National Efforts to **Coordinate Studies and Databases** to Review and **Improve Methods** to Assess **Extreme Storm Events**

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Engineering and Construction
US Army Corps of Engineers - HQ

Briefing On Flooding and Other Extreme Weather Events

Nuclear Regulatory Commission

16 October 2013

US Army Corps of Engineers
BUILDING STRONG®

Agenda

- Background
- Interagency collaboration on flood and extreme storm related activities
- Cataloging of extreme storm events
- R&D on flood flow and rain frequency analyses
- Summary

USACE Mission Areas

BUILDING STRONG

Military Programs

- MILCON for Modular Force Global Positioning
- BRAC 05
- Field Force Engineering
- MILCON Transformation
- Environmental Restoration

Real Estate

- DOD Recruiting Facilities
- Contingency Operations
- Acquire, Manage and Dispose

Homeland Security

- Critical Infrastructure
- Anti Terrorism Plans
- Intelligence
- Facility Security Partnership

Interagency Support

- Federal
- State
- Local
- International

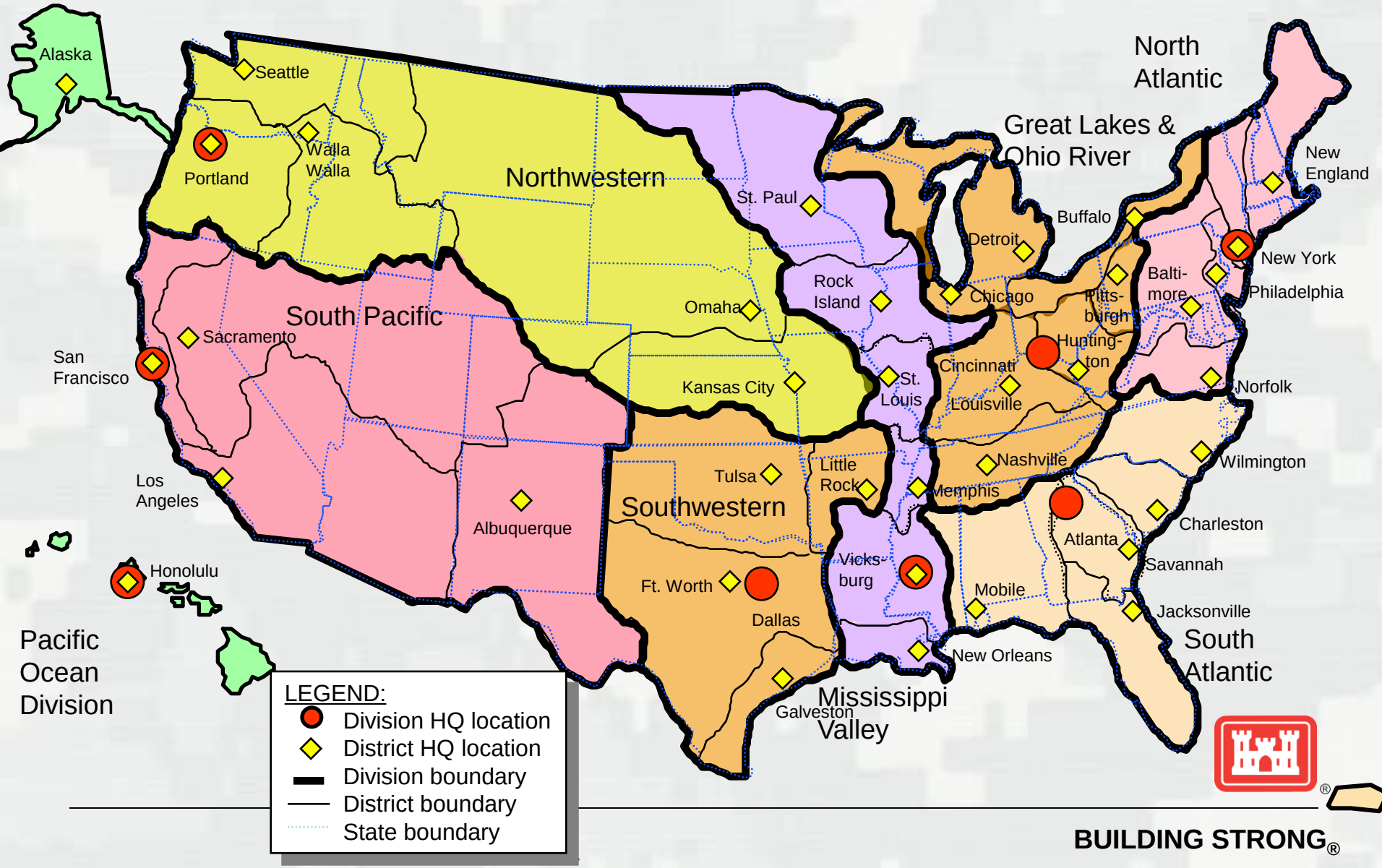
Civil Works

- **Flood Risk Management**
- Navigation, Hydropower
- Water Supply, Regulatory
- Recreation, Disaster Response
- Environmental Restoration

Research & Development

- **Water Resources**
- Environment
- Installations
- Warfighter

Civil Works Divisions & Districts



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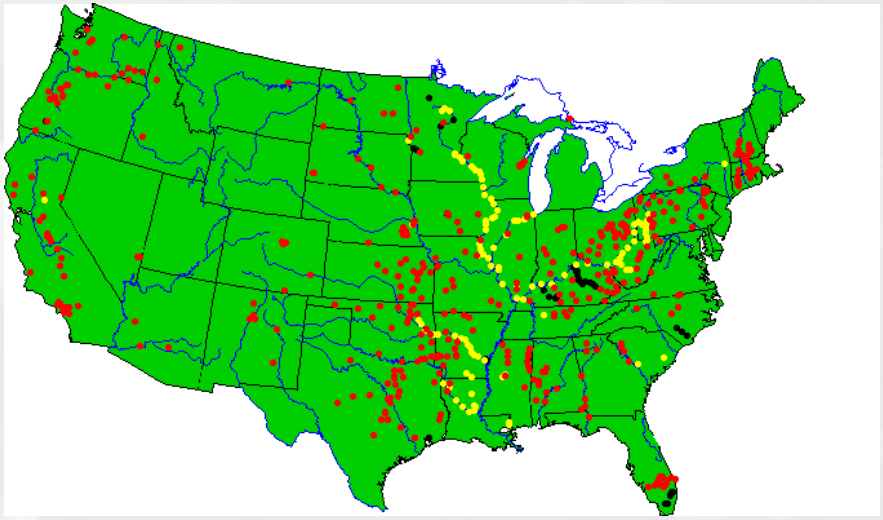
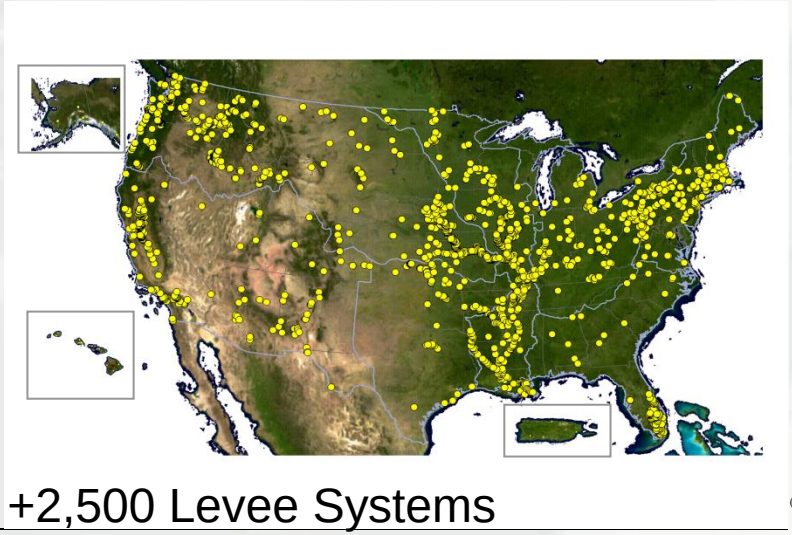
Infrastructure in USACE



