

The Historic Missouri River Flood of 2011

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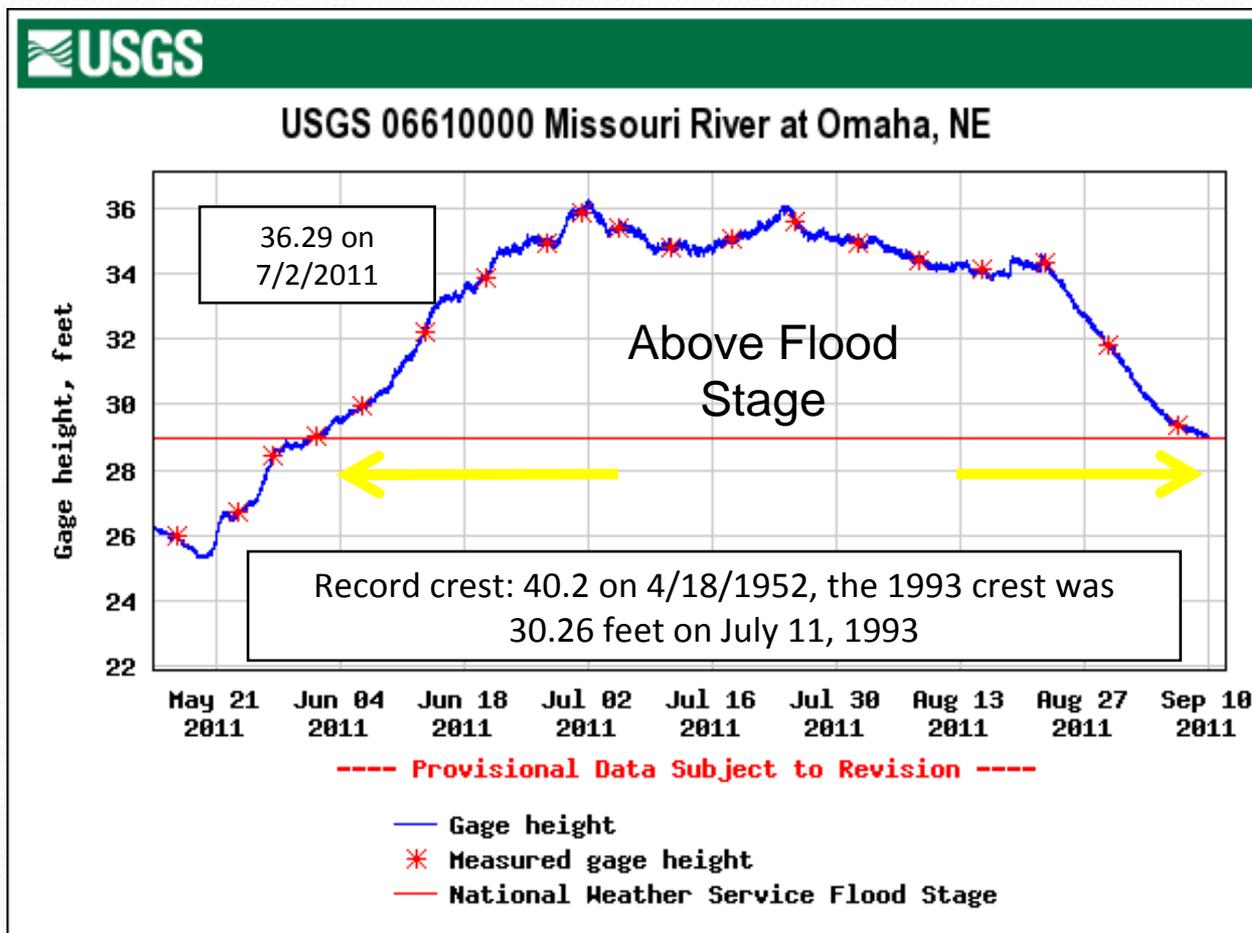
National Severe Weather Workshop
Norman, OK - March 1, 2012



Introduction

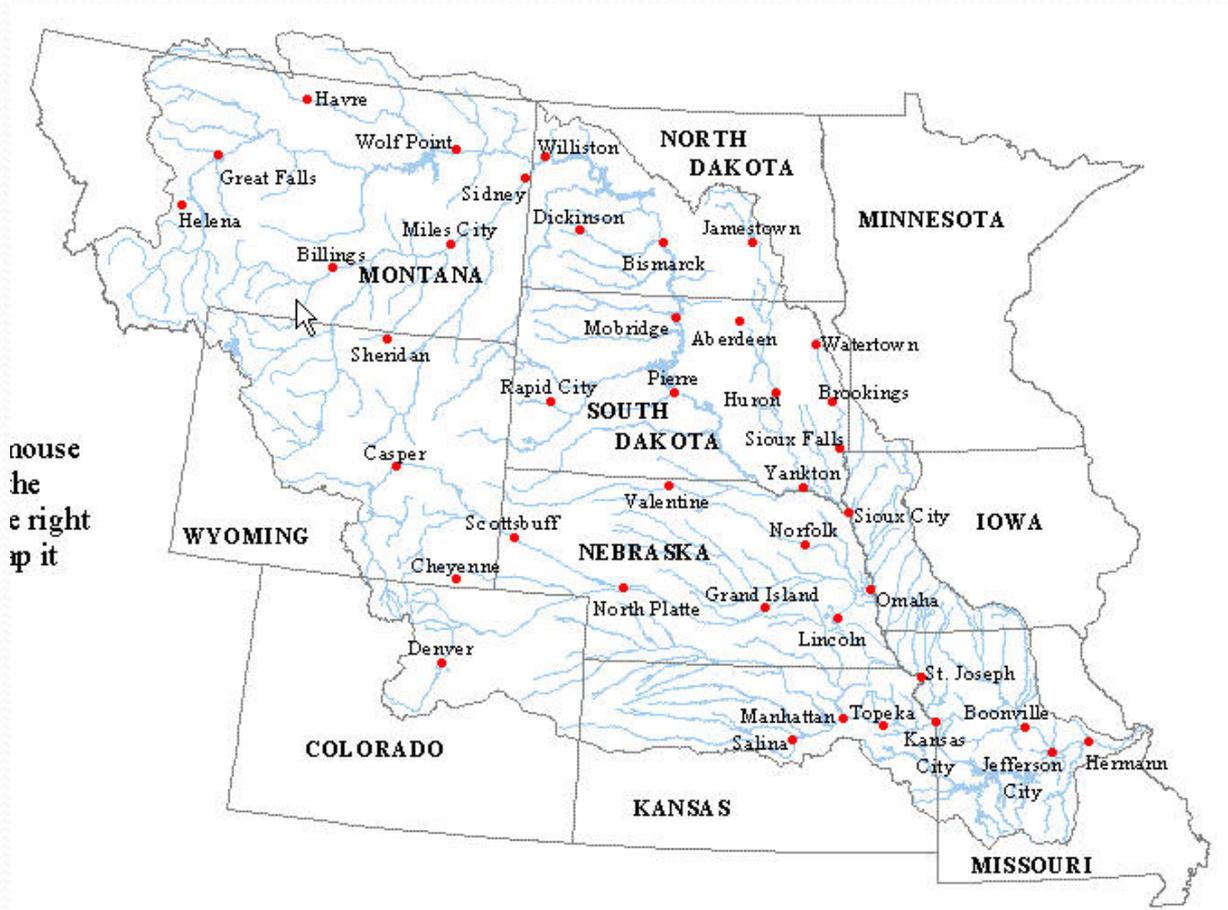
- In 2011, the Missouri River basin experienced record snowmelt and record rainfall leading to historic levels of runoff. Flooding on the Missouri River lasted for months.
- We (the Missouri River Valley) typically experience varying degrees of flooding each year associated with the spring snowmelt, then melting from the mountain snowpack and spring/summer rains in June. The Missouri River Basin reservoirs were built in large part to mitigate this flooding.
- Historical significant floods for our hydrologic service area include: 1844, 1881, 1951, 1952, 1967, 1984, 1993, 1997, 2010.
- This presentation will discuss the event and how the National Weather Service at Omaha/Valley provided decision support services to the United States Corps of Engineer (USACE) and other stakeholders.

