KANSAS CITY DISTRICT
FLOOD CONTROL OPERATIONS IN 2019

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USACE – KANSAS CITY DISTRICT FLOOD CONTROL OPERATIONS

1. How USACE reservoirs provide and manage Flood Control
2. March 2019 Event
3. May/June 2019 Event
4. Where we are now and where we are going

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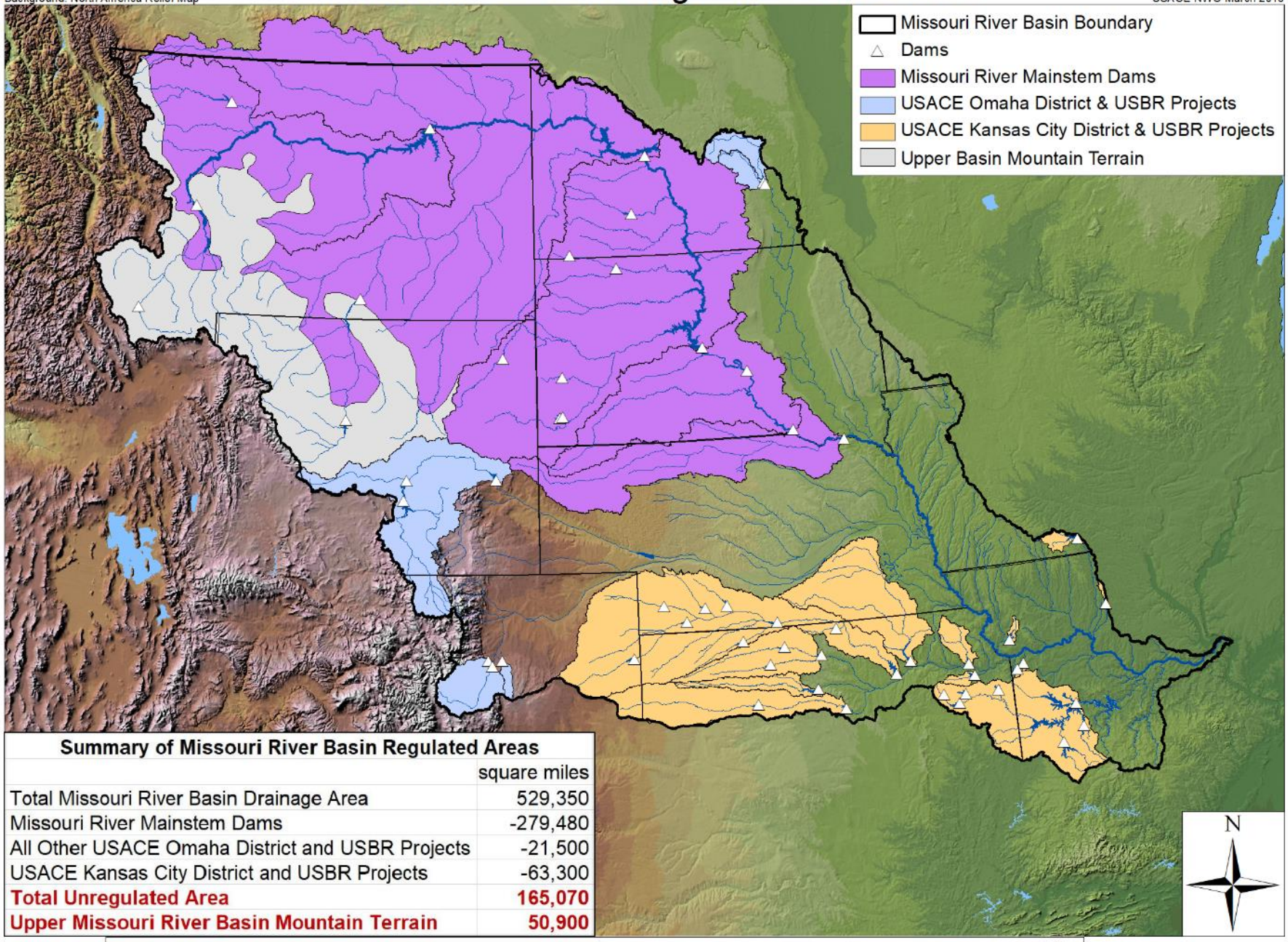
Missouri River Basin Regulated Watersheds

