RESERVOIR ADAPTIVE MANAGEMENT: WHAT WEATHER FORECAST ENHANCEMENTS ARE NEEDED IN TEXAS?

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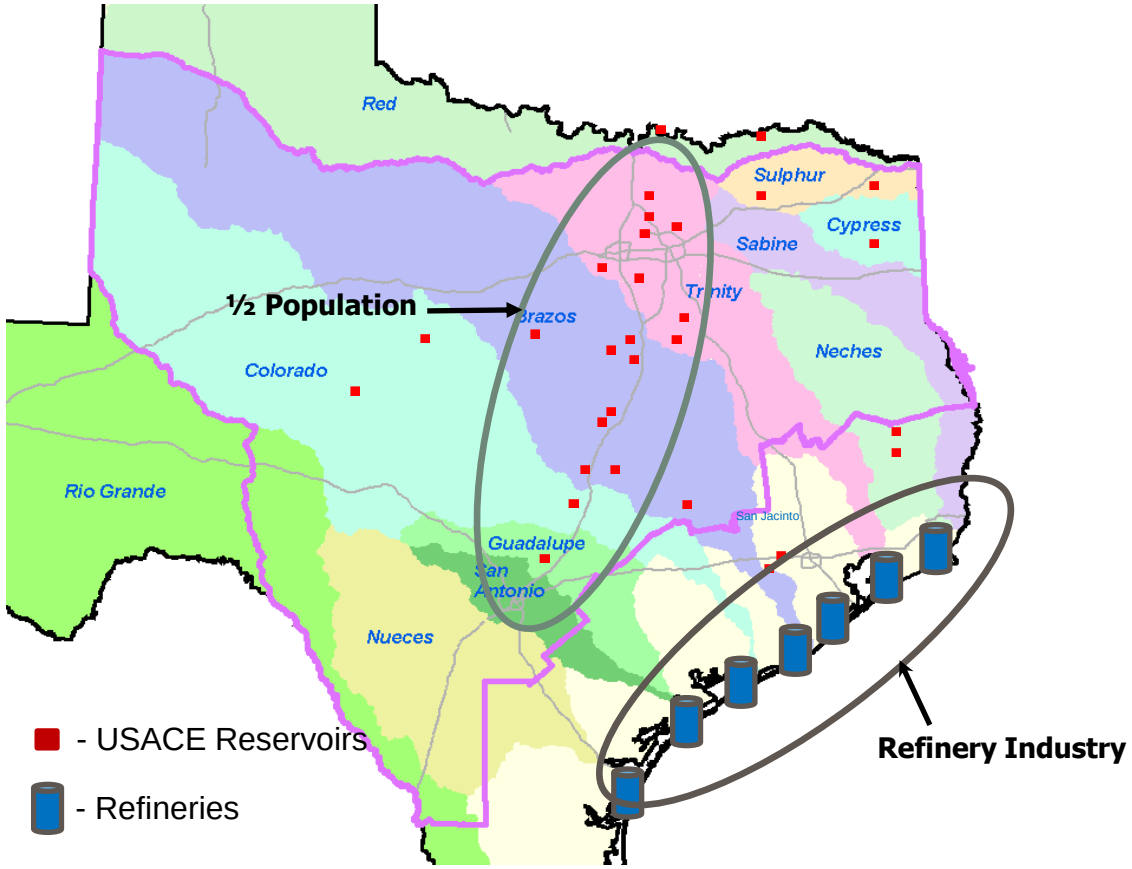
US Army Corps of Engineers ®

