North Central Texas Council of Governments

Planning to Reduce Future Flood Risk

NCTEDD Board Meeting | February 3, 2025

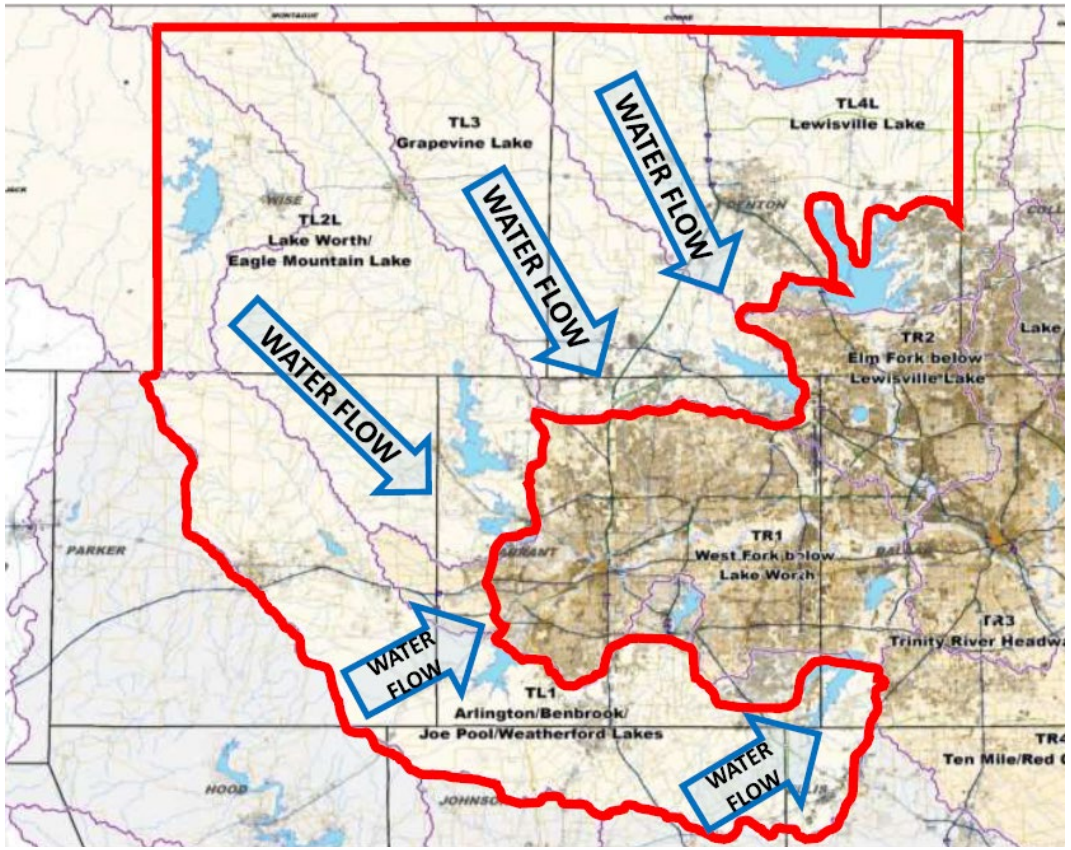
https://nctcog.org/tsi

Funded by the Texas General Land Office, Community Development Block Grant, Disaster Recovery Program.

Also Funded by the Texas Water Development Board and Texas Department of Transportation.

Integrated Transportation and Stormwater Infrastructure (TSI) Initiative

1. Demonstrate **proactive planning** that integrates transportation, stormwater, and environmental planning
2. **Reduce flooding within and downstream** from rapidly growing communities, including increasing the resiliency of infrastructure
3. Develop tools and resources, including policy recommendations, to **empower communities** to adopt higher floodplain management standards
4. **Implement local-scale innovation** in hydrologic and hydraulic modeling and emergency management modeling
5. Produce **planning-level models for transportation infrastructure and stormwater detention**



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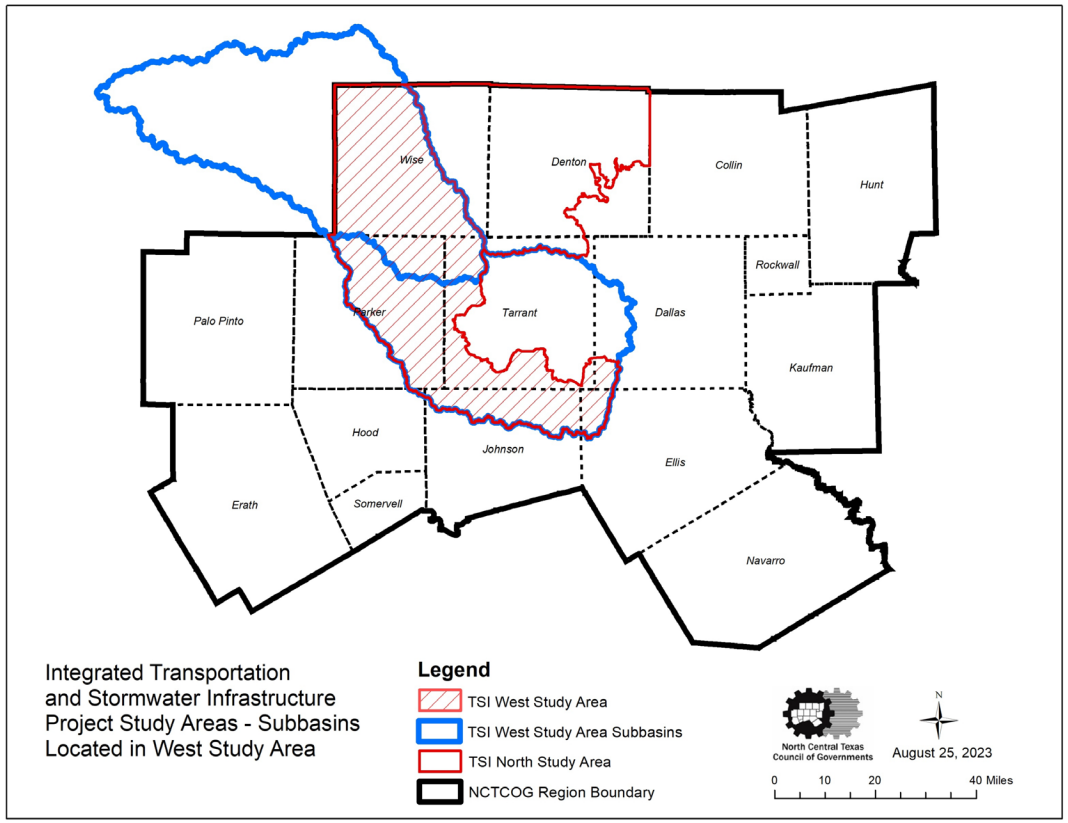
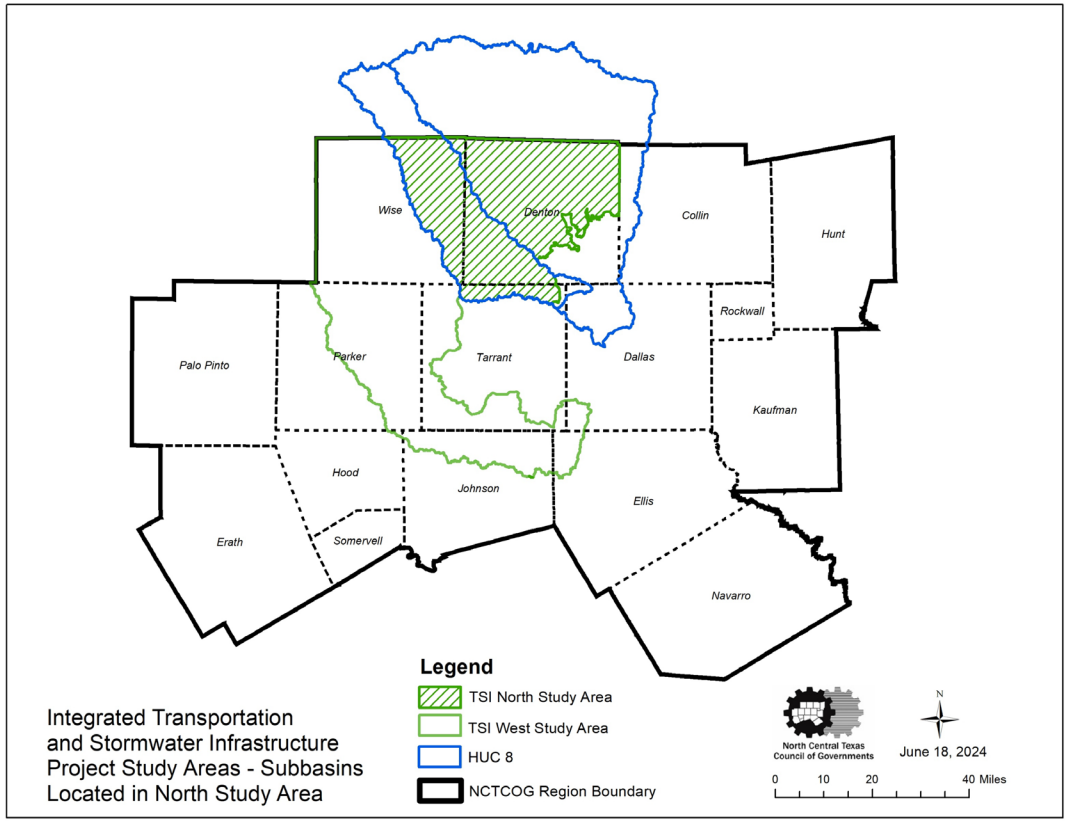
West and North Study Areas





