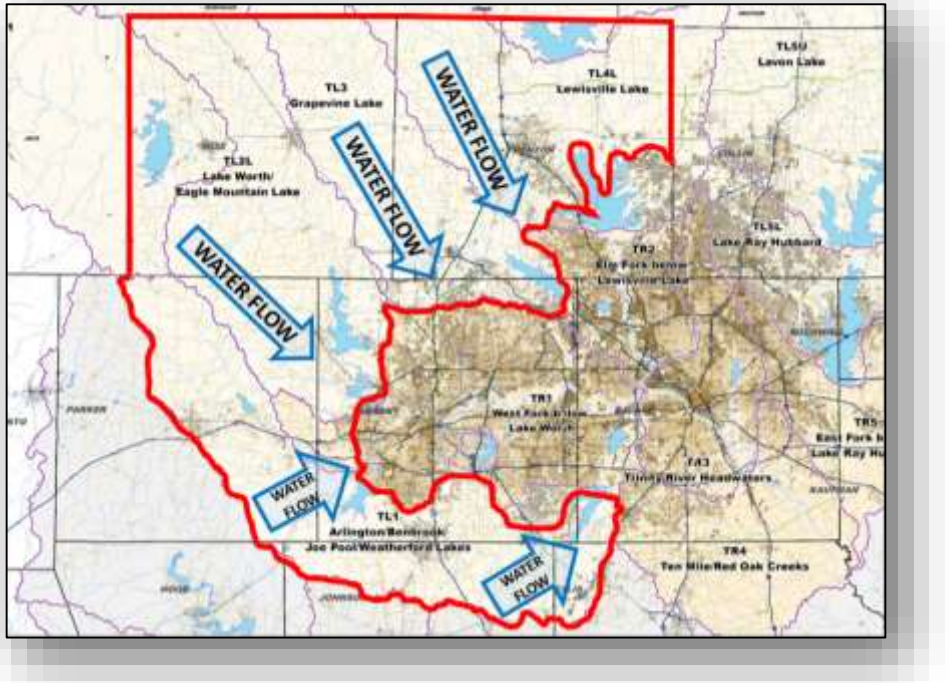
December 3, 2019 Floodplain Administrators/CRS Users Group:

INTEGRATED PLANNING OF REGIONAL TRANSPORTATION AND STORMWATER MANAGEMENT TOGETHER AS A SYSTEM OF IMPROVEMENTS: PREVENTION VS. RESPONSE



Presenter: Edith Marvin, P.E., Director of Environment & Development, NCTCOG
Presenter: Jerry Cotter, P.E., Chief of Water Resources, USACE, Fort Worth District
Partner: Michael Morris, P.E., Director of Transportation, NCTCOG

North Central Texas Council of Governments

BUILDING STRONG®

Flooding continues to be a challenge in North Texas

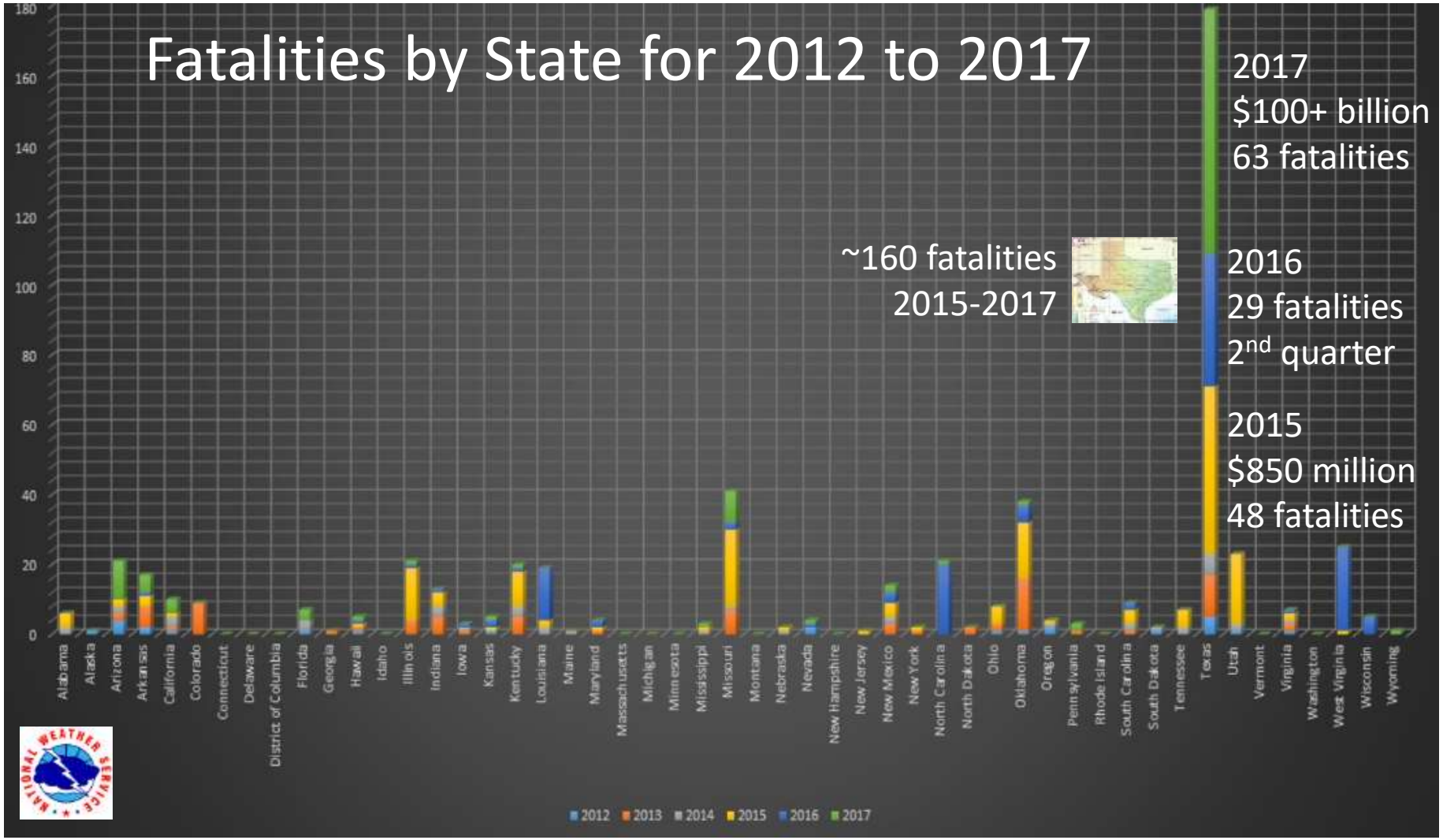
Threats: Increased flooding and safety risks; cost of infrastructure, stormwater, environmental restoration

DeSoto Fire Rescue

Solution: Innovative partnerships and integrated infrastructure

Flooding Fatalities and damages

Texas far outpaces other states in flood related fatalities & flood related damages

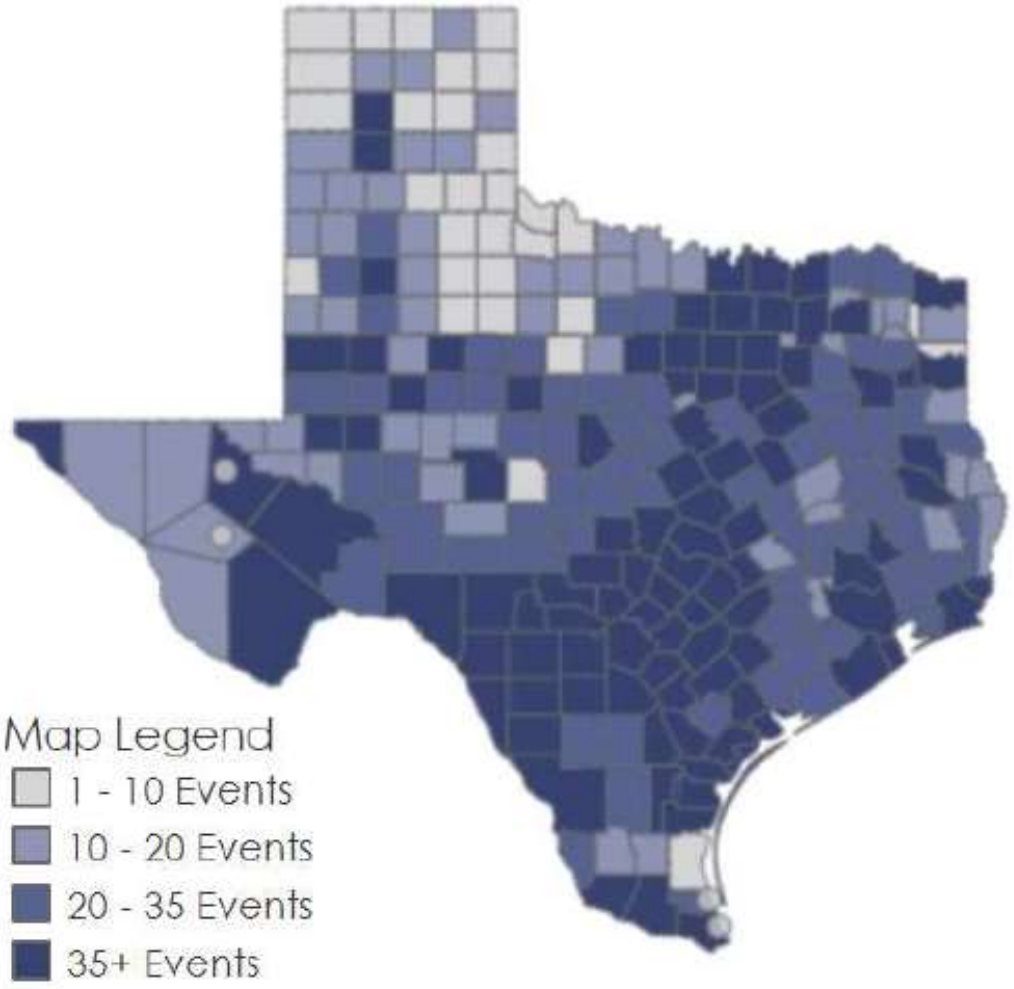


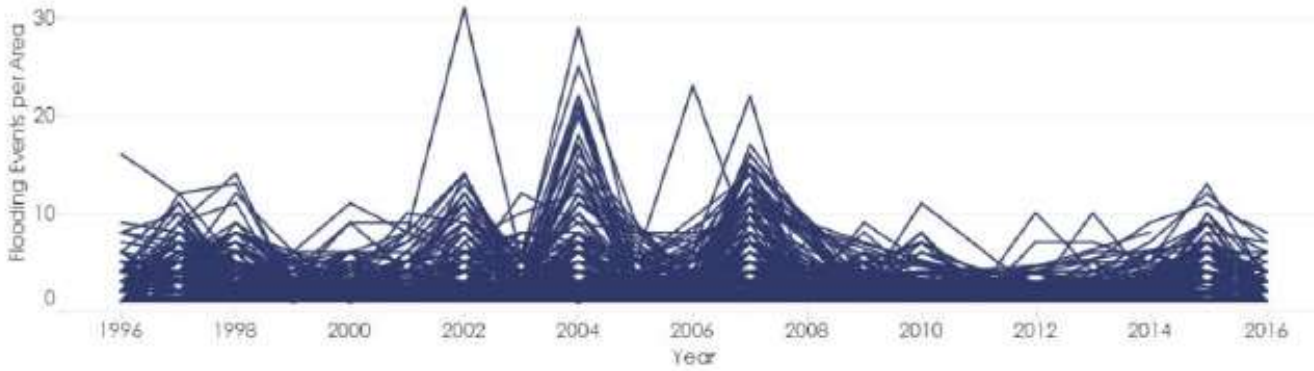
5 Year Tally of Flood Fatalities

North Central Texas Council of Governments

(Source: Gregory Waller, Service Coordination Hydrologist, NWS – West Gulf River Forecast Center, http://www.nws.noaa.gov/om/hazstats.shtml, 11/18 TFMA)

1996 -2016 FLOODING IN TEXAS





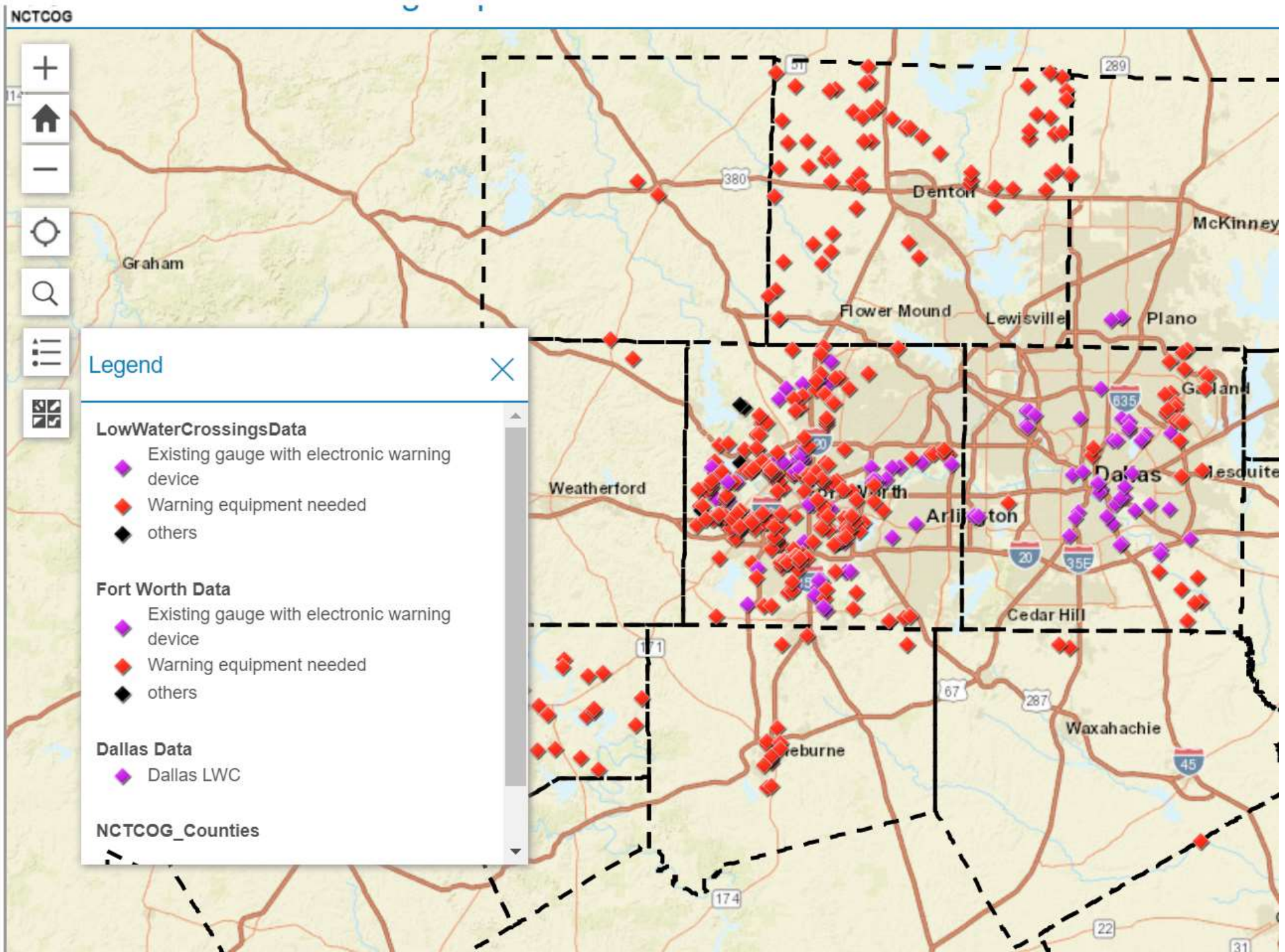
Costs of Flooding

The National Flood Insurance Program (NFIP) provides flood insurance to homeowners, renters, and business owners. FEMA's Individuals and Households Program (IHP) provides financial assistance and direct services to eligible individuals and households who have uninsured or underinsured necessary expenses and serious needs. See differences in NFIP claims paid to individuals from 1996-2016 and funding from IHP for flood-related damages from 2006-2016 for your state.

Source: www.fema.gov/data-visualization-floods-data-visualization

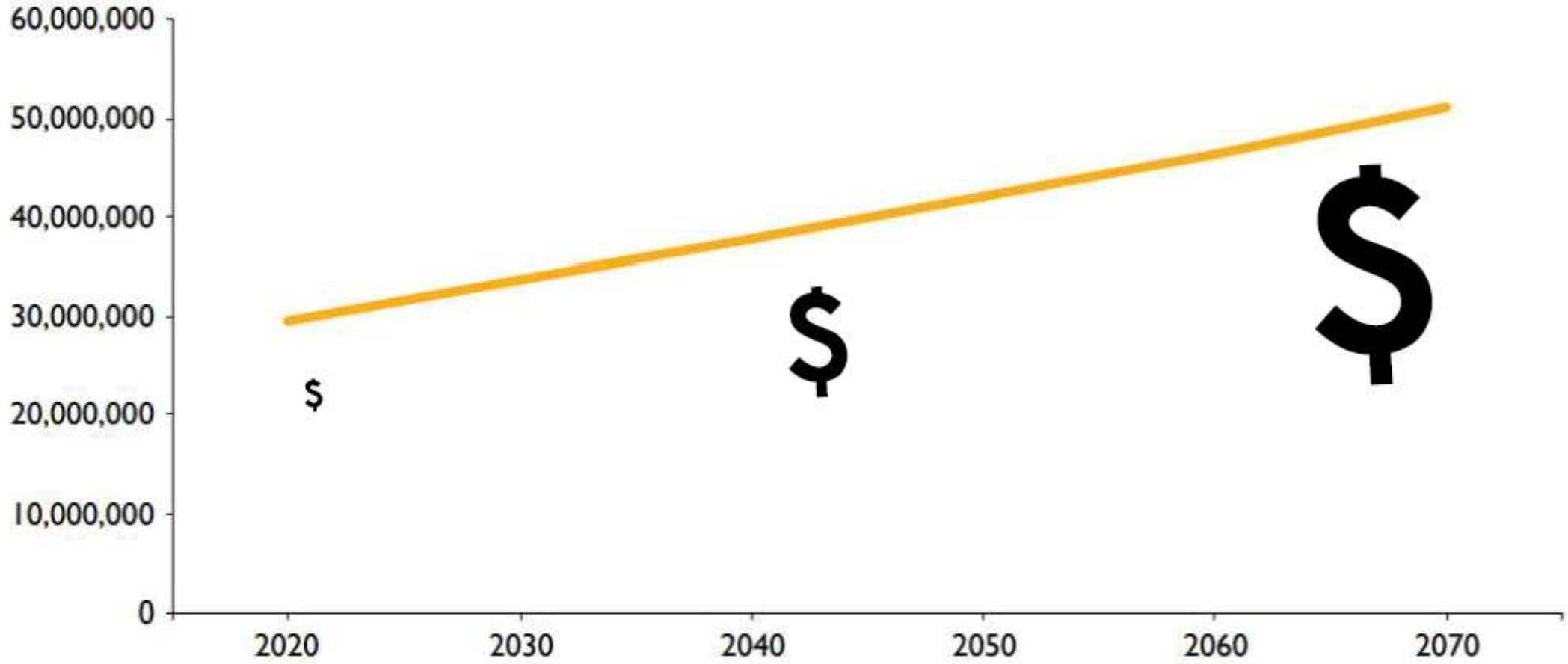
Perspective:
With only a few members reporting yet on Low Water Crossing Locations,
504 existing;
391 needed

This indicates a flaw in infrastructure design standards



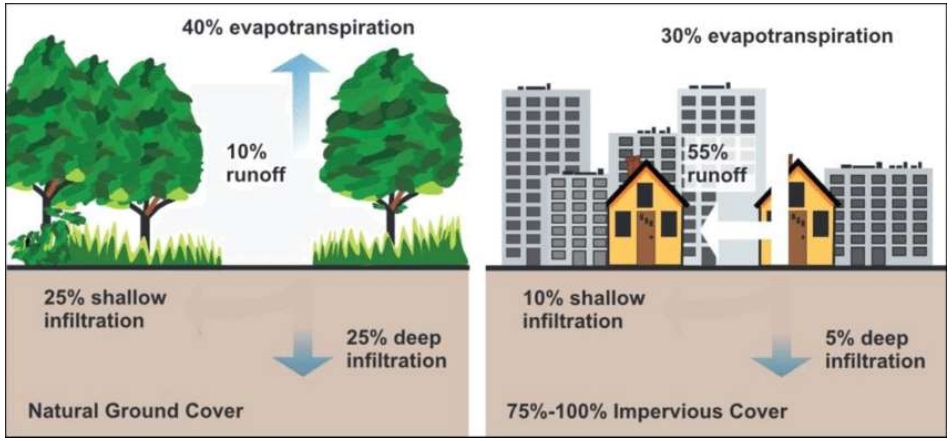
TEXAS INCREASING FLOOD DAMAGES

Figure 5.1 - Projected population in Texas

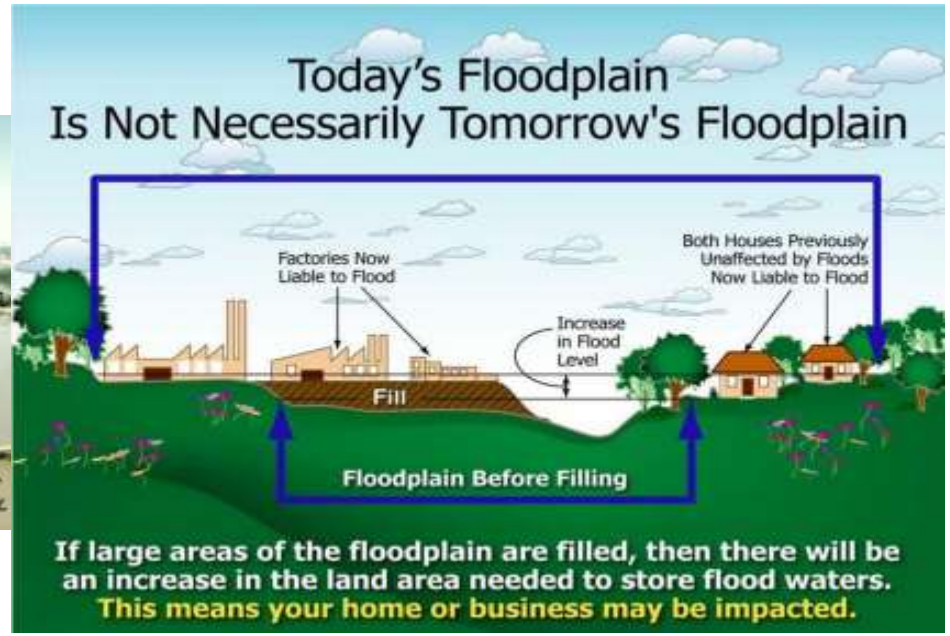


Growth and Development Increases Flooding

- Floodplains are among the most valuable ecosystems on earth, they are also one of the most threatened
- Growth and development increases impervious cover and runoff
- Growth and development depletes storage
- Flooding increased
- Maintaining capacity over time



Kazemi, Hamidreza (Kasra. (2014). Evaluating the effectiveness and hydrological performance of green infrastructure stormwater control measures. 10.18297/etd/1744



(Photo by Jason Cooley, Jason@texasstormchasers.com), November 2018 TFMA presentation

Heavy Rains Lead to Sewage Spills in Multiple North Texas Cities

Published Oct 16, 2018 at 9:10 AM – NBC5 DFW

https://www.nbcdfw.com/weather/stories/Heavy-Rains-Lead-to-Sewage-Spills-in-Multiple-North-Texas-Cities-497679751.html

INVESTIGATES

119 million gallons of sewage overflow in DFW, by the numbers

A closer look at sewage overflows here and across Texas.