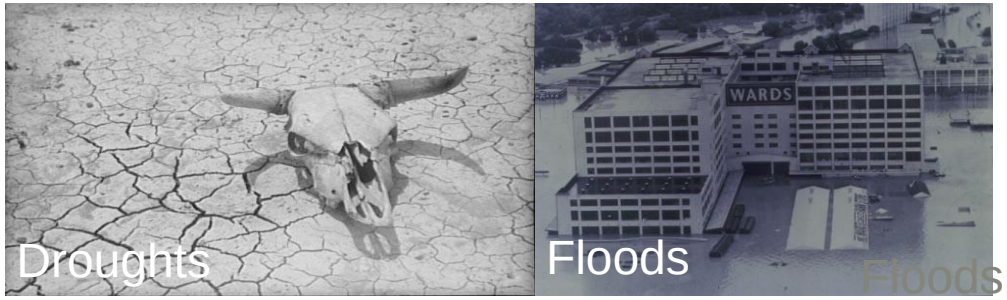
INCREASING RESILIENCY - STATEWIDE FEDERAL RESERVOIR DEVELOPMENT

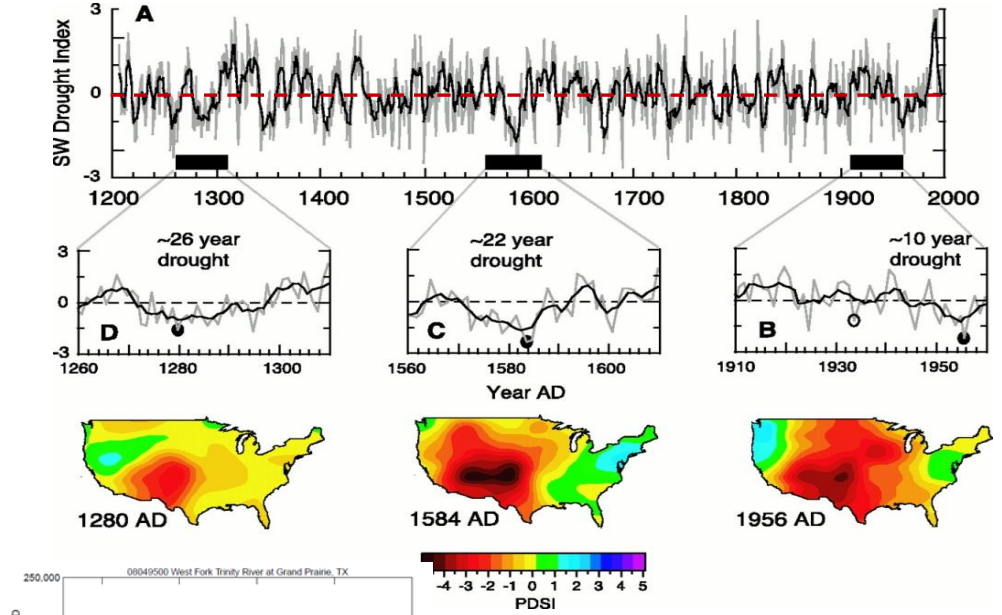
- Federally funded multi-purpose reservoirs, 400+ nationally, 32 statewide
- Nationally 10M ac-ft supplies 85M people, 115 communities
- Statewide WS storage 6.5 M ac-ft contracted, 1/3 TX surface water.
- Navigation, hydropower, environmental and rec.
- Population growth, 1100/day, 30M to 54M 2050
- ½ population along I35
- 2nd largest in GDP,
- 3rd largest ag. production
- 32% of refinery capacity
- Significant drought vulnerabilities
- Significant current and future WS deficits
- $80B projected cost including 23 new reservoirs
- Pumping
- **What about adaptive management?**
- **Flood storage 13.4 M ac-ft**
  - **5% - 20% FIRO**

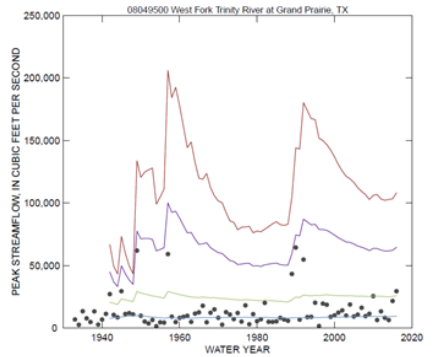


CLIMATE VARIABILITY & WATERSHED DEVELOPMENT

- Annual rainfall totals in DFW from 20” – 60”
- Paleohydrology indicates more severe droughts have occurred historically
- Flood-flow-frequency analysis using historical data shows significant variability
- Brazos and Colorado River Basins show significant downward trends in runoff