Missouri River Stages at Omaha this Summer



Levee Tops
 Omaha Flood Wall = 41.0
 Omaha/CB Levees = 38.0
 Bellevue = 36.6

Missouri River Basin and Reservoir System



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Snowpack in the Northern Rockies

Beartooth Pass, WY



June 21, 2011 – Approaching the northeast entrance to Yellowstone Park

Glacier National Park, MT

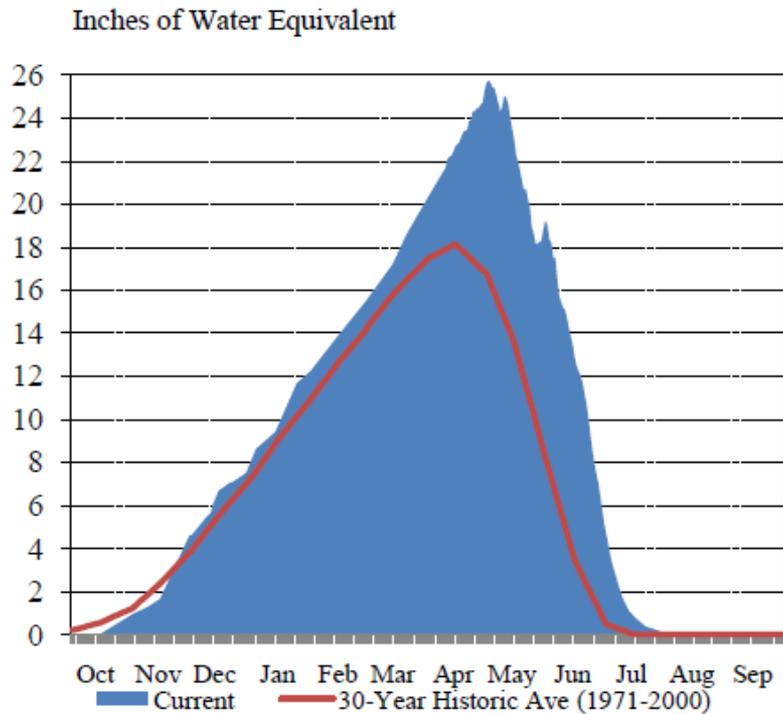


July 7, 2011 – Logan Pass Visitor Center. Going-to-the-Sun Road had their latest opening ever on July 13th

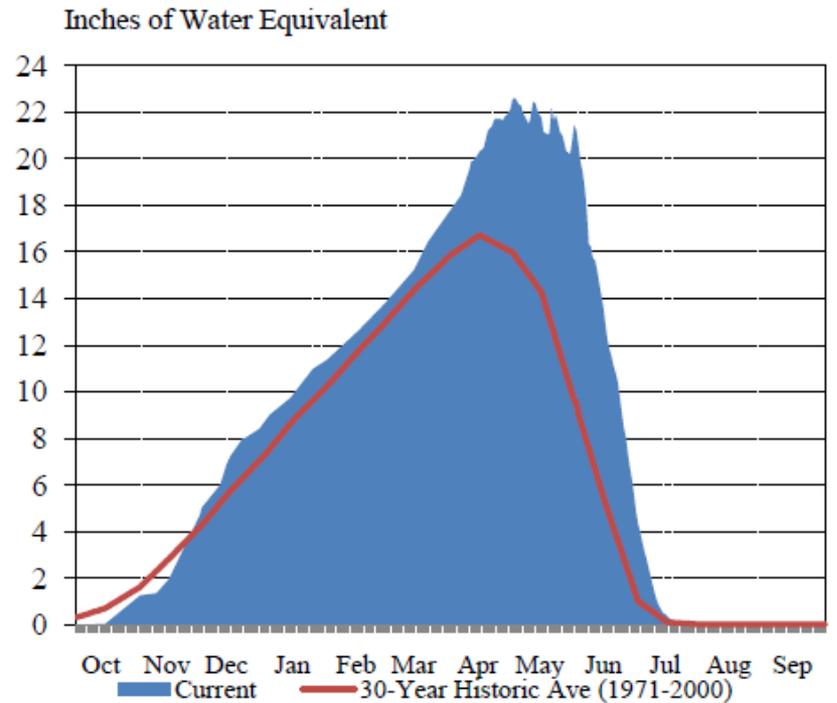
For the third time in the Montana park's 100-year history, the uppermost reaches of Going-to-the-Sun Road were closed over the 4th of July weekend.