Author: Ryan Osborne, Charlotte Huffman
Published: 7:00 PM CST February 21, 2019
Updated: 10:13 PM CST February 22, 2019

In 2018, more than 119 million gallons of sewage overflowed onto the streets and lakes of Dallas-Fort Worth. That's 119,090,756 gallons, to be exact, over more than 1,700 overflow incidents.

https://www.wfaa.com/article/news/local/investigates/119-million-gallons-of-sewage-overflow-in-dfw-by-the-numbers/287-f4de9146-1f77-41e1-af03-0b48ab3311f2

By Steve Pickett February 23, 2018 at 7:10 pm Filed Under: flooding, Lake Estates, Lake Rockwall, Local TV, Rockwall

http://www.fox4news.com/news/overnight-flooding-likely-for-parts-of-north-texas

Parts of North Texas see flooding overnight

By FOX4News.com Staff

POSTED FEB 28 2018 10:23PM CST
UPDATED MAR 01 2018 07:35AM CST

CARROLLTON, Texas - Heavy rain flooded parts of Collin, Dallas, Denton and Tarrant counties Wednesday night.

There was a flash flood warning for those parts of the Metroplex until just after midnight. Those living in low-lying areas were encouraged to move to higher ground.

Several cars got stuck in high water in the Dallas suburb of Carrollton. Firefighters were called out to rescue people in the heavily-flooded intersections near North Denton Drive and Jeanette Way as well as Countryside and North Josey Lane.

The service road on Central Expressway in Allen in Collin County was closed by flooding south of Bethany Drive. High water and debris covered the road. Highway officials had to set up barricades to keep people away.

Rain flooded an apartment complex in suburban Coppell. Viewers submitted pictures of standing water in the parking lot of the Wellington Place Apartments on MacArthur Boulevard near Sandy Lake Road. The complex has flooded before, including twice in 2015.

Homes in a new development just off Highway 380 in Princeton, east of McKinney, also flooded. Video posted on Facebook showed one family sweeping fast-moving water out of their house. A creek behind the house filled with water and flooded at least five homes.

"Look at this. It's like a river right here in my brother's side of the house. The landscaping is ruined. The sprinkler system is going to have to be redone. They have brand new furniture in this house. It's ruined," said Monica Moncier, whose brother's home flooded.

The family just moved into the house in November. They're upset with the builder and the city of Princeton.

http://www.fox4news.com/news/continued-north-texas-rain-causing-problems-for-some

FORT WORTH

North Texas neighborhoods are flooding more than ever before. Why?

BY BILL HANNA AND LUKE RANKER

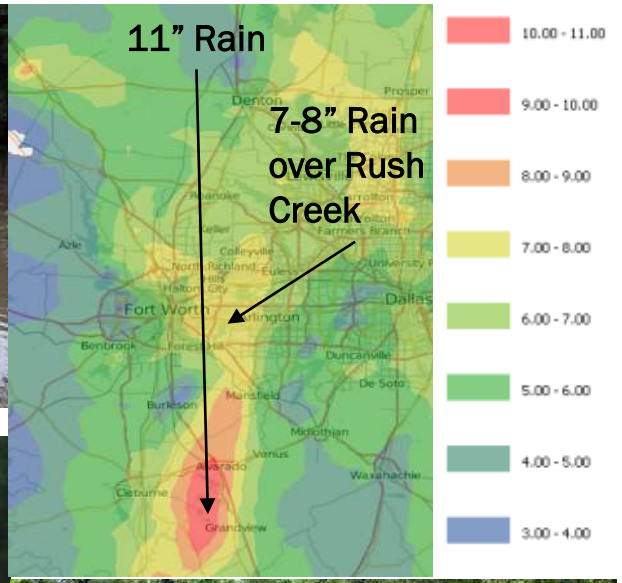
OCTOBER 12, 2018 06:00 AM, UPDATED OCTOBER 12, 2018 04:07 PM

https://www.star-telegram.com/news/local/community/fort-worth/article219740795.html

Community Impacts

Tropical Storm Hermine – Arlington, Texas September 2010

- Extreme drought
- 2010 Tropical Storm Hermine
- Extensive flooding
- No fatalities
- Buy-outs for 150 residences
- $17+ M



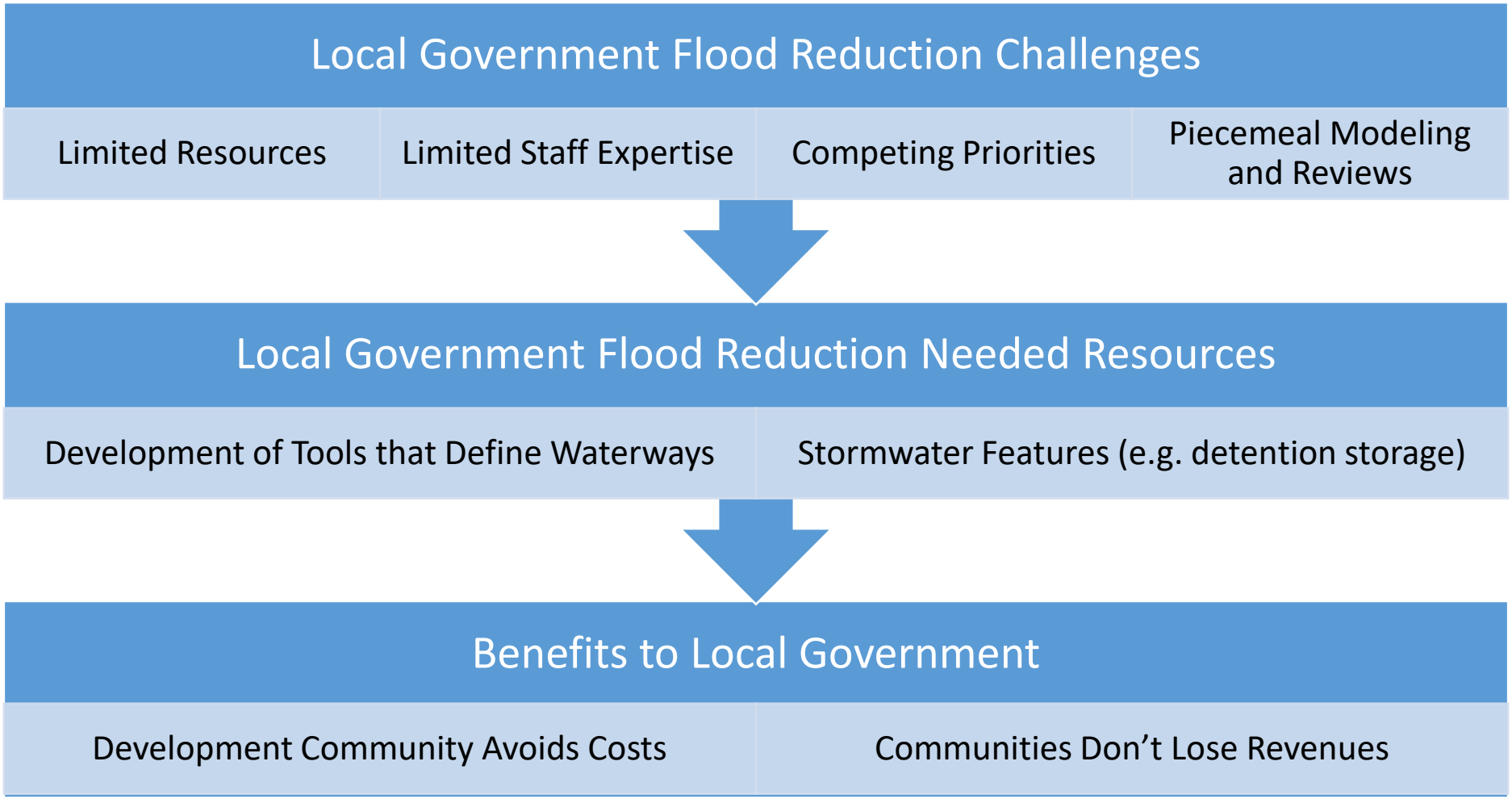
REGIONALLY RECOMMENDED STANDARDS IN WATERSHED MANAGEMENT*

For New Development Within County Regulated Areas

1	Design infrastructure to fully developed conditions with approved land-use maps if data is available
2	Begin protection at the most upstream end of the watershed above Federal Emergency Management Agency Limit of Detail Study
3	Maintain unfilled valley storage areas
4	Protect against and reduce erosive velocities
5	Match pre-developed site runoffs
6	Verify/require adequate downstream conveyance
7	Require freeboard from fully developed (if data is available) and changing watershed conditions
8	Define written operation and maintenance responsibilities
9	Size conveyance of street and storm systems adequately to safely convey traffic
10	Create stream buffers and preserve open space; limit clearing and grading
11	Consider regional (on or off stream) detention incentives
12	Implement Conservation and/or Cluster Development incentives
13	Encouraging low impact development techniques and/or green infrastructure

*Developed by the North Central Texas Countywide Watershed Management Roundtable, March 14, 2017

EXISTING CHALLENGES WITH FLOOD REDUCTION EFFORTS



INTERIM REPORT
to the 86th Texas Legislature

HOUSE COMMITTEE ON COUNTY AFFAIRS

January 2019

State Recommendation:

The January 2019 Interim Report to the 86th Texas Legislature from the House Committee on County Affairs contains a recommendation that the Texas Legislature should explore a regional approach to floodplain regulation, allowing counties that share watersheds to adopt similar regulations, as allowed by the Texas State Water Code.

CHARGE II - Evaluate whether counties have the necessary ordinance-making and enforcement authority to deal with flood risk in unincorporated rural and suburban areas of Texas. Additionally, examine whether counties have adequate resources and authority to ensure that new development in unincorporated areas is not susceptible to flooding.

3. **The Texas Legislature should explore a regional approach to flood plain regulation, allowing counties that share watersheds to adopt similar regulations.**
The Water Code also allows counties to restrict certain development and to regulate construction in the flood plain. Counties use this authority to mandate certain designs to mitigate flooding, to prevent flooding on neighboring properties, and to minimize erosion. However, although a county may adopt these standards for flood management, the impact of these regulations may be muted when surrounding counties do not adopt similar regulations.

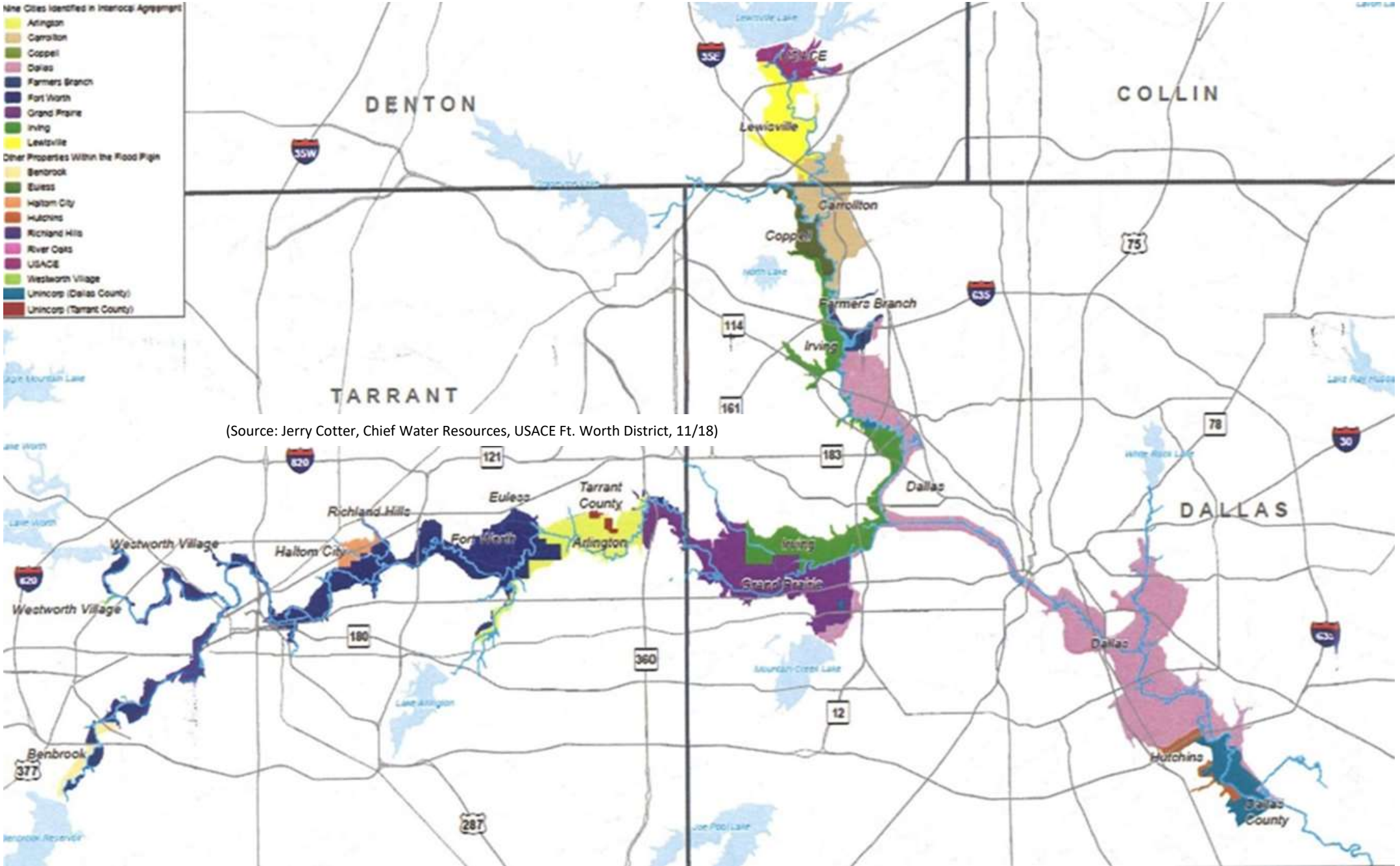
https://house.texas.gov/_media/pdf/committees/reports/85interim/County-Affairs-Committee-Interim-Report-2018.pdf

EXISTING NORTH CENTRAL TEXAS WATERSHED MANAGEMENT TOOL

<u>iSWM Resources</u>

- Technical Manual - Criteria Manual

EXISTING TRINITY RIVER CORRIDOR PROGRAM

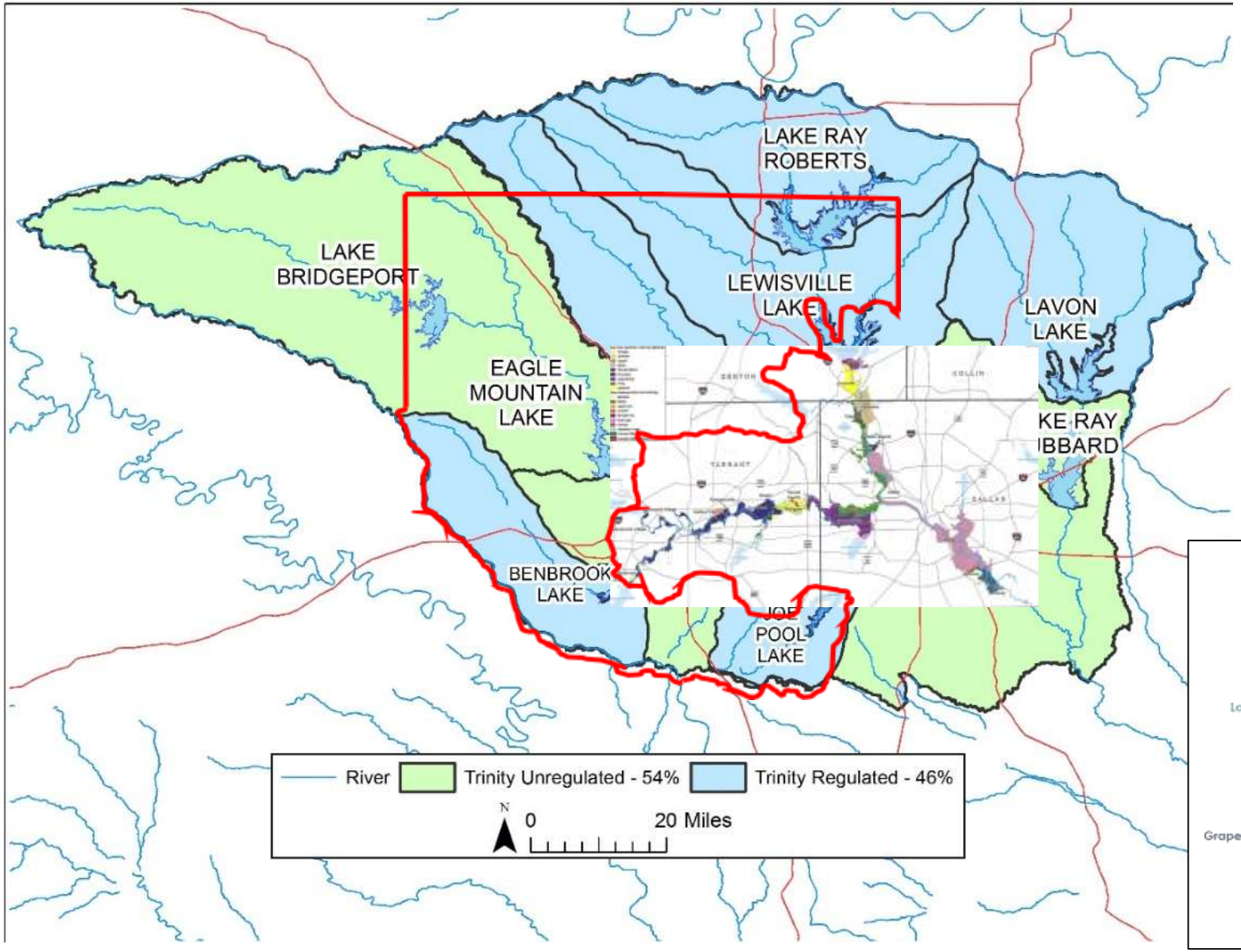


(Source: Jerry Cotter, Chief Water Resources, USACE Ft. Worth District, 11/18)

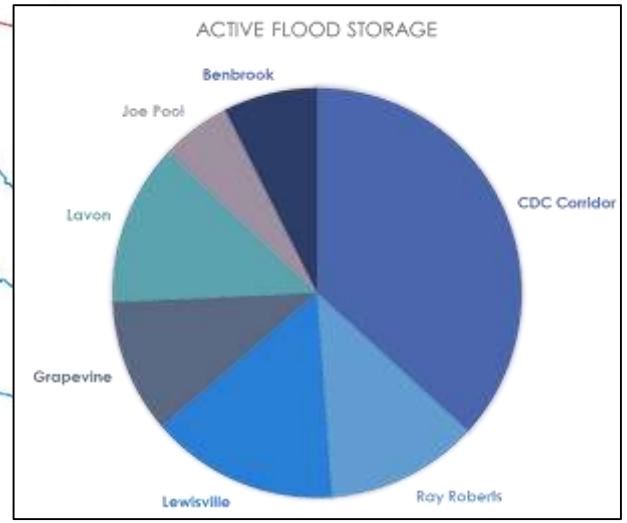
Partners:
Arlington
Carrollton
Coppell
Dallas
Farmers Branch
Fort Worth
Grand Prairie
Irving
Lewisville
Dallas County
Tarrant County
Denton County
TRWD
TRA

NCTCOG
USACE
FEMA
TWDB

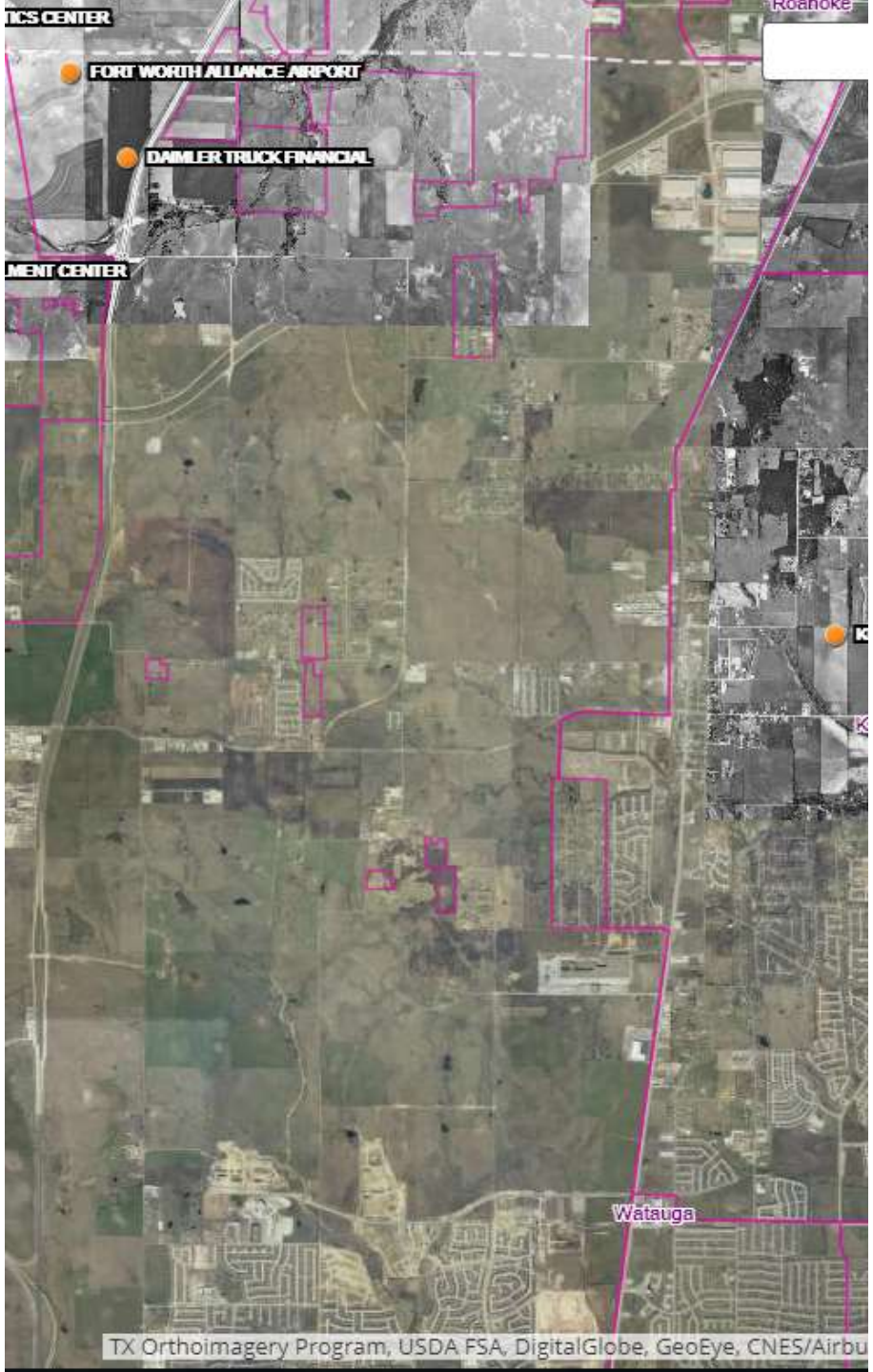
USACE Dallas-Fort Worth - Flood Reduction and Water Supply System

