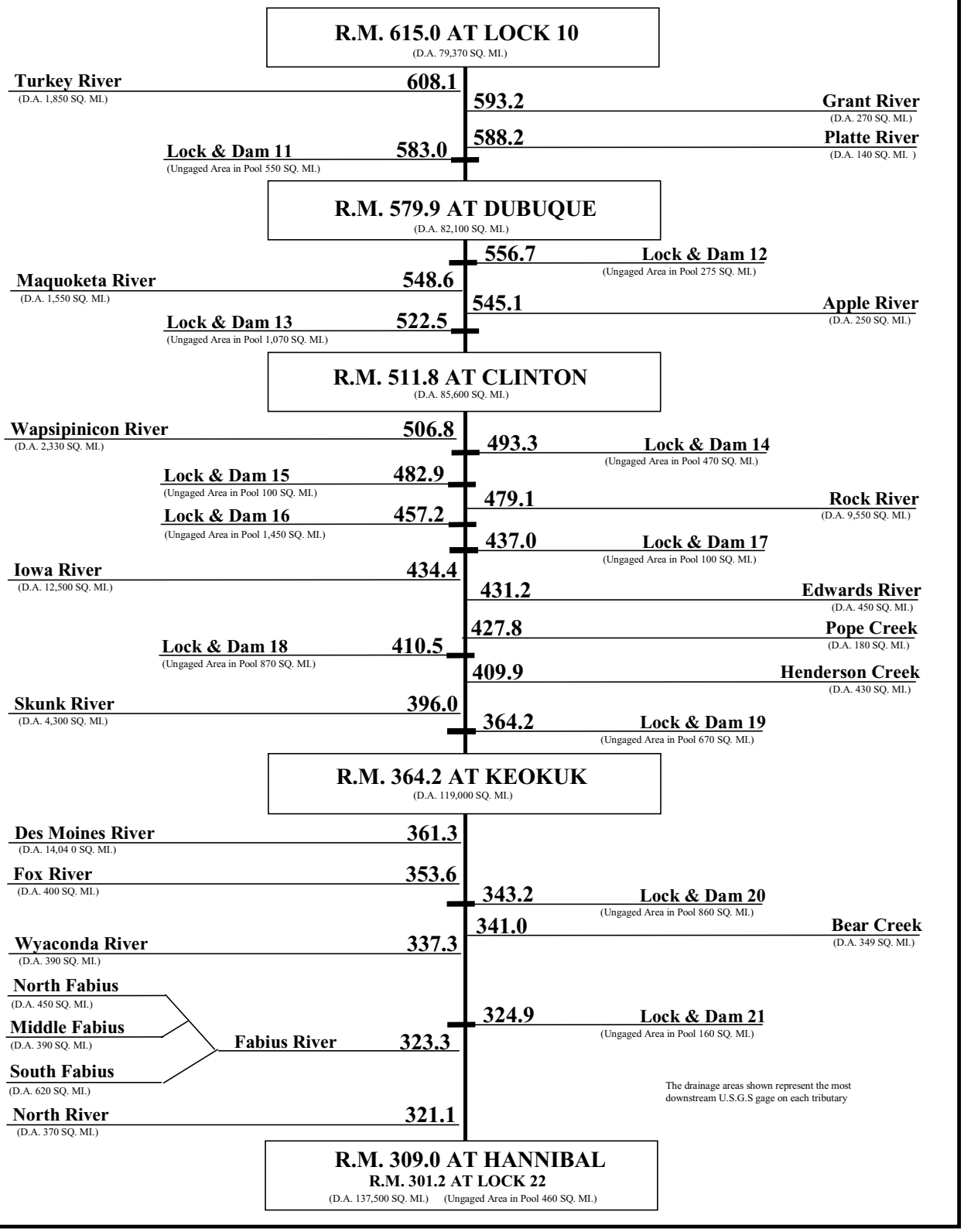


Plate C-M-15

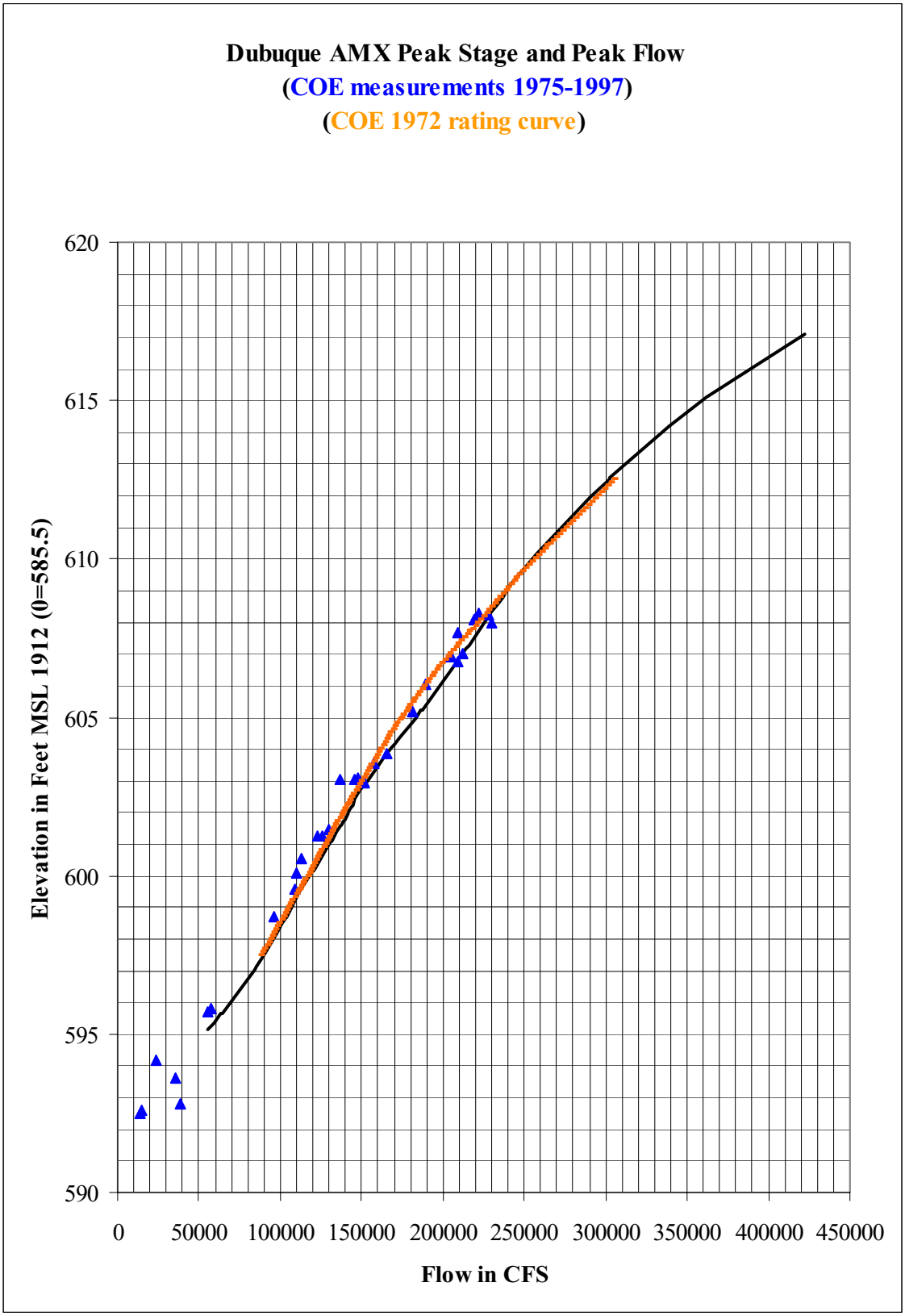

Dubuque AMX Peak Stage and Peak Flow
(COE measurements 1975-1997)
(COE 1972 rating curve)
Elevation in Feet MSL 1912 (0=585.5)
620
615
610
605
600
595
590
0
50000
100000
150000
200000
250000
300000
350000
400000
450000
Flow in CFS

Plate C-M-16

Clinton AMX Peak Stage and Peak Flow RM 511.6
(USGS Measurements at RM 511.8)

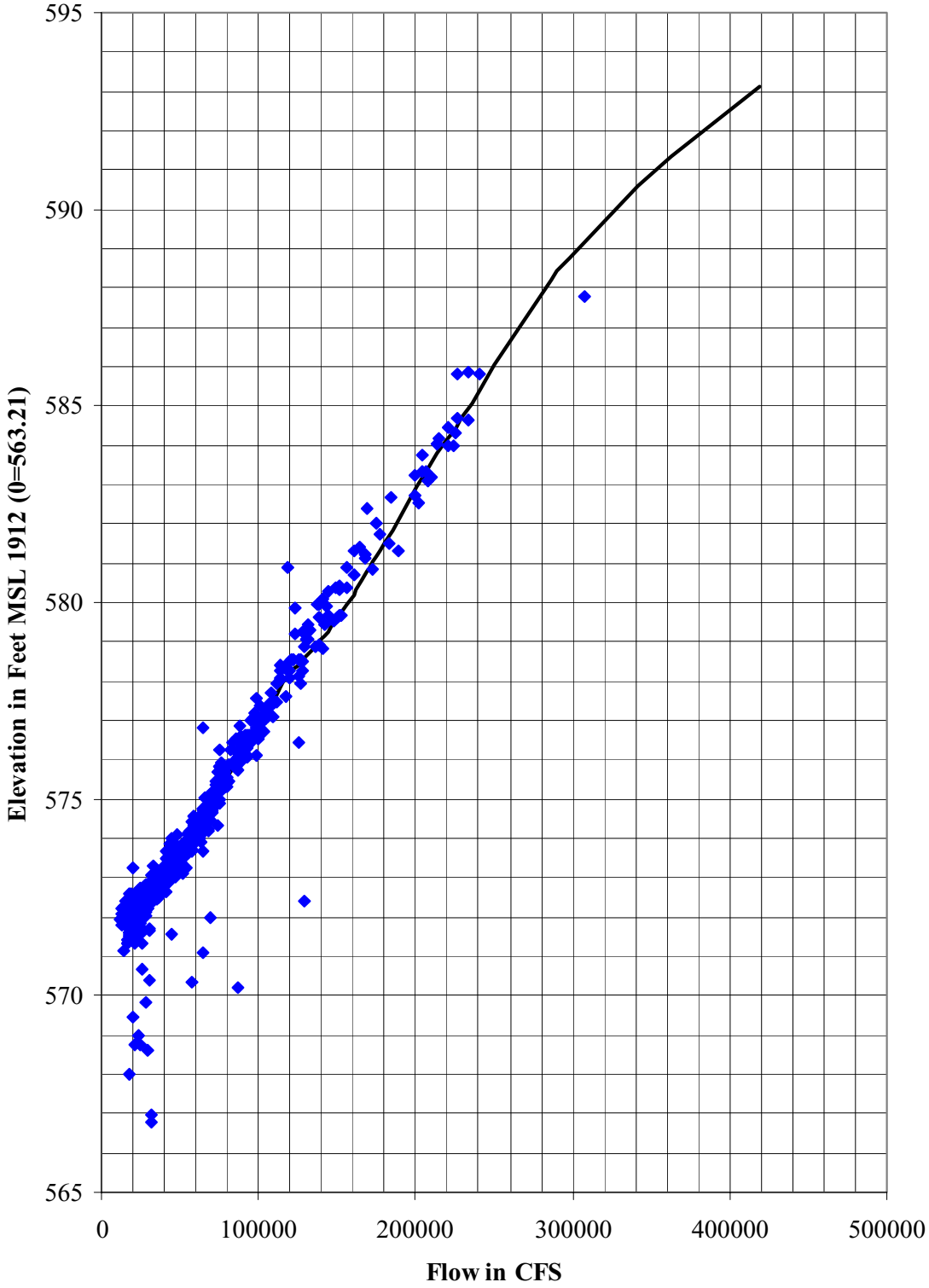


Plate C-M-17

Keokuk AMX Regulated Peak Stage and Peak Flow
(USGS 10/1993 rating)

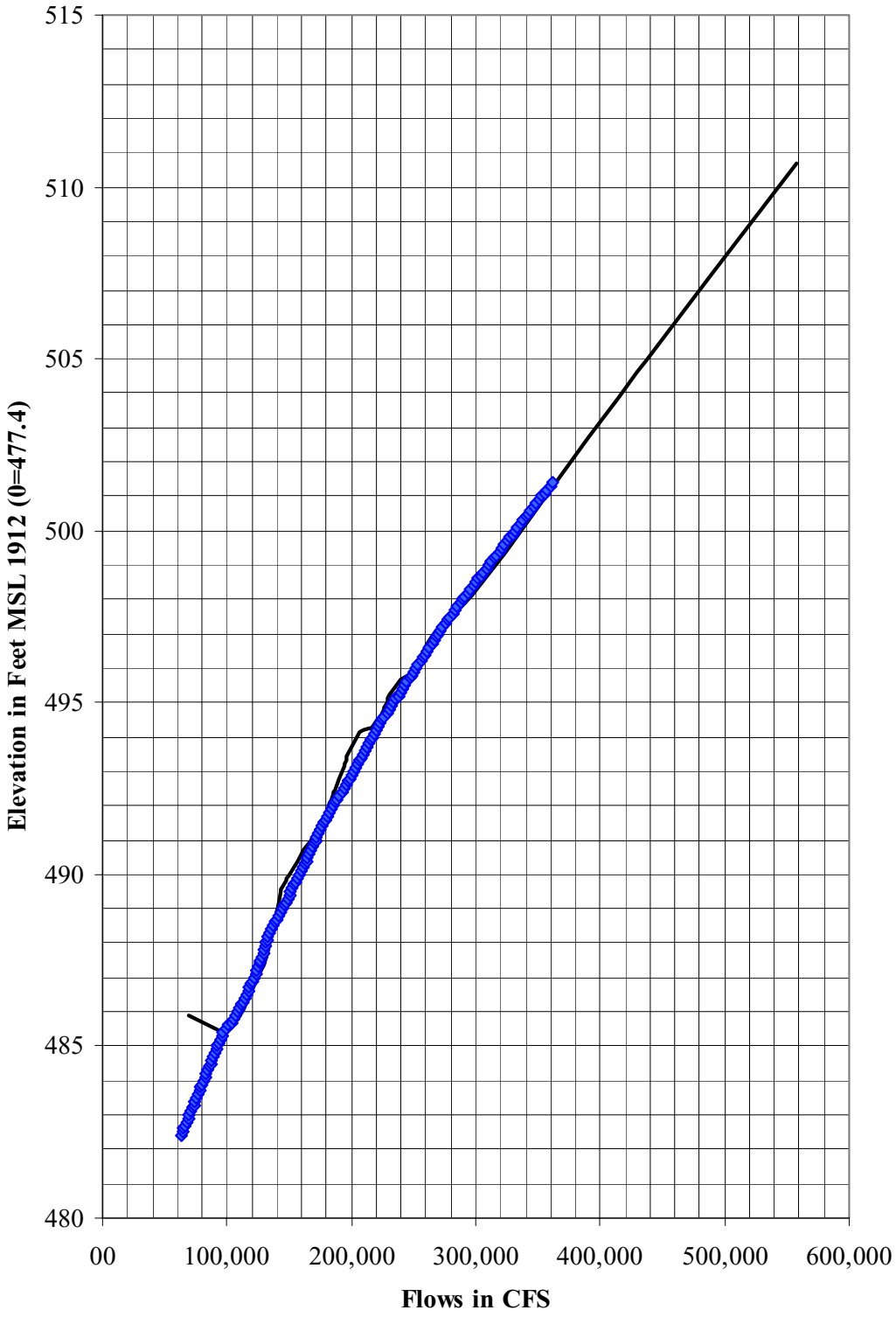


Plate C-M-18

Hannibal AMX Regulated Peak Stage and Peak Flow

(COE Rating Reference A.F.B. 1954/ S.K. 1998)

(1993 COE Measurements)