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Project Area Details

- 85 cities and portions of 8 counties
- 126% increase in population (2020 – 2045)
- 60% undeveloped (2015)
- 19% growth in impervious surface (2006 – 2016)
- > 7,000 miles of streams and > 274,000 acres of 100-year floodplain

Photo courtesy of City of Newark

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Ongoing Regional Challenges

Urbanization Demands

- About 50,000 people are moving to the study area every year
- More urbanization and development leads to more impervious surfaces

Stormwater Data

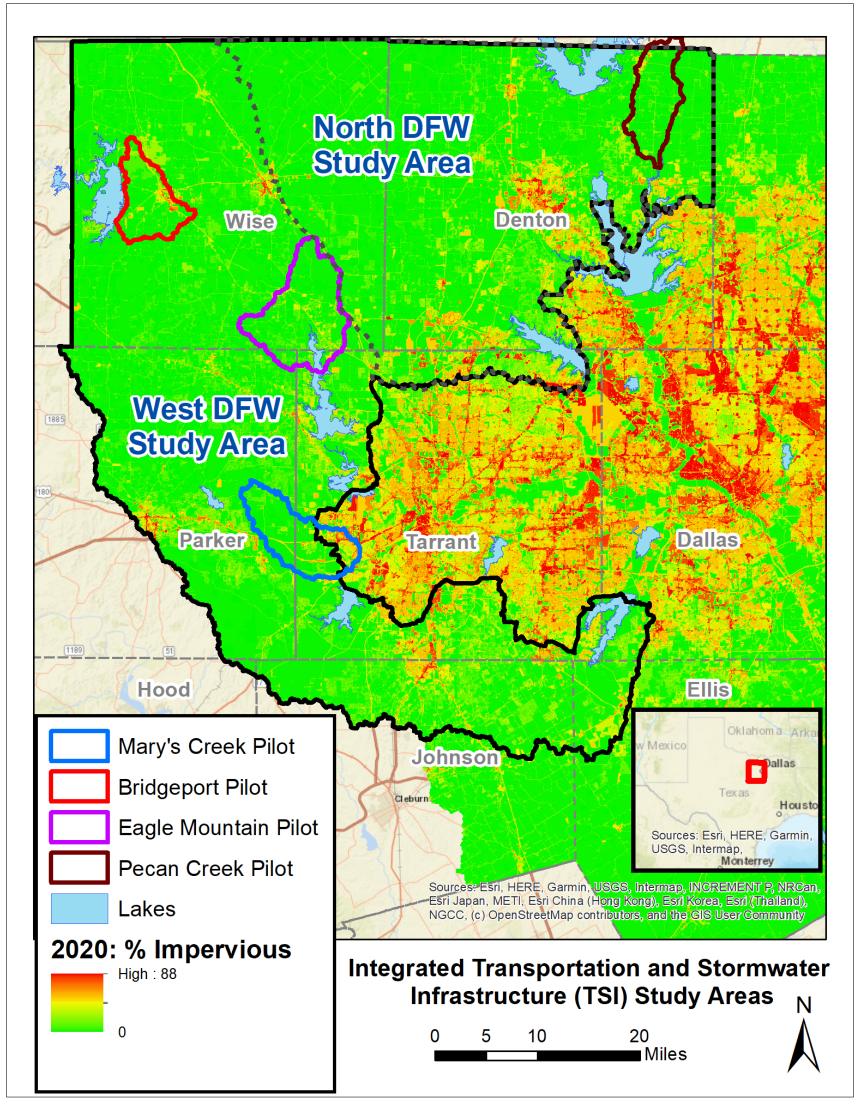
- No regionwide infrastructure data
- Piece-meal/lacks connectivity
- NOAA Atlas 14 updated rainfall estimates but only updated every 10 years

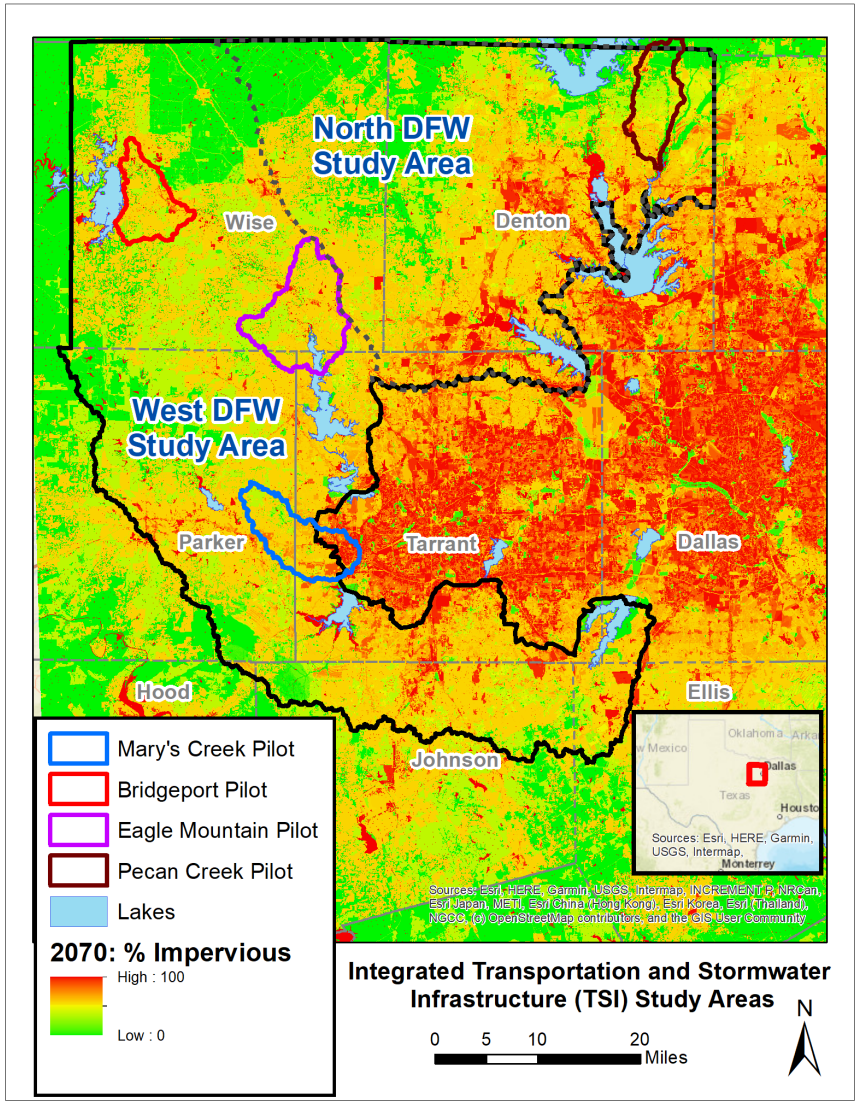
Transportation Funding

- Transportation spending is high and growing, including for asset management
- Rate of deterioration for transportation infrastructure increasing