Missouri River Basin Mountain Snowpack Water Content 2010-2011

Total above Fort Peck

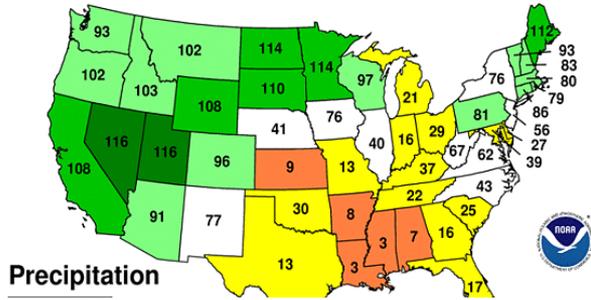


Total Fort Peck to Garrison



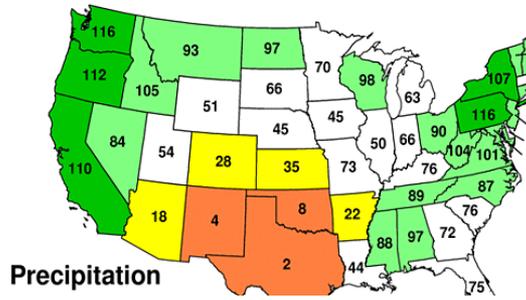
December 2010 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



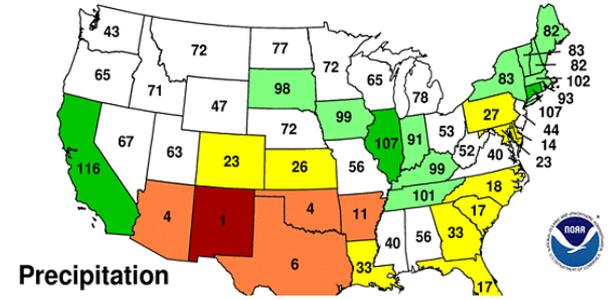
March 2011 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



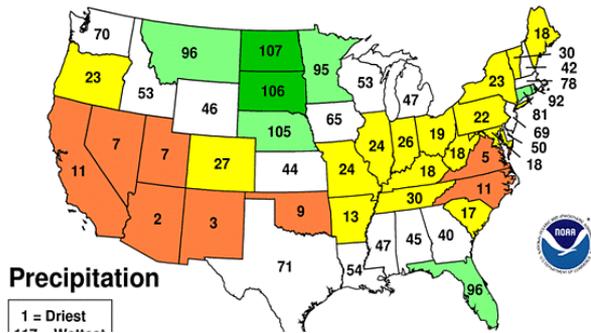
June 2011 Statewide Rank

National Climatic Data Center/NESDIS/NOAA



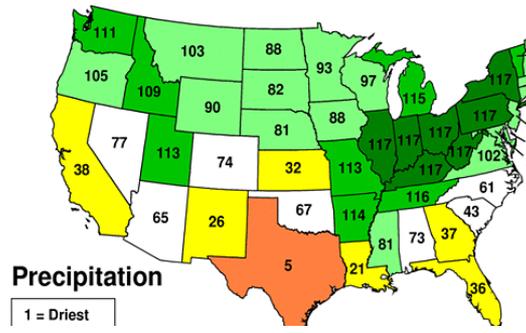
January 2011 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



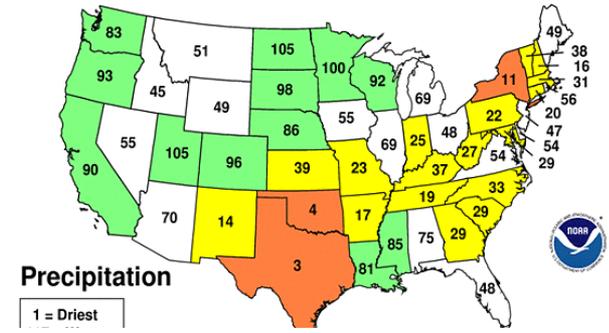
April 2011 Statewide Rank

National Climatic Data Center/NESDIS/NOAA



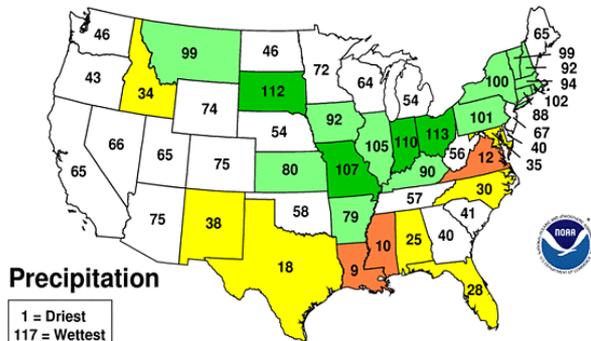
July 2011 Statewide Rank

National Climatic Data Center/NESDIS/NOAA



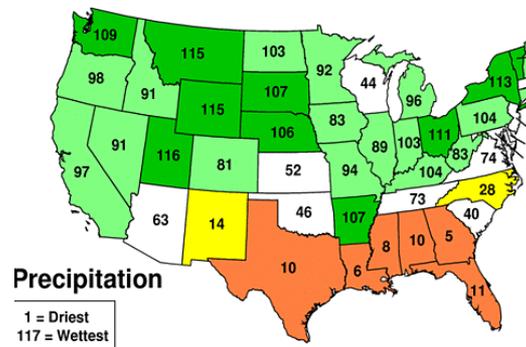
February 2011 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



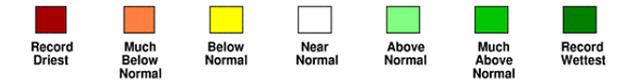
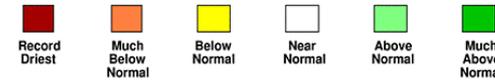
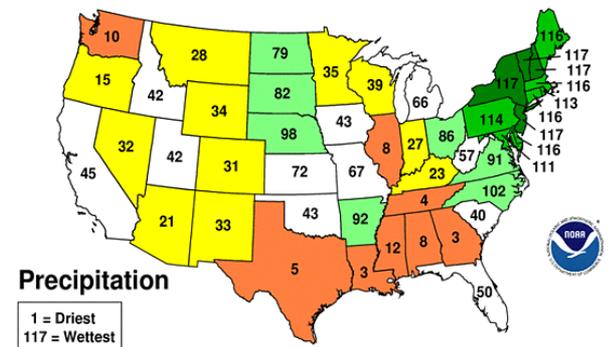
May 2011 Statewide Rank

