

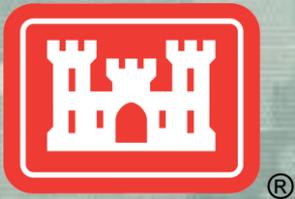
Missouri River Mainstem Reservoir System

US Army
Corps of Engineers

2011 Flood Regulation



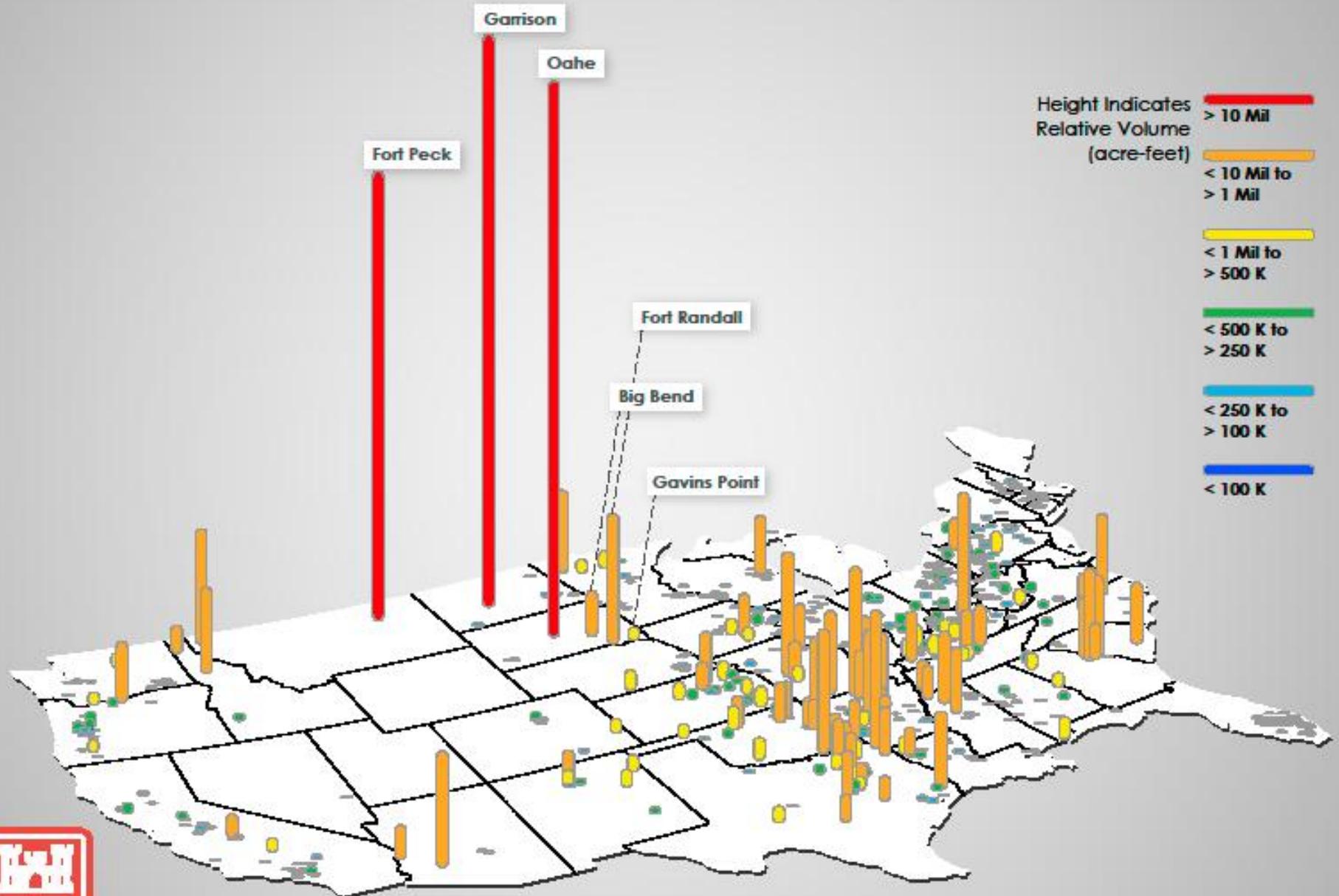
1 August 2011



US Army Corps of Engineers
BUILDING STRONG®



Storage Capacity of Corps Reservoirs

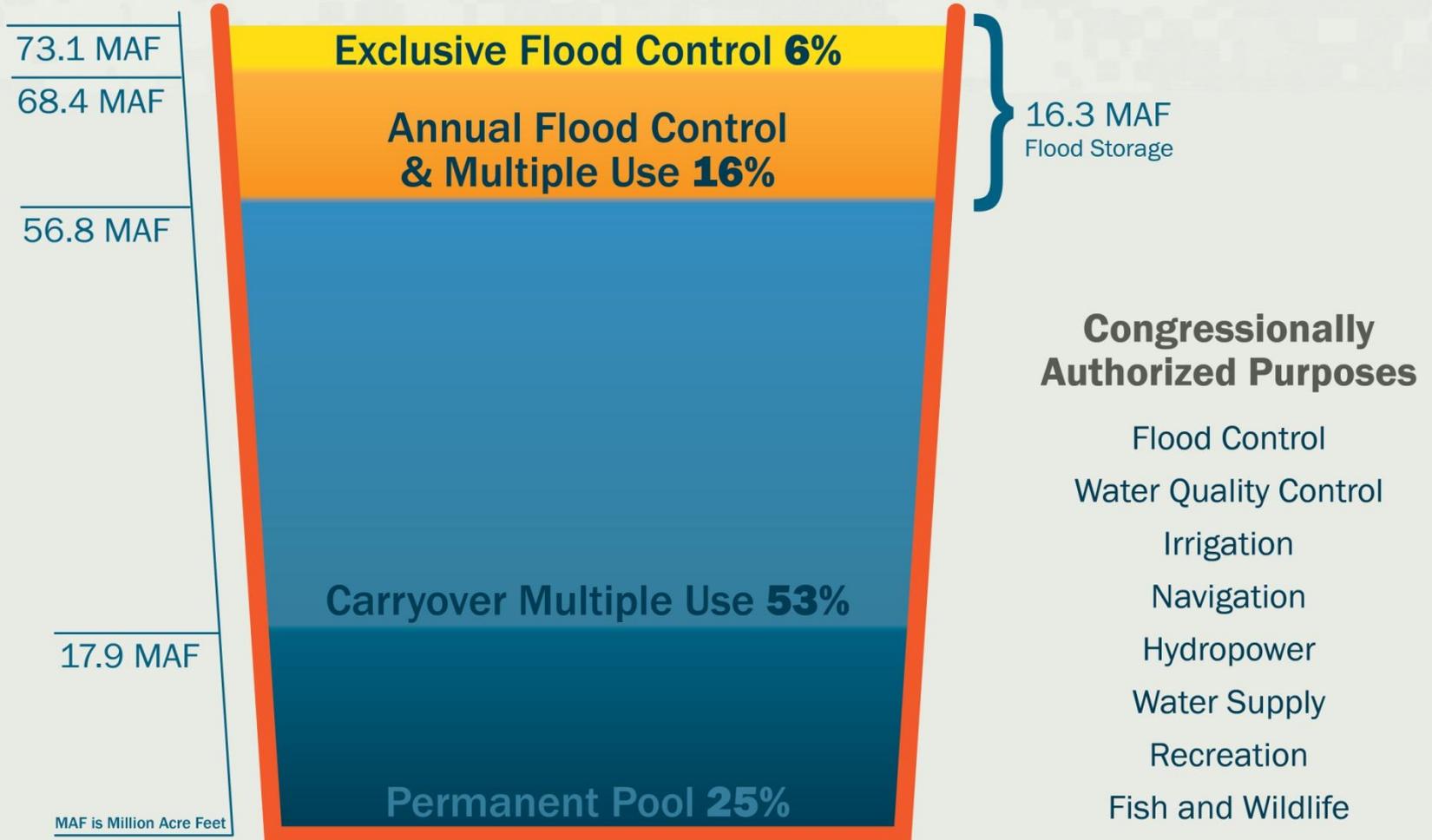




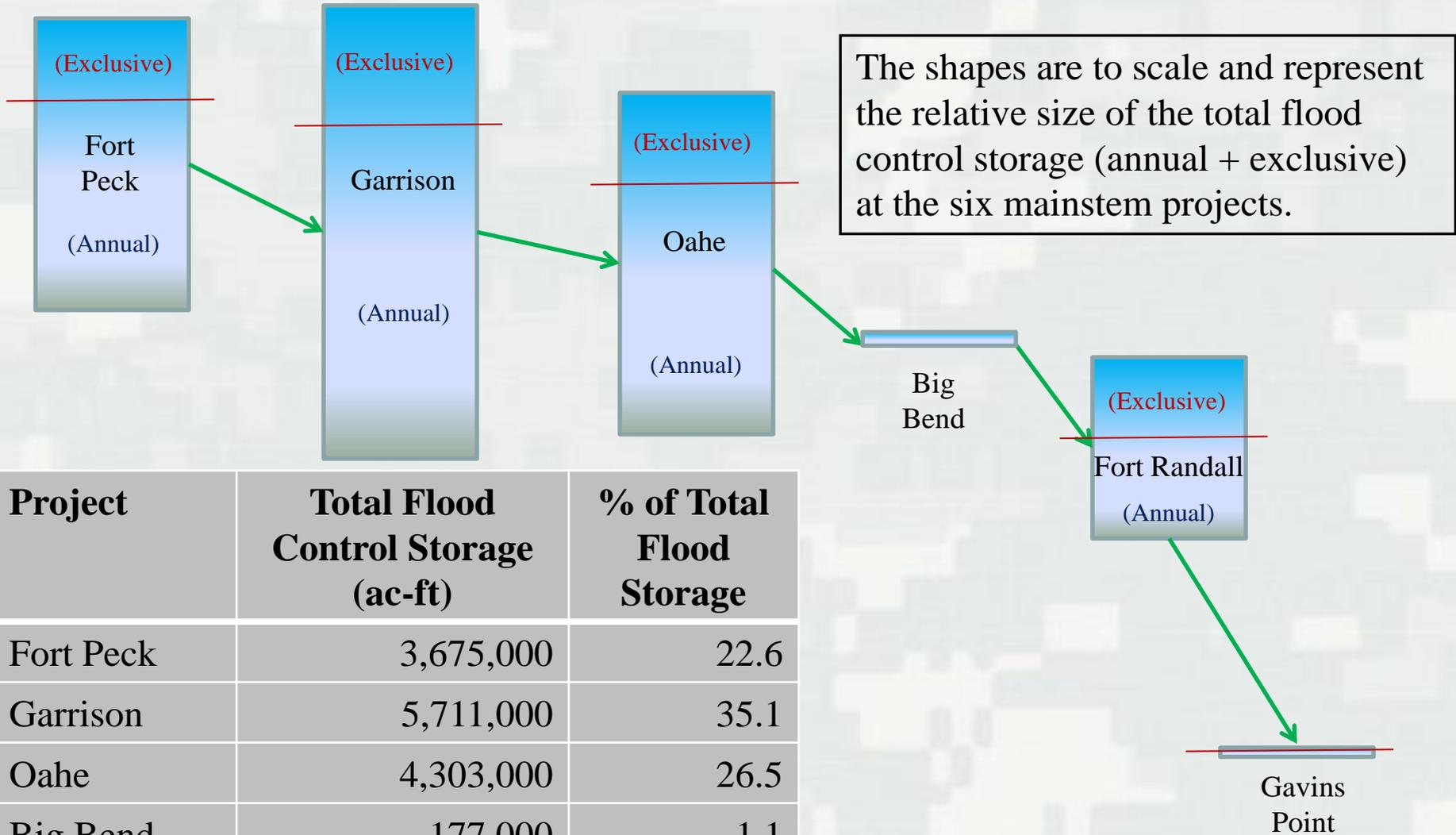
US Army Corps of Engineers
BUILDING STRONG