Typical Urbanization Adds Impervious Surfaces

2020 (6.4% Impervious) → **2070 (35.2% Impervious)**





Benefits for Region

- **Reduce Flood Damage Costs**
  - Mitigate flood risks, allowing the region to save on potential flood damage repairs and associated costs
- **Promote Sustainable Development**
  - Support projects that promote sustainable urban development, balancing growth with environmental protection, and prioritizing long-term economic stability
- **Enhance Infrastructure Resilience**
  - Invest in resilience to strengthen transportation and stormwater systems, reducing the frequency and severity of disruptions
- **Affect Insurance Premiums**
  - Participation in flood management programs can reduce flood insurance premiums for property owners

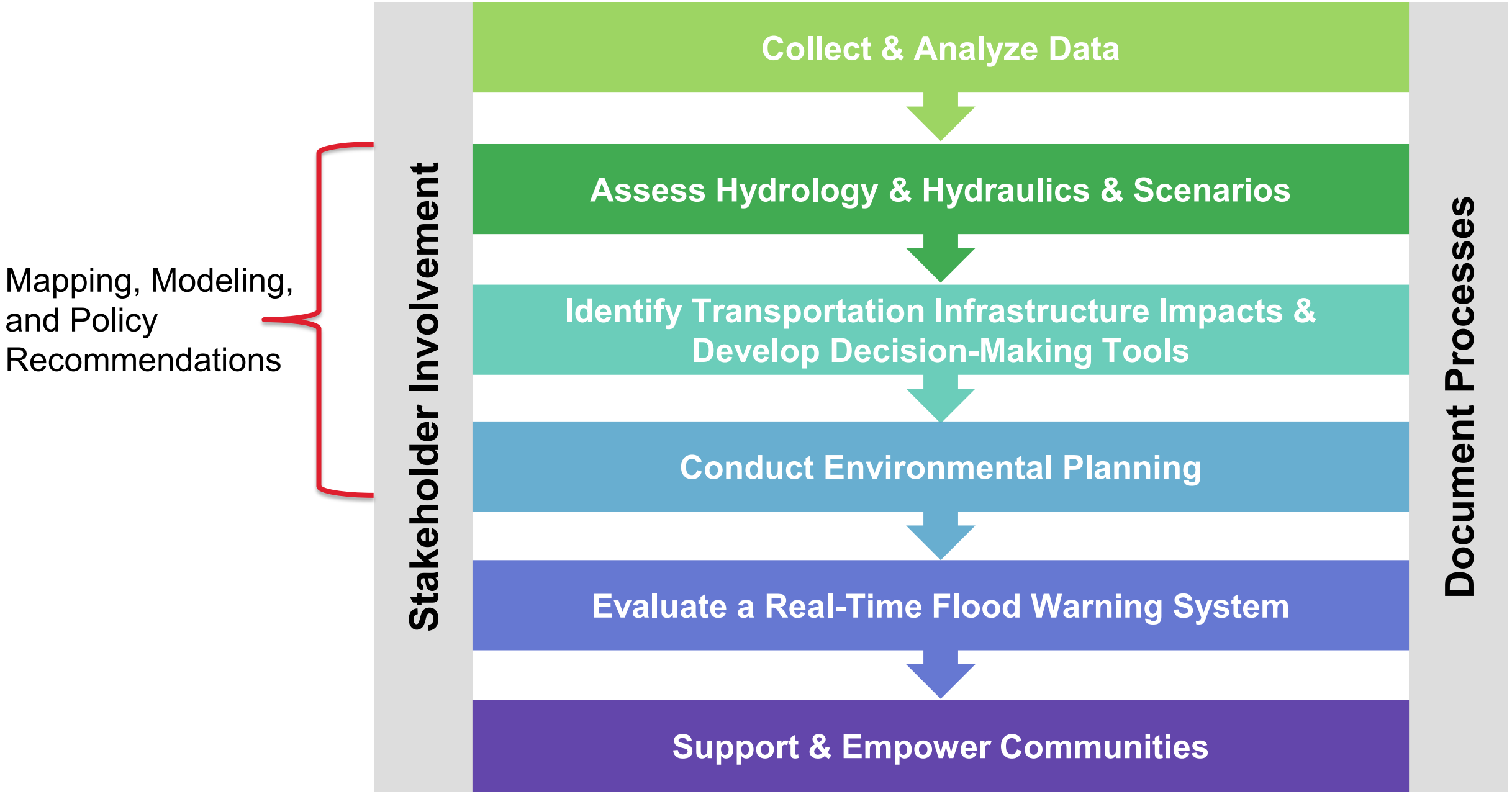
Challenges and Benefits for the Economic Community

Challenges

- Property Damage: Floods can cause extensive damage to buildings, machinery, and inventory
- Business Interruption: Operations may be halted, leading to loss of revenue
- Supply Chain Disruptions: Flooding can disrupt supply chains, affecting the availability of goods and services

Opportunities

- Green Infrastructure: Investing in green infrastructure can mitigate flood risks and enhance resilience
- Improved Zoning and Planning: Improved land use data can prevent construction in high-risk flood areas
- Innovation in Flood Management: Improving technologies and solutions for flood prediction and prevention can assist with transit



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Transportation Challenges

WHAT: Responding to Federal Resiliency Needs

- **USDOT FY 2018-22 Strategic Plan:** "DOT will increase its effectiveness in ensuring infrastructure is resilient enough to withstand extreme weather."
- **FHWA** requires resilience to be considered in:
  - FHWA programs & policies (Order 5520)
  - Transportation Asset Management Plans (23 CFR 515)
  - Transportation planning (23 CFR 450)
  - Roads / bridges repeatedly damaged by emergency events (23 CFR 667)

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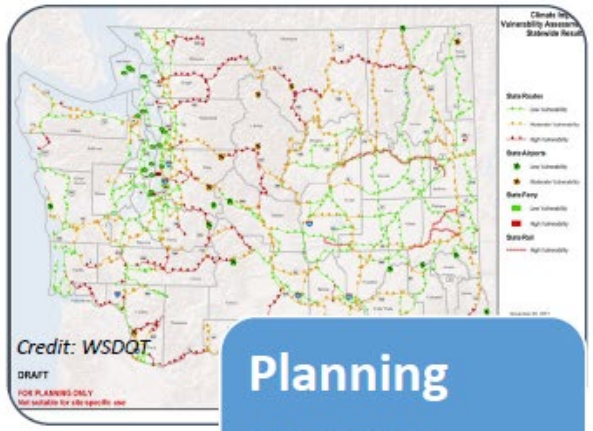
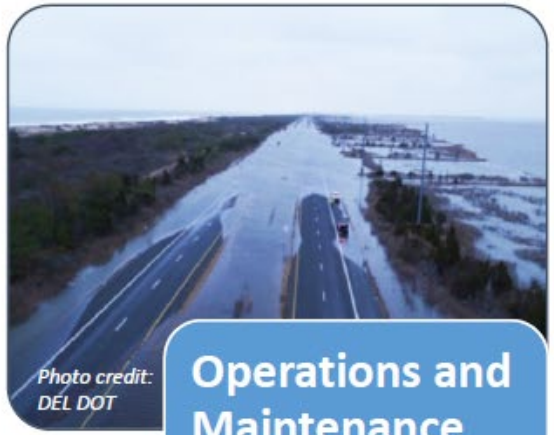
Texas Department of Transportation

DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA



Planning
- Long Range Transportation Plans
- Asset Management Plans

Project Level
- Environmental Processes
- Engineering
- Design



Operations and Maintenance
- Emergency Response

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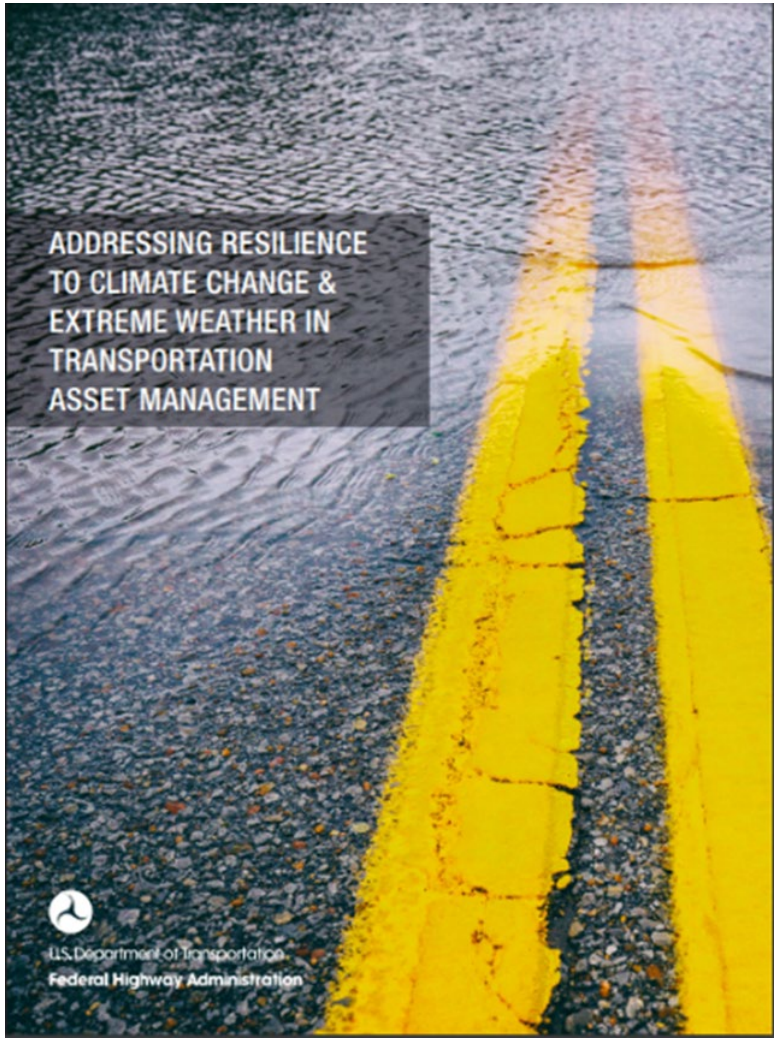
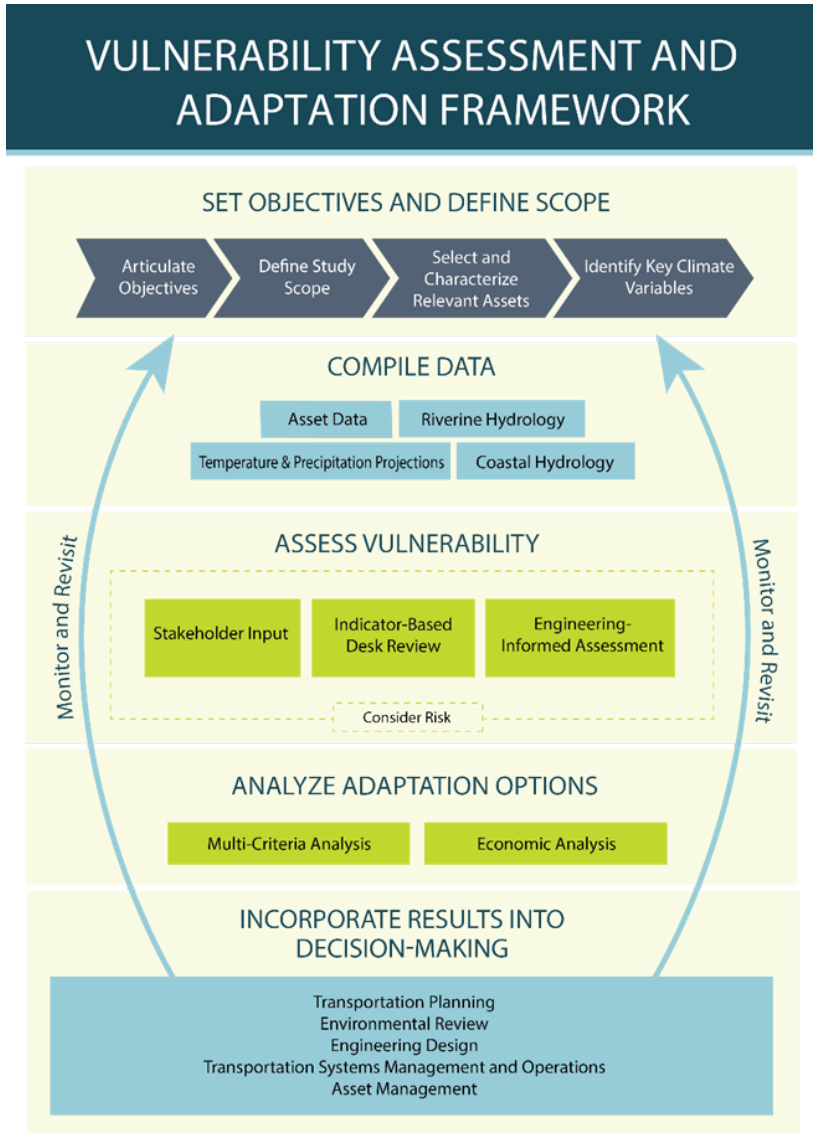
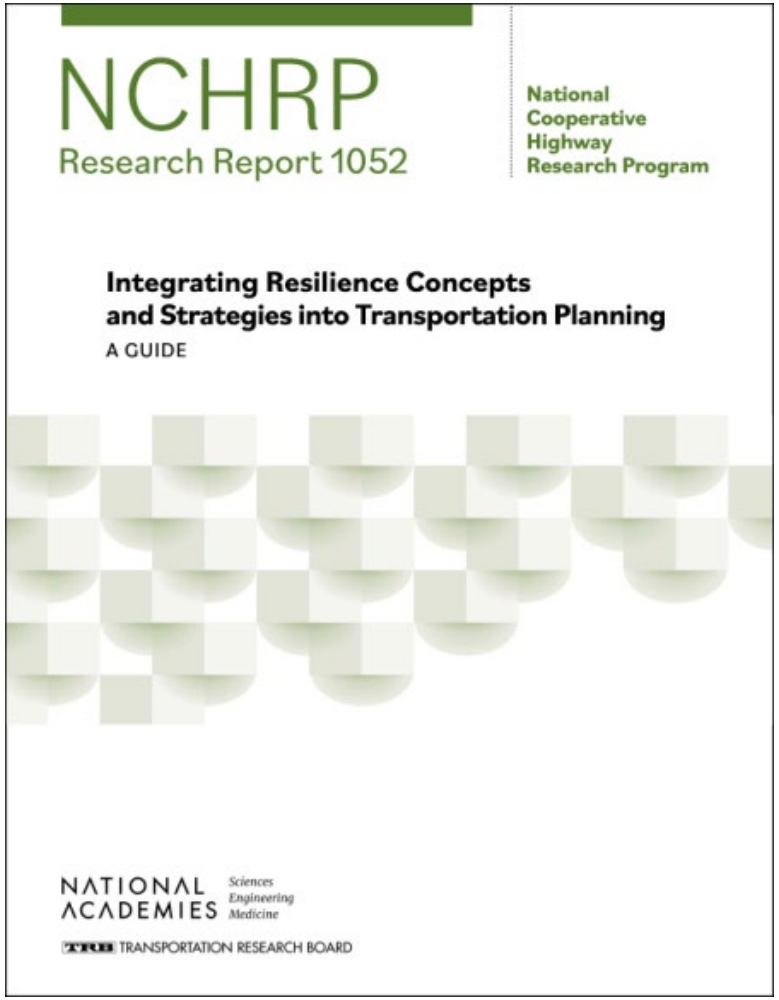
HOW: Utilizing & Amplifying Best Practices



Source: FHWA (2023)



Source: FHWA (2017)



Source: NCHRP (2023)