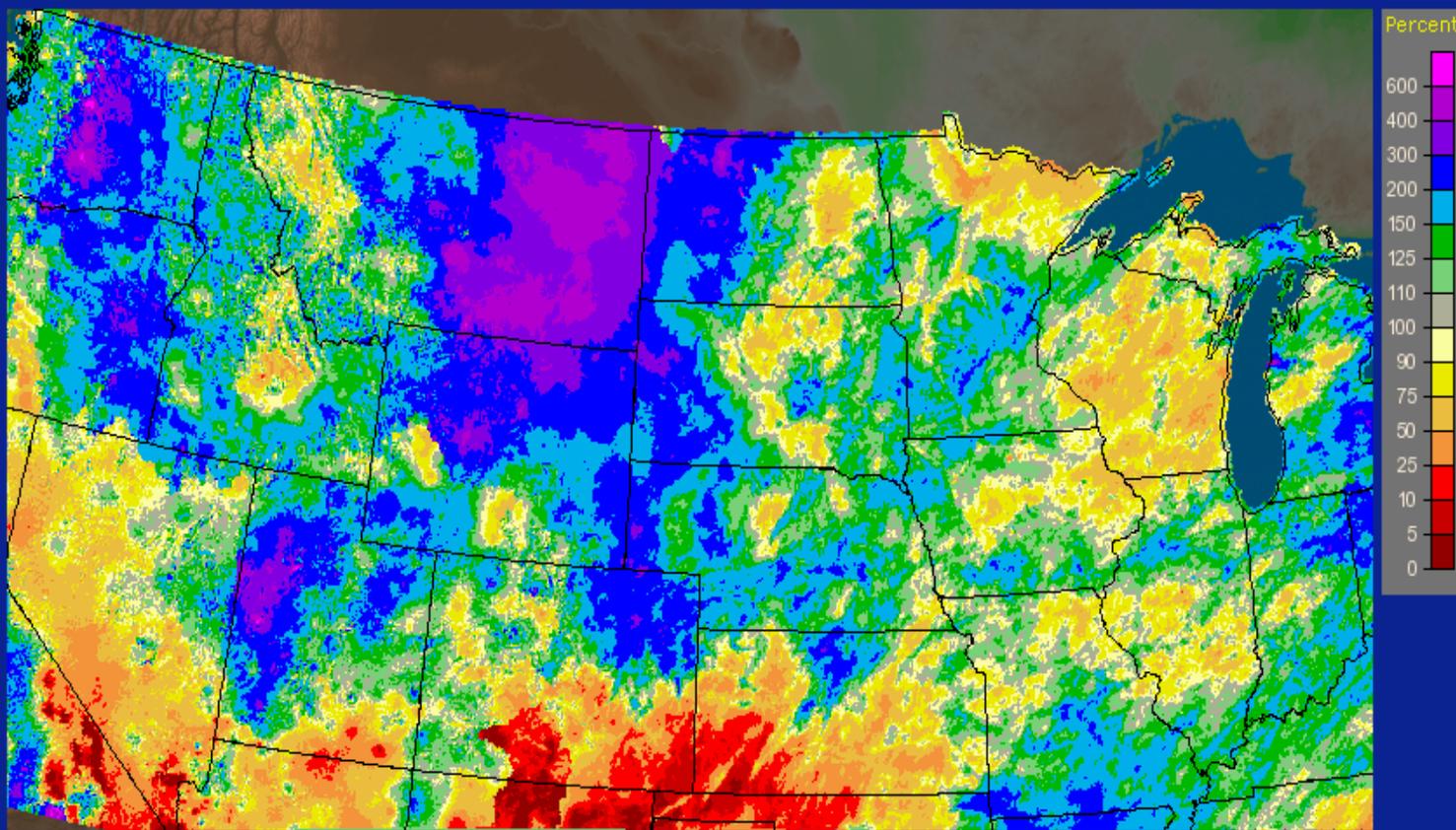
National Climatic Data Center/NESDIS/NOAA



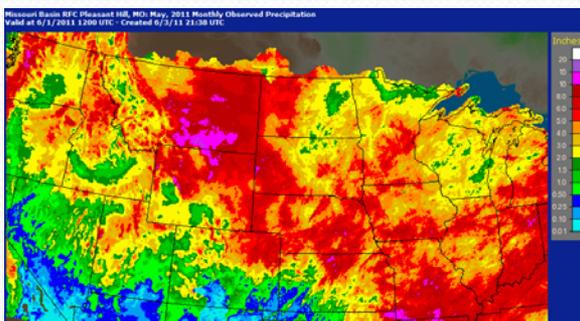
August 2011 Statewide Rank

National Climatic Data Center/NESDIS/NOAA

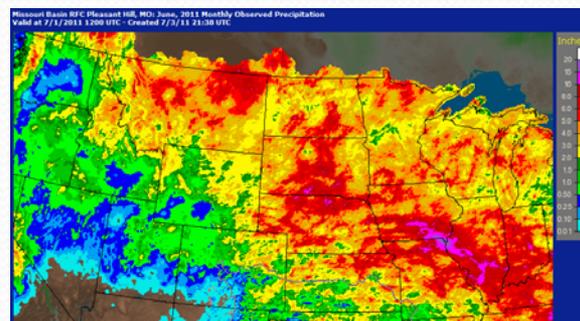




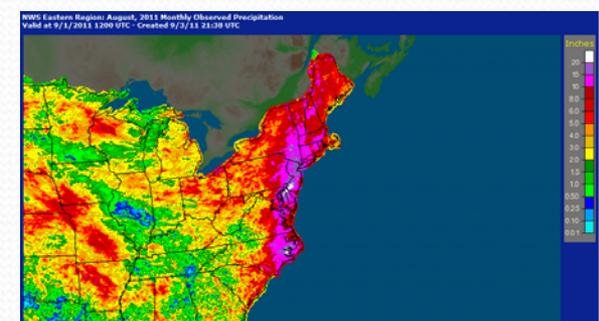
The total volume of water falling in the upper Missouri River Basin during May-June 2011 estimated to be four times that compared to what fell across the eastern U.S. during hurricane Irene