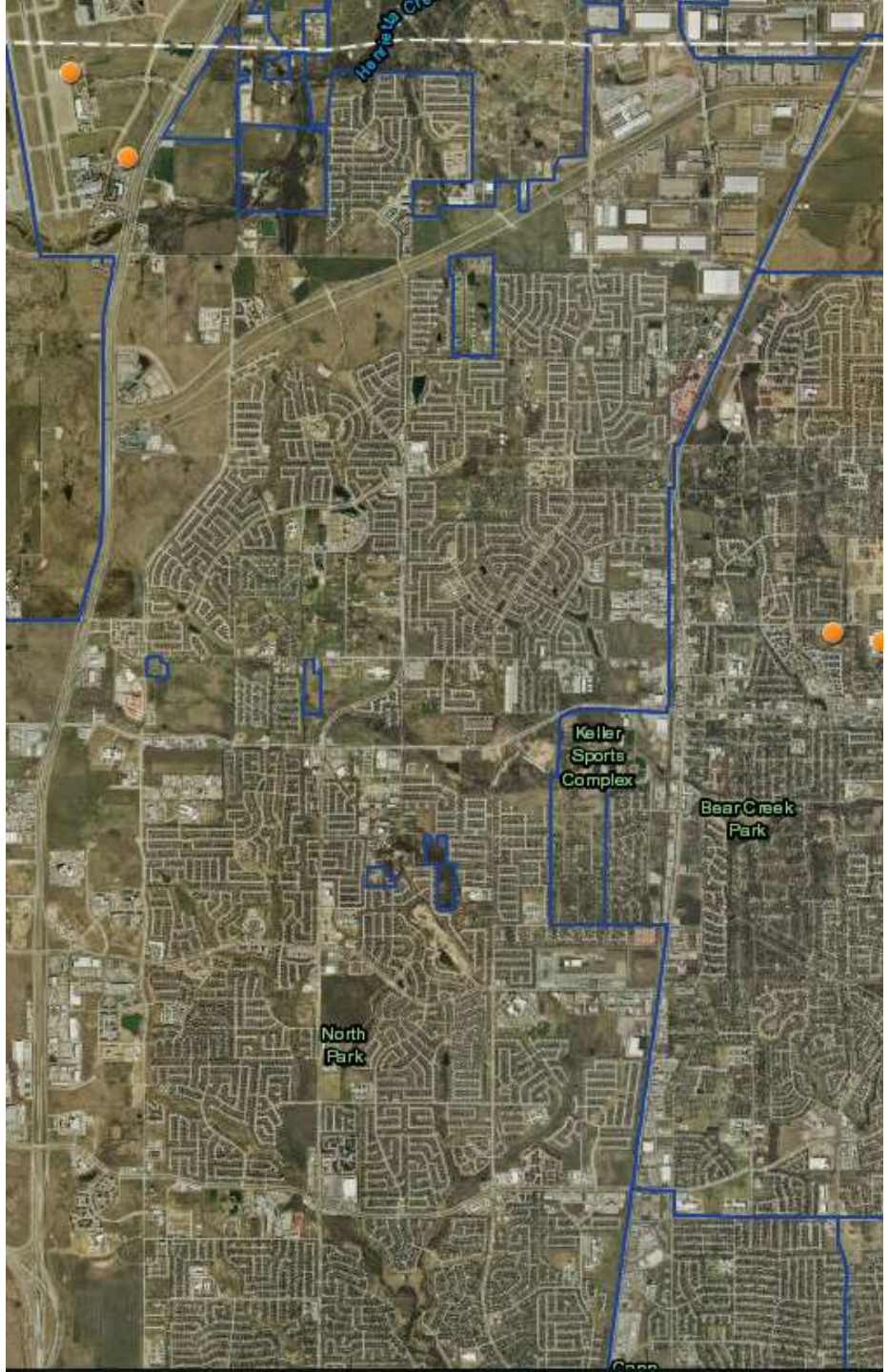


- Devastating floods, 1908, 1942, 1949
- 6 multi-purpose reservoirs (1952-1987)
- 2 federal levee systems
- DFW Flood Control System
  - 7.4 million people
  - $100+ billion in damages prevented
  - $2 - $3 billion annually
- Water supply system
- Total cost $2.5 billion
- *Must be operated as a system*



Typical Master Plans:
* Thoroughfare/Roadway (freeway, highway, arterial, collector)
* Wastewater (treatment system and major trunks)
* Water system (provider, major trunks, pressure zones, elevated and ground tanks)
* Parks (trail systems and green space connections)
* Solid Waste (landfill capacity, trash disposal contracts)
* Fire and police stations/protections
* Other – but typically not stormwater by watershed – “drainage as-you-build”

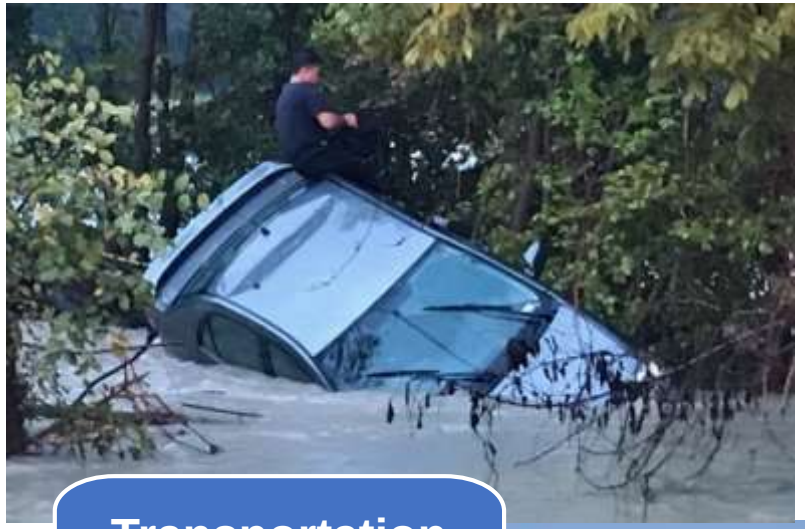




Key points

- Project should complement, leverage and build upon existing resources and systems
  - ►iSWM
  - ►Common vision
  - ►DFW USACE/Communities regional flood control system (does not protect against all threats)
- Should be a collaboration between local, state and federal partners
- We are not currently comprehensively planning stormwater infrastructure
- Should provide a formal definition of the project and project area for areas where highest potential for cost effective efforts are and where best practices are not yet in place
- Comprehensive stormwater infrastructure planning should be evaluated through a range of hydrologic loading utilizing latest technologies… not just 100-year

WHAT/WHY: Comprehensive, collaborative planning will dissolve silos and improve delivery of consolidated, adaptive infrastructure *before* expected population growth makes addressing these issues more difficult and costly



DeSoto Fire Rescue

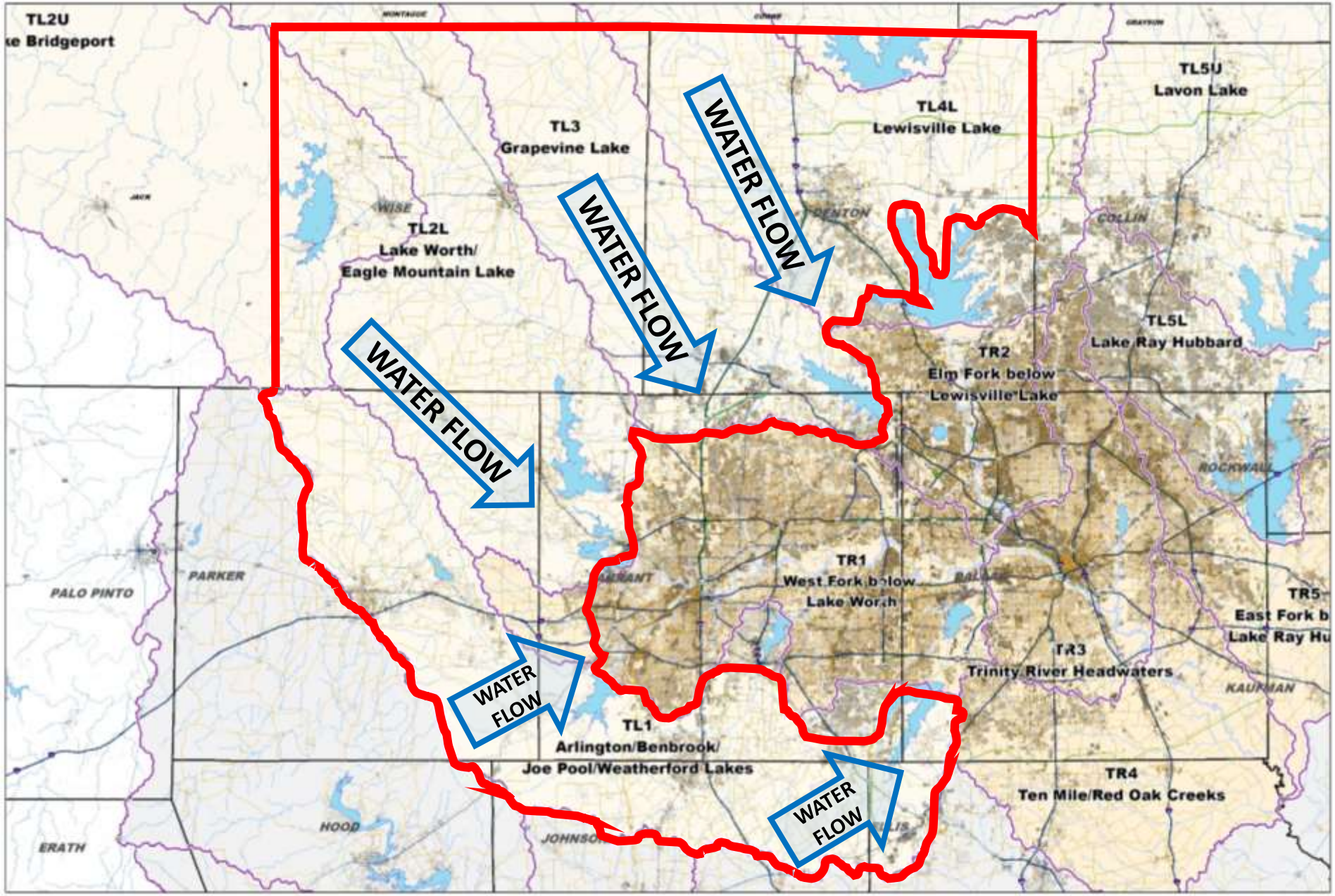
Transportation Infrastructure and Safety

City of Waxahachie

Stormwater Runoff

Teague Nall and Perkins, Inc.

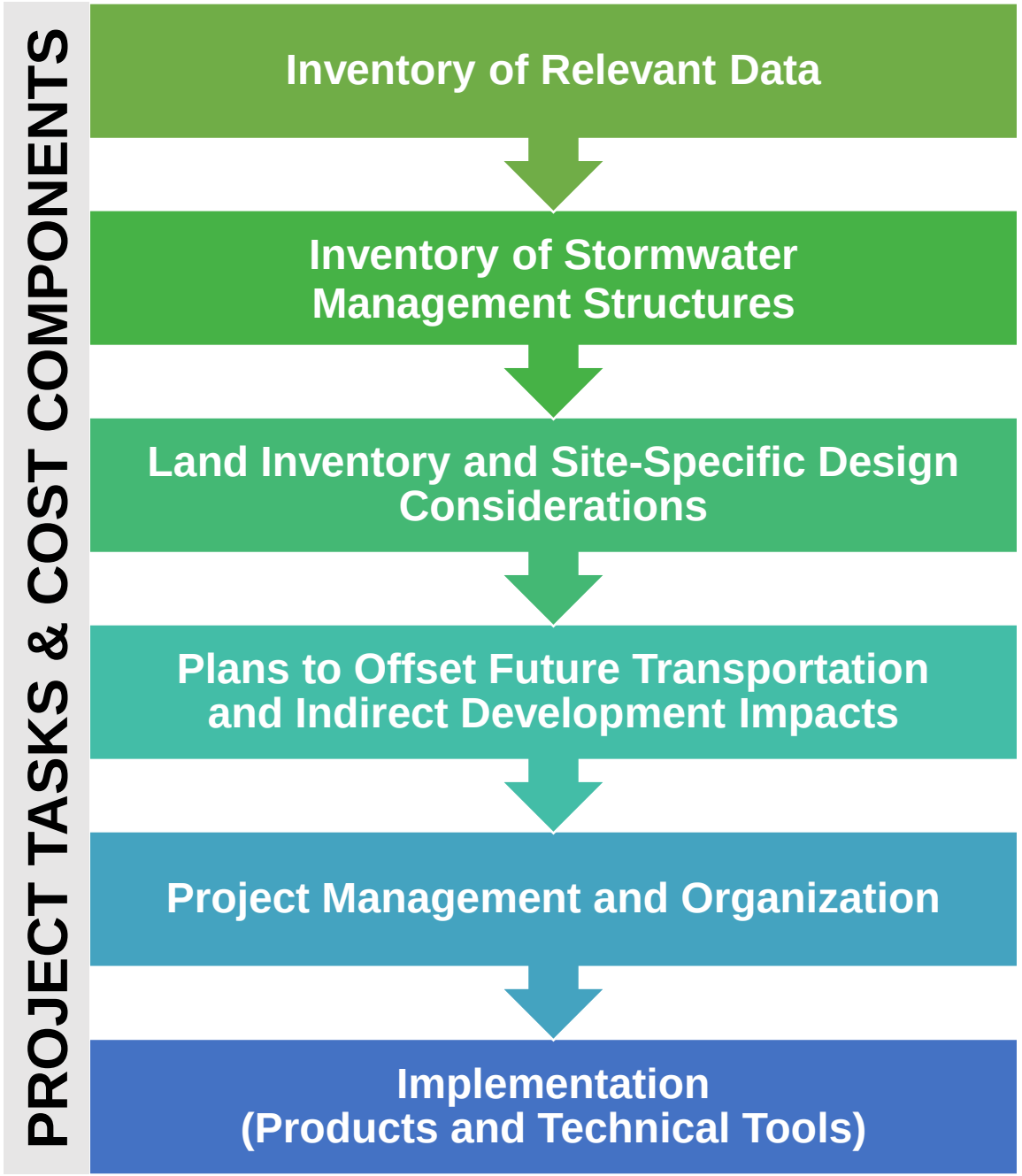
Environmental Features and Tools



WHERE: Proposed Study Area

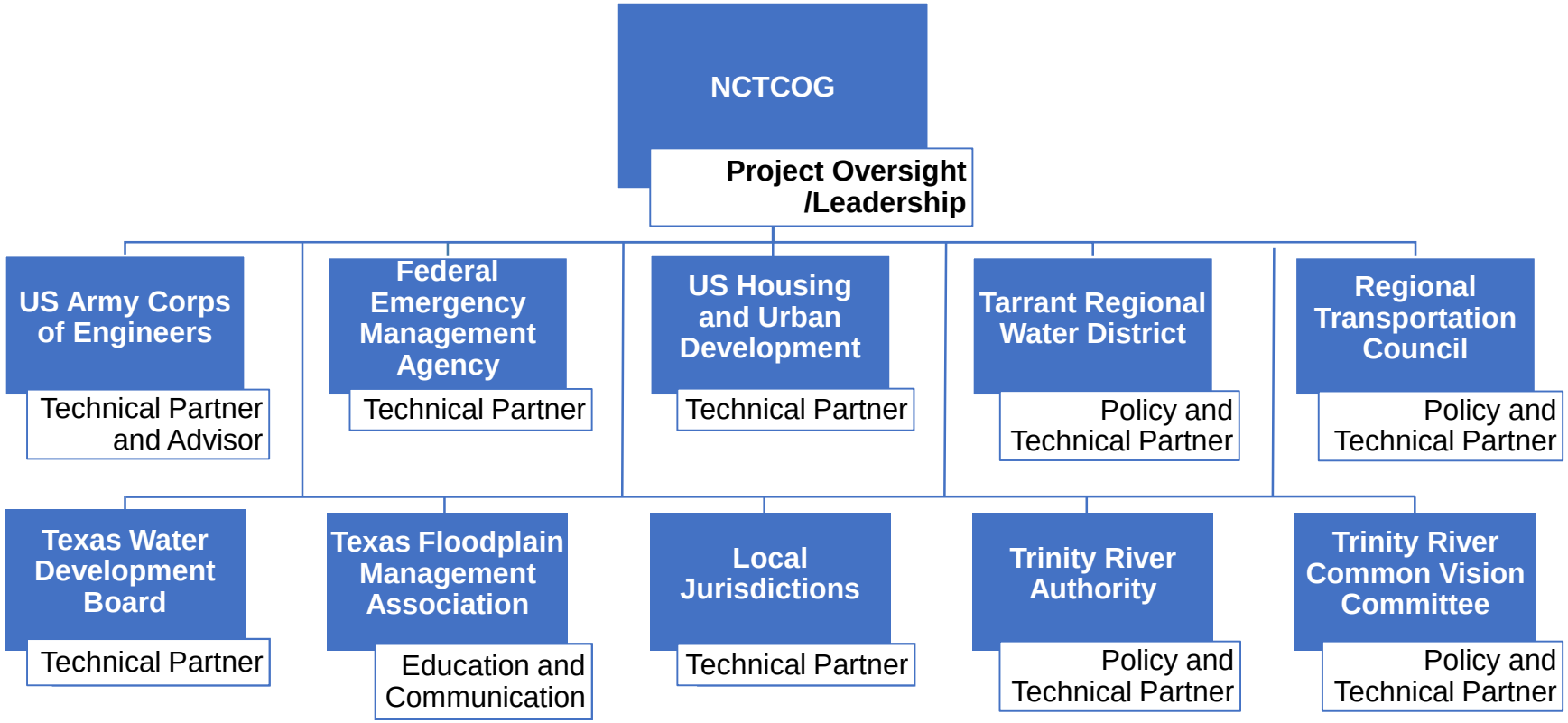
North Central Texas
Council of Governments

HOW: Integrate regional transportation planning, regional stormwater management planning, and environmental planning to develop consolidated, adaptive infrastructure



WHO: Project Team Members

A working group of partners and stakeholders to carry out a comprehensive planning effort in Wise County and portions of Dallas, Denton, Ellis, Johnson, Parker, and Tarrant counties



Additional Transportation Interests: PREVENTION VS. RESPONSE

Transportation Infrastructure

- Structure Elevation / Culverts / Model Growth
- Mechanical Culverts?
- Transportation “LEED” Certified (Ray Roberts / Lewisville)
- Green Parkway Widths / Detention

Safety

- Technology / Routing
- Prioritization / Low Lying Facilities

Stormwater

- Minimize / Reduce Downstream
- Detention
- Tools, Data, Experts

Additional Transportation Interests: PREVENTION VS. RESPONSE CON'T.

Environmental Features

- Tree Farms / Intentional Saturation
- Filtration / Recharge

Wetland and Stream Bed Mitigation Banking

Environmental Stewardship as a Revenue Element

- Mitigation Banking
- Horse Farms
- Eco-Tourism

CONTRIBUTIONS:

Partners are critical to making this possible

Texas General Land Office (GLO)	US Housing and Urban Development (HUD)	US Army Corps of Engineers (USACE)	Federal Emergency Management Agency (FEMA)	Texas Department of Transportation (TxDOT)	Texas Water Development Board (TWDB)	Regional Transportation Council (RTC)
$?	$ GLO	$?	$ ✓	$ RTC	$	$ 3M

… +

Project Funding Goal: $10 Million

Project Has Begun With Getting the Money

RETURN ON INVESTMENT

2017 "*Natural Hazard Mitigation Saves*" report by: National Institute of Building Sciences Institute, Multi-hazard Mitigation Council (MMC), at the direction of the U.S. Congress

Riverine flooding – for $1 invested in mitigation strategies and higher standards (versus recovery from flooding actions), communities save $5-7

National Benefit-Cost Ratio Per Peril *BCR numbers in this study have been rounded	Federally Funded	Beyond Code Requirements
Overall Hazard Benefit-Cost Ratio	6:1	4:1
Riverine Flood	7:1	5:1
Hurricane Surge	Too few grants	7:1
Wind	5:1	5:1
Earthquake	3:1	4:1
Wildland-Urban Interface Fire	3:1	4:1

Table 1. Benefit-Cost Ratio by Hazard and Mitigation Measure.