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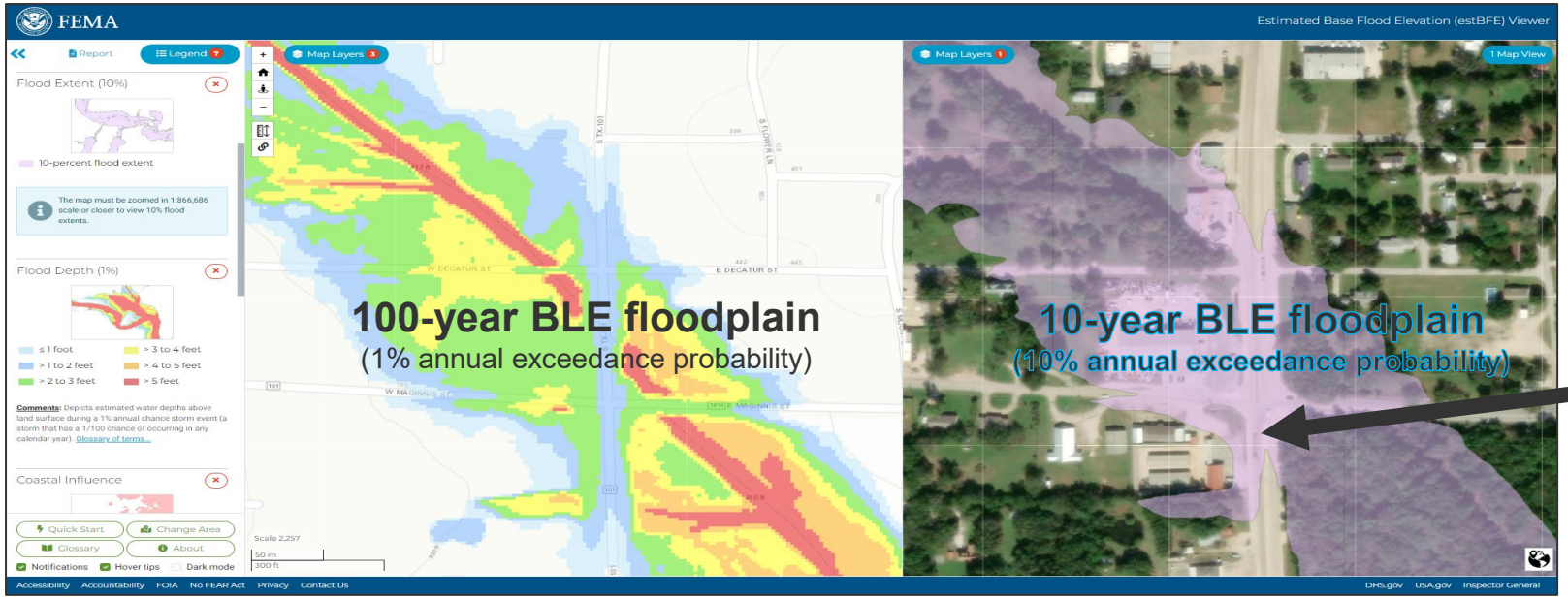
HOW: Integrating Enhanced Base Level Engineering (BLE)



Source: InFRM Estimated Base Flood Elevation Viewer: https://webapps.usgs.gov/infrm/estBFE/

NOWData - NOAA Online Weather Data Enlarge results Print

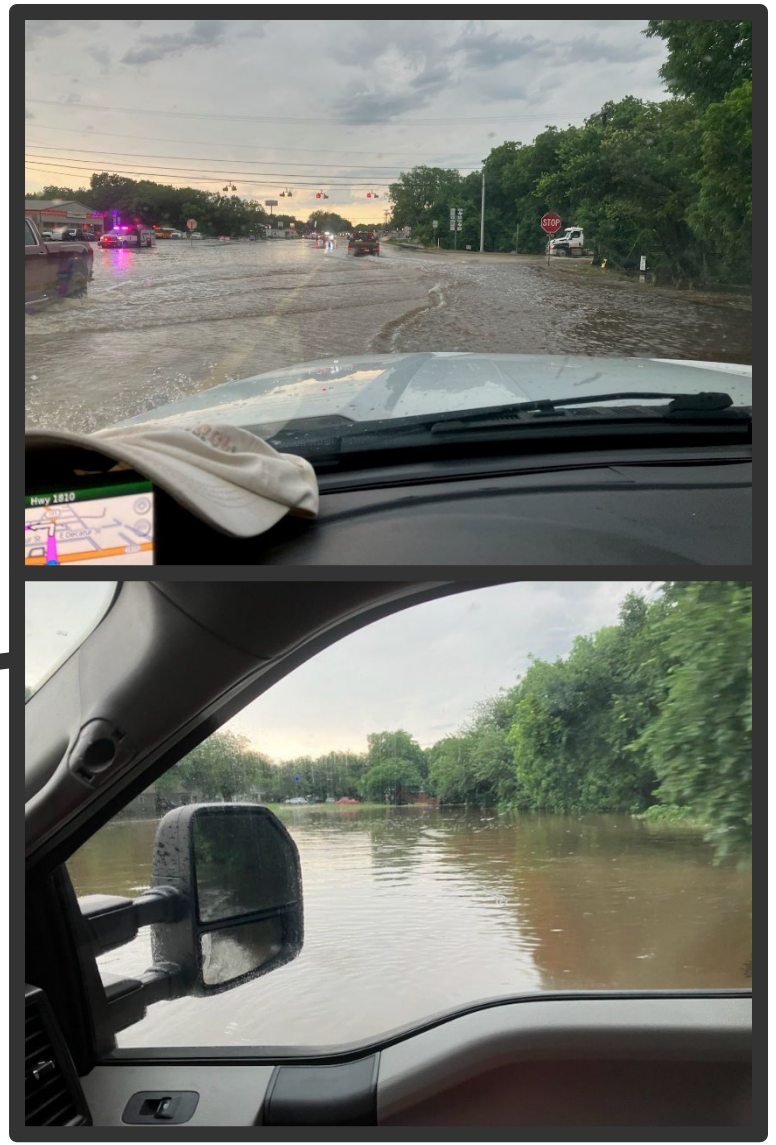
Climatological Data for DECATUR MUNICIPAL AIRPORT, TX - May 2024

Click column heading to sort ascending, click again to sort descending.

Date	Temperature				HDD	CDD	Precipitation
	Maximum	Minimum	Average	Departure			
2024-05-28	80	63	71.5	M	0	7	2.40

Source: NOAA Climatological Data: http://www.weather.gov/climate

Precipitation Duration	Recurrence Interval (years)
15-min	500
30-min	50
60-min	10
2-hr	5
6-hr	1