May Rainfall 2011



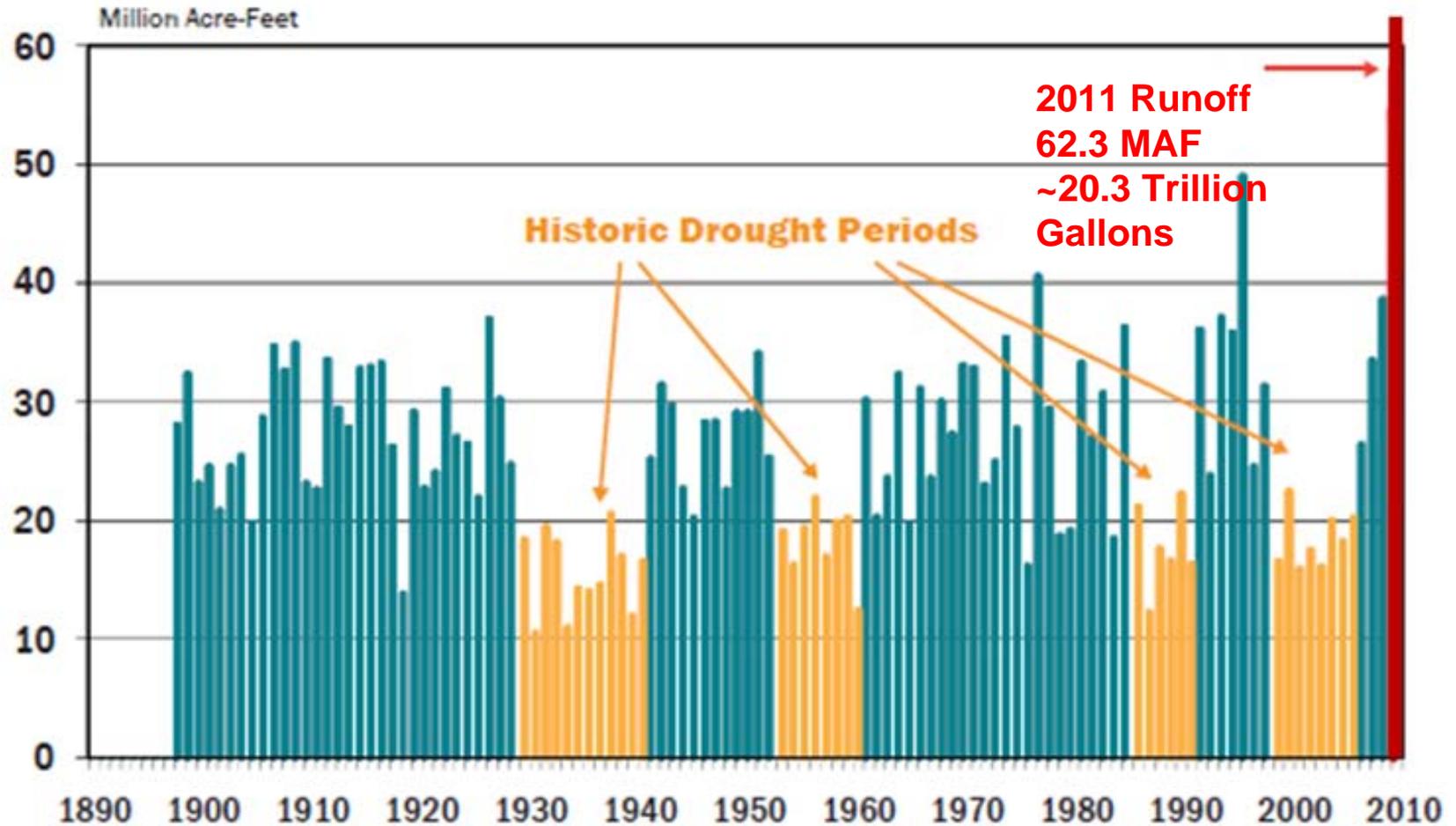
June Rainfall 2011



August Rainfall

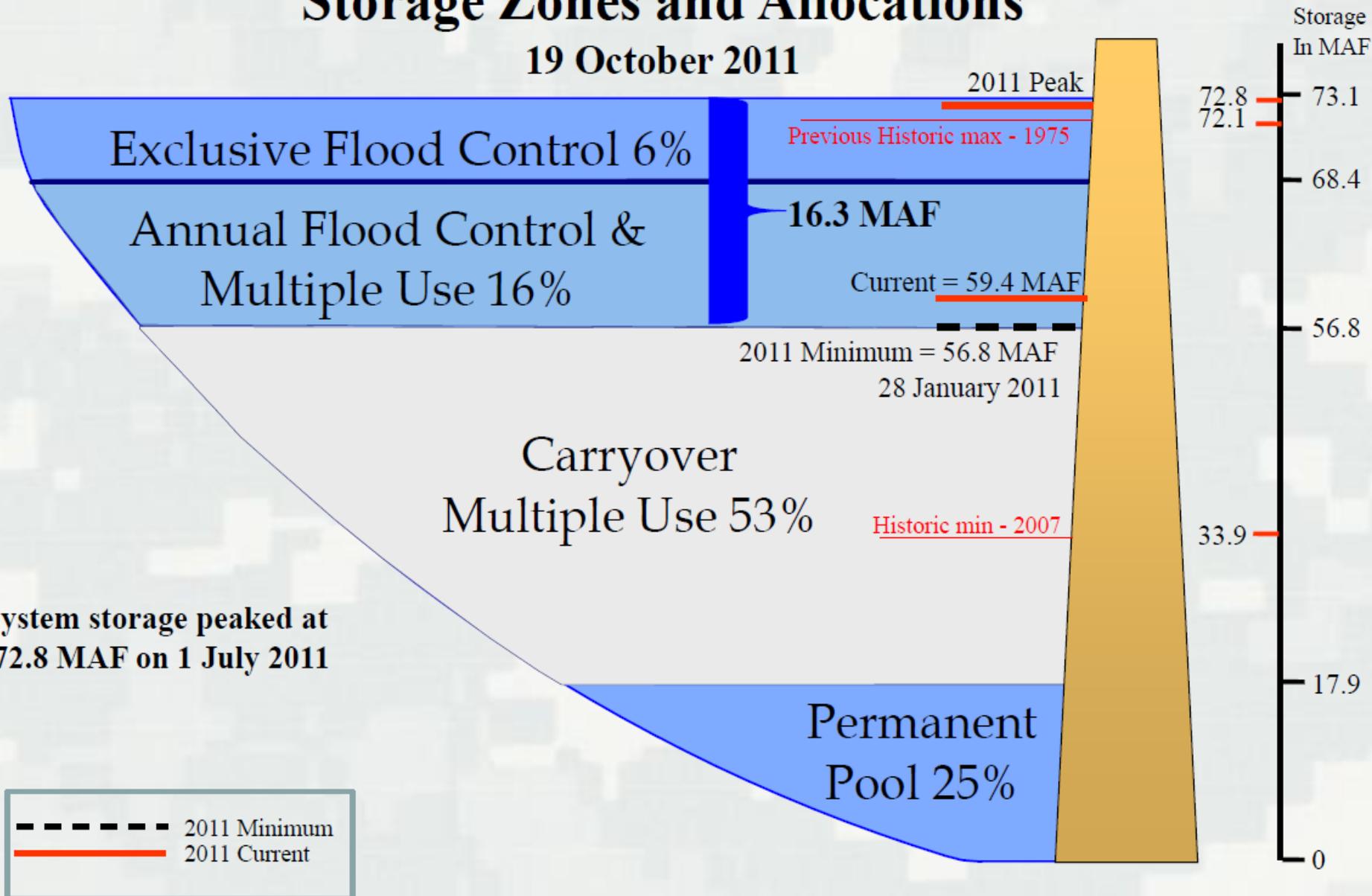
2011

Annual Runoff 1898 - 2011 Above Sioux City, Iowa



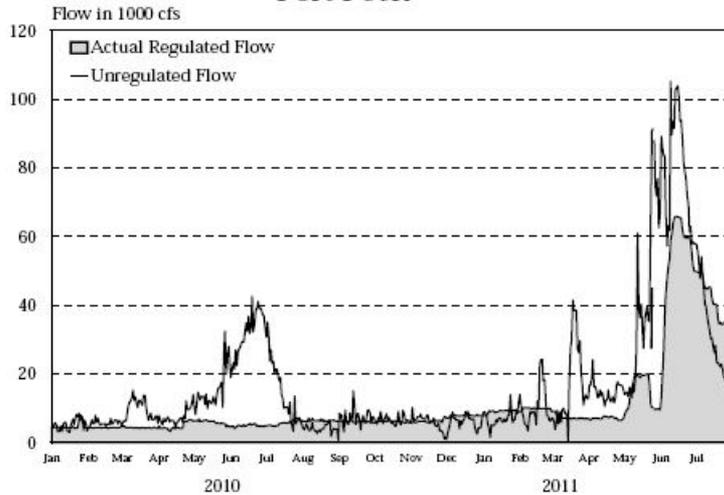
Missouri River Mainstem System Storage Zones and Allocations

19 October 2011

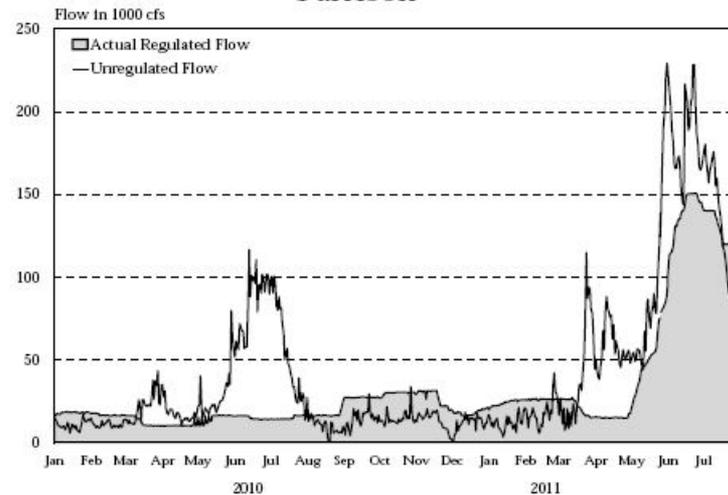


Reservoir Release and Unregulated Flow