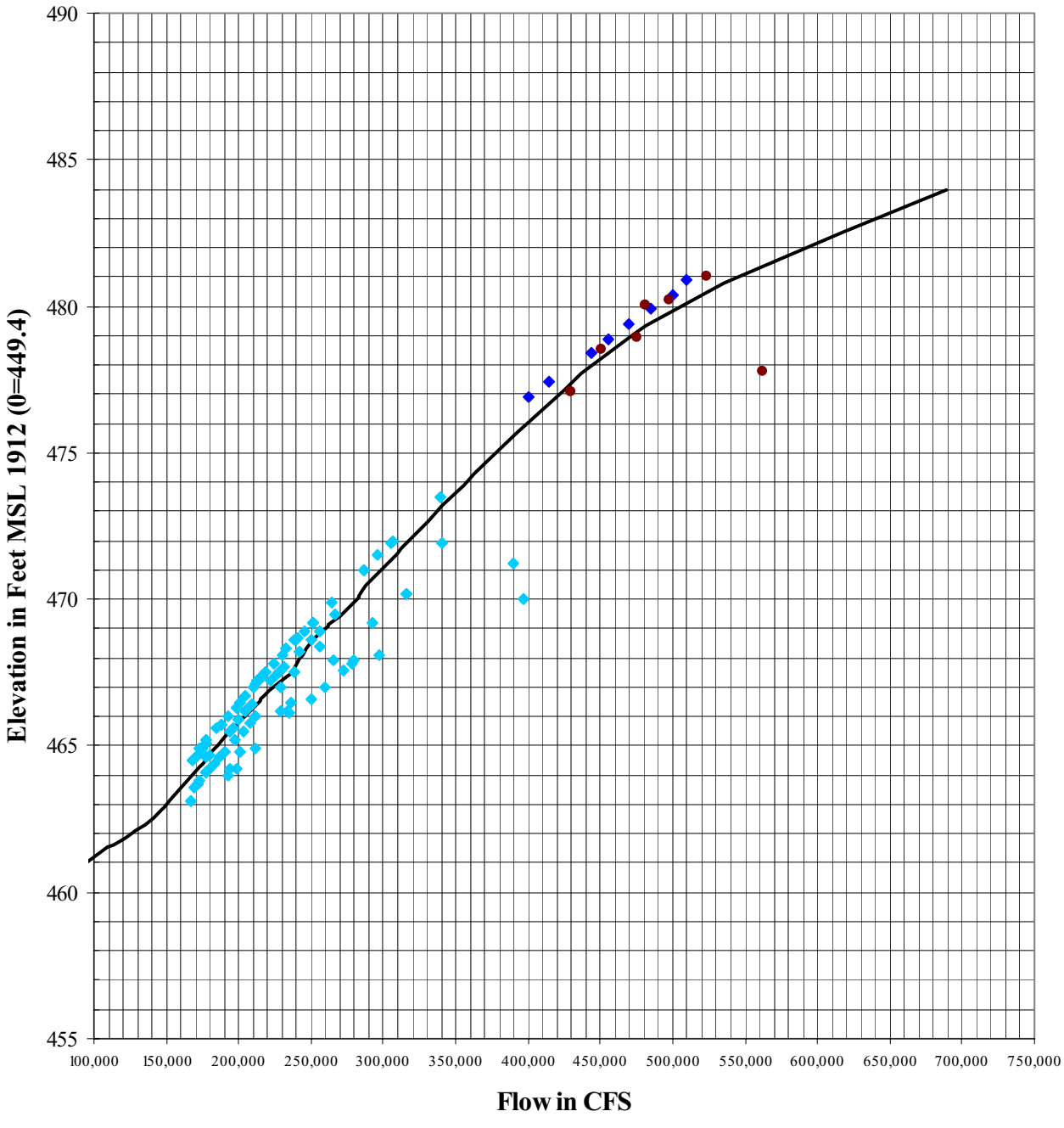


Plate C-M-19

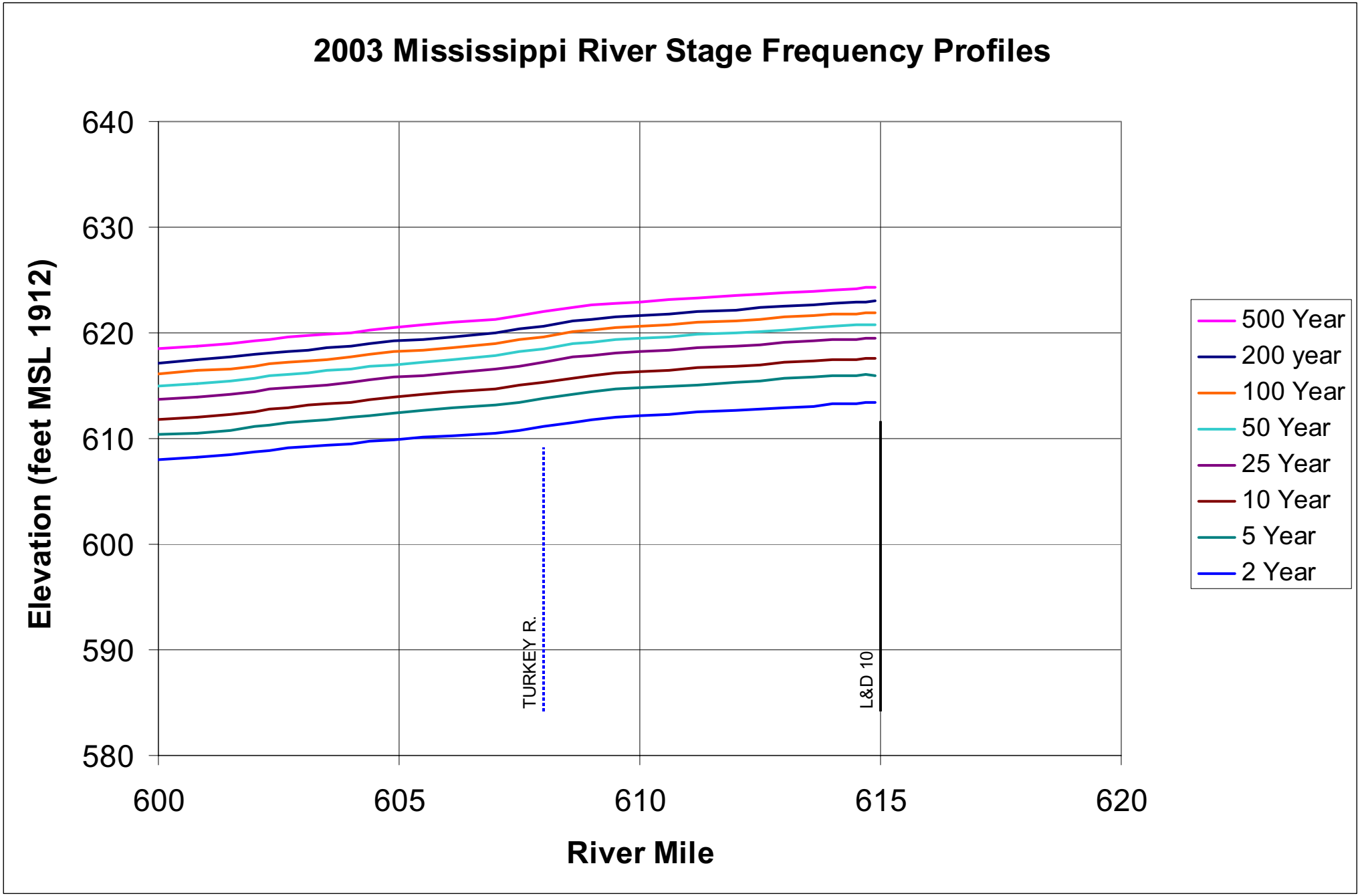

2003 Mississippi River Stage Frequency Profiles
Elevation (feet MSL 1912)
640
630
620
610
600
590
580
600
605
610
615
620
River Mile
TURKEY R.
L&D 10
500 Year
200 year
100 Year
50 Year
25 Year
10 Year
5 Year
2 Year

Plate C-M-20

2003 Mississippi River Stage Frequency Profiles

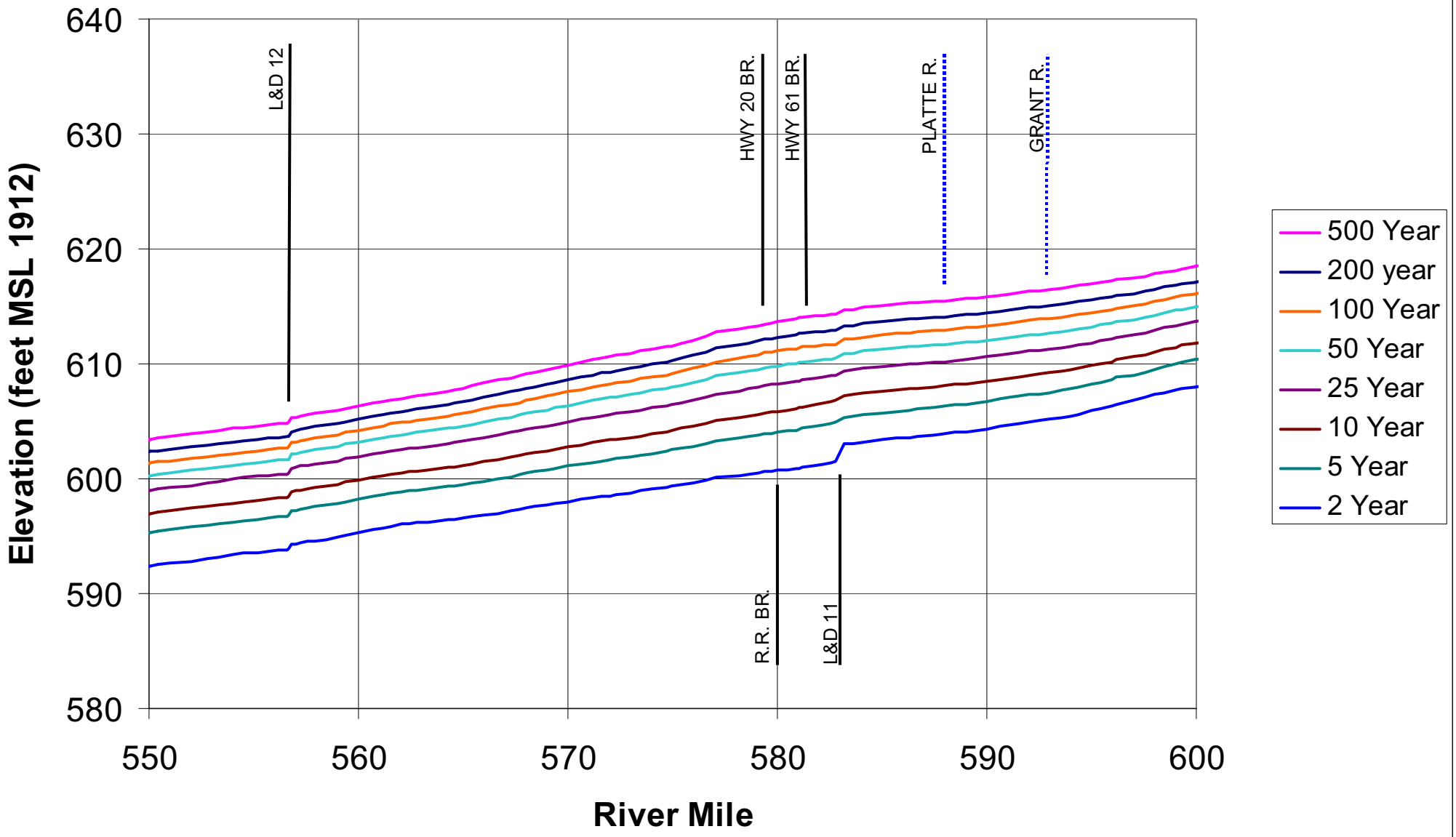


Plate C-M-21

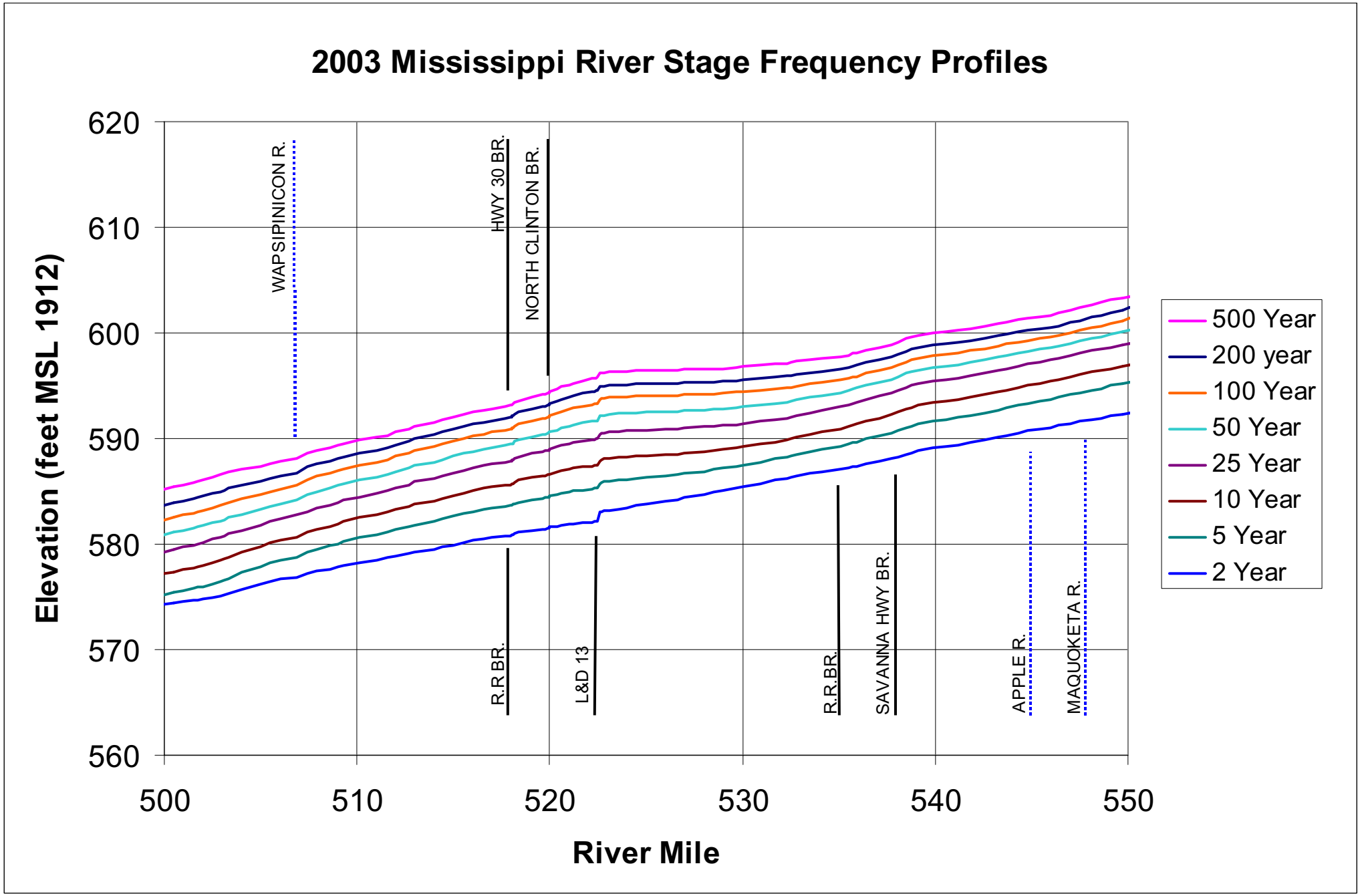

2003 Mississippi River Stage Frequency Profiles
Elevation (feet MSL 1912)
620
610
600
590
580
570
560
500
510
520
530
540
550
River Mile
WAPSIPINICON R.
HWY 30 BR.
NORTH CLINTON BR.
R.R BR.
L&D 13
R.R.BR.
SAVANNA HWY BR.
APPLE R.
MAQUOKETA R.
500 Year
200 year
100 Year
50 Year
25 Year
10 Year
5 Year
2 Year

Plate C-M-22

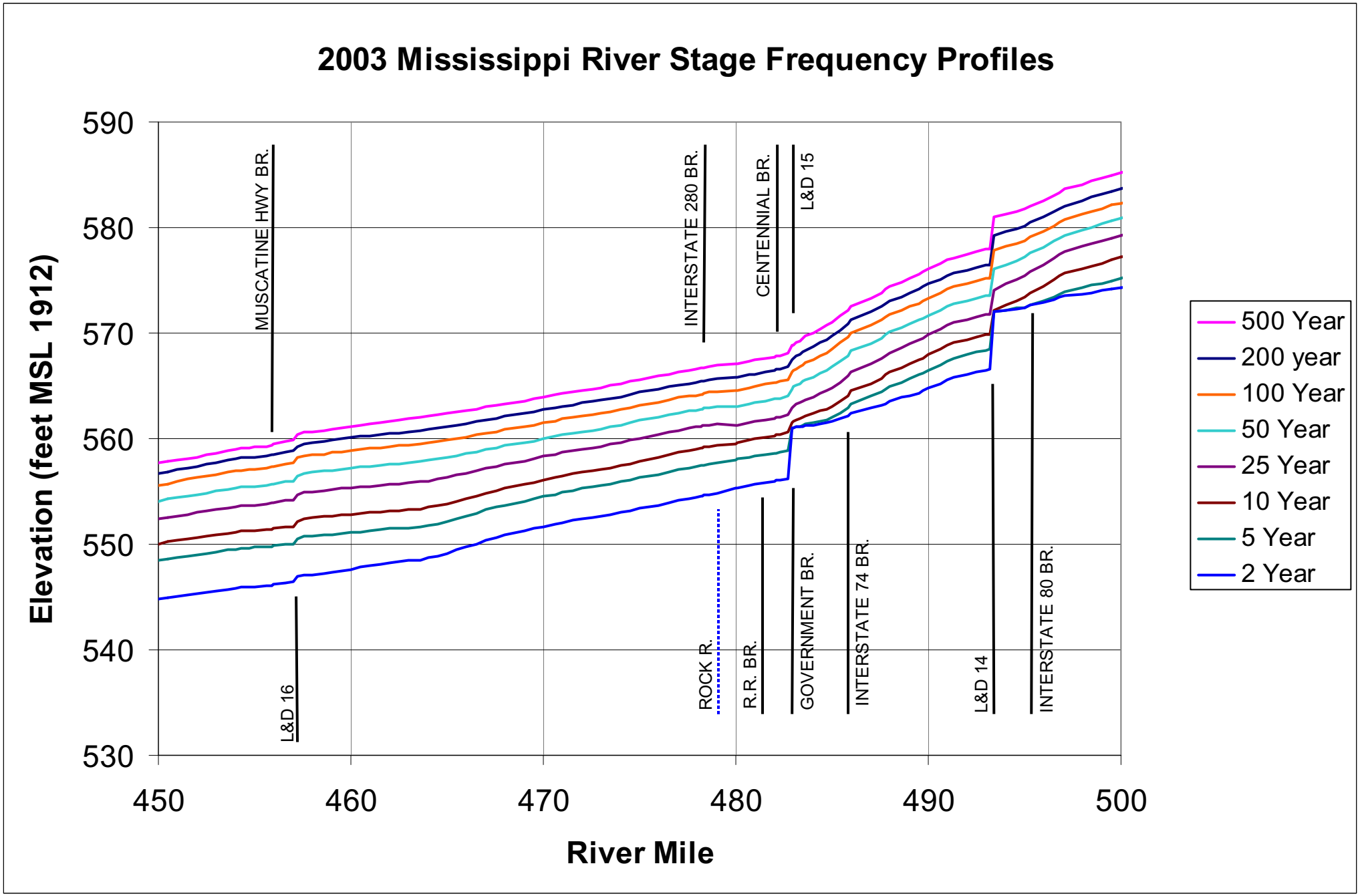

2003 Mississippi River Stage Frequency Profiles
Elevation (feet MSL 1912)
590
580
570
560
550
540
530
450
460
470
480
490
500
River Mile
MUSCATINE HWY BR.
INTERSTATE 280 BR.
CENTENNIAL BR.
L&D 15
L&D 16
ROCK R.
R.R. BR.
GOVERNMENT BR.
INTERSTATE 74 BR.
L&D 14
INTERSTATE 80 BR.
500 Year
200 year
100 Year
50 Year
25 Year
10 Year
5 Year
2 Year

