2021 OMAHA SAME POST INDUSTRY DAY PROGRAM

MISSOURI RIVER 2019 FLOOD RECOVERY RECAP

6 OCT 2021
1115-1200 HRS

Kayla Eckert Uptmor
Chief, Civil Works
Omaha District Congressional Liaison

US Army Corps of Engineers®

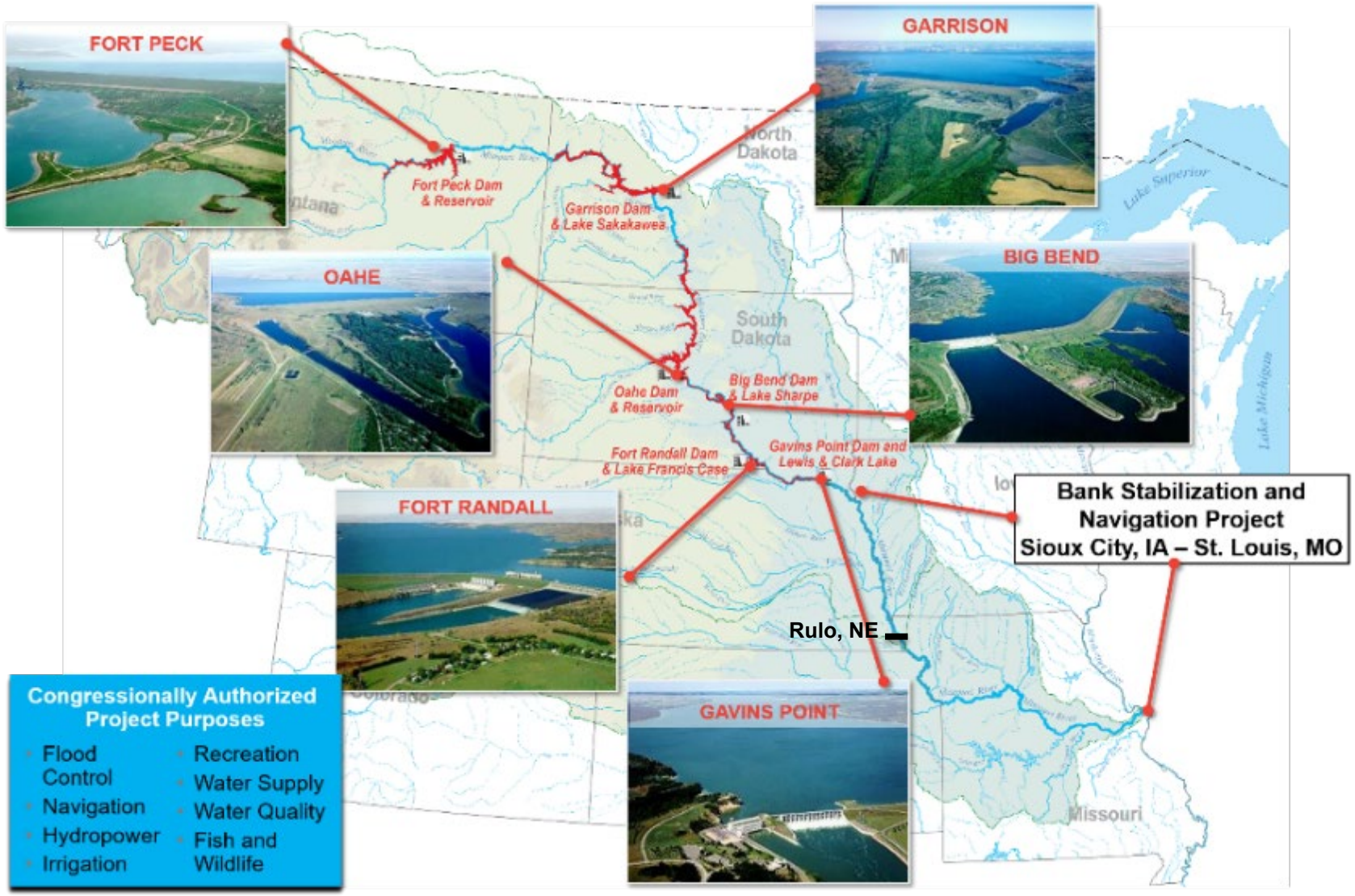
AGENDA/BLUF

- **Missouri River Water Management Update** – Drought is projected to continue and possibly worsen likely resulting in water access issues.

- **Flood Repairs –** Placed over $695M since March of 2019, equivalent to a MEGA size projects. All scheduled levee systems were restored to full height by 01 March 2020.

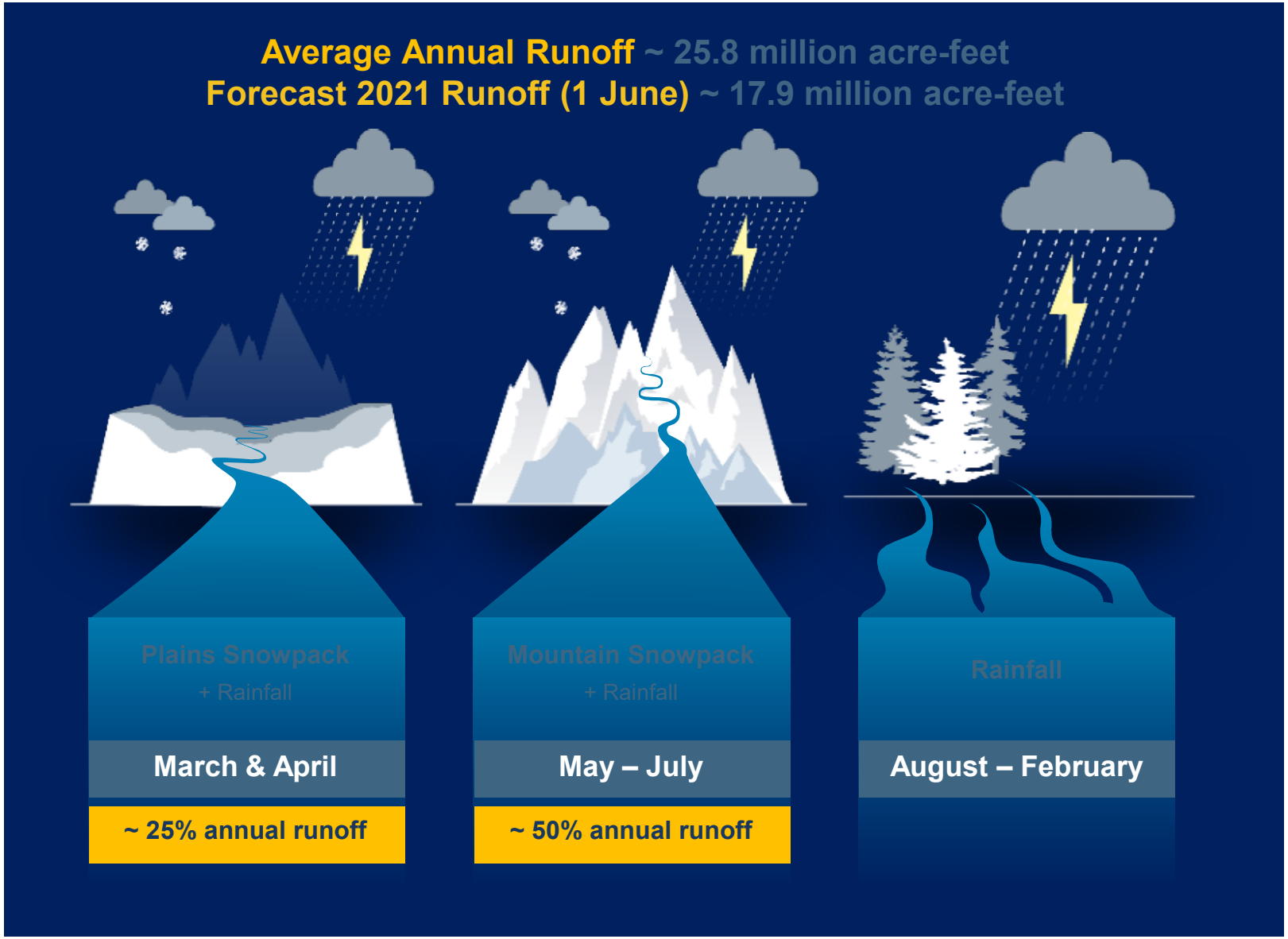
- **Navigation Repairs -** Repair execution is dependent on river conditions during construction, rock availability, and the timing of funding. Current unfunded need is $316M.