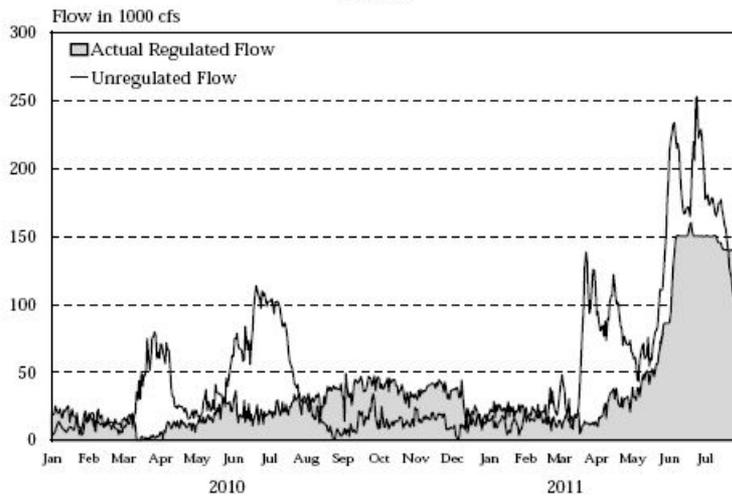
Fort Peck



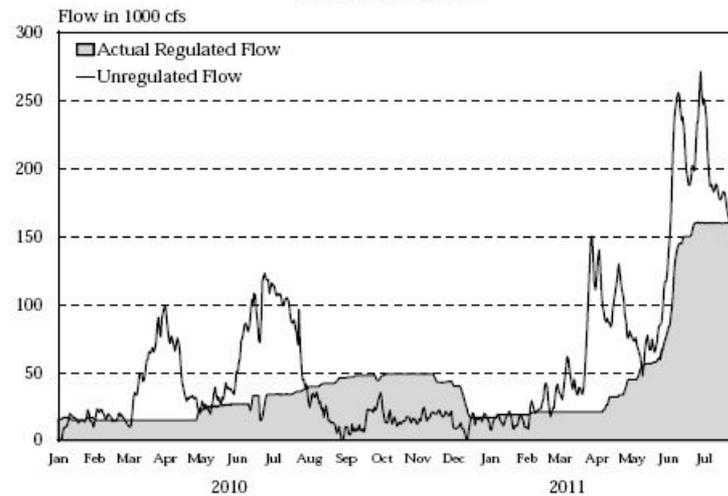
Garrison



Oahe



Gavins Point



Peaks in Flow Reduced – Duration of High Flows Increased

Gavins Pt. Dam (Near Yankton, SD)



Photo – Jay Pickthorn – Argus Leader –Tuesday, June 14, 2011-150,000 cfs
Peak release was 160,700 cfs June 27, 2011

1680/I29 near Omaha's Eppley Airfield



Photo-moravings.blogspot.com

Flood Impacts...