Plate C-M-23

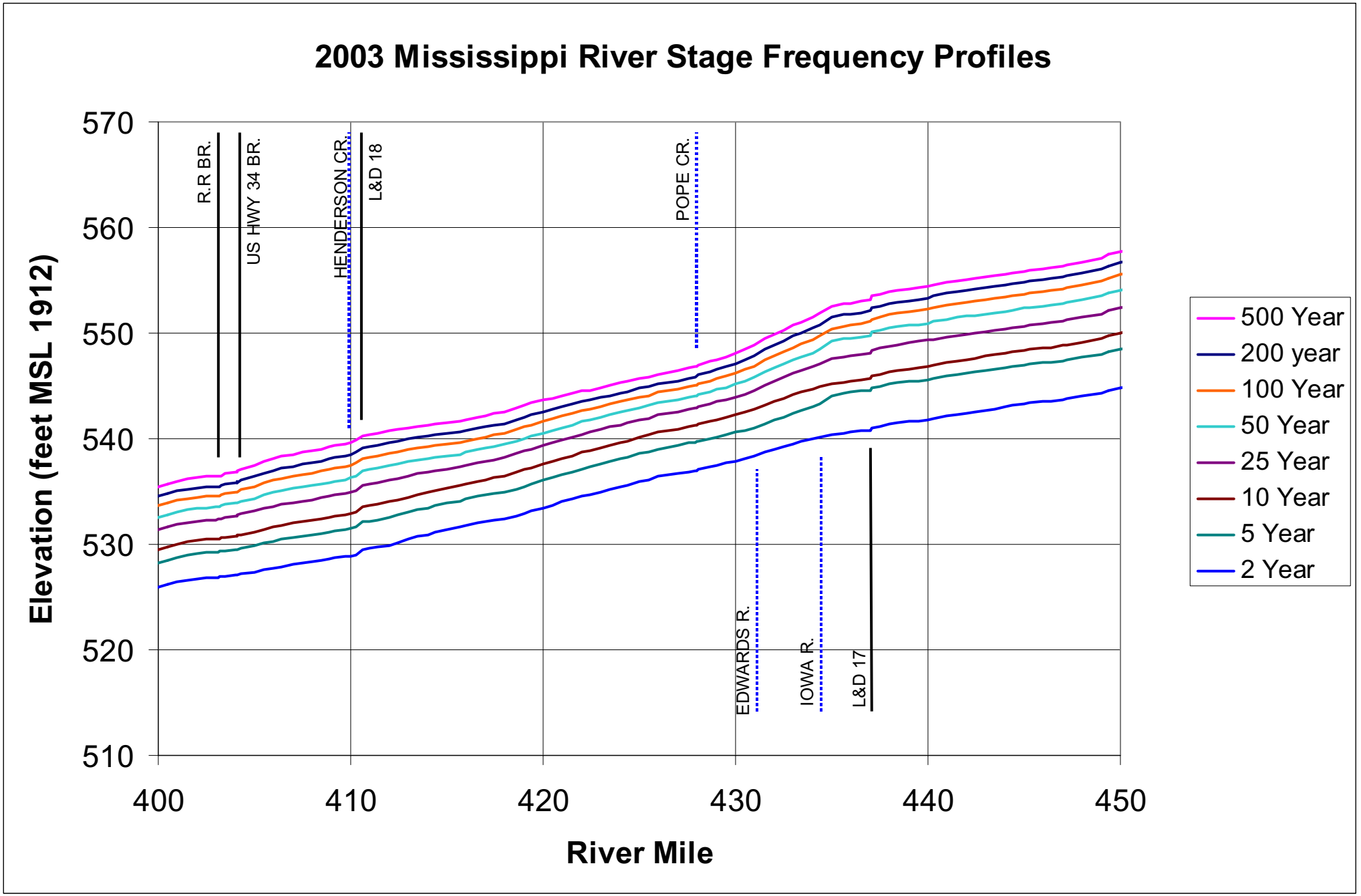

2003 Mississippi River Stage Frequency Profiles
Elevation (feet MSL 1912)
River Mile
570
560
550
540
530
520
510
400
410
420
430
440
450
R.R BR.
US HWY 34 BR.
HENDERSON CR.
L&D 18
POPE CR.
EDWARDS R.
IOWA R.
L&D 17
500 Year
200 year
100 Year
50 Year
25 Year
10 Year
5 Year
2 Year

Plate C-M-24

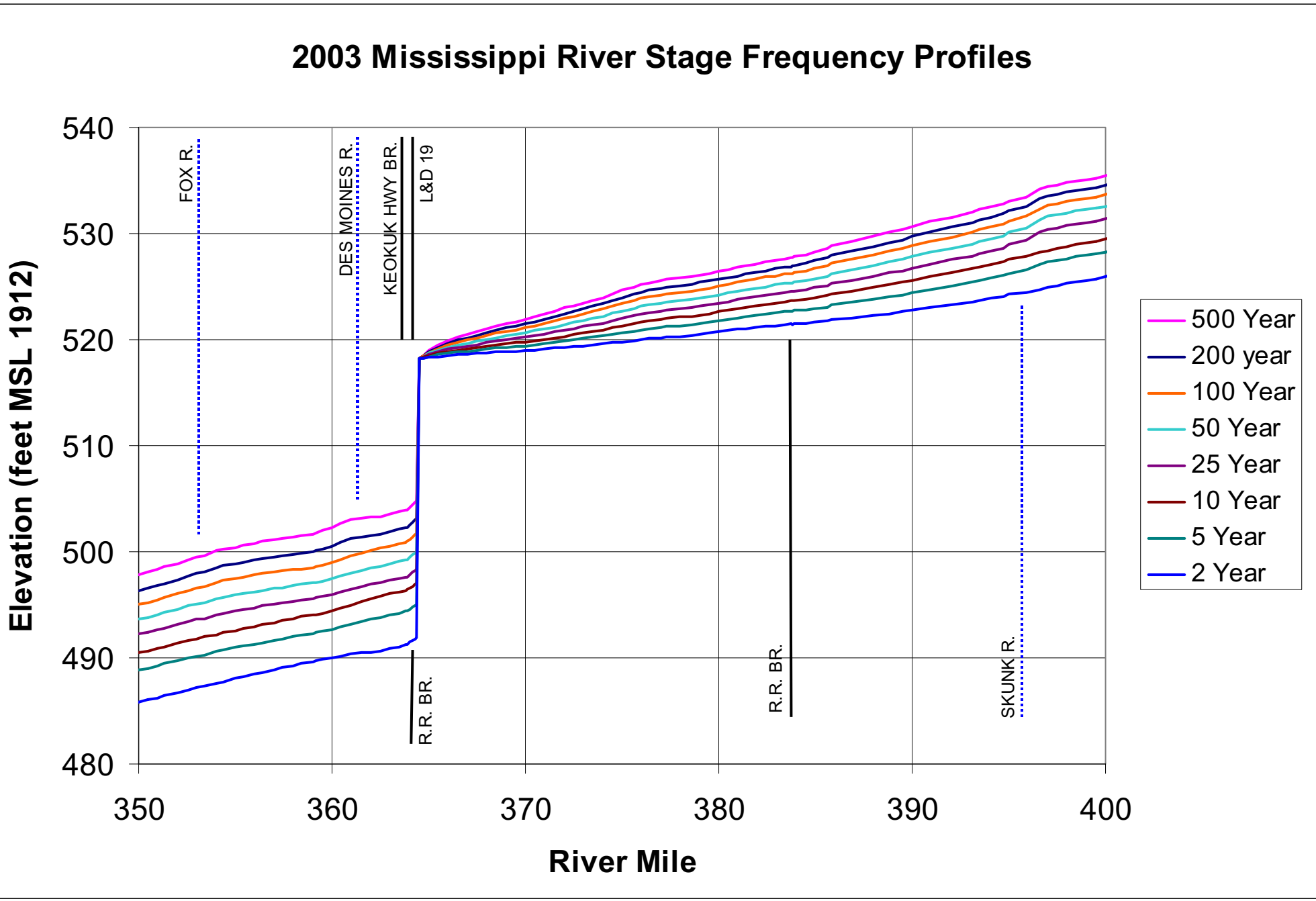

2003 Mississippi River Stage Frequency Profiles
Elevation (feet MSL 1912)
River Mile
540
530
520
510
500
490
480
350
360
370
380
390
400
FOX R.
DES MOINES R.
KEOKUK HWY BR.
L&D 19
R.R. BR.
R.R. BR.
SKUNK R.
500 Year
200 year
100 Year
50 Year
25 Year
10 Year
5 Year
2 Year

Plate C-M-25

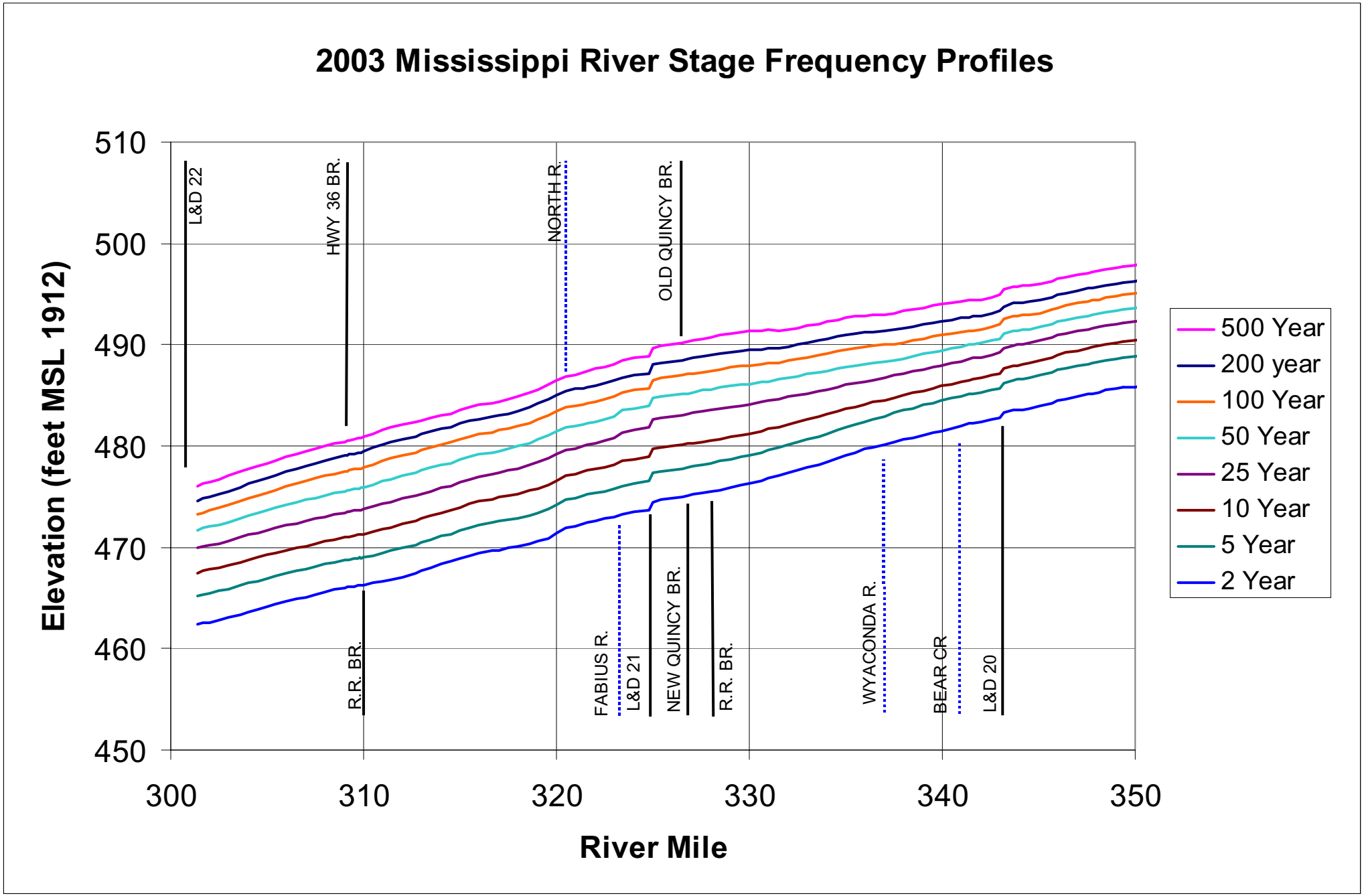

2003 Mississippi River Stage Frequency Profiles
Elevation (feet MSL 1912)
River Mile
510
500
490
480
470
460
450
300
310
320
330
340
350
L&D 22
HWY 36 BR.
NORTH R.
OLD QUINCY BR.
R.R. BR.
FABIUS R.
L&D 21
NEW QUINCY BR.
R.R. BR.
WYACONDA R.
BEAR CR
L&D 20
500 Year
200 year
100 Year
50 Year
25 Year
10 Year
5 Year
2 Year

Plate C-M-26

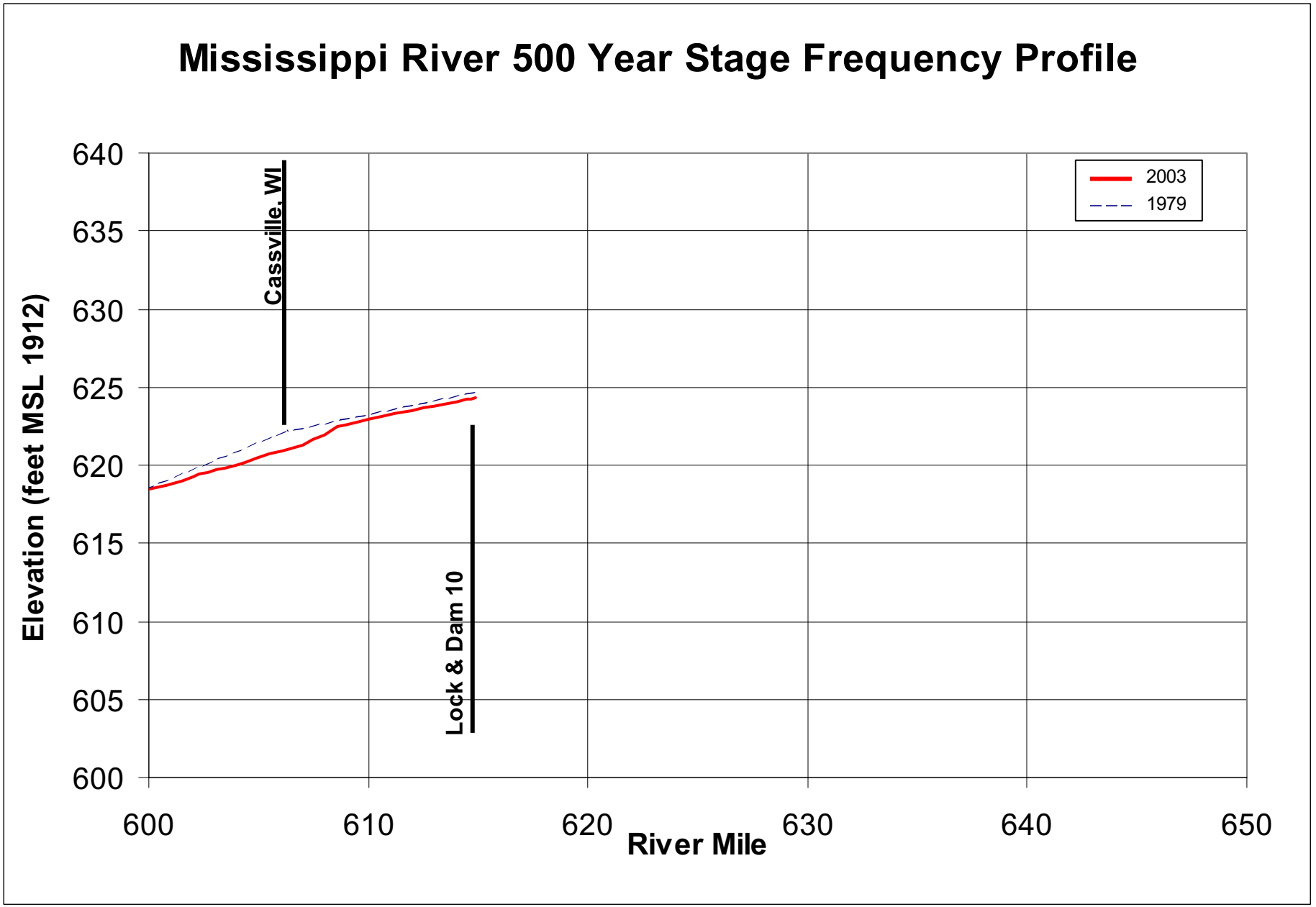
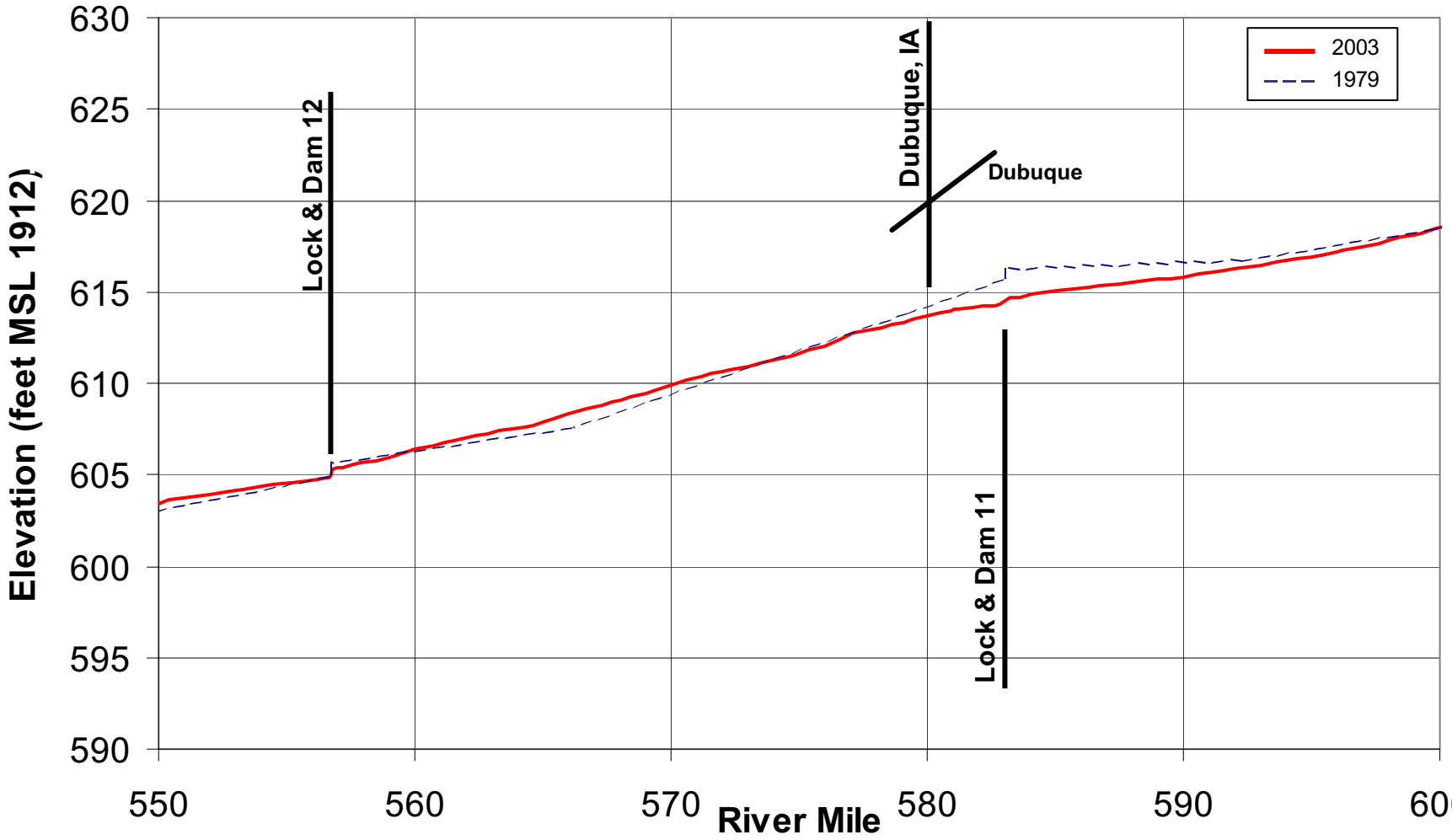