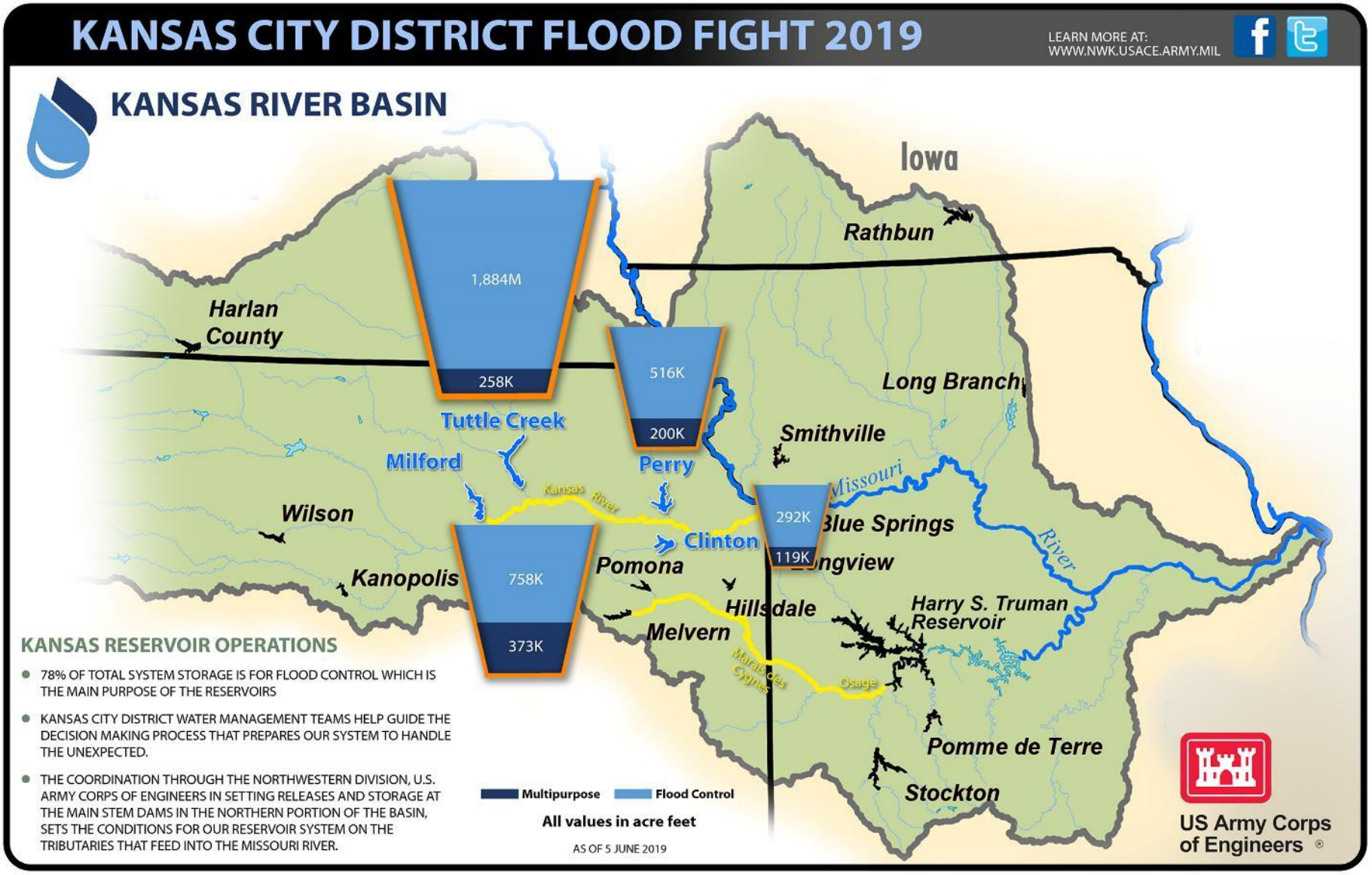
Background: North America Relief Map

USACE NWO March 2016

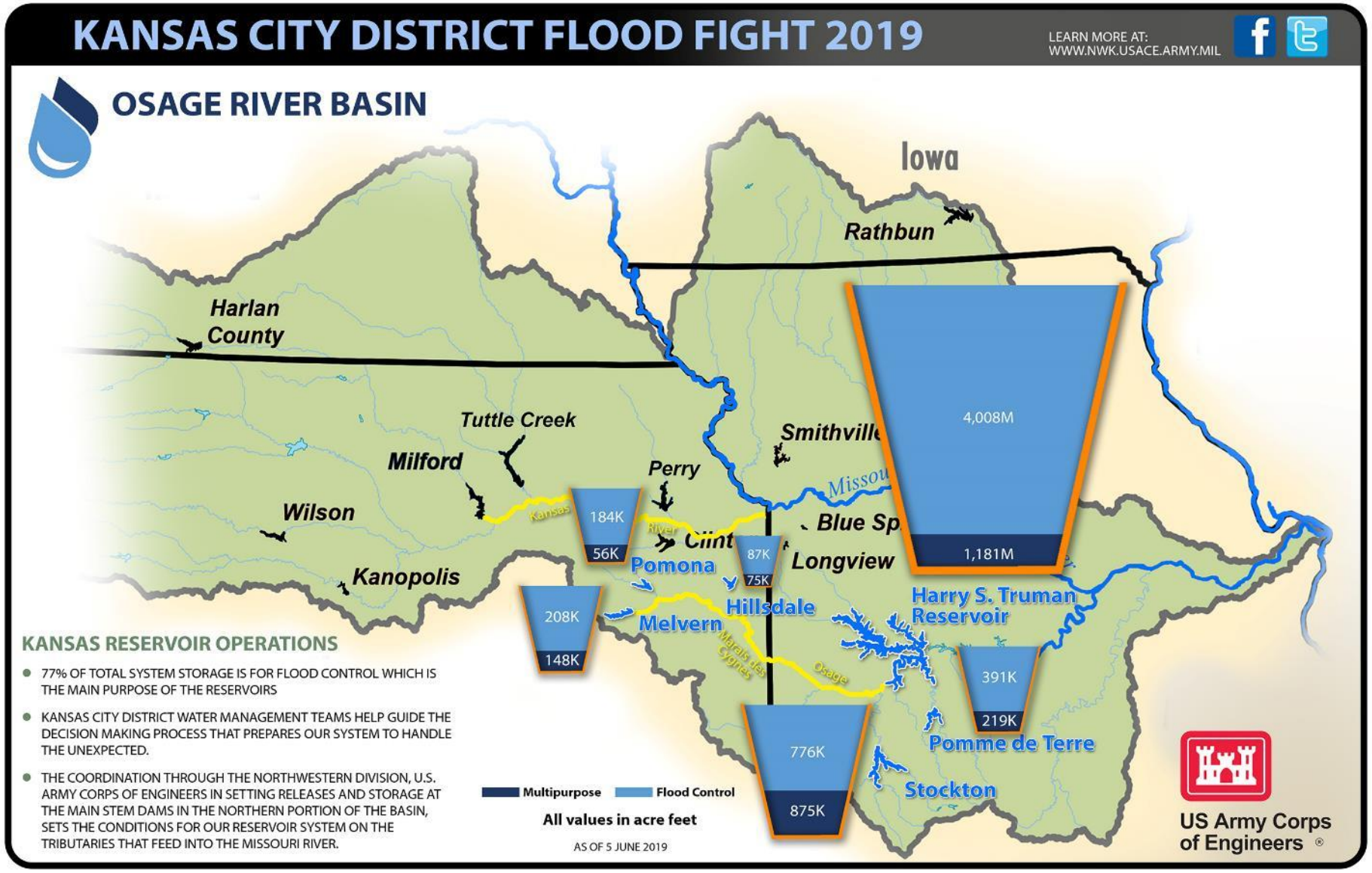


Summary of Missouri River Basin Regulated Areas	
	square miles
Total Missouri River Basin Drainage Area	529,350
Missouri River Mainstem Dams	-279,480
All Other USACE Omaha District and USBR Projects	-21,500
USACE Kansas City District and USBR Projects	-63,300
Total Unregulated Area	**165,070**
Upper Missouri River Basin Mountain Terrain	**50,900**

RESERVOIR FLOOD STORAGE – KANSAS BASIN



RESERVOIR FLOOD STORAGE – OSAGE BASIN



NWK FLOOD CONTROL OPERATIONS

- Follow rules and limitations within each project's Water Control Manual
  - Releases only takes place when downstream conditions allow.
  - Releases are specifically sized, coordinated, and carefully timed.
  - Releases never exceed the maximum authorized limit associated with each "Phase".
- Storage in Lake; Phase I, Phase II, or Phase III (can vary seasonally)
- Release rate (cfs) limited by "space available" downstream
- Rules provide for balanced risk and management of flood waters.

