

MISSISSIPPI RIVER AND TRIBUTARIES WATERWAYS ACTION PLAN

**MISSOURI RIVER ANNEX
2016**



MISSOURI RIVER ANNEX

Introduction

This appendix provides general information and target gages to be used as a guideline for a crisis on the Missouri River. Like a crisis on the Upper Mississippi River (UMR), it is the responsibility of the United States Coast Guard (USCG), Army Corps of Engineers (USACE), and River Industry representatives to meet and discuss conditions on the Missouri River and to *annually* review the actions specified in the plan. *This annex will normally be reviewed in conjunction with the winter navigation meeting.* In Section 4 of this annex, the Missouri River has Action Plan Tables for High Water, Low Water and High Current. An Action Plan Table for ice conditions is not included as navigation does not normally occur during the ice period mid December to mid March of each year. The tables are divided by river reaches with three action phases (e.g., *Watch, Action, and Recovery Phases*) described in the plan. Support tables of historical river flow discharges and river stage references, including recommended close and open watch stages, are included.

Section 1 – Geographic Description

The Missouri River Basin drains 529,000 square miles, including about 9,700 square miles located in Canada. The basin spans 10 states, including all of Nebraska, most of Montana, Wyoming, North Dakota, and South Dakota; about half of Kansas and Missouri; and smaller parts of Iowa, Colorado, and Minnesota. The Missouri is fed from several major tributaries, the Yellowstone, Platte, Kansas, Grand, and Osage Rivers.

The Missouri River extends 2,619 miles from its utmost source at Browers Spring on Hell Roaring Creek and 2,321 miles from Three Forks, Montana where the Jefferson, Madison, and Gallatin Rivers converge. The Missouri River is the longest river in the United States, draining one sixth of the country. The Missouri River Mainstem System (System) consists of six dams and reservoirs on the Missouri River located in Montana, North Dakota, South Dakota, and Nebraska. The six are Ft. Peck Dam in Montana, Garrison Dam in North Dakota, Oahe Dam, Big Bend Dam and Ft. Randall Dam in South Dakota and Gavins Point Dam in South Dakota and Nebraska. The System has a capacity to store 73.1 million acre-ft of water, which makes it the largest reservoir system in North America. The USACE regulates the System to serve the congressionally authorized project purposes of flood control, navigation, irrigation, hydropower, water supply, water quality, recreation, and fish and wildlife. The USACE considers all of the congressionally authorized project purposes when making decisions to optimize the development and utilization of the water resources of the Missouri River Basin to best serve the needs of the people. The System is regulated as a hydraulically and electrically integrated system. Runoff from above the System is stored in the six reservoirs. Water is released from the System as needed for downstream flow support. Released water from the lowest dam in the System, Gavins Point Dam, flows down the Missouri River, which includes the Bank Stabilization and Navigation Project from Sioux City, Iowa to the mouth near St. Louis, Missouri.

The Missouri River Bank Stabilization and Navigation Project was first authorized in 1912 with six subsequent authorizations that changed channel dimensions and extended channel reaches. The most recent authorization was by the March 2, 1945 Rivers and Harbors Act. This act authorized a 9 foot deep by minimum 300 foot wide navigation channel from Sioux City, Iowa to the mouth. The 734.8 mile navigation channel is continuous and free flowing without the use of locks or dams. A sinuous course of reverse bends and controlled river width was managed by constructing rock or piling structures called dikes and revetments. Dikes were constructed perpendicular to the flow and revetments were constructed parallel to the flow. This arrangement manages the constant movement of sediment to minimize channel shoaling providing a consistent and reliable navigation channel without the need for maintenance dredging.

Acronym List for Upper Missouri River Annex

USACE = ARMY CORPS OF ENGINEERS
AWO = AMERICAN WATERWAYS OPERATORS
BNM = BROADCAST NOTICE TO MARINERS
CFS = CUBIC FEET PER SECOND
CRP = CONSTRUCTION REFERENCE PLANE
dwb = DISTRICT WESTERN BRIDGES
ICP = INCIDENT COMMAND POST
JIC = JOINT INFORMATION CENTER
MOR = MISSOURI RIVER
MRAC = MISSOURI RIVER ACTION COMMITTEE
NOAA = NATIONAL OCEANIC ATMOSPHERIC ADMINISTRATION
NWO = USACE OMAHA DISTRICT
NWD = USACE NORTHWESTERN DIVISION
NWK = USACE KANSAS CITY DISTRICT
NWS = NATIONAL WEATHER SERVICE
O&M = OPERATION AND MAINTENANCE
PMV = PERMANENTLY MOORED VESSEL
RIAC = RIVER INDUSTRY ACTION COMMITTEE
RIBB = RIVER INFORMATION BULLETIN BOARD
RM = RIVER MILE
UMIB = URGENT MARINE INFORMATION BROADCAST
UMR = UPPER MISSISSIPPI RIVER
USCG = UNITED STATES COAST GUARD
USGS = UNITED STATES GEOLOGICAL SURVEY
WAP = WATERWAYS ACTION PLAN

Section 2 – Parties and Roles

U.S. Coast Guard (USCG)

The USCG Sector Commander Upper Mississippi River, with its principal office in St Louis, MO is responsible for safety of navigation, security, and law enforcement along the Missouri River. The USCG Sector Upper Mississippi River Prevention Depart., Waterways Branch, using the cutters Gasconade, stationed in Omaha, and the Cheyenne, stationed in St. Louis, is responsible for maintaining and setting buoys and shore aids along the Missouri River. The Prevention Department also focuses on licensed mariners issues, permits, casualty investigations, and security verifications. The USCG Sector Upper Mississippi River Response Department uses USCG small boats, other law enforcement partnerships and first responders to patrol and respond to emergencies or incidents on the Missouri River.

U.S. Army Corps of Engineers (USACE)

The day to day operation and maintenance (O&M) for the Missouri River Bank Stabilization and Navigation Project, Sioux City, IA to the Mouth is managed by two river field offices. The Missouri River Project Office, located in north Omaha, at river mile 627.0, is responsible for the O&M from Sioux City, Iowa to Rulo, Nebraska. The Missouri River Area Office, located at Napoleon, Missouri, at river mile 328.7, is responsible for the O&M from Rulo to the mouth and has a satellite floating plant facility at Gasconade Harbor at river mile 104.5. These offices report to Omaha District (NWO) and Kansas City District (NWK) respectively. NWO and NWK report to the Northwestern Division (NWD), Portland, Oregon. There is a Division Regional Office in Omaha, Nebraska that provides the day to day support for both Districts concerning the Missouri River. NWK and NWO have Water Management functions for the regulation of tributary dams in the Missouri River basin dividing their responsibilities at Rulo, Nebraska. The NWD Missouri River Basin Regional Office located in Omaha has the Water Management responsibilities for the Missouri River Mainstem System and coordinating responsibilities on tributary reservoir regulation.

U.S. Coast Guard District Eight Bridge Branch (dwb)

The Bridge Administration Program has a mandated responsibility to protect the public right of navigation. Activities include determining location of navigation channel piers and issuing bridge permits. They establish, revise and monitor drawbridge regulations and prescribe bridge lighting. Also, Truman-Hobbs studies of unreasonable obstructive bridges are conducted on a nationwide basis.

RIAC & MRAC

The River Industry Action Committee (RIAC) is an association of companies and organizations, who are stakeholders in the commercial industry on the inland rivers, however are more focused on the Mississippi, Ohio and Illinois Rivers. As the name suggests, they act in an advisory capacity on a wide range of issues affecting the activities of the industry on the rivers. They provide an industry perspective to the USCG and the USACE on matters such as high and low water, ice conditions, shoaling, marine accidents, etc. During 2008 the Missouri River navigation stakeholders formed the Missouri River Action Committee (MRAC) to function in a similar way as RIAC to provide industry representation with the USACE and USCG to interact and coordinate emergency responses.

Missouri River Ice Team (MRIT)

The Missouri River Ice Team is made up of private and industry volunteers who make regular observations and reports to the USACE on the ice conditions of the Missouri River during winter operations. These observations are reported to the basin. Although the Missouri River navigation industry avoids operating during ice conditions on the Missouri River, they often use the information to enter the river in the spring early in advance of reservoir support or leave the river late in the fall after the end of reservoir support. They will do this if during those years the reservoir system is releasing flood storage or tributary conditions provide adequate navigation flows. Reservoir flow support for navigation under normal conditions is from April 1 to December 1. This period is outside the normal ice buildup.

Designated Waterfront Facilities

The commercial interests of the designated waterfront facilities are directly impacted by navigation conditions on the Missouri River, and any actions taken by the USCG or USACE of Engineers in response to hazardous conditions that develop on the river. These facilities can play a valuable role in providing feedback to other parties on both river conditions and impact of proposed actions of the USCG and USACE.

State Emergency Managers

Hazardous conditions on the Missouri River, particularly high water/flooding conditions, frequently involve state emergency managers, as they become involved in responding to affected communities, and take a direct interest in conditions or activities that can affect the levee systems that protect those communities. State emergency management offices coordinate state, private and federal support to local and tribal governments. It's important to provide timely risk assessment information and incident briefings to the state emergency management offices. Risk assessments and incident briefings will then be shared by the appropriate state emergency management office with local/tribal emergency managers and other appropriate agencies through Situation Reports and other forms of notification. Requests for assistance by a local/tribal government must be coordinated through state emergency management. Emergency contact information follows.

USACE POSITION Kansas City District RM 498.4 – 0.0	DUTIES & RESPONSIBILITIES	EQUALS	USCG POSITION	DUTIES & RESPONSIBILITIES
Assistant Area Engineer, Missouri River Area Office, Napoleon, MO	Day to day O&M Missouri River, Rulo, NE to the mouth		Sector Upper Mississippi River Chief of Waterways	Manages daily waterway management and casualty operations
Area Engineer, Missouri River Area Office, Napoleon, MO	Supervises Missouri River Area Office		Sector Upper Mississippi River Chief of Waterways	Manages daily waterway management and casualty operations
Chief of Operations, Kansas City District	Supervises Operations Manager		Sector Upper Mississippi River Chief of Response	Supervises operational response issues
Chief, Water Control for Tributaries	Supports Chief of Operations		Sector Upper Mississippi River Chief of Prevention	Manages daily waterway management and casualty operations
Chief, Reservoir Control Center Northwestern Div	Coordinates with Chief of Water Control & Supports Division Commander		Sector Upper Mississippi River Chief of Prevention	Manages daily waterway management and casualty operations
District Commander Kansas City District	Supervises Chief of Operations		Commander Sector Upper Mississippi River	Senior USCG officer in area
Division Commander Northwestern Division	Supervises District Commander		Commander USCG Eighth District - d8	Senior USCG officer in District

USACE POSITION Omaha District RM 734.8 – 498.4	DUTIES & RESPONSIBILITIES	EQUALS	USCG POSITION	DUTIES & RESPONSIBILITIES
River Foreman, Missouri River Project Office, Omaha, NE	Day to day O&M Missouri River, Sioux City, IA to Rulo, NE		Sector Upper Mississippi River Chief of Prevention	Manages daily waterway management and casualty operations
Operations Manager, Missouri River Project Office, Omaha, NE	Day to day O&M Missouri River, Sioux City, IA to Rulo, NE		Sector Upper Mississippi River Chief of Prevention	Manages daily waterway management and casualty operations
Chief of Operations, Omaha District	Supervises Operations Manager		Sector Upper Mississippi River Chief of Response	Supervises operational response issues
Chief, Water Control for Tributaries	Supports Chief of Operations		Sector Upper Mississippi River Chief of Prevention	Manages daily waterway management and casualty operations
Chief, Reservoir Control Center Northwestern Div	Coordinates with Chief of Water Control & Supports Division Commander		Sector Upper Mississippi River Chief of Prevention	Manages daily waterway management and casualty operations
District Commander Omaha District	Supervises Chief of Operations		Commander Sector Upper Mississippi River	Senior USCG officer in area
Division Commander Northwestern Division	Supervises District Commander		Commander USCG Eighth District - d8	Senior USCG officer in District

Section 3 - Communications

Initiation of Communications Plan

This section provides guidance on the methods of communicating and receiving information. The USCG and maritime industry all carefully monitor river conditions and levels. When any of the conditions warrant attention, (rising water, falling water, high current, or any other hazardous condition), any Missouri River stakeholder can request a conference call by contacting the USCG Sector UMR Chief of Waterways. The USCG will discuss the concerns with the appropriate USACE contacts to decide if a phone conference is necessary. If further discussion is needed, the members listed on the following pages of this section, to include Industry and State personnel, will be contacted via email or phone call. The RIAC chair will contact those members of their respective organizations. A teleconference will be set up to confer with all parties on possible measures to take and joint courses of action using the guidance from this annex as a basis to make a determination. By conferring frequently with all Missouri River stakeholders a joint action plan to safely navigate during the condition that warranted initiating the communications plan will be developed. The action plan will then be communicated to all Missouri River stakeholders and the public using Broadcast Notice to Mariners, posting on the SECUMR Homeport, press releases if appropriate, and, if time permits, Local Notice to Mariners.