MISSOURI RIVER SYSTEM



- 529,350 Square Miles
  - 1/6 of CONUS
- 2,341 Miles Long
- 10 States, 2 Canadian Provinces
- **River of Thirds**
  - **1/3 Channelized**
  - **1/3 Impounded**
  - **1/3 Natural State**
- 279,480 mi^2 Regulated by Mainstem Projects
- 83,800 mi^2 Regulated by Tributary Projects
- 165,070 mi^2 Unregulated

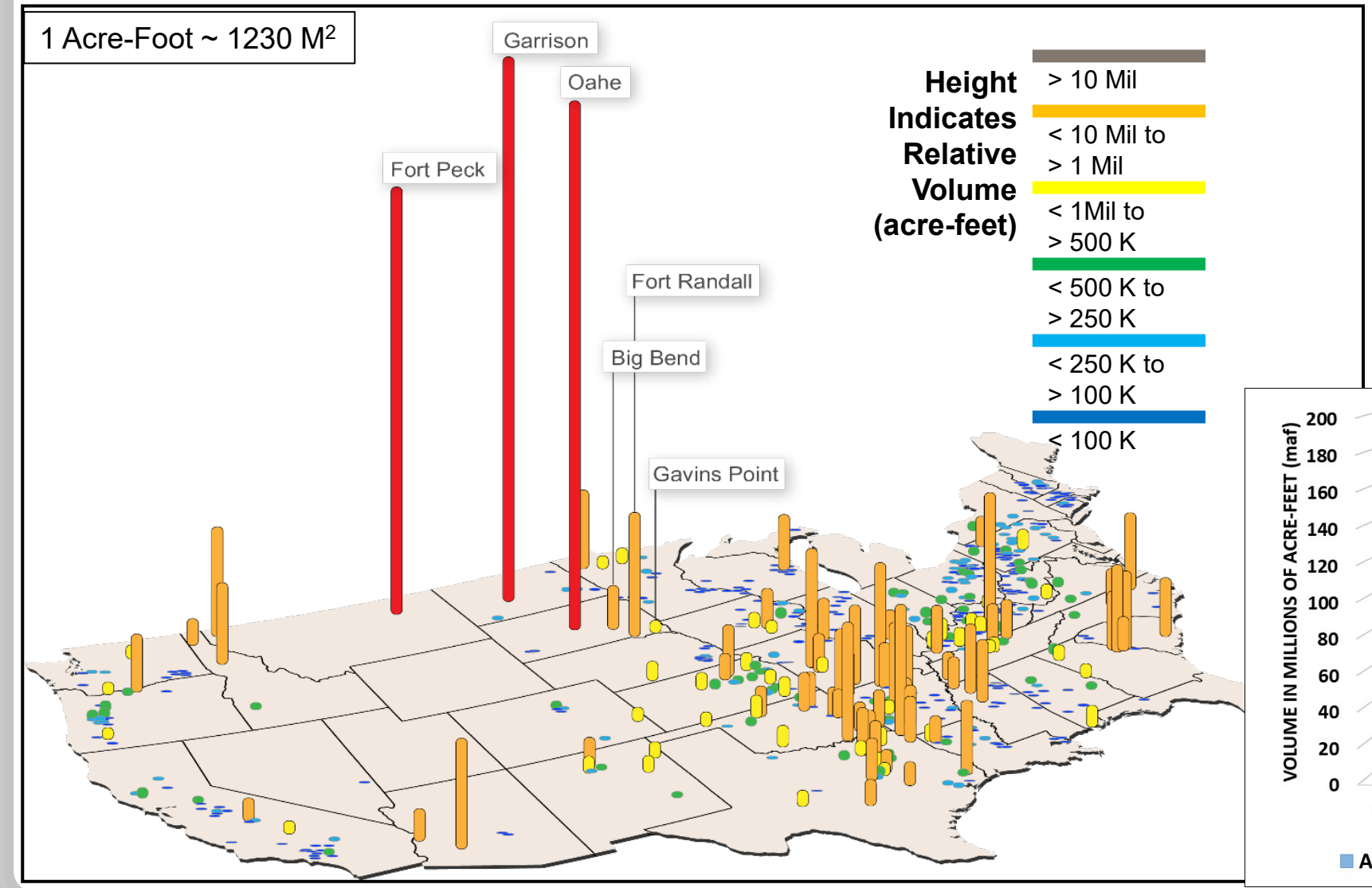
MISSOURI RIVER BASIN – RUNOFF ABOVE SIOUX CITY, IA



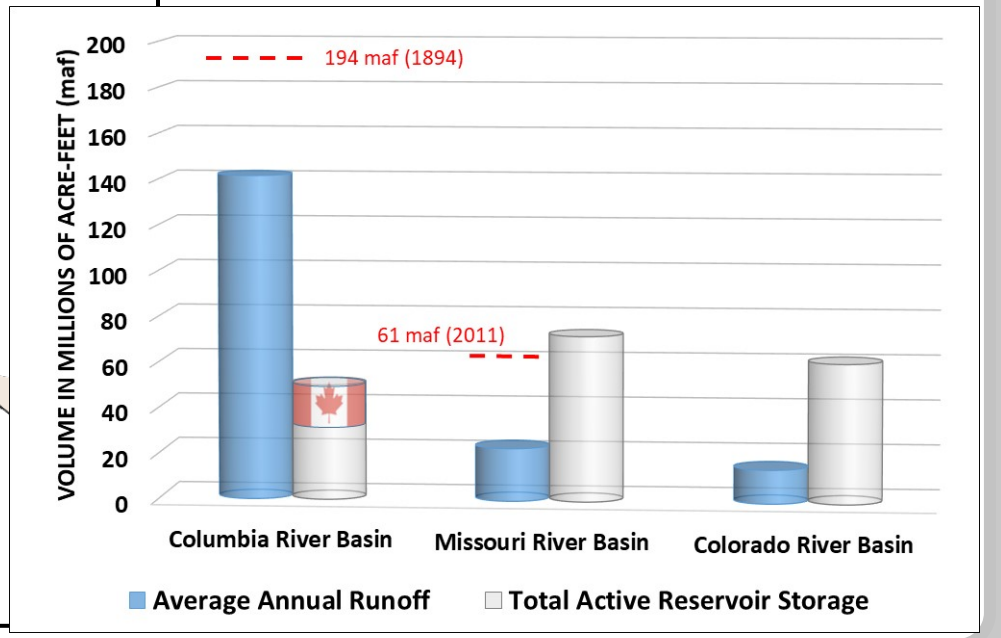
- Snowmelt and Rainfall Driven
- Runoff Season Generally Begins Around 1 March
- Three Primary Runoff Periods
  - March-April, Plains Snowpack and Rainfall (~25%)
  - May-July, Mountain Snowpack and Rainfall (~50%)
  - August-February, Rainfall and Base Flow (~25%)
- Runoff – Highly Variable
  - Year to Year
  - Month to Month