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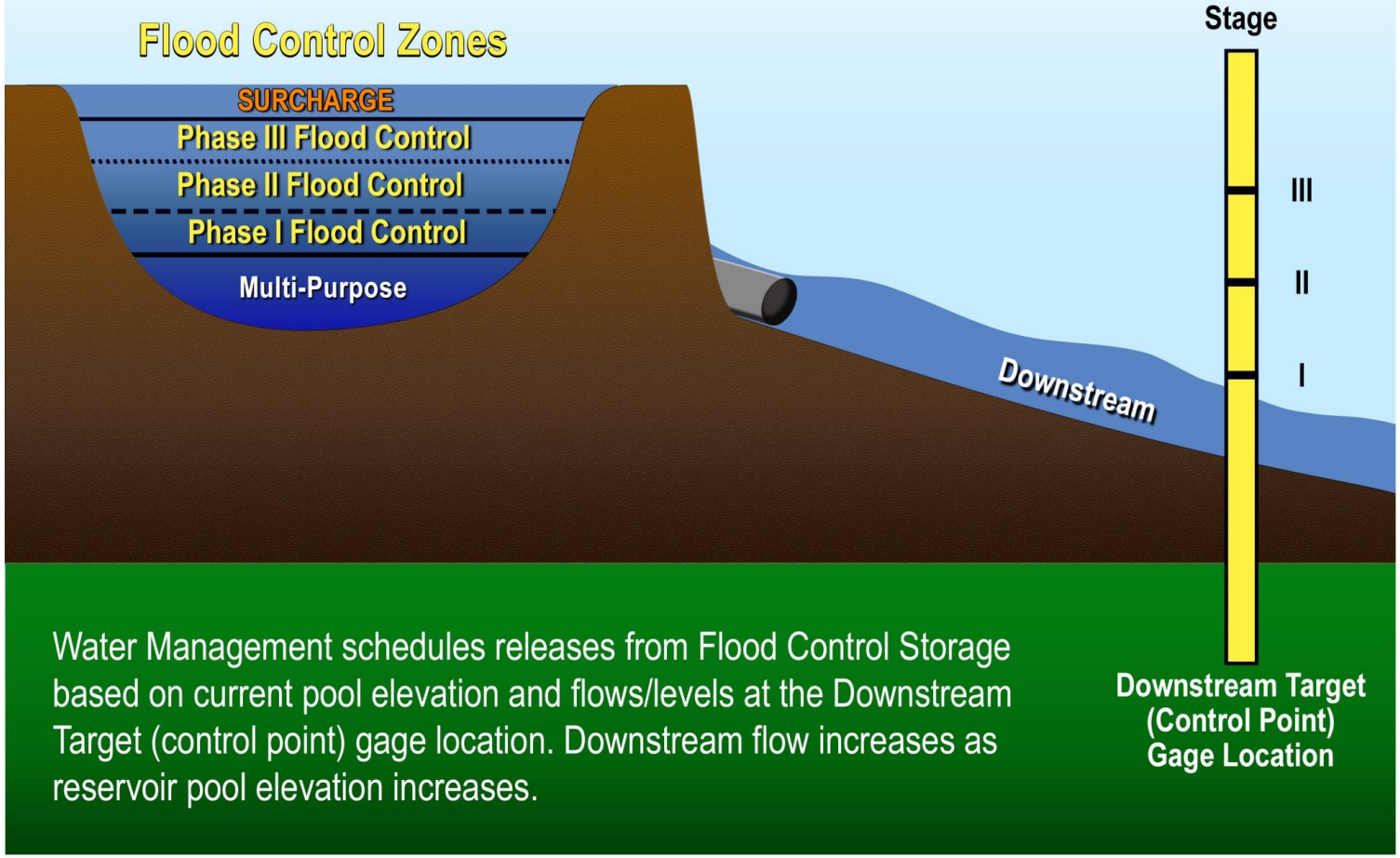
Relationship between Control Points and Flood Control Zones



Water Management schedules releases from Flood Control Storage based on current pool elevation and flows/levels at the Downstream Target (control point) gage location. Downstream flow increases as reservoir pool elevation increases.

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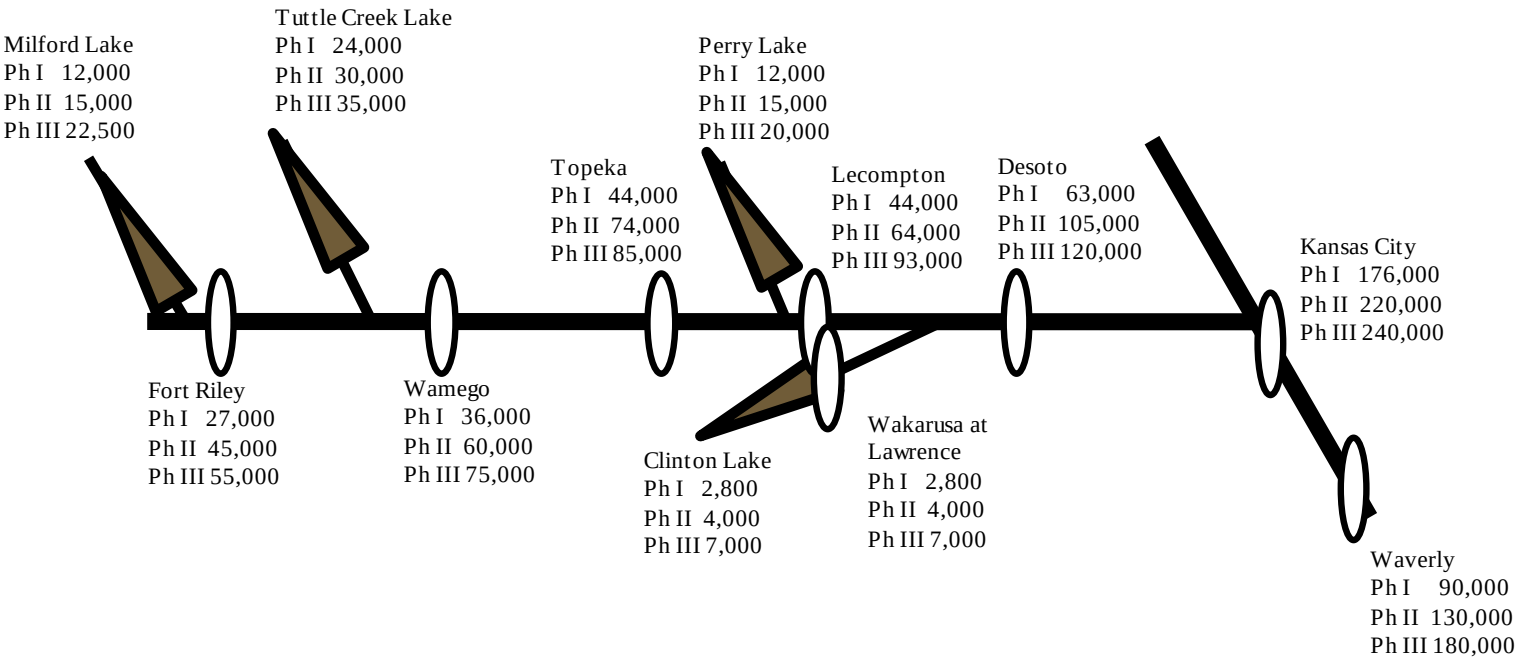
KANSAS RIVER
CONTROL POINT GAGES



All flows are in cfs; schematic is not to scale.