In the event of an unexpected river closure, the following steps will be considered to reopen the river: Conduct test tows if necessary for potential problem areas. Develop and initiate recovery plan to clear the queue. Issue advisory or establish safety zone if deemed necessary that indicates extreme low water, high water, or high current. USCG will reset buoys in those narrow channel locations within reach. USACE will continue increased level of channel reconnaissance. Consider draft limits, tow sizes, and helper boats. Evaluate fleet dimensions. Be aware of shifting channels, emergency dredging may be required at some locations. Consider restrictions on single skin barge movement. Continue communications. (e-mails, conference calls or others) – consider establishing notices, advisories and/or safety zones as needed using standard communication links between USACE, USCG and Industry.

Phone Conference Call Agenda:

- I. Roll Call by Phone Conference Host
- II. Protocol for Conference Call
- III. Open Statement by Chairman or Co-Chairman of RIAC on Issues
- IV. Weather Forecast by NWS or USACE
- V. River Stage Forecast by USACE
- VI. Channel Report for Area Of Concern by USACE
- VII. Status of Dredging and Next Scheduled Locations
- VIII. USCG Report on Advisories and Remarks
- IX. USCG Buoy Tender Report on Channel Conditions
- X. River Condition Report and Issues of Conference Call by Industry
- XI. Discussion of Issues on Current Situations
- XII. Assessment, Actions to Be Taken
- XIII. Closing

All Agencies & Organizations

To ensure effective interagency cooperation during periods of coordinated response to rising water, falling water, very high current or other hazardous river conditions, stakeholder organizations are advised to **maintain active and ongoing communications with one another during normal river conditions and while planning together for joint response activities.**

This will greatly facilitate speedy and effective communications under the pressure of responding to an event. These communications will be facilitated by the contact listing on the following pages of this section. As an aid to those looking to better understand USCG and USACE internal notification procedures, a description of these procedures is provided in paragraph "Notifications" that follows.

Vessel to Vessel and Vessel to Shore Communications

VHF communications on the Missouri River are handled by the communications center at USCG Sector Upper Mississippi River in St. Louis, MO. Primary contact is made on channel 16 then; generally, you will be instructed to switch to another channel to continue discussion.

Notifications

U. S. Coast Guard

The USCG maintains a 24 x 7 live watch at Sector Upper Mississippi River Command Center in St. Louis, MO. Hazardous river conditions are monitored by Sector personnel and reported as appropriate to the Commander, Sector Upper Mississippi River. As conditions dictate, the Commander, Sector Upper Mississippi River, will release Broadcast Notices to Mariners (BNM) or Urgent Marine Information Broadcasts (UMIB) with safety advisories, safety zones, or river closures. This information will also be posted on the SECUMR Homeport. As noted above, these waterways control measures are determined in consultation with the USACE and representative of the river industry.

Sector Upper Mississippi River Contact: 314-269-2500

Sector 24 Hour Contact Numbers: 314-269-2332 or 314-269-2463

Corps of Engineers

During Normal Work Hours

During periods of hazardous river conditions the USACE field offices work closely with river users and the basin river communities. The field office staff reports the river conditions and impacts to their respective District Office and NWD Point of Contact. The USACE has two district offices responsible for the Missouri River; the Omaha District and the Kansas City District. The District boundaries split at Rulo, Nebraska (RM 498.4). The field staff report to district staff persons within Operations Division and Emergency Management Division. Operations Division staff will inform the District Water Control or Water Management Offices, the district leadership and the District Commander. They will also notify Division Water Management. They will then contact appropriate staff person in the Division Office, who will notify, the appropriate Division leadership and the Division Commander. The District Operations staff will coordinate with the USCG throughout the hazardous period. When river conditions become too hazardous for safe navigation or if continuing navigation causes an unsafe

condition such as causing levee erosion or interfering with flood fighting, etc, the USACE through the appropriate District Commander will make recommendations to the USCG to issue safety zone restrictions or river closures. Likewise as river conditions improve the USACE through the appropriate District Commander will make recommendations to the USCG to remove the safety zone restrictions or reopen the river to navigation.

Corps of Engineers

After Normal Work Hours, Weekends and Holidays

Any USACE staff person, field office, District or Division who becomes knowledgeable of a hazardous river condition will contact the Kansas City District or Omaha District Emergency Management Office 24 hour phone number. Here the most up-to-date contact list with home and cell phone numbers are maintained of USACE staff responsible for emergency response to hazardous river conditions.

Kansas City Emergency Management Office: Eugene Kneuvean (816) 426-6320
Omaha District Emergency Management Office: Matthew Krajewski (402) 995-2448

Iowa Homeland Security & Emergency Management Department (HSEMD)

HLSEM is responsible for coordinating emergency preparedness activities across the State of Iowa. Iowa Homeland Security supports asset protection initiatives and promotes security awareness among all citizens. When an emergency of state or regional significance occurs, HLSEM coordinates response and recovery assistance. HLSEM engage all state response capabilities and facilitate emergency aid across local and state political boundaries. When it is needed, HLSEM is responsible for requesting and coordinating assistance from partner states and the federal government.

HLSEM believes that productive information sharing relationships are critical to homeland security and emergency preparedness. When information concerning the safety and security of Iowa's citizens and communities becomes available, please contact the HLSEM Duty Officer at 515-979-2200 or 515-725-3231. The Duty Officer can put you in contact with Operations Officer (MARSEC POC), or Chief of Operations.

Missouri State Emergency Management Agency

The Missouri State Emergency Management Agency (SEMA) coordinates and develops the State Emergency Operations Plan, oversees Missouri's disaster preparedness, floodplain management, hazard mitigation and public assistance programs as well as coordinates the state's response operations for all types of large-scale emergencies anywhere in the state.

SEMA and the State Emergency Operations Center (SEOC) are located at the Missouri Army National Guard Ike Skelton Training Site, east of Jefferson City. SEMA has a state-of-the-art facility and technical equipment to direct Missouri's disaster emergency response and recovery operations. The SEOC enables all state agencies to come together during an emergency, gather information from local jurisdictions and quickly respond to the disaster. The EOC has fully

functional workstations, access to communication resources that include radio, telephone, satellite and wireless computer links.

The State EOC is designed to support 24/7 operations with kitchen facilities, showers, security, and lodging capability. The Missouri Information Analysis Center is located directly adjacent to SEMA offices and is an integral part of Missouri's response team.

SEMA has direct coordination and support for local emergency managers through nine area coordinators, one assigned to each region of the state. These SEMA employees have vehicles equipped with the latest in radio, satellite and mobile data terminal technology, most recently used during a dam failure in rural Missouri.

SEMA has a 24-hour duty officer who can be reached at (573) 751-2748; SEMA's agency toll-free number is (800) 298-6289.

SEMA's Director is Mr. Ron Walker and Deputy Director is Ms. Dawn Warren.

Nebraska State Emergency Management Agency

The State Emergency Management Agency mission is to provide for the coordination and implementation of measures and procedures designed to meet the danger to the citizens and communities of Nebraska caused by natural, man-made or technological disasters, civil disturbances, or hostile military or paramilitary action. To prepare for a prompt and efficient response protects lives and prevents the loss of property from all hazards. To ensure that the public is served in a timely and efficient manner, to provide for effective utilization of resources to support local political subdivisions in disaster recovery activities and to establish and implement a management system for coordinating State agencies', Federal agencies', private and non-governmental agencies' respond using the multi-agency coordination structure in the National Response Plan (NRP) and in accordance with the National Incident Management System (NIMS). The Nebraska State Emergency Management Agency can be contacted 24 hours a day all year at 402-471-7421.

North Dakota Department of Emergency Services

The N.D. Department of Emergency Services (NDDDES), comprised of the Divisions of Homeland Security and State Radio, provides 24/7 emergency communications and resource coordination with more than 50 lead and support agencies, private enterprise and voluntary organizations to assist local jurisdictions in disaster and emergency response activities. Each community maintains a direct responsibility for the safety of its citizens. Local and tribal governments provide initial response to incidents, emergencies, disasters or catastrophes. Local Emergency Managers serve a key role in coordinating response and recovery efforts and offer a better understanding of the situation and accompanying resource requirements. NDDDES supports response and recovery coordination with Emergency Managers in each county and tribal nation within the state of North Dakota as well as the cities of Bismarck and Fargo.

The State Emergency Operations Center (SEOC) utilizes the Incident Command System (ICS) and serves as a central location for coordinating technical and resource assistance from state,

federal, private, and voluntary agencies in support of local government. WebEOC, which aids coordination and interoperability of response and recovery activities among affected jurisdictions, is used in the SEOC to report and track information in order to provide situational awareness to responding agencies and jurisdictions. In addition the SEOC uses EmerGeo, a GIS mapping software tool that interfaces with WebEOC, to develop a common operating picture. The section maintains a 24/7 duty officer who monitors day-to-day incidents, activities and events throughout the state. The Duty Officer also serves as the primary contact for incident reporting and requests for state and federal assistance. The Duty Officer can be reached via State Radio at (701) 328-9921.

Kansas Emergency Management

The mission of the Division of Emergency Management is to provide a 24-hour operation to reduce loss of life and property, protect Kansans from all hazards by providing and coordinating resources, expertise, leadership and advocacy through a comprehensive, risk-based emergency management program of mitigation, preparedness, response and recovery.

The current Emergency Management Program in Kansas stems from two major legislative initiatives: the Federal Robert T. Stafford Disaster Relief Act, as amended, and Chapter 48, Article 9 of the Kansas Statutes Annotated. The Division of Emergency Management is the arm of the Adjutant General's Department that provides mitigation advocacy, planning requirements and guidance, response coordination, and administration of recovery programs for the civil sector of the State, regardless of the type of hazards.

The Kansas Statutes Annotated requires that each county maintain a disaster agency responsible for emergency preparedness and coordination of response to disasters. The Statutes also require each county to maintain an Emergency Operations Plan that has been approved by the Division of Emergency Management. These statutes are the basis for the State/local relationship, which is solidified by continued contacts and mutual assistance on day-to-day operations, and during times of disasters. The State and local governments work together to provide training to local emergency management and response personnel. The same is true for the conduct of periodic exercises to test the State and local emergency management systems. Kansas Emergency Management can be contacted 24 hours a day all year at 785-291-3333

South Dakota Emergency Management

The Office of Emergency Management is charged with the overall mission of protecting South Dakota's citizens and their property from the effects of natural, manmade, and technological disasters. To fulfill this mission, the Office recognizes and utilizes the four phases of emergency management:

Preparedness: Actions taken in advance of an emergency/disaster to develop operational capabilities and facilitate response operations. Such measures may include the development of plans, procedures, warning and communications systems, and mutual aid agreements and emergency public information.

Response: Actions taken during or after an emergency/disaster to save lives, minimize damages and enhance recovery operations. These measures include activation of emergency operation centers, plans, emergency communications system, public warning, mass care, shelter, search and rescue, and security measures.

Recovery: Actions taken over the short or long term to return vital life support systems to minimum standards or to return life to normal or improved levels. Such measures include damage assessment, supplemental assistance, economic impact studies, and mitigation of damages sustained.

Mitigation: Actions that can be taken to eliminate or reduce the degree of long term risk. Such measures include building codes, public education, hazard vulnerability analysis and zoning laws and resolutions.

South Dakota Emergency Management can be contacted 24 hours a day all year at 605-773-3231.

Contact Information

In order to facilitate communications between Missouri River stakeholders, a contact list is provided on the following pages. This contact list is for internal use only and shall not be provided to non-plan users without permission by the contacted.

GOVERNMENT AGENCY USACE of Engineers	DESIGNATED CONTACT	PHONE NUMBER	E-MAIL ADDRESS	WHEN CONTACTED
Kansas City District Emergency Management	Staff – 24 hour Eugene Kneuvean, Act. Chief EM	816-426-6320	eugene.j.kneuvean@usace.army.com	All Situations
Omaha District Emergency Management	Staff – 24 hour Matthew Krajewski, Chief EM	402-995-2448	matthew.s.krajewski@usace.army.mil	All Situations
Missouri River Area Office, Napoleon, MO (RM 328.7) Reach (RM 498.4 – 0.0) Glasgow Project Office	James Rudy, Area Engineer James Campbell , Asst Area Engr. (RM 226.4) Staff	816-240-8131 816-389-3511 660-580-0294 cell 816-389-3680 816-591-3107 cell 660-338-2278	james.d.rudy@usace.army.mil james.d.campbell@usace.army.mil	All Situations
Missouri River Project Office, Omaha, NE (RM 626.7) Reach (RM 734.8 – 498.4)	Dave Sobczyk, Operations Mgr Alan Schmidt, River Foreman	402-996-3745 402-996-3755 402-306-5981 cell	dave.f.sobczyk@usace.army.mil alan.p.schmidt@usace.army.mil	All Situations
Kansas District Reach (RM 498.4 – 0.0)	Chris Purzer, Chief Water Mgt Stu Cook, Chief Operations Michael Chapman, Chief, River Engineering & Restoration Col Andrew Sexton, District Cmdr	816-389-3156 816-389-3342 816-389-3310 816-808-8924 cell 816-389-3202	christopher.a.purzer@usace.army.mil stuart.r.cook2@usace.army.mil michael.d.chapman@usace.army.mil andrew.d.sexton@usace.army.mil	All Situations
Omaha District Reach (RM 734.8 – 498.4)	Kellie Bergman, Chief Water Mgt Katy Schenk, Chief Operations Dan Pridal, Chief Sediment & Channel Stabilization Section Col John W. Henderson, District Cmdr	404-995-2308 402-995-2435 402-995-2336 402-995-2001	kellie.k.bergman@usace.army.mil kathryn.m.schenk@usace.army.mil daniel.b.pridal@usace.army.mil john.w.henderson@usace.army.mil	All Situations
Northwestern Division	Eric Braun, Navigation Jody Farhat, Chief, Water Mgt Kevin Grode, Water Mgt Mike Swenson, Water Mgt Lori Rux, Chief Program Support BG Scott Spellmon, Cmdr	503-808-3721 402-996-3840 402-996-3875 402-996-3860 503-808-3880 503-808-3700	eric.p.braun@usace.army.mil jody.s.farhat@usace.army.mil kevin.r.grode@usace.army.mil michael.a.swenson@usace.army.mil lori.rux@usace.army.mil scott.a.spellmon2@usace.army.mil	All Situations