Mississippi River 500 Year Stage Frequency Profile
Elevation (feet MSL 1912)
640
635
630
625
620
615
610
605
600
Cassville, WI
Lock & Dam 10
2003
1979
600
610
620
630
640
650
River Mile

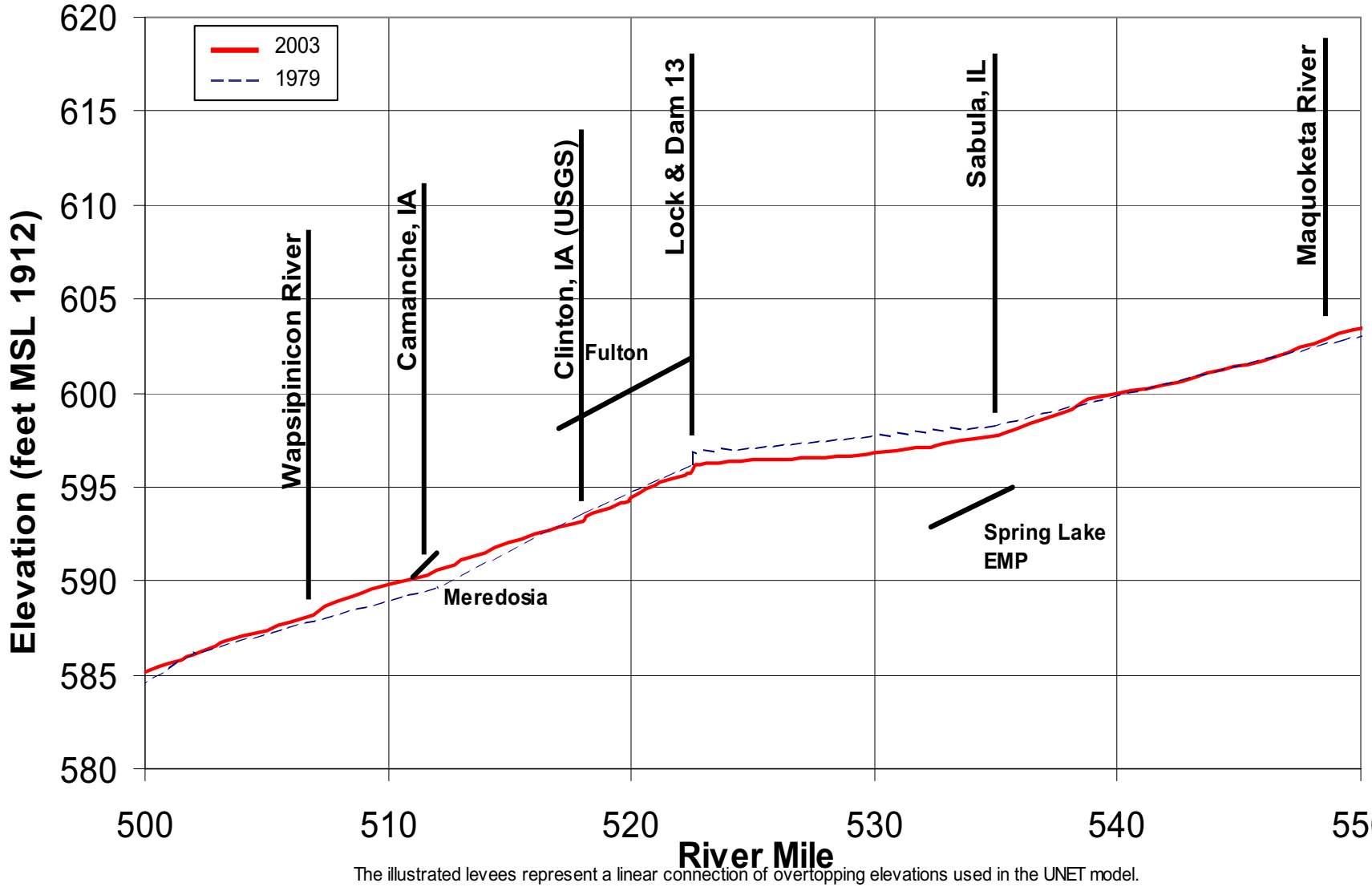
Plate C-M-27

Mississippi River 500 Year Stage Frequency Profile
Left Bank



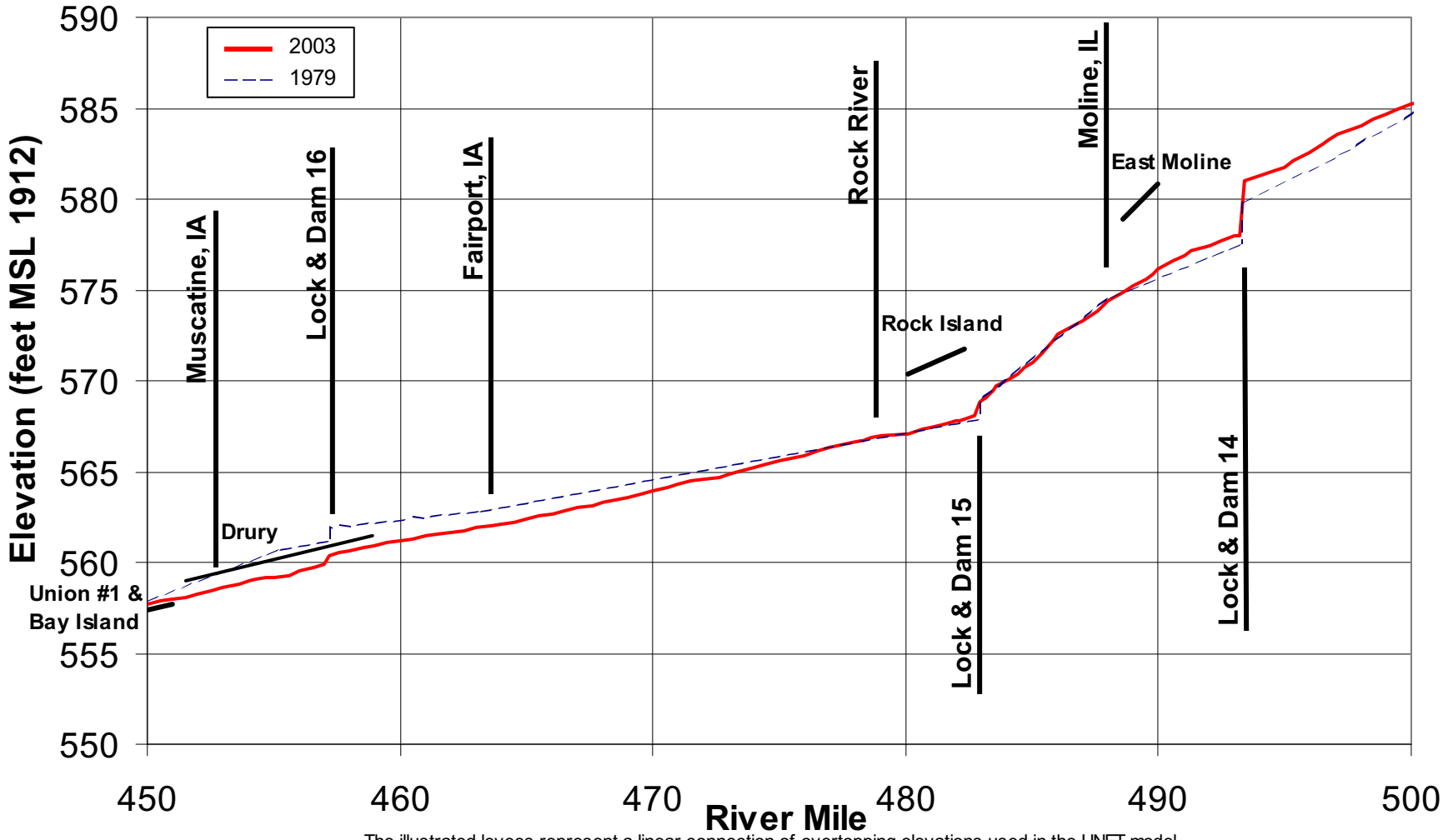
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations betw een the illustrated end points should not be assumed linear.

Mississippi River 500 Year Stage Frequency Profile
Left Bank



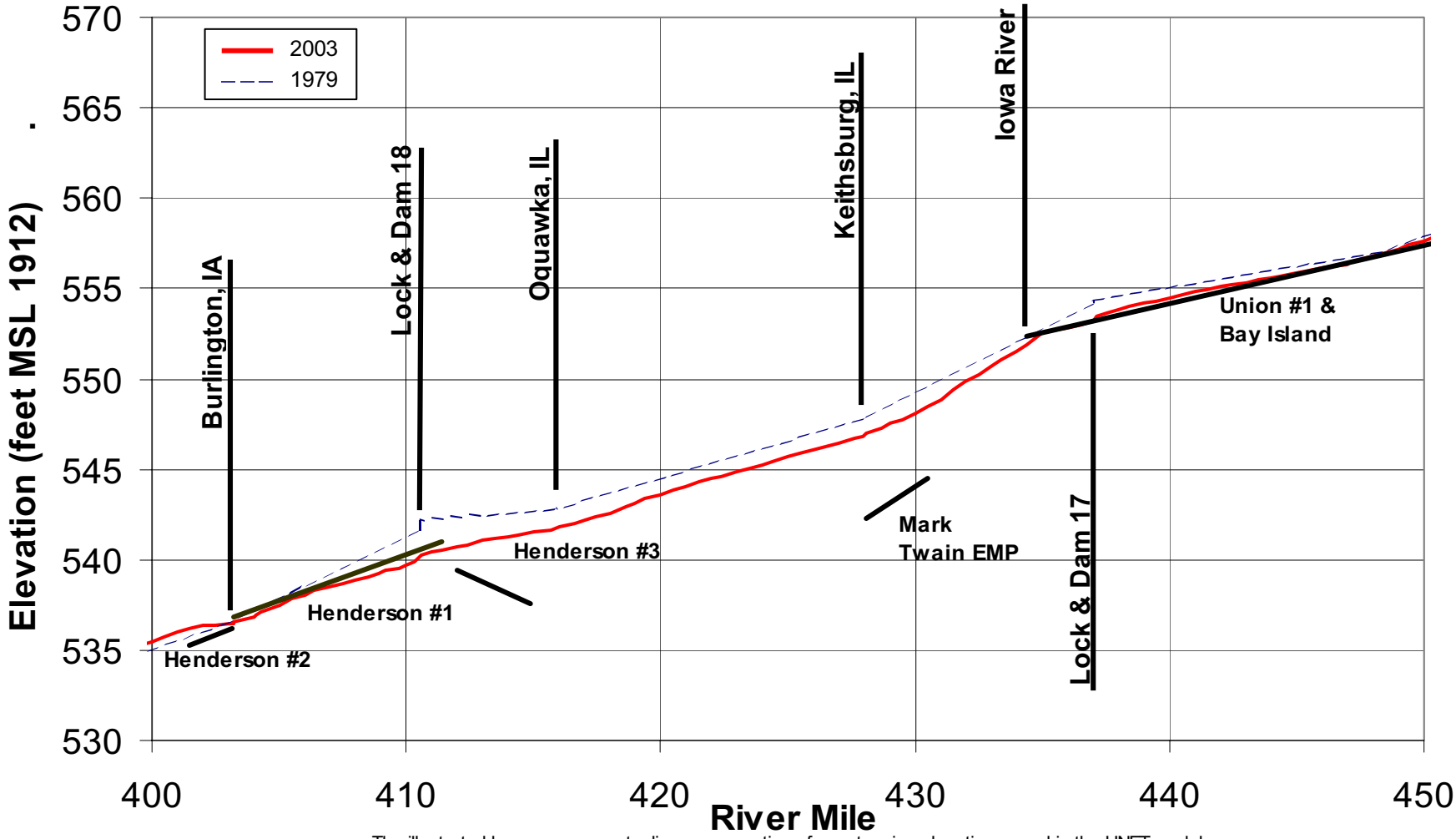
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations betw een the illustrated end points should not be assumed linear.