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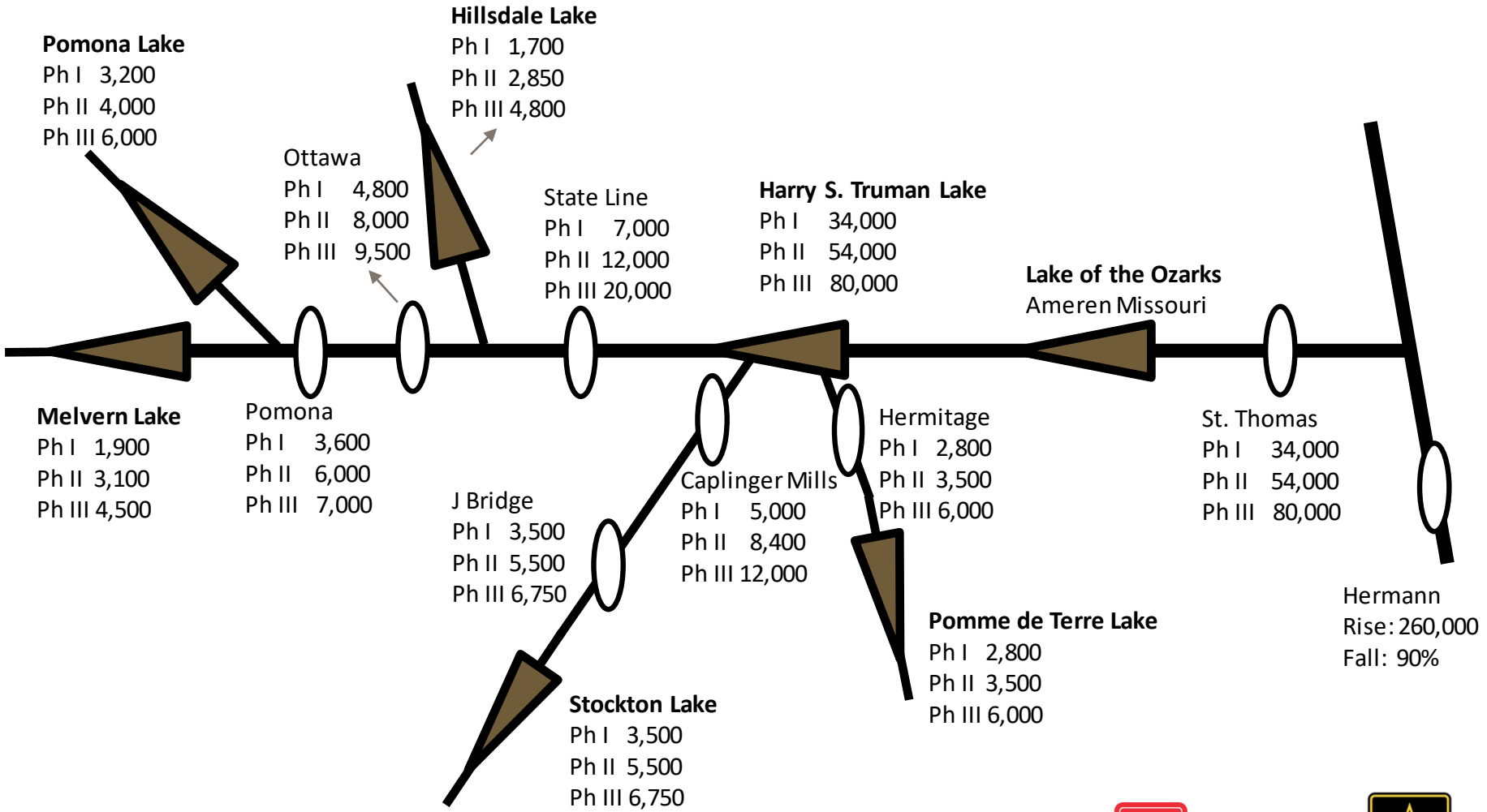
OSAGE RIVER BASIN
CONTROL POINT GAGES



All flows are in cfs; schematic is not to scale.