GOVERNMENT AGENCY U.S. USCG	DESIGNATED CONTACT	PHONE NUMBER	E-MAIL ADDRESS	WHEN CONTACTED
Sector Upper Mississippi River	Communication Center	314-269-2332 314-269-2463 24/7		All Situations
Sector Commander UMR, St. Louis, MO	CAPT Martin Malloy	314-269-2600	martin.l.malloy@uscg.mil	All Situations
Sector UMR, Waterways/ATON	CWO Tim Guy	314-269-2575 319-520-8556 cell	sumrwaterways@uscg.mil	All Situations
Sector UMR, Chief of Response	LCDR Susana Lee-Kiddey	314-269-2540 314-704-9041 cell	Susana.E.lee-kiddey@uscg.mil	All Situations
Sector UMR, Chief of Prevention	LCDR Sean Peterson	314-269-2568 314-704-8934 cell	sean.m.peterson@uscg.mil	All Situations
Sector UMR, Chief of Waterway	LCDR Kristine Neeley	314-269-2560	kristine.b.neeley@uscg.mil	All Situations
Cutter Gasconade, Omaha	BMCM Jason Willey	402-451-7681 402-657-9235 cell	jason.h.willey@uscg.mil	All Situations
Cutter Cheyenne, St. Louis	BMCM Scott Ehrich	314-771-4325 314-303-9300 cell 254-377-9419 sat	scott.w.ehrich@uscg.mil	All Situations
Bridge Admin – Western Rivers	Eric Washburn	314-269-2378	eric.washburn@uscg.mil	All Situations

STATE EMERGENCY MANAGEMENT AGENCIES	DESIGNATED CONTACT	PHONE NUMBER	E-MAIL ADDRESS	WHEN CONTACTED
Wyoming Office of Homeland Security	Staff Kim Johnson	306-777-4663 24/7 307-777-4910	NA kim.johnson@wyo.gov	All Situations
North Dakota Division of Homeland Security, Dep. of Emergency Services	Duty Officer Greg Wilz, Director	701-328-9921 24/7	nddes@nd.gov	All Situations
South Dakota Office of Emergency Management	Duty Officer Tina Titze, Director	605-773-3231 24/7	tina.titze@state.sd.us	All Situations
Iowa Homeland Security & Emergency Management Department (HSEMD)	24 hr Duty Officer Mark Schouten, Director	515-979-2200 24/7	NA	All Situations
Nebraska Emergency Management Agency	Staff Cindy Newsham, Admin Assistant	402-471-7421 24/7 402-471-7415	NA cindy.newsham@nema.ne.gov	All Situations
Missouri State Emergency	Staff Ron Walker, Director	573-751-2748 24/7	NA	All Situations

COMPANY / ORGANIZATION	DESIGNATED CONTACT	PHONE NUMBER	E-MAIL ADDRESS	WHEN CONTACTED
TOWING COMPANIES				
ACBL River Operations	Jerry Torok	281-372-0675		All Situations
River Marine Enterprises LLC				All Situations
Excell Marine				All Situations
Jefferson City River Terminal	Steve Bohlken	573-634-3020	sbohlken@capitalsandcompany.com	All Situations
Hermann Sand and Gravel, Inc	Steve Engemann	573-486-2913 573-220-4908 cell	steve@hermannsand.com engemann454@yahoo.com	All Situations
Magnolia Marine Transport Co.	Michael Carpenter Roger Harris	601-638-5921 601-638-5921	Michael.carpenter@ergon.com roger.harris@ergon.com	All Situations
McDonough Marine Service	Ron White	281-452-5887 504-780-8100	rowwhite@marmac.net	All Situations
RIVERBOAT EXCURSIONS				
L&C Riverboat, Bismarck, ND -1315.5	Cpt Jim Stellick	701-255-4233 701-226-9346 cell	lewisandclark@qwest.net	All Situations
River City Star - 617.0	Tami Bader	402-342-7827		All Situations
The Spirit of Brownville - 535.1	Randal Smith	402-825-6441	rs94313@navix.net	All Situations
RIVER CONTRACTOR				
Ellis Construction company	William "Ace" Ellis Sonny Kimbenling	816-257-2300 816-225-6252 cell 816-806-1284 cell		All Situations
SHIPPING TERMINALS				
Big Soo Terminal, Sioux City - 727.8	Kevin Knepper	712-258-0537	kevin@tegracorp.com	All Situations
Jebro, Inc(Knife Riv) Sioux City - 727.5	Bob Cheever	712-277-8855	bob.cheever@jebro.com	All Situations
M&Q LLC Lyons, NE - 648.5	Mike Olson	402-870-0554 cell	mike@mmgllc.com	All Situations
Port of Omaha Terminal Kinder Morgan - 624.0				All Situations
Gavilon, Nebraska City	Kory Tanner	402-873-6684	Kory.tanner@gavilon.com	All Situations
Westway Terminal (Ergon Walcott)386.4				All Situations

COMPANY / ORGANIZATION	DESIGNATED CONTACT	PHONE NUMBER	E-MAIL ADDRESS	WHEN CONTACTED
Midwest Terminal Warehouse, KC - 367.1	Joe LaMothe	816-231-8811	joe.lamothe@ipr-mwt.com	All Situations
BRENNTAG, Kansas City - 360.6	Brian Bridgeman	816-483-9996	bbridgeman@brenntag.com	All Situations
Agriservices of Brunswick - 256.3	Bill Jackson Kevin Holcer	660-549-3351 800-279-4229	bill@agriservices.com kevin@agriservices.com	All Situations
Jefferson City River Terminal -143.3	Steve Bohlken	573-634-4880 573-893-4110 24/7	sbohlken@capitalsandcompany.com	All Situations
USACE maintains a complete contact list of 86 terminals. The USCG maintains a copy of the listing.	Kevin Grode, W Mgt LCDR Neeley CWO Tim Guy	402-996-3875 314-269-2560 314-269-2575	kevin.r.grode@usace.army.mil Kristine.b.neeley@uscg.mil SUMRWaterways@uscg.mil	All Situations
SAND & GRAVEL TERMINALS				
Holiday Sand & Gravel Office-Lenexa	Mike Odell	913-492-5920 913-438-0240 cell	mrodell@hollidaysand.com	
Holiday Sand and Gravel Co. - 447.6	Mike Clouse	816-232-7771		All Situations
Holiday Sand and Gravel Co. - 371.8	Chuck Clark	816-741-6466	plant11@hollidaysand.com	All Situations
Holiday Sand and Gravel Co. - 360.1	Mike Clouse	816-454-5250		All Situations
Capital Sand Co. -317.1, 226.2, 197.0, 186.3, 181.6, 143.2	Steve Bohlken	573-634-3020	sbohlken@capitalsandcompany.com	All Situations
Hermann Sand and Gravel, Inc - 96.9	Steve Engemann	573-486-2913	engemann454@yahoo.com	All Situations
Washington Sand Co. - 68.1	Alan Korman	636-239-6638		All Situations
Lafarge North America. - 43.9, 28.1, 27.8	Sandy Peterson	314-739-0169 314-581-4193 24/7		All Situations
POWER STATIONS				
OPPD Ft Calhoun Nuclear Power Station (RM 645.9)	Control Room Shift Manager	402-533-6632 24/7	Staff on Duty	All Situations
NPPD Cooper Nuclear Power Station (RM 532.65)	Shift Supervisor	402-825-5253 24/7	Staff on Duty	All Situations
Ameren Callaway Nuclear Power Station (RM 115.4)	Control Room	573-676-8234 24/7	Staff on Duty	All Situations
COMPANY / ORGANIZATION	DESIGNATED CONTACT	PHONE NUMBER	E-MAIL ADDRESS	WHEN CONTACTED

There are 11 other power companies with 18 intakes on the Missouri River for coal fired thermal plants. The USACE maintains the contact listing. The USCG has a copy of the listing.	Eric Braun Kevin Grode, W Mgt LCDR Neeley CWO Tim Guy	503-808-3721 402-996-3875 314-269-2560 314-269-2575	eric.p.braun@usace.army.mil kevin.r.grode@usace.army.mil krisine.b.neeley@uscg.mil SUMRWaterways@uscg.mil	All Situations
MUNICIPAL WATER SUPPLY				
There are 13 Water Supply Companies with 19 water supply intakes on the Missouri River. The USACE maintains the contact listing. The USCG has a copy of the listing.	Eric Braun Kevin Grode, W Mgt LCDR Neeley CWO Tim Guy	503-808-3721 402-996-3875 314-269-2560 314-269-2575	eric.p.braun@usace.army.mil kevin.r.grode@usace.army.mil krisine.b.neeley@uscg.mil SUMRWaterways@uscg.mil	All Situations
INDUSTRIAL WATER SUPPLY				
Terra International Incorporated	Dan Walters	712-233-6265	dwalters@terrainindustries.com	All Situations
CASINO RIVERBOATS				
Argosy Gaming Co., Riverboat Casino, Argosy IV (RM 731.9) PMV				All Situations
Ameristar Riverboat Casino Ameristar (RM 614.6) PMV				All Situations
MARINAS				
The USACE maintains the contact listing. The USCG has a copy of the listing.				
BRIDGE TENDERS				
Atchison UP RR Bridge (RM 422.6)	Scott Johnson (wife Mary Anne)	913-367-0097 402-616-4723 cell	sjmjdoodle87@yahoo.com	High Water
RIAC & MRAC				
River Industry Action Committee Representative from Ingram Barge	Bernie Heroff, St. Louis	618-286-1517 314-304-2557 cell	Bernard.Heroff@adm.com	All Situations
Missouri River Action Committee	Steve Engemann Michael Carpenter	573-486-2913 601-638-5921	steve@hermannsand.com Michael.carpenter@ergon.com	All Situation

INTERNET SITE PURPOSE	ADDRESS
USCG Sector Upper Mississippi River	http://www.uscg.mil/d8/sectUMR/
USCG Bridge Program Division	http://www.uscg.mil/hq/cg5/cg5411/
USACE Northwestern Division Water Management	http://www.nwd-mr.usace.army.mil/rcc/index.html
USACE Kansas City District Water Management	http://www.nwk.usace.army.mil/watermanagement/
USACE Kansas City District Navigation Page	http://www.nwk.usace.army.mil/Missions/CivilWorks/Navigation.aspx
USACE Missouri River Facebook Page	https://www.facebook.com/MORiverNavigation
USACE Omaha District Water Control	https://www.nwo.usace.army.mil/hydro/water_control/index.html
NWS – National Weather Service	http://www.nws.noaa.gov/
HPC – Hydrometeorological Prediction Center	http://www.hpc.ncep.noaa.gov/qpf/24hrqpfall.html
USGS – Missouri River Gage, Sioux City, Iowa (RM 732.2)	http://waterdata.usgs.gov/ne/nwis/uv?06486000
USGS – Missouri River Gage, Decatur, Nebraska (RM 691.0)	http://waterdata.usgs.gov/ne/nwis/uv?06601200
USGS – Missouri River Gage, Omaha, Nebraska (RM 615.9)	http://waterdata.usgs.gov/ne/nwis/uv?06610000
USGS – Missouri River Gage, Nebraska City, NE (RM 562.6)	http://waterdata.usgs.gov/ne/nwis/uv?06807000
USGS – Missouri River Gage, Rulo, Nebraska (RM 498.1)	http://waterdata.usgs.gov/ne/nwis/uv?06813500
USGS – Missouri River Gage, St. Joseph, Missouri (RM 448.2)	http://waterdata.usgs.gov/mo/nwis/uv?06818000
USGS – Missouri River Gage, Kansas City, Missouri (RM366.1)	http://waterdata.usgs.gov/mo/nwis/uv?06893000
USGS – Missouri River Gage, Waverly, Missouri (RM293.4)	http://waterdata.usgs.gov/mo/nwis/uv?06895500
USGS – Missouri River Gage, Glasgow, Missouri (RM226.3)	http://waterdata.usgs.gov/mo/nwis/uv?06906500
USGS – Missouri River Gage, Boonville, Missouri (RM197.1)	http://waterdata.usgs.gov/mo/nwis/uv?06909000
USGS – Missouri River Gage, Jefferson City, MO (RM 143.9)	http://waterdata.usgs.gov/mo/nwis/uv?06910450
USGS – Missouri River Gage, Hermann, Missouri (RM 97.9)	http://waterdata.usgs.gov/mo/nwis/uv?06934500
USGS – Missouri River Gage, St. Charles, Missouri (RM 28.2)	http://waterdata.usgs.gov/mo/nwis/uv?06935965
USGS – Mississippi River Gage, St. Louis, Missouri (RM 190.2 or 1044)	http://waterdata.usgs.gov/mo/nwis/uv?07010000
USACE Rock Island District – Navigation Information Connection	http://www2.mvr.usace.army.mil/NIC2/default.cfm
River Industry Bulletin Board	http://www.ribb.com/index.php

Section 4 – Action Plan

The actions to be taken during High Water, Low Water and High Current conditions are described in the following Action Plan Tables. The Action Plan Tables are supplemented by Tables 1, 2 and 3. The supplemental tables provide specific Missouri River flood information and various stage and discharge information to provide a basis for use of the Action Plan Tables as well as an understanding of how the hazardous event compares historically. An Action Plan Table for Ice conditions is not provided since the Missouri River is not used by the navigation industry when ice forms, normally mid December thru mid March. In addition to the discussions on Tables 1, 2 and 3, there are discussions of Project Operations for the Missouri River Master Water Control Manual and Annual Operating Plan, and Project Operations for Buoying Recommendations for Minimum Service Flow Support.