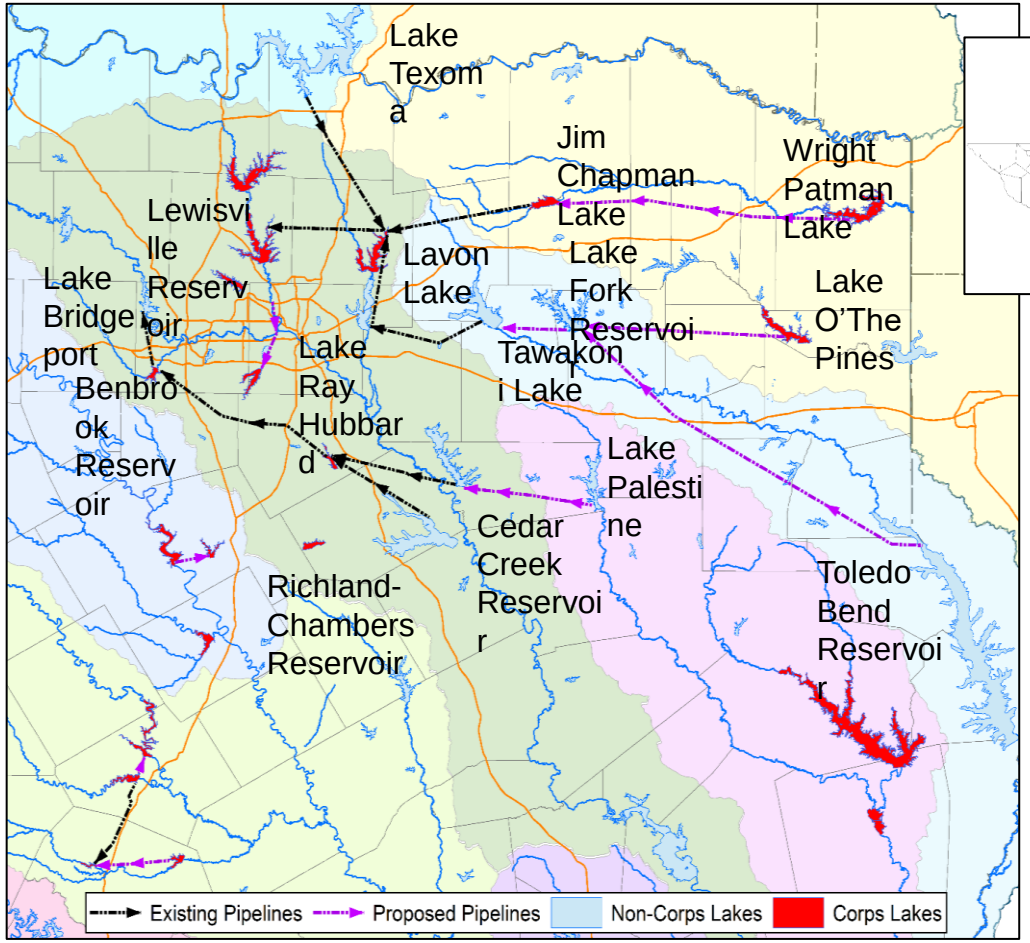




FUTURE CHALLENGES
EXISTING AND PROPOSED PIPELINES

Water Supply Community

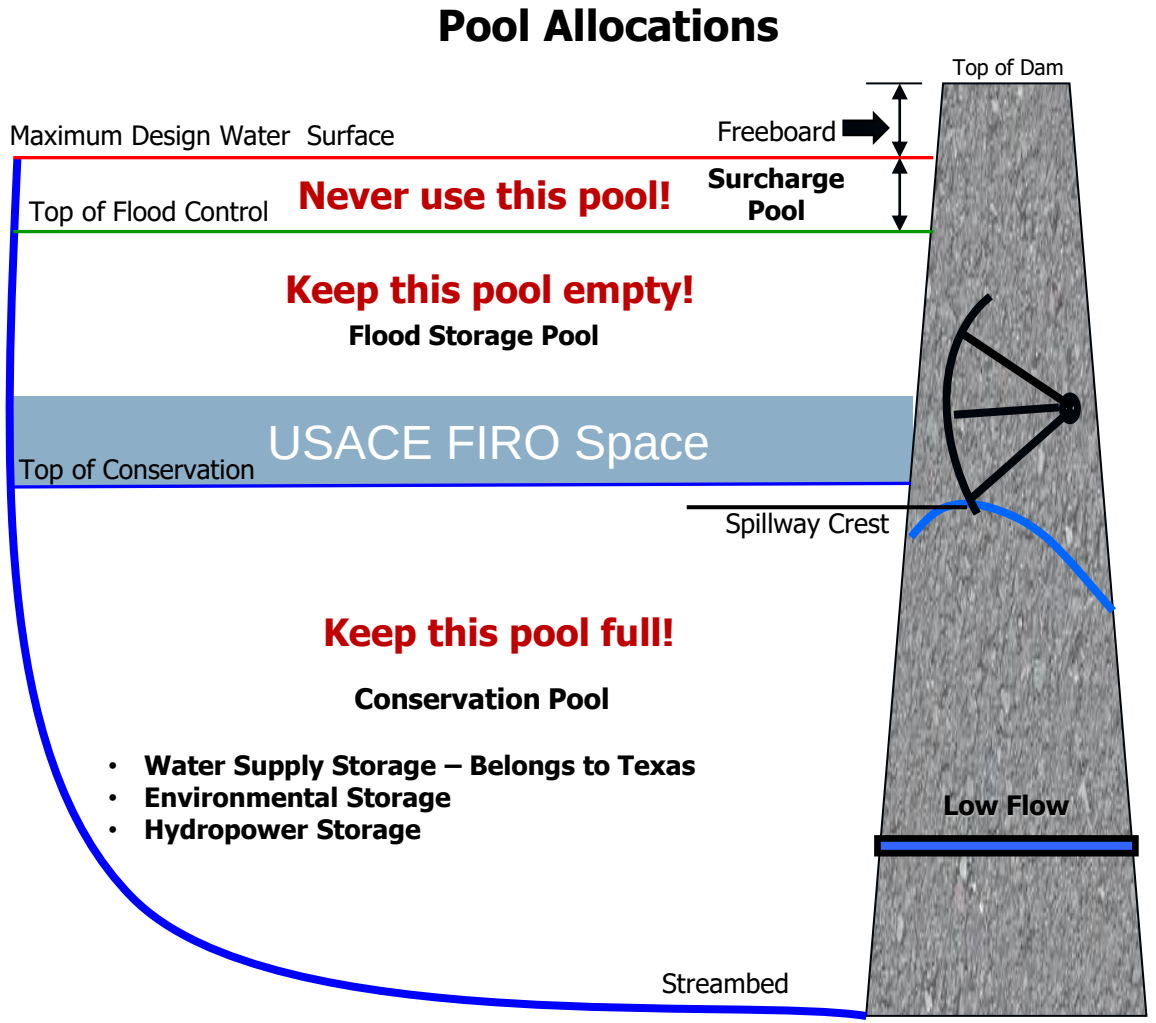
- ~1500 miles of constructed or planned pipelines
- Transport of water to population centers
- Can be seasonal or shortage driven
- Population will continue to increase
- Conservation will be needed