MISSOURI RIVER MAINSTEM RESERVOIR SYSTEM

USACE Reservoir Storage Capacity

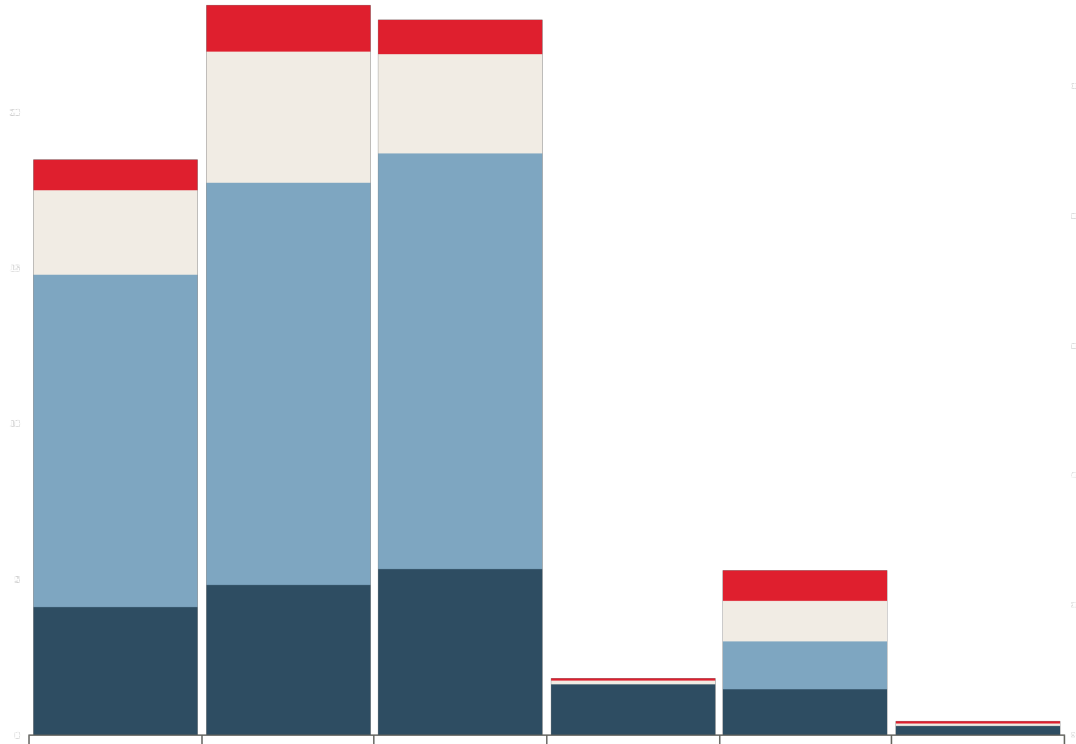


- Largest Reservoir Storage System in North America (72.4 MAF)
- Garrison, Oahe and Fort Peck are the 3rd, 4th, and 5th Largest Storage Reservoirs in the Federal Inventory
- Total Storage ~ 3 x Ave Runoff (see below)



MAINSTEM PROJECTS - STORAGE

- Upper Three Projects (Big 3) Drive the System
  - 88% of Total Storage
  - 85 % of Flood Control Storage
  - 96% of Carryover Multiple Use Storage
- Big Bend, and Gavins Point are Re-Regulation Projects (do not fluctuate)
- Fort Randall Provides Winter Storage/Hydropower, and Local Flood Control
- Big Bend, Fort Randall and Gavins Point are Relatively Un-effected by Drought



	Fort Peck	Garrison	Oahe	Big Bend	Fort Randall	Gavins Point
Exclusive Flood	0.971	1.495	1.107	0.061	0.986	0.054
Annual Flood	2.704	4.211	3.208	0.118	1.306	0.079
Carryover	10.7	12.951	13.353		1.532	
Permanent	4.088	4.794	5.315	1.631	1.469	0.295
Gross Storage in MAF	18.463	23.451	22.983	1.81	5.293	0.428
72.4 MAF System Storage	25%	32%	31%	3%	8%	1%
Accumulative %	25	57	88	91	99	100

AUTHORIZATION/MISSION

- Eight Authorized Purposes
  - Flood Control – Requires Empty Space
  - Navigation
  - Water Supply
  - Hydropower
  - Water Quality Control
  - Recreation
  - Irrigation
  - Fish and Wildlife

Requires Access to Water or Releases

- Purpose ≠ Priority: One priority is life safety.
- Runoff Driven System – The runoff drives system releases and is managed on an annual basis. We do not carryover water in the flood control zones
- Basically operate for flood control or meeting downstream targets (navigation, Water Supply)
- Must comply with all laws (e.g. ESA*, CWA, etc.)

* - As Hydrologic Conditions Allow

2021 MISSOURI RIVER WATER MANAGEMENT SUMMARY

BLUF

– Severe Drought Conditions in the Upper Basin

– Full-Service Flow Support 1 April – 1 July

– Less than Full-Service Flow Support 1 July - 1 December (1500 cfs below full service)

– Reservoir level at Fort Peck, Garrison and Oahe will decline (10-11 feet down by 31 Dec 2021)

– Water Access
  - Irrigators in Montana
  - Possible Recreational Access in the Upper Three Reservoirs
  - Possible Municipal Water Access Issues in the Lower River this Winter

– Begin 2022 Runoff Season ~ 8.3 MAF below the Base of the Flood Control Pool (forecasted)

– Less than Full-Service Flow Support to begin 2022 Navigation Season (forecasted)

MISSOURI RIVER 2019 FLOOD

WHAT LED TO THE MARCH 15, 2019 FLOOD EVENT?

- High soil moisture in Fall 2018 leading into winter

- Extremely cold temperatures in February 2019 and early March 2019
  - Significant frost depths limiting infiltration
  - Thick river ice with ice jamming occurred
  - Above normal, and in some cases, record snowfall

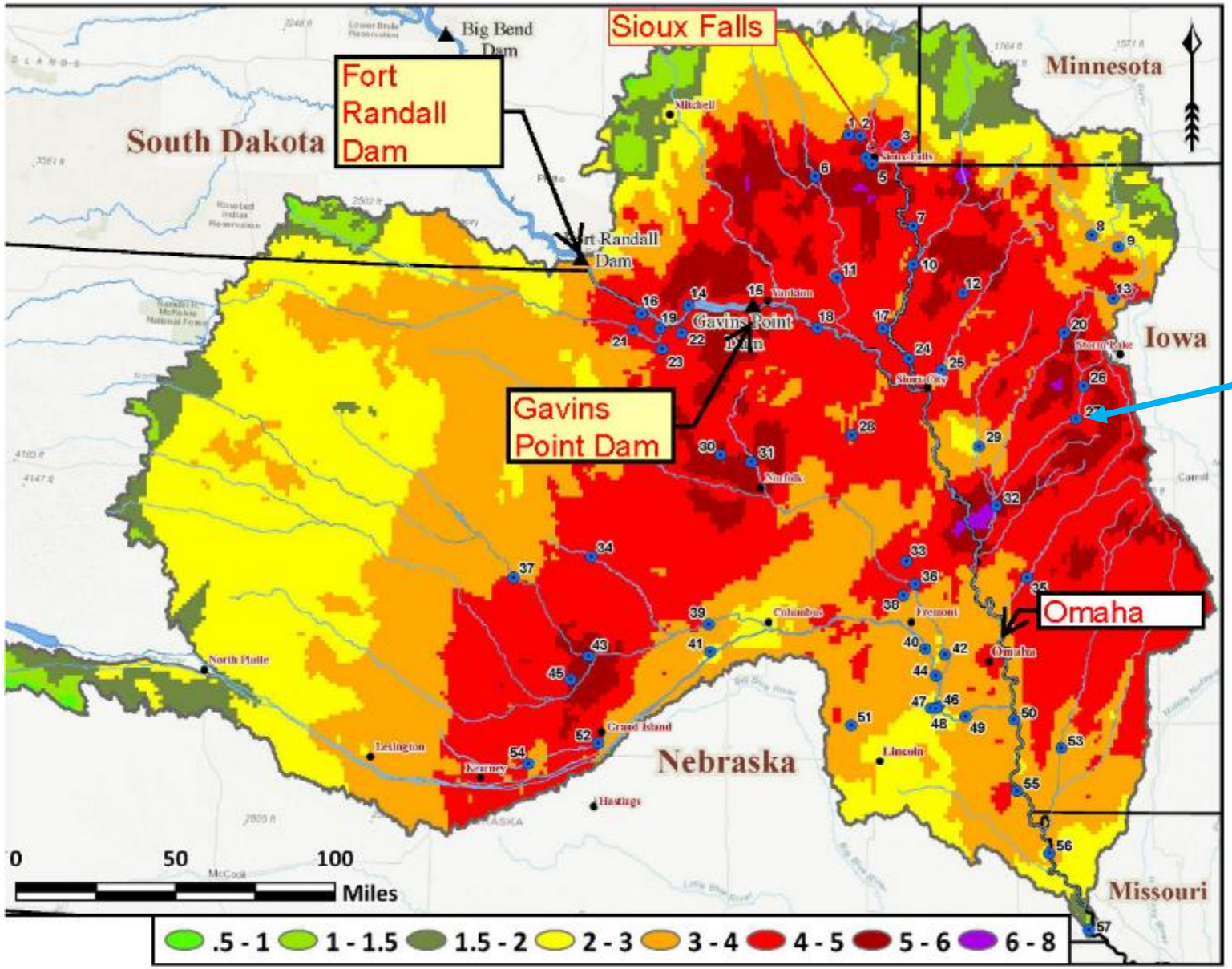
- Bomb cyclone dumped 2.25 inches of warm rain on frozen soil and heavy, wet snowpack (March 12-14, 2019)