Table 1

This table shows the US Geological Survey (USGS) historical maximum discharges from the reservoirs since the Missouri River System was fully operational in 1967. The maximum design discharge capacity of the dams as well as the USGS maximum recorded discharge near the dams is listed. In addition the USGS maximum discharge of record with the dams in place since 1967 and the USGS maximum discharge of record for the downstream gaging stations from Sioux City downstream are shown.

Table 2

This table shows the Construction Reference Plane (CRP) stages and USGS discharges for the gaging stations from Sioux City to near the mouth at St. Charles. The CRP is a design profile used for constructing and maintaining the revetment and dike system. See glossary in the main report for detailed definition of CRP. Revisions to the CRP are required to reflect periodic changes within the basin due to flood events, channel degradation and aggradations and other river related circumstances. The Kansas City District updated the CRP for the Rulo to mouth reach in 2010. Omaha District updated the CRP for Sioux City to Rulo reach in 2006. Revisions impacting this Action Plan will be reflected in future updates. The CRP provides river users an approximate baseline for full service navigation stages for the entire navigable river reach. Table 2 also shows the full service navigation discharges at the four gage locations that serve as flow targets. These targets are met by releasing appropriate flows from the reservoir system so that the discharge at each gaging station at least meets the flow target. One gaging station may just meet the target while the others may equal or exceed the target. Full service navigation discharges provides for the 9 feet deep by minimum of 300 feet wide navigation channel. Minimum service navigation discharges are also listed for the same gages. Minimum service navigation discharges provide for an 8 feet deep by minimum of 200 feet wide navigation channel. Below Kansas City there are no navigation discharge flow targets established. Tributary flows generally supplement the flows downstream below Kansas City providing the required navigation flow support. Below Kansas City the USACE, USCG and towing industry use the CRP stages as an approximation of full service navigation support as a comparison baseline. However, it must be noted that the discharges corresponding to the CRP stages are

slightly higher than the full service target discharge with the addition of normal tributary inflows from Kansas City to the mouth.

Table 3

This table shows the flood stages with discharges at the gaging stations from Sioux City to near the mouth at St. Charles. Also shown are the “extreme high water watch stages” at specific gaging stations. These watch stages are used as guidelines by the USACE in coordinated discussions with the USCG. The watch stages represent historic river levels where continuing river navigation would have impacted flood fighting activities, threatened levee integrity or caused significant infrastructure damage along the river. Because of development activity along the floodway, accretion in the floodway, and levee crest changes, these watch stages can change. However, these stages provide a reasonable reference to begin necessary actions to consider river safety zones or closings and openings. Field observations and experience will be used to update the stages.

PROJECT OPERATIONS – MISSOURI RIVER MASTER WATER CONTROL MANUAL AND ANNUAL OPERATING PLAN

Navigation support flows are initiated from Gavins Point Dam (R 811.1) on or about March 20th each year. There is about a 10 day lead time for releases from Gavins Point Dam to reach the mouth. These flows provide flow support for the calendar year navigation season, which normally runs from 1 April thru 30 November at the mouth of the Missouri River. To meet downstream flow support requirements navigation flow targets have been established at Sioux City, IA, Omaha & Nebraska City, NE and Kansas City, MO. Depending on the available system water supply these targets vary from 31,000 to 25,000 cfs at Sioux City, 31,000 to 25,000 cfs at Omaha, 37,000 to 31,000 cfs at Nebraska City and 41,000 to 35,000 cfs at Kansas City. The upper range is used when the system has normal to above normal water supply and the lower range, less 6000 cfs, is used during periods of low upstream system water supply during an extended drought. The full service flow support level refers to the upper range and the minimum service flow support refers to the lowest range. Service between full and minimum is called intermediate service. The Missouri River Water Management team runs daily Missouri River forecasts and makes daily release changes if required to meet the required flow targets during the navigation season. From early to mid-May to mid-August releases are scheduled steady to accommodate the Endangered Least Tern and Threatened Piping Plover nesting on the Missouri River. Releases are scheduled at a higher rate than required early in the nesting season to keep birds nesting high on sandbars so that the necessary amount of flow will most likely be at the navigation target later in the season when downstream tributary flows recede in July or August. From early to mid-May, releases are scheduled steady to mid-August, to accommodate the Endangered Least Tern and Threatened Piping Plover nesting on the Missouri River. Water Management will increase discharges to some higher flow, to approximate what would be generally needed to meet navigation targets during July-August. Support flows tend to be higher during mid-to-late summer, as tributary flows recede. The higher discharges in spring would spur the birds to nest higher. Then when greater support flows are needed in the summer, the higher nests should equate to reduced loss of birds. The Master Manual also provides for the

spring pulse operation designed for the endangered Pallid Sturgeon during March and May if the reservoir system storage threshold is above 36.5 million acre feet (maf) and the downstream flood thresholds are not exceeded. The season length is variable based on system water supply conditions as determined by the reservoir storage check on 1 July. The season length can be reduced no greater than two months. If an extended drought and usage of the system causes the system storage to be less than or equal to 31 million acre feet, navigation for that year will not be supported by system releases. During years of above normal water supply the season is often extended to December 10th to provide additional floodwater evacuation to prepare the system for the following runoff season prior to winter freeze in.

PROJECT OPERATIONS – BUOYING RECOMMENDATIONS FOR MINIMUM SERVICE FLOW SUPPORT

Since the reservoir system was fully operational in 1967 there have been two major droughts, 1988 -1993 and 2000 - 2007. The first drought period, 1988-1993, provided the first opportunity to understand the performance of the navigation channel design during minimum service flow support. An USACE memo to the USCG, dated February 14, 1990, recommended buoying the river to provide an 8 feet deep channel within the widths available. During the March 26, 1990 Joint USACE and USCG Meeting, it was agreed that the USCG buoy to 8 feet deep, but it was also agreed that the USCG would consider issuing a Notice to Mariners of any areas with channel dimensions that were less than 8 feet x 200 feet. If the channel conditions could only support dimensions less than 8 feet x 150 feet the USCG would consider establishing a Safety Zone for those reaches on a case by case basis. During the drought of 2000 - 2007 for minimum service flow support the same buoying and notification operations were implemented.

ACTION PLAN TABLE – High Water, Sioux City, IA to the Mouth RM 734.8 – 0.0

The Action Plan Table consists of seven tables that consider High Water for the seven reaches that divide up the navigation channel from Sioux City to the mouth. These reaches are the Sioux City Reach from river mile 734.8 to 630, the Omaha Reach from 630 to 500, the St. Joseph Reach from 500 to 400, the Kansas City Reach from river mile 400 to 300, the Brunswick Reach from river mile 300 to 200, the Jefferson Reach from river mile 200 to 100 and the Washington Reach from river mile 100 to 0.0. The tables show Trigger Readings for making decisions. These readings include flood stages and extreme high water watch stages that are also shown on Table 3.

In addition to the standard Action Plan Tables for High Water, a High Water Stage Trigger Table is provided to help simplify the comparison between discharge, stage and the action decisions.

ACTION PLAN TABLE – Low Water, Kansas City, MO to the Mouth RM 366.1 – 0.0

Low water is a significant issue for the reach from Kansas City to the mouth. River reaches upstream are supported by reservoir releases that provide the minimum required navigation flows. Low water is generally not an issue for the upstream reaches. However sometimes navigation target flows are slightly missed as a result of flow regulation for endangered species or unexpected reductions from tributary flows. Missing the target flow at the Kansas City gage or low tributary drought influenced inflows impacts the reach downstream the most. Therefore Action Plan Tables for Low Water include only the four reaches within Kansas City to the mouth. These reaches are the Kansas City Reach from river mile 366.1 to 300, the Brunswick Reach from river mile 300 to 200, the Jefferson Reach from river mile 200 to 100 and the Washington Reach from river mile 100 to 0.0. The Kansas City Reach begins at river mile 366.1 as this is the most downstream target gage location for supporting navigation flows from the reservoir system. The lowest discharge Trigger Reading indicated for the Kansas City gage for normal operations corresponds with minimum service navigation flows of 35,000 cubic feet per second (cfs). The falling water discharges at the Kansas City gage corresponds to a missed target situation. The falling water discharges downstream are a result of a missed target at Kansas City and/or drought conditions on the tributaries. Mainstem river gages that have locations that correspond to the upstream and downstream river mile positions for each river reach are used for Trigger Reading discharges.

The Action Plan Tables for Low Water include both discharge and gage information. Although discharge is what maintains the channel, stage is most often used as a river flow benchmark. For any given river discharge the stage can fluctuate due to river sediment bed forms moving downstream. The stages provided for the low water table are the best average stage for the discharges indicated.

In addition to the standard Action Plan Tables for Low Water, a Low Water Trigger Table is provided to help simplify the comparison between discharge, stage and the action decisions.

ACTION PLAN TABLE – High Current, Sioux City, IA to the Mouth RM 734.8 – 0.0

The seven tables provided consider high current using high discharges caused by basin or regional flood events for the entire navigable river reach. These reaches are the Sioux City Reach from river mile 734.8 to 630, the Omaha Reach from 630 to 500, the St. Joseph Reach from 500 to 400, the Kansas City Reach from river mile 400 to 300, the Brunswick Reach from river mile 300 to 200, the Jefferson Reach from river mile 200 to 100 and the Washington Reach from river mile 100 to 0.0. The greatest concerns for the high and very high currents are those created by flood waters carried by the river. Experience indicates that although the greatest of these flows can be navigated against it will be other factors that make the decision to issue advisories or establish safety zones or river closures.

Individual tributaries can receive significant rain events that have currents reaching the confluence of the Missouri River that penetrate well into the channel. These situations provide high current navigation challenges for tows that pass a flooding tributary confluence. However

these are infrequent and short lived events and the majority of tows safely pass on the opposite side of the river to avoid the side energy.

Dam/Reservoir	State	Maximum Discharge Of Record With Dams 1967- Present (cfs)	Maximum Design Discharge Capacity (cfs)	Maximum Discharge Of Record Near Dams (cfs)
Fort Peck Dam - Fort Peck Lake	MT	65,900 (Jun 2011)	275,000	137,000 (Jun 1953)
Garrison Dam - Lake Sakakawea	ND	150,600 (Jun 2011)	827,000	348,000 (Apr 1952)
Oahe Dam - Lake Oahe	SD	160,300 (Jun 2011)	304,000	440,000 (Apr 1952)
Big Bend Dam - Lake Sharpe	SD	166,300 (Jun 2011)	390,000	440,000 (Apr 1952)
Fort Randall Dam - Lake Francis Case	SD	160,000 July 2011	620,000	447,000 (Apr 1952)
Gavins Point Dam - Lewis and Clark Lake	SD & NE	160,700 (Jun 2011)	584,000	480,000 (Apr 1952)
Gage Location	River Mile	Maximum Discharge Of Record With Dams 1967- Present (cfs)		Maximum Discharge of Record Prior to 1967 Before Dams Fully Operational (cfs)
Sioux City, IA	732.3	192,000 (Jul 2011)		441,000 (Apr 1952)
Decatur, NE	691.0	191,000 ((Jun 2011))		NA*
Omaha, NE	615.9	217,000 (Jul 2011)		396,000 (Apr 1952)
Nebraska City, NE	562.6	229,000 (Jul 2011)		414,000 (Apr 1952)
Rulo, NE	498.1	328,000 (Jul 2011)		358,000 (Apr 1952)
St. Joseph, MO	448.2	335,000 (Jul 1993)		397,000 (Apr 1952)
Kansas City, MO	366.1	541,000 (Jul 1993)		625,000 (Jun 1844)
Waverly, MO	293.2	633,000 (Jul 1993)		549,000 (Jul 1951)
Boonville, MO	196.6	755,000 (Jul 1993)		710,000 (Jun 1844)
Hermann, MO	97.9	750,000 (Jul 1993)		700,000 (Jun 1844)
* NA – Not Applicable as there is not enough historic record				