702 Dams

"Infrastructure follows Floods, People Follow Infrastructure"

- Portfolio Stats:
  - Very Large
  - Aging (+55 years)
  - Relatively untested
  - Geotechnical Challenges Dominate



+2,500 Levee Systems

INTERAGENCY COLLABORATION

US Army Corps of Engineers®

NOAA — National Oceanic and Atmospheric Administration — U.S. Department of Commerce

USGS science for a changing world

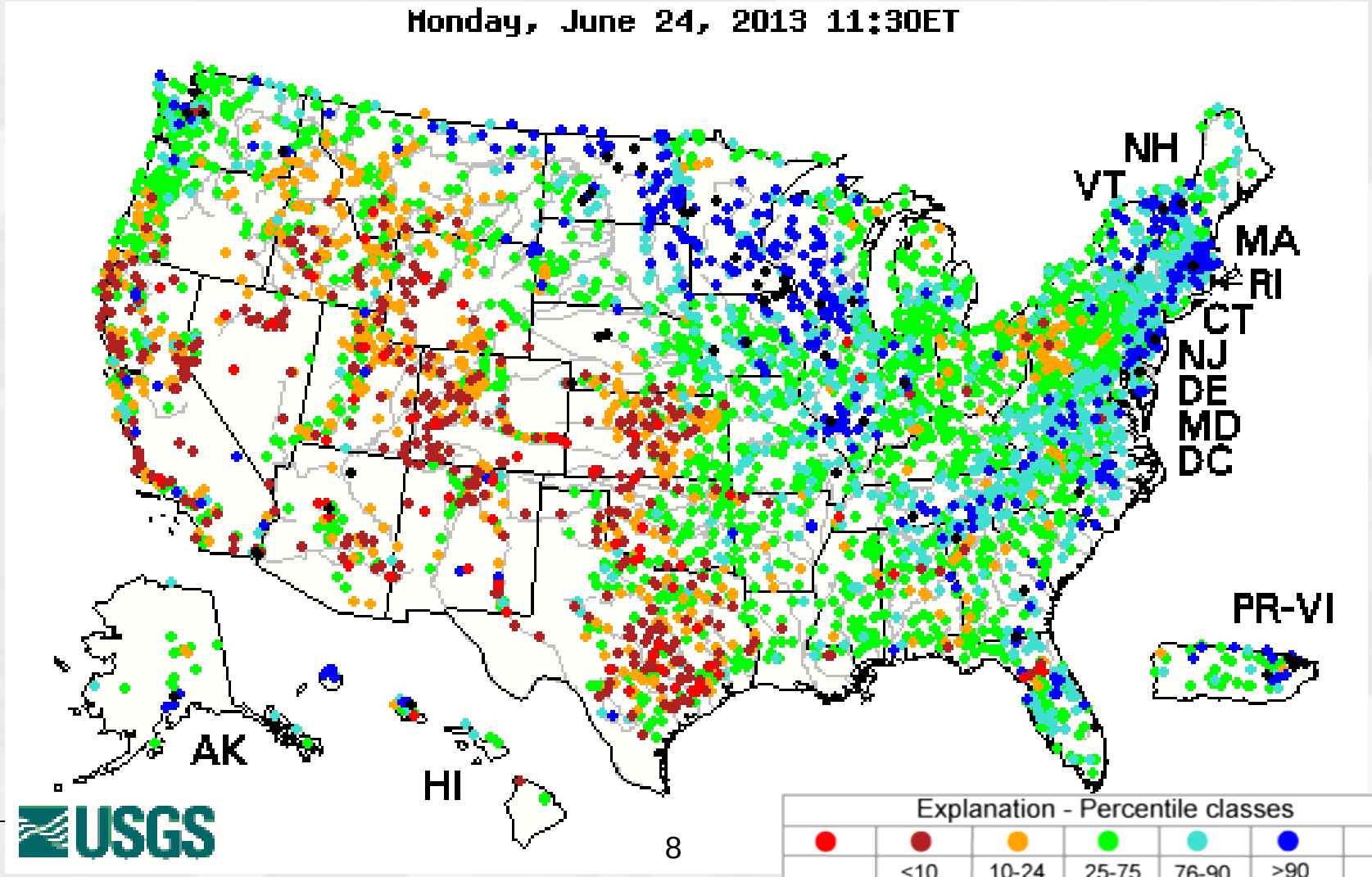
GAVINS POINT DAM

Fort Calhoun Nuclear Power Plant

National Weather Service Support

- Provide Weather, Rain and Climate Forecasts:
  - Short-term (24-, 48- and 72-hour, 5-day)
  - Long-term (30-day and 90-day outlook)
- Provide River Flood Forecasting (a collaborative effort between agencies)
- *Rainfall Data Analysis - Publications*
  - *100-, 500-, 1000-year return period (Atlas 14, TP40)*
  - *Probable Maximum Precipitation - PMP (HMRs)*

US Geological Survey (USGS)
National Stream Gauging Program

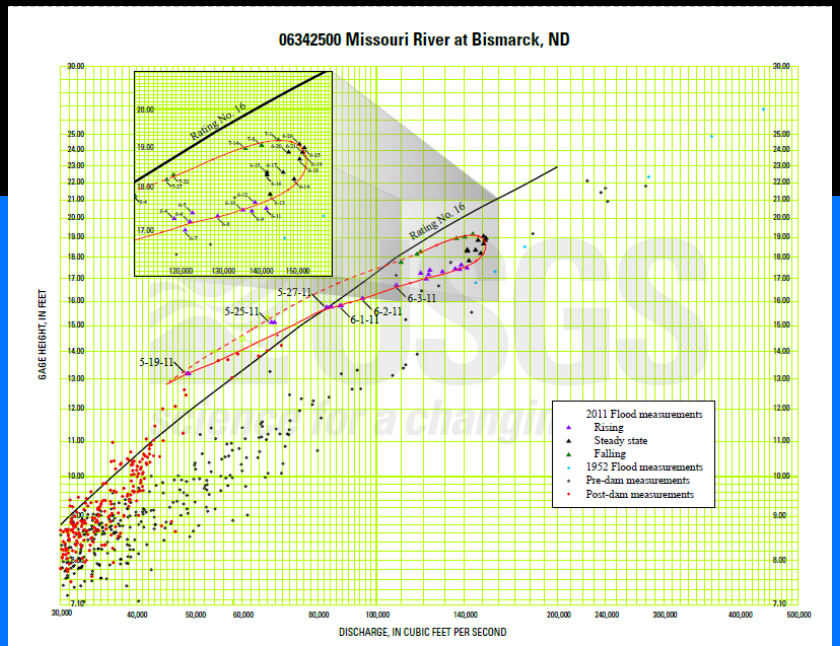


USGS

RDG Deployment Prior to Flood

Minnesota River at Granite Falls, MN.