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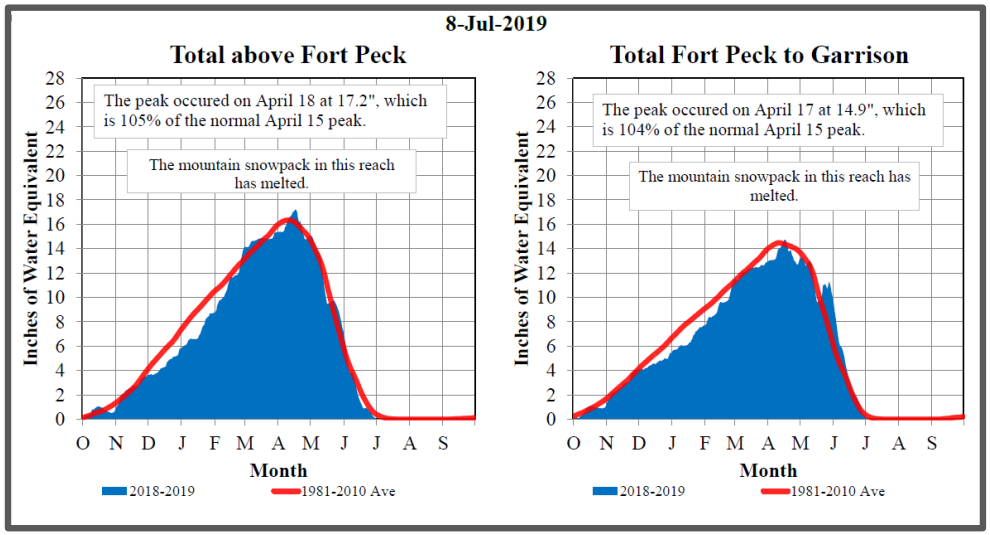
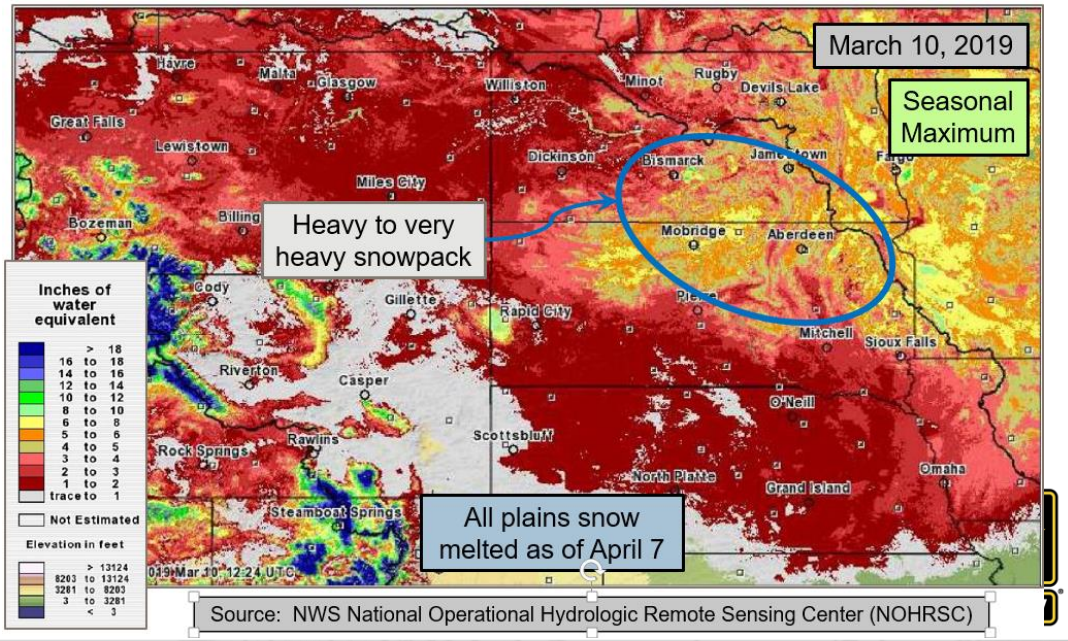
MARCH FLOOD EVENT - SNOWPACK



- Mountain snowpack was about average in 2019
- One difference between 2019 and 2011 … mountain snowpack was MUCH ABOVE average in 2011.

- Plains snowpack was present in the entire upper basin, Nebraska and Iowa
- Heavy to very heavy plains snowpack in portions of the central and eastern Dakotas
- Deeply frozen soils resulted in little to no infiltration during March snowmelt/rainfall events



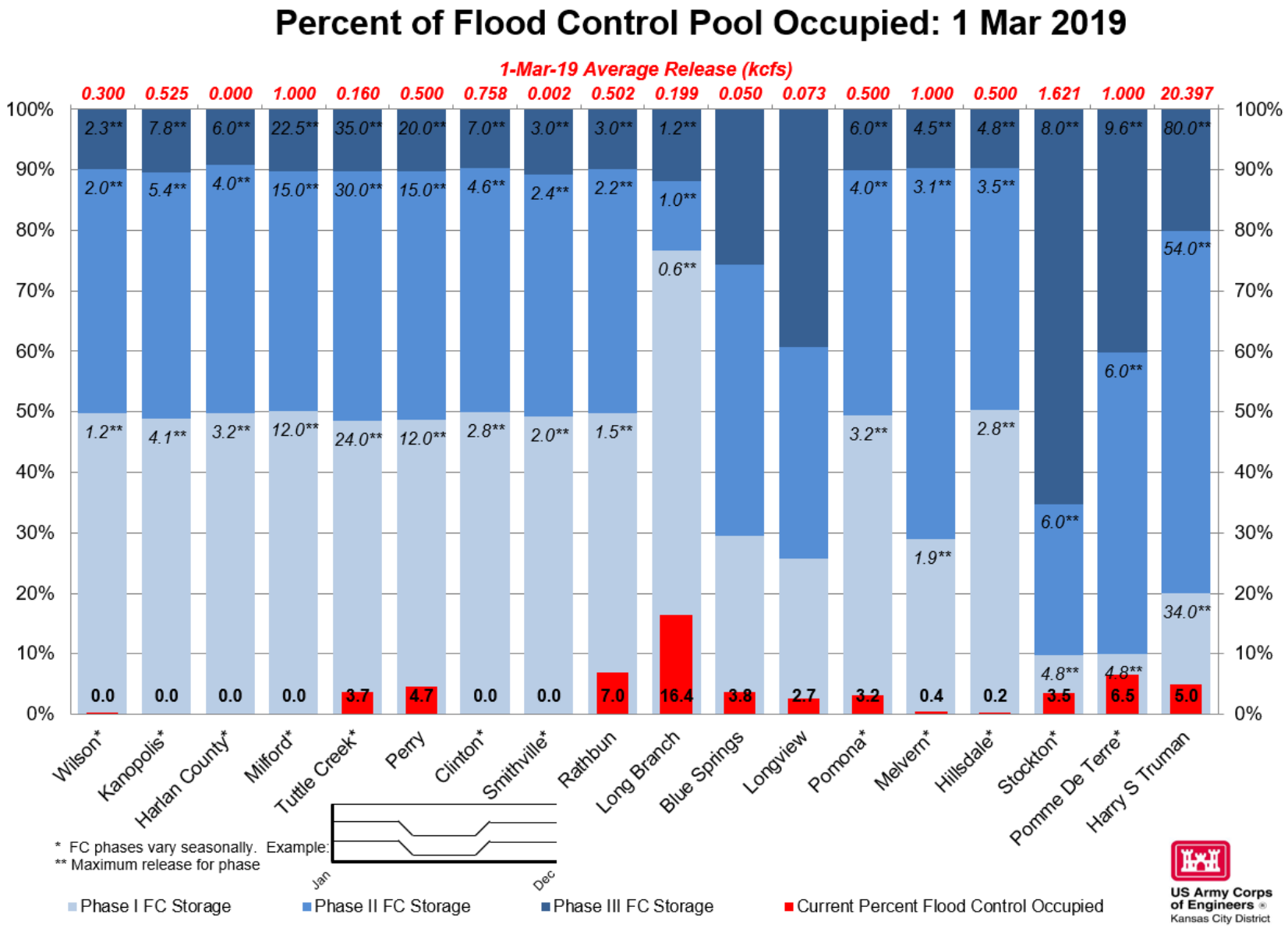
MARCH FLOOD EVENT - FLOWS

Peak Streamflows on the Mainstem of the Missouri River and its Tributaries Floods of 13-17 March 2019