- People were evacuated/displaced; property damaged/lost
- Farmland scoured out; livelihoods lost
- Transportation interrupted (including Interstates 29/I680 closed for months)
- Nuclear plants were shutdown/threatened (Fort Calhoun nuclear plant and Cooper nuclear plant)
- Omaha's Eppley Airfield & Offutt Air Force base threatened
- Levees breached
- Sewage treatment plants threatened
- Local impacts map by county can be found here:
<http://www.omaha.com/article/20110612/NEWS01/110619970/1009#interactive-missouri-river-flood-map>



May 29, 2011

Photo by Jeff Beiermann OWH



June 15, 2011

Photo by Nati Harnik AP

Flooding

Labor Sculpture

Created by Matthew Placzek



June 30, 2011

Photo by Mark Davis OWH



Fort Calhoun Nuclear Plant – June 16, 2011

Photo-U.S. Army Corps of Engineers



Farmland North of Omaha

Pictures-Omaha World Herald

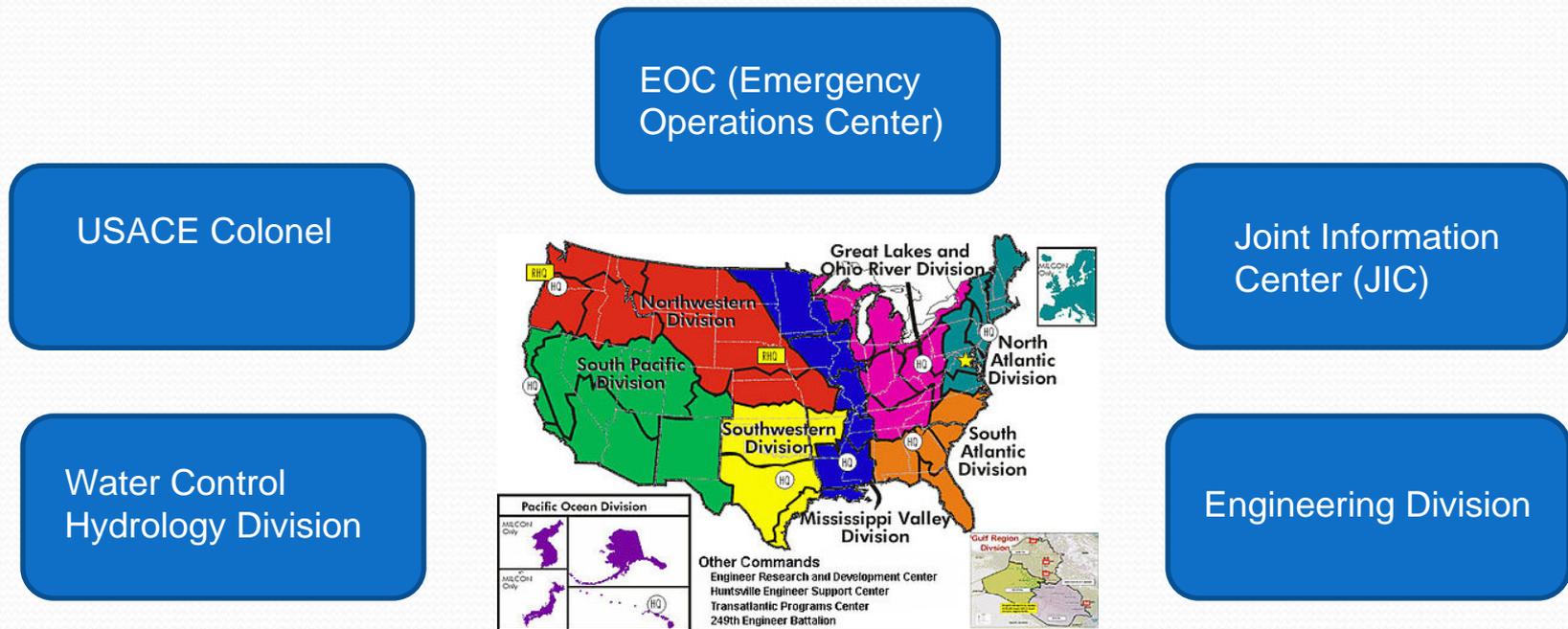


Timeline

- **Hydrology:** Already issuing flood statements in April and early May due to elevated stages from Plattsmouth to Rulo.
- Gavins Pt. releases averaged 30,300 cfs during April 2011. (long term April average is 24,800 cfs) Planned releases increased from 45kcfs to 57.5kcfs in early May.
- May 24th Gavins Pt. releases of 60kcfs projected to increase to 75 kcfs by June 1
- May 25th increased releases to 85kcfs by June 4-15
- May 29 planned increase to 150,000 cfs by mid June- inundation maps updated for new release max.
- June 5 Levee 575 failure impacting Hamburg and I29
- September 15 flooding subsides

U.S. Army Corps of Engineers – Omaha

- Riverwatch daily bulletins began 5/13/11
- 5/30 USACE established Joint Information Center for Missouri River flooding. Resource for the public.
- 6/1 NWS to USACE-Omaha –Interacted with the following:



NOAA/NWS Decision Support Services

- South Dakota Daily Situation Report (NWS Offices serving SD) in progress
- Omaha/Valley NWS on-site support for USACE 6/1/11
- Discussions with HPC – QPF forecasts and desire for probabilistic QPF (not only for 6-hr periods, but for risk analysis and varying time periods and thresholds, scenarios, i.e. 72-hr accumulations from bias corrected ensemble runs) 6/3/11
- MBRFC staff to USACE 6/5/11
- Nebraska EOC assesses activation 6/6/11 – Hastings, NE NWS office provide daily on-site EOC support
- IA State EOC/IA Homeland Security assesses activation 6/7/11



Typical DSS at the USACE



- Arrive at USACE Omaha ~ 7 am
- Brief EOC at 9 am (Face-to-Face Briefing 30min. -24hr precipitation, radar, REMOP, HPC days 1-5 QPF forecasts, wind forecast for reservoir sites-consistent messages between NWS offices/NCEP/MBRFC. Use hourly weather graphs, NDFD etc.). The second part of the briefing was all Water Control/Hydrology related.
- Written Weather Narratives Due by Noon (Discussion of precipitation over the past 24hrs., expected precipitation for the next three days, temperatures (effects on snow/melting of snow) plus table of 7-day forecast, and winds).