* **Installation of Rapid Deployment Gages (RDG)**
* **Special Streamflow Measurements (extreme events)**
* **Flow Rating extensions**



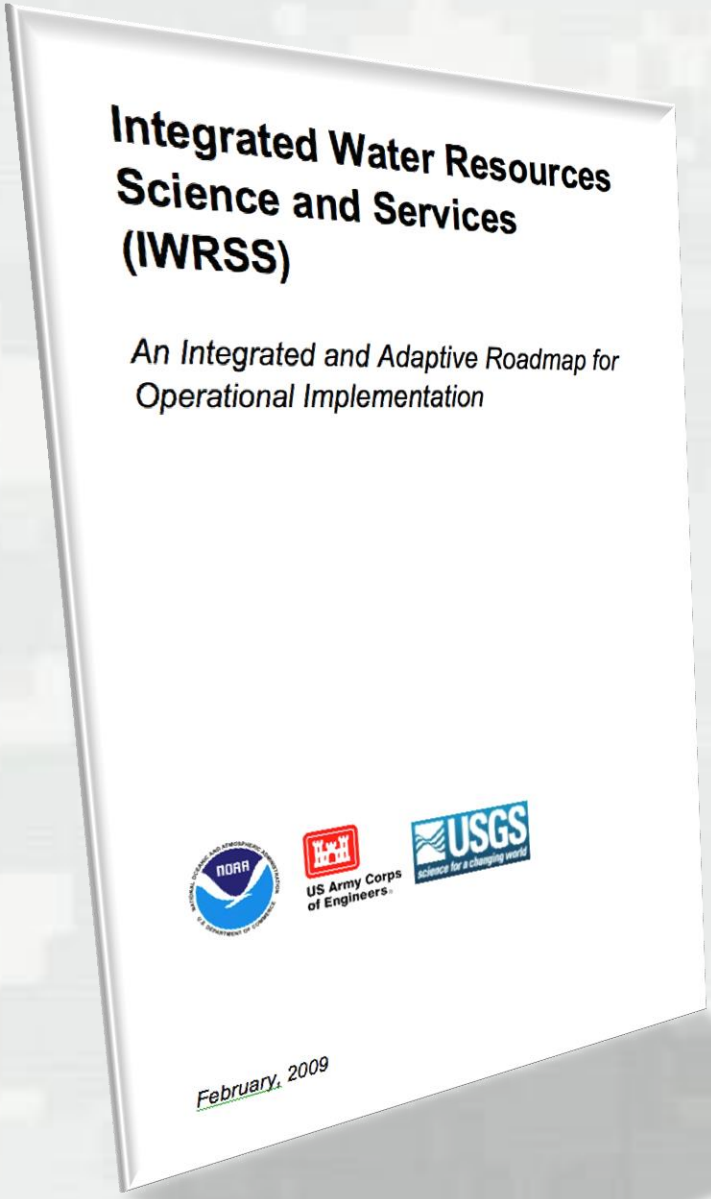
IWRSS

INTEGRATED WATER RESOURCES SCIENCE AND SERVICES

US Army Corps of Engineers®

NOAA — National Oceanic and Atmospheric Administration — U.S. Department of Commerce

USGS science for a changing world



IWRSS

Framework aligning the capabilities of multiple agencies with complementary water-related missions to address major water resource challenges and stakeholder needs

MOU – USACE, NOAA, USGS

"Collaborative Science, Services and Tools to Support Integrated and Adaptive Water Resources Management"

May 11, 2011

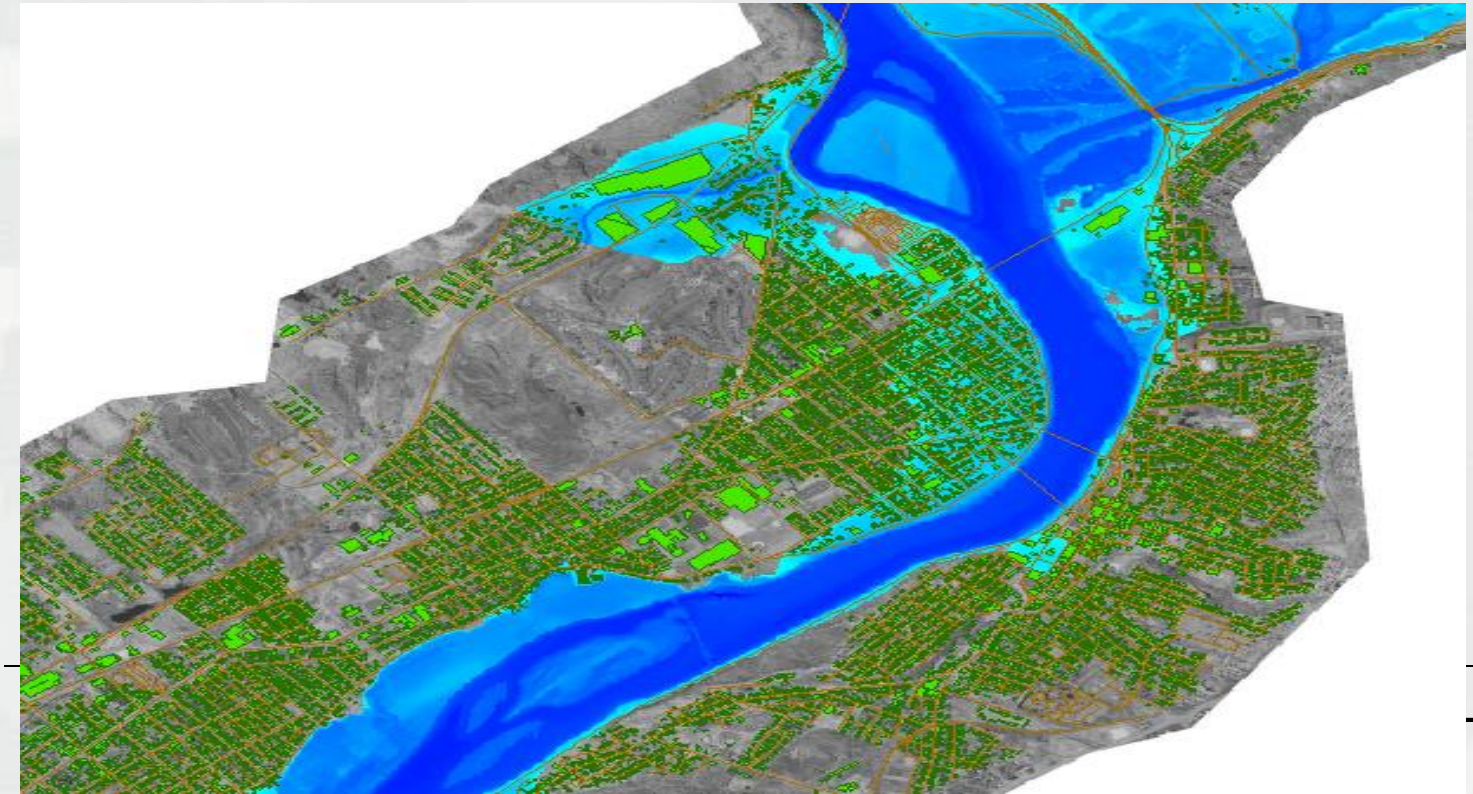
Assistant Secretary of the Army for Civil Works
Deputy Undersecretary of Commerce for Oceans and Atmosphere
Director of the U.S. Geological Survey