Missouri River Mainstem Reservoir System

Zones & Allocations of the Total Storage Capacity



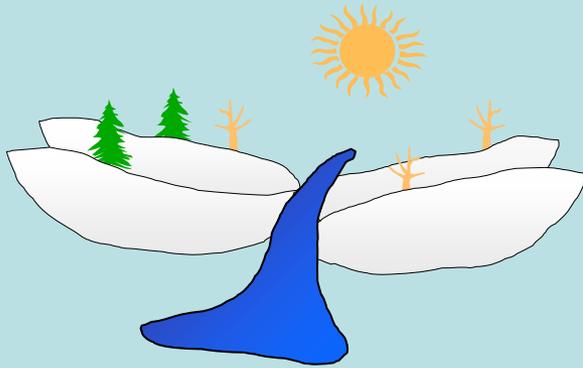
Flood Control Storage



Project	Total Flood Control Storage (ac-ft)	% of Total Flood Storage
Fort Peck	3,675,000	22.6
Garrison	5,711,000	35.1
Oahe	4,303,000	26.5
Big Bend	177,000	1.1
Fort Randall	2,294,000	14.1
Gavins Point	108,000	0.7

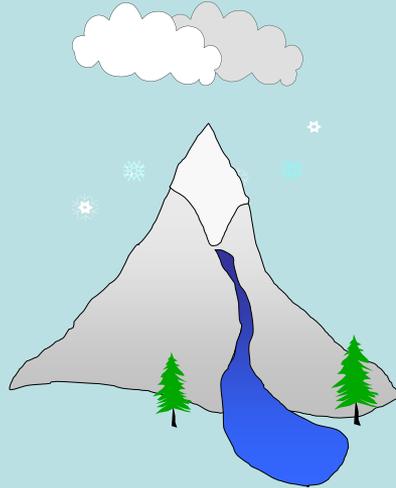
Runoff Components

Plains Snowpack



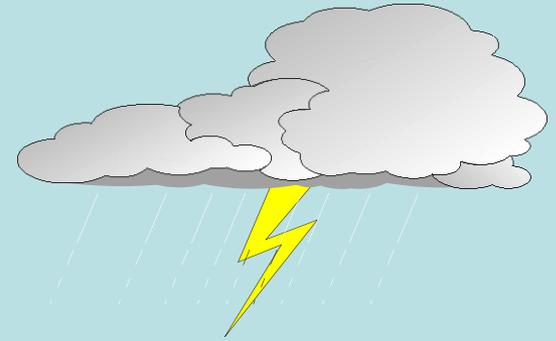
March and April

Mountain Snowpack



May, June and July

Rainfall



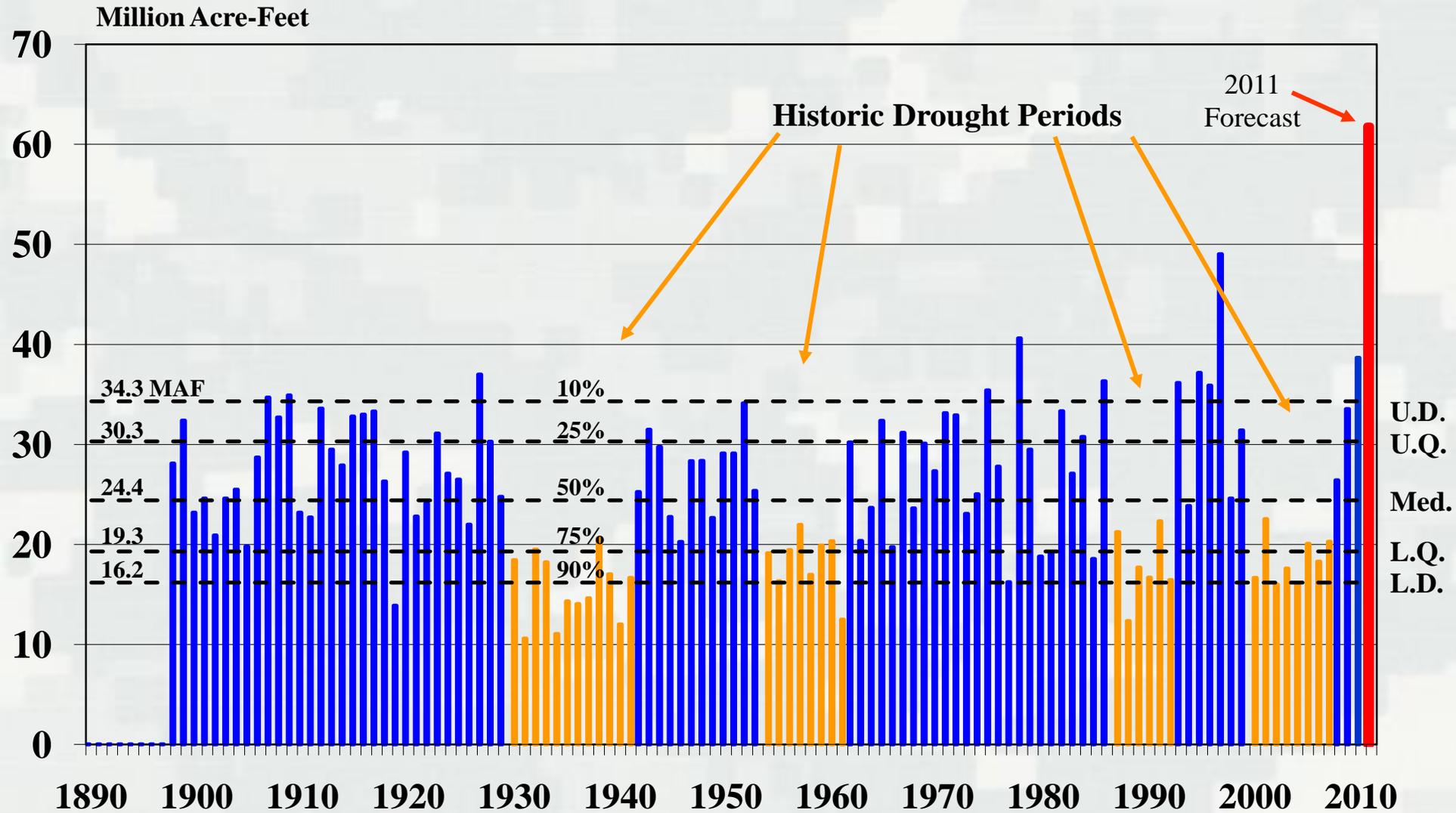
March through October

2011 Forecast* = 61.8 MAF

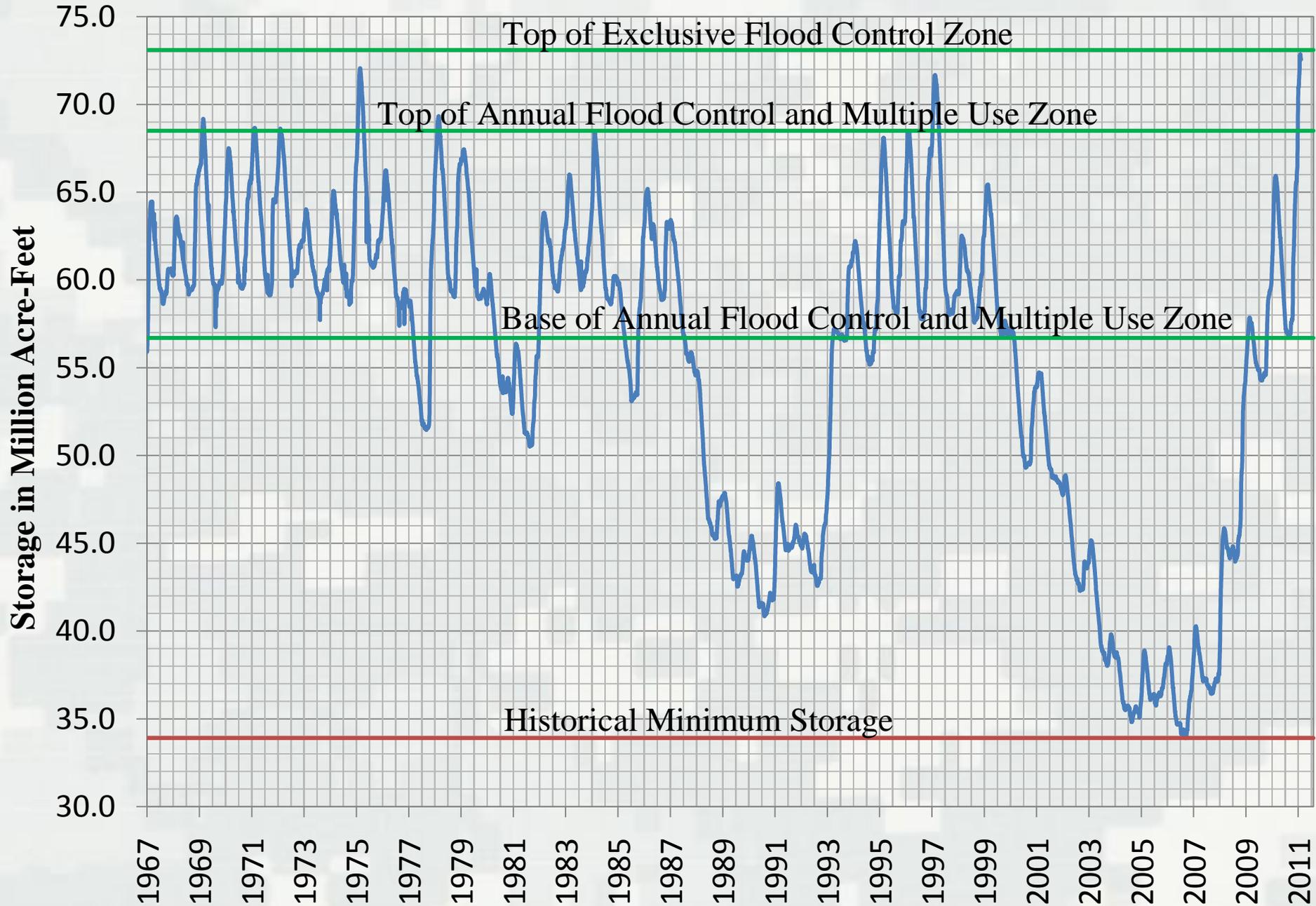
Highest runoff since 1898

Previous Record was 49.0 MAF in 1997