Mississippi River 500 Year Stage Frequency Profile
Left Bank



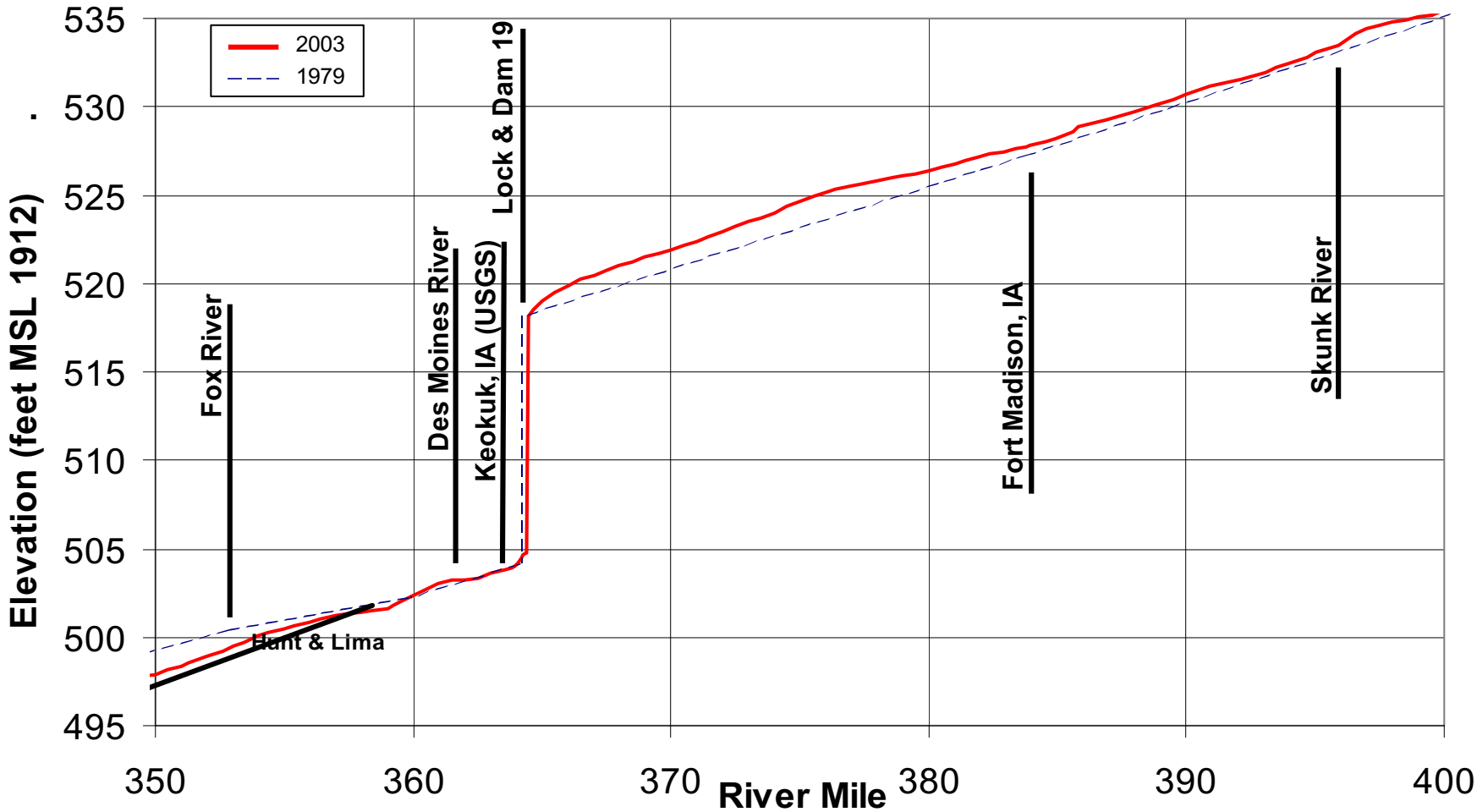
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 500 Year Stage Frequency Profile
Left Bank



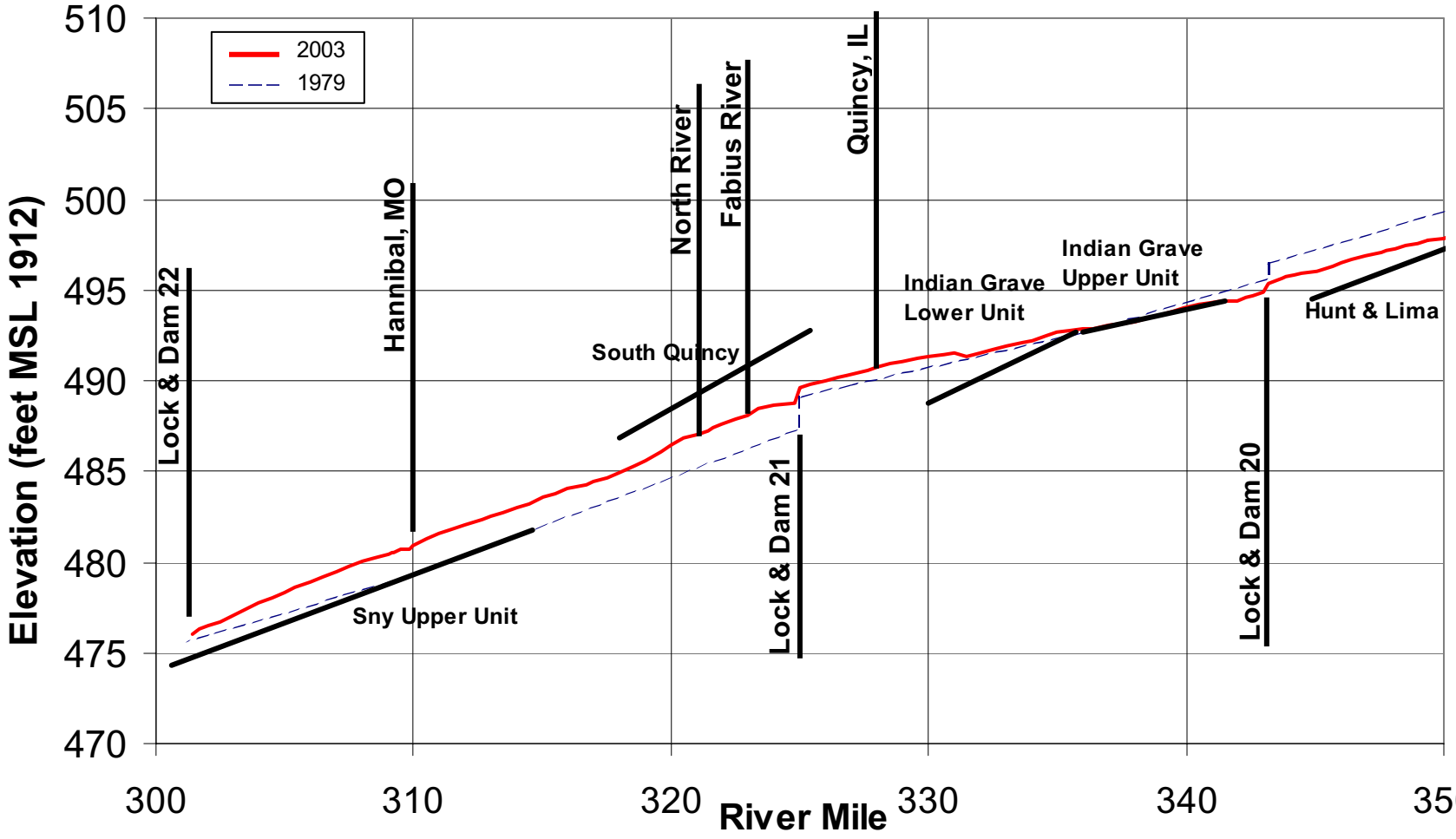
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations betw een the illustrated end points should not be assumed linear.

Mississippi River 500 Year Stage Frequency Profile
Left Bank



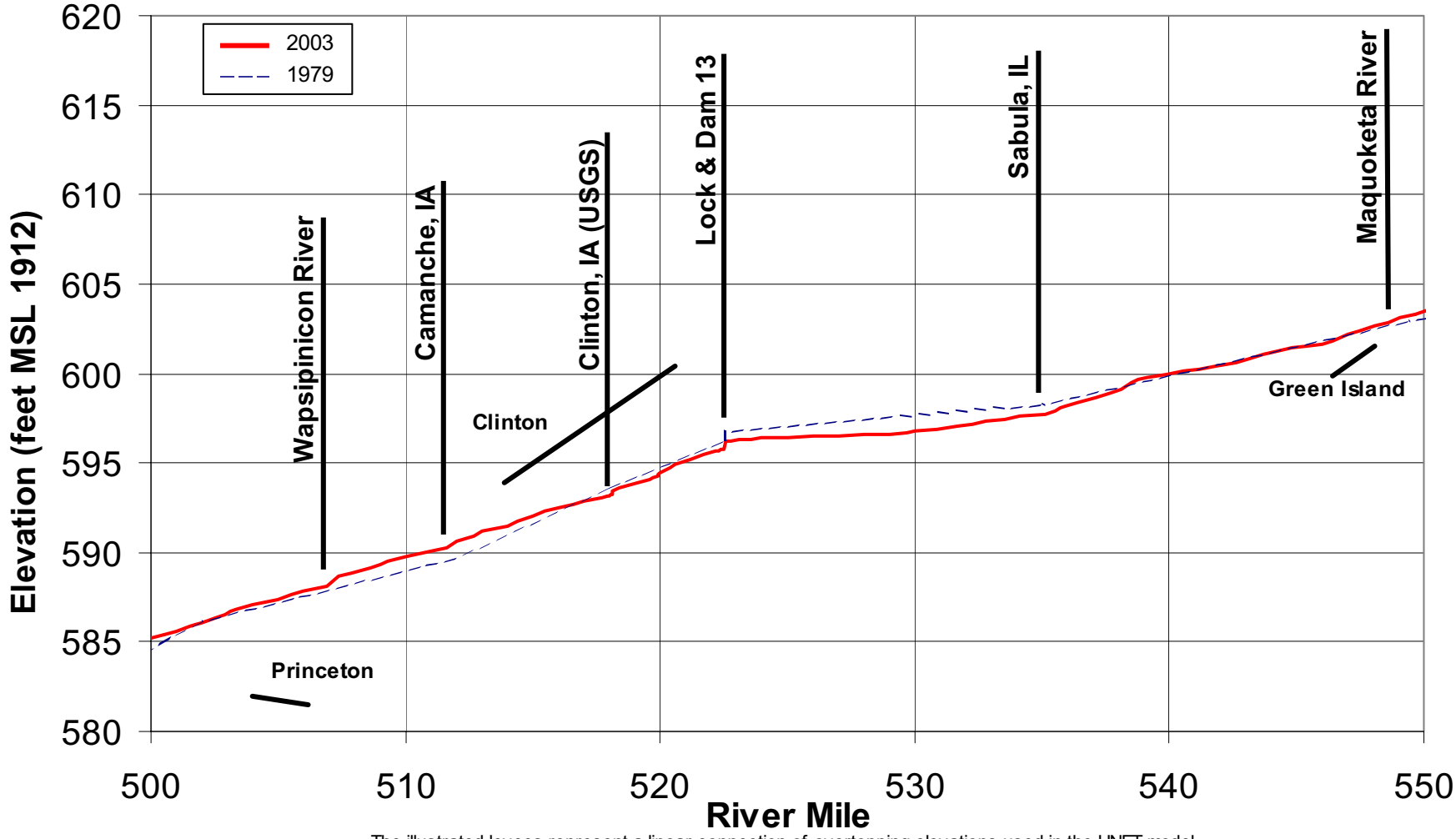
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 500 Year Stage Frequency Profile
Left Bank



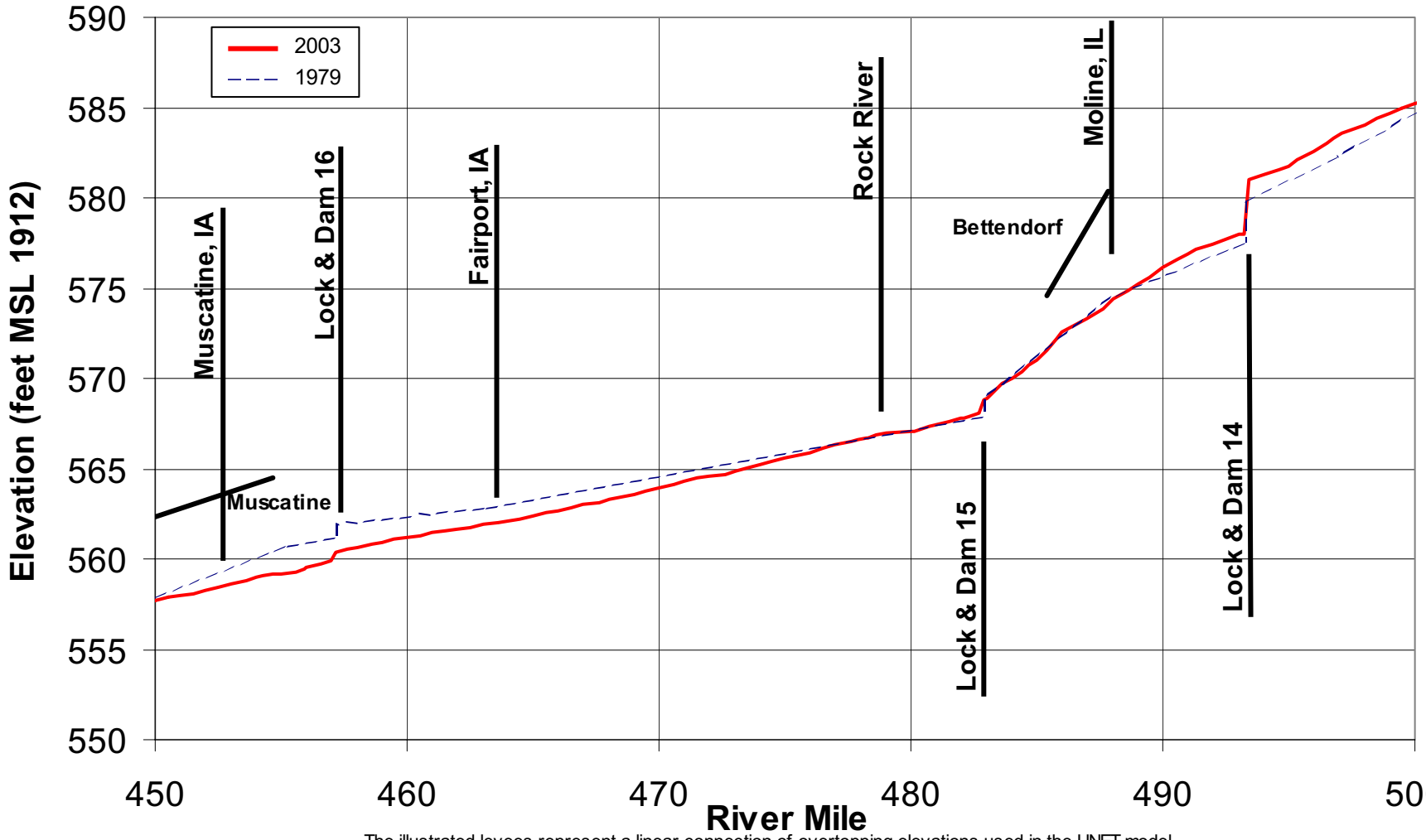
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 500 Year Stage Frequency Profile
Right Bank



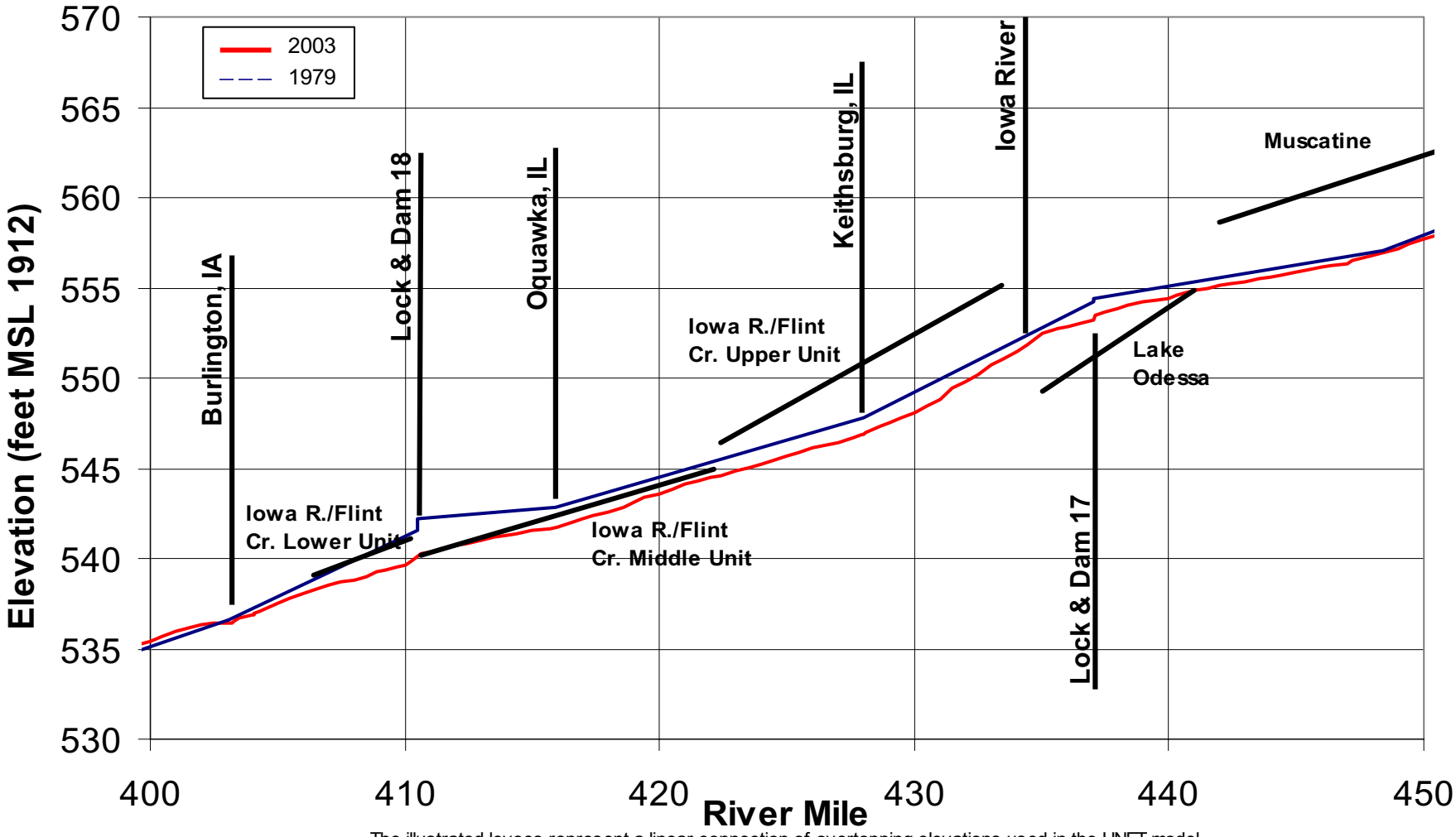
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 500 Year Stage Frequency Profile
Right Bank