USACE OPERATIONS – WHAT ARE FIRO OPERATIONS

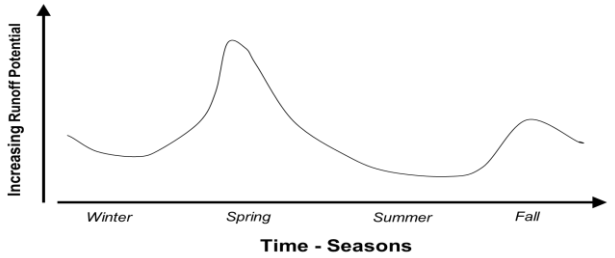
- Reservoir Operations
  - Follow WCM "Plan of Operation" for reservoir system
  - Store water in conservation pools
  - Temporarily store flood inflow to maintain safe DS conditions
  - Safely release water into DS river reaches
  - **Utilizing NWS products**

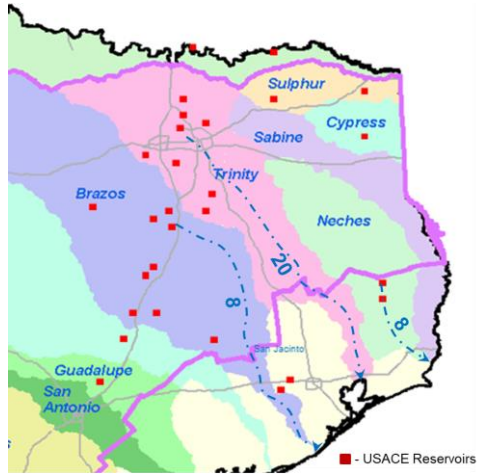
- USACE FIRO (adaptive management)
  - Technology driven flexibilities
  - Targets lower 5% - 20% of flood pool
  - Many examples of FIRO through deviations
  - Requires improvements in short-term and mid-range forecasts
  - Integrate forecast improvements into NWS products (ESP & HEFS)
  - Reservoir operational analysis
  - Initially supported thru deviations
  - Codified within a WCP

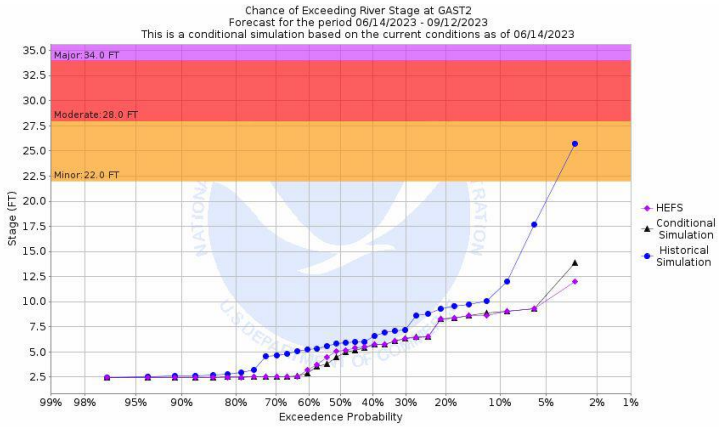


CURRENT ACTIVITIES

- Precipitation/storm studies
  - Catalogs
  - Physical properties
  - NOAA Atlas 14
- Watershed Studies
  - Runoff potential (70%-80% variations) & trends
  - Requires 3-4 week lead times
- Technology improvements and implementations
  - HEFS & ESP implementations and evaluations
  - CWMS
  - Storm shifting
  - RiverWare
  - Improved evaporation estimates with automated tools
- Collaboration and organization
  - Connect researchers and operators