Missouri River Mainstem System Annual Runoff above Sioux City, IA

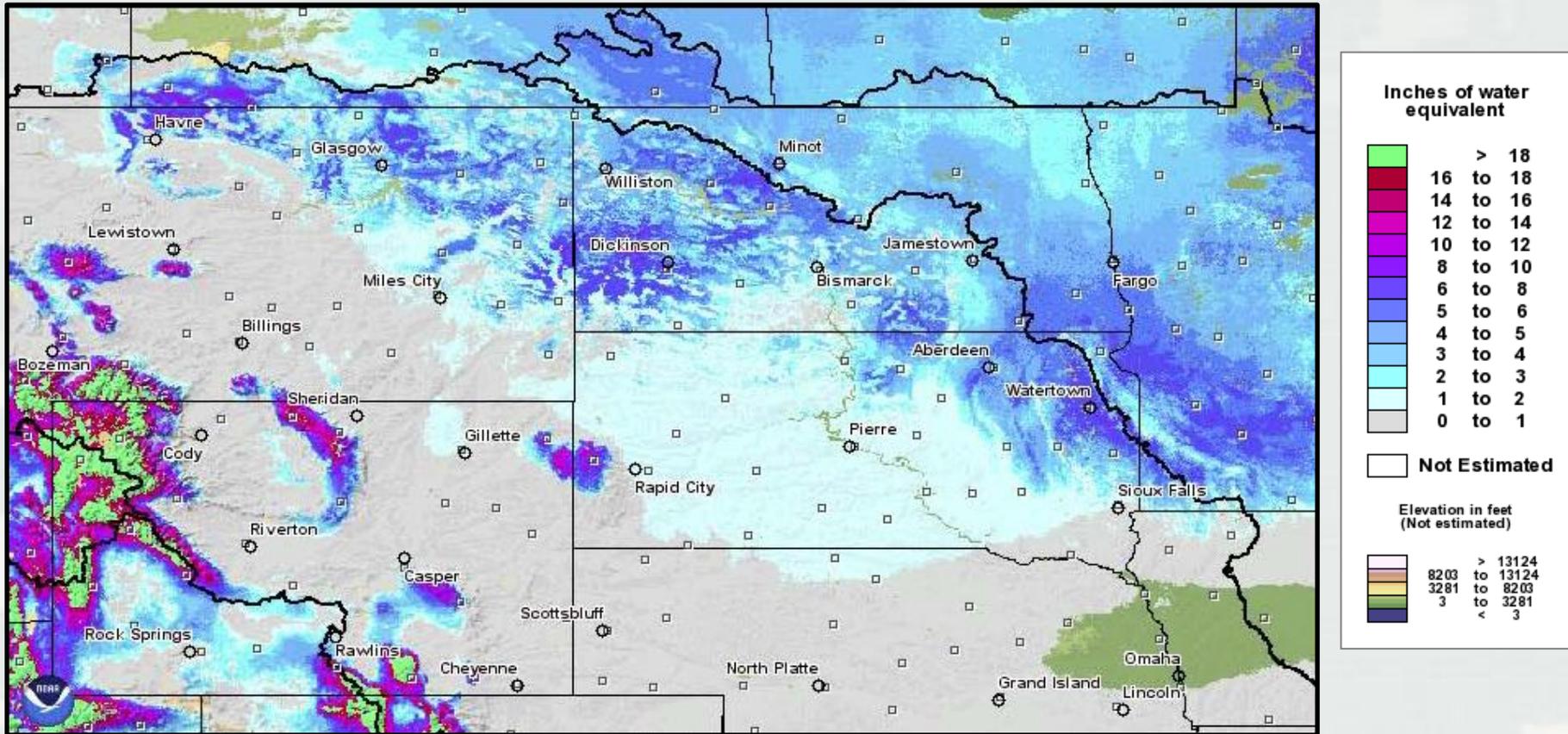


Missouri River Mainstem Reservoir System



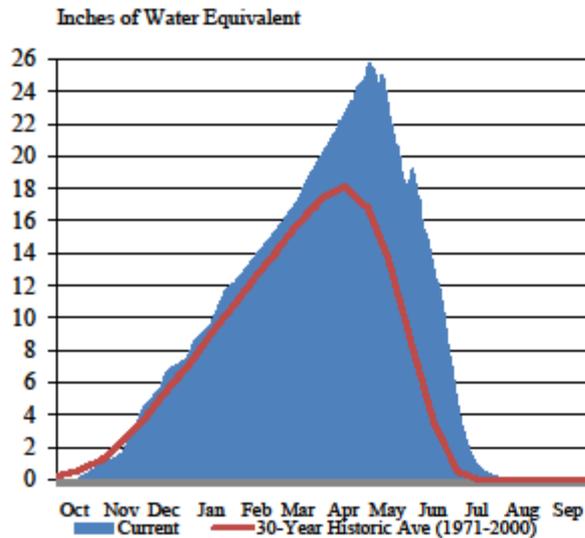
Plains Snowpack

25 February 2011

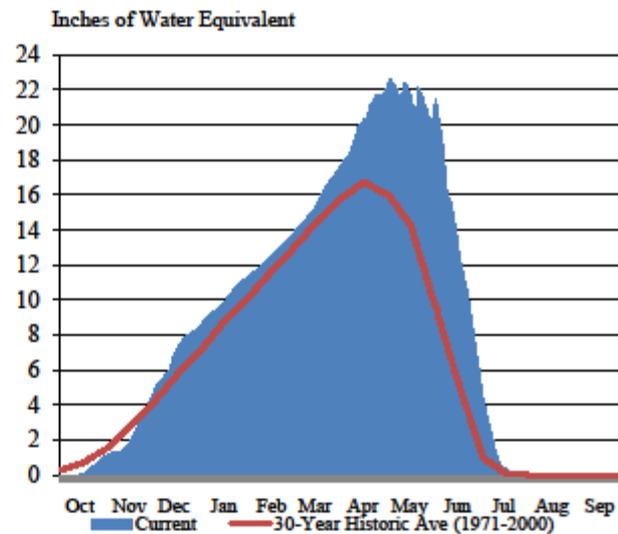


Missouri River Basin Mountain Snowpack Water Content 2010-2011

Total above Fort Peck



Total Fort Peck to Garrison



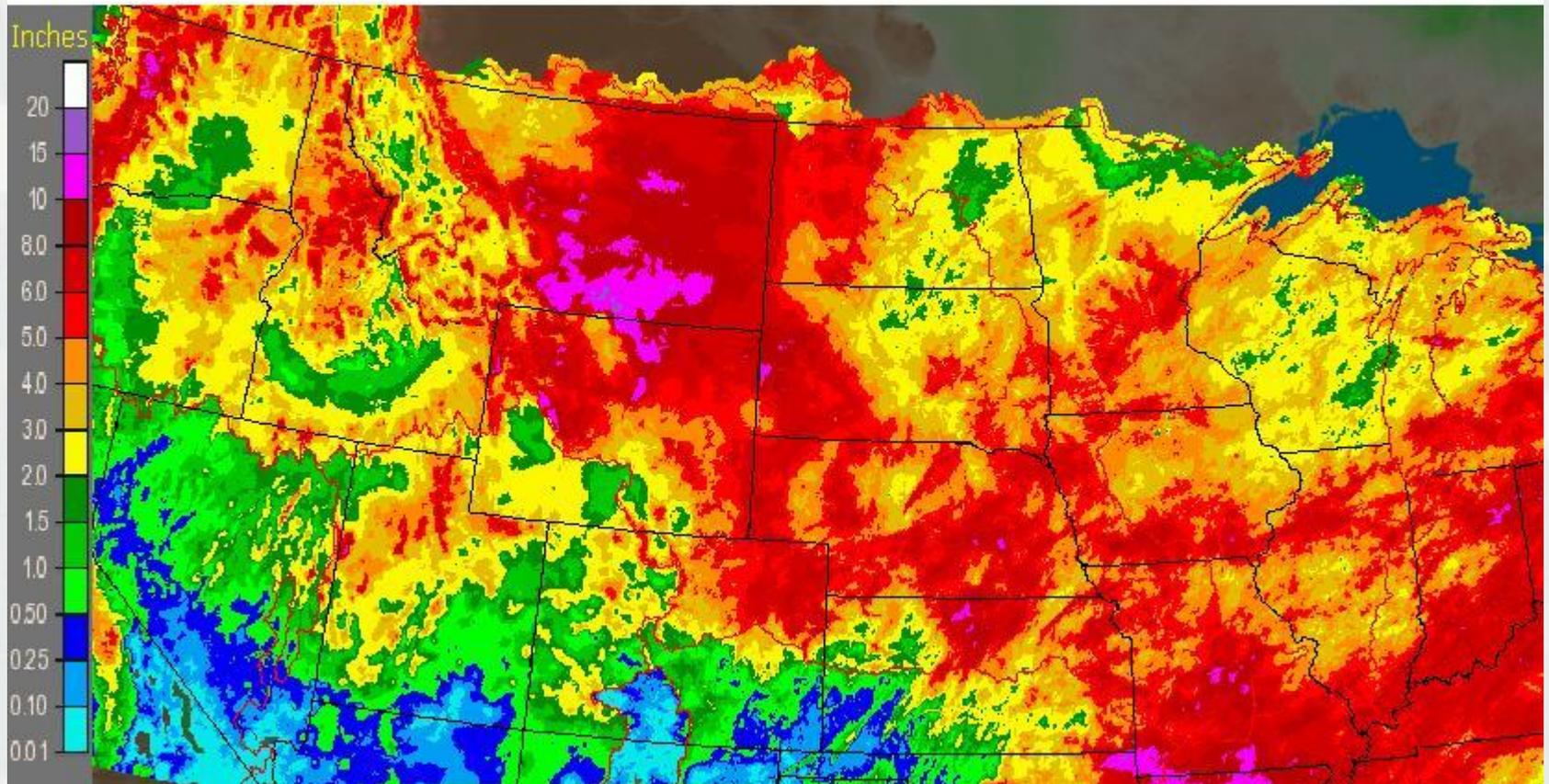
The Missouri River Basin mountain snowpack normally peaks near April 15. The mountain snowpack in both the "Total above Fort Peck" and the "Total Fort Peck to Garrison" reaches peaked on May 2 at 141 percent and 136 percent of the normal April 15 peak, respectively. As of August 1, the mountain snowpack has melted in both reaches .

August 1, 2011

Provisional data. Subject to revision.