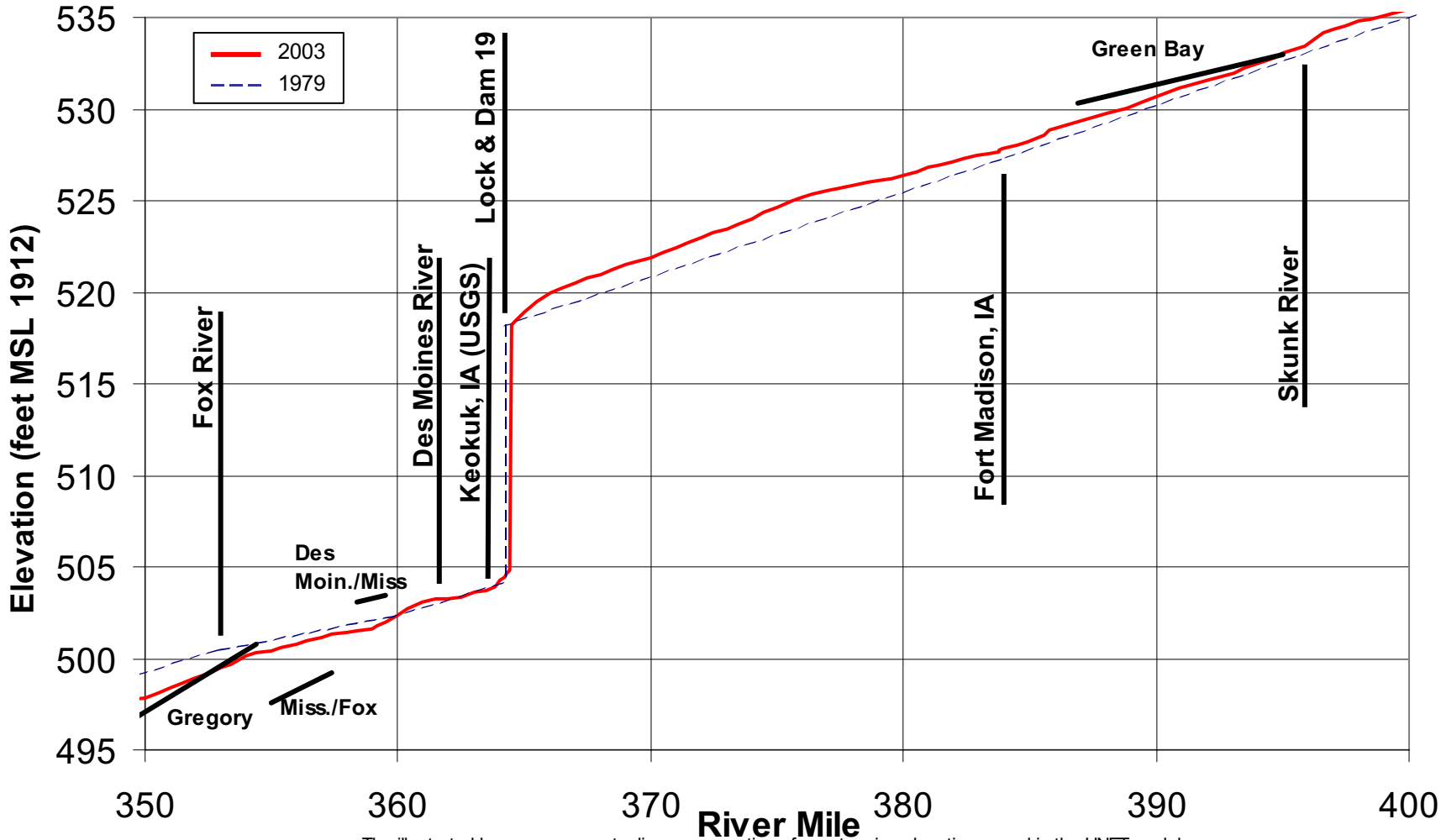
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 500 Year Stage Frequency Profile
Right Bank



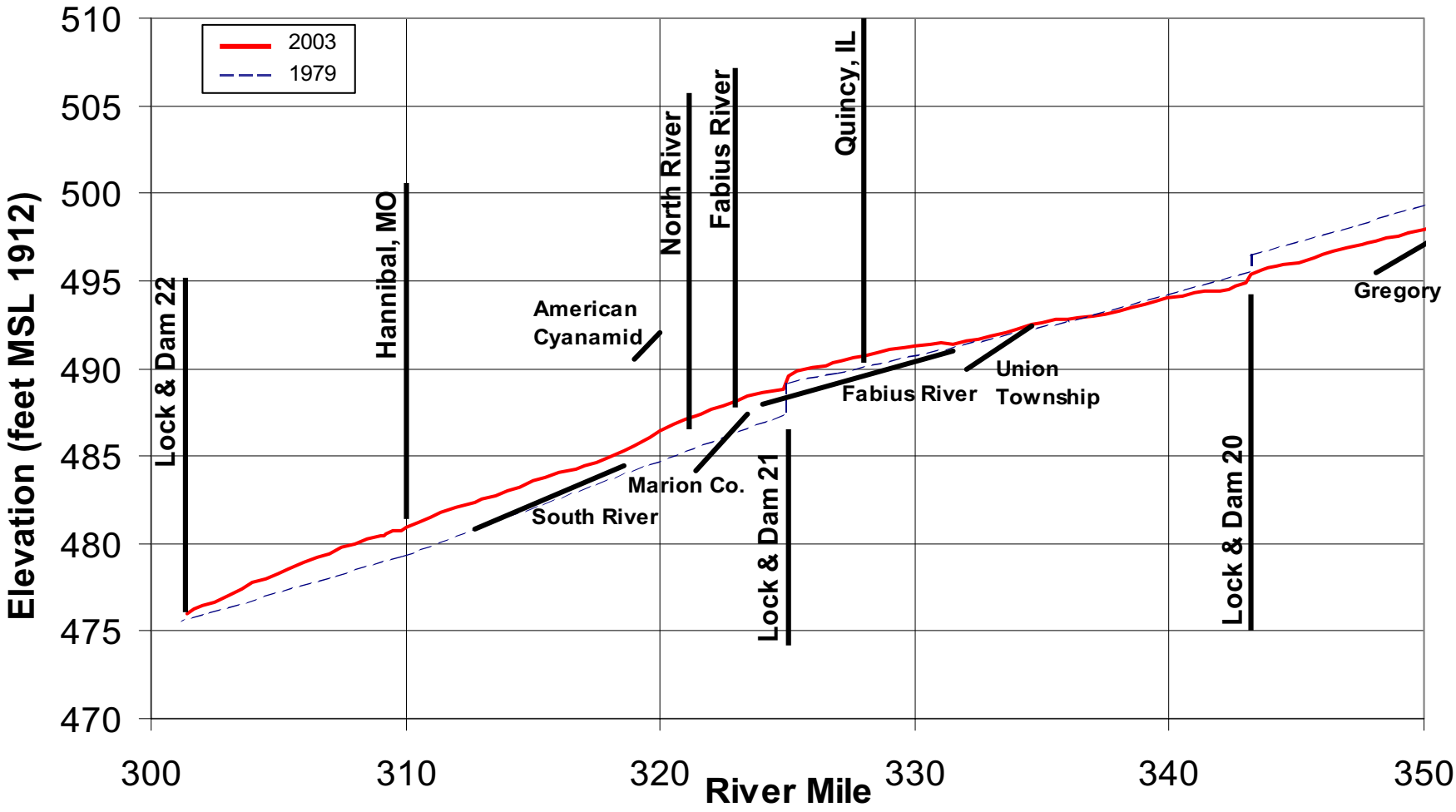
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 500 Year Stage Frequency Profile
Right Bank



The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 500 Year Stage Frequency Profile
Right Bank



The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 100 Year Stage Frequency Profile

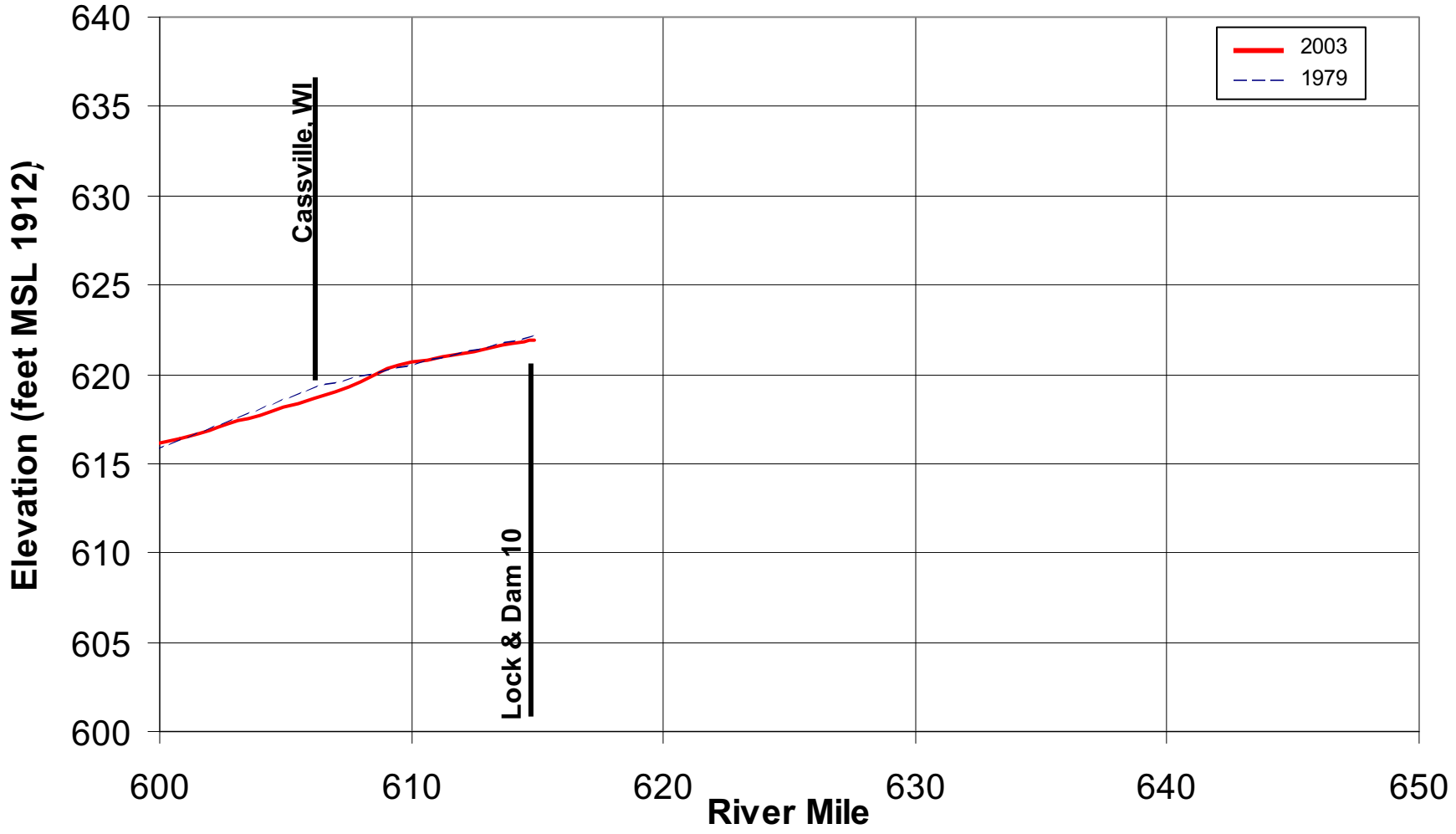
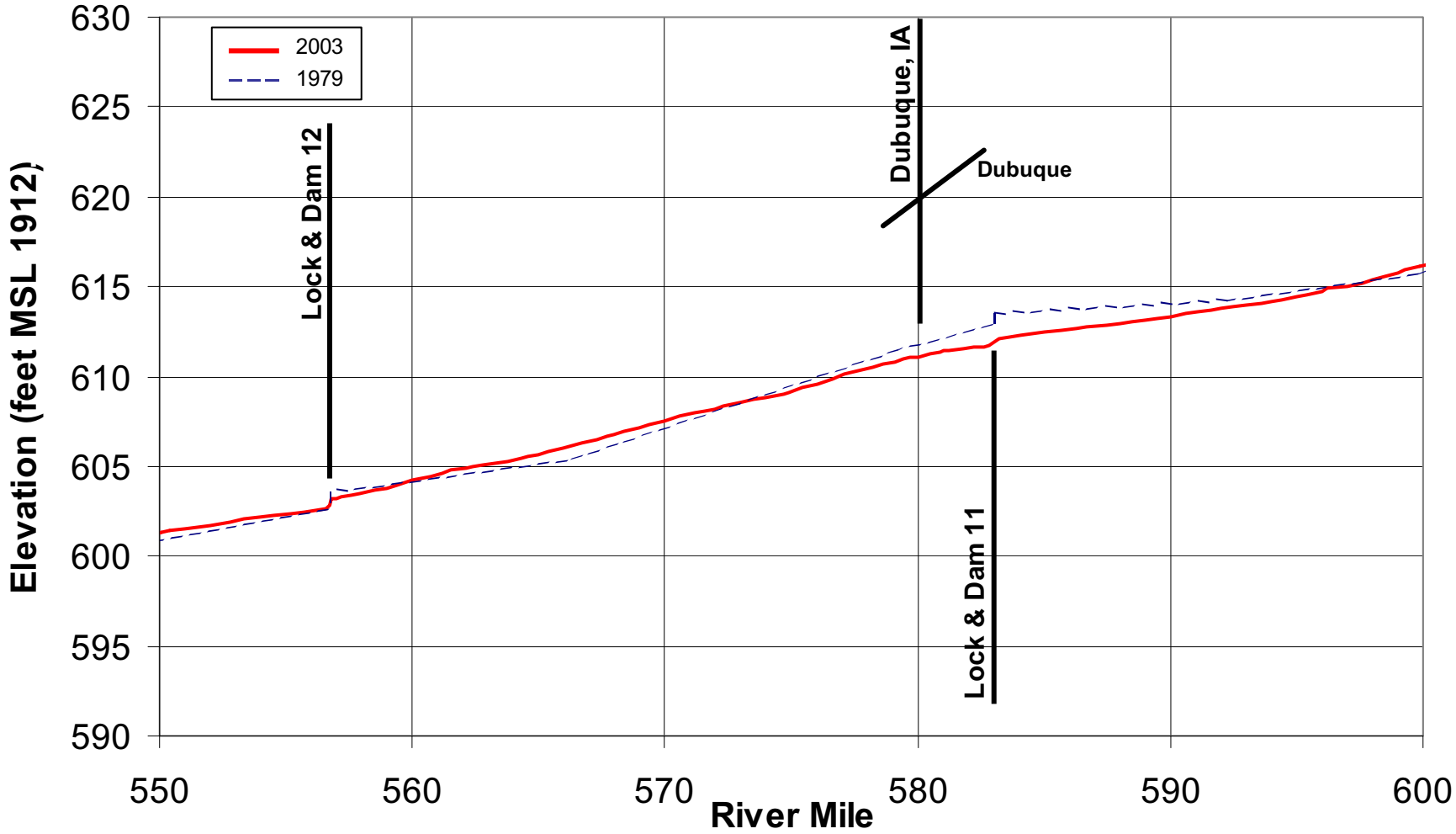