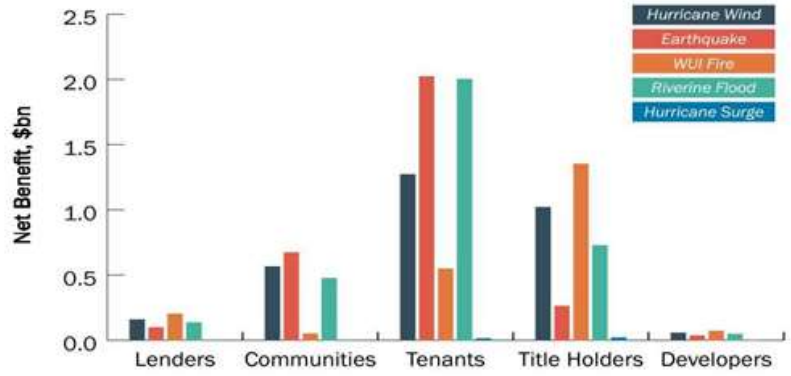
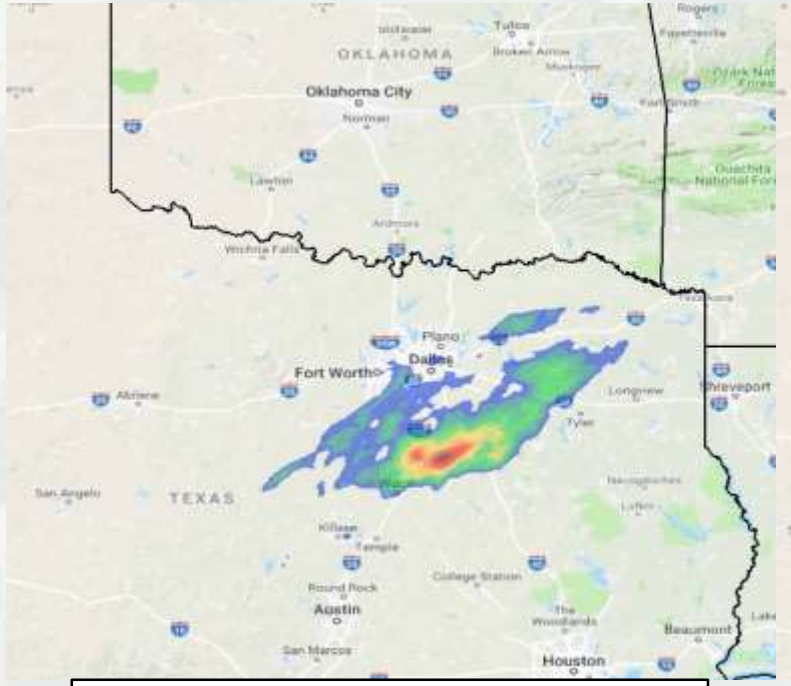


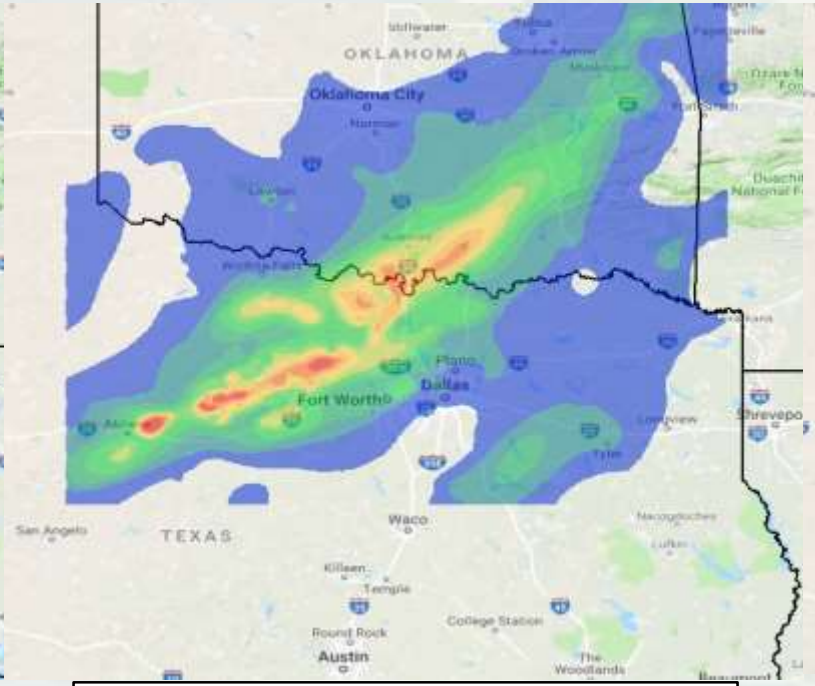
Figure 8. Stakeholder net benefits resulting from one year of constructing all new buildings to exceed select 2015 IBC and IRC requirements or to comply with 2015 IWUIC.

Source:http://www.wbdg.org/files/pdfs/MS2_2017Interim%20Report.pdf

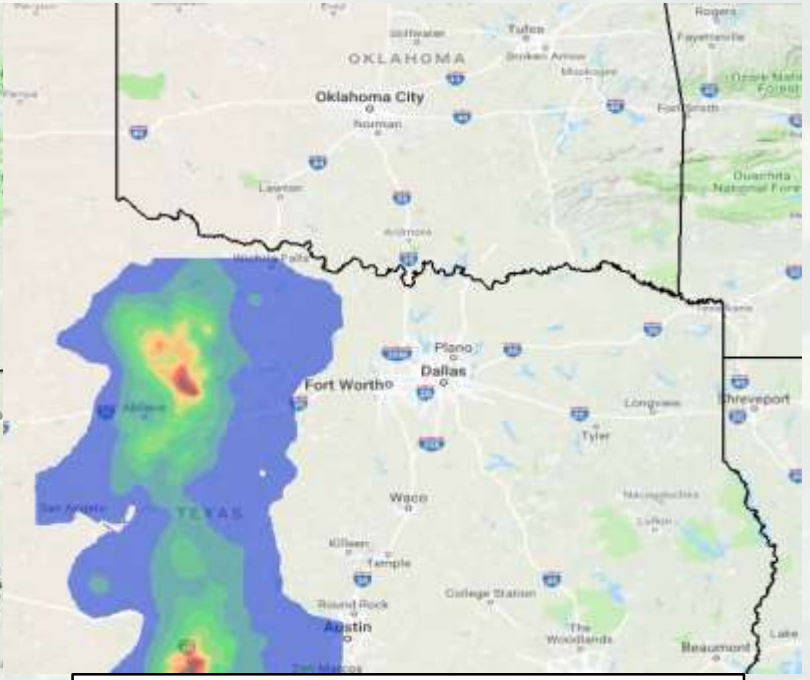
Storms Exceeding Infrastructure and NFIP Standards



2015 Tropical Storm Patricia – 24.2”
90 miles south of DFW



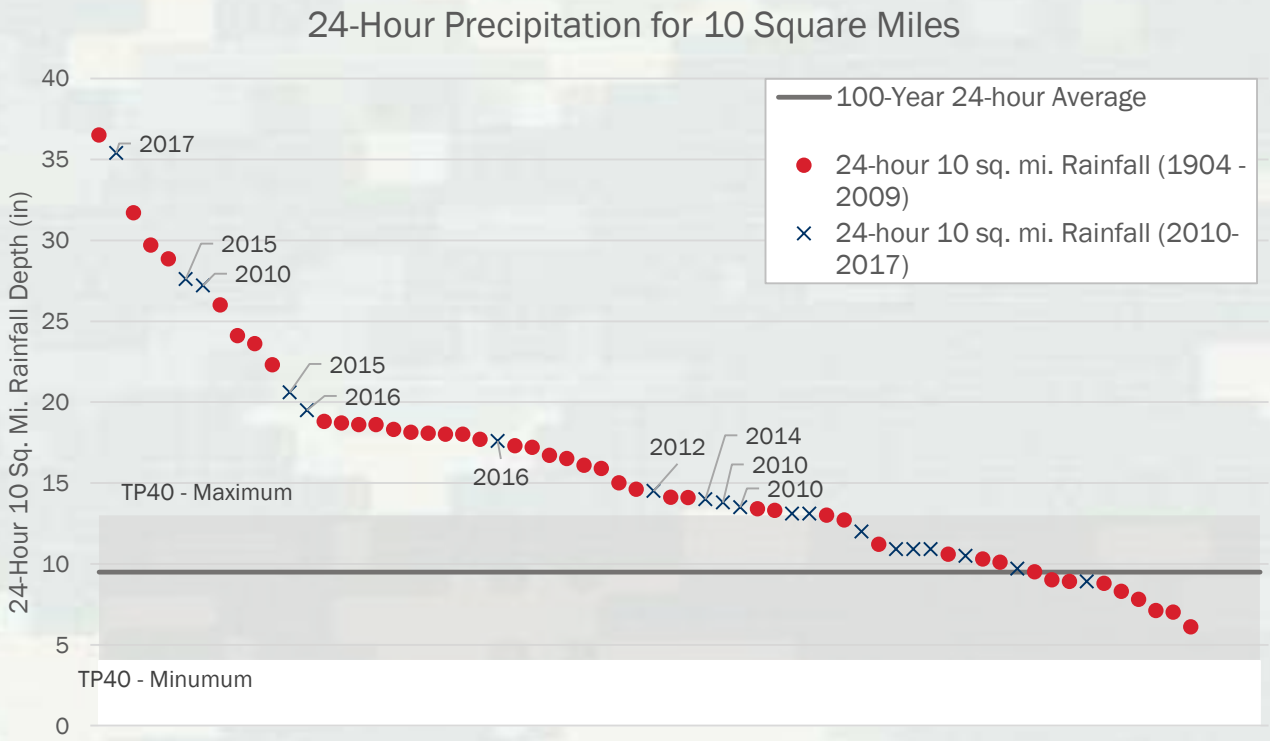
1981 Tropical Storm Norma – 18.7”
90 miles west of DFW



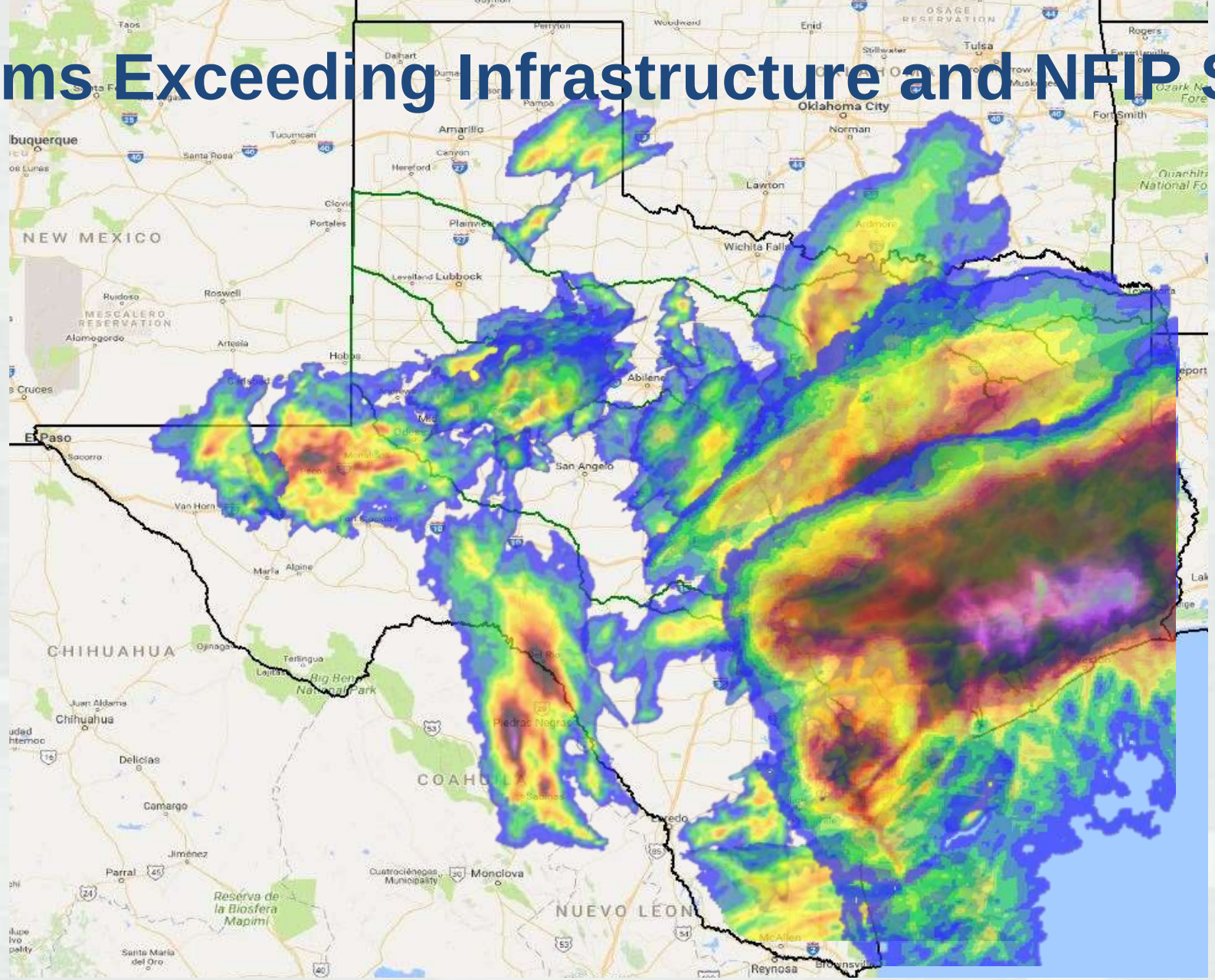
1978 Tropical Storm Amelia – 27.2”
75 miles west of DFW

Storms Exceeding Infrastructure and NFIP Standards

- Regional observed storms
  - ► USACE extreme storm database
- 24-hour rainfall for 10 mi^2
- Plotted in descending order
- Grey band is current design standard (100-year) for all of TX
- Blue X's points are 2010-2017 storms that exceed 100-year
- 18 events exceeded the 100-yr design standard

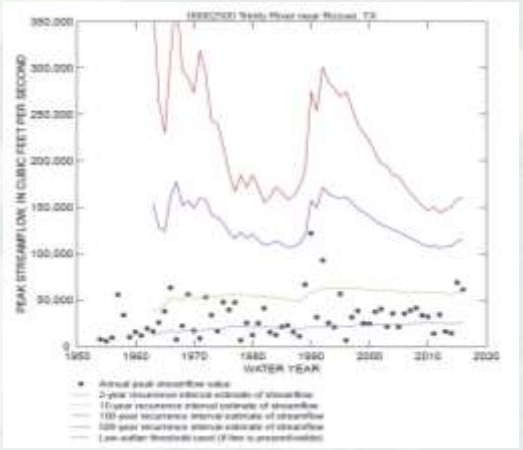


Storms Exceeding Infrastructure and NFIP Standards



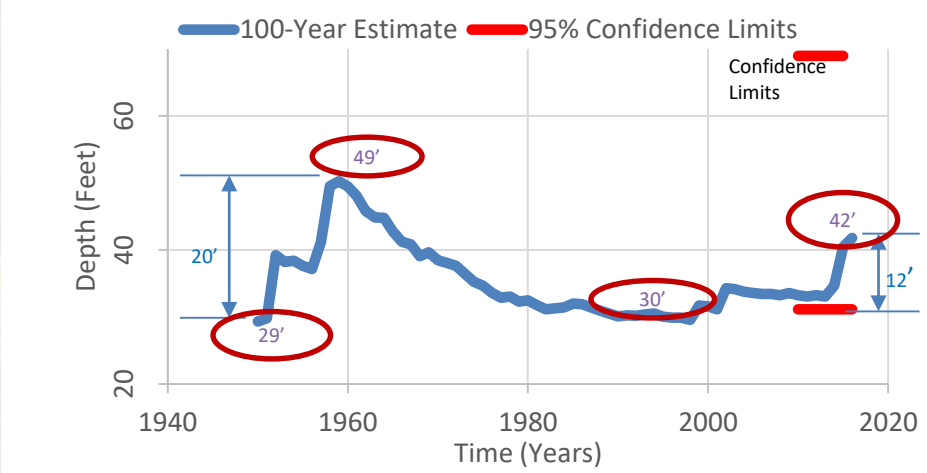
Uncertainty In Determination of 100 Year BFE

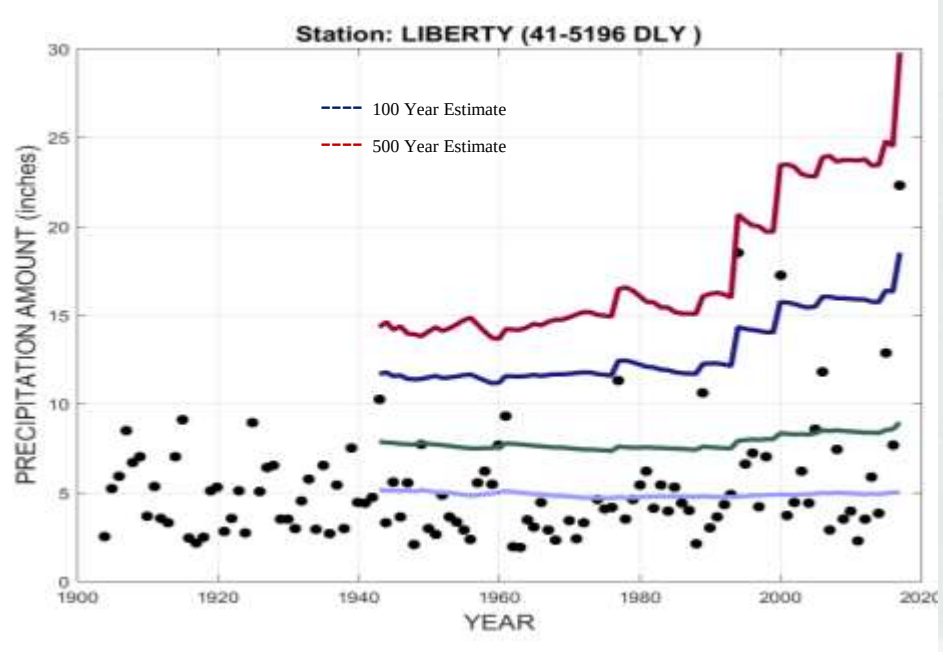
- Many techniques to estimate flood and rainfall frequencies rely on observations
- Need record length 3-4 times estimated return interval
- Short Observation Periods - On average TX has 50 years of stream record and 70 years of precipitation records
- Significant variability and/or non-stationarity observed in flood flow and rainfall frequency estimates



Trinity River at Rosser

Guadalupe River at Victoria





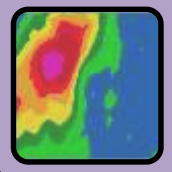
Interagency Flood Risk Management (InFRM)

- Established 2014
- Integrated Water Resources Science and Services (IWRSS) program
- Regional (FEMA Region 6)/Statewide/Basin-wide approaches & support
- Supports common missions
- Collaboration
- Leveraging resources and information
- Limit duplication of effort
- www.InFRM.US

InFRM Academic Council

BUILDING STRONG®

Components of Flood Impact Determinations



Meteorology
- How much rain

Watershed Hydrology
- How much runoff

River Hydraulics
- How deep will the water get

Consequences
- Critical infrastructure
  - Homes, Businesses, Hospitals

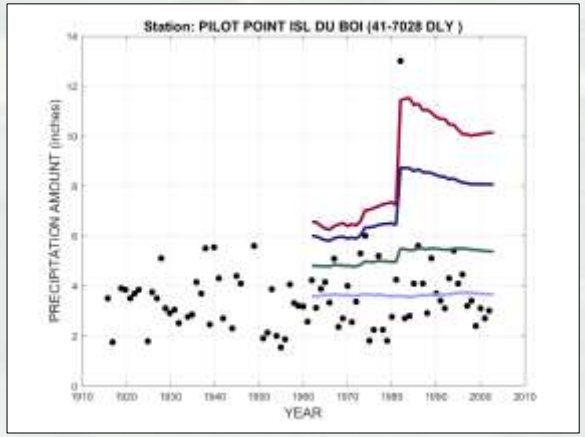
Emergency Response/Recovery	Emergency Preparedness	Infrastructure Planning
Observed & Future Rainfall	Historical Events W/in Region	Design Standard “100yr Rainfall”
Real-time Runoff	What-if Runoff Scenarios	100-year Runoff
Real-time Inundations	What-if Inundations	100-year Inundations
Real-time Impacts	Preparedness Impacts	Planning Infrastructure

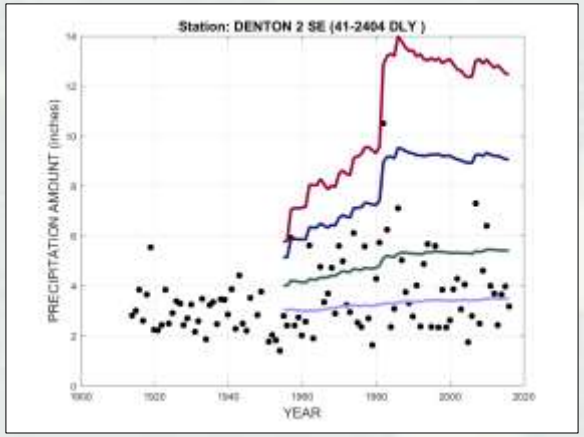
NOAA Atlas 14, Precipitation Frequency Estimates (Planning and Mitigation)

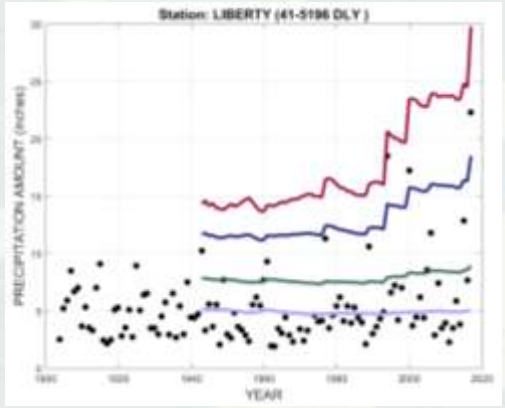
InFRM
INTERAGENCY FLOOD RISK MANAGEMENT

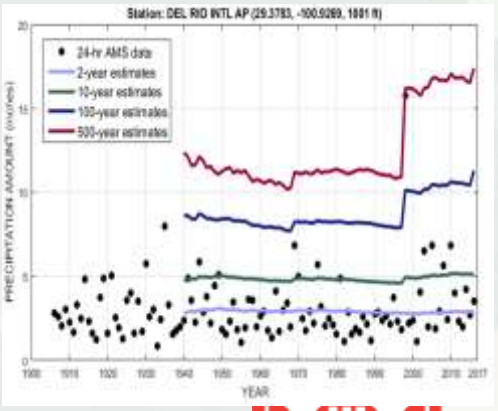
InFRM – NOAA Atlas 14, Are We Done?

- Should you be concerned about?
  - ► Climate variability, extreme weather, drought and climate change?
  - ► How will we manage these phenomena?
- Do we understand what is happening with the weather and climate change?
- Do we need additional studies? ($3 - $4 M)
  - ► Other methods to estimate precipitation frequency (check)
  - ► Trend analysis
  - ► Storm studies
- Trend and storm studies underway (NOAA/USACE)
- Responsibility?
- Cost?