IWRSS: Two Charters

1. National Flood Inundation Mapping
2. System Interoperability and Data Synchronization

National Flood Inundation Mapping

Purpose: to support the collaborative actions required to develop common flood inundation maps, products and services that will help the USACE, USGS, and NWS fulfill their missions.



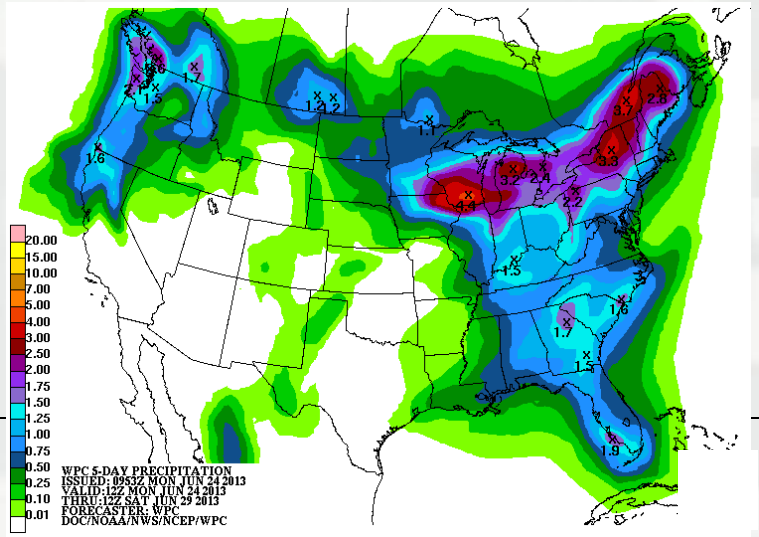
System Interoperability and Data Synchronization

Major systems used across the 3 agencies will be made interoperable, i.e., data and information will be able to flow between them seamlessly.

Purpose: to define requirements and technical specifications for system interoperability and data synchronization.

USACE Extreme Storm Team

- 2008 – Sub-committee on Hydrology (of Advisory Committee on Water Information - USGS) establishes Interagency Federal Work Group on Extreme Strom Events
- 2010 – USACE establishes Extreme Storm Team
  - ► 12-member team
  - ► Collaboration with USBR



Extreme Storm Data Needs

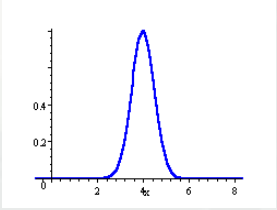
- Data Archiving & Analysis of Extreme Storm Events
- Regional and Site-Specific Probable Maximum Precipitation (PMP) Studies
- NWS/NOAA Hydro-meteorological Reports (HMR's) updates

USACE Extreme Storm Projects

- **Update Extreme Storm Catalog**
  - Digitize Historic Storm Isohyetal Maps
  - Convert Radar Imagery for Rainfall
  - **Develop Extreme Storm Database**
- **Combine Database with USBR**
- Set up Web Site to Disseminate Data
- Chena Basin Site Specific PMP Study
- Review Wyoming Statewide PMP Study

2013 R&D Project – ERDC, USACE

- Objective: Provide new, district-usable tools for improved estimation of **extreme precipitation and flow frequency**
- Methods:
  - Create software that implements existing and **new analytical methods –state-of-the-art** for **precipitation and flow frequency**
  - Develop new modeling techniques for extending precipitation and flow frequency curves
  - Use spiral delivery methods to successively roll out products
  - Use technical advisory committee to provide input on products, direction
- Products:
  - **Develop Precipitation Frequency Software**
  - **Develop Flow Frequency Software**



Summary

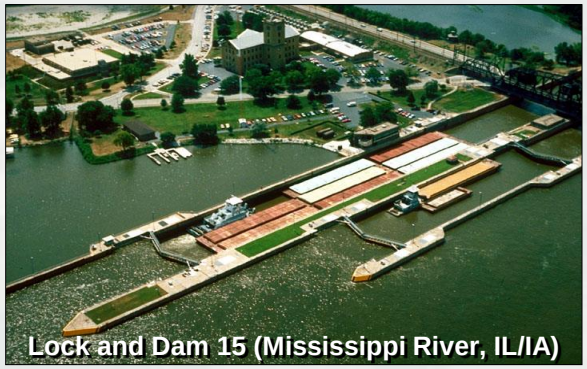
- Interagency collaboration on flood and extreme storm related activities with USACE, NOAA, and USGS;
- Cataloging of historical extreme storm events – national significance; and
- R&D on flood flow and rain frequency analyses, specifically, from extreme storm events.

Questions ?

BACK UP SLIDES

Civil Works Program

Preserving the Strength of the Nation


Lock and Dam 15 (Mississippi River, IL/IA)


Flood Wall, Williamson, KY


Florida Everglades

Delivering enduring, comprehensive, sustainable, and integrated solutions to the Nation's water resources and related challenges through collaboration with our stakeholders

(Regions, States, localities, Tribes, other Federal agencies)

($1.884 B) Navigation (39%)

($1.370 B) Flood Risk (28%) Management

($655 M) Ecosystem (14%) Restoration & Stewardship

($210 M) Hydropower (4%)

($252 M) Recreation & Natural (5%) Resource Management

($200 M) Regulatory Program: (4%) Wetlands & Waterways

($33 M) Water Supply (1%)

($35 M) Emergency Management (1%)

($187 M) Expenses (4%)

(FY 2014 President's Budget)