Dry Creek: May 28, 2024

Source: Tarrant Regional Water District

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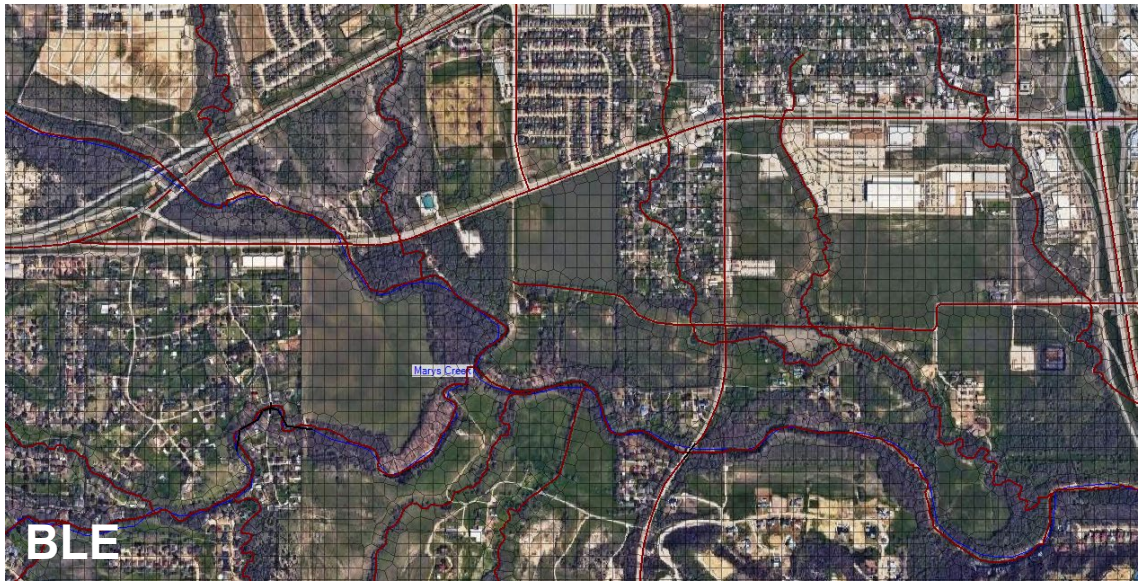
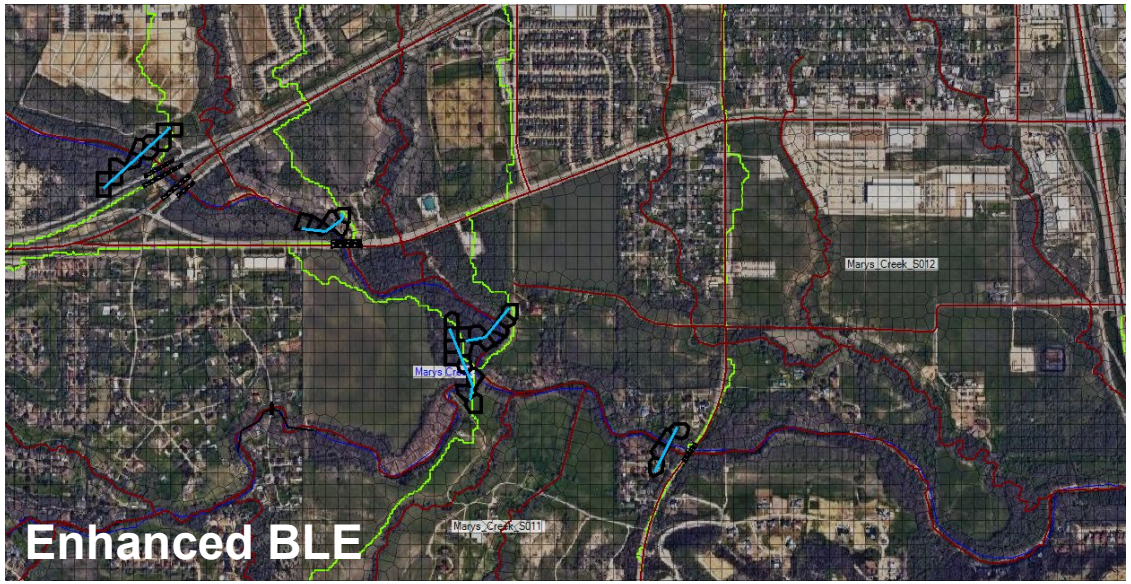
Source: NOAA Atlas 14 Point Precipitation Frequency Estimates for ~2.4" in Chico, Texas: https://hdsc.nws.noaa.gov/pfds/pfds_map_cont.html

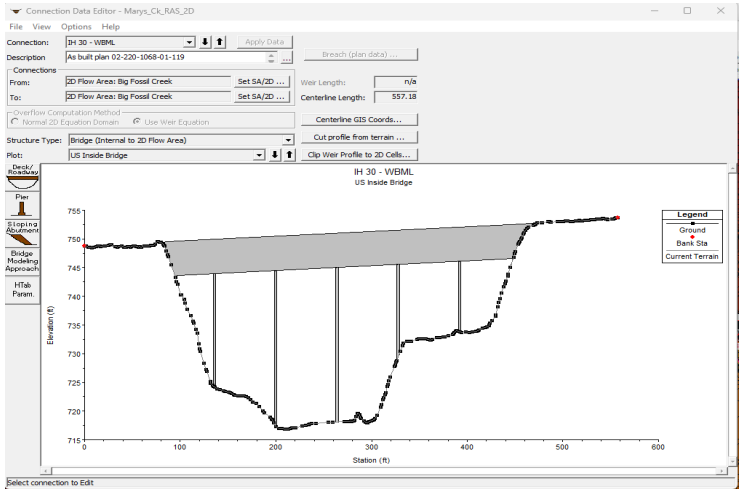
WHY: Bridge Condition, Performance, & Future "Right-Sizing"





BLE Enhancements:

- Refined hydrologic sub-basins
- Simulation of current/future conditions & flow scenarios
- Added bridges & culverts with improved data on geographical & engineering parameters



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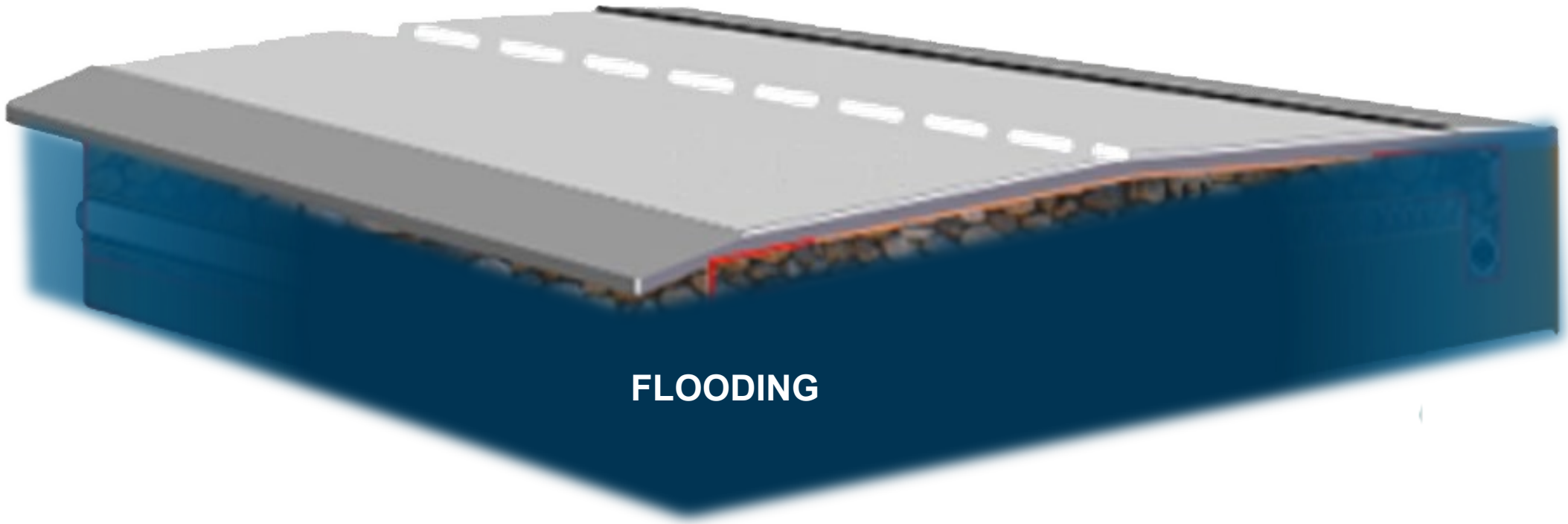
WHY: Pavement Condition & Performance

- Flooding can erode pavement base layers, weakening the foundation
- Once flooding inundates all layers, pavement stiffness & integrity can be reduced dramatically
- Short- / long-term operations effects
- Overall structural performance & design life impacted