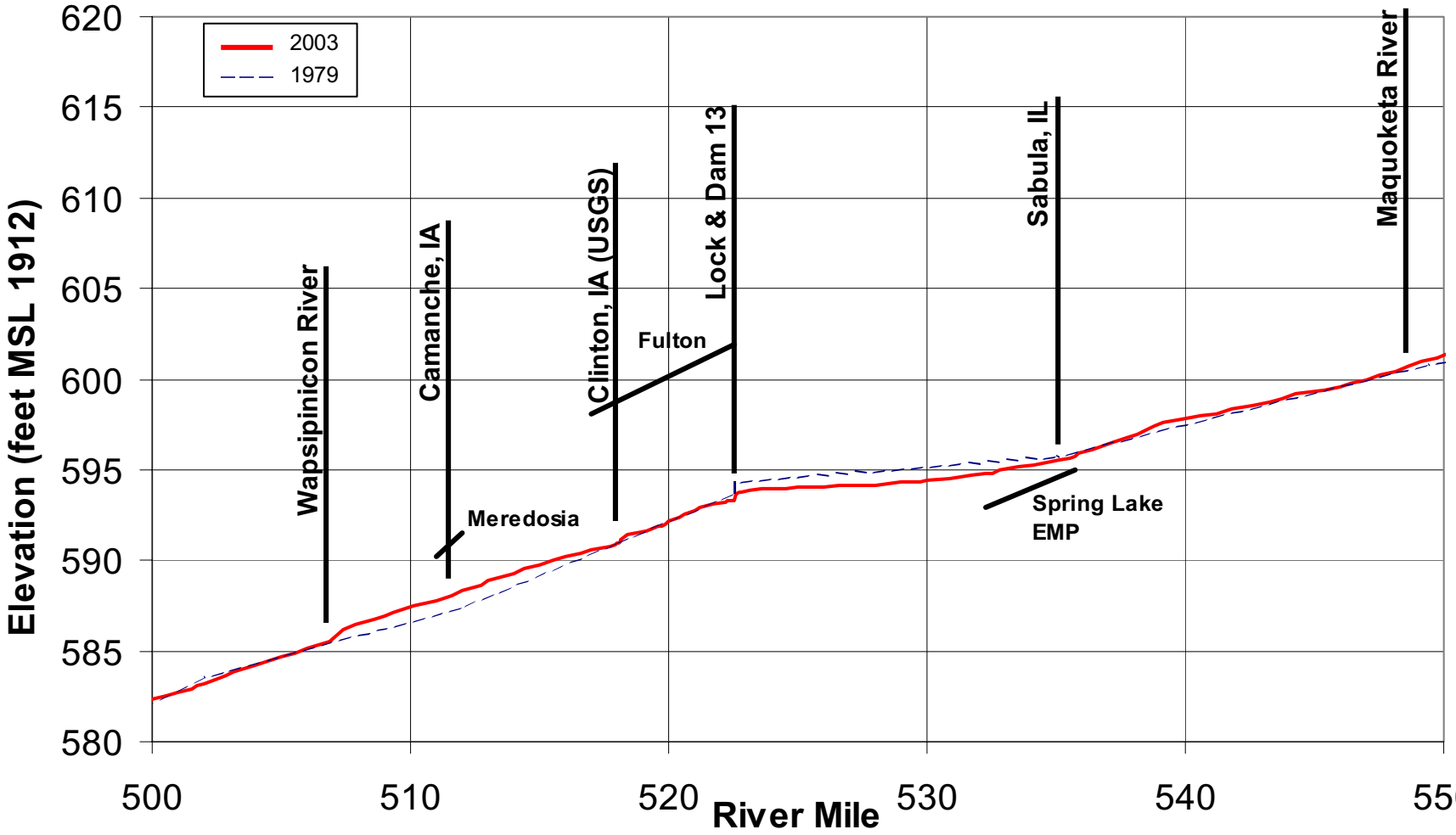
Plate C-M-39

Mississippi River 100 Year Stage Frequency Profile
Left Bank



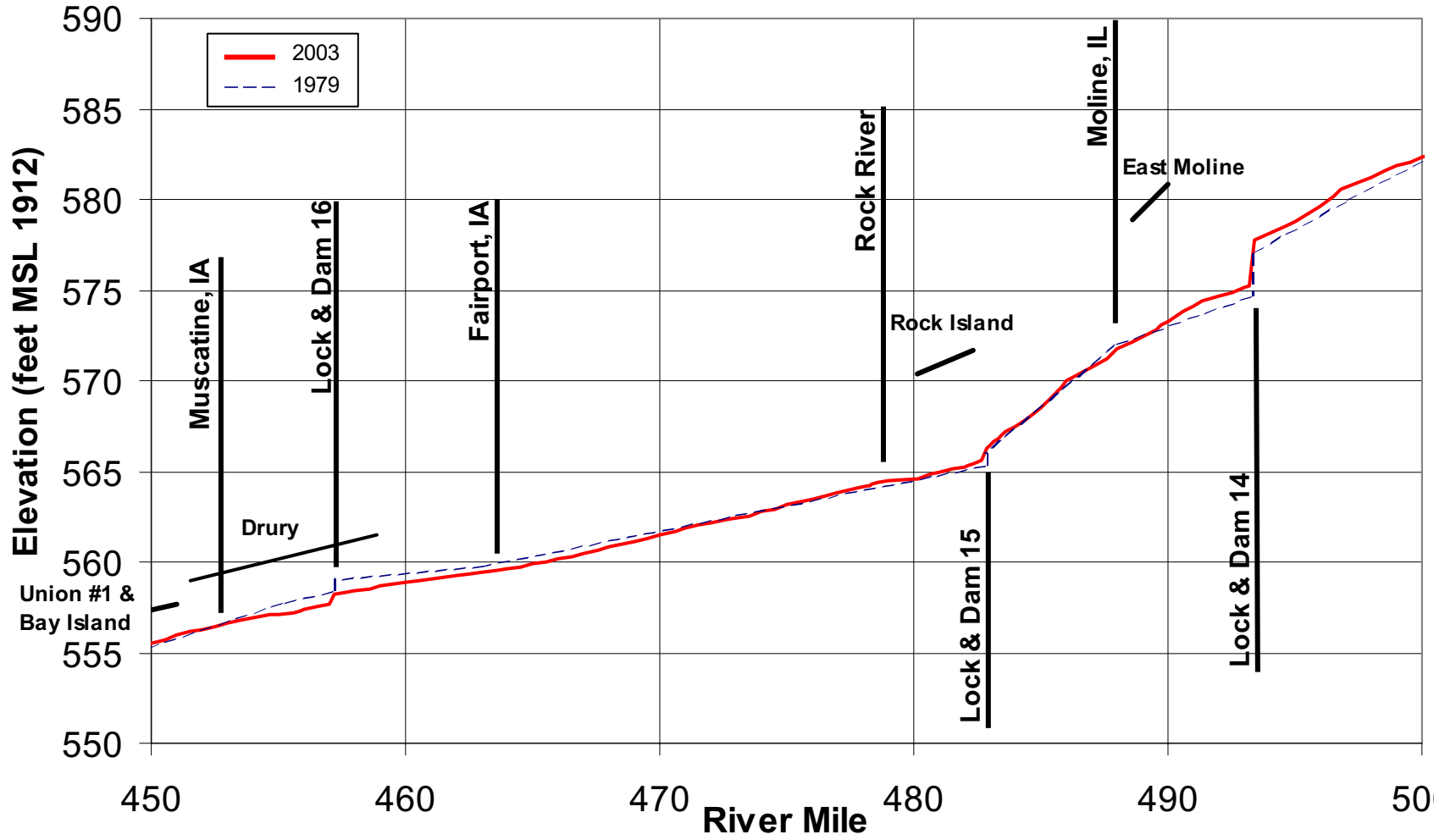
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations betw een the illustrated end points should not be assumed linear.

Mississippi River 100 Year Stage Frequency Profile
Left Bank



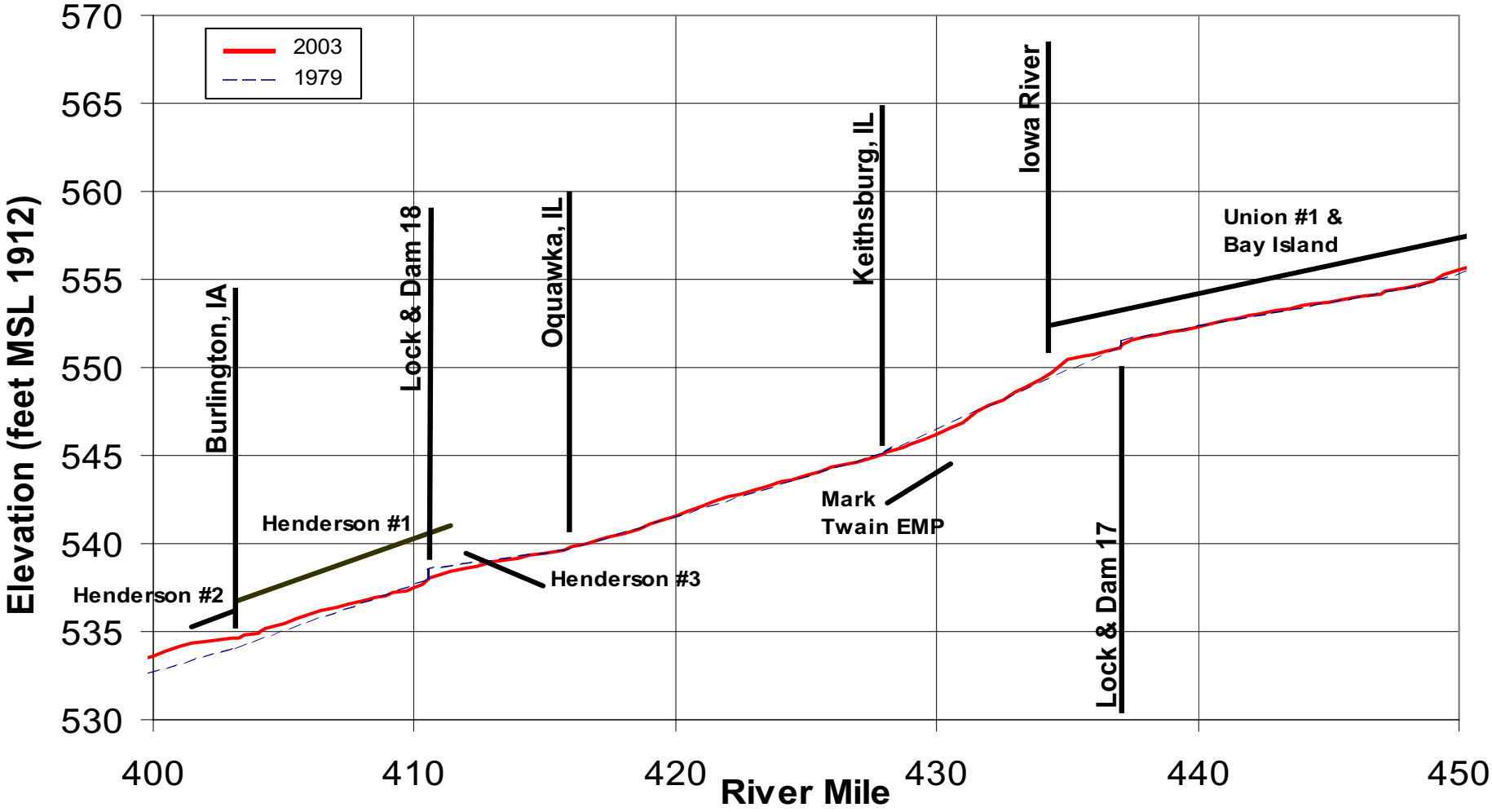
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 100 Year Stage Frequency Profile
Left Bank



The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

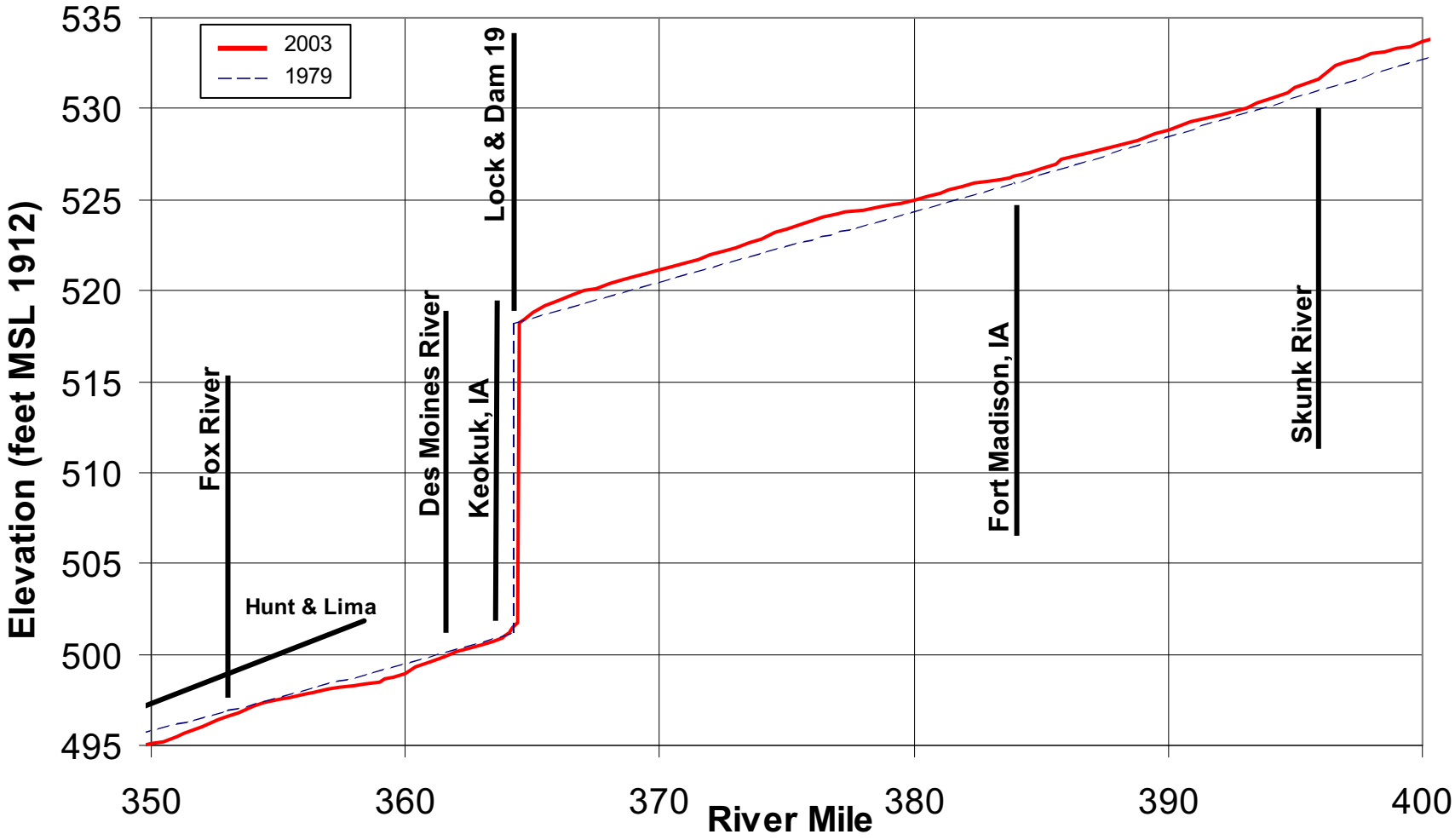
Mississippi River 100 Year Stage Frequency Profile
Left Bank



The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

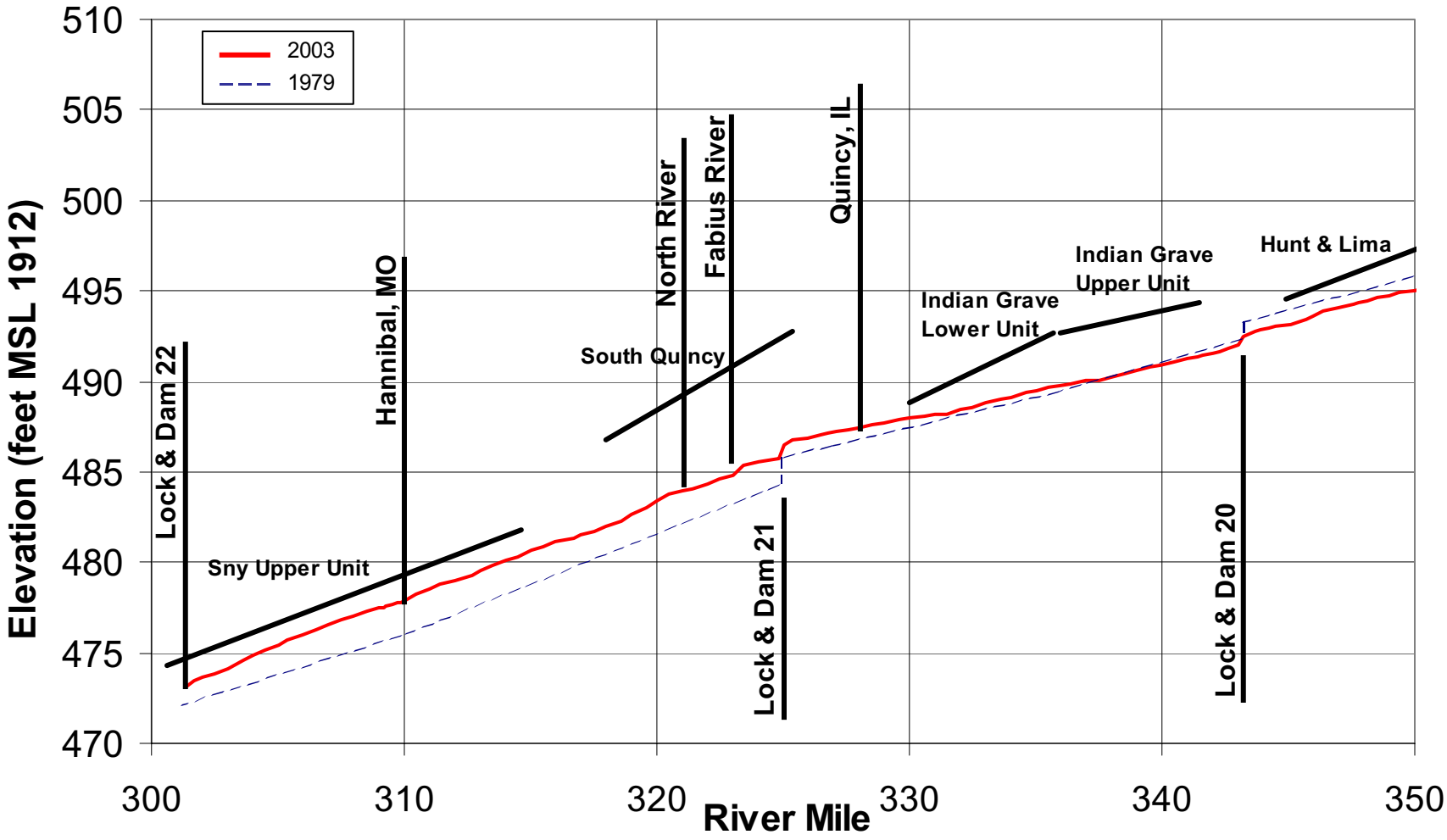
Plate C-M-43

Mississippi River 100 Year Stage Frequency Profile
Left Bank



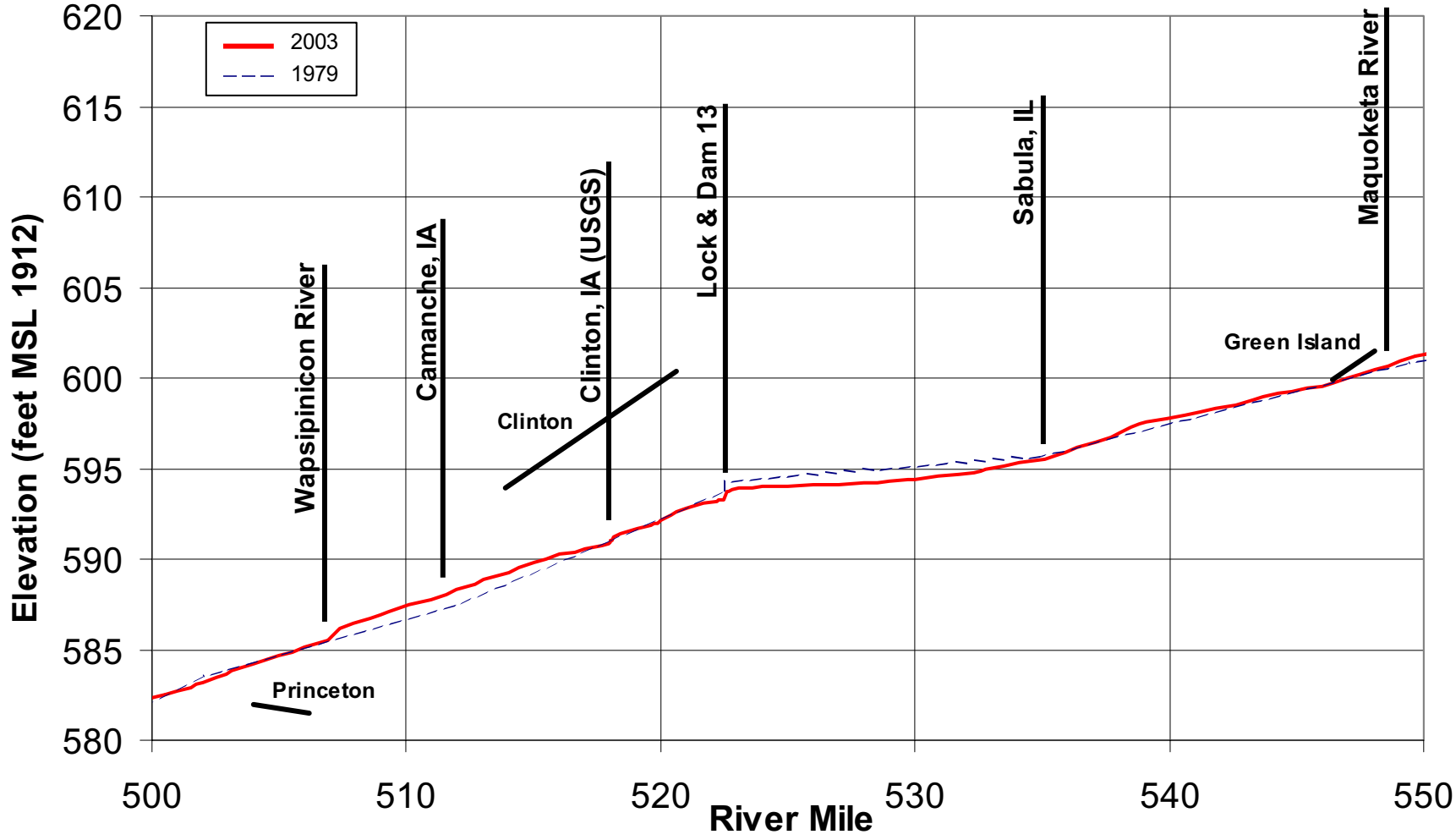
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 100 Year Stage Frequency Profile
Left Bank