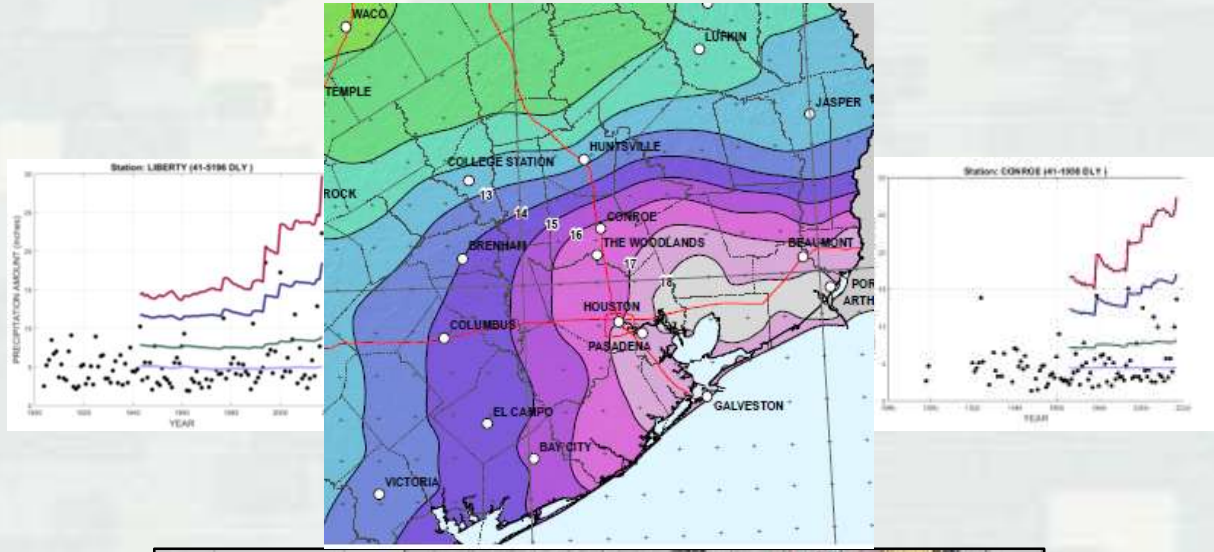






Changes in weather and climate

- USACE policy – USACE will adapt projects and operations to climate change
- NOAA Atlas 14 => 30% change in precipitation
- This translates directly to an increase in flood risk, e.g. 500-yr is now 100-yr
- Climate change, what do we know?
- Water supply
  - Petroleum production H2O dependent
  - 30%-50% of nations needs



STRONG®

Watershed Hydrology Assessments
What is the 100-Year Flow (Planning and Mitigation)

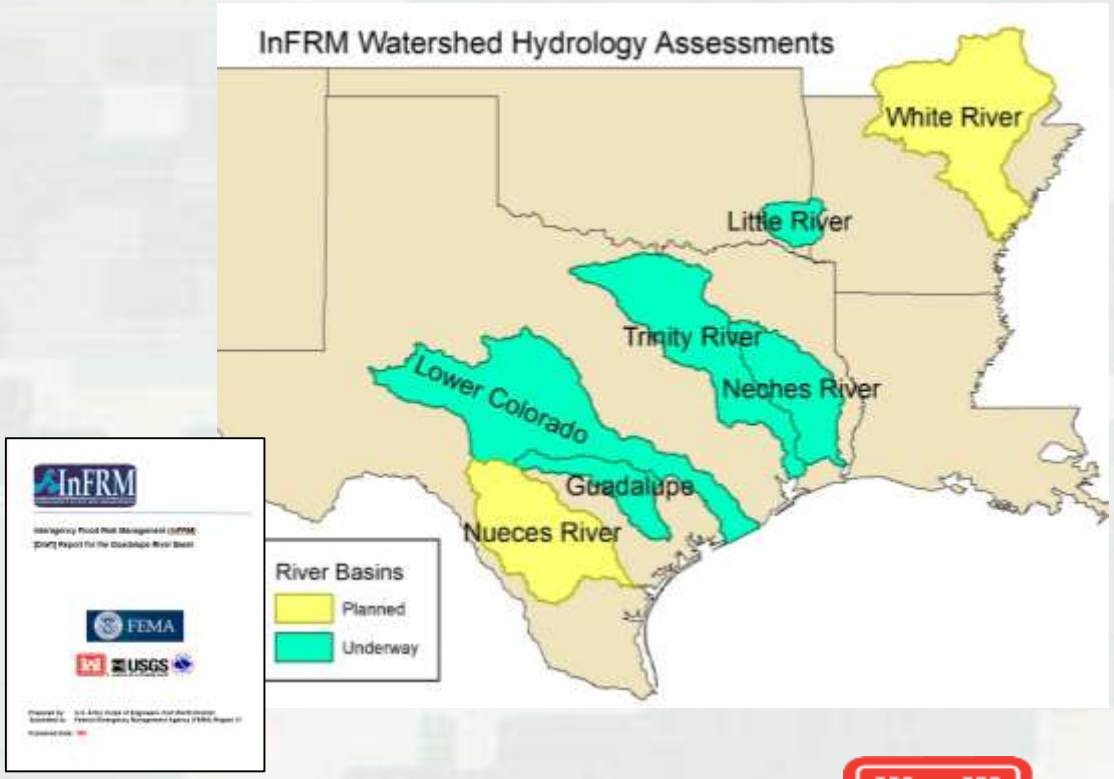
INTERAGENCY FLOOD RISK MANAGEMENT

InFRM Watershed Hydrology Assessments

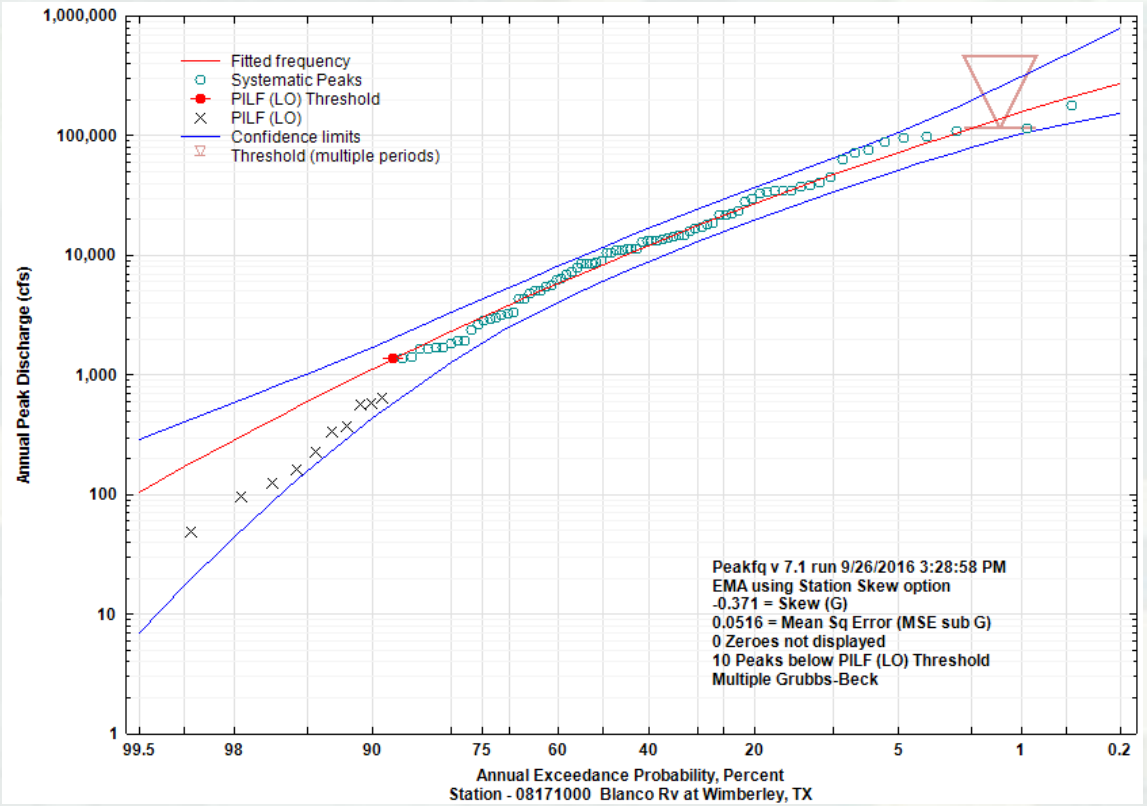
sponsored by FEMA Region 6

- Watershed level vs. community level
- Current Basins
  - Guadalupe
  - Trinity
  - Neches
  - Colorado
- Provides
  - Frequency Flows for Design & NFIP 2-yr, 5-yr, 10-r, 25-yr, 50-yr, 100-yr, 250-yr, 500-yr
  - Existing, future and climate change conditions
- Benefits
  - FEMA NFIP
  - Supports all infrastructure groups
  - Independent non-political science based result using multiple methods

What is the 100-year flood?

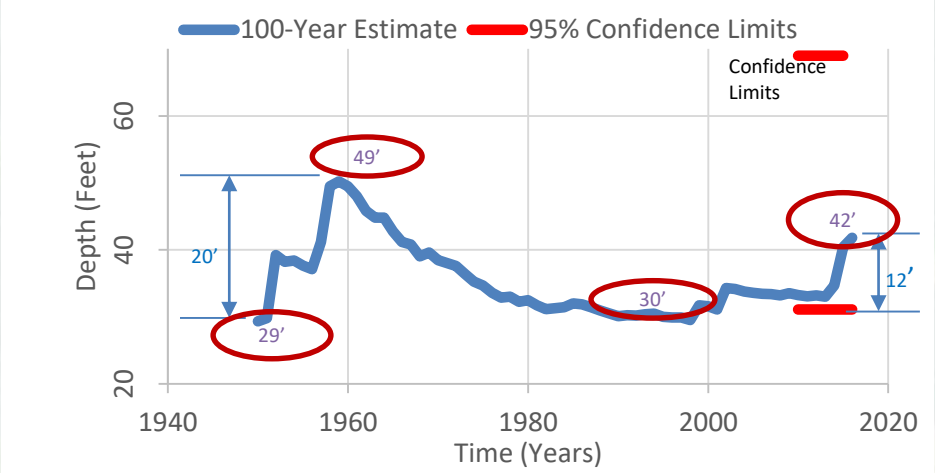


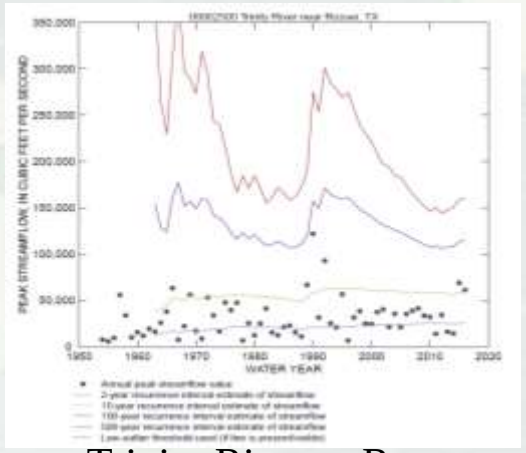
Flood Flow Frequency Curve, Blanco River at Wimberley, TX



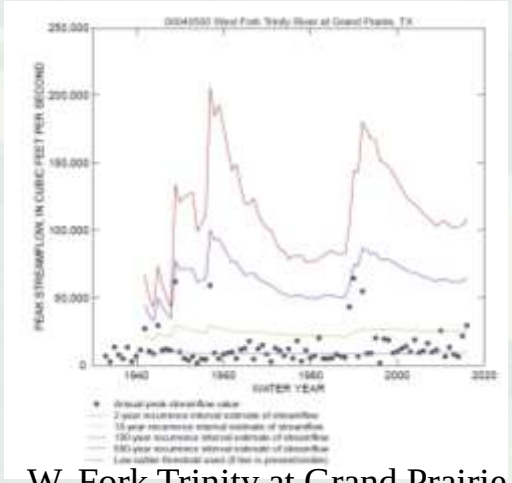
InFRM – Why WHA's, Non-Stationary Trends In Flood Flow Frequency Estimates, Guadalupe River, TX

- Additional non-stationarities Guadalupe River system

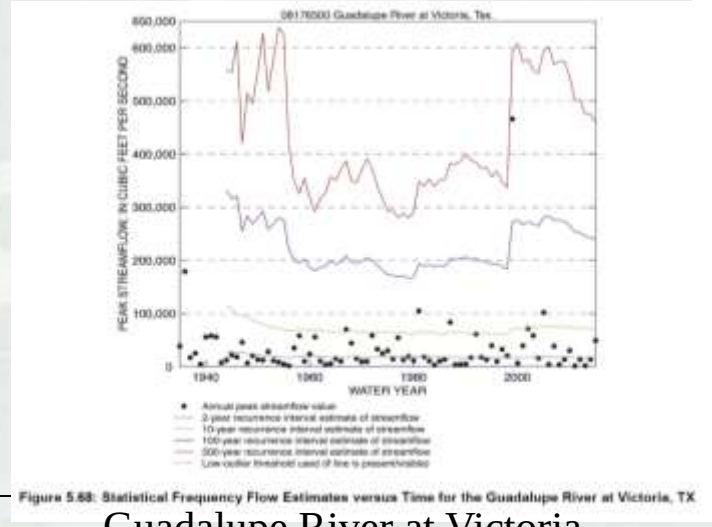




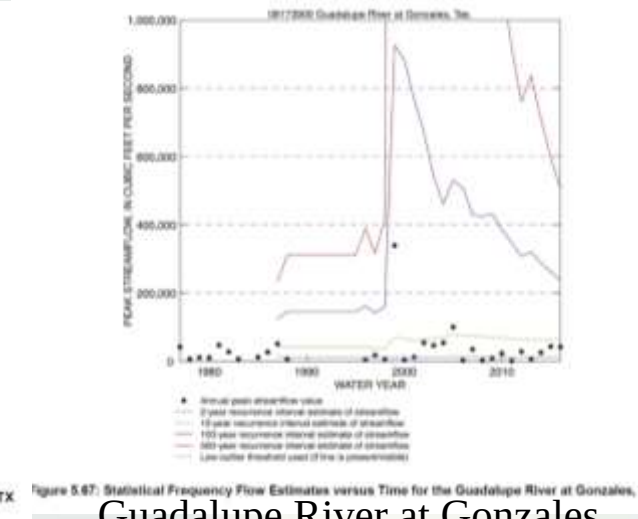
Trinity River at Rosser



W. Fork Trinity at Grand Prairie

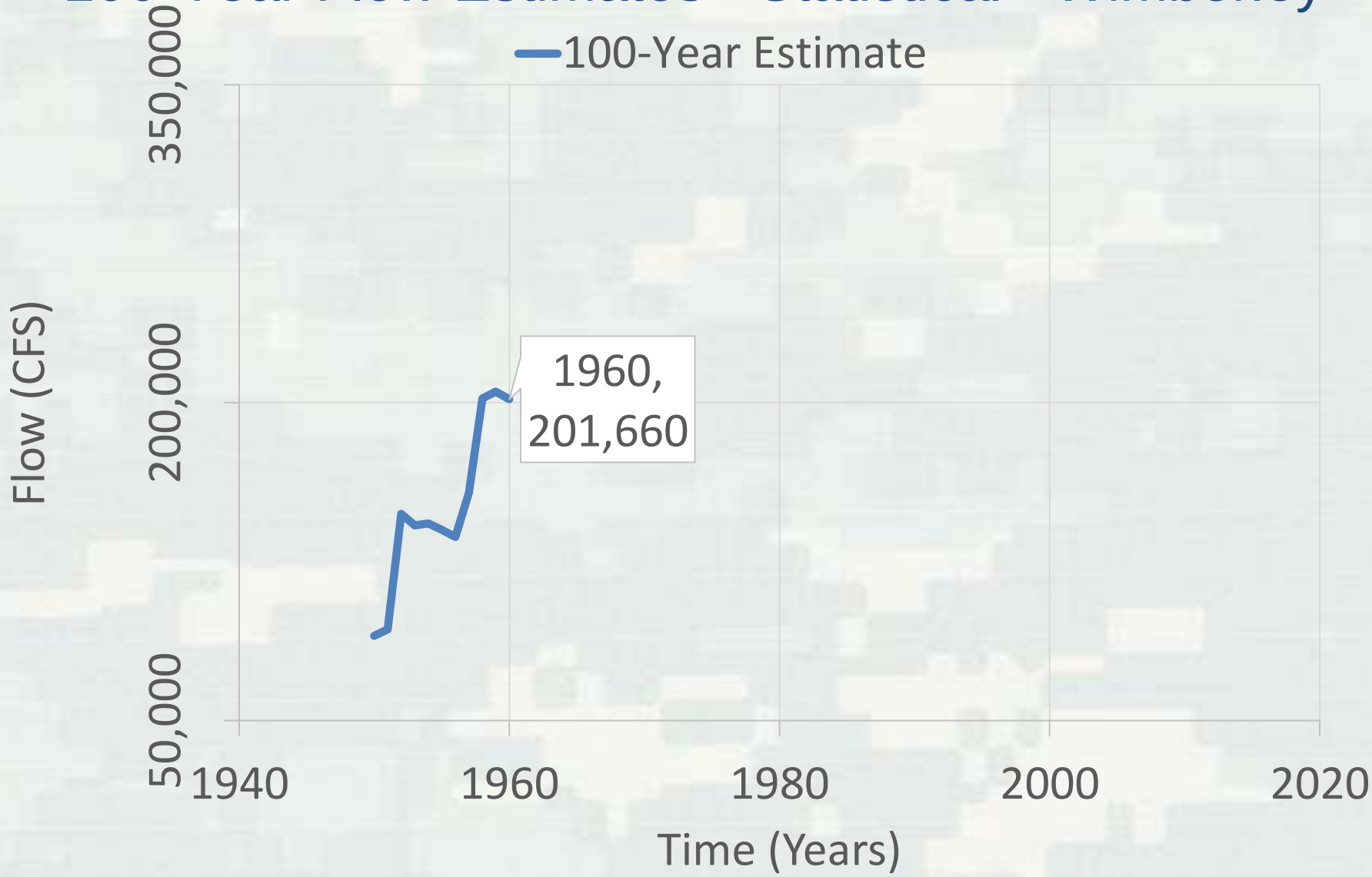


Guadalupe River at Victoria

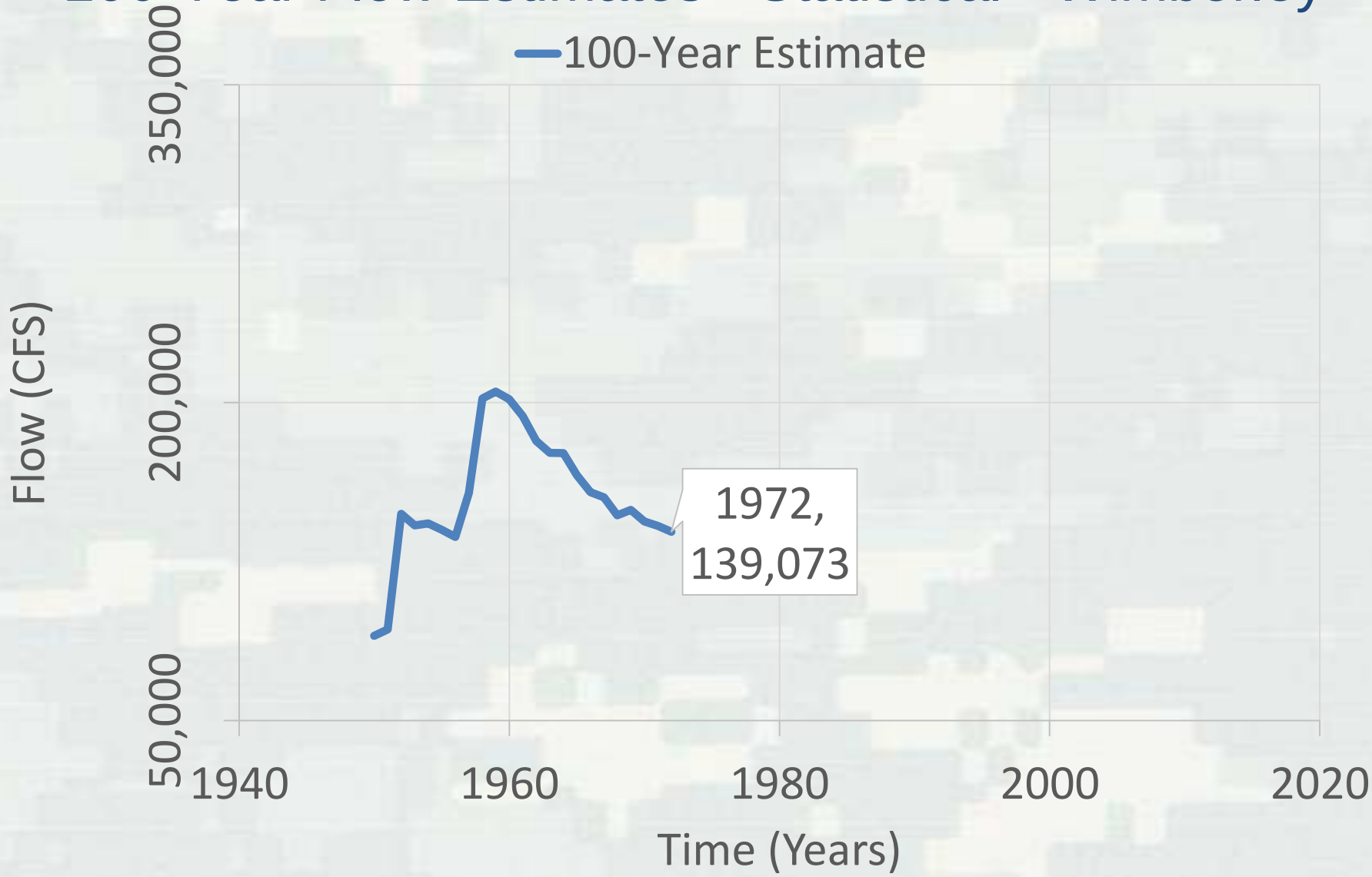


Guadalupe River at Gonzales

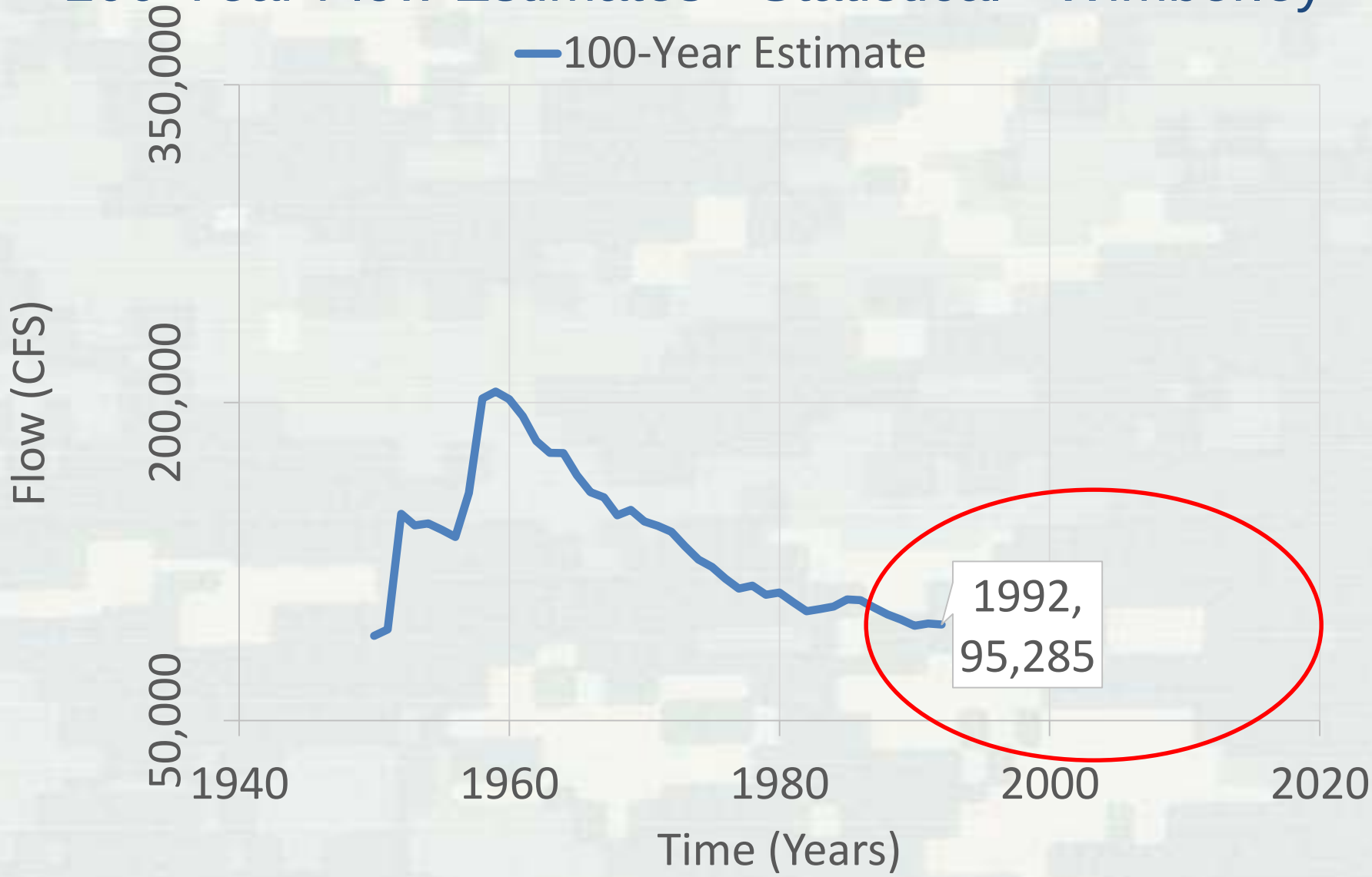
100-Year Flow Estimates - Statistical - Wimberley