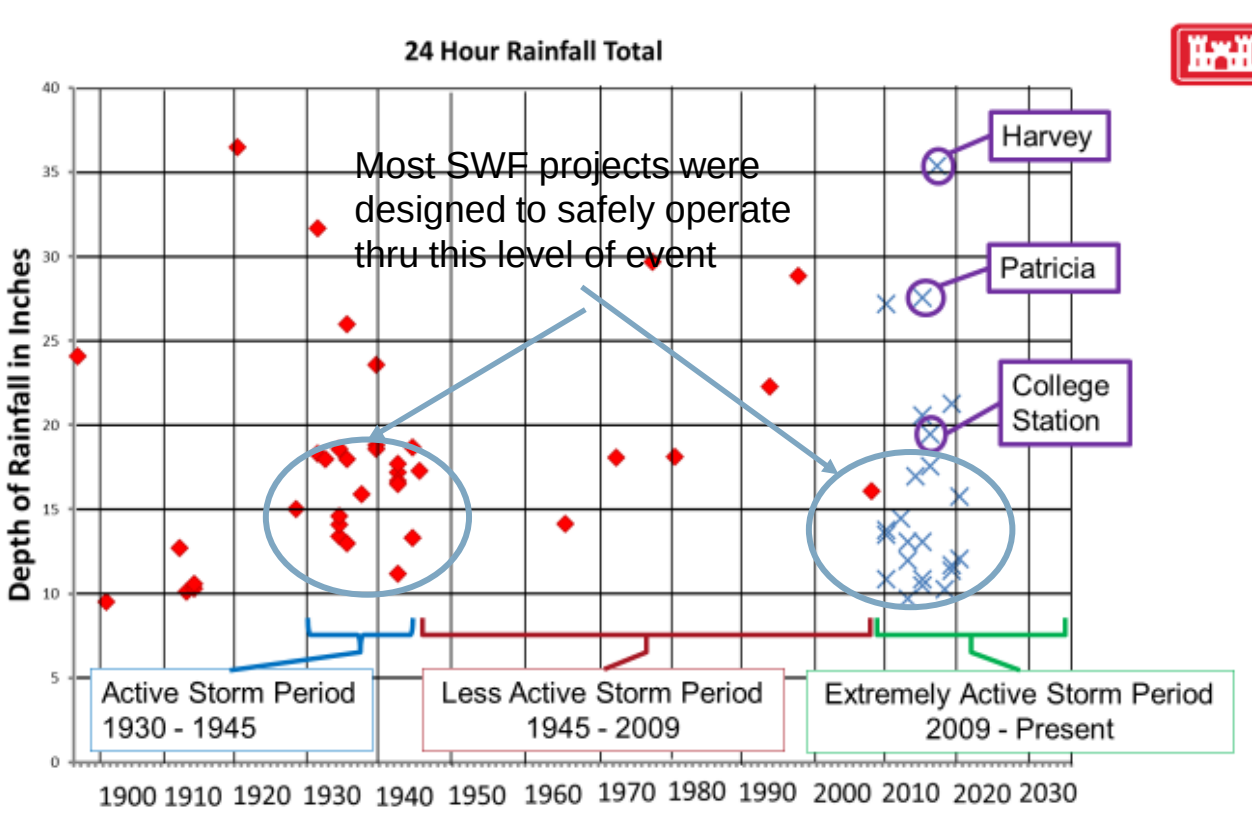






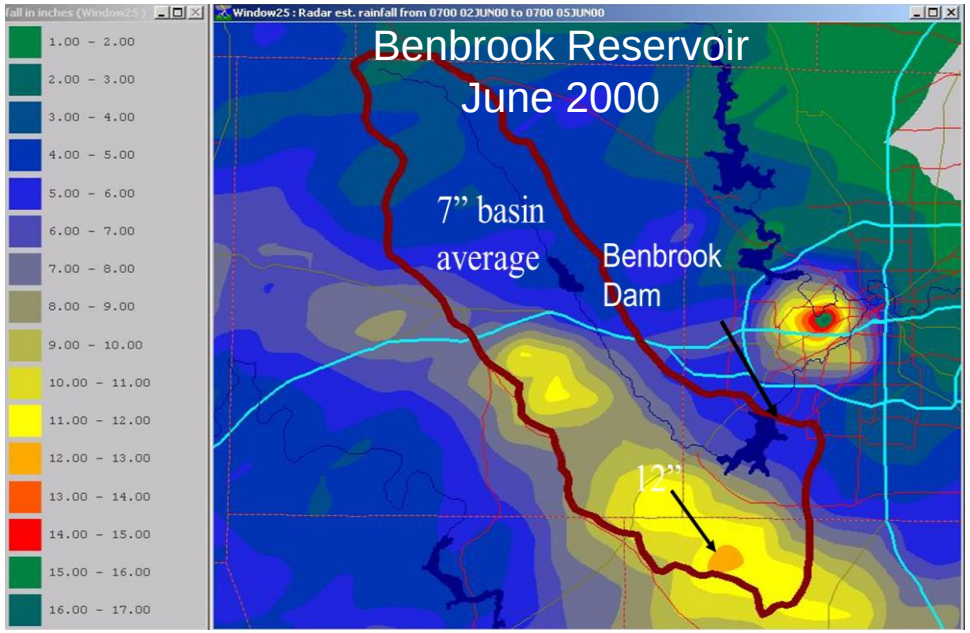
MOST SWF PROJECTS ARE OPERATE SAFELY THRU LARGE STORM EVENTS

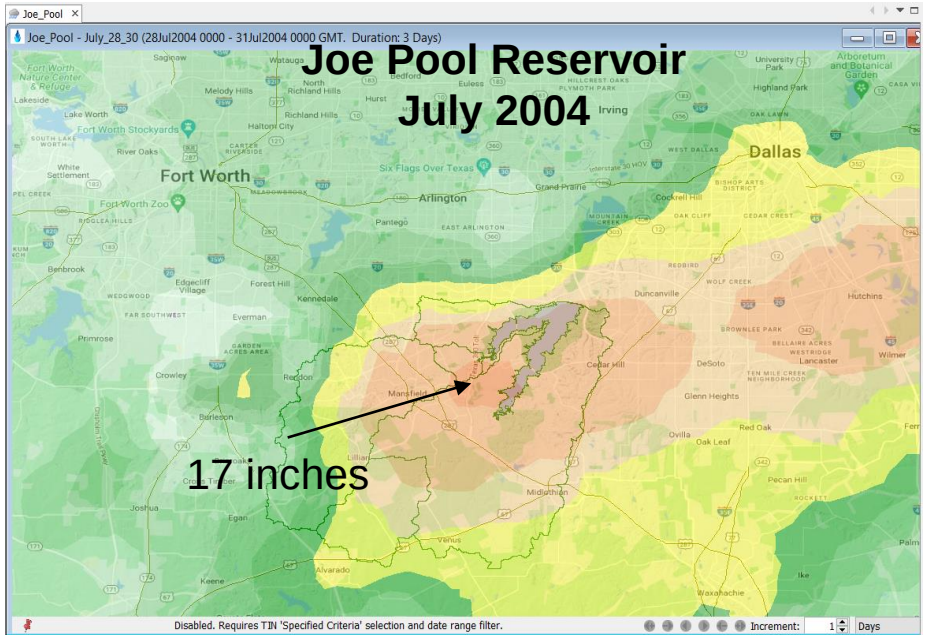
- SWF multipurpose reservoirs designed to operate full range of loading including historical observations
- 100-yr events (10 inches in 24 hours for DFW area) are easily managed
- This capacity may provide operational flexibilities that could be leveraged for FIRO