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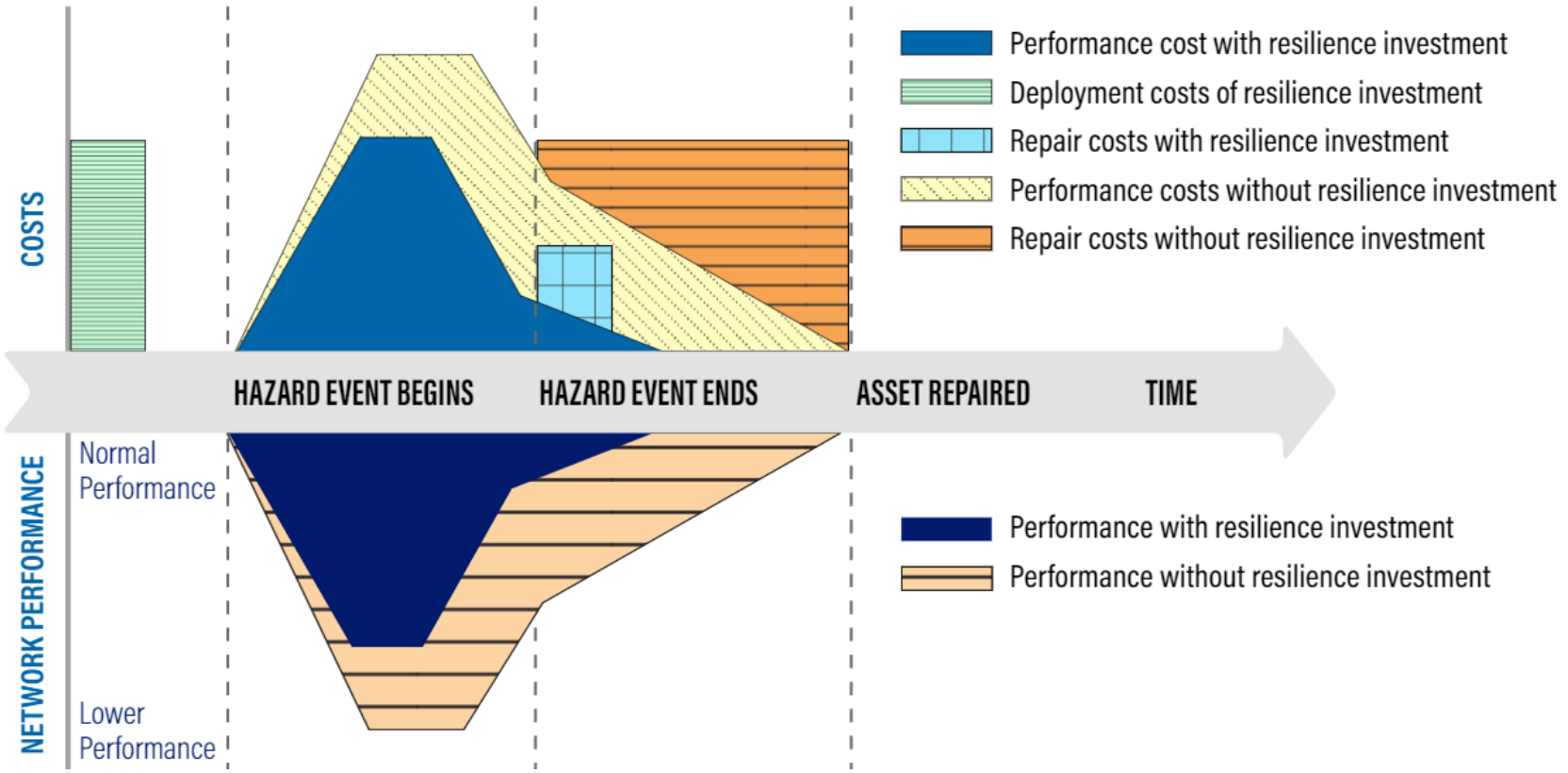
WHY: Optimizing Return on Investment (ROI)

Improvements to:

- Potential scenario-based damage / disruption costs
- Capital & operational costs of resilience investments
- Monetized system performance / time changes
- Costs of asset repair, rehabilitation, & replacement options with and/or without resilience changes



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Environmental/Economic Benefits

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Why Invest in Stormwater Management (i.e., why do we care?)

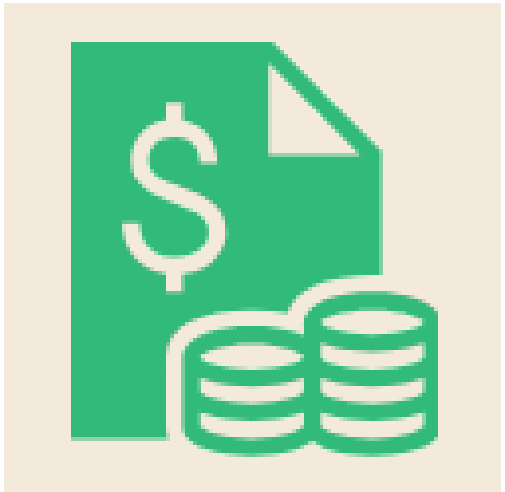
- DFW is growing by 100,000 to 150,000 people every year
- Much of the development is happening in floodplains
  - Increased runoff + Decreased floodwater storage ⟶ Big Flood Problem
- Big flood problems then lead to:
  - $ Damages to infrastructure, private property, businesses, recreation, etc.
  - $ Reduced property values, reduced income, reduced quality of life, reduced growth

Return on Investment

- What are our best investment options?

- What are the costs?
  - Installation/construction costs
  - Maintenance costs
  - Land requirement & costs

- What are the benefits?
  - Certainty / Reliability
  - Reduced flooding
  - Co-benefits



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Benefits of Green Stormwater Infrastructure & Nature Based Solutions

- Financial Cost Savings $$
  - Infrastructure investment costs – It can be cheaper!
  - Water treatment/ management savings
  - Energy savings
- Quality of Life Improvements
  - Greenspace - Nicer place to live and work
  - Aesthetics
  - Recreation
  - Cooler environment
  - Improved air / water quality
  - Health benefits

Bottom Line: Effects on Financial Costs, Property Values, Business Environment, and Quality of Life

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TSI Study Products

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GSI/NBS Suitability Index (GIS Stacking Model)

Environmental

Topographical
Elevation, Slope, Aspect, Curvature, TWI, TRI

Meteorological
Rainfall intensity, Temperature

Land use/cover
NDVI, Curve number, NRCS BMPs

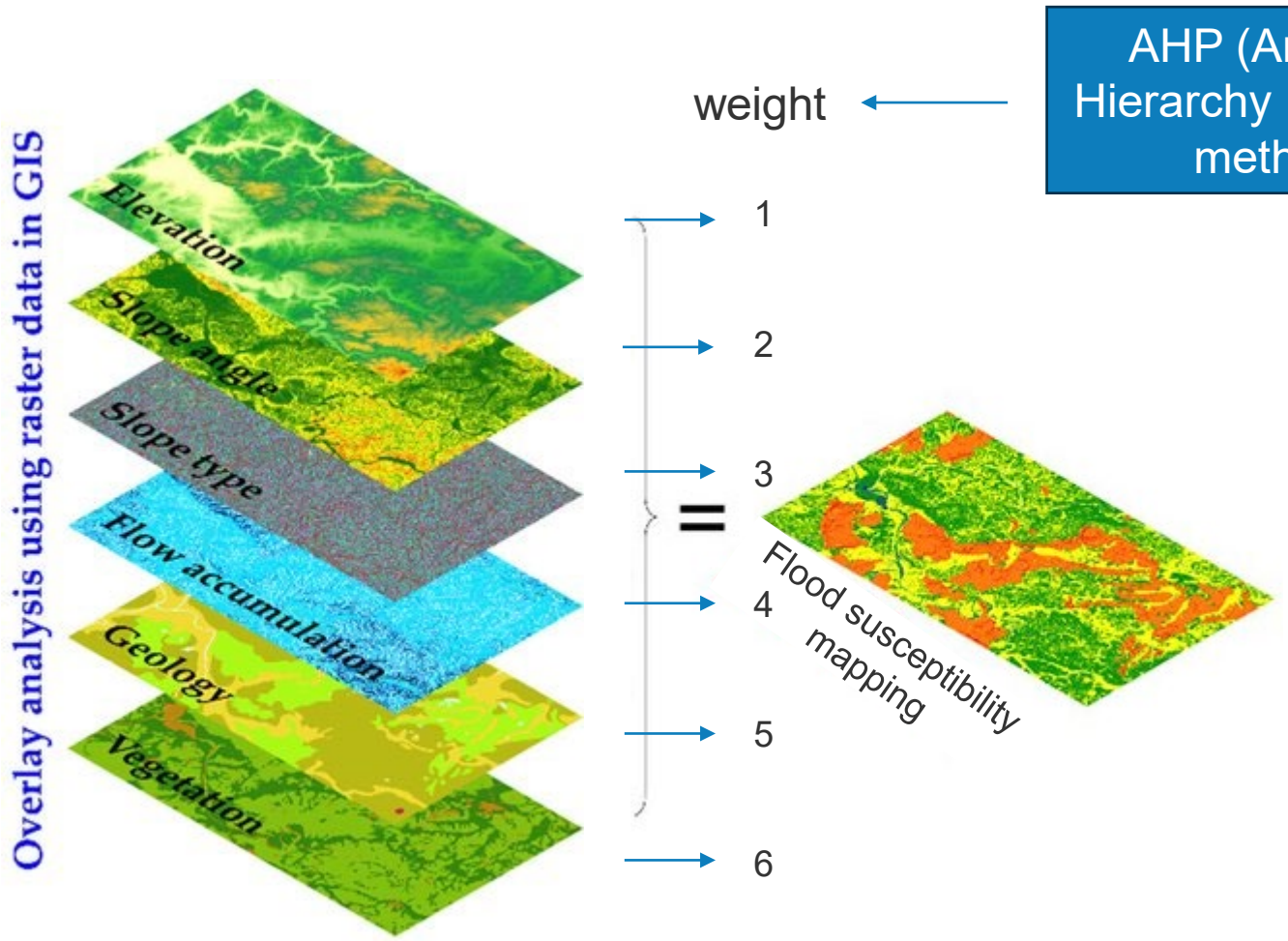
Hydromorphological
Distance from river, Stream density, Time of concentration