- Rain and melting snow on frozen ground led to significant runoff across southeastern SD, eastern NE, and western IA

March 2019 unregulated flood event is unprecedented in the region.

– 45 river gages set new records
MO River (5); South Dakota (8); Iowa (8); Nebraska (24)

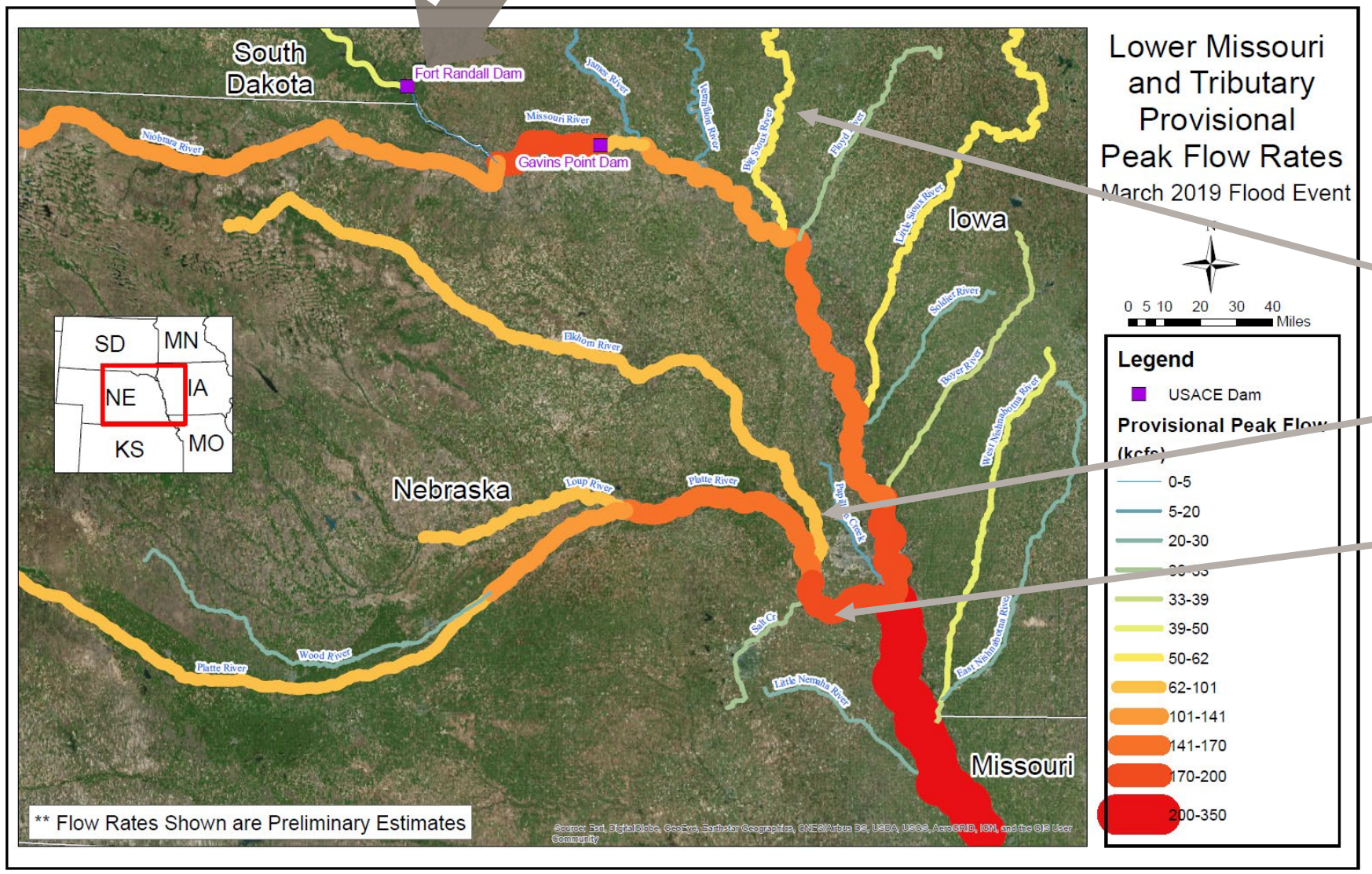
MID-MARCH 2019 – PRECIPITATION PLUS SNOW WATER MELT



Each Blue Dot is a River Gage that set a **new record stage** in March 2019

MISSOURI RIVER DOWNSTREAM OF FORT RANDALL DURING FLOOD

OVERVIEW – THE FLOOD



Peak Flows – March 2019

<u>Missouri River</u>
Sioux City – 159,000 CFS
Nebraska City – 342,000 CFS

<u>Big Sioux River</u>
Hawarden, IA – 58,100 CFS

<u>Elkhorn River</u>
Waterloo, NE - 132,000 CFS

<u>Platte River</u>
Louisville, NE - 252,000 CFS

<u>Gavins Point Dam Flows</u>
Max 2011 - 160,000 CFS
Max 2019 - 80,000 CFS

PAST BASIN FLOODS (DAMAGES AND REPAIR COSTS)

1993

- 12 Damaged Levees (NWO)
  - L-550 overtopped (inlet and outlet breaches)
- Damage primarily from overtopping
- $84M Rehab Cost (NWO & NWK combined)

1997

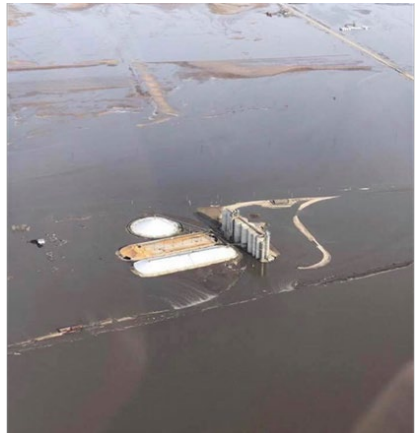
- No breaches

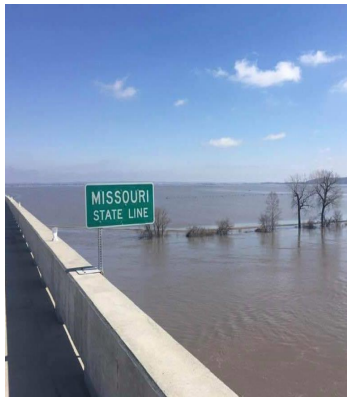
2011

- 5 Breaches
- Failure mode primarily foundation failure
  - Long duration event
- $250M Rehab Cost