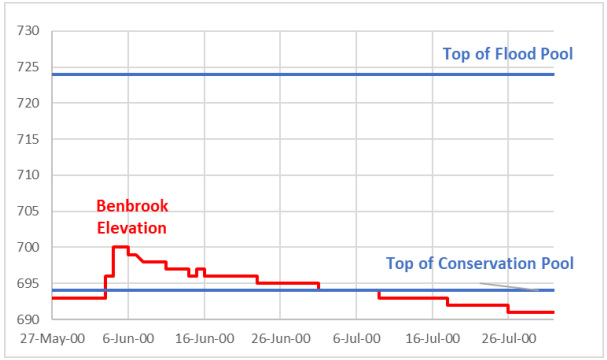


EXTREME EVENTS – SMALLER EVENTS WITH DRY ANTECEDENT CONDITIONS

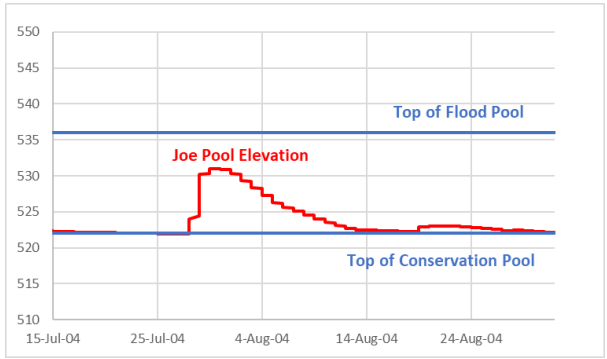
- Reservoirs are designed to operate thru extreme events
- June 2000 and July 2004 dry WS events suggest:
  - ➢ Projects operate through 12” & 17” events
  - ➢ 15% storage in Benbrook
  - ➢ 50% storage in Joe Pool
  - ➢ Ok for FIRO 5% - 20 % retention in flood pool







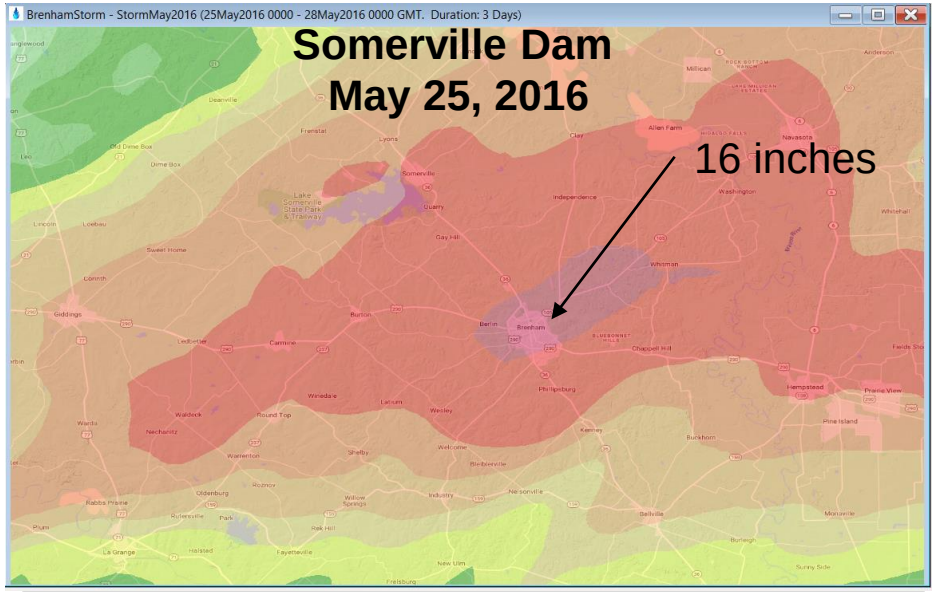
Benbrook Lake rose 6’