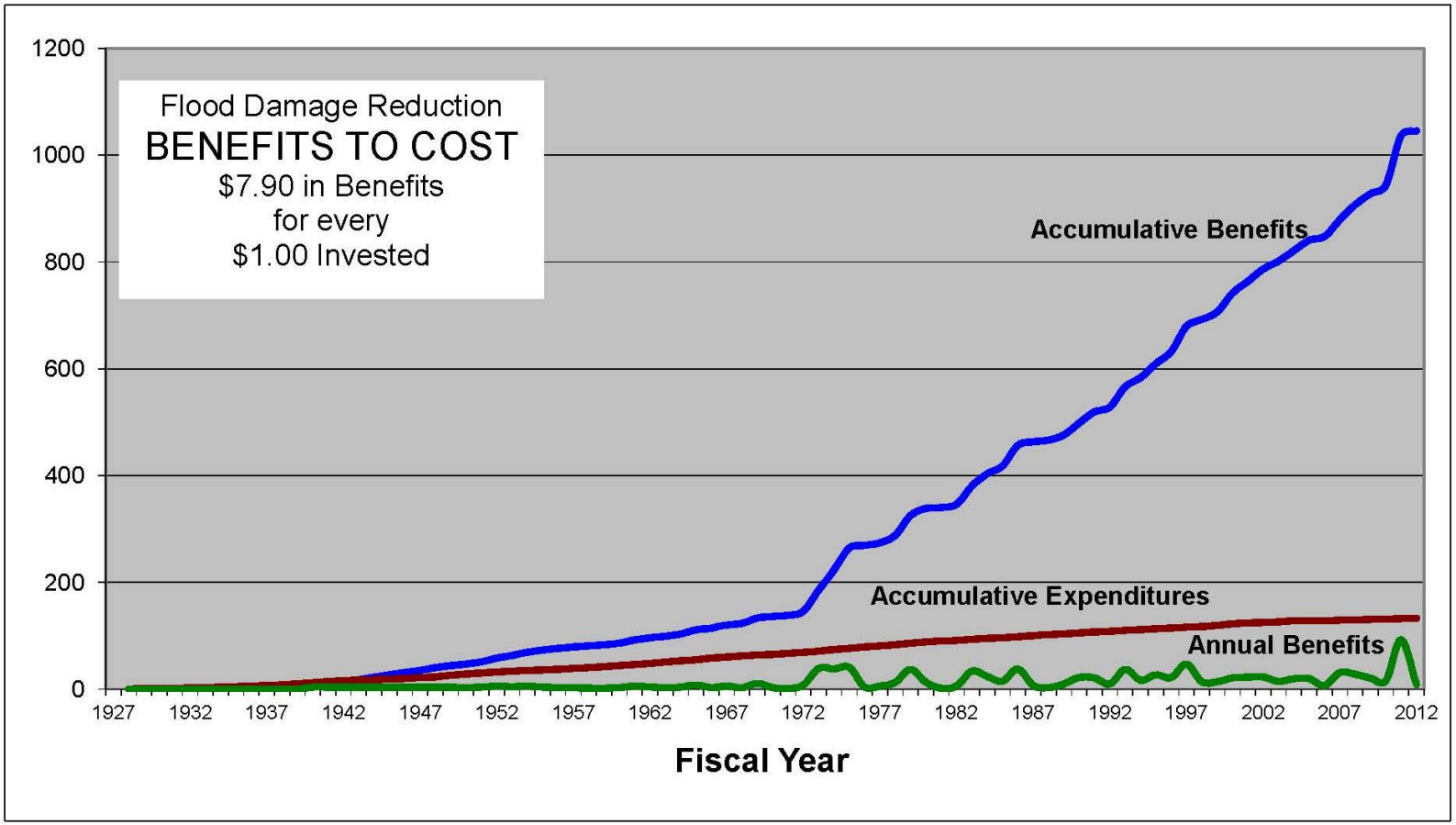

Dredge ESSAYONS (Coos Bay, OR)


Greers Ferry Lake, AR


Bonneville II Powerhouse, WA

Benefits of Federal Projects (Damages Prevented)
Accumulative Corps Expenditures (Principle plus O&M)

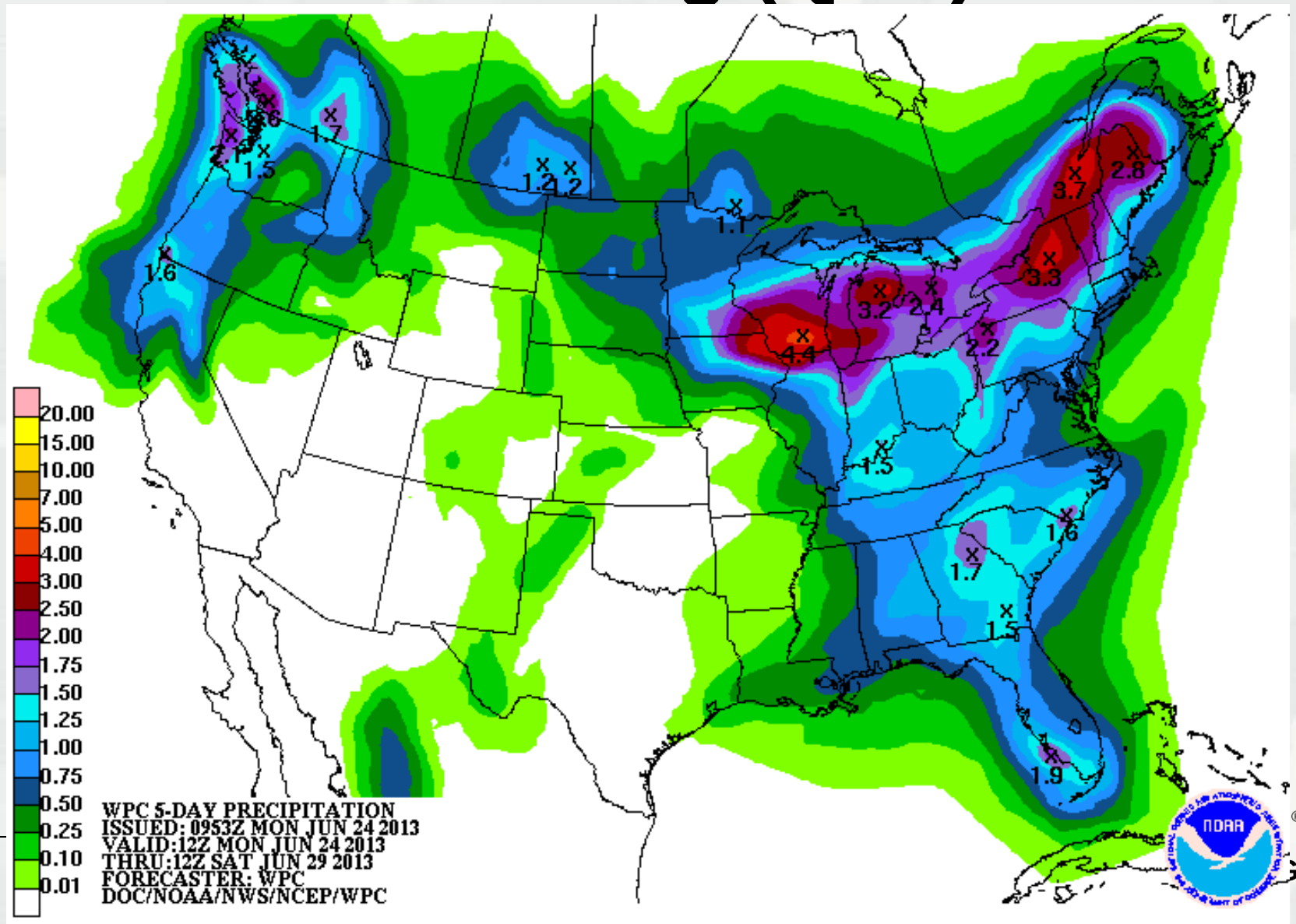
Adjusted to 2000 Using Construction Cost Index EM 1110-2-1304 (Mar 2013 revision)