Typical DSS at the USACE

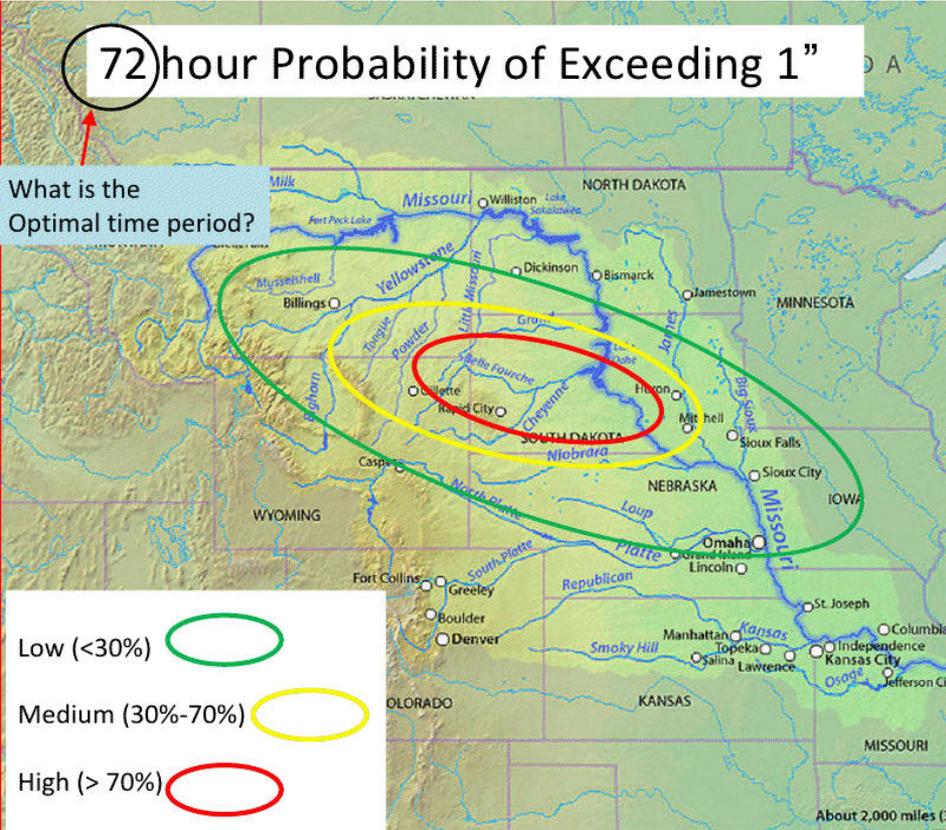


- **CMT** (Crisis Management Team) **Briefing at 1 or 3 pm** (Webinar format in EOC with CMT -shortened version of above information-many people on the call –dam operators)
- **KC District Briefing (conf. call) at 2:00 pm**
- **Navigation Briefing (conf. call) at 4:00 pm**
- **MRJIC Stakeholder Call at 6:00 pm** (call is intended for Congressional Delegation, Tribes, State Government, Local Government, and Press)
- **Internal summary for NWS before leaving**
- **Leave USACE ~ 8 pm**

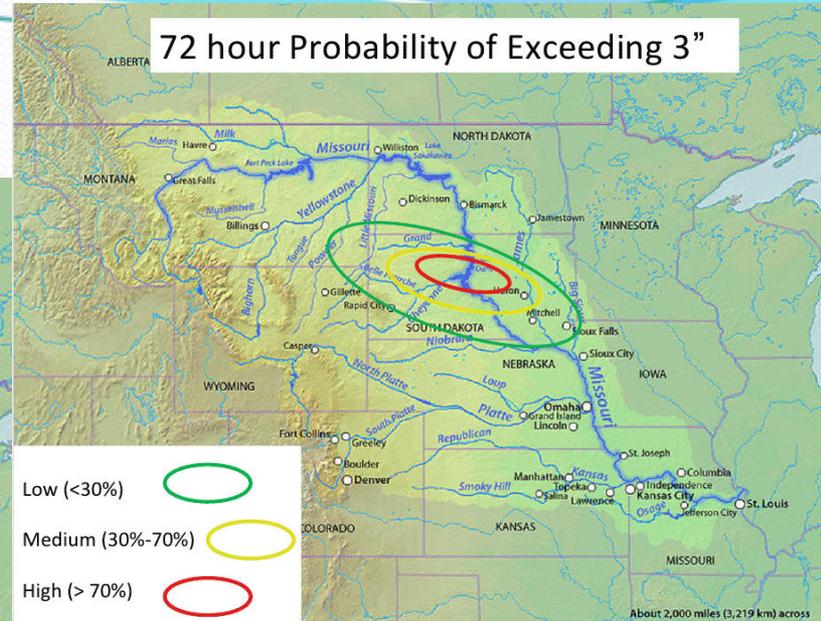
Product Development??

72 hour Probability of Exceeding 1"

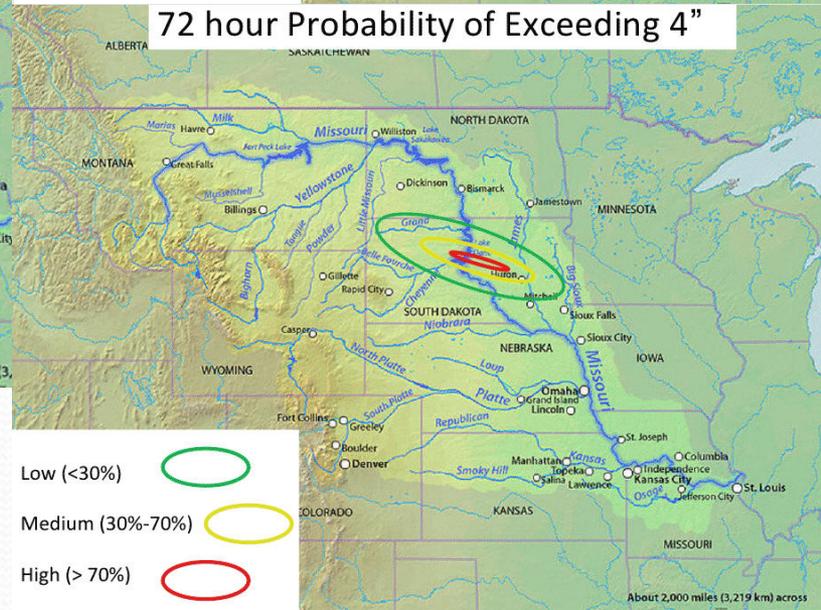
What is the Optimal time period?



72 hour Probability of Exceeding 3"



72 hour Probability of Exceeding 4"



Conclusions

- The flooding the Missouri River Basin experienced was the result of record snowmelt and record rainfall leading to historic levels of runoff.
- Although flooding on the Missouri River is not unique, the record runoff produced new opportunities for the NWS to provide enhanced decision support services and building of relationships with Federal and local partners.

Links/Resources:

- <http://www.weather.gov/> - National Weather Service
- Omaha World Herald Flood Archive
www.omaha.com/flood
- U.S. Army Corps of Engineers Press Releases.
<http://www.nwo.usace.army.mil/pa/2011/newsreleases2011.html>
- U.S. Army Corps of Engineers Annual Operating Plan
<http://www.nwd-mr.usace.army.mil/rcc/reports/pdfs/finalAOP2011-2012.pdf>
- HPC
<http://www.hpc.ncep.noaa.gov/qpf/qpf2.shtml>
http://www.hpc.ncep.noaa.gov/pqpf/conus_hpc_pqpf.php

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