May 2011 Precipitation

Missouri Basin RFC Pleasant Hill, MO: May, 2011 Monthly Observed Precipitation
Valid at 6/1/2011 1200 UTC- Created 6/2/11 17:40 UTC



Missouri River Mainstem Reservoir May 2011 Runoff

Total runoff above Sioux City = 10.5 MAF

Wettest May on record

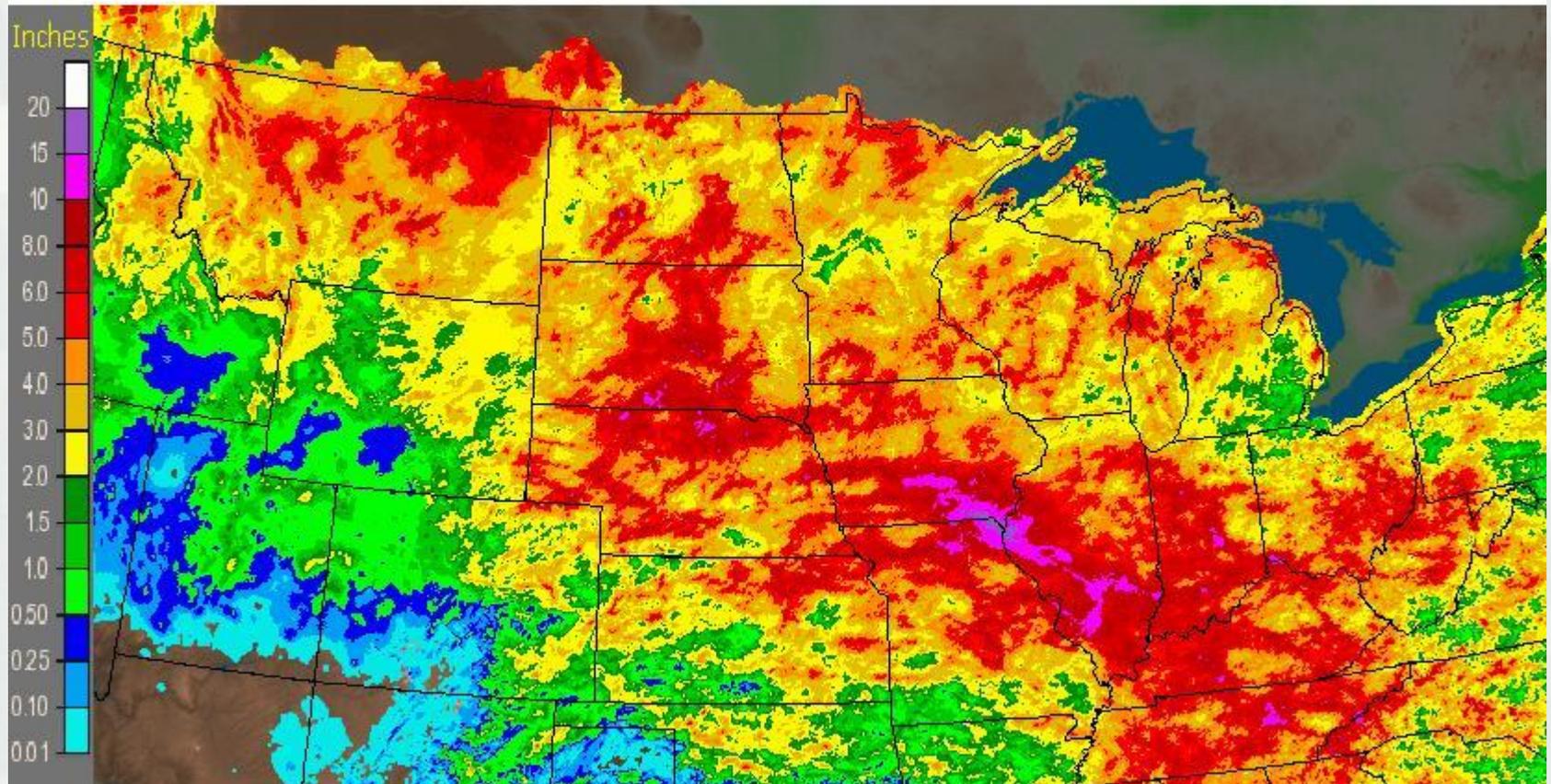
Second (now third) highest single month on record

	<u>2011</u>	<u>Previous May</u> <u>Record</u>
Fort Peck	2.9 MAF	2.6 MAF(1975)
Garrison	4.4 MAF	2.8 MAF(1978)
Fort Peck and Garrison	7.3 MAF	6.7 MAF(1952)
Total Above Sioux City	10.5 MAF	7.2 MAF(1995)



June 2011 Precipitation

NWS Central Region: June, 2011 Monthly Observed Precipitation
Valid at 7/1/2011 1200 UTC- Created 7/2/11 17:40 UTC



Missouri River Mainstem Reservoir June 2011 Runoff

Total runoff above Sioux City = 13.8 MAF

Wettest June on record

Highest single month on record

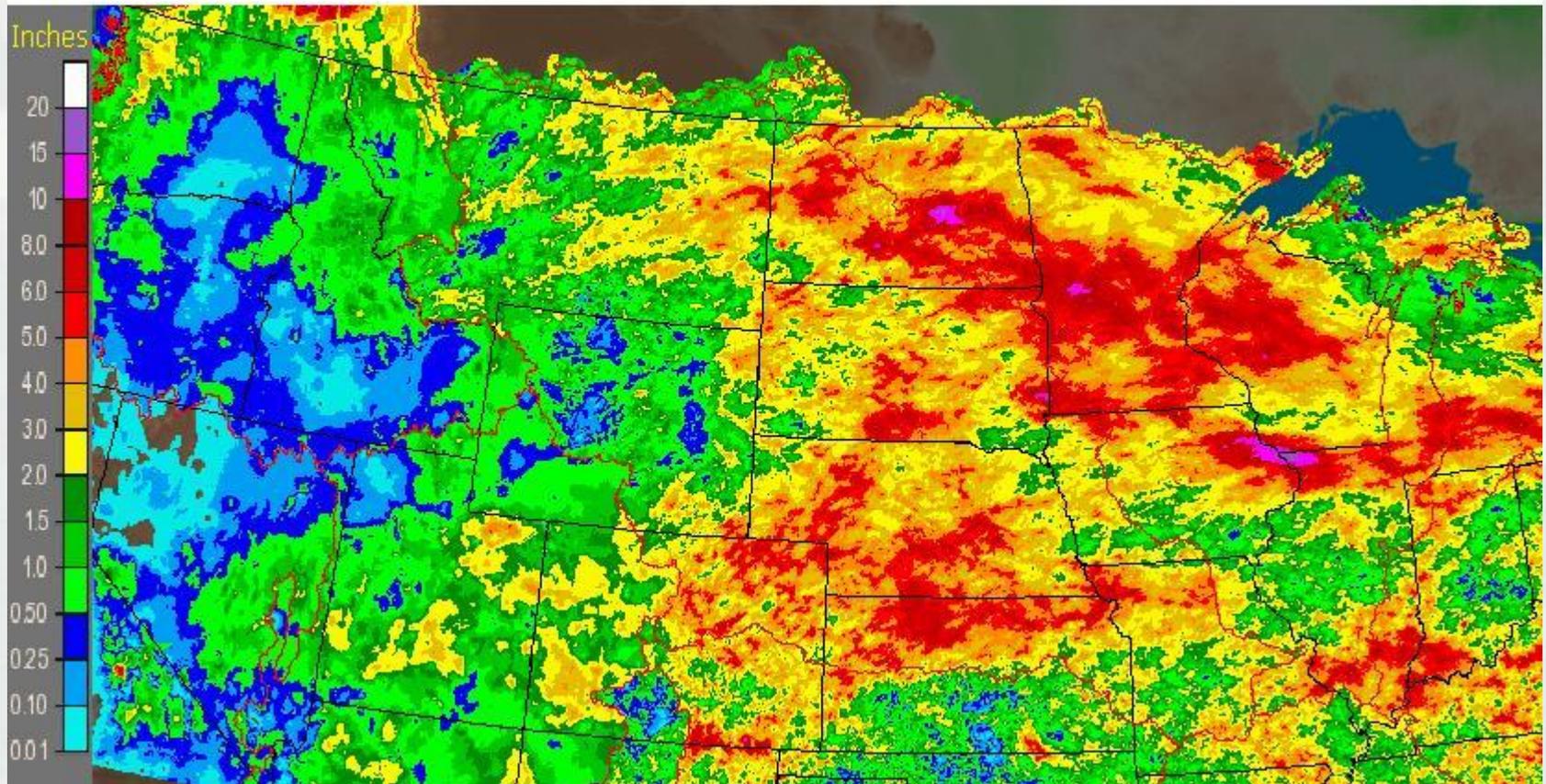
Previous record was 13.2 MAF in April 1952

	<u>2011</u>	<u>Previous June Record</u>
Garrison	6.2 MAF	5.1 MAF(1909)
Fort Randall	0.9 MAF	0.7 MAF(1962)
Total Above Sioux City	13.8 MAF	10.3 MAF(1909)



July 2011 Precipitation

Missouri Basin RFC Pleasant Hill, MO: July, 2011 Monthly Observed Precipitation
Valid at 8/1/2011 1200 UTC- Created 8/2/11 17:40 UTC