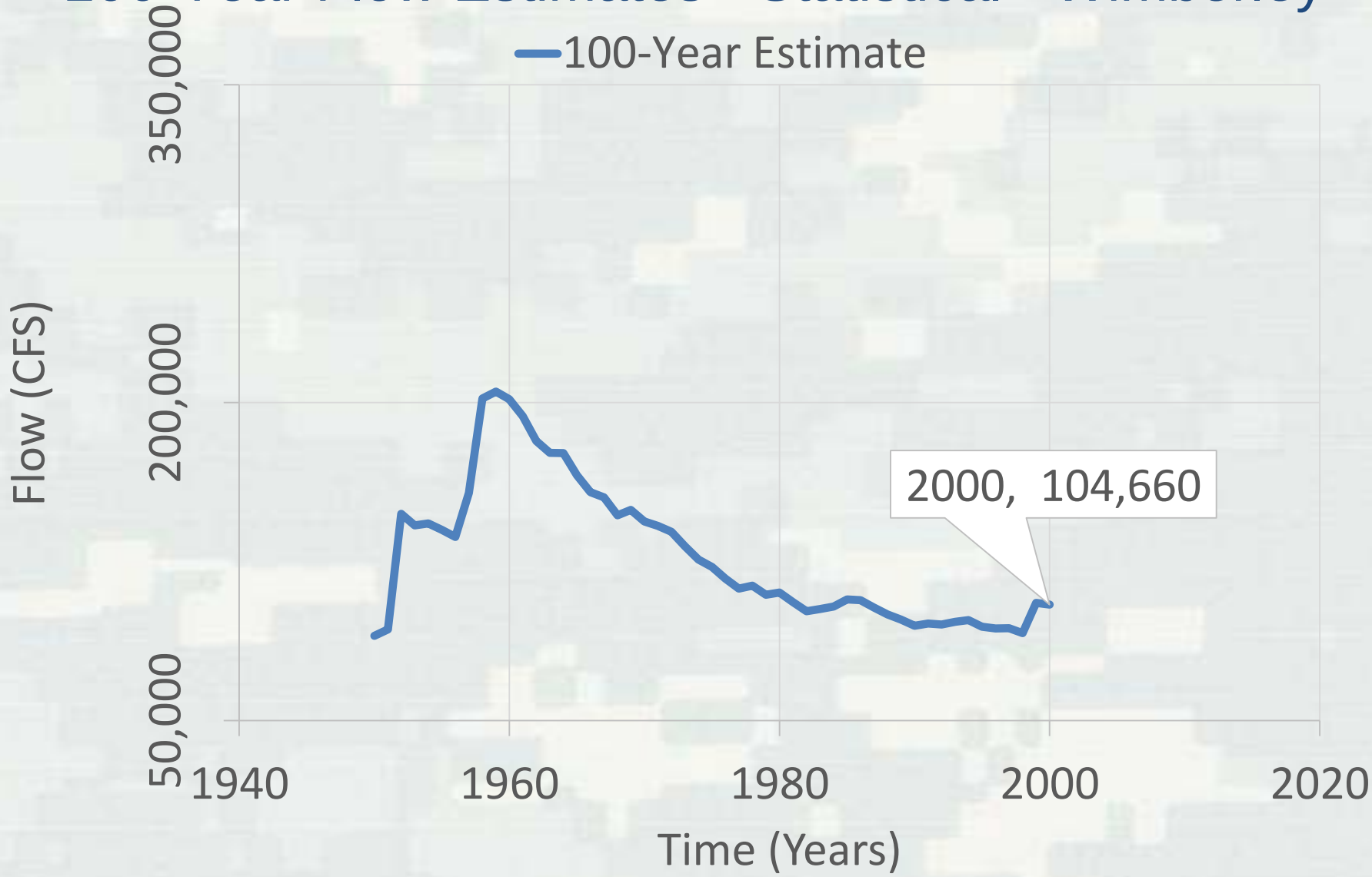
100-Year Flow Estimates - Statistical - Wimberley



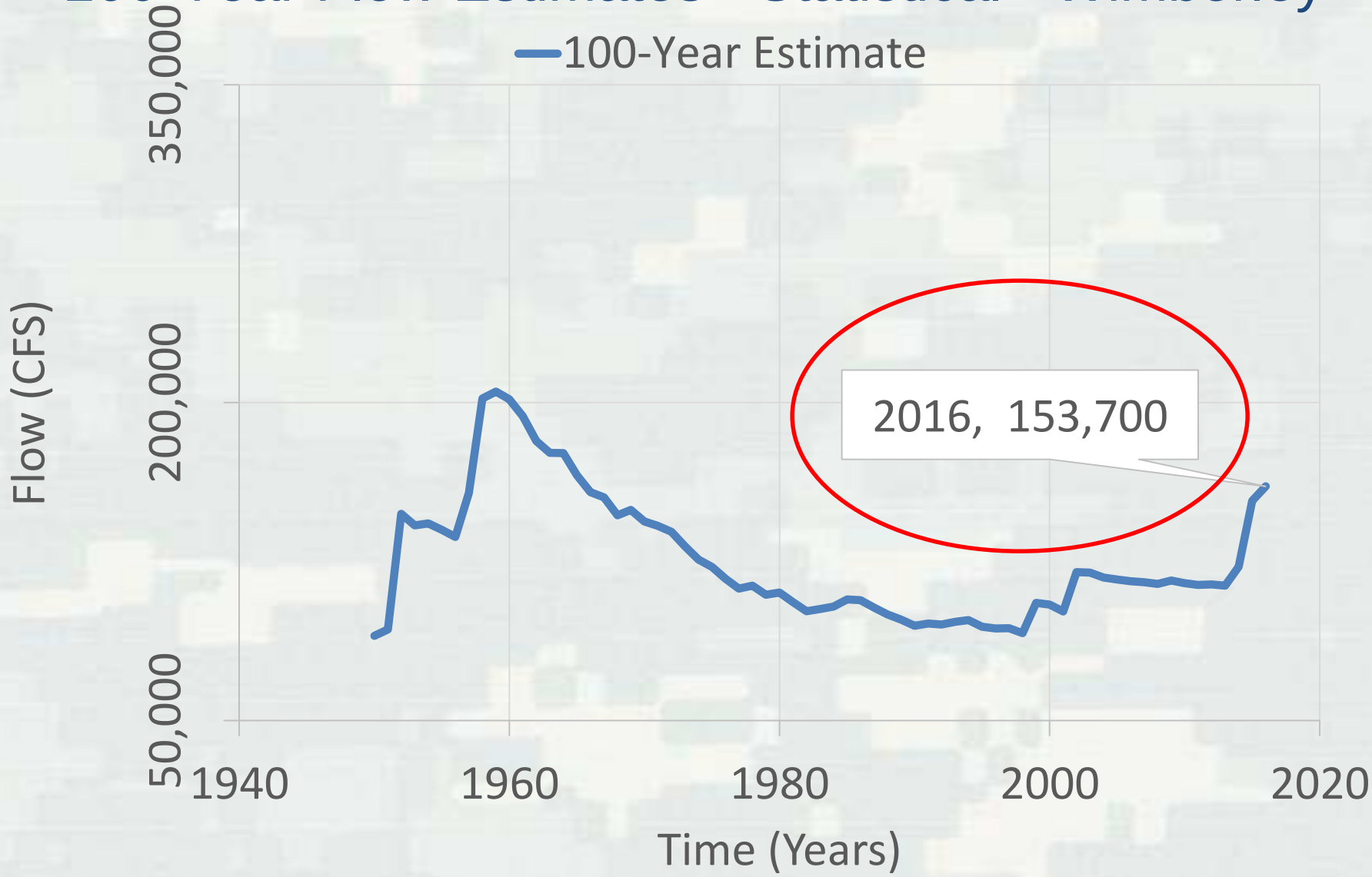
100-Year Flow Estimates - Statistical - Wimberley



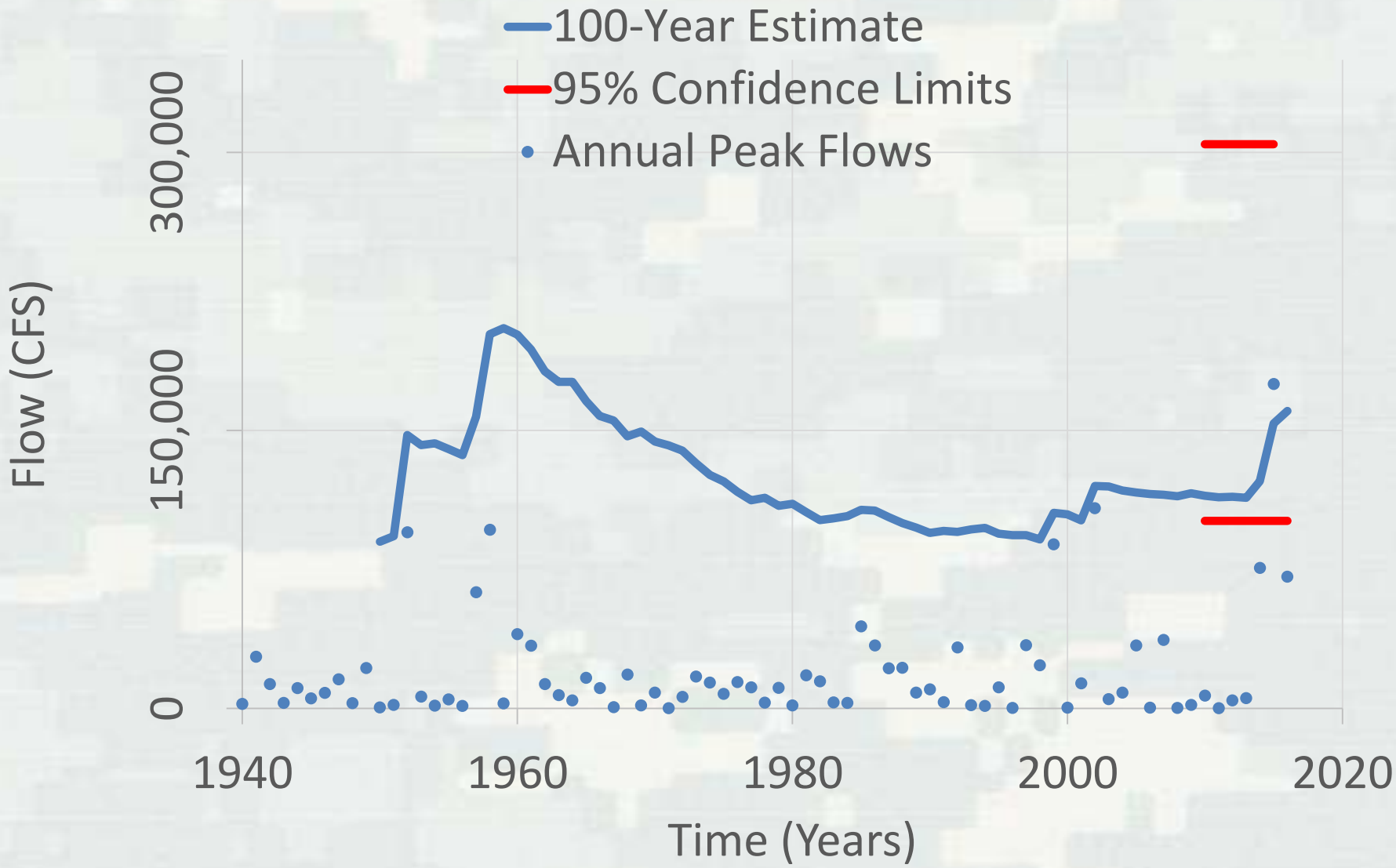
100-Year Flow Estimates - Statistical - Wimberley



100-Year Flow Estimates - Statistical - Wimberley

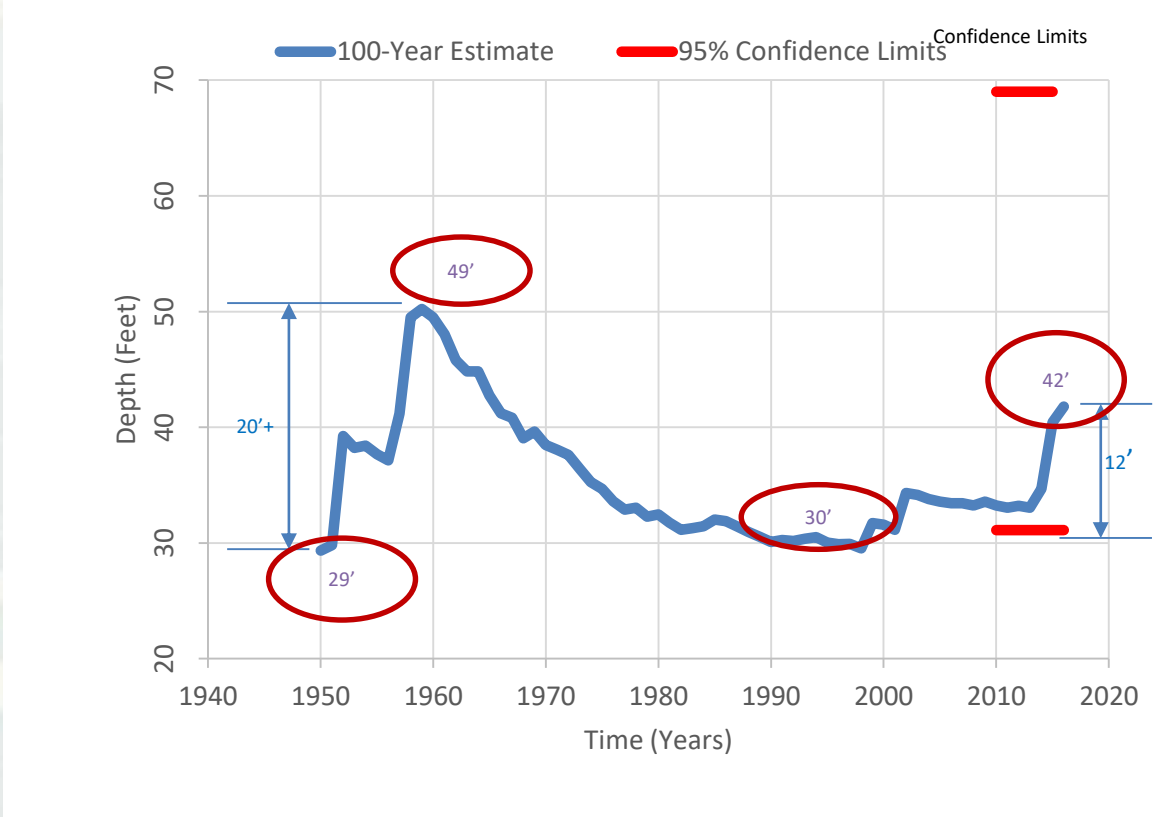


100-Year Flow Estimates - Statistical - Wimberley



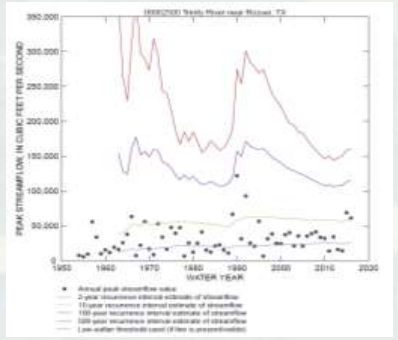
Limitations and Uncertainty Associated with Statistical Hydrology

- Average record length for TX is around 60 years
- Supports estimation of a 20-yr return interval
- Variation in stages at Wimberley is 20’
- Need 300-400 years of record to adequately estimate the 100-yr using this technique
- Should not be used alone
- Highly impacted by development and regulation (dams)

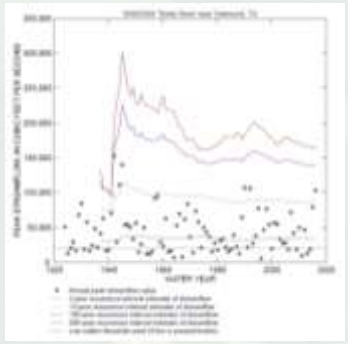


InFRM – Why WHA's, Non-Stationary Trends in Flood Flow Frequency Estimates, Trinity River, TX

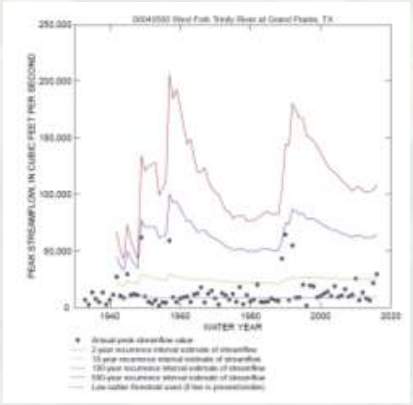
- Additional non-stationarities Trinity River system