*** Record Peak Streamflow**
+ Record Peak Stage

Location	Peak Flow, cfs	Date
Gavins Point Inflow (Niobrara)*+	182,000	14-Mar
Gavins Point Outflow	100,000	15-Mar
James R.	23,400	15-Mar
Vermillion R.	16,800	17-Mar
Big Sioux R.	68,900	16-Mar
Missouri R. - Sioux City, IA	166,000	17-Mar
Floyd R.	33,500	15-Mar
Maple R. *	26,800	15-Mar
Little Sioux R. *+	58,400	15-Mar
Soldier R.	27,500	14-Mar
Boyer R. *+	35,400	14-Mar
Missouri R. – Omaha, NE	189,000	17-Mar
Elkhorn R. *+	101,000	16-Mar
Platte R. *+	193,000	16-Mar
Missouri R. - Nebraska City, NE *+	345,000	16-Mar
Nishnabotna R.	38,500	16-Mar
Nodaway R.	29,100	15-Mar
Little Nemaha R.	27,000	14-Mar
Big Nemaha R.	37,000	13-Mar
Missouri R. – Rulo, NE+	338,000	20-Mar
Missouri R. – St. Joseph, MO+	318,000	22-Mar
Kansas R.	26,000	14-Mar
Missouri R. – Kansas City, MO	294,000	24-Mar
Missouri R. – Waverly, MO+	304,000	26-Mar
Grand R.	58,000	15-Mar
Missouri R. – Boonville, MO	295,000	31-Mar
Missouri R. – Hermann, MO	320,000	31-Mar