TABLE 1 – Reservoir and Channel Flood Discharge Records

Gage Location	River Mile	2006 CRP Stage (ft)	Approximate Discharge at 2006 CRP Stage (cfs)	Full Service Navigation Discharge (cfs)	Minimum Service Navigation Discharge (cfs)
Sioux City, IA	732.3	14.9	30,500	31,000	25,000
Decatur, NE	691.0	22.1	31,000		
Blair, NE	648.3	15.4	NA*		
Omaha, NE	615.9	16.7	33,400	31,000	25,000
Plattsmouth, NE	591.5	16.3	NA		
Nebraska City, NE	562.6	9.7	37,500	37,000	31,000
Brownville, NE	535.3	24.9	NA		
Rulo, NE	498.0	9.3	38,900		
		2010 CRP Stage (ft)	Approximate Discharge at 2010 CRP Stage (cfs)		
St. Joseph, MO	448.2	7.7	40,600		
Atchison, KS	422.6	11.6	NA		
Kansas City, MO	366.1	10.0	44,200	41,000	35,000
Napoleon, MO	328.7	7.2	NA		
Lexington, MO	317.3	13.6	NA		
Waverly, MO	293.2	11.1	45,100	41,900***	39,000***
Miami, MO	262.6	8.4	NA		
Glasgow, MO	226.3	12.8	NA		
Boonville, MO	196.6	8.1	48,300	45,100***	42,000***
Jefferson City, MO	143.9	8.2**	NA		
Gasconade Harbor	104.5	9.6	NA		
Hermann, MO	97.9	7.1	55,900	52,700***	50,000***
Washington, MO	67.6	3.3**	NA		
St. Charles, MO	28.2	10.1	55,900	52,700***	50,000***
* NA – Not Applicable					
** Elevation Datum NAVD88					
***Navigation Targets not used below Kansas City. Calculated Full Service Flows and Minimum Service Flows					

TABLE 2 – Construction Reference Plane Stage & Discharge and Navigation Service Discharge

Gage Location	River Mile	Flood Stage (ft)	Approximate Flood Stage Discharge (cfs)	Extreme High Water Watch Stages (ft)	Extreme High Water Watch Discharge (cfs)
Sioux City, IA	732.3	30	134,000	30 & Above	134,000+
Decatur, NE	691.0	35	101,000	35	101,000
Blair, NE *	648.3	29	NA	29	NA
Omaha, NE	615.9	29	139,000	29 & Above	139,000+
Plattsmouth, NE *	591.5	26	NA	26	NA
Nebraska City, NE	562.6	18	80,700	17 & Above	74,000+
Brownville, NE *	535.3	32	NA	31 & Above	NA
Rulo, NE	498.0	17	84,000	17 & Above	84,000+
St. Joseph, MO	448.2	17	88,000	20 & Above	118,000+
Atchison, KS**	422.6	22	108,000	26 & Above	-----
Kansas City, MO	366.1	32	231,000	35 & Above	274,000+
Napoleon, MO	328.7	17	107,000	-----	-----
Lexington, MO	317.3	22	110,000	-----	-----
Waverly, MO	293.2	20	114,000	25 & Above	167,000+
Miami, MO	262.6	18	128,000	25 & Above	185,000+
Glasgow, MO	226.3	25	147,000	27 & Above	204,000+
Boonville, MO	196.6	21	160,000	25 & Above	214,000+
Jefferson City, MO	143.9	23	182,000	26 & Above	238,000+
Gasconade Harbor	104.5	22	197,000	-----	-----
Hermann, MO	97.9	21	200,000	25 & Above	255,000+
Washington, MO	67.6	20	238,000	26 & Above	268,000+
St. Charles, MO	28.2	25	214,000	27 & Above	280,000+
* This Gage is not rated					
** The bridge tender for the Union Pacific RR Bridge at Atchison, KS may close the swingspan section when the Atchison river gage reaches a stage of 26 feet with a rising river predicted. The concern is drift lodging into the bull gear of the center pier preventing the closing of the bridge to railroad traffic. The bridge tender checks for any nearby towboat traffic to coordinate the closing. See contact list for bridge tender information.					

TABLE 3 – Flood Stages and Extreme High Water Watch Stages

ACTION PLAN TABLE
HIGH WATER
Sioux City, IA to the Mouth
RM 734.8 – 0.0

ACTION PLAN TABLE – HIGH WATER, Sioux City Reach RM 734.8 – 630.0

CRITICAL LOCATION DESCRIPTION	TRIGGER READING (Feet)	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
	Sioux City 28.0 Omaha 21.0	Rising		Normal Operations		As stage rises at gages listed or series of gage locations at other reaches consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gage frequently.
	Sioux City 29.0 Omaha 26.0	Rising		High Water	Watch	Initiate communication plan. Issue advisory that indicates high water and drift potential. All tow boat operators should be experienced in high water operations. Advise the use of caution and minimize wake. Consider tow restrictions, hp requirements, dangers of down streaming, discuss mooring arrangements, and bridge clearance issues.
River Mile 734.8 - 630.0 SIOUX CITY REACH Missouri River Gages Sioux City – RM 732.3 Omaha - RM 615.9	Sioux City 30.0 Omaha 29.0	Rising		Extreme High Water	Action	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions to determine the need to establish a safety zone/river closure. Discourage/prohibit recreational vessel transit, assess bridge clearances in advance, minimize speed to avoid wake damage, favor center of channel, prohibit laying up on levees, caution in passing/meeting situations, monitor fleeting areas and mooring lines/arrangements, review anchoring req, have towboat attend fleets at all times, coordinate with adjacent facilities/fleeters for assistance in event of breakaway, pre-identify lay-up areas in event of river closure, allow fleeting to continue, advise swift current caution. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Sioux City 29.0 Omaha 26.0	Falling		High Water	Recovery	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions if and when to reopen the river (if a safety zone or closure was established). Determine what action advisories need to be removed or remain depending on river conditions. Issue advisory that indicates high water and to exercise caution. Users to report hazardous conditions to USCG. Initiate communications plan if river level begins rising.
	Sioux City 28.0 Omaha 21.0	Falling		Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.

ACTION PLAN TABLE – HIGH WATER, Omaha Reach RM 630.0 – 500.0

CRITICAL LOCATION DESCRIPTION	TRIGGER READING (Feet)	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
	Omaha 21.0 Rulo 15.0	Rising		Normal Operations		As stage rises at gages listed or series of gage locations at other reaches consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gage frequently.
	Omaha 26.0 Rulo 17.0	Rising		High Water	Watch	Initiate communication plan. Issue advisory that indicates high water and drift potential. All tow boat operators should be experienced in high water operations. Advise the use of caution and minimize wake. Consider tow restrictions, hp requirements, dangers of down streaming, discuss mooring arrangements, and bridge clearance issues.
River Mile 630.0-500.0 OMAHA REACH Missouri River Gages Omaha – RM 615.9 Rulo – RM 498.0	Omaha 29.0 Rulo 20.0	Rising		Extreme High Water	Action	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions to determine the need to establish a safety zone/river closure. Discourage/prohibit recreational vessel transit, assess bridge clearances in advance, minimize speed to avoid wake damage, favor center of channel, prohibit laying up on levees, caution in passing/meeting situations, monitor fleeting areas and mooring lines/arrangements, review anchoring req, have towboat attend fleets at all times, coordinate with adjacent facilities/fleeters for assistance in event of breakaway, pre-identify lay-up areas in event of river closure, allow fleeting to continue, advise swift current caution. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Omaha 26.0 Rulo 17.0	Falling		High Water	Recovery	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions if and when to reopen the river (if a safety zone or closure was established). Determine what action advisories need to be removed or remain depending on river conditions. Issue advisory that indicates high water and to exercise caution. Users to report hazardous conditions to USCG. Initiate communications plan if river level begins rising.
	Omaha 21.0 Rulo 15.0	Falling		Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.

ACTION PLAN TABLE – HIGH WATER, St. Joseph Reach RM 500.0 – 400.0

CRITICAL LOCATION DESCRIPTION	TRIGGER READING (Feet)	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
	Rulo 15.0 St. Joseph 15.0 Atchison 21.0 Kansas City 30	Rising		Normal Operations		As stage rises at gages listed or series of gage locations at other reaches consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gage frequently.
	Rulo 17.0 St. Joseph 17.0 Atchison 22.0 Kansas City 32	Rising		High Water	Watch	Initiate communication plan. Issue advisory that indicates high water and drift potential. All tow boat operators should be experienced in high water operations. Advise the use of caution and minimize wake. Consider tow restrictions, hp requirements, dangers of down streaming, discuss mooring arrangements, and bridge clearance issues.
River Mile 500.0-400.0 ST. JOSEPH REACH Missouri River Gages Rulo – RM 498.0 St. Joseph – RM 448.2 Atchison – RM 422.6 Kansas City – RM 366.1	Rulo 20.0 St. Joseph 20.0 Atchison 26.0 RR Bridge (RM 422.6) may close span Kansas City 35	Rising		Extreme High Water	Action	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions to determine the need to establish a safety zone/river closure. Discourage/prohibit recreational vessel transit, assess bridge clearances in advance, minimize speed to avoid wake damage, favor center of channel, prohibit laying up on levees, caution in passing/meeting situations, monitor fleeting areas and mooring lines/arrangements, review anchoring req, have towboat attend fleets at all times, coordinate with adjacent facilities/fleeters for assistance in event of breakaway, pre-identify lay-up areas in event of river closure, allow fleeting to continue, advise swift current caution. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Rulo 17.0 St. Joseph 17.0 Atchison 22.0 Kansas City 32	Falling		High Water	Recovery	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions if and when to reopen the river (if a safety zone or closure was established). Determine what action advisories need to be removed or remain depending on river conditions. Issue advisory that indicates high water and to exercise caution. Users to report hazardous conditions to USCG. Initiate communications plan if river level begins rising.
	Rulo 15.0 St. Joseph 15.0 Atchison 21.0 Kansas City 30	Falling		Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.

ACTION PLAN TABLE – HIGH WATER, Kansas City Reach RM 400.0 – 300.0

CRITICAL LOCATION DESCRIPTION	TRIGGER READING (Feet)	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
	Kansas City 30 Waverly 20.0	Rising		Normal Operations		As stage rises at gages listed or series of gage locations at other reaches consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gage frequently.
	Kansas City 32 Waverly 22.0	Rising		High Water	Watch	Initiate communication plan. Issue advisory that indicates high water and drift potential. All tow boat operators should be experienced in high water operations. Advise the use of caution and minimize wake. Consider tow restrictions, hp requirements, dangers of down streaming, discuss mooring arrangements, and bridge clearance issues.
River Mile 400.0-300.0 KANSAS CITY REACH Missouri River Gages Kansas City – RM 366.1 Waverly – RM 293.2	Kansas City 35 Waverly 25.0	Rising		Extreme High Water	Action	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions to determine the need to establish a safety zone/river closure. Discourage/prohibit recreational vessel transit, assess bridge clearances in advance, minimize speed to avoid wake damage, favor center of channel, prohibit laying up on levees, caution in passing/meeting situations, monitor fleeting areas and mooring lines/arrangements, review anchoring req, have towboat attend fleets at all times, coordinate with adjacent facilities/fleeters for assistance in event of breakaway, pre-identify lay-up areas in event of river closure, allow fleeting to continue, advise swift current caution. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Kansas City 32 Waverly 22.0	Falling		High Water	Recovery	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions if and when to reopen the river (if a safety zone or closure was established). Determine what action advisories need to be removed or remain depending on river conditions. Issue advisory that indicates high water and to exercise caution. Users to report hazardous conditions to USCG. Initiate communications plan if river level begins rising.
	Kansas City 30 Waverly 20.0	Falling		Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.

ACTION PLAN TABLE – HIGH WATER, Brunswick Reach RM 300.0 – 200.0

CRITICAL LOCATION DESCRIPTION	TRIGGER READING (Feet)	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
	Waverly 20.0 Miami 18.0 Glasgow 22.0 Boonville 20.0	Rising		Normal Operations		As stage rises at gages listed or series of gage locations at other reaches consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gage frequently.
	Waverly 22.0 Miami 21.0 Glasgow 25.0 Boonville 21.0	Rising		High Water	Watch	Initiate communication plan. Issue advisory that indicates high water and drift potential. All tow boat operators should be experienced in high water operations. Advise the use of caution and minimize wake. Consider tow restrictions, hp requirements, dangers of down streaming, discuss mooring arrangements, and bridge clearance issues.
River Mile 300.0-200.0 BRUNSWICK REACH Missouri River Gages Waverly – RM 293.2 Miami – RM 262.6 Glasgow – RM 226.3 Boonville – RM 196.6	Waverly 25.0 Miami 25.0 Glasgow 27.0 Boonville 25.0	Rising		Extreme High Water	Action	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions to determine the need to establish a safety zone/river closure. Discourage/prohibit recreational vessel transit, assess bridge clearances in advance, minimize speed to avoid wake damage, favor center of channel, prohibit laying up on levees, caution in passing/meeting situations, monitor fleeting areas and mooring lines/arrangements, review anchoring req, have towboat attend fleets at all times, coordinate with adjacent facilities/fleeters for assistance in event of breakaway, pre-identify lay-up areas in event of river closure, allow fleeting to continue, advise swift current caution. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Waverly 22.0 Miami 21.0 Glasgow 25.0 Boonville 21.0	Falling		High Water	Recovery	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions if and when to reopen the river (if a safety zone or closure was established). Determine what action advisories need to be removed or remain depending on river conditions. Issue advisory that indicates high water and to exercise caution. Users to report hazardous conditions to USCG. Initiate communications plan if river level begins rising.
	Waverly 20.0 Miami 18.0 Glasgow 22.0 Boonville 20.0	Falling		Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.