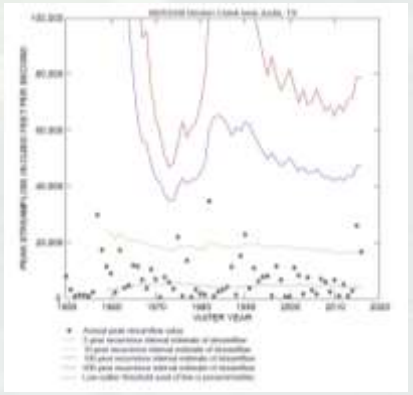
Trinity River at Rosser



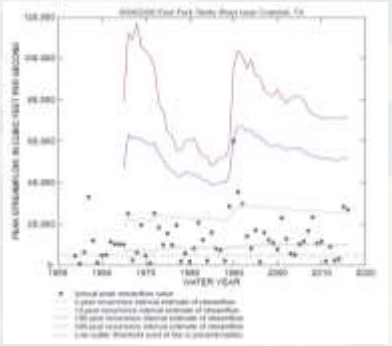
Trinity River at Oakwood



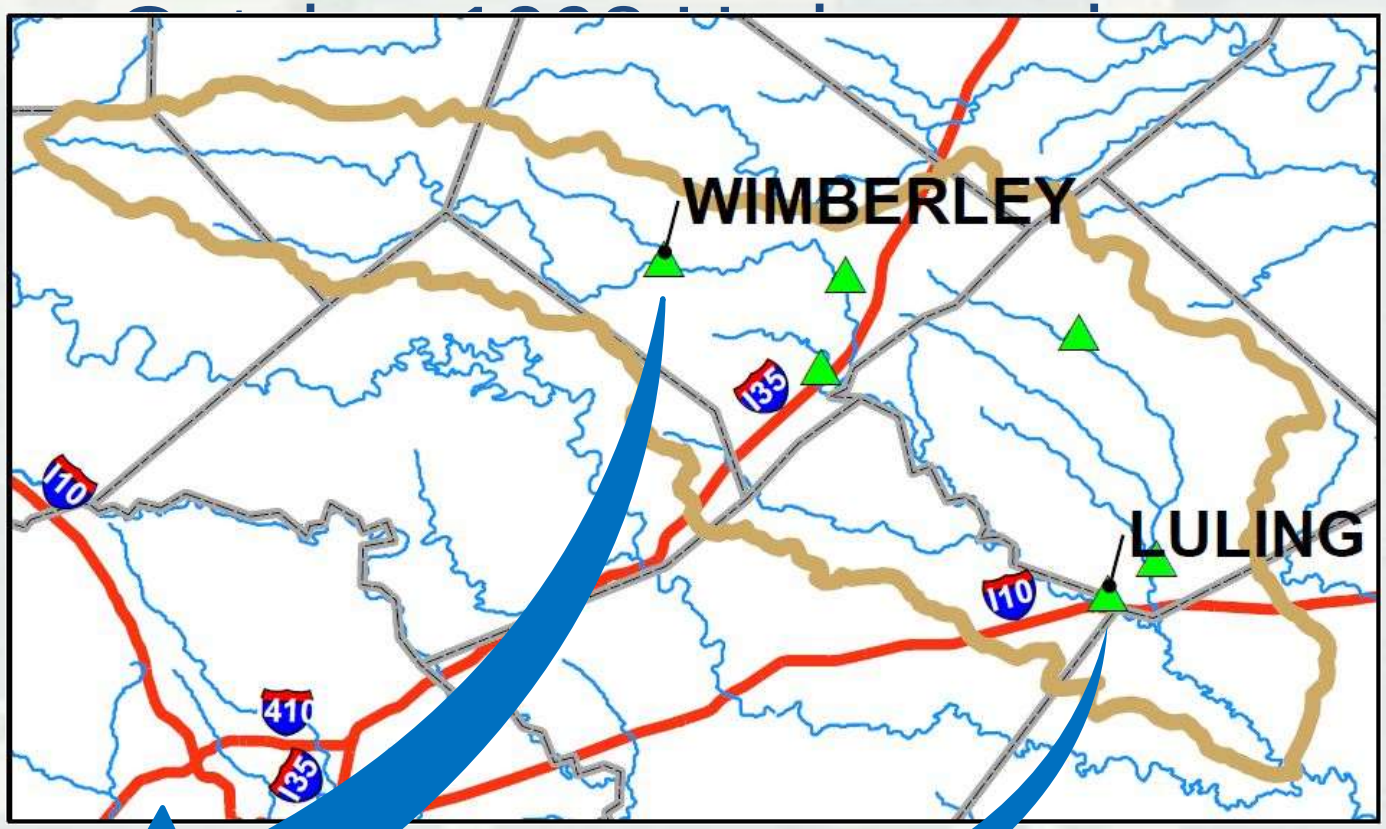
W. Fork Trinity at Grand Prairie

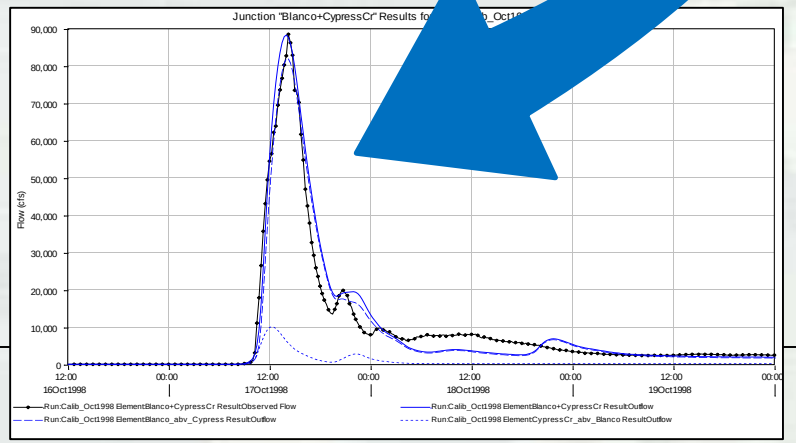


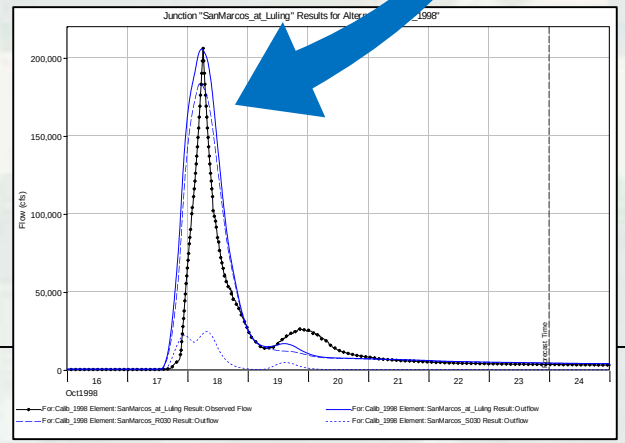
Denton Creek at Justin

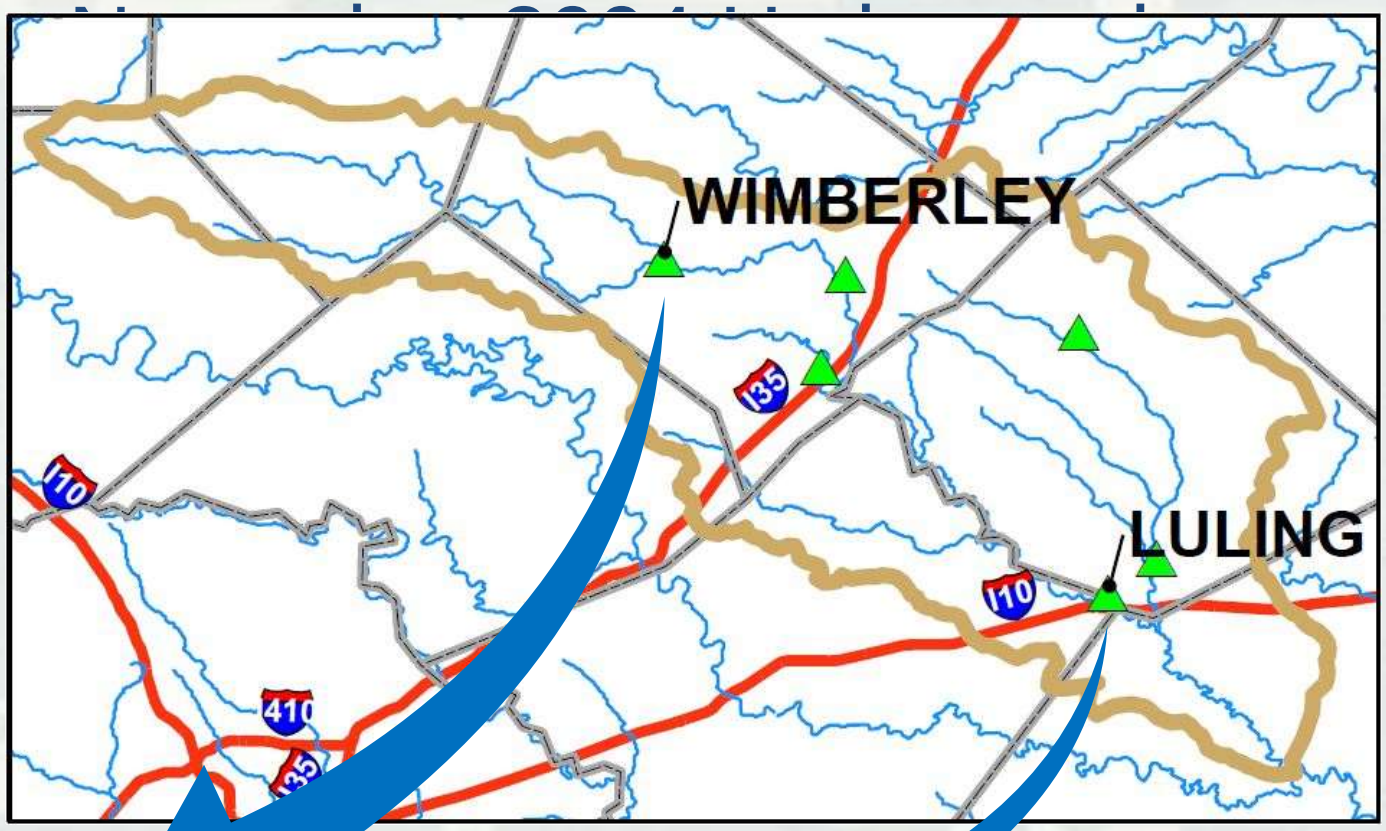


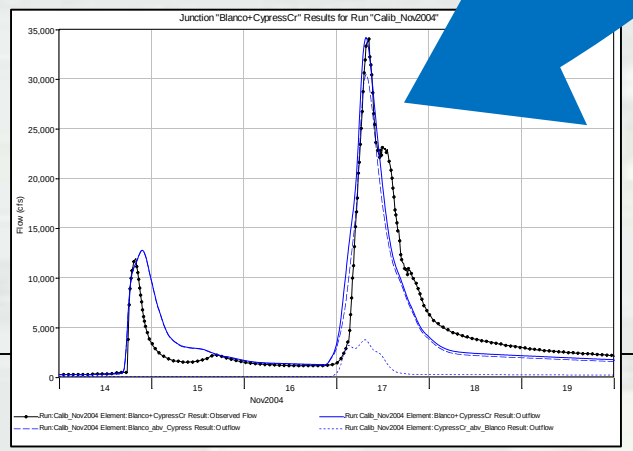
E. Fork Trinity River at Crandall

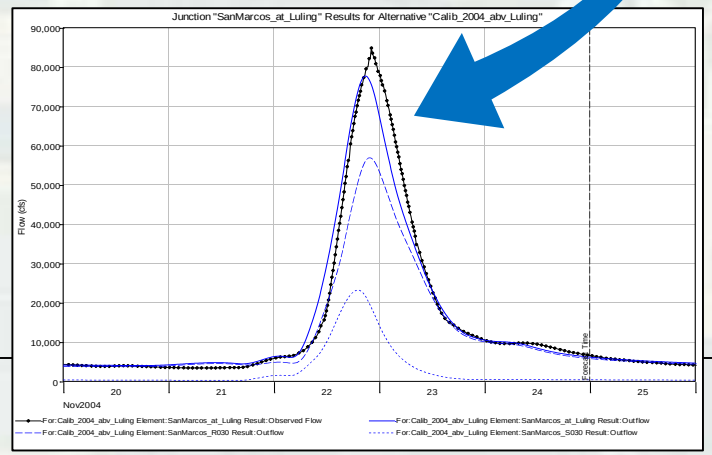

WIMBERLEY
LULING
I35
I10
I10
410
I35

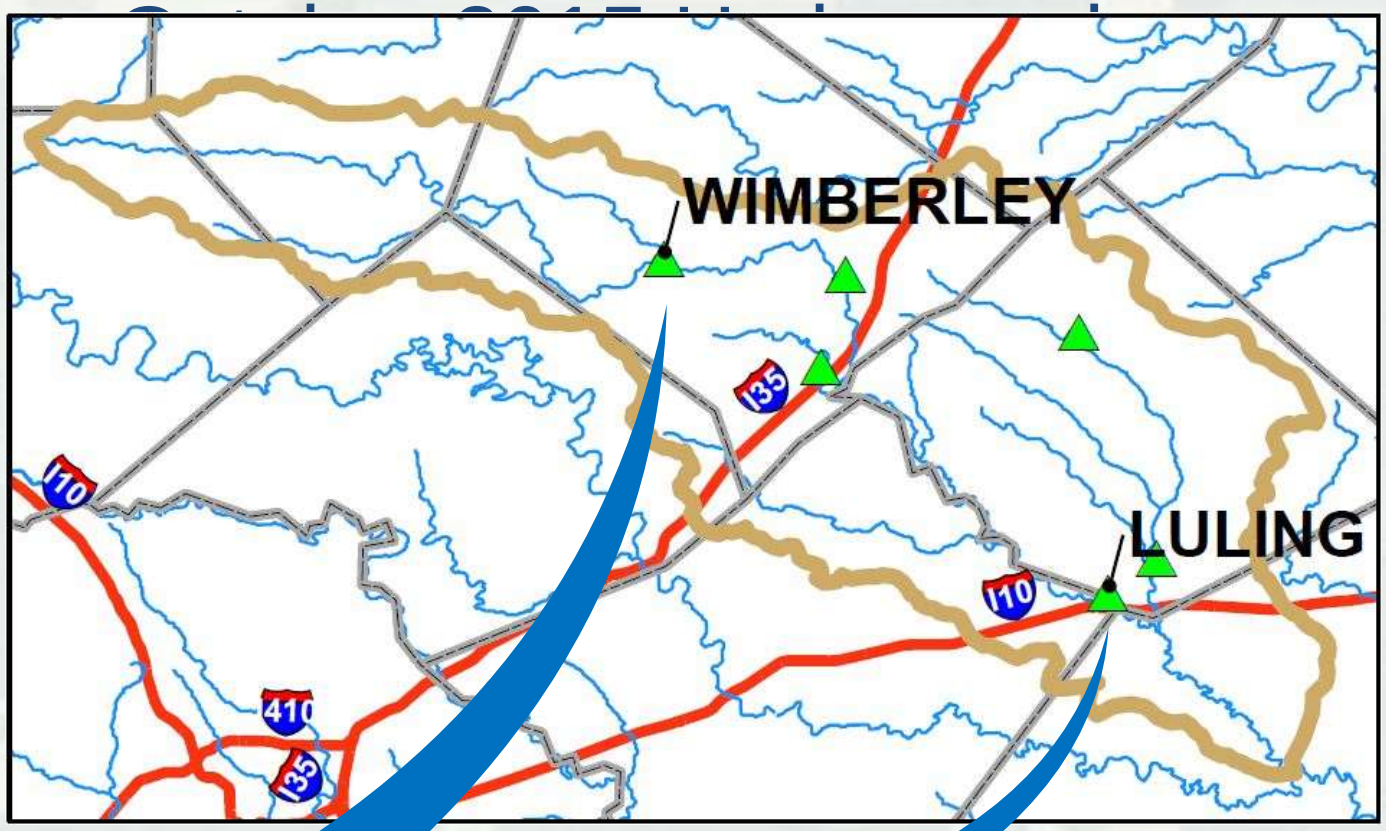

Junction "Blanco+CypressCr" Results fo
Flow (cfs)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
12:00
16Oct1998
00:00
12:00
17Oct1998
00:00
12:00
18Oct1998
00:00
12:00
19Oct1998
00:00
Run:Calib_Oct1998 Element:Blanco+CypressCr Result:Observed Flow
Run:Calib_Oct1998 Element:Blanco+CypressCr Result:Outflow
Run:Calib_Oct1998 Element:Blanco_abv_Cypress Result:Outflow
Run:Calib_Oct1998 Element:CypressCr_abv_Blanco Result:Outflow

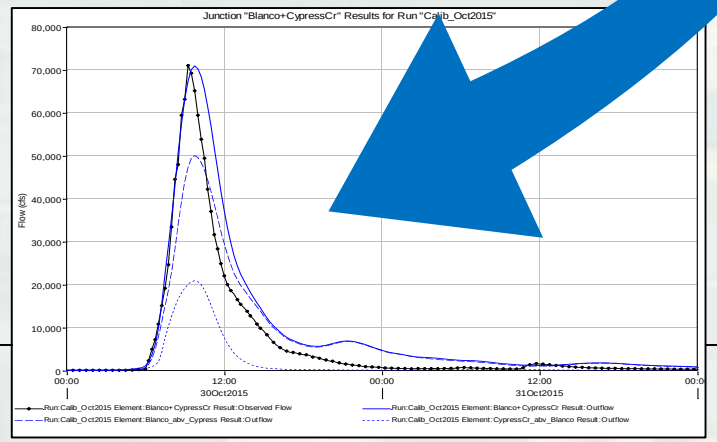

Junction "SanMarcos_at_Luling" Results for Alte
Flow (cfs)
200,000
150,000
100,000
50,000
0
16
17
18
19
20
21
22
23
24
Oct1998
For:Calib_1998 Element:SanMarcos_at_Luling Result:Observed Flow
For:Calib_1998 Element:SanMarcos_at_Luling Result:Outflow
For:Calib_1998 Element:SanMarcos_R030 Result:Outflow
For:Calib_1998 Element:SanMarcos_S030 Result:Outflow

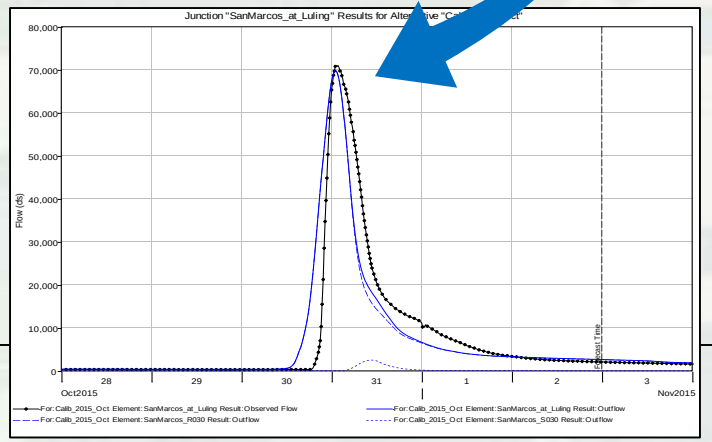

WIMBERLEY
LULING
I35
I10
I10
410
I35


Junction "Blanco+CypressCr" Results for Run "Calib_Nov2004"
Flow (cfs)
Nov2004
Run:Calib_Nov2004 Element:Blanco+CypressCr Result:Observed Flow
Run:Calib_Nov2004 Element:Blanco+CypressCr Result:Outflow
Run:Calib_Nov2004 Element:Blanco_abv_Cypress Result:Outflow
Run:Calib_Nov2004 Element:CypressCr_abv_Blanco Result:Outflow


Junction "SanMarcos_at_Luling" Results for Alternative "Calib_2004_abv_Luling"
Flow (cfs)
Nov2004
For:Calib_2004_abv_Luling Element:SanMarcos_at_Luling Result:Observed Flow
For:Calib_2004_abv_Luling Element:SanMarcos_at_Luling Result:Outflow
For:Calib_2004_abv_Luling Element:SanMarcos_R030 Result:Outflow
For:Calib_2004_abv_Luling Element:SanMarcos_S030 Result:Outflow

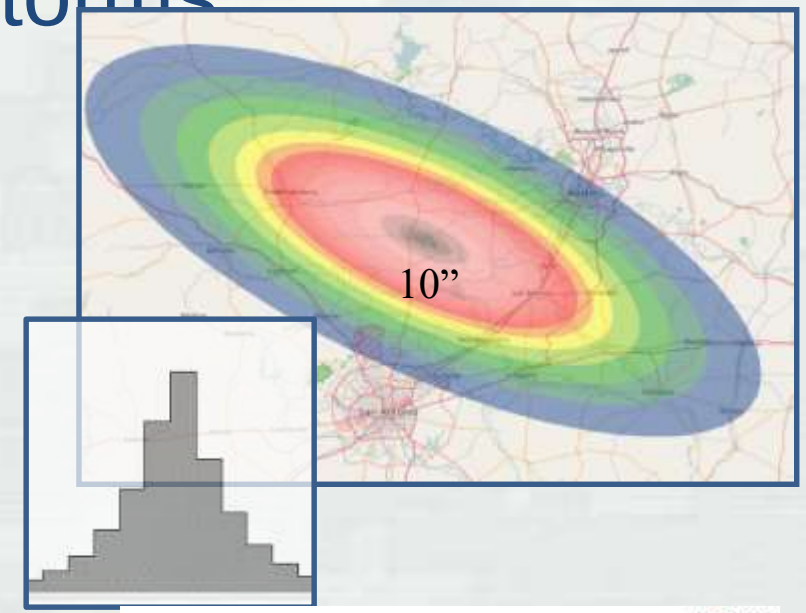

WIMBERLEY
LULING
I35
I10
I10
410
I35

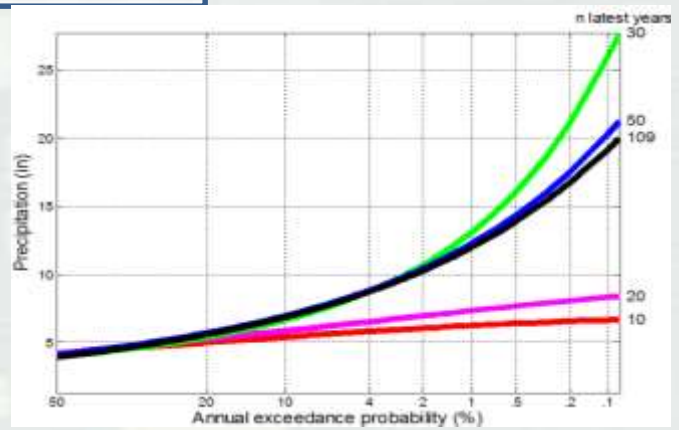

Junction "Blanco+CypressCr" Results for Run "Calib_Oct2015"
Flow (cfs)
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
00:00
12:00
30Oct2015
00:00
12:00
31Oct2015
00:0
Run:Calib_Oct2015 Element:Blanco+CypressCr Result:Observed Flow
Run:Calib_Oct2015 Element:Blanco+CypressCr Result:Outflow
Run:Calib_Oct2015 Element:Blanco_abv_Cypress Result:Outflow
Run:Calib_Oct2015 Element:CypressCr_abv_Blanco Result:Outflow


Junction "SanMarcos_at_Luling" Results for Alte
Flow (cfs)
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
28
29
30
31
1
2
3
Oct2015
Nov2015
Forecast Time
For:Calib_2015_Oct Element:SanMarcos_at_Luling Result:Observed Flow
For:Calib_2015_Oct Element:SanMarcos_at_Luling Result:Outflow
For:Calib_2015_Oct Element:SanMarcos_R030 Result:Outflow
For:Calib_2015_Oct Element:SanMarcos_S030 Result:Outflow

Design Storms

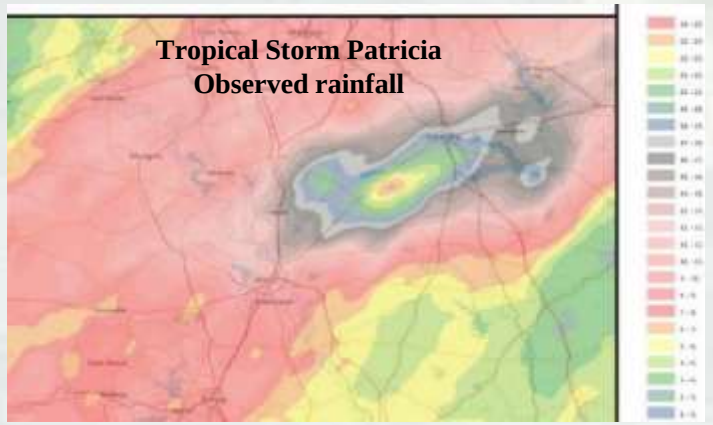
- Represents extreme events
- Reflects intense rainfalls
- Utilizes NOAA and Dr. Asquith precipitation frequency estimates
- Gage density much higher than stream network
- Less variability with increasing record length

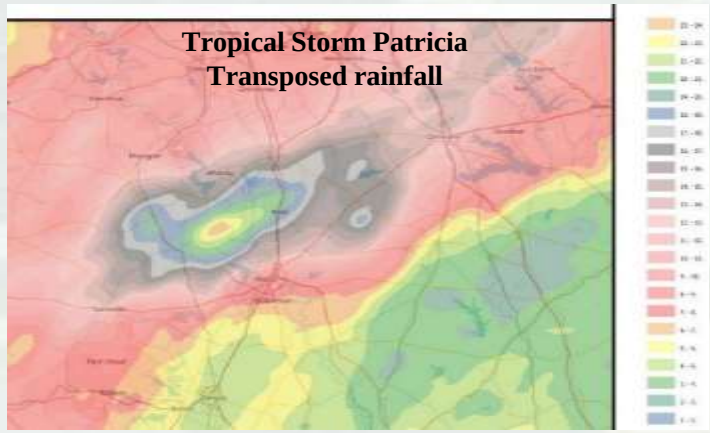


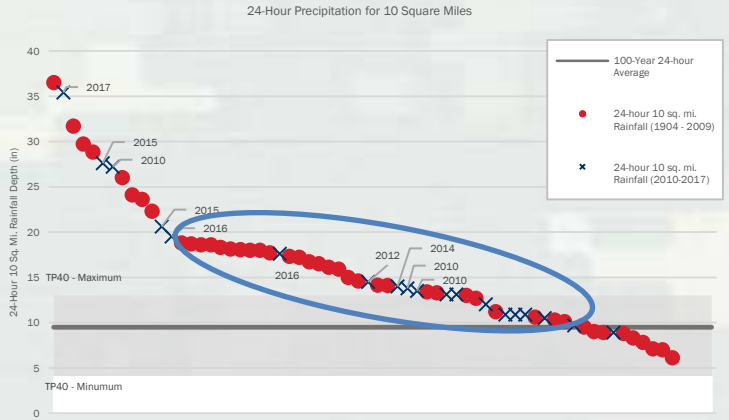


How?: Realistic Meteorological and Hydrologic Loading

- Existing conditions 100-yr
- Future conditions 100-yr
- Alternative meteorological and hydrologic loading
  - ►Leverage regional storm catalog
  - ►Storm transpositions using **HEC-MetVue**
- Realistic indication of flooding potential