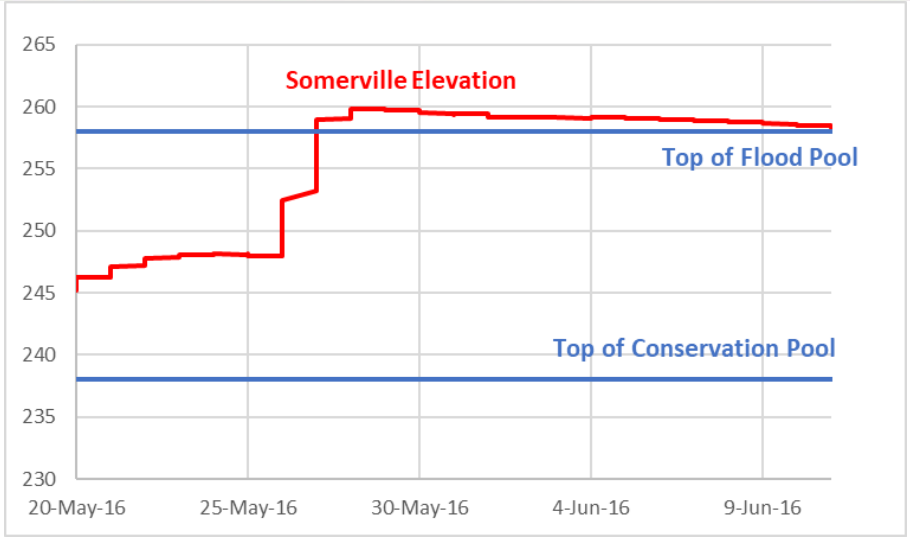


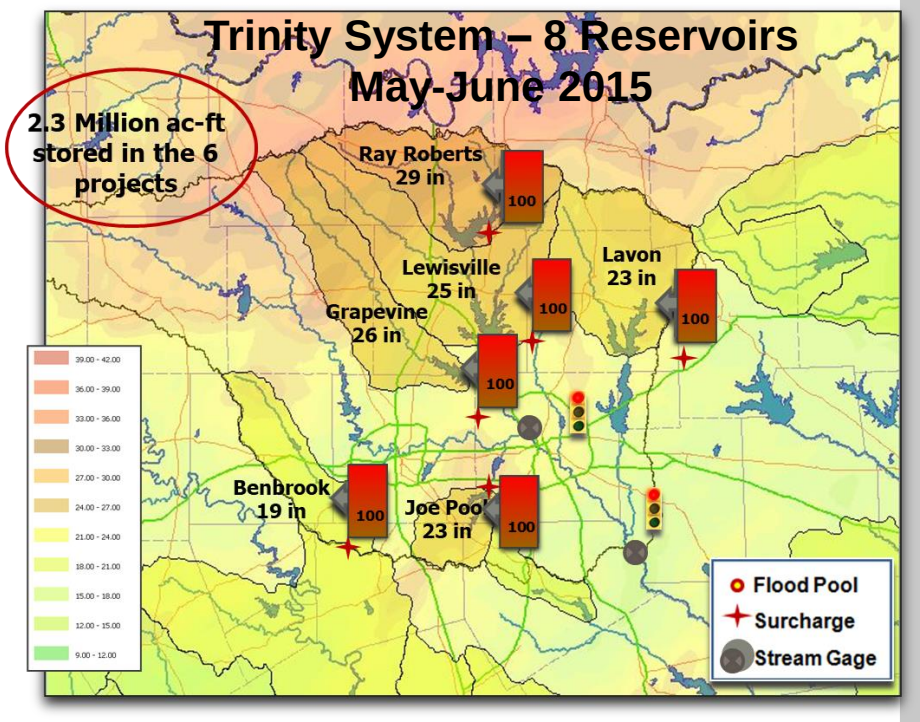
Joe Pool Lake rose 12’

EXTREME EVENTS – FIRO ADVERSE

- Larger events with wet antecedent or high intensities may cause problems
- Larger 16” May 2016 Somerville event triggered a surcharge release
- May – June 2015 training storms, 6 weeks, triggered surcharge releases in all 8 USACE Trinity River reservoirs
- No FIRO operations suggested