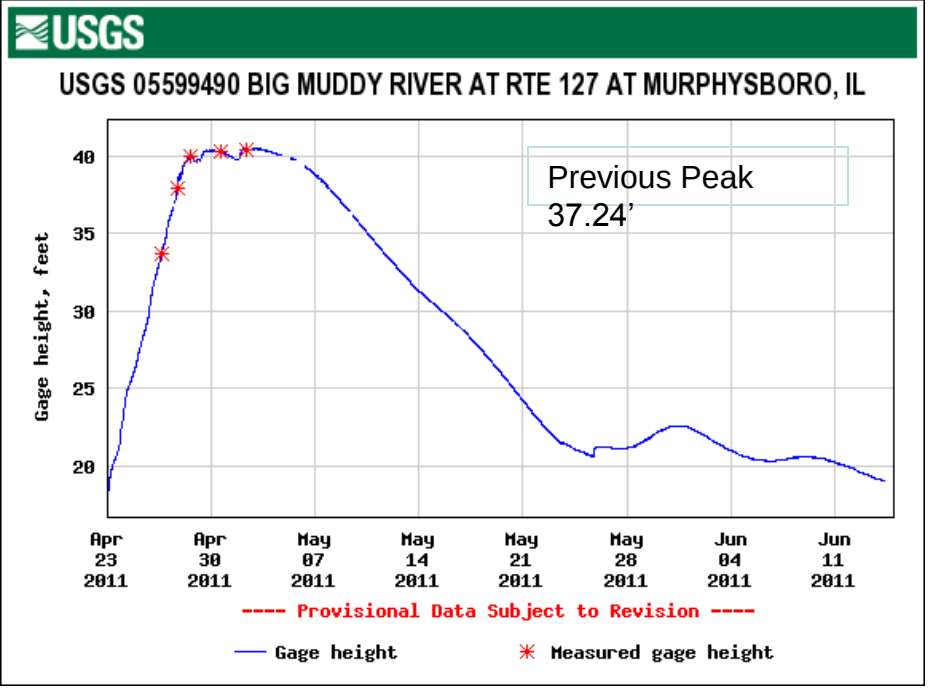


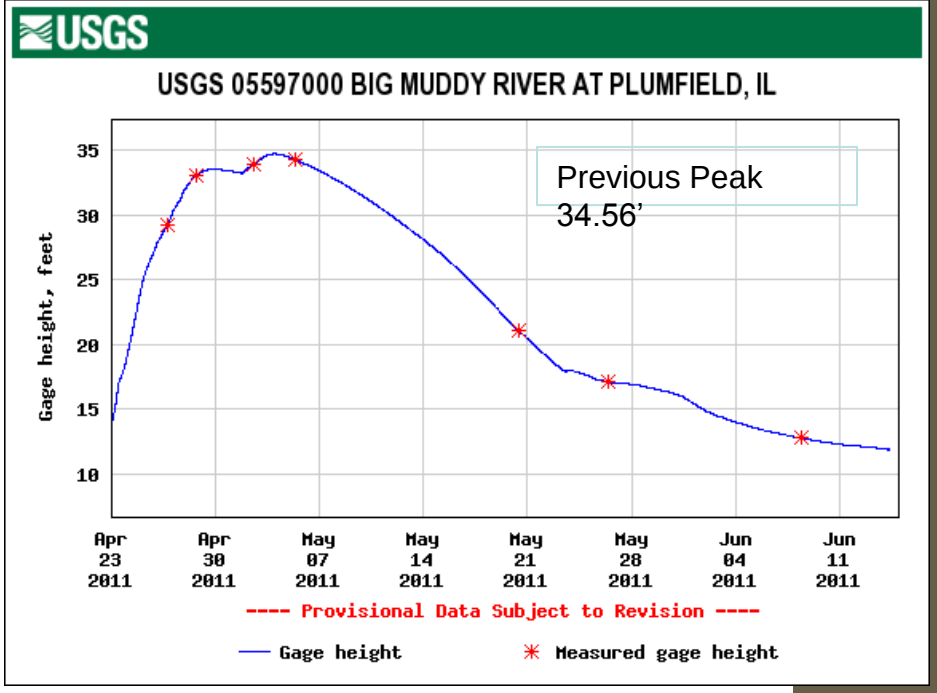
Communication/Collaboration

- Continuous forecast coordination between NWS forecasters and USACE decision makers including 100+ scenarios for spillway operations
- Daily coordination with USGS & USACE on real time discharge measurements to help validate and adjust hydraulic models and rating curves
- NWS personnel stationed at USACE Emergency Operations Center
- HEC-RAS collaboration with USACE, NWS, & HEC

Quantitative Precipitation Forecasting (QPF)