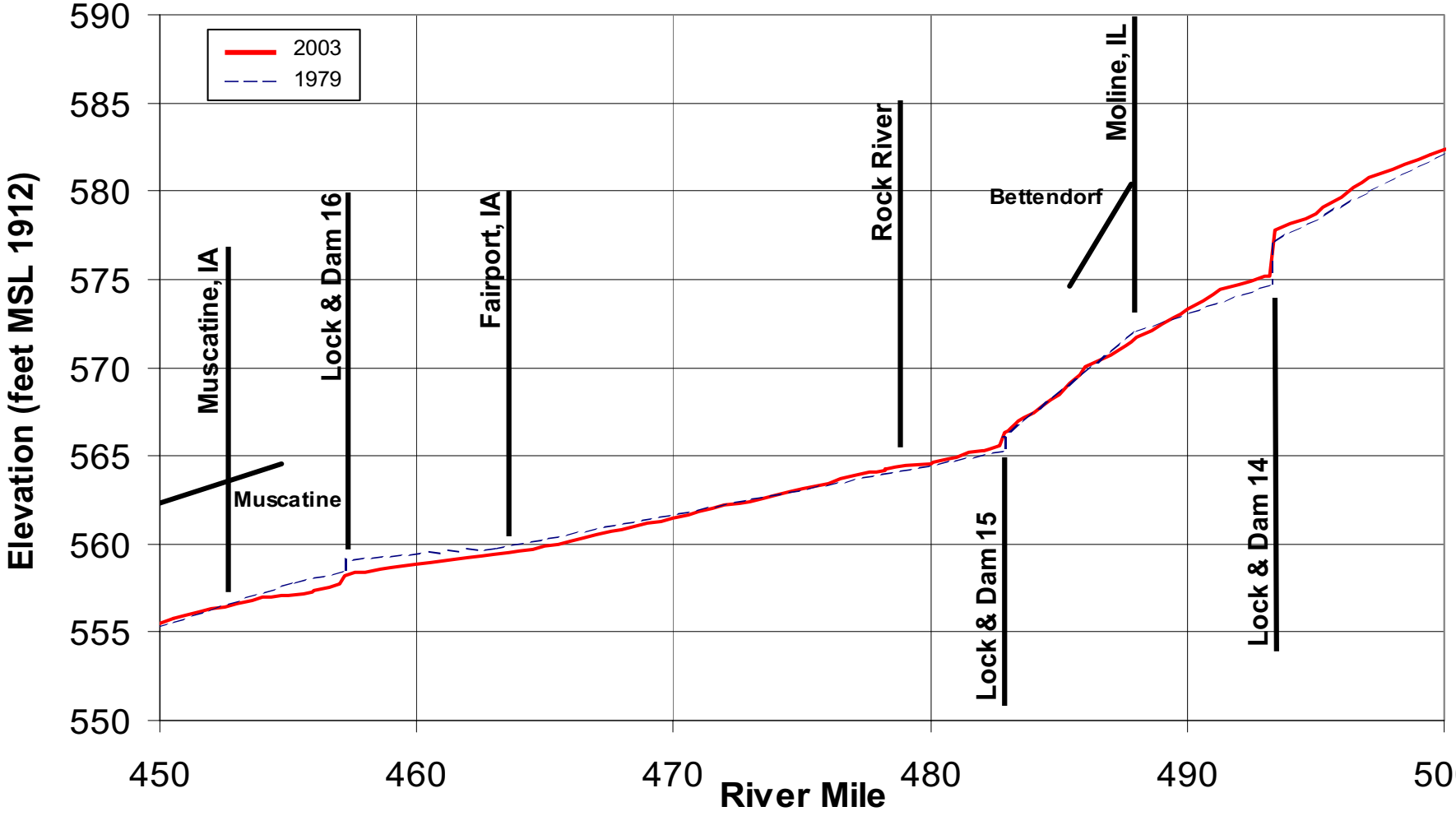
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations betw een the illustrated end points should not be assumed linear.

Mississippi River 100 Year Stage Frequency Profile
Right Bank



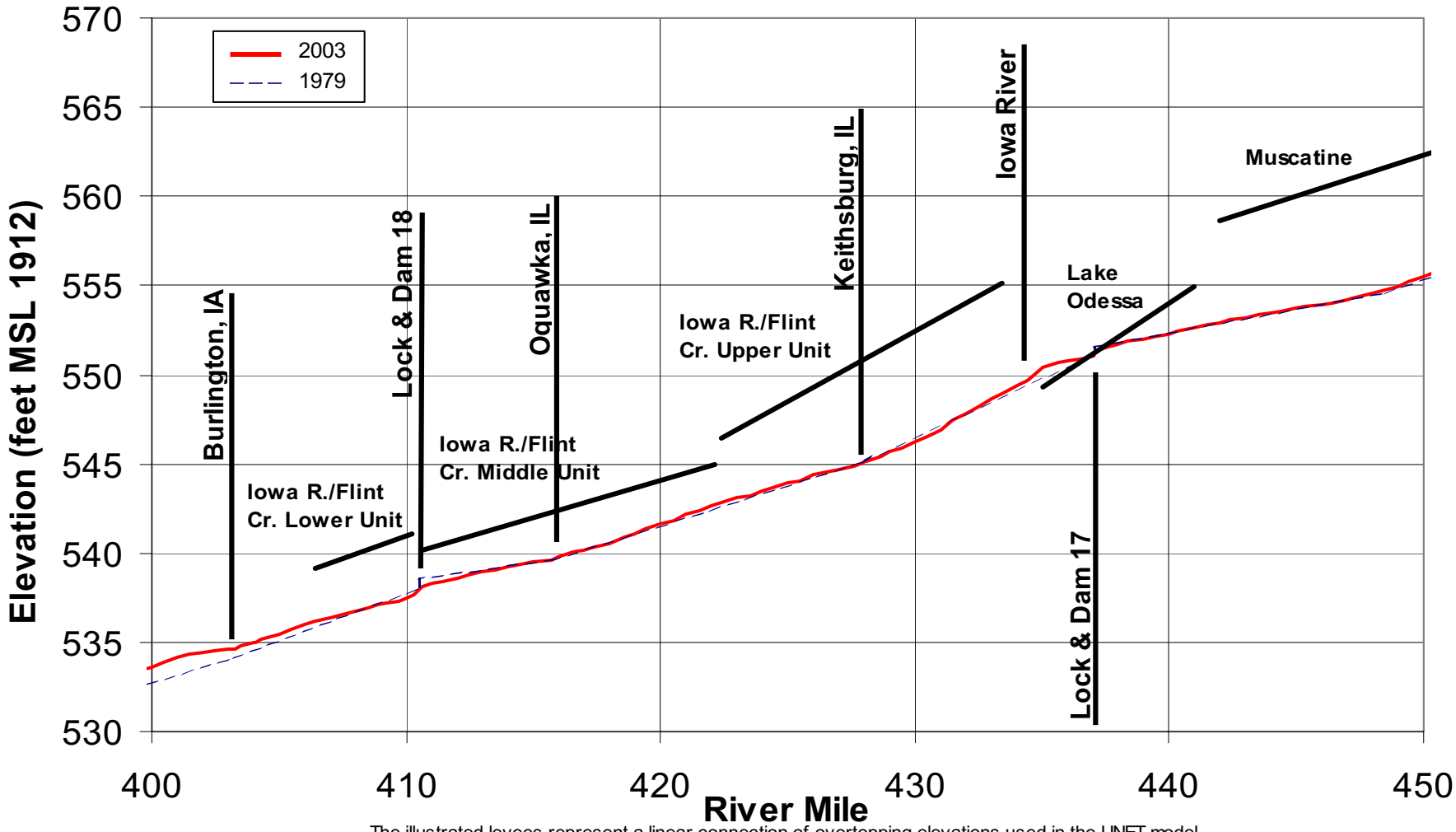
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations betw een the illustrated end points should not be assumed linear.

Mississippi River 100 Year Stage Frequency Profile
Right Bank



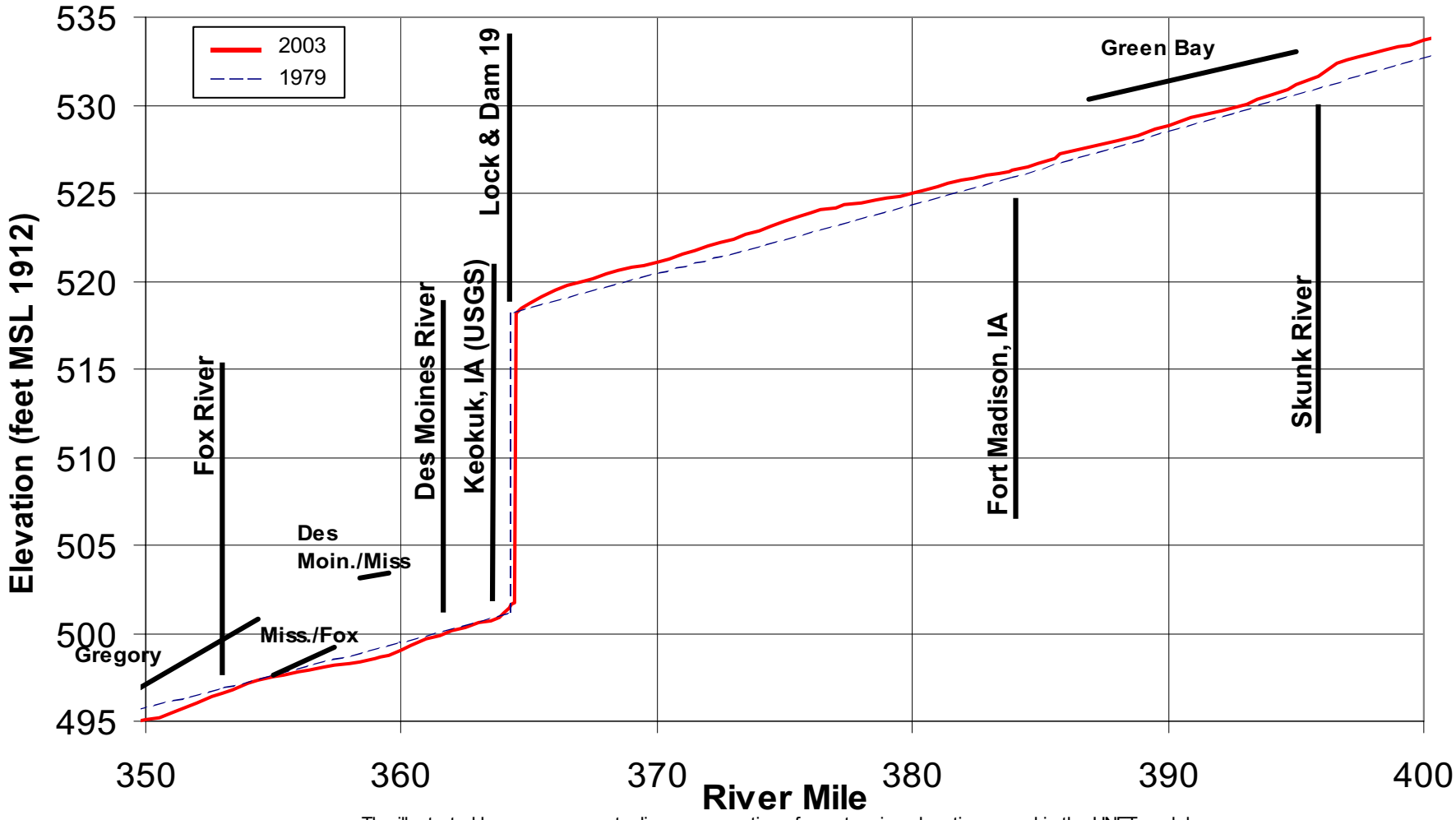
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations betw een the illustrated end points should not be assumed linear.

Mississippi River 100 Year Stage Frequency Profile
Right Bank



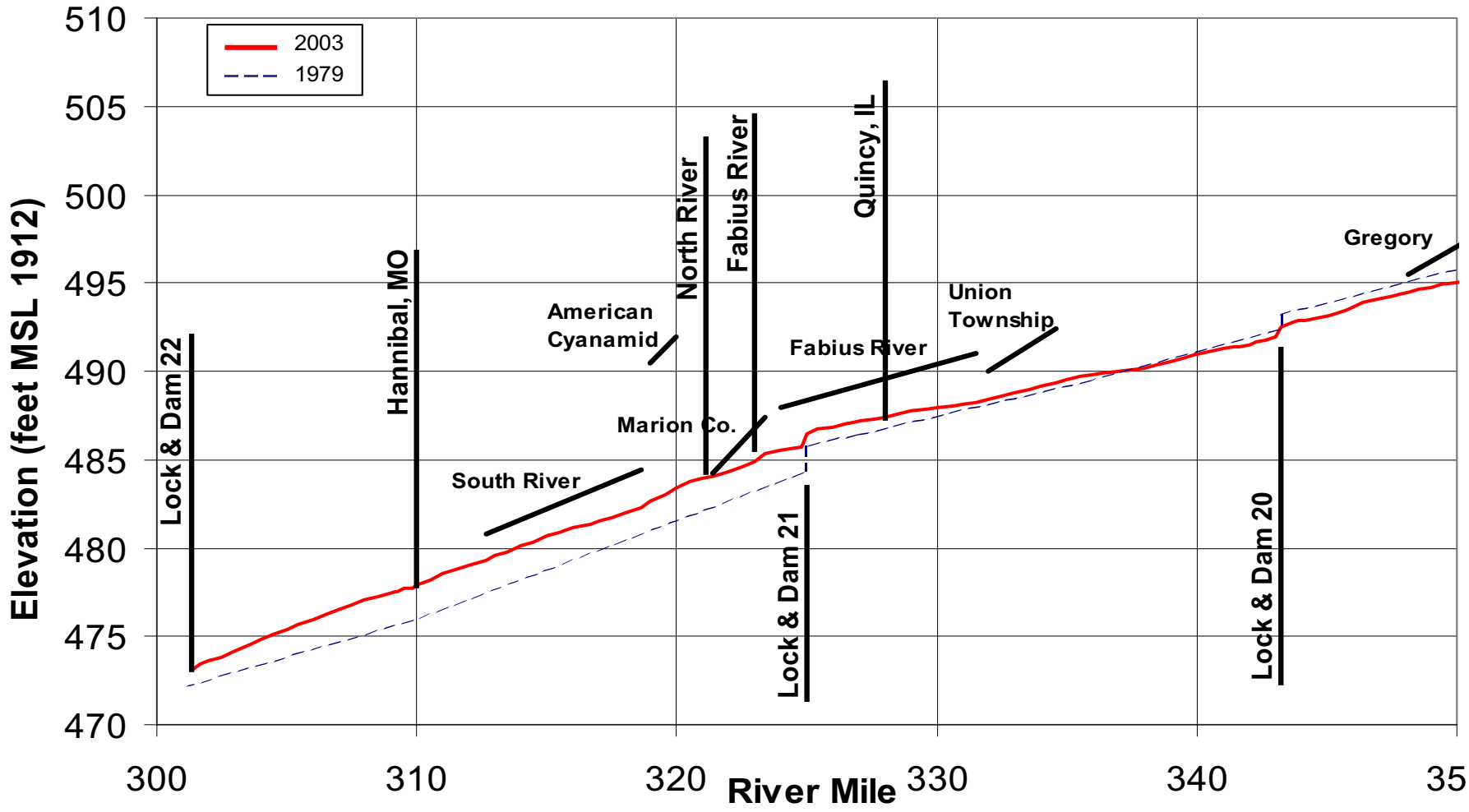
The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations betw een the illustrated end points should not be assumed linear.

Mississippi River 100 Year Stage Frequency Profile
Right Bank



The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations between the illustrated end points should not be assumed linear.

Mississippi River 100 Year Stage Frequency Profile
Right Bank



The illustrated levees represent a linear connection of overtopping elevations used in the UNET model.
Actual levee elevations betw een the illustrated end points should not be assumed linear.