ACTION PLAN TABLE – HIGH WATER, Jefferson Reach RM 200.0 – 100.0

CRITICAL LOCATION DESCRIPTION	TRIGGER READING (Feet)	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
	Boonville 20.0 Jeff. City 22.0 Hermann 20.0	Rising		Normal Operations		As stage rises at gages listed or series of gage locations at other reaches consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gage frequently.
	Boonville 21.0 Jefferson City 23.0 Hermann 21.0	Rising		High Water	Watch	Initiate communication plan. Issue advisory that indicates high water and drift potential. All tow boat operators should be experienced in high water operations. Advise the use of caution and minimize wake. Consider tow restrictions, hp requirements, dangers of down streaming, discuss mooring arrangements, and bridge clearance issues.
River Mile 200.0-100.0 JEFFERSON REACH Missouri River Gages Boonville – RM 196.6 Jefferson City – RM 143.9 Hermann – RM 97.9	Boonville 25.0 Jefferson City 26.0 Hermann 25.0	Rising		Extreme High Water	Action	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions to determine the need to establish a safety zone/river closure. Discourage/prohibit recreational vessel transit, assess bridge clearances in advance, minimize speed to avoid wake damage, favor center of channel, prohibit laying up on levees, caution in passing/meeting situations, monitor fleeting areas and mooring lines/arrangements, review anchoring req, have towboat attend fleets at all times, coordinate with adjacent facilities/fleeters for assistance in event of breakaway, pre-identify lay-up areas in event of river closure, allow fleeting to continue, advise swift current caution. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Boonville 21.0 Jefferson City 23.0 Hermann 21.0	Falling		High Water	Recovery	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions if and when to reopen the river (if a safety zone or closure was established). Determine what action advisories need to be removed or remain depending on river conditions. Issue advisory that indicates high water and to exercise caution. Users to report hazardous conditions to USCG. Initiate communications plan if river level begins rising.
	Boonville 20.0 Jeff. City 22.0 Hermann 20.0	Falling		Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.

ACTION PLAN TABLE – HIGH WATER, Washington Reach RM 100.0 – 0.0

CRITICAL LOCATION DESCRIPTION	TRIGGER READING	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
	Hermann 20.0 Washington 19 St. Charles 22.0	Rising		Normal Operations		As stage rises at gages listed or series of gage locations at other reaches consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gage frequently.
	Hermann 21.0 Washington 20 St. Charles 25.0	Rising		High Water	Watch	Initiate communication plan. Issue advisory that indicates high water and drift potential. All tow boat operators should be experienced in high water operations. Advise the use of caution and minimize wake. Consider tow restrictions, hp requirements, dangers of down streaming, discuss mooring arrangements, and bridge clearance issues.
River Mile 100.0-0.0 WASHINGTON REACH Missouri River Gages Hermann – RM 97.9 Washington – RM 67.6 St. Charles – RM 28.2	Hermann 25.0 Washington 26 St. Charles 27.0	Rising		Extreme High Water	Action	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions to determine the need to establish a safety zone/river closure. Discourage/prohibit recreational vessel transit, assess bridge clearances in advance, minimize speed to avoid wake damage, favor center of channel, prohibit laying up on levees, caution in passing/meeting situations, monitor fleeting areas and mooring lines/arrangements, review anchoring req, have towboat attend fleets at all times, coordinate with adjacent facilities/fleeters for assistance in event of breakaway, pre-identify lay-up areas in event of river closure, allow fleeting to continue, advise swift current caution. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Hermann 21.0 Washington 20 St. Charles 25.0	Falling		High Water	Recovery	Use stage along with high current reports, impacted river reach, towboat positions and levee conditions if and when to reopen the river (if a safety zone or closure was established). Determine what action advisories need to be removed or remain depending on river conditions. Issue advisory that indicates high water and to exercise caution. Users to report hazardous conditions to USCG. Initiate communications plan if river level begins rising.
	Hermann 20.0 Washington 19 St. Charles 22.0	Falling		Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.

MISSOURI RIVER WAP ANNEX HIGH WATER STAGE TRIGGER TABLE – 2011 Version

RISING GAGE READING***

Reach	Gage Location	No Action	Trigger Stage Reading (ft)*		
			Normal Operations	High Water	Extreme High Water
SIOUX CITY REACH RM 734.8 - 630	Sioux City	< 28	28 - 29	29 - 30	> 30
	Omaha	< 21	21 - 26	26 - 29	> 29
OMAHA REACH RM 630 - 500	Omaha	< 21	21 - 26	26 - 29	> 29
	Rulo	< 15	15 - 17	17 - 20	> 20
ST JOSEPH REACH RM 500 - 400	Rulo	< 15	15 - 17	17 - 20	> 20
	St. Joseph	< 15	15 - 17	17 - 20	> 20
	Atchison	< 21	21 - 22	22 - 26	> 26
	Kansas City	< 30	30 - 32	32 - 35	> 35
KANSAS CITY REACH RM 400 - 300	Kansas City	< 30	30 - 32	32 - 35	> 35
	Waverly	< 20	20 - 22	22 - 25	> 25
BRUNSWICK REACH RM 300 - 200	Waverly	< 20	20 - 22	22 - 25	> 25
	Miami	< 18	18 - 21	21 - 25	> 25
	Glasgow	< 22	22 - 25	25 - 27	> 27
	Boonville	< 20	20 - 21	21 - 25	> 25
JEFFERSON REACH RM 200 - 100	Boonville	< 20	20 - 21	21 - 25	> 25
	Jefferson City	< 22	22 - 23	23 - 26	> 26
	Hermann	< 20	20 - 21	21 - 25	> 25
HERMANN REACH RM 100 - 0	Hermann	< 20	20 - 21	21 - 25	> 25
	Washington	< 19	19 - 20	20 - 26	> 26
	St. Charles	< 22	22 - 25	25 - 27	> 27

6:00 am NWS	National Weather Service Forecast – 6 am & 5 day				
Gage Stage Today (ft) date	Gage Stage Forecast (ft) date	Gage Stage Forecast (ft) date	Gage Stage Forecast (ft) date	Gage Stage Forecast (ft) date	Gage Stage Forecast (ft) date

* NOTE: For Falling Gage Reading Review the Table Columns from Right to Left

**NOTE: Color Code the today and forecasted stage readings for Visual Display

***NOTE: Trigger Stages are informational and not used as absolute decision points

	Normal Operations**
	High Water**
	Extreme High Water**
	No Action

ACTION PLAN TABLES

LOW WATER

Kansas City, MO to the Mouth
RM 366.1 – 0.0

ACTION PLAN TABLE – LOW WATER, Kansas City Reach 366.1 - 300

CRITICAL REACH DESCRIPTION	TRIGGER READING DISCHARGE	TRIGGER READING STAGE	TREND	DESCRIPTION	PHASE	ACTION
	Kansas City 35,000 cfs Waverly 39,000 cfs	Kansas City 8.0 feet Waverly 10.2 feet	Falling	Normal Operations		As discharge falls or series of gage locations fall consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gauges frequently. USACE to plan additional channel reconnaissance surveys.
	Kansas City 34,000 cfs Waverly 37,000 cfs	Kansas City 7.8 feet Waverly 10.0 feet	Falling	Low Water	Watch	Initiate communication plan. Issue advisory that indicates low water. Advise the use of caution. Consider tow restrictions. USACE initiates increased channel reconnaissance surveys.
River Mile 366.1 - 300 KANSAS CITY REACH Missouri River Gages KC - RM 366.1 Waverly - RM 293.2	Kansas City < 34,000 cfs Waverly < 37,000 cfs	Kansas City < 7.8 feet Waverly < 10.0 feet	Falling	Extreme Low Water	Action	Issue advisory that indicates extreme low water. USCG will reset buoys in those narrow channel locations within reach. USACE will continue increased level of channel reconnaissance. Emergency Dredging may be required at some locations. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Kansas City < 34,000 cfs Waverly < 37,000 cfs	Kansas City < 7.8 feet Waverly < 10.0 feet	Rising	Extreme Low Water	Recovery	Continue advisory that indicates extreme low water. USCG will monitor buoys in those narrow channel locations within reach. USACE will continue increased level of channel reconnaissance. Emergency dredging may be required at some locations.
	Kansas City 34,000 cfs Waverly 37,000 cfs	Kansas City 7.8 feet Waverly 10.0 feet	Rising	Low Water	Recovery	Issue advisory that indicates changes from extreme low water to low water. USACE reconnaissance to continue.
	Kansas City 35,000 cfs Waverly 39,000 cfs	Kansas City 8.0 feet Waverly 10.2 feet	Rising	Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.

ACTION PLAN TABLE – LOW WATER, Brunswick Reach 300 - 200

CRITICAL REACH DESCRIPTION	TRIGGER READING DISCHARGE	TRIGGER READING STAGE	TREND	DESCRIPTION	PHASE	ACTION
	Waverly 39,000 cfs	Waverly 10.2 feet				As discharge falls or series of gage locations fall consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gauges frequently. USACE to plan additional channel reconnaissance surveys.
	Boonville 42,000 cfs	Boonville 7.0 feet	Falling	Normal Operations		
	Waverly 37,000 cfs	Waverly 10.0 feet				Initiate communication plan. Issue advisory that indicates low water. Advise the use of caution. Consider tow restrictions. USACE initiates increased channel reconnaissance surveys.
	Boonville 40,000 cfs	Boonville 6.5 feet	Falling	Low Water	Watch	
River Mile 300 - 200 BRUNSWICK REACH Missouri River Gages Waverly - RM 293.2 Boonville - RM 196.6	Waverly < 37,000 cfs	Waverly < 10.0 feet				Issue advisory that indicates extreme low water. USCG will reset buoys in those narrow channel locations within reach. USACE will continue increased level of channel reconnaissance. Emergency Dredging may be required at some locations. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Boonville < 40,000 cfs	Boonville < 6.5 feet	Falling	Extreme Low Water	Action	
	Waverly < 37,000 cfs	Waverly < 10.0 feet				Continue advisory that indicates extreme low water. USCG will monitor buoys in those narrow channel locations within reach. USACE will continue increased level of channel reconnaissance. Emergency dredging may be required at some locations.
	Boonville < 40,000 cfs	Boonville < 6.5 feet	Rising	Extreme Low Water	Recovery	
	Waverly 37,000 cfs	Waverly 10.0 feet				Issue advisory that indicates changes from extreme low water to low water. USACE reconnaissance to continue.
	Boonville 40,000 cfs	Boonville 6.5 feet	Rising	Low Water	Recovery	
	Waverly 39,000 cfs	Waverly 10.2 feet				Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.
	Boonville	Boonville	Rising	Normal Operations	Recovery	

	42,000 cfs	7.0 feet				
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ACTION PLAN TABLE – LOW WATER, Jefferson Reach 200 - 100

CRITICAL REACH DESCRIPTION	TRIGGER READING DISCHARGE	TRIGGER READING STAGE	TREND	DESCRIPTION	PHASE	ACTION
	Boonville 42,000 cfs	Boonville 7.0 feet				As discharge falls or series of gage locations fall consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gauges frequently. USACE to plan additional channel reconnaissance surveys.
	Hermann 50,000 cfs	Hermann 6.0 feet	Falling	Normal Operations		
	Boonville 40,000 cfs	Boonville 6.5 feet				Initiate communication plan. Issue advisory that indicates low water. Advise the use of caution. Consider tow restrictions. USACE initiates increased channel reconnaissance surveys.
	Hermann 47,000 cfs	Hermann 5.2 feet	Falling	Low Water	Watch	
River Mile 200 - 100 JEFFERSON REACH Missouri River Gages Boonville - RM 196.6 Hermann - RM 97.9	Boonville < 40,000 cfs	Boonville < 6.5 feet				Issue advisory that indicates extreme low water. USCG will reset buoys in those narrow channel locations within reach. USACE will continue increased level of channel reconnaissance. Emergency Dredging may be required at some locations. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Hermann < 47,000 cfs	Hermann < 5.2 feet	Falling	Extreme Low Water	Action	
	Boonville < 40,000 cfs	Boonville < 6.5 feet				Continue advisory that indicates extreme low water. USCG will monitor buoys in those narrow channel locations within reach. USACE will continue increased level of channel reconnaissance. Emergency dredging may be required at some locations.
	Hermann < 47,000 cfs	Hermann < 5.2 feet	Rising	Extreme Low Water	Recovery	
	Boonville 40,000 cfs	Boonville 6.5 feet				Issue advisory that indicates changes from extreme low water to low water. USACE reconnaissance to continue.
	Hermann 47,000 cfs	Hermann 5.2 feet	Rising	Low Water	Recovery	

	Boonville 42,000 cfs	Boonville 7.0 feet				Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.
	Hermann 50,000 cfs	Hermann 6.0 feet	Rising	Normal Operations	Recovery	

ACTION PLAN TABLE – LOW WATER, Washington Reach 100 – 0.0

CRITICAL REACH DESCRIPTION	TRIGGER READING DISCHARGE	TRIGGER READING STAGE	TREND	DESCRIPTION	PHASE	ACTION
	Hermann 50,000 cfs	Hermann 6.0 feet	Falling	Normal Operations		As discharge falls or series of gage locations fall consider the need to initiate communications plan with USACE, MRAC, RIAC, and USCG. Monitor river gauges frequently. USACE to plan additional channel reconnaissance surveys.
	Hermann 47,000 cfs	Hermann 5.2 feet	Falling	Low Water	Watch	Initiate communication plan. Issue advisory that indicates low water. Advise the use of caution. Consider tow restrictions. USACE initiates increased channel reconnaissance surveys.
River Mile 100 - 0.0 WASHINGTON REACH Missouri River Gage Hermann - RM 97.9	Hermann < 47,000 cfs	Hermann < 5.2 feet	Falling	Extreme Low Water	Action	Issue advisory that indicates extreme low water. USCG will reset buoys in those narrow channel locations within reach. USACE will continue increased level of channel reconnaissance. Emergency Dredging may be required at some locations. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
	Hermann < 47,000 cfs	Hermann < 5.2 feet	Rising	Extreme Low Water	Recovery	Continue advisory that indicates extreme low water. USCG will monitor buoys in those narrow channel locations within reach. USACE will continue increased level of channel reconnaissance. Emergency dredging may be required at some locations.
	Hermann 47,000 cfs	Hermann 5.2 feet	Rising	Low Water	Recovery	Issue advisory that indicates changes from extreme low water to low water. USACE reconnaissance to continue.