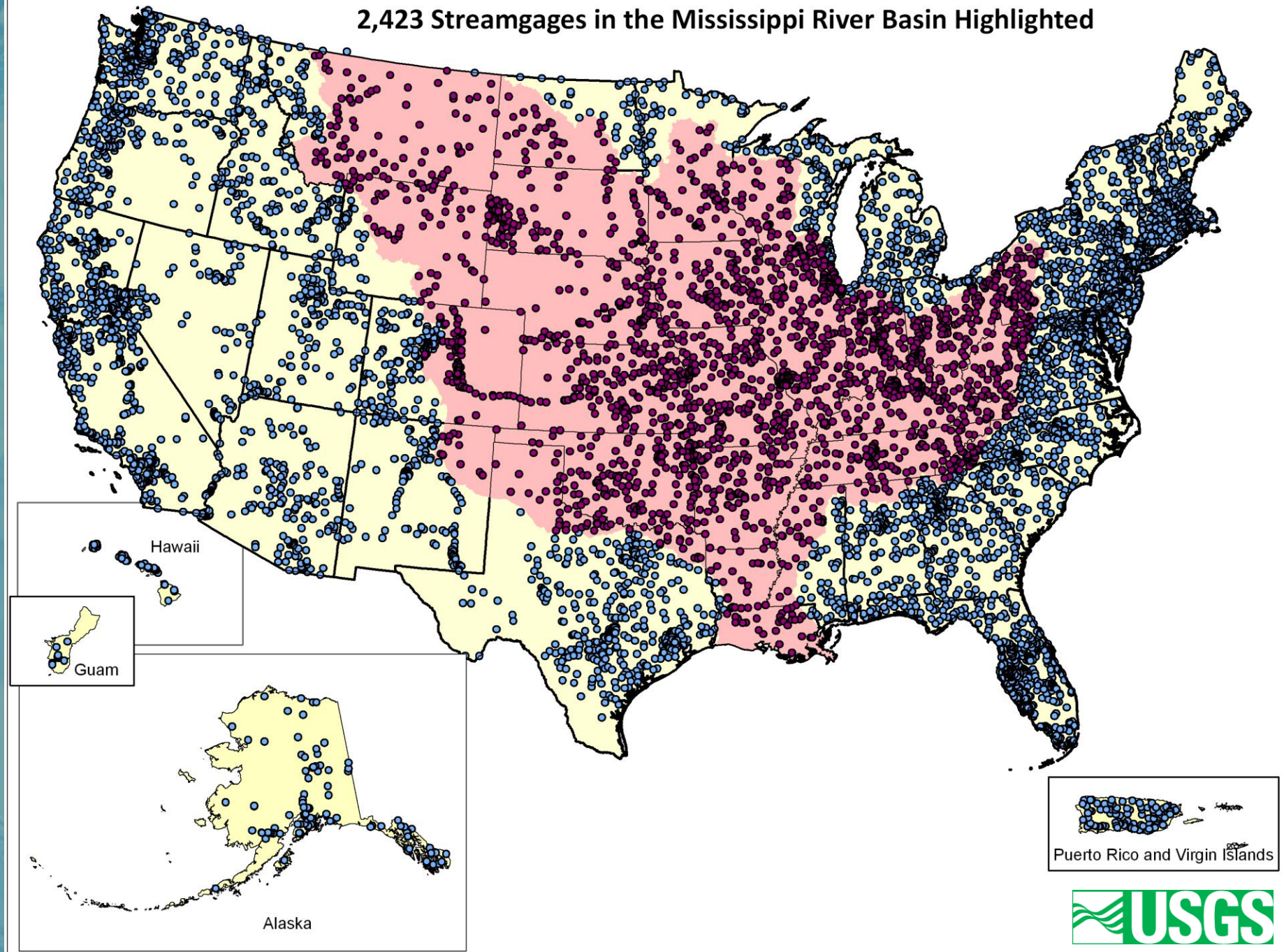



USGS
USGS 05599490 BIG MUDDY RIVER AT RTE 127 AT MURPHYSBORO, IL
Previous Peak
37.24'
Gage height, feet
40
35
30
25
20
Apr 23 2011
Apr 30 2011
May 07 2011
May 14 2011
May 21 2011
May 28 2011
Jun 04 2011
Jun 11 2011
---- Provisional Data Subject to Revision ----
Gage height
Measured gage height


USGS
USGS 05597000 BIG MUDDY RIVER AT PLUMFIELD, IL
Previous Peak
34.56'
Gage height, feet
35
30
25
20
15
10
Apr 23 2011
Apr 30 2011
May 07 2011
May 14 2011
May 21 2011
May 28 2011
Jun 04 2011
Jun 11 2011
---- Provisional Data Subject to Revision ----
Gage height
Measured gage height


USGS


04/28/2011


USGS Streamgages Active in Water-year 2010, Total 7,845
2,423 Streamgages in the Mississippi River Basin Highlighted
Hawaii
Guam
Alaska
Puerto Rico and Virgin Islands
USGS

Extreme Storm Data Sources

- US Storm Rainfall Events (1882-1973)
- Bucket Surveys (USACE, USBR, NWS)
- NOAA COOP Observations (1753-2012)
- NWS Radar Estimates (1993-2012)
- CoCoRaHS (1998-2012)
- Local & Regional Precipitation Networks
  (NERain, SD-AWDN, NDAWN, DOT, ALERT, etc)