Missouri River Mainstem Reservoir July 2011 Runoff

Total runoff above Sioux City = 10.0 MAF

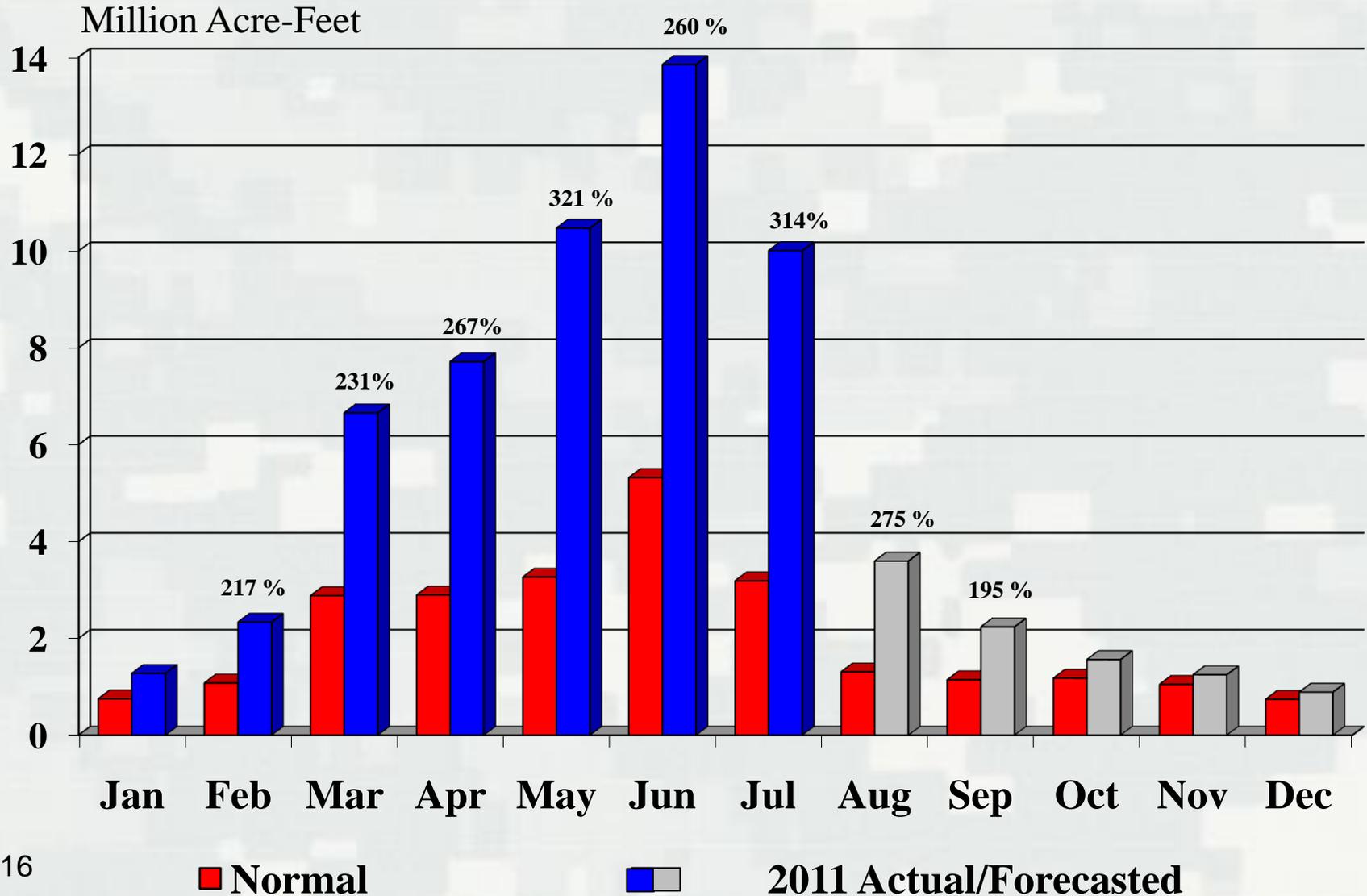
Wettest July on record

Fifth highest single month on record

	<u>2011</u>	<u>Previous July Record</u>
Garrison	5.6 MAF	4.1 MAF(1907)
Total above Sioux City	10.0 MAF	8.2 MAF (1993)



Missouri River Runoff above Sioux City 2011 Actual/Forecasted versus Normal



2011 Mainstem System Regulation

(What We Forecast)

- Full flood control capacity of the mainstem reservoir system was available at the start of the 2011 runoff season
 - ▶ 2010 was 3rd highest runoff year on record
 - ▶ All flood water was evacuated prior to start of runoff
- Until rain events in May, there was no need to evacuate water at historic levels
 - ▶ April 1 runoff forecast = 33.8 MAF; Gavins Point peak releases = 39 to 45 kcfs
 - ▶ May 1 runoff forecast = 44.0 MAF; Gavins Point peak releases = 57.5 kcfs
 - ▶ June 1 runoff forecast = 54.6 MAF; Gavins Point peak releases = 150 kcfs



2011 Mainstem System Regulation (What Actually Happened)

- Unprecedented runoff occurred in the Missouri River Basin above Sioux City, Iowa during May, June and July
 - ▶ June was the single wettest month on record with 13.8 MAF of runoff, surpassing the old record of 13.2 MAF set in April 1952.
 - ▶ May was the third wettest single month on record, with 10.5 MAF of runoff shattering the previous May record of 7.2 MAF set in May 1995
 - ▶ July was the fifth wettest single month on record with 10.0 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



2011 Mainstem System Regulation

(Dispelling Rumors and Myths)

- Mainstem Reservoir System has been operated in accordance with the Master Manual, with flood control as the highest purpose.
- Release schedules have been coordinated with Corps Divisions along the Mississippi River, but we do not have authority to regulate the mainstem reservoir system solely for the benefit of the Mississippi River.
- No operational decisions have been driven by Endangered Species Act (nesting least terns and piping plovers or pallid sturgeon); reservoirs have been operating for flood risk reduction.
- The dams are safe and we're monitoring them closely.
- We released water when we should have; we could not have evacuated earlier.



2011 Mainstem System Regulation

(The Way Ahead)

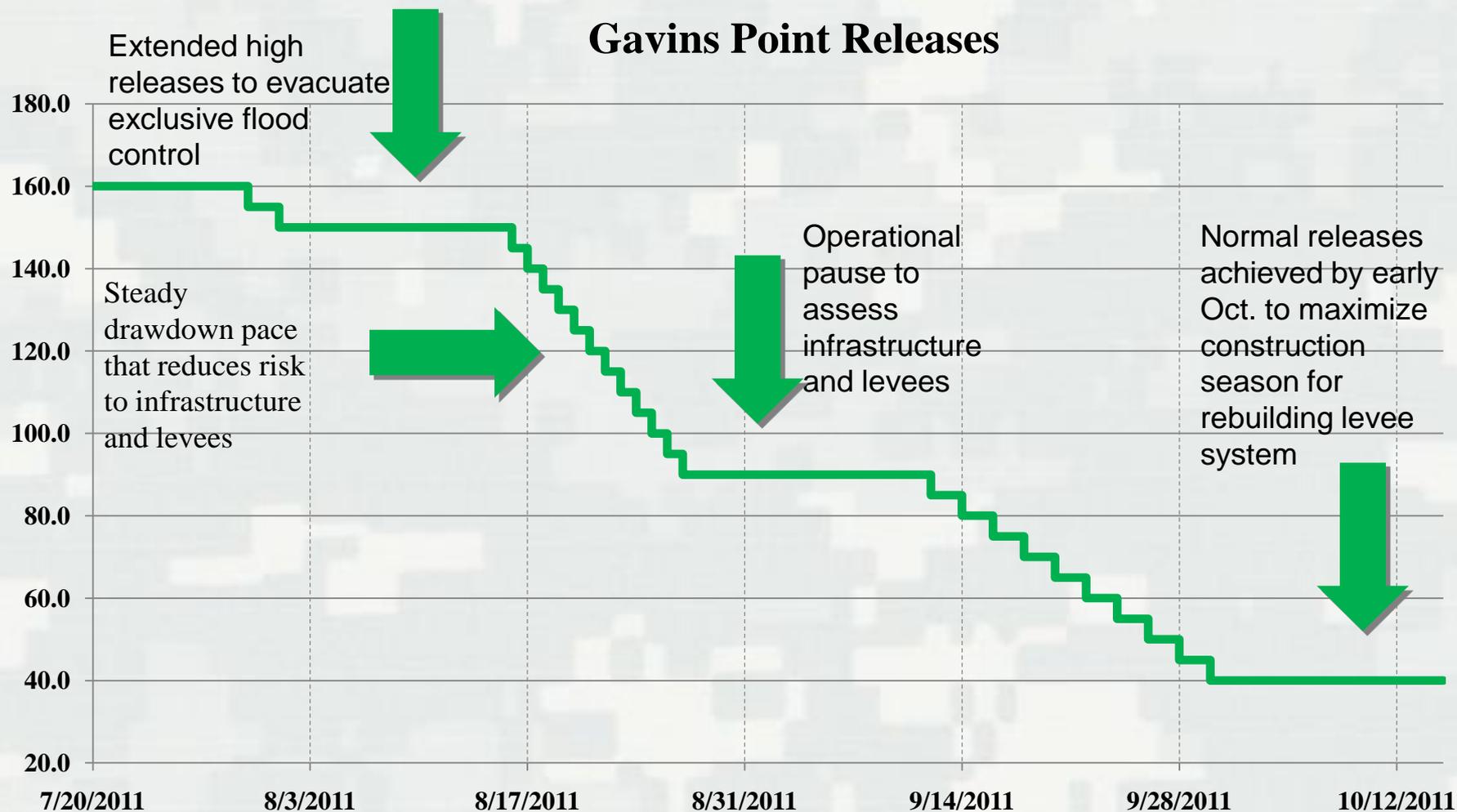
- **Desired end state:** Restore the System infrastructure and levees to pre-2011 event condition and ensure adequate storage for the 2012 runoff season—be **READY** for 2012
- Determine the best strategy to evacuate remaining 2011 runoff
- Assess risks related to achieving end state via multiple evacuation strategies
- Evacuate the water out of the system as fast as possible in a responsible way to enable:
 - ▶ Return of citizens to homes, farms and businesses to begin recovery
 - ▶ Inspection, assessment and repair of infrastructure and levees
 - ▶ Engender public confidence with Governor and Congressional support
- Reduce known risks where we can and anticipate other risks, both known and unknown



Key Engineering Considerations

- 
- Evacuate exclusive flood control zones of all reservoirs as soon as possible—gain back our flexibility.
 - Ensure fall releases are low enough to facilitate damage assessment and repair of infrastructure and levees (<40k cfs).
 - Ensure winter releases are low enough to permit winter construction and minimize the risk of ice jam flooding (<20k cfs).
 - Ensure rates of change in releases and reservoir levels are acceptable.
 - Consider releases that take water off critical infrastructure.
 - Consider releases that avoid continued use of various project features such as spillways and outlet tunnels.
 - Consider releases that allow temporary measures to be removed.