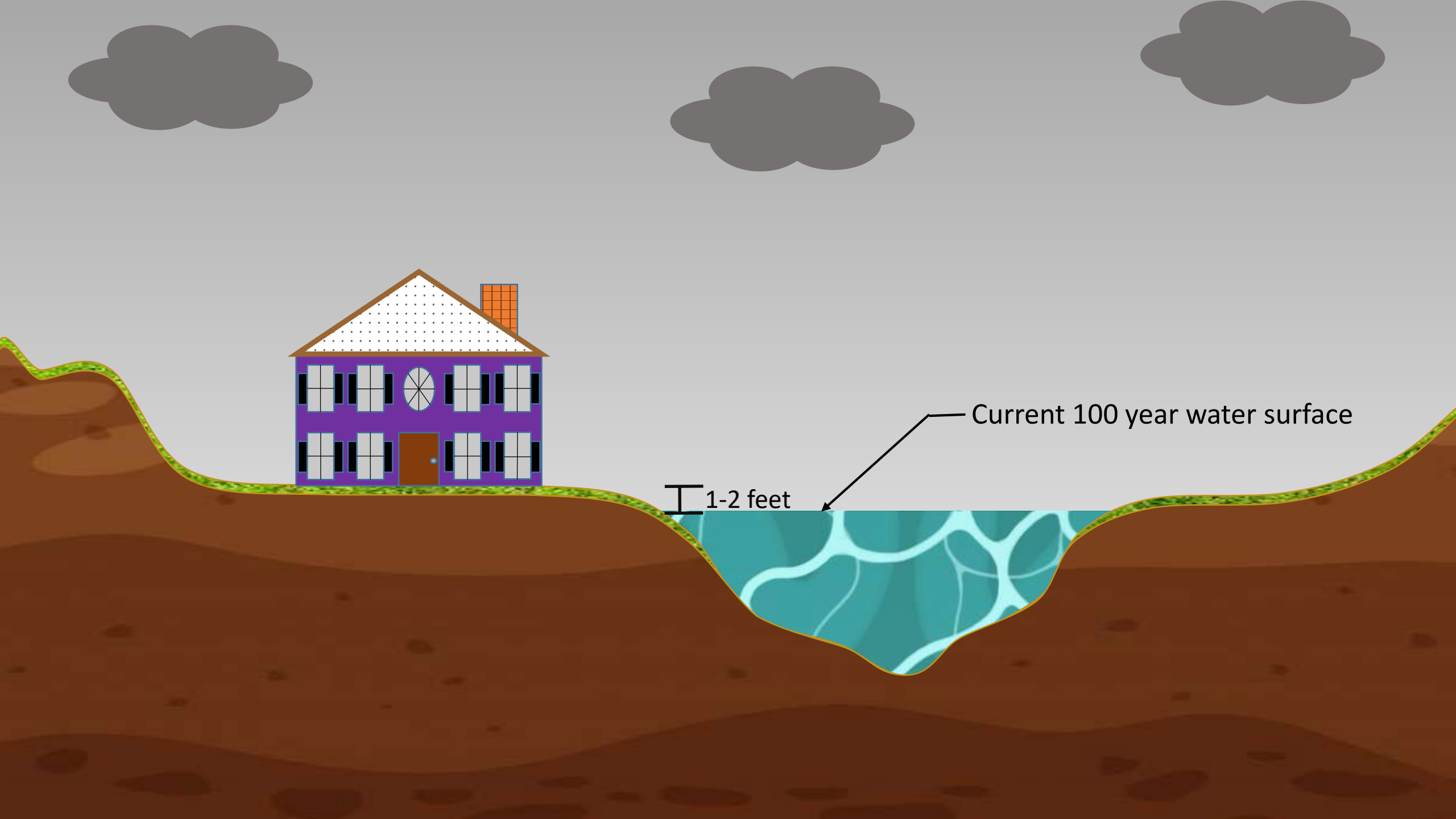




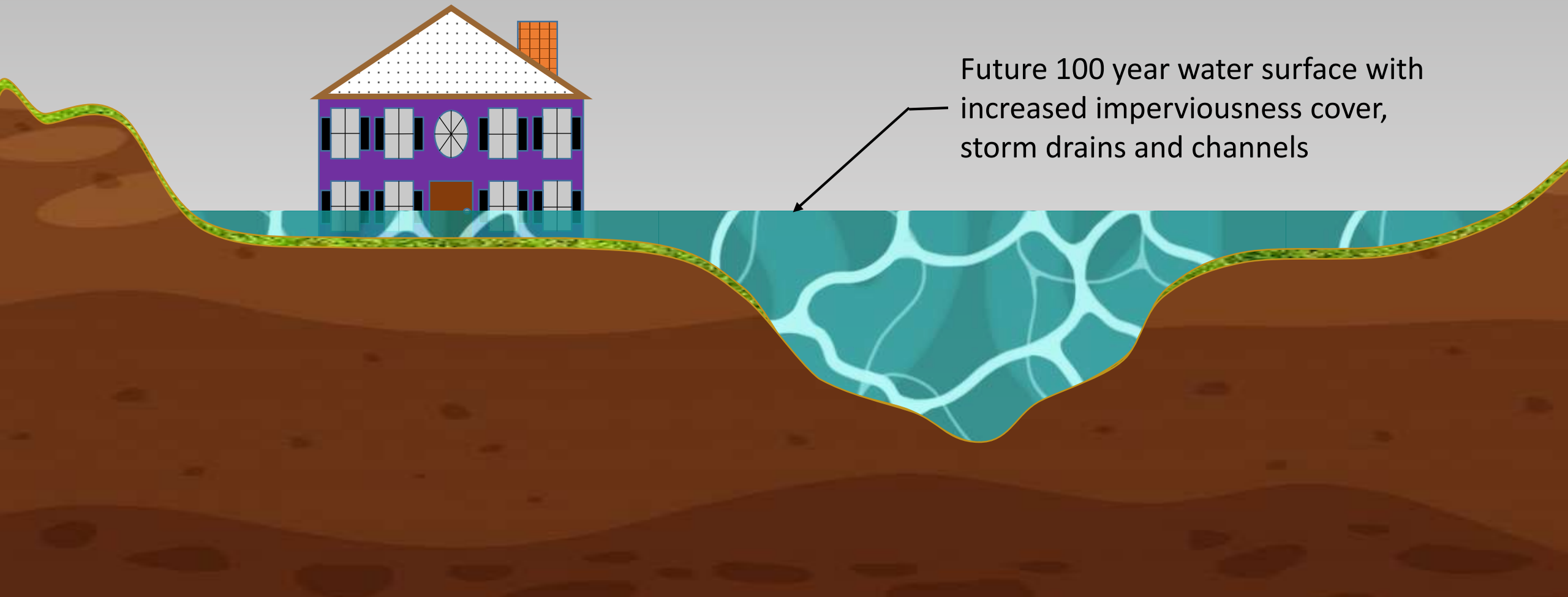
BUILDING STRONG®

- 1:100 probability changes for blocks of years
- > 1:4 chance of being flooded over a 30 year mortgage
- > 1:2 chance of flooding over life of the structure (80 years)

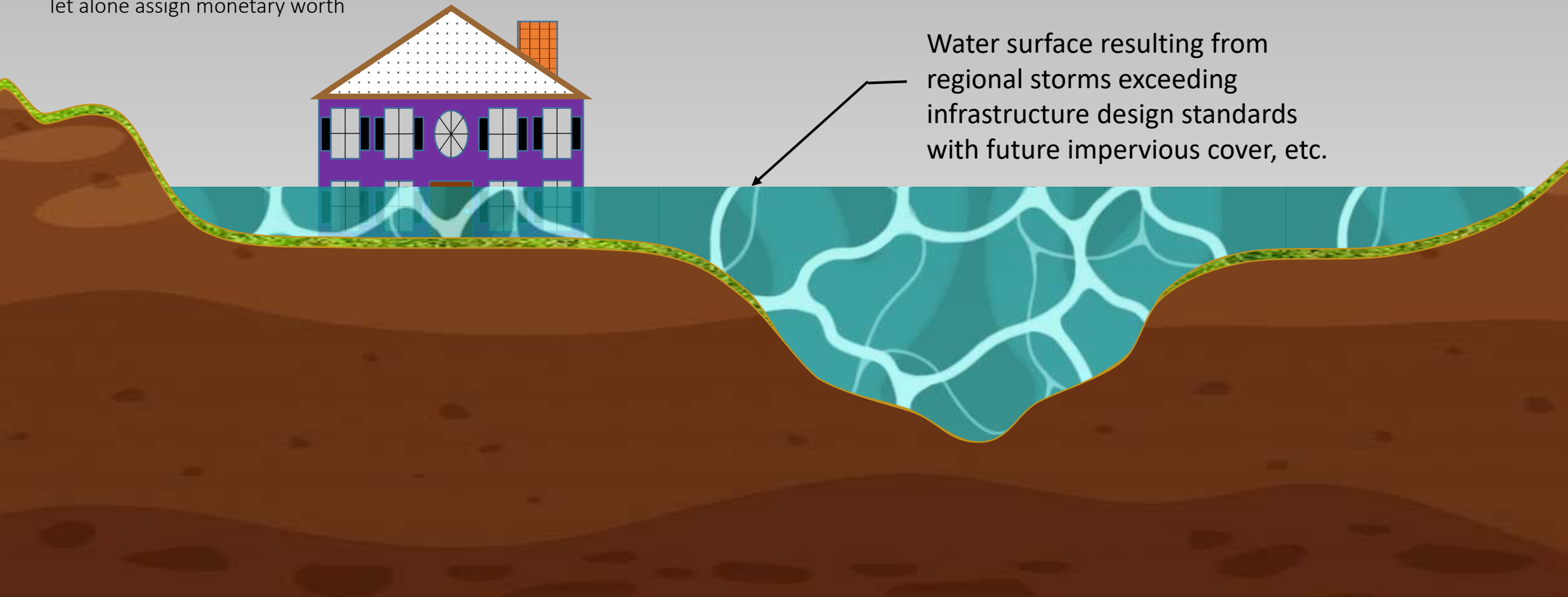
Current 100 year water surface


Current 100 year water surface
1-2 feet

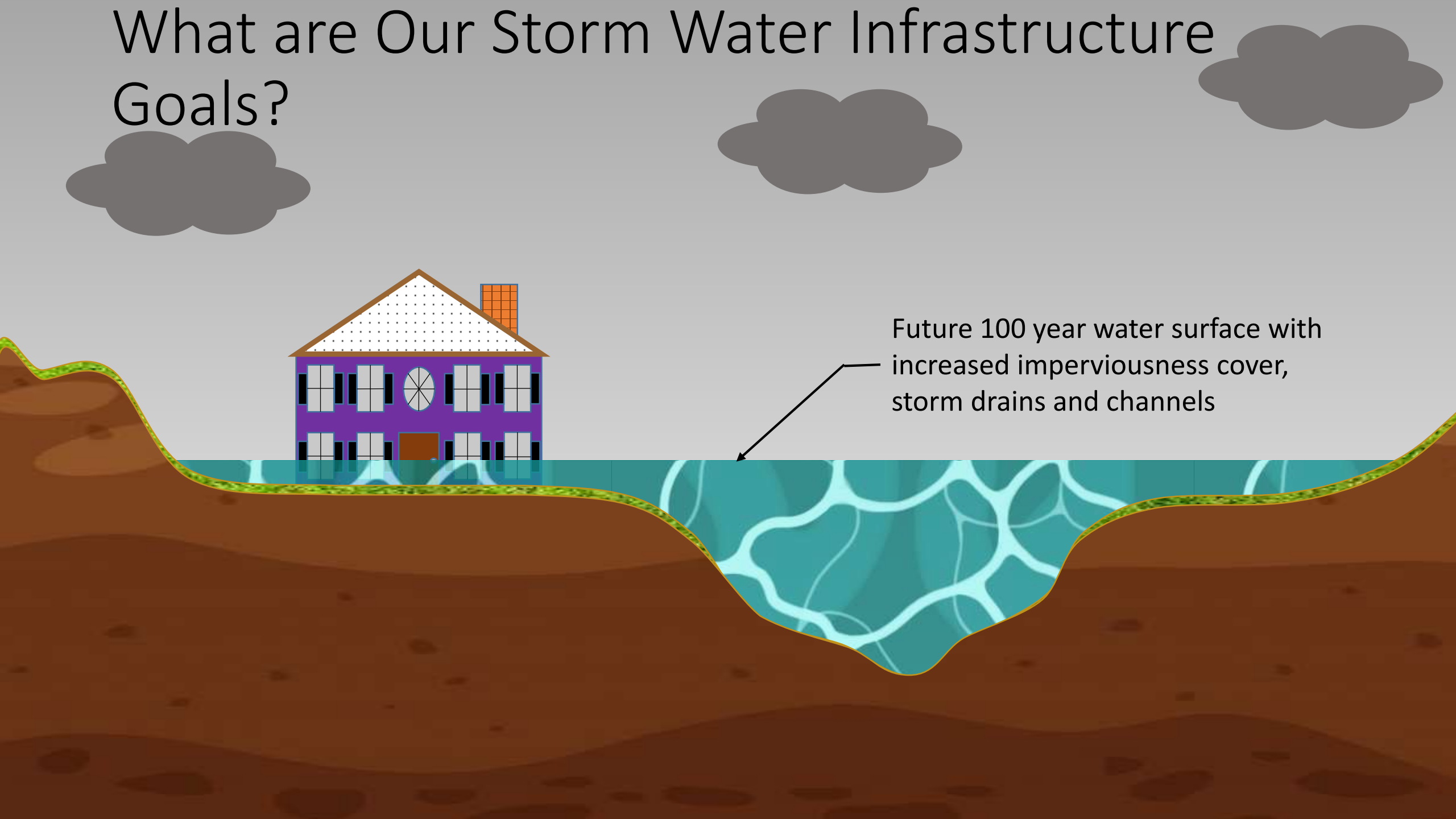
- Destroy property (homes, automobiles, belongings)
- Take lives
- Destroy Infrastructure, transportation, waste water, water, human services
- Disconnect people - friends, schools, work, and familiar places
- Ruin family photos and heirlooms
- Alter relationships



- Permanent harm to culture and way of life
- Impact the most socially and financially marginal people
- Long-term consequences to the health (mental) and collective well-being of those effected
- Loss of pets
- Destroy natural ecosystems that are integral parts of communities
- Disrupt populations in ways that are difficult to articulate, let alone assign monetary worth

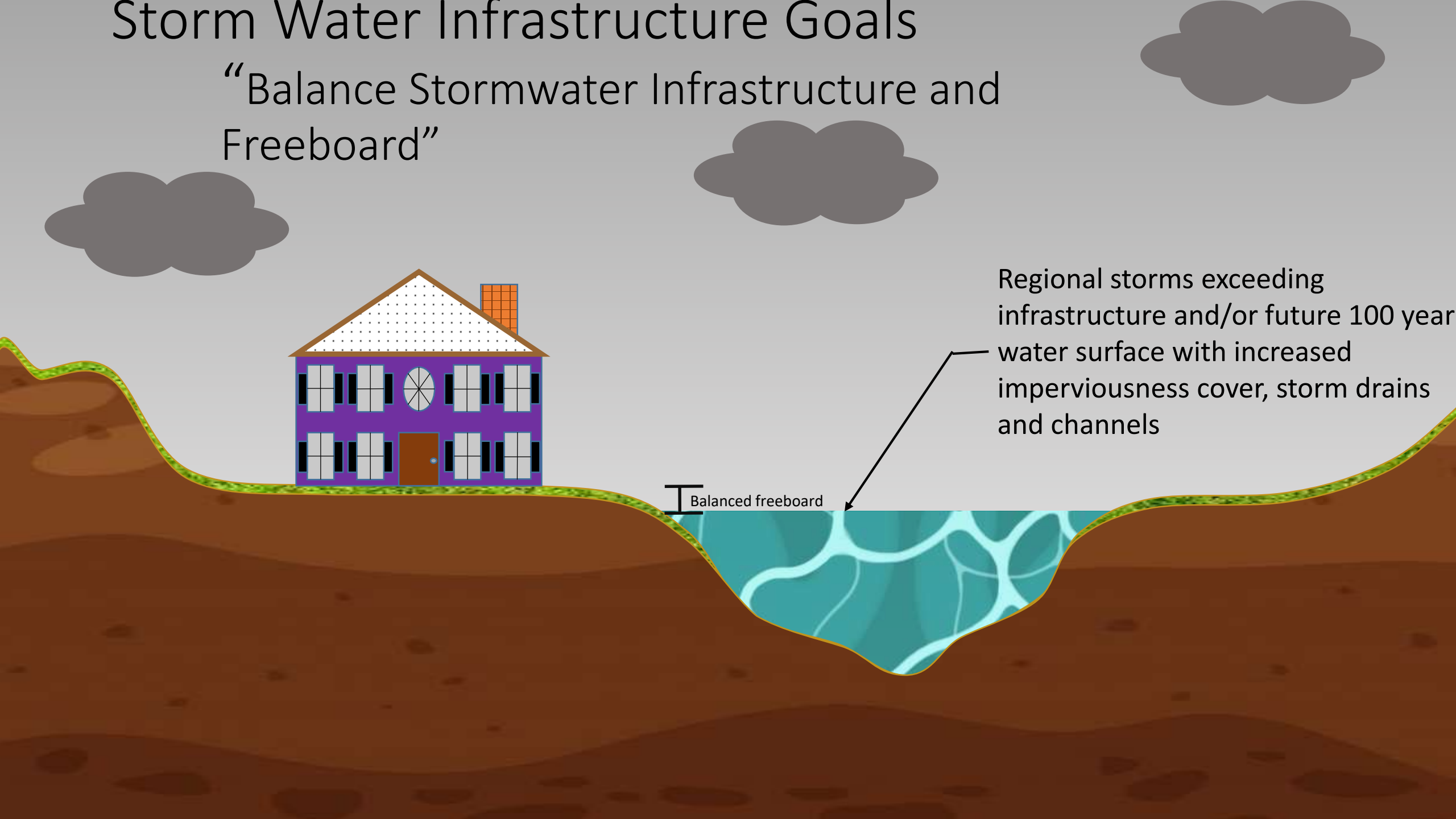


What are Our Storm Water Infrastructure Goals?



Storm Water Infrastructure Goals

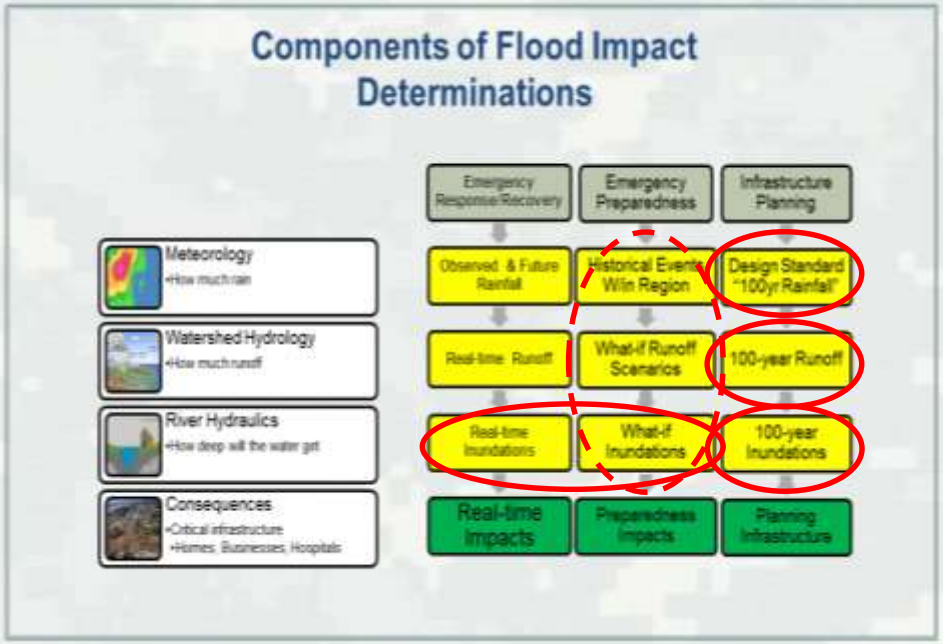
"Balance Stormwater Infrastructure and Freeboard"



Flood Risk Management Modeling

- Meteorology (what precipitation should we expect)
  - NOAA Atlas 14 (what is the 100-year rainfall)
  - WHA design storms
  - Regional USACE storm database (storm transpositions)
- Hydrology (how will the watersheds respond)
  - Watershed Hydrology Assessments (WHA) (what is the 100-year flow)
  - Detailed Mary's Creek study
  - CDC or Common Vision studies
  - Storm transposition results
- Hydraulics (how deep)
  - Enhancements to FEMA Base Level Engineering (BLE) products
  - Other hydraulic studies
  - New hydraulic studies
- Stormwater infrastructure plans (range of hydrologic loading)
  - Distributed smaller
  - Large regional
  - Combinations
  - To collector level
- Mitigation areas (banks)
- WE CAN DO THIS TOGETHER! - Multi-discipline team
  - Federal, state and local partners
  - A/E's, environmental firms
  - University researchers

InFRM Partnership



Flood Risk Products and Uses

- Numerical models (meteorology, hydrology, hydraulics)
  - Existing conditions
  - Future conditions for impervious cover and hydraulic efficiency
  - Planning/preparedness/response
- Regulatory
  - Update technical basis for NFIP mapping (100-yr flood)
- Stormwater infrastructure plans
- Emergency preparedness
  - What-if scenarios
- Emergency response
  - Basis for real-time inundation mapping
- Environmental mitigation plans
- Groundwater recharge
- Open space connectivity opportunities
- Other infrastructure needs

Project Scope of Work Elements:

- Secure funding and agreements
- Inventory available regional data
- Generate 2055 storm runoff estimations
- Analyze areas where reductions are needed
- Evaluate locations for stormwater management structures
- Lead project management and organization:
  - coordinate with stakeholders
  - identify and manage contracts
  - continued communication with stakeholders
  - data and resource dissemination
  - encourage implementation of plans/use of tools developed
- Combined master planning for transportation infrastructure and safety, with future conditions stormwater runoff, with meaningful environmental features
- Ensure products result in reduced channel erosion and stream sediment transport
- Provide regulatory tools and example policies for more resiliency
- Follow through with Implementation (products and technical tools): address challenges faced by implementing entities, who have limited resources, including staff, expertise, and funding.

- **Members of Congress Attending**

Members of Congress	Congressional Staff
Hon. Eddie Bernice Johnson (TX-30)	Julie Agarwal, Senior Transportation Policy Advisor
Hon. Collin Allred (TX-32)	Judith Tankel, District Director
Hon. Marc Veasey (TX-33)	Anne Hagan, District Director
Hon. Ronald Wright (TX-06)	Ricky Rodriguez, Community Outreach
Hon. John Ratcliffe's Staff (TX-04)	James Baker, Director of Public Policy

- **Local, State, National Agency Attending**

1. North Central Texas Council of Governments	2. Texas Floodplain Management Association
3. US Army Corps of Engineers	4. Texas General Land Office
5. Federal Emergency Management Agency (FEMA)	6. Texas Water Development Board
7. US Housing and Urban Development (HUD)	8. Trinity River Authority of Texas
9. Tarrant Regional Water District	10. Texas General Land Office

BIPARTISAN FLOODING NORTH TEXAS ROUNDTABLE AGENDA

DATE: MONDAY, JULY 8, 2019

TIME: 8:30 – 10:00 AM (CDT)

LOCATION: DALLAS REGIONAL CHAMBERS - TOYOTA BOARD ROOM

- **Agenda by speaker: Michael Morris, Director of Transportation**
  North Central Texas Council of Governments

- Welcome to Dallas Regional Chamber (DRC)	Chief Executive Officer of DRC
- Introduction of Today's Topic	Hon. Congresswoman Johnson
- Introduction of Attendees	All
- Responding to Flooding vs. Prevention	All
- Project from North Central Texas on Prevention	NCTCOG/USACE
- Project Funding Proposal: $10 Million (Non-Legislative)	NCTCOG/USACE
- Opportunity for a National Shift in Policy	Congressional Delegation
- Next Steps for Congressional Delegation, If Any	Congressional Delegation
- Next Steps for Project Team	NCTCOG/USACE

- Definitions:
  - NCTCOG (North Central Texas Council of Governments)
  - USACE (United States Army Corps of Engineers)

INTEGRATED PLANNING OF REGIONAL TRANSPORTATION AND STORMWATER MANAGEMENT TOGETHER AS A SYSTEM OF IMPROVEMENTS: PREVENTION VS. RESPONSE

QUESTIONS/CONTACT:

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