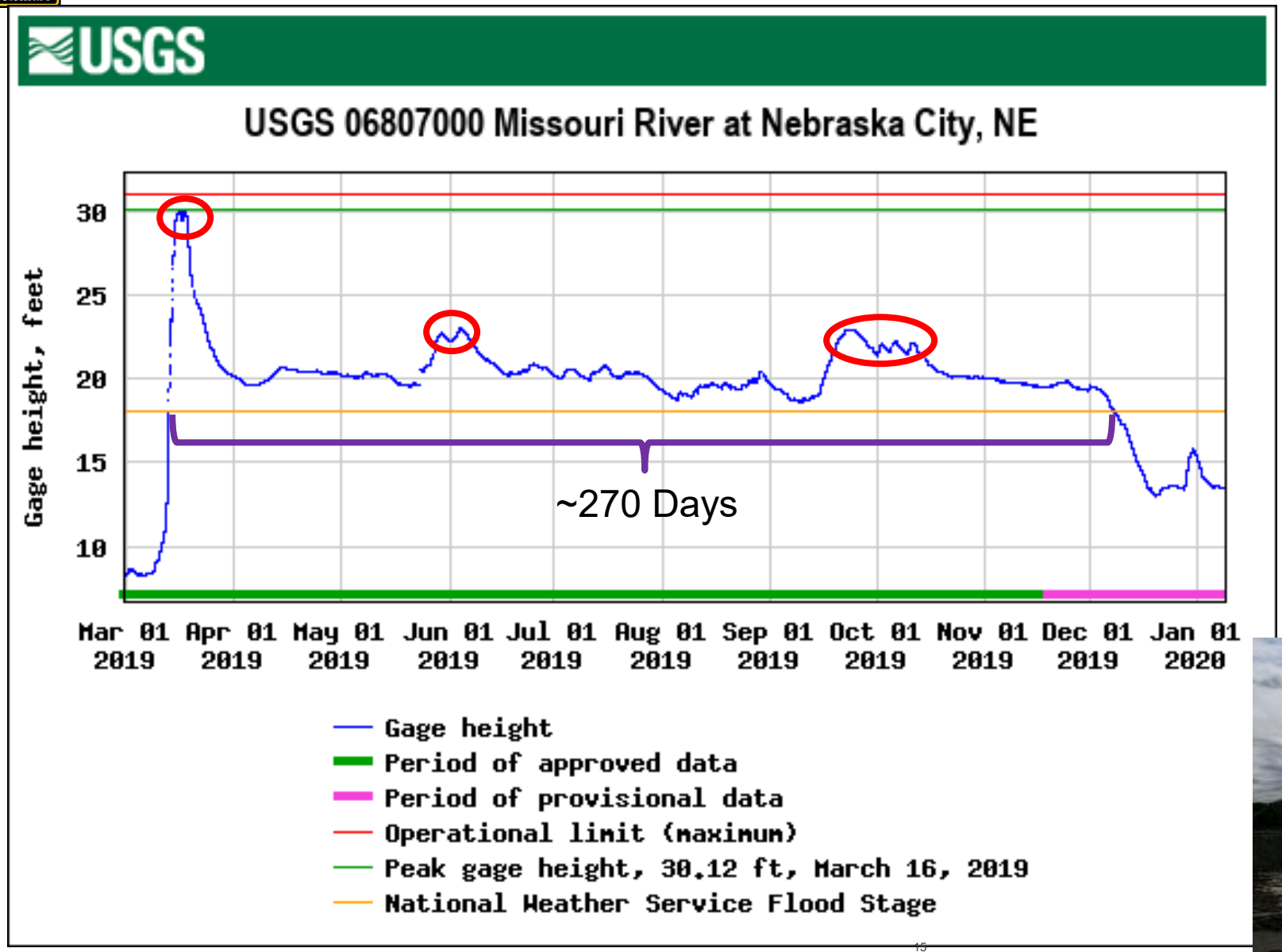
2019 OVERALL DAMAGE

- Over 50 Breaches (widespread, unprecedented damage)
  - 17 breaches on systems inactive in PL 84-99
- Failure mode primarily overtopping
  - Short duration events
  - Reloading of levees on Memorial Day
- Requests for assistance on levee systems active in PL 84-99
  - 60 levee and channel systems (60 completed Project Information Reports)
  - 352 miles of levees



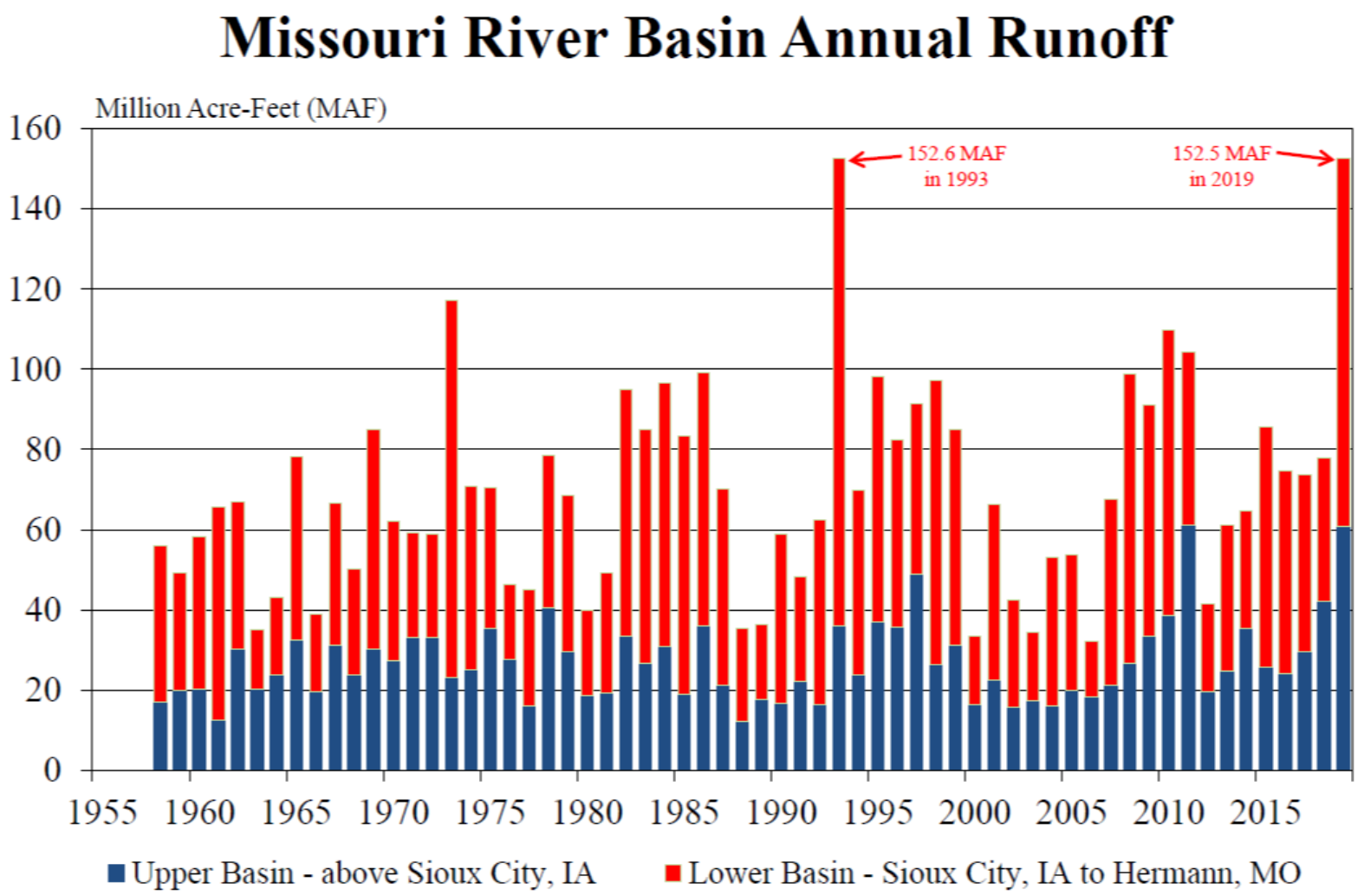


FLOOD DURATION (~270 DAYS)