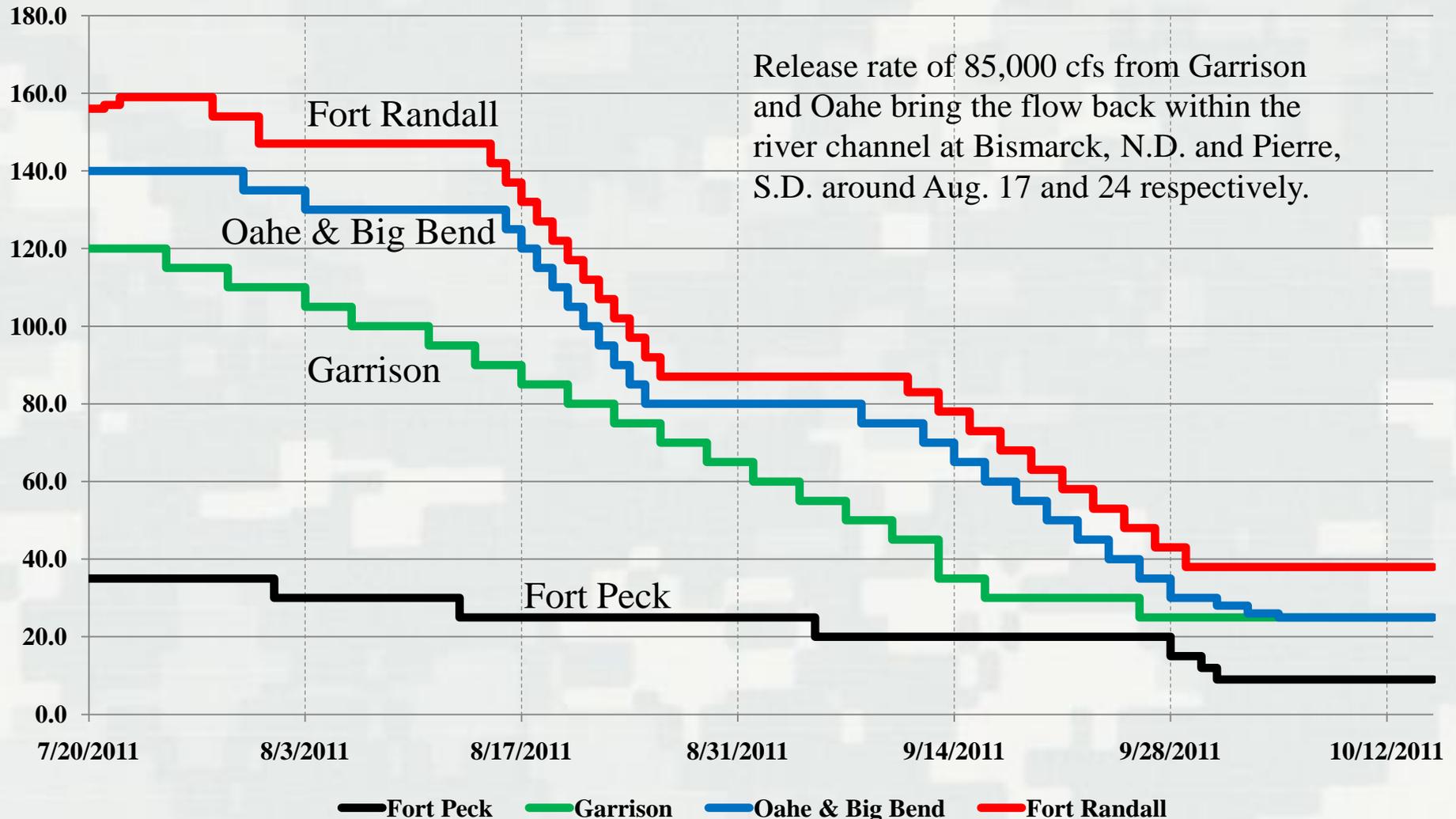
Drawdown Strategy



All dates provided above are best approximations, based on current forecast conditions and the best available information at the time. Adjustments to the release schedule may be necessary if conditions change.

Drawdown Strategy

Fort Peck, Garrison, Oahe/Big Bend, and Fort Randall Releases



All dates provided above are best approximations, based on current forecast conditions and the best available information at the time. Adjustments to the release schedule may be necessary if conditions change.

Questions?