	Hermann 50,000 cfs	Hermann 6.0 feet	Rising	Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Users to report hazardous conditions to the USCG. Cease all advisories if conditions allow.
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MISSOURI RIVER WAP ANNEX LOW WATER DISCHARGE & STAGE TRIGGER TABLE – 2011 Version

FALLING GAGE READING***

Gage Location	Minimum Service Navigation Discharge & Stage**		Normal Operations		WATCH PHASE		ACTION PHASE	
					Low Water		Extreme	
	(cfs)	(ft)	(cfs)	(ft)	(cfs)	(ft)	(cfs)	(ft)
Kansas City (RM 366.1)	35,000*	8.0	35,000 +	8.0 +	35,000 - 34,000	8.0 – 7.8	< 34,000	< 7.8
Waverly (RM 293.2)	NA	NA	39,000 +	10.2 +	39,000 - 37,000	10.2 – 10	< 37,000	< 10
Boonville (RM 196.6)	NA	NA	42,000 +	7.0 +	42,000 - 40,000	7.0 – 6.5	< 40,000	< 6.5
Hermann (RM 97.9)	NA	NA	50,000 +	6.0 +	50,000 - 47,000	6.0 – 5.2	< 47,000	< 5.2

RISING GAGE READING***

Gage Location	RECOVERY PHASES						Minimum Service Navigation Discharge & Stage	
	Extreme Low Water		Low Water		Normal Operations			
	(cfs)	(ft)	(cfs)	(ft)	(cfs)	(ft)	(cfs)	(ft)
Kansas City (RM 366.1)	< 34,000	< 7.8	34,000 - 35,000	7.8 – 8.0	35,000 +	8.0 +	35,000*	8.0
Waverly (RM 293.2)	< 37,000	< 10	37,000 - 39,000	10 – 10.2	39,000 +	10.2 +	NA	NA
Boonville (RM 196.6)	< 40,000	< 6.5	40,000 - 42,000	6.5 – 7.0	42,000 +	7.0 +	NA	NA
Hermann (RM 97.9)	< 47,000	< 5.2	47,000 - 50,000	5.2 – 6.0	50,000 +	6.0 +	NA	NA

*NOTE: The minimum navigation service flow target for Kansas City is 35,000 cubic feet per second. This flow is usually met throughout the navigation season. However during the nesting season for the endangered shore birds, the piping plover and the interior least tern, constant Gavins Point Dam releases are made. These flows are usually high enough to provide the necessary

flow targets. Occasionally drought conditions in the lower basin cause the target to be missed. If water is available in the Kansas state reservoirs, they can be used to assist in meeting the necessary target flow at Kansas City.

****NOTE:** River stages fluctuate for the same river discharge. The stages listed for the discharges shown are based on analysis of the river Stage discharge relationships during the 2007 Navigation year with updates from the 2010 CRP results.

*****NOTE:** Trigger Gage Readings are informational and not used as absolute decision points

MISSOURI RIVER WAP ANNEX LOW WATER DISCHARGE & STAGE TRIGGER FORECAST TABLE

Gage Location	Gage Discharge Today's date	Gage Discharge Forecast date						
Kansas City (RM 366.1)								
Waverly (RM 293.4)								
Boonville (RM 197.1)								
Hermann (RM 97.9)								

Gage Location	Gage Stage Today's date	Gage Stage Forecast date						
Kansas City (RM 366.1)								
Waverly (RM 293.4)								
Boonville (RM 197.1)								
Hermann (RM 97.9)								

	Normal Operations
	Low Water
	Extreme Low Water

ACTION PLAN TABLES
HIGH CURRENT
Sioux City, IA to the Mouth
RM 734.8 – 0.0

ACTION PLAN TABLE – HIGH CURRENT, Sioux City Reach RM 734.8 – 630.0

CRITICAL REACH DESCRIPTION	TRIGGER READING	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
		Rising	Sioux City 31,000 cfs Omaha 31,000 cfs	Normal Operations		As current rises towards trigger current, consider need to initiate communications plan
		Rising	Sioux City 70,000 cfs Omaha 75,000 cfs	High Current	Watch	Initiate communication plan, consider a safety advisory; Begin assessments of hazardous condition. Discuss voluntary horsepower and tow size restrictions. Cautious of accessibility terminals. Consider safety advisory for UMR fleet due to drift. Consider standing up ICP.
River Mile 734.8-630.0 SIOUX CITY REACH Missouri River Gages Sioux City - RM 732.3 Omaha - RM 615.9		Rising	Sioux City 90,000 cfs Omaha 100,000 cfs	Very High Current	Action	Use high current information along with extreme high water, flood fighting reports, impacted river reach, towboat positions and levee conditions to determine the need to revise the safety advisory, establish a safety zone, or river closure. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
		Falling	Sioux City 90,000 cfs Omaha 100,000 cfs	Very High Current	Recovery	Consider revisions to advisory on safety zone restrictions or closure. Continue to report hazardous conditions.
		Falling	Sioux City 70,000 cfs Omaha 75,000 cfs	High Current	Recovery	Consider revisions to safety advisory that indicates swift currents. Report hazardous condition. Discuss voluntary horsepower and tow size restrictions.
		Falling	Sioux City 31,000 cfs Omaha 31,000 cfs	Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Report any hazardous conditions to the USCG.

ACTION PLAN TABLE – HIGH CURRENT, Omaha Reach RM 630.0 – 500.0

CRITICAL REACH DESCRIPTION	TRIGGER READING	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
		Rising	Omaha 31,000 cfs Rulo 39,000 cfs	Normal Operations		As current rises towards trigger current, consider need to initiate communications plan
		Rising	Omaha 75,000 cfs Rulo 84,000 cfs	High Current	Watch	Initiate communication plan, consider a safety advisory; Begin assessments of hazardous condition. Discuss voluntary horsepower and tow size restrictions. Cautious of accessibility terminals. Consider safety advisory for UMR fleet due to drift. Consider standing up ICP.
River Mile 630.0-500.0 OMAHA REACH Missouri River Gages Omaha - RM 615.9 Rulo – RM 498.0		Rising	Omaha 100,000 cfs Rulo 110,000 cfs	Very High Current	Action	Use high current information along with extreme high water, flood fighting reports, impacted river reach, towboat positions and levee conditions to determine the need to revise the safety advisory, establish a safety zone, or river closure. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
		Falling	Omaha 100,000 cfs Rulo 110,000 cfs	Very High Current	Recovery	Consider revisions to advisory on safety zone restrictions or closure. Continue to report hazardous conditions.
		Falling	Omaha 75,000 cfs Rulo 84,000 cfs	High Current	Recovery	Consider revisions to safety advisory that indicates swift currents. Report hazardous condition. Discuss voluntary horsepower and tow size restrictions.
		Falling	Omaha 31,000 cfs Rulo 39,000 cfs	Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Report any hazardous conditions to the USCG.

ACTION PLAN TABLE – HIGH CURRENT, St. Joseph Reach RM 500.0 – 400.0

CRITICAL REACH DESCRIPTION	TRIGGER READING	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
		Rising	Rulo 39,000 cfs Kansas City 41,000 cfs	Normal Operations		As current rises towards trigger current, consider need to initiate communications plan
		Rising	Rulo 84,000 cfs Kansas City 110,000 cfs	High Current	Watch	Initiate communication plan, consider a safety advisory; Begin assessments of hazardous condition. Discuss voluntary horsepower and tow size restrictions. Cautious of accessibility terminals. Consider safety advisory for UMR fleet due to drift. Consider standing up ICP.
River Mile 500.0-400.0 ST. JOSEPH REACH Missouri River Gages Rulo – RM 498.0 Kansas City – RM 366.1		Rising	Rulo 110,000 cfs Kansas City 160,000 cfs	Very High Current	Action	Use high current information along with extreme high water, flood fighting reports, impacted river reach, towboat positions and levee conditions to determine the need to revise the safety advisory, establish a safety zone, or river closure. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
		Falling	Rulo 110,000 cfs Kansas City 160,000 cfs	Very High Current	Recovery	Consider revisions to advisory on safety zone restrictions or closure. Continue to report hazardous conditions.
		Falling	Rulo 84,000 cfs Kansas City 110,000 cfs	High Current	Recovery	Consider revisions to safety advisory that indicates swift currents. Report hazardous condition. Discuss voluntary horsepower and tow size restrictions.
		Falling	Rulo 39,000 cfs Kansas City 41,000 cfs	Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Report any hazardous conditions to the USCG.

ACTION PLAN TABLE – HIGH CURRENT, Kansas City Reach RM 400.0 – 300.0

CRITICAL REACH DESCRIPTION	TRIGGER READING	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
		Rising	Kansas City 41,000 cfs Waverly 45,000 cfs	Normal Operations		As current rises towards trigger current, consider need to initiate communications plan
		Rising	Kansas City 110,000 cfs Waverly 114,000 cfs	High Current	Watch	Initiate communication plan, consider a safety advisory; Begin assessments of hazardous condition. Discuss voluntary horsepower and tow size restrictions. Cautious of accessibility terminals. Consider safety advisory for UMR fleet due to drift. Consider standing up ICP.
River Mile 400.0-300.0 KANSAS CITY REACH Missouri River Gages Kansas City – RM 366.1 Waverly – RM 293.2		Rising	Kansas City 160,000 cfs Waverly 167,000 cfs	Very High Current	Action	Use high current information along with extreme high water, flood fighting reports, impacted river reach, towboat positions and levee conditions to determine the need to revise the safety advisory, establish a safety zone, or river closure. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
		Falling	Kansas City 160,000 cfs Waverly 167,000 cfs	Very High Current	Recovery	Consider revisions to advisory on safety zone restrictions or closure. Continue to report hazardous conditions.
		Falling	Kansas City 110,000 cfs Waverly 114,000 cfs	High Current	Recovery	Consider revisions to safety advisory that indicates swift currents. Report hazardous condition. Discuss voluntary horsepower and tow size restrictions.
		Falling	Kansas City 41,000 cfs Waverly 45,000 cfs	Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Report any hazardous conditions to the USCG.

ACTION PLAN TABLE – HIGH CURRENT, Brunswick Reach RM 300.0 – 200.0

CRITICAL REACH DESCRIPTION	TRIGGER READING	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
		Rising	Waverly 45,000 cfs Boonville 48,000 cfs	Normal Operations		As current rises towards trigger current, consider need to initiate communications plan
		Rising	Waverly 114,000 cfs Boonville 160,000 cfs	High Current	Watch	Initiate communication plan, consider a safety advisory; Begin assessments of hazardous condition. Discuss voluntary horsepower and tow size restrictions. Cautious of accessibility terminals. Consider safety advisory for UMR fleet due to drift. Consider standing up ICP.
River Mile 300.0-200.0 BRUNSWICK REACH Missouri River Gages Waverly – RM 293.2 Boonville – RM 196.6		Rising	Waverly 167,000 cfs Boonville 214,000 cfs	Very High Current	Action	Use high current information along with extreme high water, flood fighting reports, impacted river reach, towboat positions and levee conditions to determine the need to revise the safety advisory, establish a safety zone, or river closure. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
		Falling	Waverly 167,000 cfs Boonville 214,000 cfs	Very High Current	Recovery	Consider revisions to advisory on safety zone restrictions or closure. Continue to report hazardous conditions.
		Falling	Waverly 114,000 cfs Boonville 160,000 cfs	High Current	Recovery	Consider revisions to safety advisory that indicates swift currents. Report hazardous condition. Discuss voluntary horsepower and tow size restrictions.
		Falling	Waverly 45,000 cfs Boonville 48,000 cfs	Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Report any hazardous conditions to the USCG.

ACTION PLAN TABLE – HIGH CURRENT, Jefferson Reach RM 200.0 – 100.0

CRITICAL REACH DESCRIPTION	TRIGGER READING	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
		Rising	Boonville 48,000 cfs Hermann 56,000 cfs	Normal Operations		As current rises towards trigger current, consider need to initiate communications plan
		Rising	Boonville 160,000 cfs Hermann 200,000 cfs	High Current	Watch	Initiate communication plan, consider a safety advisory; Begin assessments of hazardous condition. Discuss voluntary horsepower and tow size restrictions. Cautious of accessibility terminals. Consider safety advisory for UMR fleet due to drift. Consider standing up ICP.
River Mile 200.0-100.0 JEFFERSON REACH Missouri River Gages Boonville – RM 196.6 Hermann – RM 97.9		Rising	Boonville 214,000 cfs Hermann 255,000 cfs	Very High Current	Action	Use high current information along with extreme high water, flood fighting reports, impacted river reach, towboat positions and levee conditions to determine the need to revise the safety advisory, establish a safety zone, or river closure. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
		Falling	Boonville 214,000 cfs Hermann 255,000 cfs	Very High Current	Recovery	Consider revisions to advisory on safety zone restrictions or closure. Continue to report hazardous conditions.
		Falling	Boonville 160,000 cfs Hermann 200,000 cfs	High Current	Recovery	Consider revisions to safety advisory that indicates swift currents. Report hazardous condition. Discuss voluntary horsepower and tow size restrictions.
		Falling	Boonville 48,000 cfs Hermann 56,000 cfs	Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Report any hazardous conditions to the USCG.