- 3 Events
  - March
  - May/June
  - September
- ~9 months above flood stage
  - 163 days in 2011
  - 25 days in 2003

Flood Fighting Efforts to Protect Completed Repair Efforts from Rising High Water along the L-575 Missouri River Levee System where initial breach repairs were being made (Photo Taken on 22 Sep 2019, Photo #3)



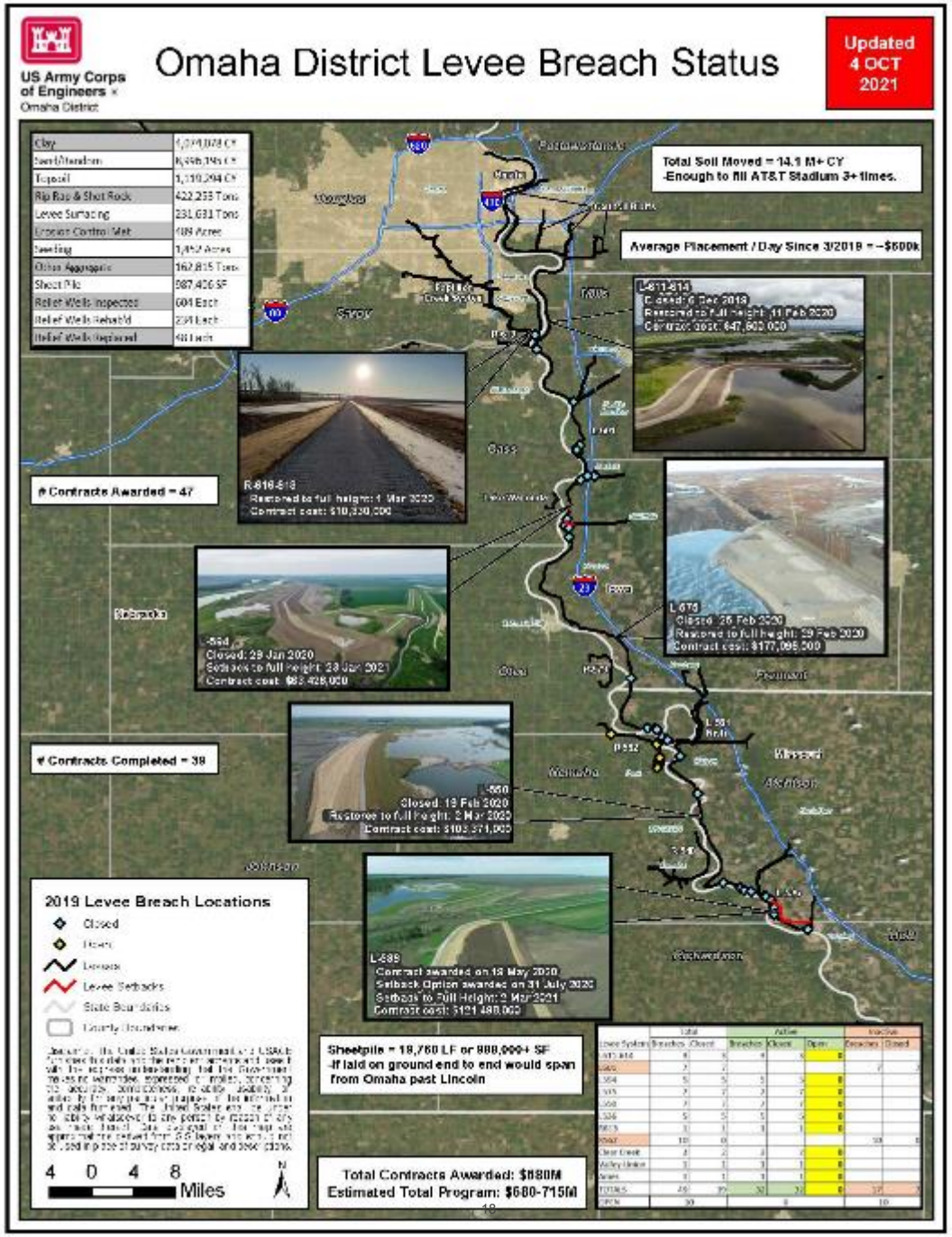
- Upper Basin Runoff 2nd highest
- Gavins Point to Sioux City 6 x average
- Lower Basin Runoff 3rd highest on record

PL84-99 PROGRAM LEVEE FACTS – 2019 FLOOD

- We have **657 miles of levees** in the PL84-99 Rehabilitation Program throughout the Omaha District Basin. (active and inactive).
- We received rehabilitation requests for 419 miles of damaged levees in NE, IA, MO, SD & WY from the 2019 high water event (active and inactive).
- We received rehabilitation requests for **369 miles of damaged levees that are ACTIVE in the above states**.
- We received rehabilitation requests for 50 miles of damaged levees that are INACTIVE in the above states.
- **Approved for construction over 330 miles of levees that are ACTIVE in the above states** (difference are ineligible damages or BCR<1.0).

Partnerships

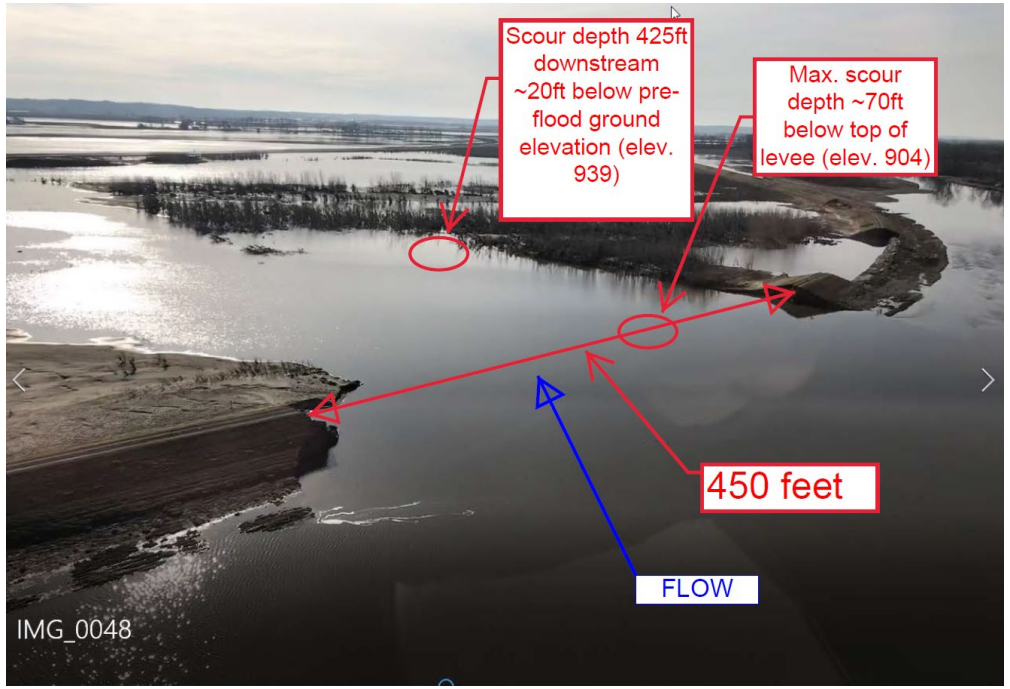
- Local, state and federal
- Levee Sponsors
- Construction Contractors from across the nation
- Congressional



Omaha Systems Restoration Team (OSRT)