MARCH FLOOD EVENT – KS RESERVOIRS



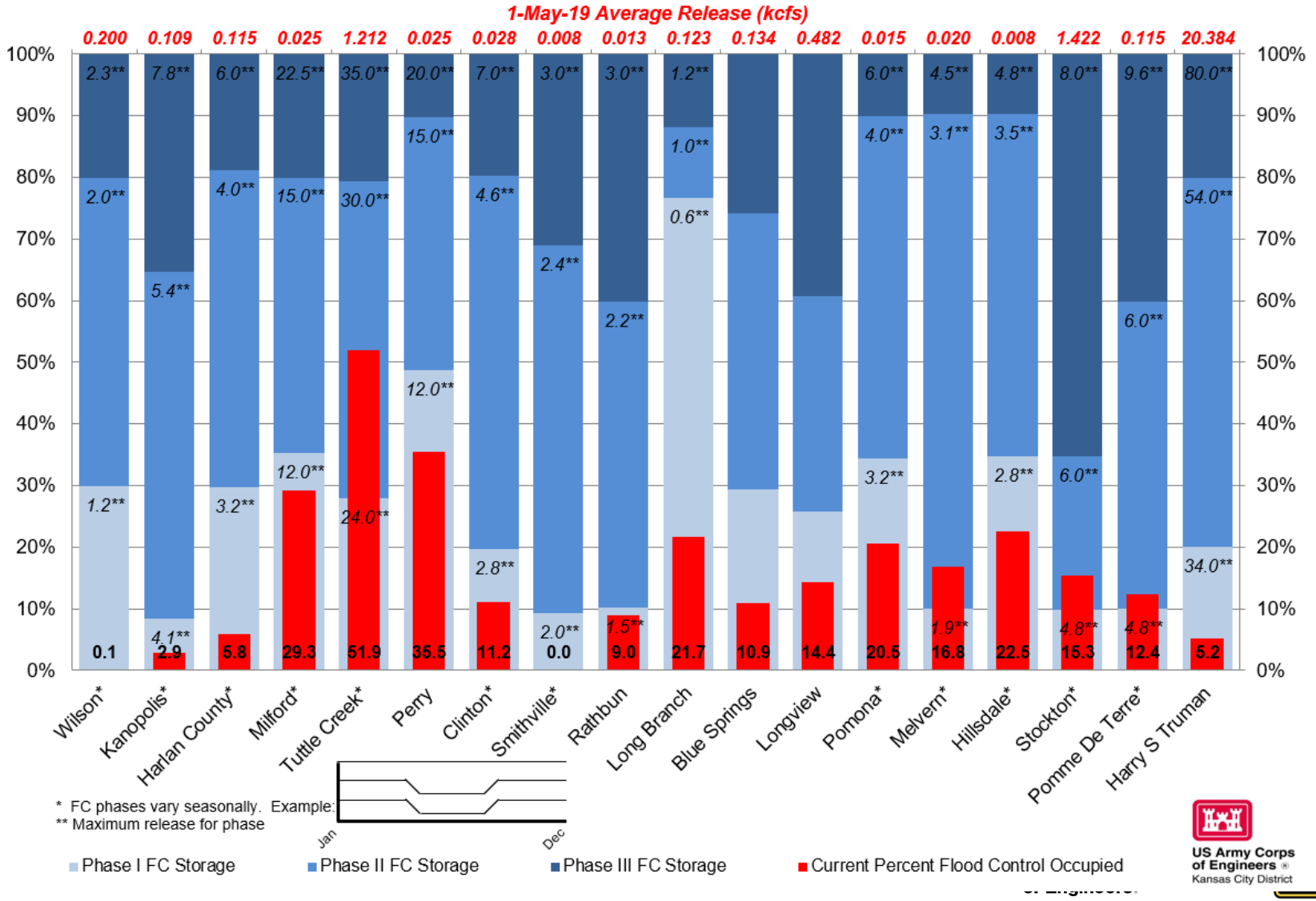
MAY - JUNE FLOOD EVENT

TUTTLE CREEK LAKE

Imagery: NASA Worldview

MAY FLOOD EVENT – KS RESERVOIRS

Percent of Flood Control Pool Occupied: 1 May 2019



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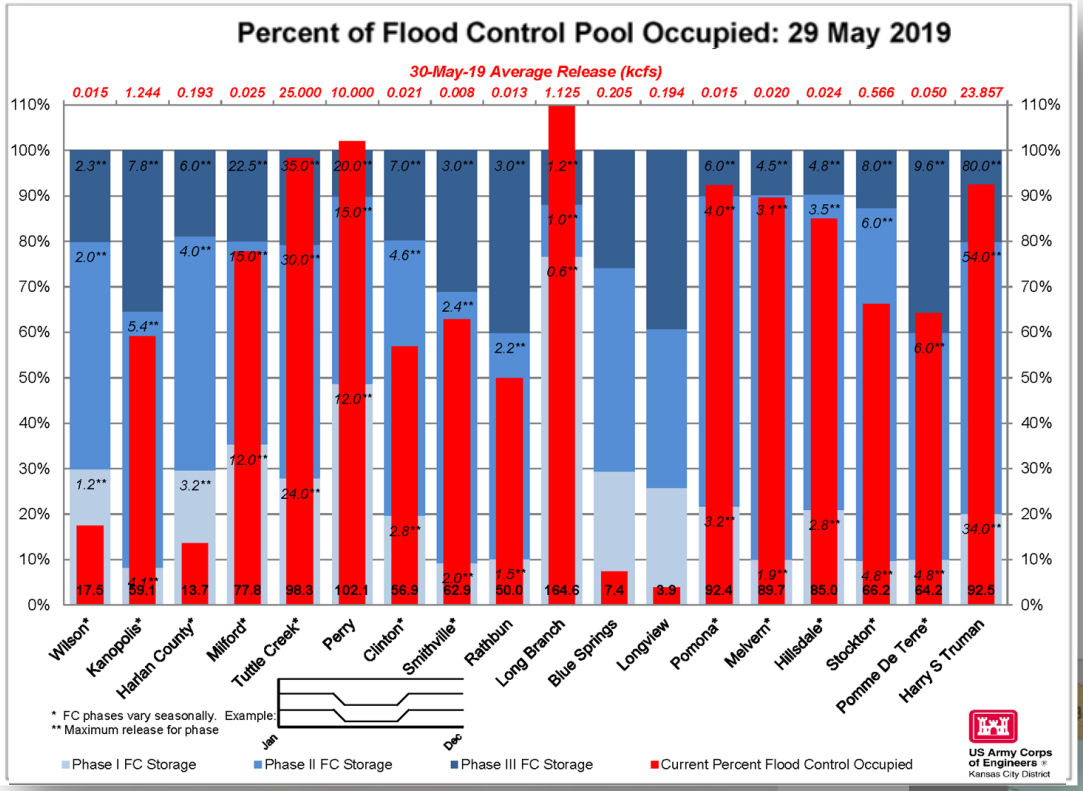
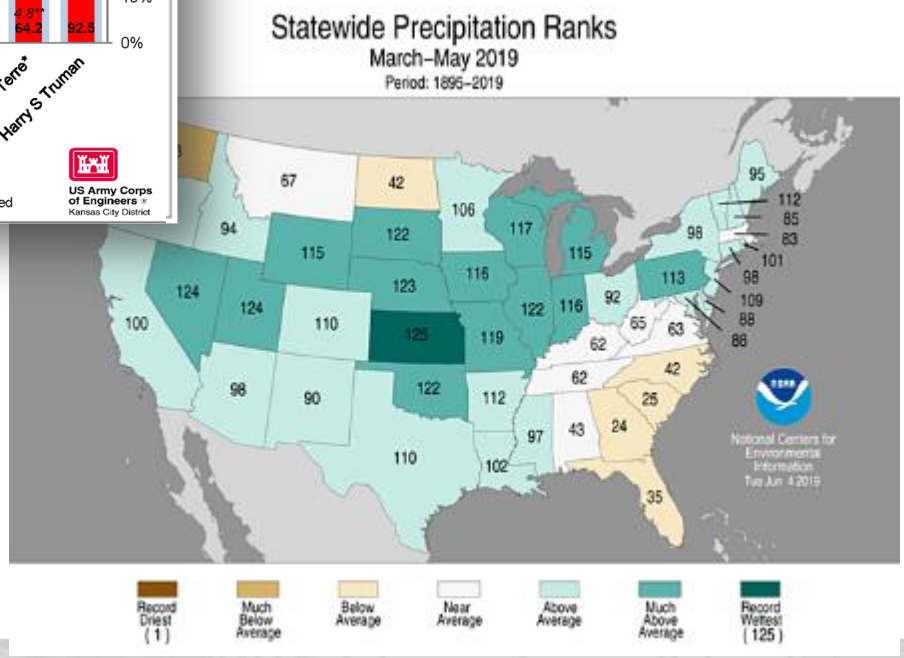
MAY - JUNE FLOODING



- May rainfall in KS averaged 10.4”; largest monthly rainfall, (exceeded July 1993).



IMPACTS TO RESERVOIRS

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- On peak day, 9 MAF of 11 MAF of flood control storage was occupied
- Surcharge operations at Harry S Truman, Tuttle Creek, Perry and Long Branch
- Record pools at 9 reservoirs: Perry, Clinton, Truman, Pomona, Melvern, Hillsdale, Pomme de Terre, Harlan County and Long Branch

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OPERATIONAL DEVIATIONS

- Deviations …
  - Are narrowly focused requests to depart from a particular rule governing operations.
  - Approval requires demonstration of valid need/benefit compared with assessed risks.

- 2019 Kansas River Deviations…
  - 24 May – Waverly Phase I / Phase II criteria raised 90/130 to 110/160
  - 31 May – Waverly/all-points suspended to re-establish 80% flood storage occupied
  - 19 June – Waverly Phase II raised 160 to 180
  - 3 September – Waverly Phase I raised 130 to 140