Socio-economical

Social vulnerability index, Population density

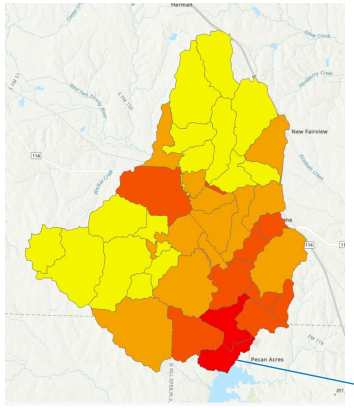
Infrastructural

Distance from transportation network, Distance from detention pond, Distance from USGS streamflow monitoring gauges



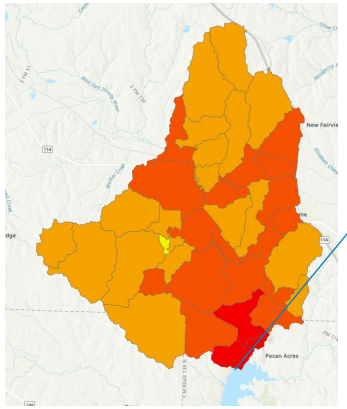
Optimizing Locations for GSI and NBS

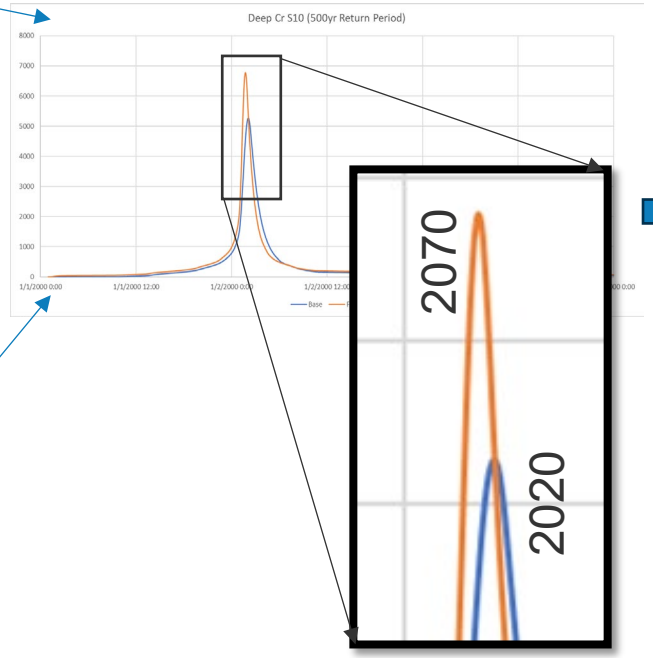
2020



Increased Imperviousness

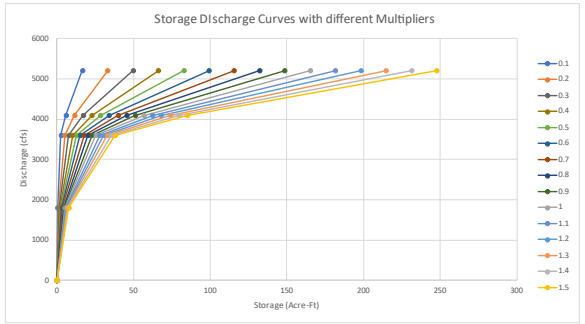
2070





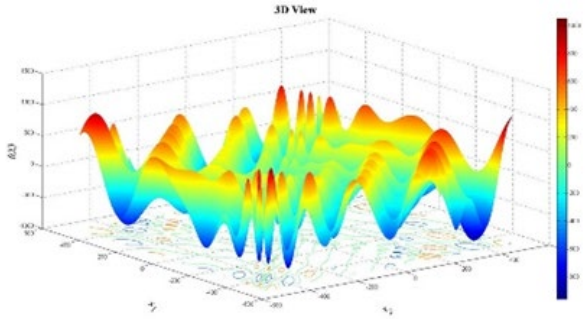
Increase in Flow

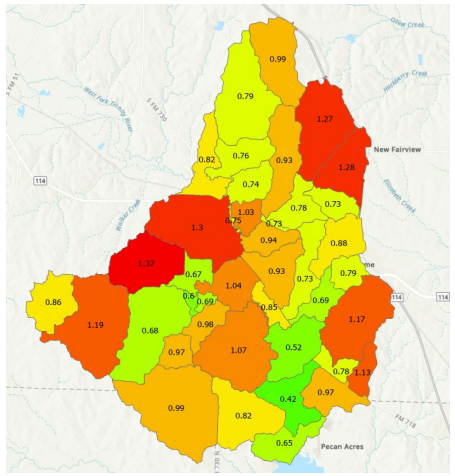
Setting Up HEC HMS Model with Reservoirs at Each Subbasin



Varying Storage Values to Best Reduce the Peak Flow

Optimized Storage Values generated from HMS Runs





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Policy and Other Recommendations

- Informed by engagement with local governments
- Tiered to accommodate communities of varying sizes and resources
  - Flood control and mitigation best practices
  - Strategies to reduce risk to low-lying transportation infrastructure
  - Locations for stream gages and strategies to utilize modeling data in real-time flood warning systems
  - Performance measures for selecting and prioritizing new transportation infrastructure
  - Cost-benefit calculations to incorporate into decision making
  - Incentives for conservation of flood-prone areas
  - Model zoning, building codes, and stormwater ordinances

Timeline

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Estimated Study Timeline

Through Fall 2025
Continue training workshops and site visits to individual communities

Winter 2025/2026
Complete H&H modeling and identify transportation, environmental and other policy recommendations

March 2026
Conduct project update meeting to present findings and seek stakeholder feedback

June 2026
Conduct project update meeting to present final products incorporating stakeholder feedback

July 2026
Submit deliverables to funding agencies

Project Partners

West Study Area

North Central Texas Council of Governments

US Army Corps of Engineers

University of Texas at Arlington

Texas A&M AgriLife Extension Service

Tarrant Regional Water District

Freese and Nichols, Inc.

Halff Associates, Inc.

North Study Area

North Central Texas Council of Governments

Upper Trinity Regional Water District

Halff Associates, Inc.

Highland Economics, LLC

Contracts pending:

University of Texas at Arlington

Texas A&M AgriLife Extension Service

US Army Corps of Engineers

Funding Partners

Texas General Land Office / Department of Housing and Urban Development

Texas Water Development Board

Texas Department of Transportation / Federal Highway Administration

US Army Corps of Engineers

Federal Emergency Management Agency

NCTCOG Public Works Council

NCTCOG Trinity River COMMON VISION Steering Committee

NCTCOG Regional Stormwater Management Coordinating Council

Questions?

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