- 100+ employees throughout District, other USACE offices
- Repaired emergency breach repairs at priority locations
- Project Information Reports (PIRs) for all damaged levees
- Awarded construction contracts for breaches
- Established Pre-Qualified Sources List
- Utilized various contracting tools to include cost reimbursable contracts

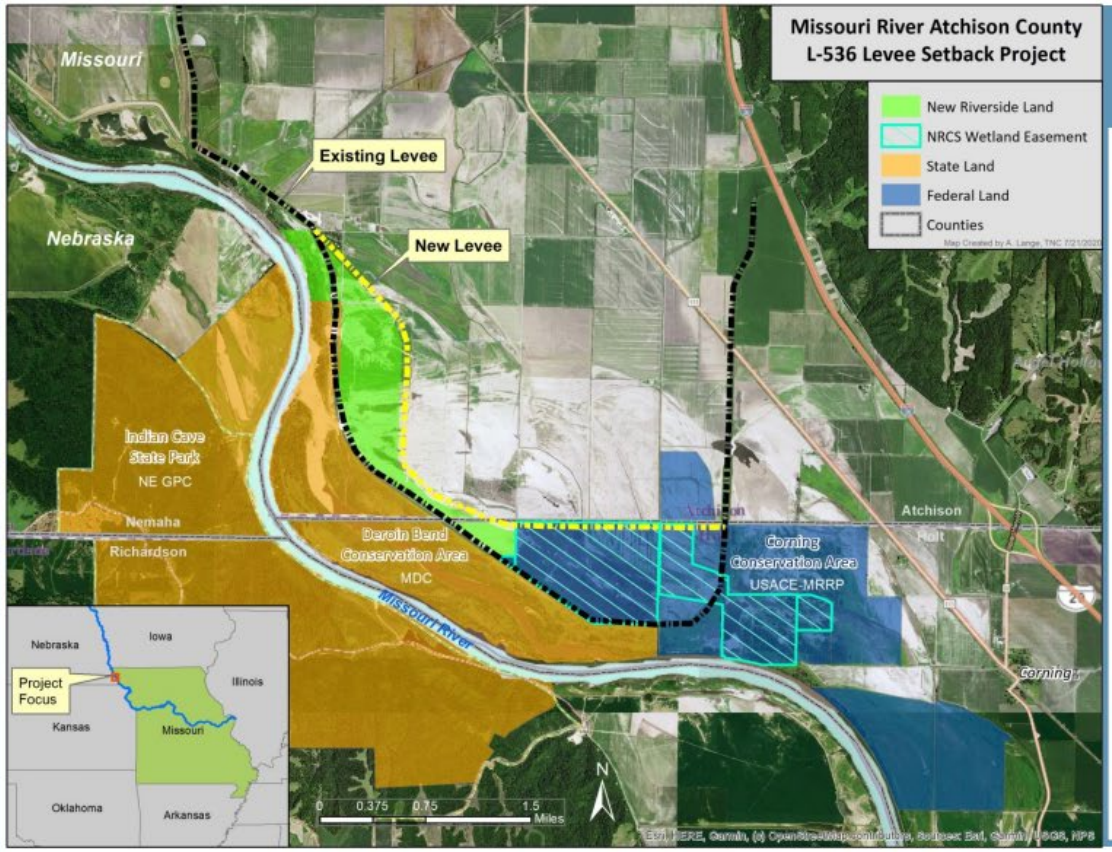
L-611-614


Scour depth 425ft downstream ~20ft below pre-flood ground elevation (elev. 939)
Max. scour depth ~70ft below top of levee (elev. 904)
450 feet
FLOW
IMG_0048


Initial Closure – 12 June

L-611-614 – SEPTEMBER 1, 2019

L-536 REALIGNMENT



2019 Flood Impact on Atchison County*

- 56,000 acres underwater
- 14 commercial businesses underwater
- 166 homes flooded
- 278 citizens forced to evacuate
- 1,295 agricultural buildings flooded
- $25 million (est.) in lost ag revenue
- 121 miles of road destroyed
- I-29 closed for approx. 187 miles between St. Joseph, MO & Omaha, NE
- US Hwy 136 bridge closed for 216 days
- Major disruption of BNSF railroad

*data from Atchison County Levee District #1

Category	Length (FT)	Length (Miles)
Breached (5)	2,120	0.40
Damaged	56,738	10.75
Scour hole, max depth		60 FT

THE PARTNERS

Atchison County Levee District
U.S. Army Corps of Engineers
USDA Natural Resources Conservation Service*
MO Department of Natural Resources
MO Department of Conservation

MO Department of Economic Development
State Emergency Management Agency
Northwest Missouri Regional Council of Governments
The Nature Conservancy

NATURE.ORG/MORIVERLEVEE

INNOVATIVE CONSTRUCTION METHODS – 2019 FLOOD RECOVERY EFFORTS

OMAHA DISTRICT, NORTHWESTERN DIVISION

US Army Corps of Engineers

WHO: Omaha Systems Restoration Team

WHAT: Use of innovative construction methods when limited sand was available and when winter weather was challenging levee construction efforts.

WHEN: 24MAR21

WHERE: Missouri River Levee System L-536

WHY: To complete the setback levee construction and schedule of a full height levee system by 01MAR21.

WHAT'S NEXT: Now that the federal portion of the levee has been constructed to full height, the team is starting to complete the berms, relief wells, and drainage structures.

Above and bottom: Equipment conditioning and hauling cohesive material out of the heated tent structures setup to keep the cohesive material workable during freezing/winter conditions

Center and left: The dredge line from the Dredge Iowa was pumping sand from the Missouri River into a containment and drainage system in the location of the land side seepage berm. Approximately 260K CY of sand was dredged into place in the levee footprint

Summary:

The Missouri River L-536 levee system was the last remaining levee system in the Omaha District AOR, that is active in the PL 84-99 program, to not be at full height. This was a deliberate decision made by the Omaha District, Levee Sponsor, and other stakeholders to allow time for the levee sponsor to work with local landowners to secure the necessary real estate in order to construct a large-scale setback on the downstream end of the L-536 levee system. The team worked with the contractor to have the setback alignment at full height before the 2021 Spring Run-Off Season, utilizing innovative construction methods to keep working during the winter weather conditions experienced in the Midwest. One such innovative method is the large, heated tent structures shown above that kept frost and moisture out of the cohesive material needed to complete the levee repairs. Also, the team found an innovative and cost-effective way of overcoming a shortage of suitable sand borrow by utilizing a dredge to harvest clean sand from the Missouri River and pump it into a containment and drainage system in the footprint of the seepage berm.