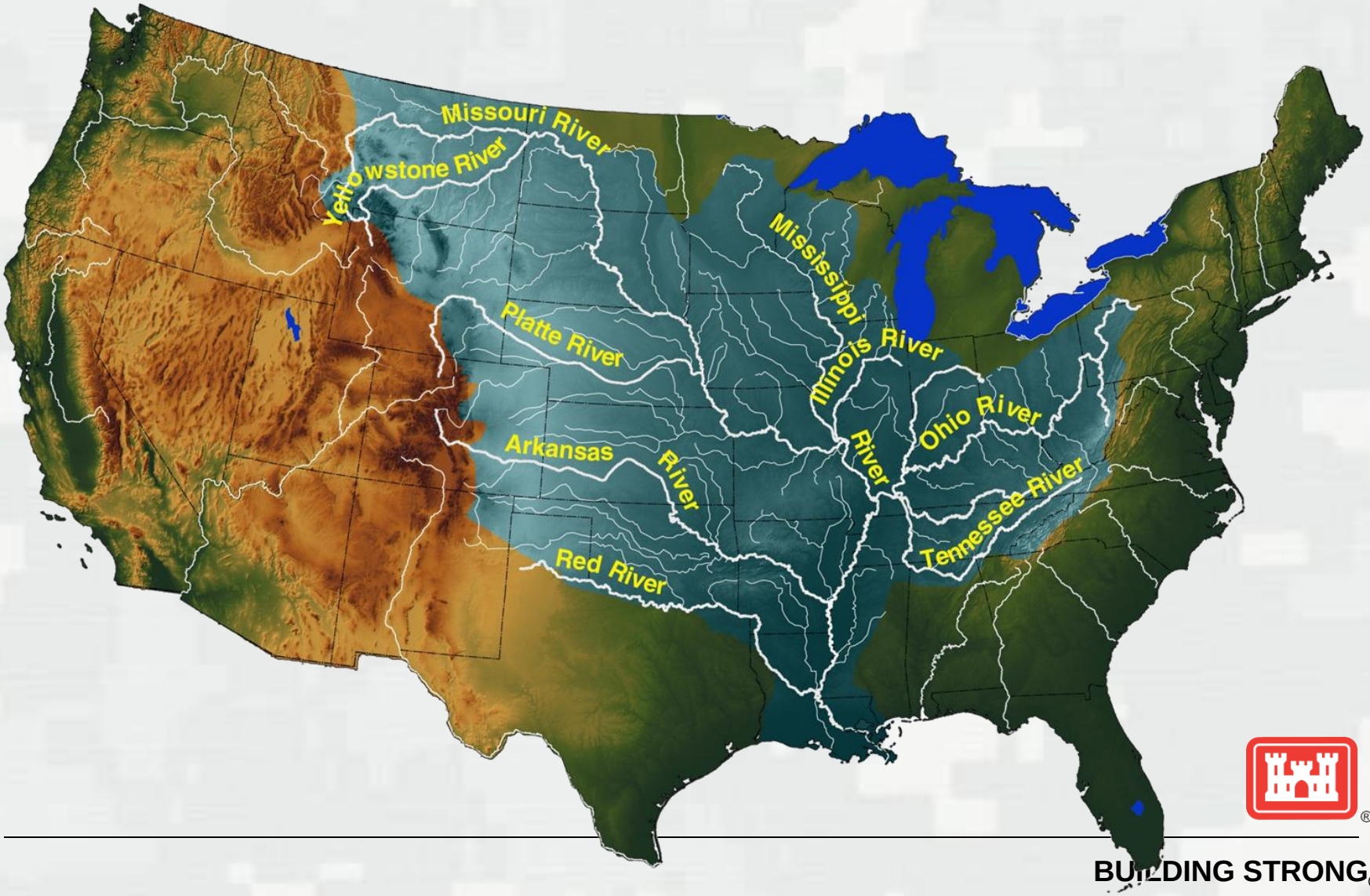
Precipitation Frequency Products

- Investigation and reports of new techniques for extended precipitation frequency and AEP data, including updated statistical and stochastic precipitation modeling techniques. The primary focus will be on the research and development of stochastic techniques.
- Development of tools for the analysis and creation of precipitation frequency and AEP curves, including the relationship of recorded extreme storms to precipitation frequency / AEP
- Development of tools to create model input data from precipitation frequency and AEP curve data
- Development of tools to create model input data from the extreme storm database
- Research into the feasibility of using regional atmospheric models to understand how to scale extreme event data into even more extreme scales
- Research, development, and implementation (including user interfaces [UI]) of tools for improved determination of confidence limits of precipitation frequency / AEP curves

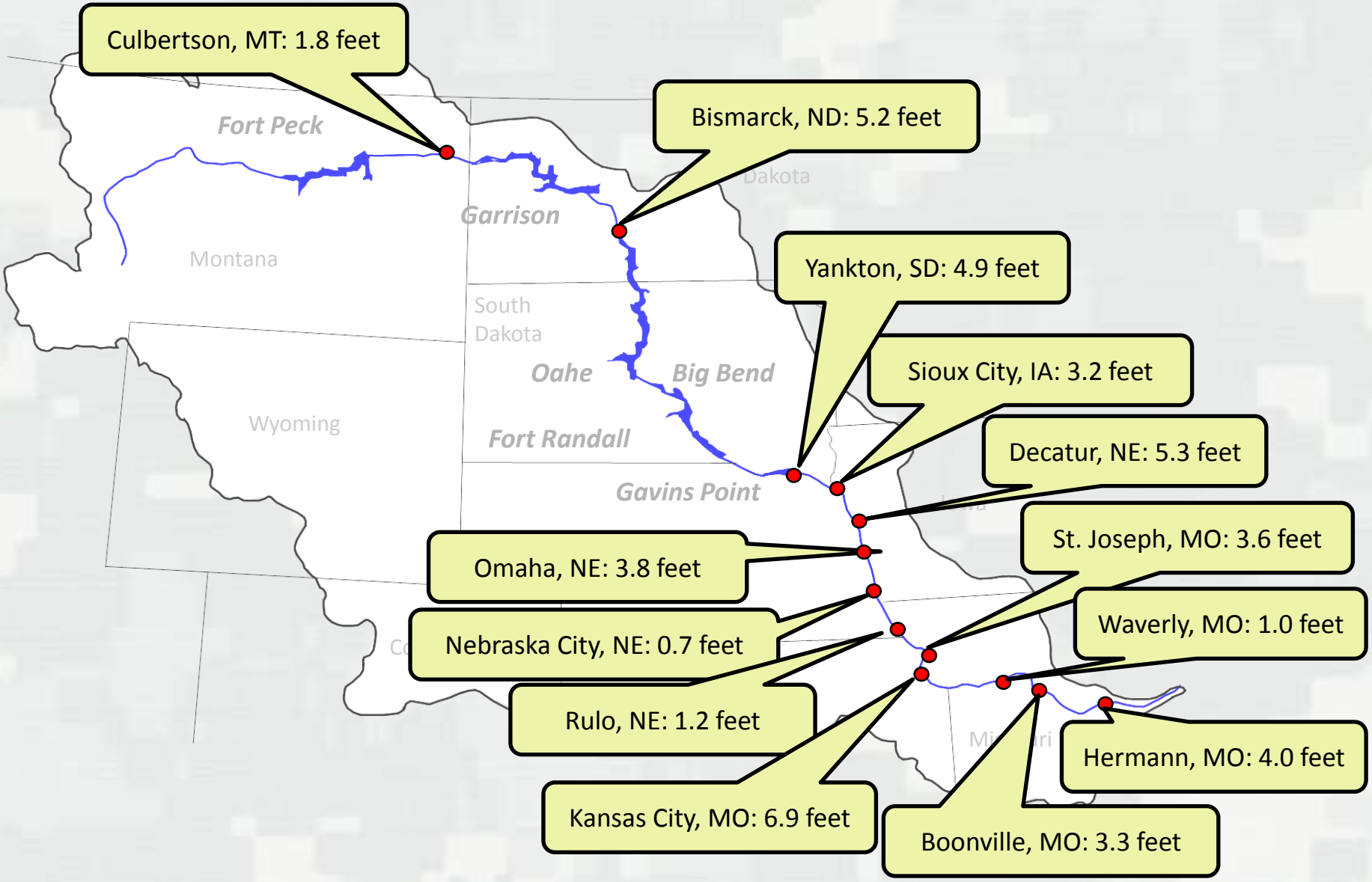
Flow Frequency Products

- Research into using the USACE hydrologic models (HEC-HMS and GSSHA) for transforming precipitation frequency / AEP data into flow frequency / AEP data
  - Testing of efficacy of approach
  - Proof-of-concept demo
  - Integration with precipitation frequency / AEP tools
  - UI development to create flow frequency / AEP
  - Guidance and tutorial documents
- Research, development, and implementation (including UI) of tools for improved determination of confidence limits of flow frequency / AEP curves
- Research and development of tools, interfaces, and capabilities to reduce local computational burden and increase usability of products

Mississippi River Watershed



Missouri River Stage Reduction Due to Reservoir Operations



2011 Flood of Record

- Much above average plains snowpack, late-arriving much above normal mountain snowpack and record May rainfall in the upper basin … flood of record.
- Runoff in 2011 was 61.0 million acre-feet (MAF), 247 percent of normal and the highest runoff in 114 years
  - May was the ninth wettest single month on record with 9.3 MAF
  - June was the single wettest month on record with 14.8 MAF of runoff, surpassing the old record of 13.2 MAF set in April 1952.
  - July was the fourth wettest single month on record with 10.2 MAF
- Combined May through July runoff of 34.3 MAF is higher than the total annual runoff in 102 of 113 years in the period of record
  - Estimated 0.2 percent annual exceedance interval

System Tested as Never Before…

- System storage peaked at a record 72.8 MAF on 1 July
  - 16 MAF stored flood waters in mainstem reservoirs
  - Corps and Bureau of Reclamation tributary reservoirs also utilized
- Four mainstem reservoirs utilized exclusive flood control zone
  - Fort Peck, Garrison, Oahe and Fort Randall
- Three mainstem reservoirs set record pool levels
  - Fort Peck, Oahe and Fort Randall
- Two mainstem reservoirs utilized surcharge storage
  - Fort Peck and Garrison
- Spillways at two mainstem dams were operated for the first time
  - Garrison and Big Bend
- Record releases from all mainstem reservoirs