Background slides



Fort Peck



Garrison



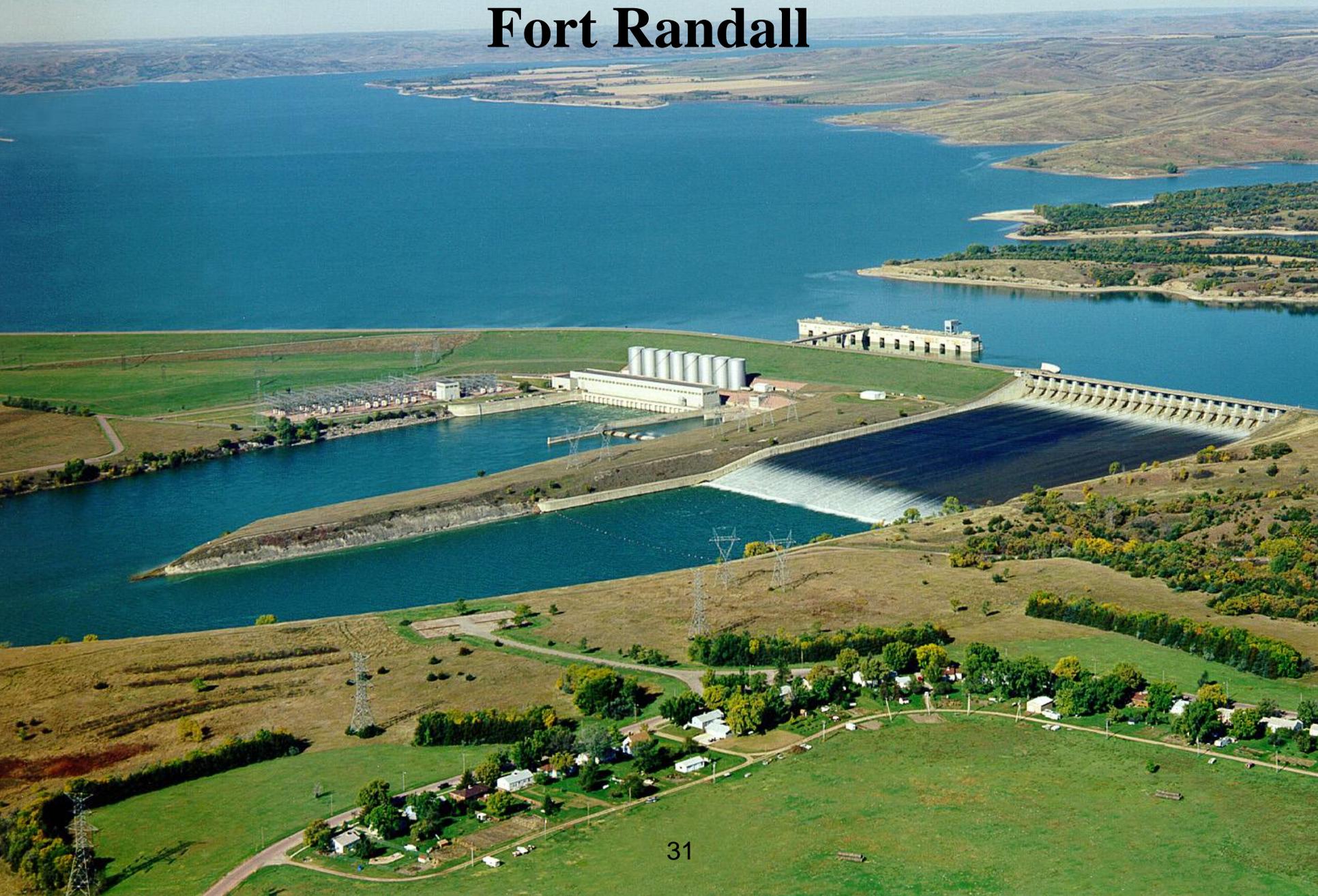
Oahe



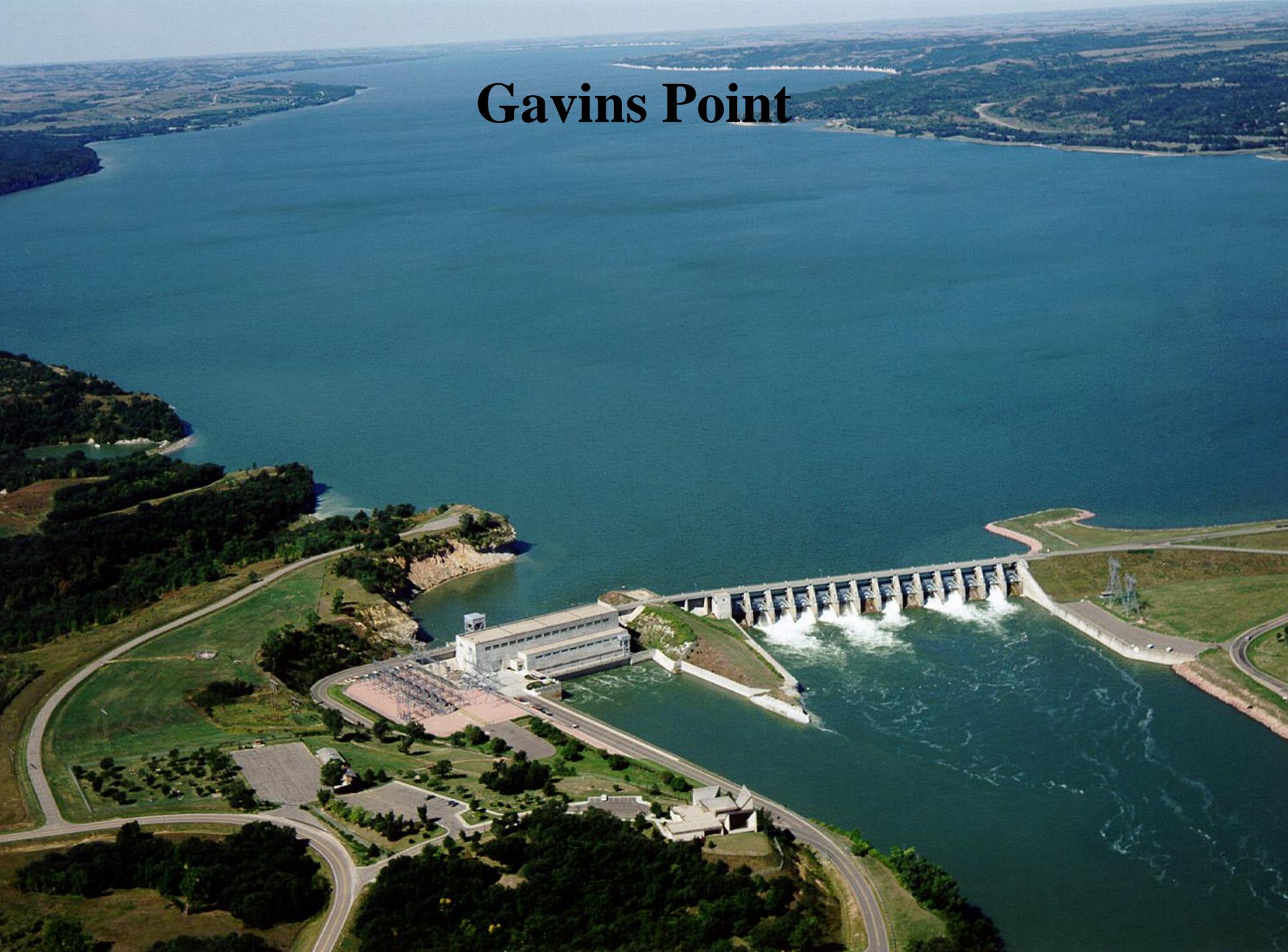
Big Bend



Fort Randall

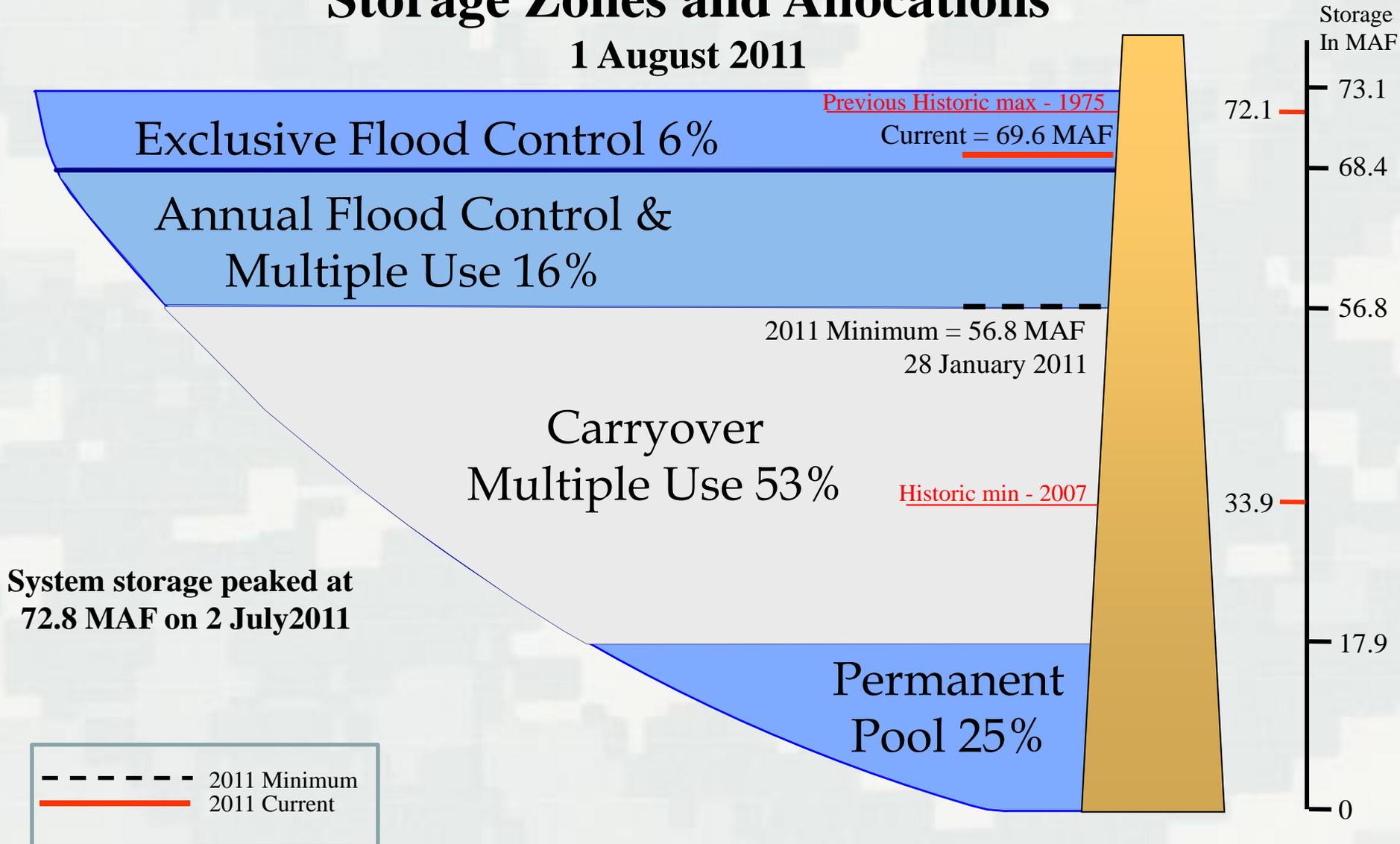


Gavins Point



Missouri River Mainstem System Storage Zones and Allocations

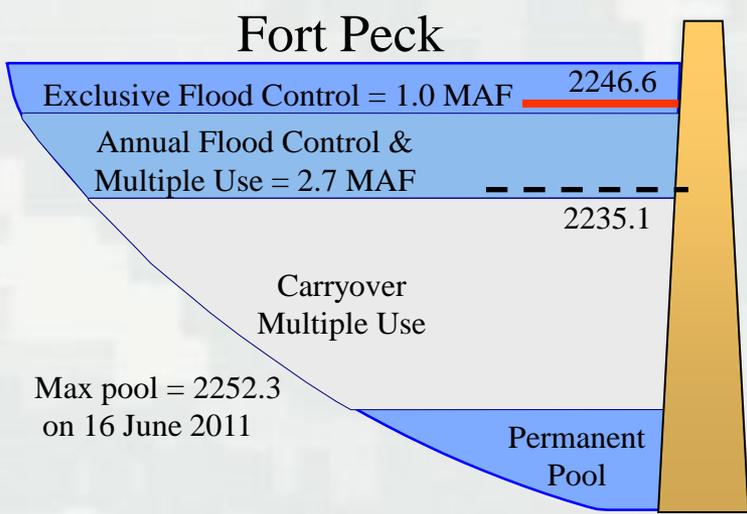
1 August 2011



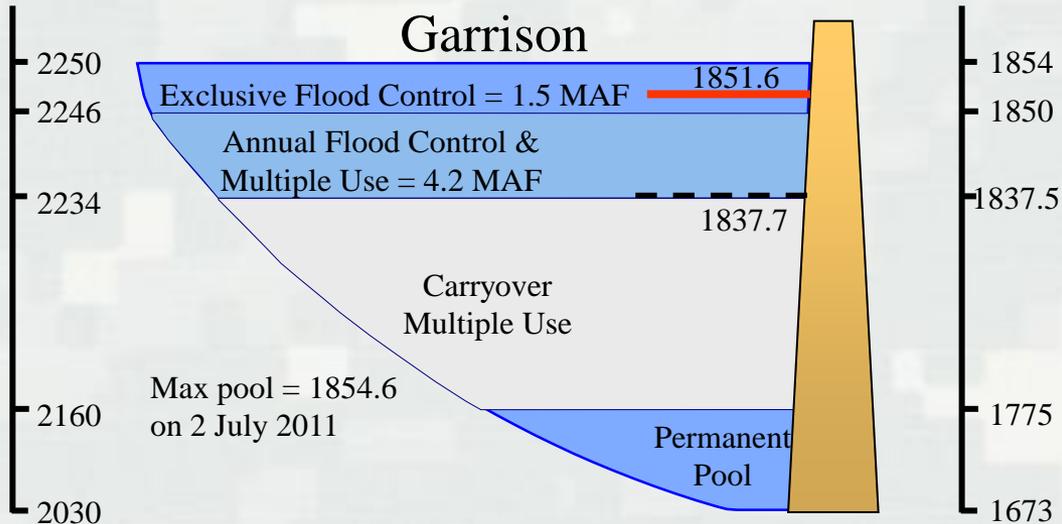
Mainstem Reservoir Levels

1 August 2011

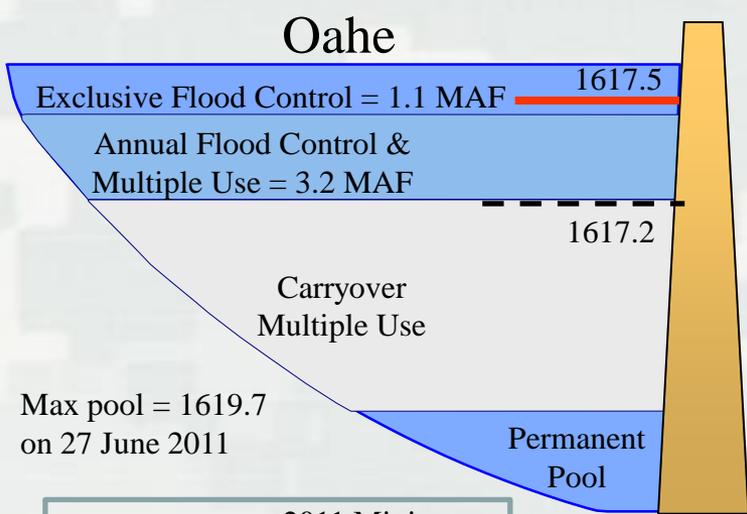
Fort Peck



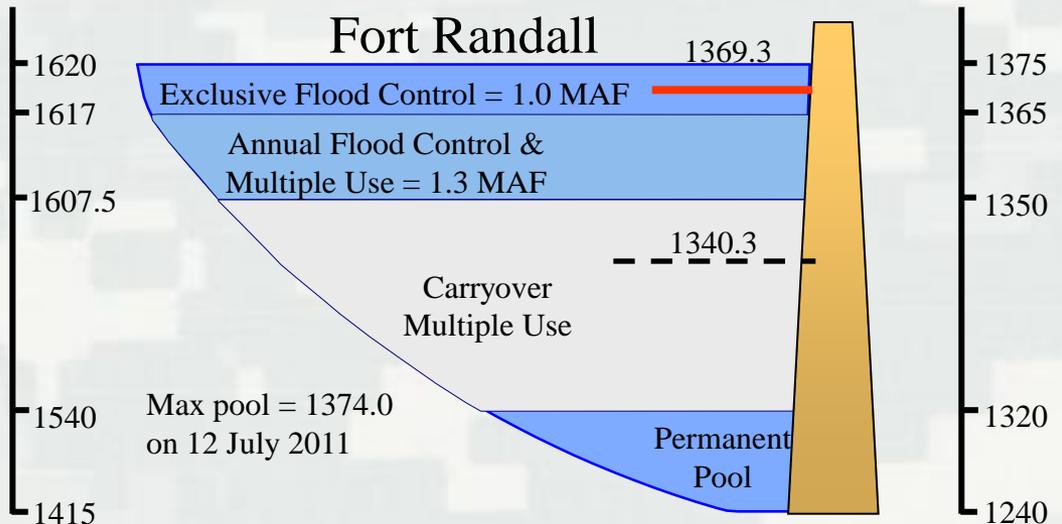
Garrison



Oahe

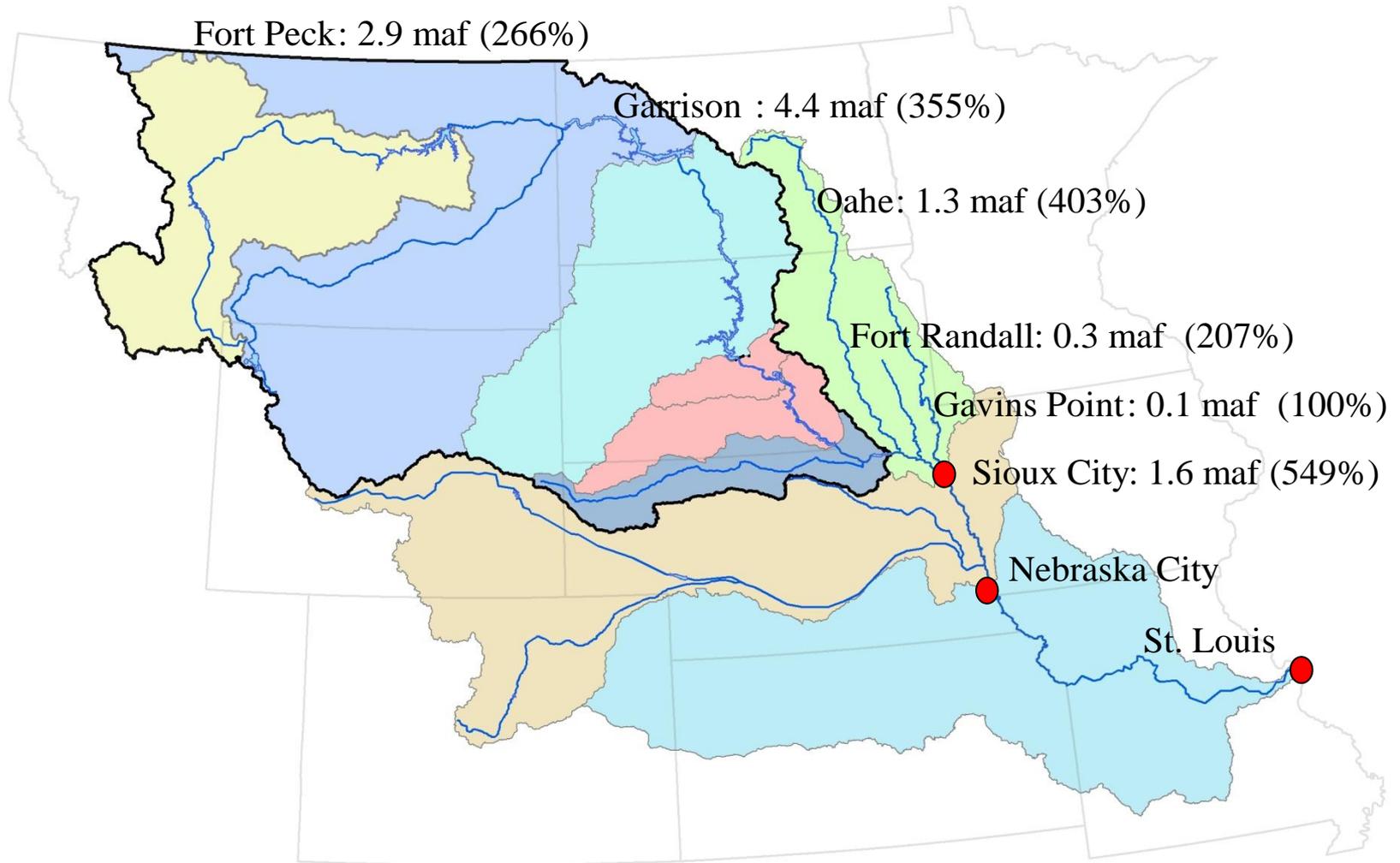


Fort Randall

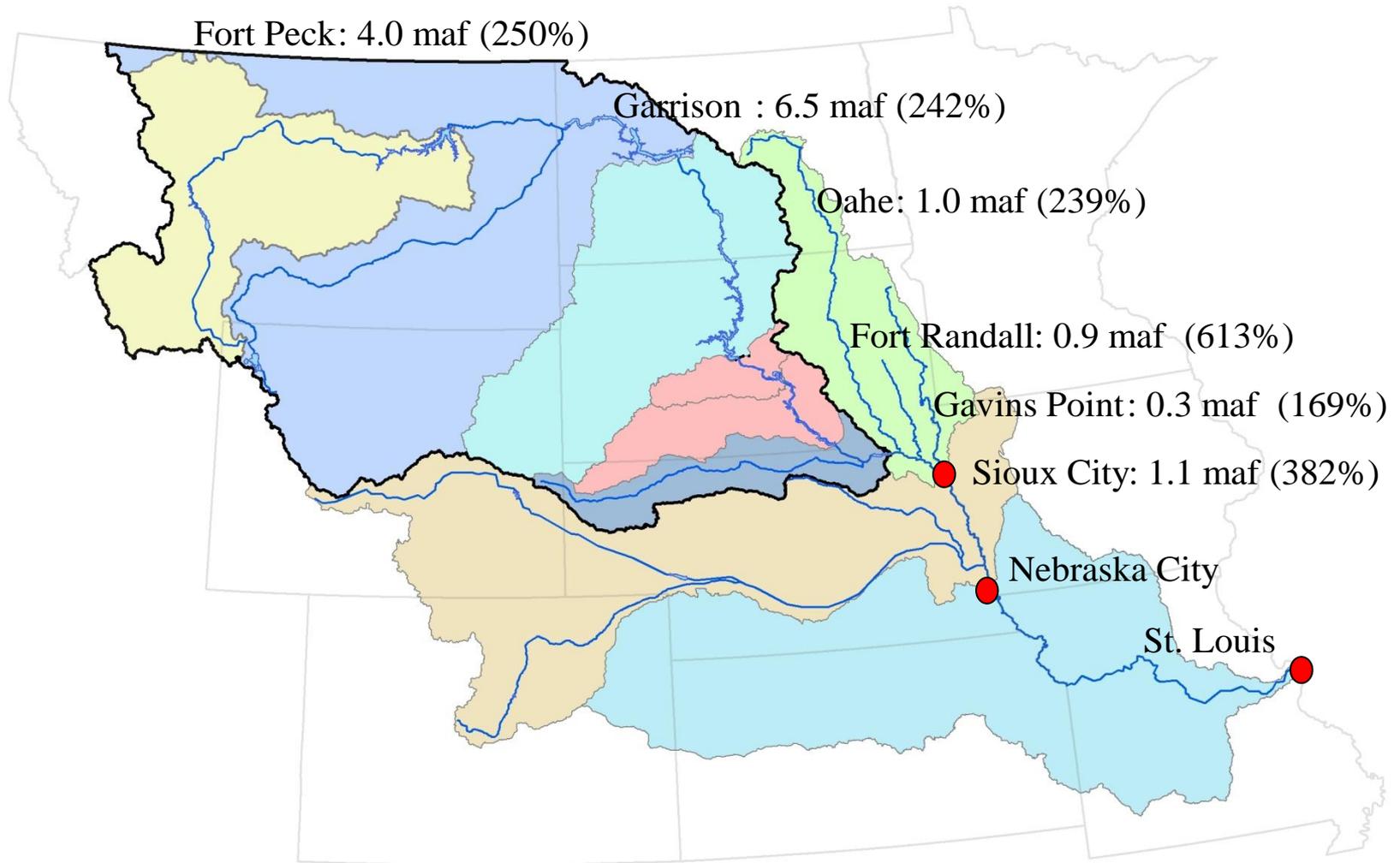


2011 Minimum
 2011 Current