Hamburg – Ditch 6 Levee Rehabilitation and Successful Collaboration

OMAHA DISTRICT, NORTHWESTERN DIVISION

WHO: Omaha District Commander

WHAT: Levee Rehabilitation and Future Potential Levee

WHEN: 21SEP21

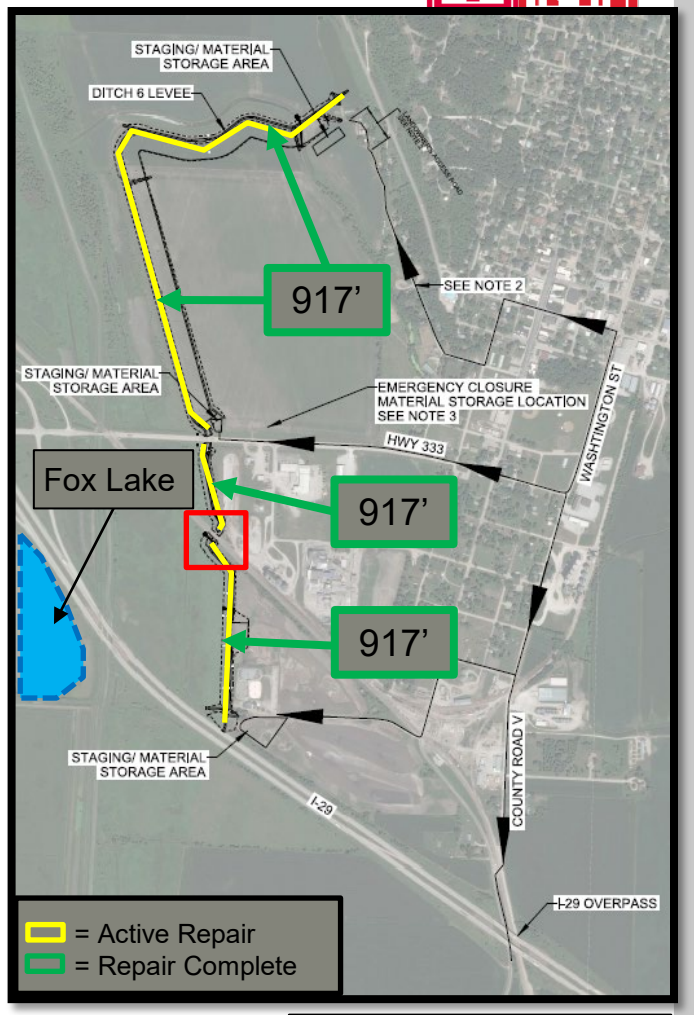
WHERE: Hamburg, Iowa

WHY: Execution and coordination of contract alternatives and real estate needs is proceeding well.

WHAT'S NEXT: Completion of Ditch 6 by 16OCT21. City of Hamburg pleased with the success of the Section 1176 agreement; and is pursuing additional Section 1176 authority (or other) and funding through State and Federal agencies for future, separate levee work to south and east of Hamburg.

Above and to Right: Progress of levee work and proximity of alternate sand borrow source at Fox Lake. Dredging of sand at Fox Lake is shown above with placement of sand seepage berm at the right.

Right: Progress of levee work and proximity of alternate sand borrow source at Fox Lake.



Summary:

The Hamburg Ditch 6 Levee was awarded with NTP on 16APR21 and required construction completion date (CCD) of 16OCT21.
A ground-breaking ceremony was held on 05May21

NAVIGATION SUMMARY

- Navigation and Environmental Structures
  - Monitoring 37 known areas of concern (29 in NWK and 8 in NWO)
  - Navigation restrictions are defined as areas where the channel is not meeting its authorized depth or width, which restricts the ability of barge traffic to navigate the river.
  - Frequent coordination and communication with industry to identify highest priority areas.
  - Intent is to restore the waterway to its full capacity by Dec 2025
  - Repair execution is dependent on river conditions during construction, rock availability, and the timing of funding
- Three-tier strategy to address both the short- and long-term navigation issues along the Lower Missouri River

  Phase 1: Repair and Remove Known Restrictions (Short Term)

  Phase 2: Repair Navigation System to Pre-Flood Conditions (Intermediate Term)

  Phase 3: Identify & Evaluate Future Navigation and Improvements (Long Term)
- Total Cumulative Contract Value to date for both Districts is $107.3M. Based on tonnage, NWK is currently 41% complete on $60.2M of awarded contracts, and NWO is currently 34% complete on $47.1M of awarded contracts.
- Total unfunded need $316M.

OMAHA DISTRICT FLOOD RECOVERY KEY POINTS

Scheduled/Eligible Missouri River Levees full height by 01 March 2020.

- RMA 2020 Crop Insurance savings $650k NW MO
- $35M 2020 commodity NW MO alone

~$695M obligated.

- ~2M CY from MRRP sites, Gov't savings $50-$100M. Reinvigorated MRRP habitat sites.

Two significant levee setbacks awarded.

- Responsive to Stakeholder (State/CODEL) request.
- Adds resiliency
- Both setbacks enabled by presence of MRRP lands

Cost-reimbursable contracts and risk informed decision - $300M in Gov't Savings.

- Example: use of sand/dredge material to close breaches when rock was unavailable

Deliberate decision for L536 strategy to "do things differently."

- System full height before 2021 run-off season (02 March 2021)

TOTAL FLOOD DAMAGES PREVENTED

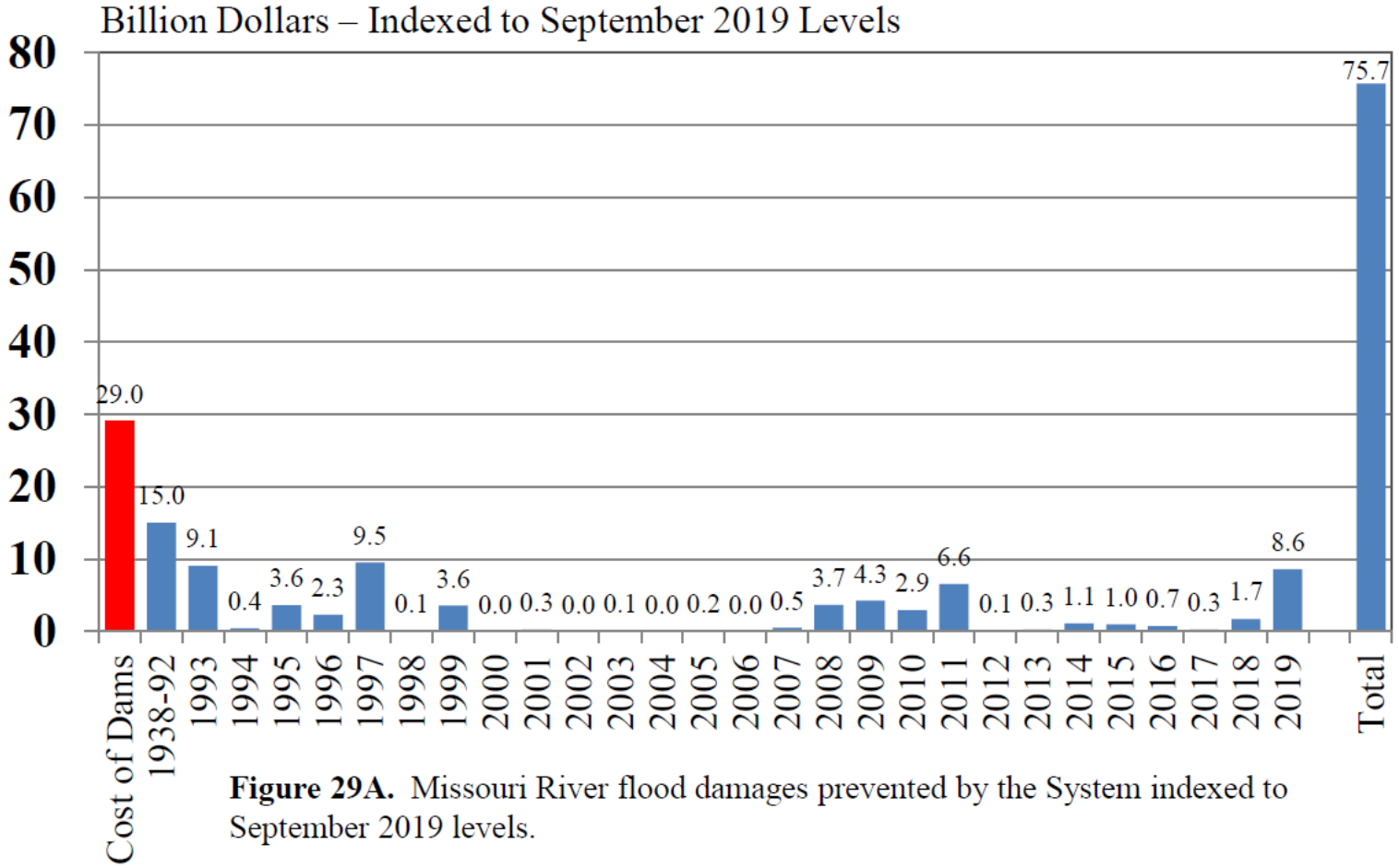


Figure 29A. Missouri River flood damages prevented by the System indexed to September 2019 levels.

QUESTIONS???