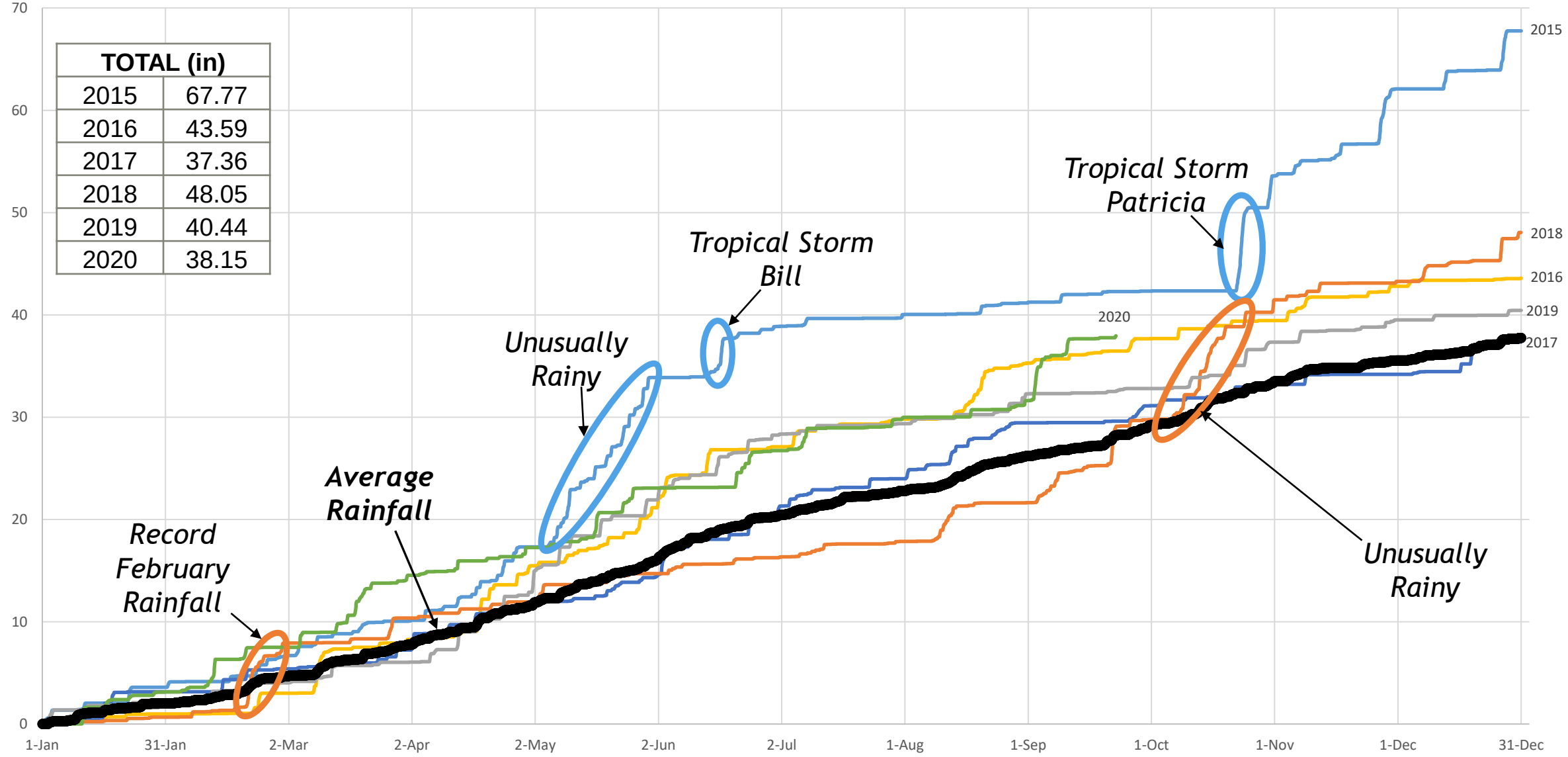




Somerville Lake rose 14’

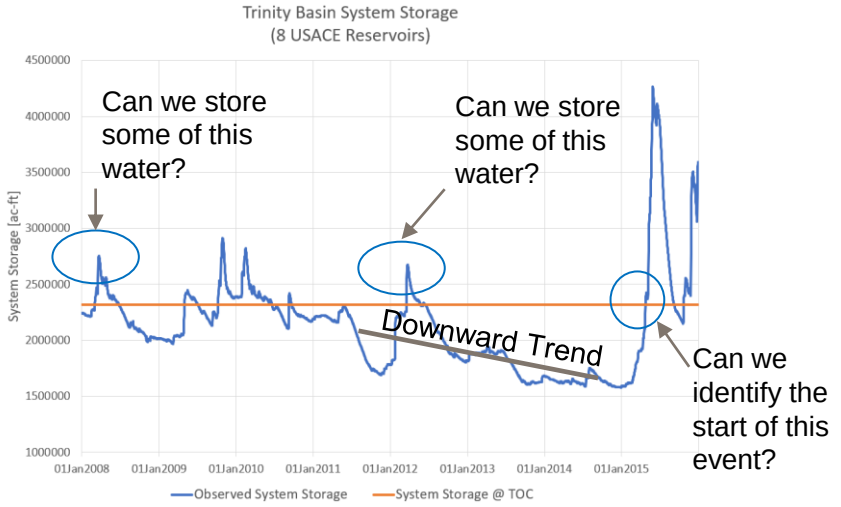
MIDDLE TRINITY BASIN AVERAGE RAINFALL PLOT

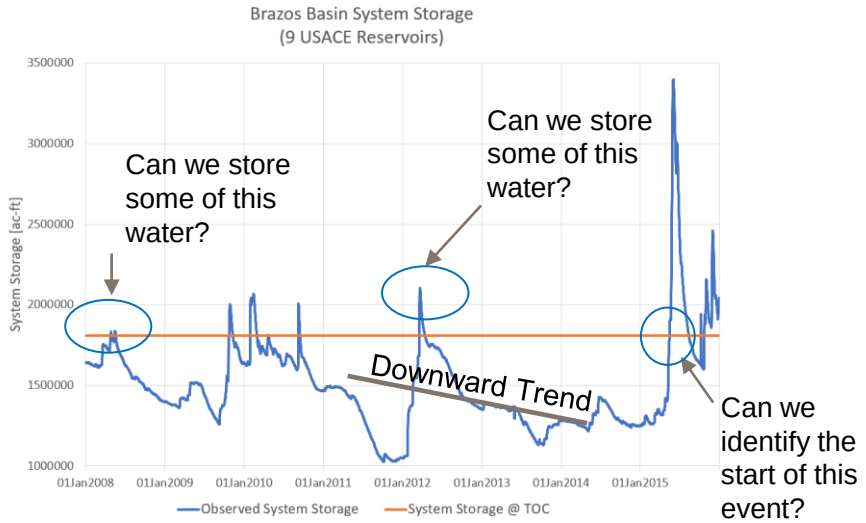
TOTAL (in)	
2015	67.77
2016	43.59
2017	37.36
2018	48.05
2019	40.44
2020	38.15



FIRO QUESTIONS

- Can more water be made available thru FIRO without costly infrastructure investments
- Can we identify major weather pattern shifts and active storm periods
- Storing flood water in late spring and early summer
  - Could reduce the need for pumping
- Droughts don't mean no water - can we identify sequential drought years and store water
- Forecast improvements need to target
  - The end of spring rains
  - Identification of persistent drought
  - Climate shifts from dry to wet and wet to dry
  - Identify training events
  - The potential for blocking factors (air masses)
- How can we increase funding, resources and research, are we effective?





QUESTIONS?

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