ACTION PLAN TABLE – HIGH CURRENT, Washington Reach RM 100.0 – 0.0

CRITICAL REACH DESCRIPTION	TRIGGER READING	TREND	TRIGGER CURRENT	DESCRIPTION	PHASE	ACTION
		Rising	Hermann 56,000 cfs St. Charles 57,000 cfs	Normal Operations		As current rises towards trigger current, consider need to initiate communications plan
		Rising	Hermann 200,000 cfs St. Charles 214,000 cfs	High Current	Watch	Initiate communication plan, consider a safety advisory; Begin assessments of hazardous condition. Discuss voluntary horsepower and tow size restrictions. Cautious of accessibility terminals. Consider safety advisory for UMR fleet due to drift. Consider standing up ICP.
River Mile 100.0-0.0 WASHINGTON REACH Missouri River Gages Hermann – RM 97.9 St. Charles – RM 28.2		Rising	Hermann 255,000 cfs St. Charles 280,000 cfs	Very High Current	Action	Use high current information along with extreme high water, flood fighting reports, impacted river reach, towboat positions and levee conditions to determine the need to revise the safety advisory, establish a safety zone, or river closure. Consider press release, and/or JIC, and formation of Incident Command Post if needed.
		Falling	Hermann 255,000 cfs St. Charles 280,000 cfs	Very High Current	Recovery	Consider revisions to advisory on safety zone restrictions or closure. Continue to report hazardous conditions.
		Falling	Hermann 200,000 cfs St. Charles 214,000 cfs	High Current	Recovery	Consider revisions to safety advisory that indicates swift currents. Report hazardous condition. Discuss voluntary horsepower and tow size restrictions.
		Falling	Hermann 56,000 cfs St. Charles 57,000 cfs	Normal Operations	Recovery	Issue final advisory that indicates return to normal operations. Report any hazardous conditions to the USCG.

Section 5 – Risk Assessment

Sector Upper Mississippi River Marine Casualty Risk Assessment Tool Assumptions for Data

1. In the WAP process USCG Marine Casualty Data is used for two of the three risk factors. There were only two risk factors listed in the Casualty Data records used, low water and high flow. Analysis of the data plus the best judgment by experienced USCG, USACE and Industry river users were combined to finalize the rankings. For high flow the best judgment by experienced USCG, USACE and Industry river users was used.
2. The Casualty Data for the Missouri River was only available since 1998. Data used is from May 1998 to May 2005. There were only 24 USCG investigation data records for Sector Upper Mississippi River's area of responsibility on the Missouri River.
3. It is important to note that the WAP guidelines did not provide any definition for the risk factors.
4. USCG and USACE staff reviewed the Casualty Data and made decisions concerning each record.
5. As the data was reviewed, individuals conducting the reviews noted several important issues:
 - a. Shoaling could occur at any stage. In light of this, groundings occurring during a low river level condition were sought to populate the low water risk assessment.
 - b. Vessel drafts were not considered, or are they included in the records.
 - c. High flow rate could have several different affect on vessels. High flow main channel current poses timing challenges on pilots to maneuver the river bends. High flows from a flood swollen tributary can force a tow closer to the opposite bank increasing navigation risks.
 - d. Cubic feet per second (cfs) is a best determination of high flow rate rather than some velocity measurement. Velocity varies across the channel and throughout the depth of the river. As water flows down river, the differentiating depths and widths of the river constantly change velocities. Velocity measurements are not normally taken on the river except at the gage locations to calibrate the stage discharge rating curves. Unless a casualty happens at one of the gage locations, velocity measurements will not be available at the casualty location. Using the cfs of the river simplifies the high flow rate analysis.
6. Initial review of the records relied on the incident narrative to make a determination risk factor contribution.
7. Where information was incomplete, a review of river stage, discharge, and other casualties at the same time were viewed for clues to determine if one of two factors contributed to the casualty.

8. Experience data for the three risk factors was also collected from USCG, USACE and Industry river users. These were made up of the USCG's two buoy tenders the Gasconade and Cheyenne, the USACE river fleet vessel operators and towing company captains and pilots.
9. All the USACE, USCG and industry rankings were consolidated into a spreadsheet for comparison and averaging. Once the casualty data was screened and the experience data considered and averaged among the participants the Risk Assessment Tools were populated.
10. For WAP uniformity, High Medium, Low definitions for each of the five formula elements (obstructions to navigation, channel width, bend radius, congestion, and casualty history count) and their corresponding point value could not be changed. Also, the format of the tool could not be altered.
11. Variables that could be changed in the Risk Assessment Tool are:
 - a. The length of river sections. The river segments used were 100 mile reaches except for the 130 mile Omaha reach and the 104.8 mile Sioux City reach.
 - b. Additional specific river locations could be added. The Platte River Confluence and the Kansas River confluence locations were specifically included because they are historically known to have chronic navigation challenges, delays or grounding events. Several others were added and included in the risk ranking.
 - c. The Acceptable Risk Score
12. The casualty data is the starting point. The working group was not bound to the tool when determining appropriate operational protocols.
13. Dissection of data may have masked problem areas which could be more visible by looking at geographic points with all casualty data available. If parties are interested in further casualty data analysis or discussions apart from the WAP forum they may contact Sector Upper Mississippi River's Response Department.

How Sector Upper Mississippi River obtained Data for the Risk Assessment

	Action Description	Approximate Incident Count /Personnel Hours
1	USCG HQ provided a download of every investigation from 1990 till present filed by Sector Upper Mississippi River.	5000/9 Hours
2	Data was refined to included only marine casualties for the last seven years ending May 2005.	N/A
3	Review of each record and eliminated all marine casualties that were plainly not the result of ice, high water, low water, or high flow (i.e. fire, mechanical failure, pollution, etc...) and did not occur on one of the three rivers included in the Waterway's Action Plan.	N/A
4	Every narrative was read to determine if the incidents were plainly stated as being the result of ice, high water, low water, or high flow.	N/A
5	<p>River levels and flow rates (when and where available from USACE and NOAA records) were assigned to each remaining record. Then, a common sense approach was made with regard to river characteristics in place at the time of the incident in order to either eliminate or include each record in a particular assessment:</p> <ul style="list-style-type: none"> • If the river level was not relatively low for the locality then the record was eliminated from the low water assessment. Groundings that occurred during high water or out of the channel (i.e. pushed in to allow other vessel to transit) were eliminated from the low water assessment. This included a thoughtful look at groundings due to shoaling (which is capable of occurring regardless of river stage). • Allisions occurring during low water were eliminated from high water or high flow assessments. • Groundings on submerged objects (dikes, timbers, unknown items) were eliminated. <p>A close look at each casualty to ensure that ice, high water, low water, or high flow was a direct contributor to the casualty. (I.e. a bridge allision during high water may have been caused by high winds and had nothing to do with river stage.)</p> <p>* Steps 1-5 completed for zones 1-30</p>	400/200 Hours
6	The risk assessment was completed and validated with extensive participation from members of industry and Coast Guard Sector Upper Mississippi River. In addition to the data described above, the Coast Guard Cutter Officer in Charge summaries based on buoy placement, and a compilation of pilot data from several industries were extensively used. The Midland (April 2001) document did not contain information for the Upper Mississippi River.	NA/unkown Hours

	RISK FACTORS				
Need for Precise Control	Navigational Complexity			Congestion	Casualty History (7 yr period)
	Obstructions to Navigation	Channel Width (Full Banks)	Bend Radius		
High	Multiple Obstructions	Narrow (single passage)	Sharp bend(>180 deg)	Traffic always present	>10
Medium	Single Obstruction	Medium (dual passage possible/likely)	Gradual bend (between 90 and 180 or	Traffic sometimes present	6>x>10
Low	No Obstructions	Wide (more than 2 vessel passage possible)	No bend (>90 deg) or no river crossing	Traffic rarely present	>6

Risk Assessment

River Reach	Calculate Risk Score	Factors to Increase Likelihood of Casualty				Casualty History	Risk Score			Score
		Obstructions to Navigation	Channel Width	Bend Radius	Congestion					
100-0.0 Washington Reach		Medium	Medium	Medium	Low	Low	33			
200-100 Jefferson Reach		Medium	Medium	Medium	Low	Low	33	High	100	
300-200 Brunswick Reach		Medium	Low	High	Medium	Low	123	Medium	10	
400-300 Kansas City Reach		High	Low	Medium	Medium	Low	123	Low	1	
500-400 St. Joseph Reach		Medium	Low	Medium	Medium	Low	33			
630-500 Omaha Reach		Medium	Low	Medium	Medium	Low	33	Casualty	2X Rate	
734.8-630 Sioux City Reach		Low	Medium	Medium	Low	Low	24			
Specific Locations										
218.0 - 211.0 (Saline City and Salt Creek Bends)		High	Medium	Medium	Medium	Low	132			
228.0 (Glasgow Bend)		High	Low	Low	Low	Low	105			
336.0 (Sibley Bend)		High	Low	Low	Low	Low	105			
368.0 - 366.0 (Kansas R. Confluence – Kansas R Bend)		Medium	High	High	Low	Low	213			
423.0 (Atchison Bend)		High	Low	Low	Low	Low	105			
448.0 (St. Joseph Bend)		High	Low	Low	Low	Low	105			
555.0 - 551.0 (Upper & Lower Hamburg Bends)		Medium	Medium	Medium	Low	Low	34			
594.5 (Platte River Confluence - Papillion Bend)		Medium	Medium	Medium	Low	Low	33			
710 - 706 (Thalweg Meander - Winnebago Bend)		High	High	Medium	Low	Low	213			

Risk Assessment

River Reach	Calculate Risk Score	Factors to Increase Likelihood of Casualty				Casualty History	Risk Score			Score
		Obstructions to Navigation	Channel Width	Bend Radius	Congestion					
100-0.0 Washington Reach		High	Medium	Medium	Low	High	321			
200-100 Jefferson Reach		High	Medium	Medium	Medium	Low	132	High	100	
300-200 Brunswick Reach		High	Medium	High	Medium	Low	222	Medium	10	
400-300 Kansas City Reach		High	Medium	High	Medium	Low	222	Low	1	
500-400 St. Joseph Reach		Medium	Medium	Medium	Medium	Low	42			
630-500 Omaha Reach		Low	Medium	Medium	Low	Low	24	Casualty	2X Rate	

734.8-630 Sioux City Reach	Medium	Medium	Medium	Low	Low	33		
Specific Locations								
218.0 - 211.0 (Saline City and Salt Creek Bends)	High	High	High	Low	Low	303		
368.0 - 366.0 (Kansas R. Confluence – Kansas R Bend)	Medium	High	High	Low	Low	213		
555.0 - 551.0 (Upper & Lower Hamburg Bends)	Medium	Medium	Medium	Low	Low	33		
594.5 (Platte River Confluence - Papillion Bend)	Medium	High	Medium	Low	Low	123		
653.0 - 651.0 (Tysons Bend)	High	Medium	High	Low	Low	213		
710 - 706 (Thalweg Meander - Winnebago Bend)	High	High	Medium	Low	Low	213		

Risk Assessment

River Reach	Factors to Increase Likelihood of Casualty					Risk Score		Score
	Obstructions to Navigation	Channel Width	Bend Radius	Congestion	Casualty History			
100-0.0 Washington Reach	Medium	Medium	Medium	Low	Low	33		
200-100 Jefferson Reach	Medium	Medium	High	Low	Low	123	High	100
300-200 Brunswick Reach	High	Medium	High	Medium	Low	222	Medium	10
400-300 Kansas City Reach	High	Medium	High	Medium	Low	222	Low	1
500-400 St. Joseph Reach	Medium	Medium	Medium	Medium	Low	42		
630-500 Omaha Reach	Medium	Medium	Medium	Medium	Low	42	Casualty	2X Rate
734.8-630 Sioux City Reach	Low	Medium	Medium	Low	Low	24		
Specific Locations								
218.0 - 211.0 (Saline City and Salt Creek Bends)	High	Medium	High	Low	Low	213		
228.0 (Glasgow Bend)	High	Low	Medium	Low	Low	114		
336.0 (Sibley Bend)	High	Low	Medium	Low	Low	114		
368.0 - 366.0 (Kansas R. Confluence – Kansas R Bend)	Medium	High	High	Low	Low	213		
423.0 (Atchison Bend)	High	Low	Medium	Low	Low	114		
555.0 - 551.0 (Upper & Lower Hamburg Bends)	Medium	Medium	Medium	Low	Low	33		
594.5 (Platte River Confluence - Papillion Bend)	Medium	High	Medium	Low	Low	123		
710 - 706 (Thalweg Meander - Winnebago Bend)	High	High	Medium	Low	Low	213		