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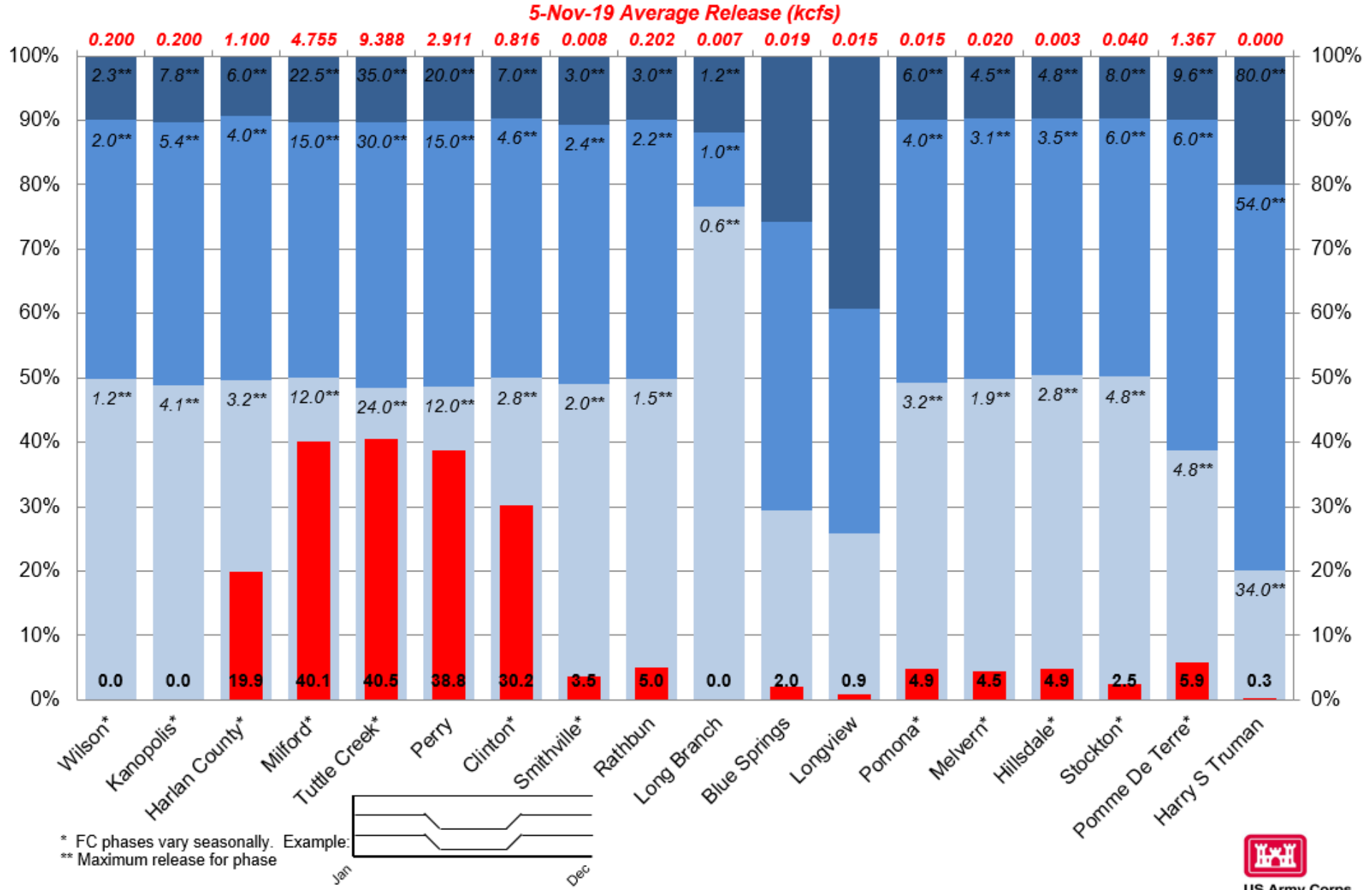
Percent of Flood Control Pool Occupied: 5 Nov 2019



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PATH FORWARD

- Kansas River Basin - utilizing current deviation to empty stored flood waters, targeting by end of December
- Osage River Basin – normal operations
- Reservoirs operated as designed – provided flood control benefits with no structural or geotechnical issues

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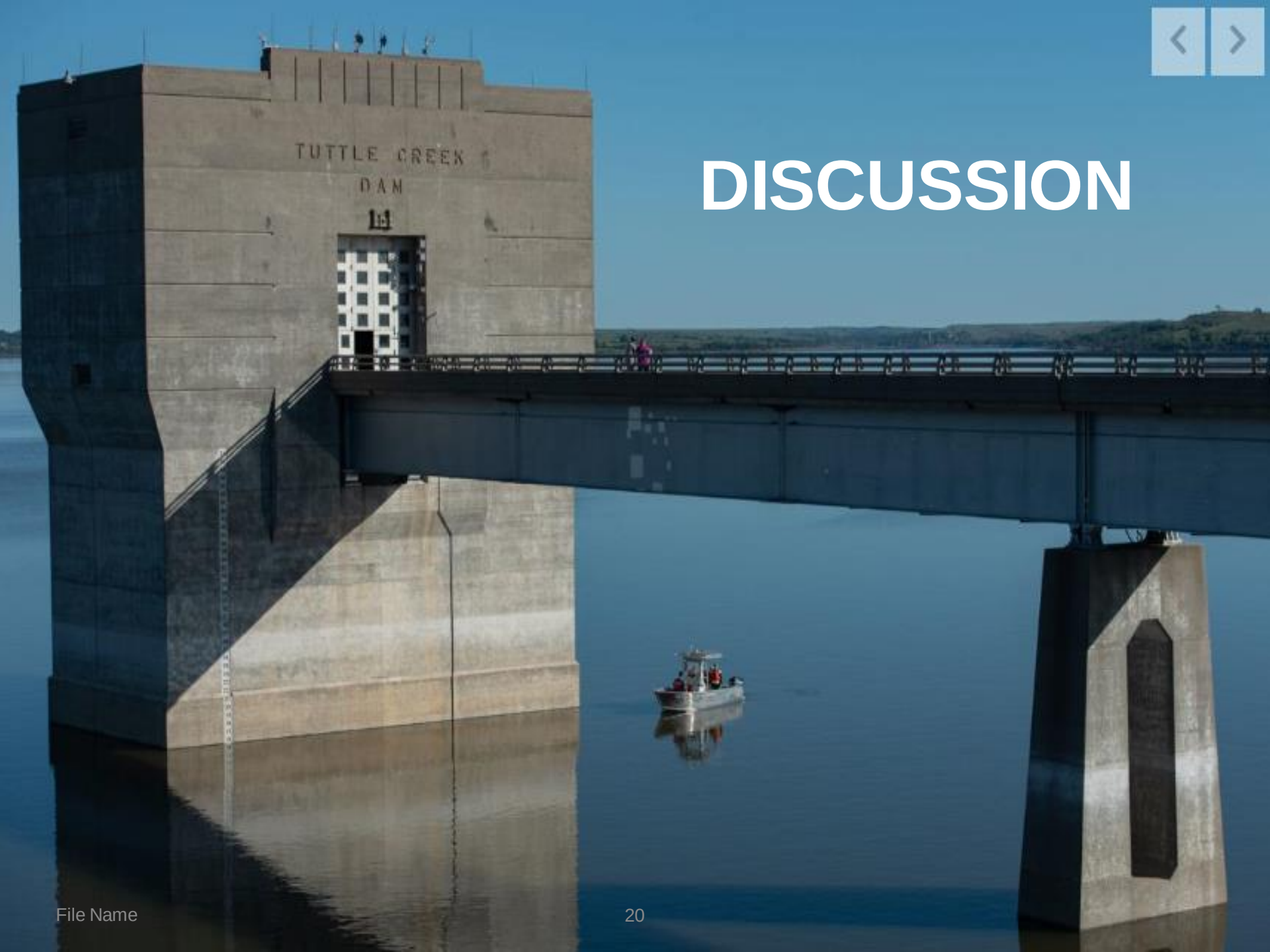

DISCUSSION