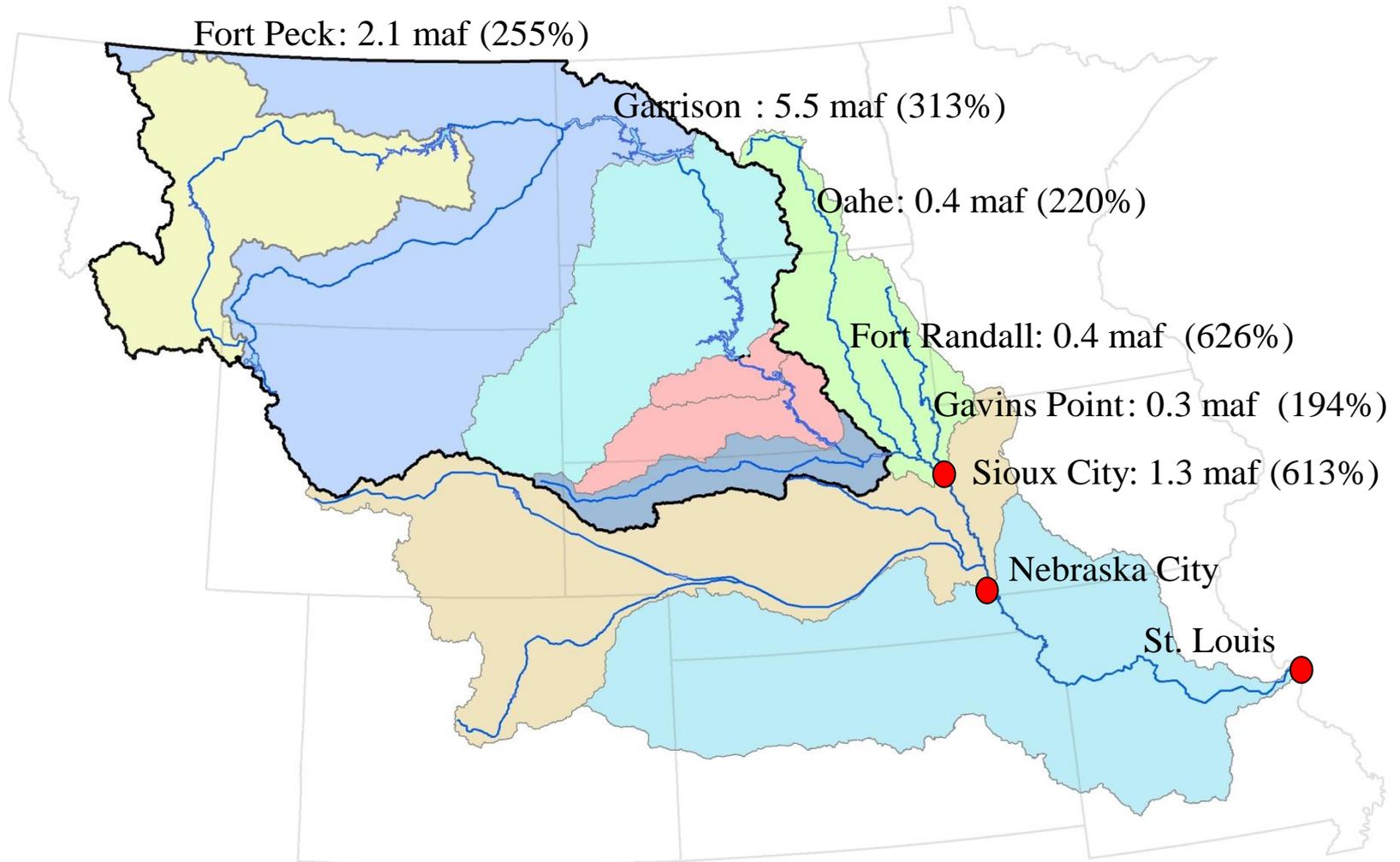
Missouri River Basin – May 2011 Runoff



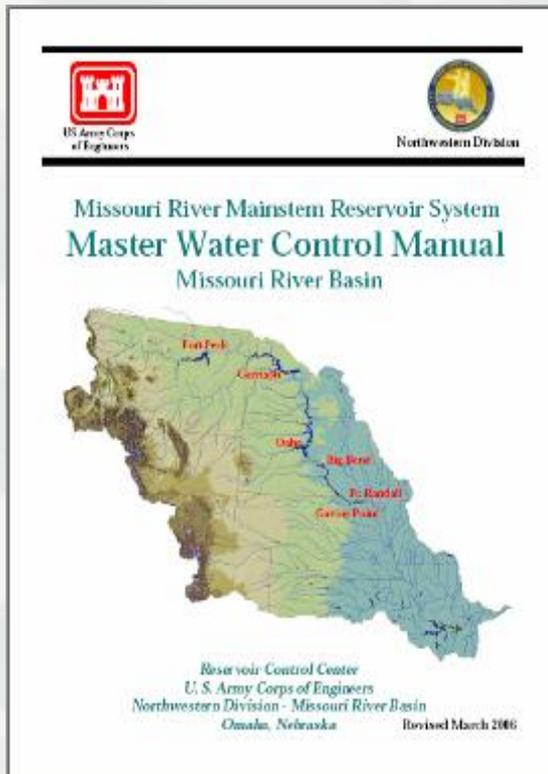
Missouri River Basin – June 2011 Runoff



Missouri River Basin – July 2011 Runoff



Missouri River Mainstem Reservoir System Master Manual



- First published in 1960
- Updated in 1975 and 1979
- Master Manual Review and Update began in November 1989 in response to late 1980's / early 1990's drought
- Amended Biological Opinion received from USFWS in December 2003
- Manual was revised for drought conservation in March 2004
- Again revised in March 2006 for Gavins Point spring pulse
- Annual Operating Plan (AOP) developed annually in accordance with Master Manual